# NL3000 CereTom® Elite
# User Manual

1-NL3000-060 Revision 35

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# Intended use of the system

The NL3000 [CereTom Elite] is intended to be used for x-ray computed tomography applications for anatomy that can be imaged in the 25cm **field of view**, primarily head and neck.

The CT system is intended to be used for both pediatric and adult imaging and as such has preset dose settings based upon weight and age. The CT images can be obtained either with or without contrast.

# Clinical Benefit

Computed Tomography (CT) provides real time imaging of bone, soft tissue and blood vessels that can provide detailed information to diagnose, plan treatment for, and evaluate many conditions in adults and children. Additionally, the detailed images provided by CT scans may eliminate the need for exploratory surgery.

# Consumer information

## Proprietary rights

NeuroLogica®, CereTom® Elite and NEU-CT-GENIII® Scanner Driver System (SDS) are registered trademarks of NeuroLogica Corporation, a subsidiary of Samsung Electronics Co., Ltd., in the United States, other countries, or both. Catphan® is a registered trademark of Phantom Laboratory, Inc. ACR Appropriateness Criteria® is a registered trademark of the American College of Radiology. Image Gently® is a registered trademark of Society for Pediatric Radiology. Doro® is a registered trademark of pro med instruments, Inc.

## Legal disclaimer

This user manual is intended as a guide for material supplied by NeuroLogica Corp. It provides the operator (you) with necessary information to carry out specific procedures and maintain NeuroLogica produced equipment. Use this manual in conjunction with instruction and training supplied by qualified NeuroLogica personnel.

Any information or descriptions contained in this manual may not be reproduced and released to any of the general public, or used in conjunction with other professional instruction without written consent of NeuroLogica Corp., USA – a subsidiary of Samsung. Direct any written inquiries to the appropriate address found in the section "Contact information".

Unauthorized copying of this user manual may not only infringe copyright but also reduce the ability of NeuroLogica Corp. to provide accurate and up-to-date information to users: limited and restricted operators, and administrators.

This user manual, though complete and accurate, may not provide answers to undocumented changes or unexpected results that could occur from system anomalies.

# Contact information

Keep user information readily available to contact **Customer Service** about general assistance or reporting on serious incidents (should they occur).

In the case of a serious incident or adverse event, please notify NeuroLogica at the below contact information and establishments local competent authorities.

To provide any comments, suggestions, or corrections to this user manual, please write to and include chapter title and page number:

**NeuroLogica Corporation**

- Customer Service
- 14 Electronics Avenue, Danvers, MA 01923 USA

- USA and Canada 1-888-564-8561
- International 1-978-564-8561
- Email support@neurologica.com

**Note** If you have questions about the clinical use of your system, speak with the **Clinical Representative**.

If you have questions about the service or functional operation of the system, speak with the **Technical Representative**.

### Damage in transportation

Closely examine all packages at the time of delivery. If you see damage, notate **"damage in shipment"** on all copies of the freight bill ***before*** you accept or sign for delivery (by the hospital receiving agent).

Whether damage is noted immediately or concealed (noticed after delivery), damage **MUST** be reported to carrier **immediately** upon discovery, or within 14 days after receipt, and content and containers held for inspection by carrier.

Keep in mind – the transportation company ***will not*** pay a claim for damage if an inspection is not requested within the 14-day period.

## User requirements

The equipment can *only* be operated by users who have received professional medical education and training, such as physicians, radiologists, and other medical specialists.

You, the user (the limited or restricted operator or the administrator), are a trained person who is certified to operate such systems ***before*** scanning or diagnosing patients. This training must include medical and x-ray education, and NeuroLogica applications training.

Everyone that uses this equipment must read, understand, and follow all instructions, precautions, and warnings.

Keep this user manual near the equipment. It is important to review the procedures and safety precautions periodically.

CAUTION Due to the mobility of the system, an external interlock is not available; however, a prescribed scan can, at any time, be terminated from the scanner or the workstation. When the user activates the scan, a 10-second, countdown-clock, scan delay (adjustable to 99 seconds) triggers. This countdown allows the user time to perform needed tasks before the scan begins.

# About this user manual

The instructions in this user manual describe how to use the NeuroLogica NL3000 CereTom Elite **Computed Tomography** (**CT**) system, manufactured by NeuroLogica Corp.

The manual applies to both old and new colors of NL3000 CereTom Elite.

NL3100 OTOScan is no longer documented in this user manual; it is covered in its own manual (1-NL3100-060).

This user manual ***does not*** provide medical explanations, but does suggest potential applications for some of the software features. This user manual describes potential safety problems and how to avoid them.

Anyone who operates this system should have received prior training ***before*** attempting to scan or diagnose patients, to include medical and x-ray education, in addition to NeuroLogica applications training.

This manual is made available in electronic format to the customer as part of each product delivery. For electronic manuals, please go to: Forms.samsungneurologica.com. Click on "Downloads" and choose "CT Manuals". The site will ask for the serial number of your product and a password. The password can be provided from Field Service.

Translation of this manual is available for any country that does not allow for English labeling. Please reach out to NeuroLogica directly if translation is required.

## Identified symbols and system classifications

The specifications and details of this user manual may change in order to improve the product or to enhance its performance.

Throughout this user manual, a yellow triangle with a black border and exclamation point is used to draw attention to those conditions or situations that fit one or more of the following criteria, which are definitions from ANSI Z535.5:

DANGER Indicates a hazardous situation, which if not avoided will result in death or serious injury.

WARNING Indicates a hazardous situation, which if not avoided could result in death or serious injury.

CAUTION Indicates a hazardous situation, which if not avoided could result in minor or moderate injury.

## Conventions used in this user manual

Table 1: Conventions used in this user manual

| Convention | Use |
|---|---|
| Commands to perform actions | To perform a string of commands, this user manual will present them as follows: **Customize > System**<br>This means click **Customize** and then click **System**. |
| **Bold** | When content refers to commands, windows, screens, dialog boxes, popups, tabs, buttons, options, keyboard keys, statuses, and modes, these items appear in **bold** for faster identification, especially in a procedure. |
| ***Italic*** | Identifies a word that is emphasized for your attention. |
| Numbered steps | Numbered paragraphs represent sequential steps that require you to take the action ***in the sequence*** provided – unless otherwise instructed.<br>Procedures that are numerical mean that the sequence is important to follow. You may perform some procedures out of the recommended sequence; however, the results may vary. |
| Notes | The appearance of a note is as such:<br>**Note** Indicates additional information to help you operate this product. |
| Hyperlink (an electronic cross-reference) | A cross reference appears in the electronic (.pdf) user manual as a hyperlink. To retrieve an electronic copy of this user manual (in .pdf), click **Help > User Manual** from the workstation.<br>A **hyperlink** is a quick way to go to another area of the user manual (the referred-to content) with a simple click. Hyperlinks appear like this: "Understanding the types of users" on page 91. In this case, hover the mouse pointer over the (gray) hyperlink text. The pointer changes to ☝. Press the **Ctrl** key on your keypad and (simultaneously) left-click the mouse button. After you left-click the hyperlink, the hyperlink takes you to the referenced area in the user manual. |
| Click vs left-click | In this user manual, click means to press the right mouse button. To left-click means to press the left mouse button. This user manual never says 'right click' as it is assumed that is the traditional way to click; however, it does point out when to left-click the mouse button. |

## Understanding the use of "you" in this user manual

Unless specifically noted, the implied "you", in this user manual, is the user (or limited operator). It is assumed users/operators are certified and medically trained personnel, qualified to use these systems. If the user is not the (implied) limited operator, the user will be specifically identified as administrator.

The following identifies those actions each user is permitted to perform:

- **Administrator** Full access permission (rights) to the system and its configuration. Can create protocols, user names and passwords, and all functions of the system.
- **Limited operator** Modified access permission (rights). Can modify protocols during system use but cannot create and save protocols; has no access to system configuration.
- **Restricted operator** No access to create, modify, save, or delete protocols; has no access to system configuration.

## Active and inactive objects

When a menu command, option, button, tab, field, and so on are dim, the item is not active (that is, not enabled). When the item is dim, it can mean additional and required tasks must be completed first or you (the user) do not have permission to complete the action. Inactive commands, buttons, and tabs are gray. An active menu command, option, button, tab, and field means you (the user) can use the item to perform an action. Active items are blue and/or highlighted – in other words, not dim.

## Applicable versions of CereTom Elite

This manual is applicable to all versions of CereTom Elite, despite the color variations.


Figure 1: Current cover (left) and former cover (right)

# Chapter 1 Compliance and Safety Requirements

It is important that you (all users: administrators, operators, and restricted operators) are aware of and familiar with compliance and safety requirements to ensure you (all users), the patient, and the systems are safe at ***all*** times.

## IEC classification and symbols

In accordance with International Safety Standard IEC 60601-1, the NL3000 CereTom Elite CT scanner is classified as Type B equipment; Class 1 equipment, internally powered equipment, and continuous connection to the supply mains in standby state and for specified loading.

Type B equipment provides an adequate degree of protection against shock, in particular regarding:

- Allowable leakage current.
- Reliability of the protective earth connection.
- (In accordance with the International Safety Standard IEC 60601-1), the manufacturer is not responsible for any consequences caused by the unauthorized modification of this equipment.
- Earth leakage current.

WARNING Equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

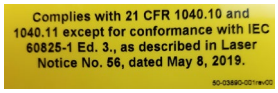
WARNING Equipment is not suitable for use with oxygen or oxygen-enriched atmospheres.

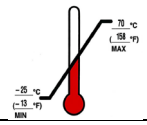
**Mode of operation** is a continuous connection to the supply mains in standby state and for specified loading conditions.

The NL3000 CereTom Elite CT scanner is patient-environment equipment.

Table 2: Applicable symbols

| Symbol | Description |
|---|---|
|  | Alternating current |
|  | Protective earth (ground) |
|  | Caution: consult accompanying documents |
|  | Caution: risk of electrical shock |

| Symbol | Description |
|---|---|
|  | Electrostatic sensitive devices |
|  | Type B equipment |
|  | X-ray warning |
|  (InTriangle) | X-ray source assembly emitting |
|  | Non-ionizing radiation |
|  | Warning: laser in use |
|   | Warning: Laser Radiation Do Not Stare Into Beam Class 2 Laser Product<br>Laser Output and Standards Information Label |
|   | Warning: FDA Laser Information |
|  | Warning: high temperature |
|  | Emergency switch |
|  | Crush warning |
|  | Foot/toe crush warning when lowering machine |
|  | System up |
|  | System down |

| Symbol | Description |
|---|---|
|  | Load limit for scan board |
|  | Temperature limits |
|  | Keep away from rain for packaging |
|  | Humidity limit for packaging |
|  | Warning: battery charging |
|  | Fuse usage |
|  | Refer to instruction in user manual/booklet |
|  | Legal Manufacturer Symbol |
| CE 2862 | CE Mark or Conformité Européenne; number below CE represent Notified Body number |
| ETL CLASSIFIED C ETL US LISTED Intertek | Intertek ETL (Edison Testing Laboratories) Mark |
| EC REP | European Authorised Representative Symbol |
| MD | Medical Device Symbol |

**WARNING** This x-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.

## Environmental specifications

**CAUTION** The specified environment must be constantly maintained: 24-hours a day, seven days a week.

Table 3: Operating environment

| | |
|---|---|
| **Operating** | |
| Ambient temperature | 15° C to 35° C (59° F to 95° F) |
| Relative humidity | 20% to 85% (non-condensing) |
| Altitude | 0-3010 m (0-10,000 ft.) |
| **Storage** | |
| Temperature | -25° C to 70° C (-13° F to 158° F) |
| Relative humidity | 20% to 85% (non-condensing) |
| **Powering system** | |
| Time period prior to powering the system | 24 hours[1] |

## Considerations when preparing gantry for use

**CAUTION** Check for obstructions before moving and system setup.

**CAUTION** Monitor scanner motion to prevent collision with surrounding environment and foreign objects.

**CAUTION** Press red **EMERGENCY STOP** button immediately in case of abnormal or unexpected motion.

**WARNING** Verify scanner is on its centipedes (fully down position) prior to positioning patient at scanner entrance.

**WARNING** Make sure all extremities are not under scanner while lowering or raising it.

[1] If the system is in a facility outside the noted operating temperature, it is recommended to allow the noted time for the system to acclimate to the environment.

**WARNING** Keep patient in view at all times. Ensure that the patient can be seen when the operator is near the LCD (touch screen) and **EMERGENCY STOP** button. Never leave the patient unattended when the patient is in the gantry.

NeuroLogica advises complying with local regulations and/or site recommendations as specified by the facility physicist or certified representative for the following:

- Use mobile x-ray protective-shielding devices. Technicians should be at correct location and consider wearing personal radiation protective equipment.
- A radiation safety plan in the working-area boundaries, to optionally include as needed, mobile x-ray protective shielding devices. Otherwise assign a larger, working area to avoid radiation to the public. Effective dose for people outside the working area should be less than 0.25mSv annually (equals to 5 uSv weekly). The air kerma rate 0.3 meters away from the working area will be smaller than 2.5 uGy/h. Have monitoring and personal dose management for occupational exposure and related public health care personnel.
- There should be a working plan before scanning. The plan should include CT condition, time, location, working area, scanning plan, and site-clearing method; clearly state the responsibilities of working, protection and management personnel. Keep a good record of the whole process.
- Restrict the working control and monitor area. Place obvious warning signs at the control-area boundaries to prevent unauthorized personnel from entering. Installation of a working status indication light is recommended.
- In accordance with the safety plan, self-monitor during the scanning process. A certified radiation representative should monitor the working area and take measurements immediately if abnormal circumstances are detected. Additionally, this should be reported to the local environmental administrative and health departments. There should be a public notice at the working area, to include the nature of work, time, location, control area, name of the working department, person in charge of the project, contact telephone number, radiation report telephone number.

# Site specification

Table 4: Site specification

| Issue | Comment |
|---|---|
| Receiving area | Secured |
| Packing material and waste | Near availability of a trash receptacle for dunnage |
| Room dimensions for use | 10ft x 10ft room with a finished level floor; recommended the room be well lit |
| Power availability | 120 VAC/15 amp wall outlets (2x) |
| Floor flatness | < 0.120in. (3mm) over 10in. (250mm) |

| | |
|---|---|
| **Note** | Not all beds are compatible for this system. Please contact Customer Service for assistance. |
| **Note** | For good image quality, the recommended practice is to keep the system free from vibration and to maintain the flatness specification noted. |

Table 5: System operating parameters

| | |
|---|---|
| Operating voltage | 100-240 VAC |
| Operating frequency | 50Hz-60Hz |
| Apparent resistance of supply mains at 120VAC | 0.3 ohms |
| Operating current at 120VAC | 13 amps |
| Heat dissipation | 1672 watts |

Table 6: Battery operating parameters

| | |
|---|---|
| Operating voltage | 42-54.4 VDC |
| Output current (peak) | 48.6 amps |

## Hazardous substances

Table 7: Hazardous substances table

| Substance/material | ≅ Weight/system |
|---|---|
| Lead | 7.48kg (16.5lbs.) |
| Cadmium | 0.035kg (0.078lbs.) |
| Mercury | 0kg (0lbs.) |
| Hexavalent chromium | 0kg (0lbs.) |
| PolyBrominated Biphenyls (PBB) | <0.45kg (<1lbs.) |
| PolyBrominated Diphenyl Ethers (PBDE) | <0.45kg (<1lbs.) |

## Part numbers and product-marking plates

Table 8: Core-system-component part numbers and product-marking plate locations

| Component | Part number | Product-marking plate locations |
|---|---|---|
| CereTom Elite gantry | 0-NL3000-000 | Near the main input plug or on the side of the system. See Figure 9. |
| CereTom Elite workstation | 10-00028-001 | On the back of the workstation. |

| Component | Part number | Product-marking plate locations |
|---|---|---|
| QA phantom | 10-00011-001 | On the back of the phantom. |

**Note** The applicable components making up the NL3000 CT scanner is identified with the nameplate statement "This product complies with radiation performance standards, 21 CFR sub-chapter J."

Table 9: Core-system component dimensions and weight

| Component | Size (inches) (w x h x d) | Size (centimeters) (w x h x d) | Weight (lbs) | Weight (kg) |
|---|---|---|---|---|
| NL3000 system | 52in. x 60in. x 28.7in. | 134in. x 153in. x 72.89in. | 966lbs | 438kg |


Figure 2: Scanner dimensions

## Locating the product-marking plate

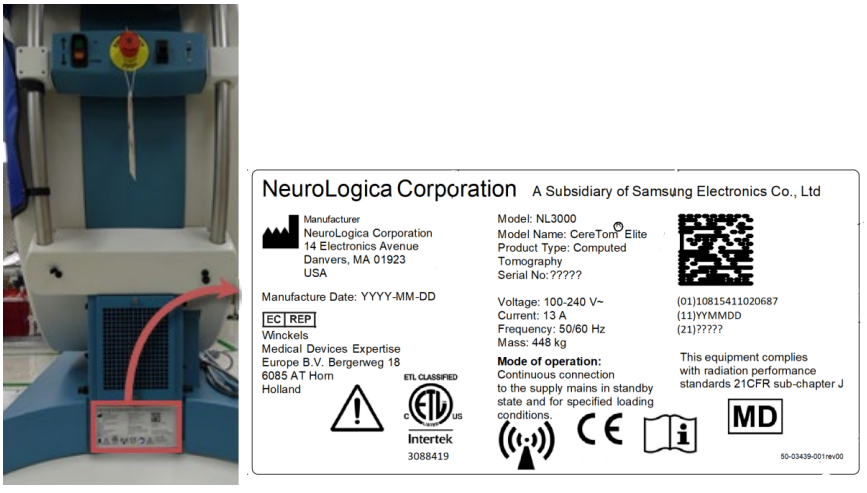



Figure 3: Product-marking plate on side of scanner

# Class 1 Type B medical devices

This equipment generates, uses, and can radiate radio-frequency energy. The equipment may cause radio-frequency interference to other medical and non-medical devices and to radio communications. To provide reasonable protection against such interference, this product complies with emission limits for Class 1 medical devices as stated in EN 60601-1-2.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause interference (which can be determined by switching the equipment on and off), the user should attempt to correct the problem using one or more of the following measures:

- Re-orient or relocate the affected device(s).
- Increase the separating space between the equipment and the affected device.
- Power the equipment from a source different from that of the affected device.
- Consult the point of purchase or the service representative for further suggestions.

NeuroLogica Corp. is not responsible for any interference caused either by the use of interconnect cables other than those recommended or by unauthorized changes or modifications to this equipment. Unauthorized changes or modifications could void the user's authority to operate the equipment.

To comply with the regulations applicable to an electromagnetic interface for a **Group 1 Class A** medical device, note the following:

- All interconnect cables to peripheral devices ***must be*** shielded and properly grounded.
- Use of cables not properly shielded and grounded may result in the equipment causing radio-frequency interference in violation of the European Union's Medical Device Directive and FCC regulations.

CAUTION Ensure there is no potentially detrimental interaction of system's irradiation with a patient's active and implantable medical devices and/or body-worn and active medical devices.

CAUTION Do not use devices that intrinsically transmit radio waves, such as a cellular phone, radio transceiver, mobile radio transmitter, radio-controlled toy, and so on. Use of these devices near this equipment could cause this equipment to malfunction. Keep power of these devices turned off when near this equipment.

- Medical staff in charge of this equipment are required to instruct technicians, patients, and other people who may be around this equipment to fully comply with the above regulations.

## Focal spot

The x-ray tube has a single, focal spot with nominal dimensions of 1.0mm wide by 1.0mm long, with a range of 1.0 to 1.4mm, as defined by IEC 336-601. The spot does not move by more than ±0.2mm due to thermal expansion in any direction. The tube does have a positional tolerance of ±1mm from the end of the anode and from the window.

## Filtration

The x-ray tube's total filtration of the irremovable layers is 4.5mm of aluminum.

## Source to Detector Distance (SID)

The SID value is 408.593mm.

## Compliance statement

**Note** All editions and years of revisions for standards noted in this chapter are static as of **Revision 31** of this ***CereTom Elite User Manual***.

The NL3000 CereTom Elite system complies with the regulatory requirements of the following:

- CAN/CSA C22.2 No 601.1-M90 (1990), 2nd Edition, Medical Electrical Equipment - Part 1: General Requirements for Safety.
- CAN/CSA C22.2 No 60601-1-08 Medical electrical equipment - Part 1: General Requirements for Basic Safety and Essential Performance.
- CAN/CSA C22.2 No 60601-1-14 Medical electrical equipment - Part 1: General Requirements for Basic Safety and Essential Performance.
- CENELEC EN 60601-1 2nd Edition, Medical Electrical Equipment - Part 1: General Requirements for Safety, includes Amendment A1:1993 and A2:1995.
- IEC 60601-1:2005 Medical electrical equipment - Part 1: General Requirements for Basic Safety and Essential Performance, 3rd Edition.
- IEC 60601-1:2012 Medical electrical equipment - Part 1: General Requirements for Basic Safety and Essential Performance
- IEC 60601-1-1 (2000) 2nd Edition: Medical Electrical Equipment, Part 1: General Requirements for Safety- Collateral Standard: Safety Requirements for Medical Electrical Systems.
- IEC 60601-1-2:2007 Ed3.0 Medical Electrical Equipment - Part 1-2: General Requirements for Basic Safety and Essential Performance - Collateral Standard: Electromagnetic Compatibility - Requirements and Tests Ed2.1 (Edition 2:2001 Consolidated with Amendment 1:2004).

- IEC 60601-1-2:2014 Ed4.0 Medical Electrical Equipment - Part 1-2: General Requirements for Basic Safety and Essential Performance - Collateral Standard: Electromagnetic Disturbances
- IEC 60601-1-3:2008 Ed3.0 Medical Electrical Equipment-Part 1-3: Collateral Standard: General Requirements for Radiation Protection in Diagnostic X-ray Equipment.
- IEC 60601-1-3:2012 Medical Electrical Equipment-Part 1-3: Collateral Standard: General Requirements for Radiation Protection in Diagnostic X-ray Equipment.
- IEC 60601-1-4 (2000) Edition 1.1 Consolidated Edition, Medical Electrical Equipment Part 1-4: General Requirements for Safety – Collateral Standard: Programmable Electrical Medical Systems.
- IEC 60601-1-6:2010 Ed3.0 Medical Electrical Equipment - Part 1-6: General Requirements for Basic Safety and Essential Performance - Collateral Standard: Usability.
- IEC 60601-1-6:2012 Ed3.1 Medical Electrical Equipment - Part 1-6: General Requirements for Basic Safety and Essential Performance - Collateral Standard: Usability.
- IEC 60601-2-32 (1994) Part 2-32, Particular Requirements for Safety sections 2.32 Specification for Associated Equipment of X-ray Equipment.
- IEC 60825-1:2014 Safety of Laser Products - Part 1: Equipment Classification, and Requirements 3rd Ed.
- IEC 60825-1:2007 Safety of Laser Products - Part 1: Equipment Classification, and Requirements 2nd Ed.
- IEC 62133:2012 Secondary Cells and Batteries Containing Alkaline or Other Non-acid Electrolytes - Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made from them, for use in Portable Applications.
- IEC 62366:2007 Application of Usability Engineering to Medical Devices.
- IEC 60601-2-44:2009 Ed3.0 Medical Electrical Equipment - Part 2-44: Particular Requirements for the Basic Safety and Essential Performance of X-ray Equipment for CT.
- IEC 60601-2-44:2012 Medical Electrical Equipment - Part 2-44: Particular Requirements for the Basic Safety and Essential Performance of X-ray Equipment for CT.
- IEC 62304:2015 Ed1.1 Medical Device Software – Software lifecycle processes
- NEMA XR-25 Specifies an Equipment Feature for CT Scanners to Produce Dose-related Notification and Alert Messages to Inform Operators Prior to Scanning if the Estimated Dose Would Exceed the Preset Levels.
- NEMA XR-29 Standard Attributes on CT Equipment Related to Dose Optimization and Manual.
- International Electrotechnical Commission (IEC) International Standards Organization, when applicable.
- Intertek Testing Service (ITS), an independent testing laboratory.
- Medical Device Good Manufacturing Practice Manual Issued by the FDA (Food and Drug Administration). Department of Health, USA.
- NeuroLogica Corporation is ISO 13485:2016 and MDSAP certified.

# EMI/EMC terms

## Electromagnetic Compatibility

**Electromagnetic Compatibility** (**EMC**) is the branch of electrical sciences that studies the unintentional generation, propagation, and reception of electromagnetic energy with reference to the unwanted effects (**Electromagnetic Interference** (**EMI**)) that such energy may induce. The goal of EMC is the correct operation, in the same electromagnetic environment, of different equipment, which use electromagnetic phenomena and the avoidance of any interference effects.

In order to achieve this, EMC pursues two different kinds of issues. Emission issues are related to the unwanted generation of electromagnetic energy, to the countermeasures that should be taken in order to reduce such generation, and to avoid the escape of any remaining energies into the external environment. Susceptibility or immunity issues, in contrast, refer to the correct operation of electrical equipment in the presence of unplanned electromagnetic disturbances.

Interference, or noise, mitigation, and hence EMC is achieved by addressing both emission and susceptibility issues, that is., quieting the sources of interference, making the coupling path between source and victim less efficient, and making the potential victim systems less vulnerable.

## Electromagnetic Interference

Electromagnetic Interference (EMI), also called **Radio Frequency Interference** (**RFI**) is an unwanted disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit. The source may be any object, artificial or natural, that carries rapidly-changing electrical currents, such as an electrical circuit, the sun, or the northern lights.

## Susceptibility

Susceptibility is the capability of an electronic system to respond to unwanted electrical energy.

### EMI/EMC compliance

This equipment complies with IEC 60601-1-2 EMC standard for medical devices.

The NL3000 CereTom Elite system is suitable to be used in an electromagnetic environment, as per the limits and recommendations described in the tables hereafter:

- Emission compliance level and limits (Table 11).
- Immunity compliance level and recommendations to maintain equipment clinical utility (Table 12, Table 13, and Table 14).

**Note** This system complies with the above mentioned EMC standard when used with supplied cables. If different cable lengths are required, contact a qualified service representative for advice.

Table 10: Acronyms and abbreviations

| Acronym and abbreviation | Definition |
|---|---|
| **CT** | Computed Tomography |
| **HIS** | Hospital Information System |
| **PACS** | Picture, Archiving, and Communication System |
| **RIS** | Radiology Information System |
| **SCU** | Service Class User |
| **SCP** | Service Class Provider |
| **CBV** | Cerebral Blood Volume |
| **CBF** | Cerebral Blood Flow |
| **MTT** | Mean Transit Time |
| **AEC** | Automatic Exposure Control |

**WARNING** Medical, electrical equipment needs special precautions regarding EMC and needs to be inst put into service according to EMC information provided in accompanying documents.

**CAUTION** Portable and mobile RF communications equipment can affect medical electrical equipment.

**CAUTION** Do not use or stack the equipment or system with other equipment and if adjacent or stacked use is necessary, the equipment or system should be observed to verify normal operation in the configuration in which it will be used.

**Note** The EMC tables and other guidelines included in this user manual provide information to the user essential in determining the suitability of the equipment or system for the electromagnetic environment of use, and in managing the electromagnetic environment of use; to permit the equipment or system to perform its intended use without disturbing other equipment and systems or non-medical electrical equipment.

Note The EMISSIONS characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If it is used in a residential environment (for which CISPR 11 class B is normally required) thisequipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

Table 11: Emission Declaration for NL3000 system

| NL3000 CereTom Elite system is intended for use in the electromagnetic environment specified below. The user of the NL3000 CereTom Elite system should assure it is used in such an environment. | | |
|---|---|---|
| **Emissions test** | **Compliance** | **Electromagnetic environment guide** |
| RF emissions<br>CISPR 11 | Group 1 | The NL3000 system uses RF energy only for internal function. Therefore, the RF emissions are very low and are not likely to cause any interference in nearby electronic equipment. |
| RF emissions<br>CISPR 11 | Class A | The NL3000 CereTom Elite system is predominantly intended for use in non-domestic environments, and not directly connected to the public mains network. The NL3000 CereTom Elite system is predominantly intended for use (for example, in hospitals) with an appropriate power supply and the recommended shielding for portable use. |
| Harmonic emissions,<br>IEC 61000-3-2 | Class A | |
| Voltage fluctuations/<br>flicker emissions,<br>IEC 61000-3-3 | Complies | |

Table 12: EMC Immunity Declaration for the NL3000 CereTom Elite system

| NL3000 CereTom Elite system is intended for use in the electromagnetic environment specified below. The user of the NL3000 CereTom Elite system should assure it is used in such an environment. | | | |
|---|---|---|---|
| **Immunity test** | **IEC 60601-1-2 test level** | **Compliance level** | **Electromagnetic environment guidance** |
| Electrostatic Discharge (ESD) IEC 61000-4-2 | ± 8 kV contact<br>± 2kV, ± 4kV, ±8kV, ±15kV air | ± 8 kV contact<br>± 2kV, ± 4kV, ±8kV, ±15kV air | Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%. |
| Electrical fast transient/burst IEC 61000-4-4 | ±2kV for power supply lines<br>±1kV for input/ output lines | ±2kV for power supply lines<br>±1KV for input/output lines | Mains power quality should be that of a typical commercial or hospital environment. |
| Surge IEC 61000-4-5 | ± 1kV line-line<br>± 2kV line-ground | ± 1kV line-line<br>± 2kV line-ground | Mains power quality should be that of a typical commercial or hospital environment. |
| Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11 | 0% UT; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°<br>40% UT; 5 cycles<br>70% UT; 25 cycles<br>0% UT; 250 cycles | 0% UT; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315°<br>40% UT; 5 cycles<br>70% UT; 25 cycles<br>0% UT; 250 cycles | Mains power quality should be that of a typical commercial or hospital environment. If the user of the NL3000 CereTom Elite system requires continued operation during power interruptions, it is recommended that the NL3000 CereTom Elite system be powered from its internal batteries. |
| Power frequency (50/60Hz) magnetic field IEC 61000-4-8 | 30 A/m, 50Hz or 60Hz | 30 A/m, 50Hz or 60Hz | Power-frequency magnetic-fields should be at levels characteristic of a typical location in a typical commercial or hospital environment. |
| Clause 8.10 | Per Table 9 | Per Table 9 | Reference to said table in IEC 60601-1-2: 2014 |

## Countermeasures against EMC related issues

Generally, it is very difficult to grapple with issues related to EMC. It may take a variable amount of time and cost to identify issues causing interference.

General countermeasures of electromagnetic interference with other equipment:

- Electromagnetic interference may be alleviated by positioning other equipment far from system.
- Electromagnetic interference may be mitigated by changing relative location (installation angle) between system and other equipment.
- Electromagnetic interference may be eased by changing wiring locations of power/signal cables of other equipment.
- Electromagnetic influence may be reduced by altering the power-supply path of other equipment.
- Electromagnetic environment specified (Table 12 and Table 13).

Table 13: EMC Immunity Declaration

| NL3000 CereTom Elite system is intended for use in the electromagnetic environment specified below. The user of the NL3000 system should assure it is used in such an environment. | | | |
|---|---|---|---|
| Immunity test | IEC 60601-1-2 test level | Compliance level | Electromagnetic environment guidance |
| Conducted<br>RF<br>IEC 61000-4-6 | 3 Vrms<br>150kHz to 80MHz | V1 = 3 Vrms | Portable and mobile RF communications equipment should be used no closer to any part of the NL3000 CereTom Elite system, including cables, than the recommended separation distance calculated from the equation appropriate for the frequency of the transmitter.<br>Recommended separation distance: see Table 14. |

NL3000 CereTom Elite system is intended for use in the electromagnetic environment specified below. The user of the NL3000 system should assure it is used in such an environment.

| Immunity test | IEC 60601-1-2 test level | Compliance level | Electromagnetic environment guidance |
|---|---|---|---|
| Radiated RF<br>IEC 61000- 4-3<br>(alternative method: IEC 61000-4-21) | 3 Vrms<br>80MHz to 2.5GHz | E1 = 3 V/m | $d = [\frac{3,5}{V_1}]\sqrt{P}$<br>$d = [\frac{3,5}{E_1}]\sqrt{P}$ 80 MHz to 800 MHz<br>$d = [\frac{7}{E_1}]\sqrt{P}$ 800 MHz to 2.5 GHz<br>Where P is the maximum power rating in watts and d is the recommended separation distance in meters.<br>Field strengths from fixed transmitters, as determined by an electromagnetic site survey, should be less than the compliance levels (V1 and E1).<br>Interference may occur in the vicinity of equipment marked with the following icon:<br>  |

Table 14: Recommended separation distances

| Recommended separation distances between portable and mobile RF communications equipment and the NL3000 CereTom Elite system | | | |
|---|---|---|---|
| NL3000 CereTom Elite system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The user of the NL3000 CereTom Elite system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the NL3000 CereTom Elite system as recommended below, according to the maximum output power of the communications equipment. | | | |
| Rated maximum output Power (P) if transmitter Watts (W) | 150kHz to 80MHz<br>Separation distance meters[2] | 80MHz to 800MHz<br>Separation distance meters[2] | 800MHz to 2.5GHz<br>Separation distance meters [2] |
| 0.01 | .12 | .12 | .23 |
| 0.1 | .38 | .38 | .73 |
| 1 | 1.2 | 1.2 | 2.3 |
| 10 | 3.8 | 3.8 | 7.3 |
| 100 | 12 | 12 | 23 |
| For transmitters rated at a maximum output power not listed above, the separation distance is estimated using the equation in the corresponding column, where P is the maximum output power rating of the transmitters in Watts (W) according to the transmitter manufacturer. | | | |

**Note** At 80MHz and 800MHz, separation distance for higher frequency range applies.

**Note** These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[2]Separation distance according to frequency of transmitter (m).

[2] Separation distance according to frequency of transmitter (m)

# Use recommendations

This product complies with IEC 60601-1-2 standard for medical devices and with radio frequency emission requirements per CISPR11 Group 1 Class A standard limits. The NL3000 CereTom Elite system is predominantly intended for use in hospitals.

Do not use devices that intentionally transmit RF signals (cellular phones, transceivers, or radio controlled products) in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment.

Adhering to the distance separation (recommended in Table 14) between 150kHz and 2.5GHz, will reduce disturbances recorded at the image level, but may not eliminate all disturbances; however, when installed and operated as specified herein, the system will maintain its essential performance by continuing to safely acquire controlled, radiological, x-ray exposures in a mobile radiography environment. For example, a 1W mobile phone (800MHz to 2.5GHz carrier frequency) will be put 2.3 meters apart from the NL3000 CereTom Elite system (in order to avoid image interference risks).

The use of accessories, transducers, and cables, other than those specified, may result in degraded, electromagnetic compatibility of the NL3000 CereTom Elite system.

The medical staff in charge of this equipment is required to instruct technicians, patients, and other people who may be around this equipment to comply fully with the above equipment requirements.

# Installation recommendations

This system complies with above-mentioned EMC standard when used with supplied cables.

In order to minimize interference risks, the following requirements apply.

## Cable shielding and grounding

All interconnect cables to peripheral devices must be shielded and properly grounded. Use of cables not properly shielded and grounded may result in the equipment causing radio-frequency interference.

## Adjacent components and equipment

NL3000 CereTom Elite system should not be used adjacent to or stacked with other equipment; if adjacent or stacked use is necessary, the NL3000 CereTom Elite system should be tested and verified to make sure normal operation in the configuration in which it is used. Consult NeuroLogica and Facility Technical Support staff regarding device/system configurations.

### Static magnetic field limits

In order to avoid interference on the NL3000 CereTom Elite system, static-field limits from the surrounding environment are specified. Static field is specified less than <1 Gauss around the unit.

### Electrostatic discharge environment and recommendations

- In order to reduce electrostatic-discharge interference, install a charge-dissipative floor-material to avoid electrostatic charge-buildup.
- The relative humidity must be at least 30 percent.
- The dissipative material must be connected to the system ground-reference.

## Facility IT-NETWORK

The CereTom Elite system utilizes the IT-NETWORK for the customer (as applicable) to communicate with the modality worklist and for supplemental, image-storage space. As part of the installation, the applicable IT-NETWORK is reviewed to create the appropriate setup to the system. Setup is done to ensure no potential concerns arise with the system.

CAUTION It is possible that the IT-NETWORK connection from the system could result in previously unidentified issue(s) to the respective population. Should this occur, please contact Customer Service right away to identify, analyze, evaluate, and resolve the issue(s).

CAUTION It is possible that any changes to the IT-NETWORK made by the facility could introduce a new issue where Customer Service needs to be contacted to address the concern, right away.

Changes to the IT-NETWORK include – but are not limited to the following:

- Changes in network configuration
- Connection to additional items
- Disconnection to items
- Updating equipment
- Upgrading equipment

## Hazard Information

Please review this material before using the system and observe basic, common-sense safety rules when operating this scanner.

## General safety considerations and statements

Review the following before using the system and observe basic, common-sense safety rules when operating the scanner:

- Become familiar with the functional hardware to help recognize serious problems.
- Do not use scanner if it appears damaged or fails.
- Wait for qualified personnel to correct any problem.

**WARNING** The health software is installed on a medical device and is required for its operation. In order to remove the software from use, the system must be decommissioned.

**WARNING** Modification of this equipment is ***not*** allowed.

**CAUTION** All non-medical electrical equipment will comply with relevant IEC and ISO safety standards.

**CAUTION** Federal law restricts the use of this device without a prescription by a physician.

**CAUTION** Always store and/or use unit in a well-ventilated area. Keep air pollution to a minimum. Keep floor clean at all times.

**CAUTION** Do not touch parts of non-medical electrical equipment in patient environment and patient simultaneously.

**CAUTION** For disposal of any material emanating from the system; follow local regulations.

**CAUTION** This system was designed for use by individuals trained in CT system operation. The user should be familiar with this user manual before scanning patients.

**CAUTION** It is the user's responsibility to make sure that after installation or subsequent modification, the system will be in compliance with the requirements of collateral standard IEC 60601-1.

**WARNING** Installation of this product is performed in accordance with Installation Manual (1-NL3000-059). All installation processes and qualified personnel are outlined in that document.

**WARNING** Proper disposal of batteries is required to ensure compliance with environmental safety guidelines. Contact authorized NeuroLogica representative for instructions.

**WARNING** Observe safety-exposure factors and operating procedures to protect patient from physical harm during contact with this x-ray scanner.

**WARNING** Observe safety requirements to prevent excessive dose exposure to patient and/or operator.

**CAUTION** Improper system usage could endanger patients and/or users and void the warranty if not operated correctly.

**CAUTION** Should the workstation encounter a computer related virus, be sure to contact Technical Support for assistance with removing said virus from the equipment.

**CAUTION** Radiation dose exposure to patients should not exceed maximum of 1Gy CTDI.

**CAUTION** For proper disposal of material at equipment's end-of-useful life; contact NeuroLogica for instructions.

**CAUTION** Equipment in which protection against electric shock relies on basic insulation *only,* should not be used in this system.

## Laser safety

The laser itself is mounted internally to the disk assembly, which spins (as prescribed by the control panel) within the system's bore. Therefore, the laser's output light will always be aimed at, and rotating within the bore itself.

### Laser parameters

- **Wavelength** = 650nm
- **Output Power** = 1mW

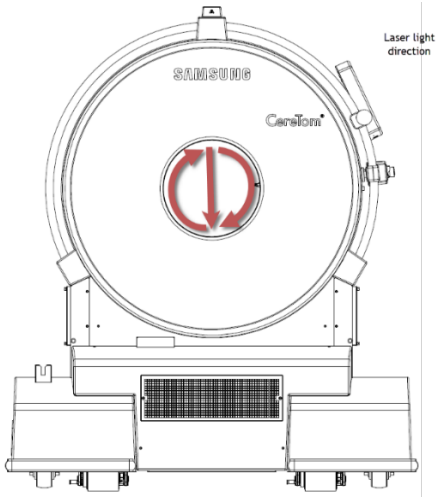



Figure 4: Laser aperture's direction

**WARNING** Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

*This statement will be a label placed on the User Interface side of the system*

**WARNING** Viewing the laser output with certain optical instruments (for example, eye loupes, magnifiers, and microscopes) within a distance of 100mm may pose an eye hazard.

**CAUTION** Instruct the patient to close his/her eyes before activating (turning **ON**) the alignment light.

**CAUTION** Closely monitor infants and infirm patients to prevent them from accidentally staring into the beam.

**CAUTION** Class 2 laser radiation when open. ***Do not*** *stare into the beam or* view directly with optical instruments.

**CAUTION** Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**CAUTION** The warning label (below, for "laser in use") is located on the front of the scanner cover and also inside the scanner to identify the presence of a laser.

## Scanner mobility safety

**CAUTION** Due to the mobility of the system, an external interlock is not available; however, a prescribed scan can, at any time, be terminated from the scanner or the workstation. When the user activates the scan, a 10-second, countdown-clock, scan delay (adjustable to 99 seconds) triggers. This countdown allows the user time to perform needed tasks before the scan begins.

**CAUTION** To prevent healthcare provider injuries, the scanner and workstation should not be moved simultaneously by a single healthcare professional. When moving the scanner about the facility, NeuroLogica recommends (in the absence of the Scanner Drive System (SDS)) that at least two people move the scanner (lengthwise, only). Be especially cautious when moving the system about an inclined floor. To prevent population injuries, a single healthcare professional ***should never*** move the scanner and workstation at the same time when the system is not connected to the SDS.

**WARNING** To prevent involuntary movement, do not position scanner on an incline while in **Transport** mode.

**WARNING** Contact Technical Support for assistance when movement is required on an incline.

**Note** Be sure there are no obstacles in front of the scanner while you move the scanner.

**CAUTION** Check to ensure proper clearance is provided to allow removal of patient from scanner in case of a power failure. This is accomplished by moving patient's support (after unlocking wheel-locks) away from scanner.

**CAUTION** To prevent patient entrapment or entanglement with accompanying equipment, slowly move scanner away from patient using the LCD (touch screen) while observing patient.

**CAUTION** Do not station or operate the system on an uneven floor. The flatness requirement is 3mm over a distance of 250mm.

**CAUTION** Prior to transporting the scanner, verify that power cord is unplugged from wall to avoid damage to cord and outlet. Verify that ethernet cable is unplugged from workstation to avoid damage to cable and connector.

### Floor level (even)

For proper operation, the system must be operated on an even, level, hard surface.

### Carpeting

***Do not*** use the system on a carpeted floor. Poor image quality could result due to unevenness of the floor.

## Electrical safety

**WARNING** The system's external AC power cord should be checked prior to use to verify there are no exposed wires or damaged insulation/prongs. Damaged prongs could result in sparking and fire. In case of such damage, contact Customer Service, immediately.

**CAUTION** Check to ensure the AC outlet is working properly before plugging in the system's AC power cord.

**WARNING** To prevent electrical shock, do not connect items that are not specified as part of the system.

**WARNING** To prevent electrical shock, do not remove the covers from the equipment. The covers protect the user and the patient from moving parts or electrical shock. Hazardous voltages are present within this equipment. The covers provide protection from radiation exposure given off from the x-ray tube. The covers also protect the equipment.

**WARNING** An electrical shock hazard: no user should apply serviceable parts; refer to qualified service personnel for any service.

**WARNING** Always electrically isolate this equipment from the main electrical supply before cleaning and disinfecting it to prevent short-circuiting or possible electrical shock.

**WARNING** Never position the mobile system in a manner that prohibits access to unplugging it or prohibits pressing the **EMERGENCY STOP** button.

**WARNING** To minimize shock hazard, the system chassis must be connected to an electrical ground. The system is grounded through the ground conductor of the supplied, three-conductor power cord. The power cord must be plugged into a three-conductor electrical outlet receptacle. Do not alter the ground connection.

**WARNING** Avoid all contact with any electrical conductor as follows:

- Allow only people who know the proper procedures and use the proper tools to install, adjust, repair, or modify the equipment.
- Only use this equipment in rooms or areas that comply with all applicable laws (or regulations having the force of law) concerning electrical safety for this type of equipment.
- The detachable cord is the disconnecting device, which is used to remove mains power from the wall socket.
- The system is internally powered.

**WARNING** For Class 1 equipment (for example, the workstation cart, AC power cord, and so on) using an alternate internal source: a warning to use the alternate source if the integrity of the protective earth conductor is in doubt.

**WARNING** Do not position the system so that it is difficult to access the AC power cord.

**CAUTION** Protect the system power cord against mechanical damage.

Where the integrity of external, protective conductor in the installation or its arrangement is in doubt, equipment is operated from its internal electrical power source.

Parts of non-medical electrical equipment in the patient environment that, after removal of covers, connectors, and so on, without the use of a tool, may be contacted by the operator during routine maintenance and calibration, will operate at a voltage not exceeding 25VAC or 60VDC or peak value supplied from a source that is separated from the supply mains in accordance by one of the methods described in IEC 60601-1.

**CAUTION** To help prevent tripping hazards, use care in the arranging of any cords (for example, AC cord, ethernet cable, and so on) when connecting to the system/workstation.

**CAUTION** To prevent damaging electrical outlet cords, check to ensure they have been removed and properly stored before transporting the scanner.

**CAUTION** All systems within the patient environment provide the same level of safety as medical equipment complying with IEC 60601-1.

**WARNING** The NL3000 CereTom Elite CT scanner contains high-voltage circuits for generating x-rays. Only trained and qualified personnel should be permitted access to the internal parts of this equipment.

**CAUTION** Use the **Universal Serial Bus** (**USB**) terminal located near the **EMERGENCY-STOP** (**E-STOP**) button for archiving to USB, *only*.

**CAUTION** For proper disposal of material at the end of the useful life of the equipment, contact NeuroLogica for instructions.

## Mechanical safety

**WARNING** In case of unwanted movement or motion, press the **EMERGENCY STOP** (**E-STOP**) button.

**WARNING** Physically assist all patients on and off the bed and into position on the scan board. Adjust the bed to the specified height for patient loading and unloading (see "Positioning the patient" on page 85).

**WARNING** When positioning the scanning platform, be careful when moving the patient support to avoid having it hit the scanner covers.

**WARNING** Position any lines (IVs and so on) attached to the patient so the lines cannot catch on the scanner during scanner travel.

**CAUTION** Prevent pinching or crushing of the patient's extremities. Keep patient's hands on the side of his/her body. Watch the patient and equipment carefully at all times during scanner movement.

**CAUTION** To prevent pinching or crushing of the operator's feet/toes, be sure extremities are not positioned under the scanner when it is being lowered from **Transport** mode to **Scan** mode.

## Radiation safety

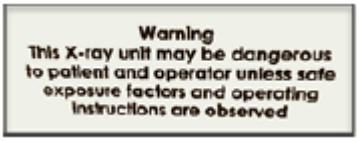



Figure 5: Dangerous to patient and operator label

**WARNING** Improperly used x-ray equipment may result in unwanted radiation exposure. Read and understand the instructions in this user manual before attempting to operate this equipment.

**CAUTION** Use technique factors prescribed by the radiologist or diagnostician. Use a dose that produces the best diagnostic results with the least x-ray exposure.

**CAUTION** All persons authorized to use the equipment must understand the dangers posed by excessive x-ray exposure. NeuroLogica recommends use of protective materials and devices.

**WARNING** Everyone having anything to do with x-ray must take adequate steps to insure protection against injury.

**CAUTION** The use of this device requires its users to receive proper training in accordance with local and national laws.

**CAUTION** ***Never*** perform calibration with patients in the scanner or while personnel are present in the vicinity of the scanner.

**CAUTION** Amber indicator lights (on the top of the scanner) illuminate during x-ray exposure.

**CAUTION** Ensure that there is no potential for detrimental interaction of the system's irradiation with a patient's active implantable medical devices and/or body-worn, active, medical devices.

X-rays can only be produced during the following conditions:

- The scanner is in the down (**Scan** mode) position.
- The **Start** button is activated.
- The workstation is connected.

## Fire and explosion safety

**DANGER** This equipment is not suitable for use in presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

**DANGER** This equipment is not suitable for use in the presence of oxygen or oxygen-enriched atmosphere.

- Fire regulation for the type of medical area being used should be fully applied, observed, and enforced. Fire extinguishers should be provided for both electrical and non-electrical fires.
- All operators of the NL3000 CereTom Elite scanner should be fully aware of and trained in the use of fire extinguishers and the firefighting equipment, and in local fire procedures.

**WARNING** Only use extinguishers on electrical or chemical fires that are specifically labeled for those purposes. Using water or other liquids on an electrical fire can lead to fatal or other serious injury.

If it is safe to do so, attempt to isolate the equipment from electrical and other supplies before attempting to fight a fire. This will reduce the risk of electrical shocks.

## EMERGENCY STOP button

**CAUTION** Check the **EMERGENCY-STOP** (**E-STOP**) button at least one time a month to ensure proper function.

**CAUTION** Every user should take a few minutes to locate the **E-STOP** before scanning the first patient.

**CAUTION** In case of emergencies, stop scanner movement immediately by pressing the **E-STOP** red push-button located on the scanner, below the LCD (touch screen).

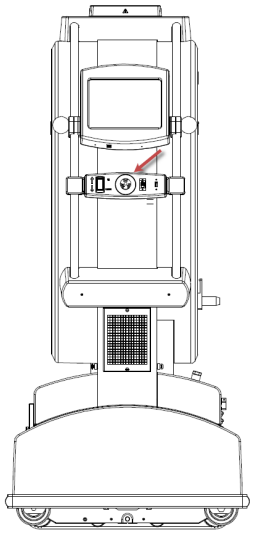


Figure 6: NL3000 CereTom Elite E-STOP locations

1. Press the **E-STOP** button to perform the following:
   - Stop system (if it loses control).
   - Stop all system motion and x-ray.
   - Remove power to the gantry drives and x-ray system.
   - If the CereTom Elite system starts to move unexpectedly.

2. Twist the **E-STOP** button clockwise until the button pops out.
   - To restore the system after pressing the **E STOP** button.
3. Make sure to resolve the situation.

| **Note** | When **E-STOP** is activated, the moving gantry may overrun by less than 10mm. |
|---|---|

## Battery safety and information

The **workstation battery capacity** status icon shows an indication of battery capacity, which is identical to the indicator on the scanner. The user should always check the indicator on the scanner to verify the batteries' status; there are four 12-volt batteries in the scanner.

CAUTION The system unit contains batteries and will always be charging when plugged into AC mains.

CAUTION In case of battery leakage, do not handle the batteries themselves nor continue to operate the system. Contact NeuroLogica for service. See "Contact information" on page 26.

### System battery capacity

The range is 0 to 100. Battery voltage and current are used to calculate the system's battery capacity based on charging (plugged in) state.

### Run time operation

During normal, run-time operation (all components, up and running), the battery capacity is being calculated one time per second. The capacity to the scanner's **Liquid Crystal Display** (**LCD**) – a touch screen – is updated at this time as well.

| **Note** | The user capacity indicator on the scanner's LCD (touch screen) is displayed in 5% increments when above 10%. When 10% and below, the displayed capacity is in 1% increments. That is, above 10% user capacity, the displayed value is always rounded to the closest multiple of 5 (for example, 93 gets rounded to 95, 42 gets rounded to 40, 47 gets rounded to 45, and so on). |
|---|---|

### State changes

After each periodic update, capacity is checked to make sure it does not fall below certain thresholds, as follows:

- Low voltage alarm state

  When **user capacity** goes below 25%, a periodic alarm will sound. It will remain in this state until the user capacity has gone back up to 27% or higher.

- Low voltage lock-out state

When the user capacity goes below 1%, the LCD (touch screen) **Main** tab's buttons are disabled and starting a scan is prohibited; for example, positioning (the ability to move the scanner) and certain protocol buttons are disabled. It will remain in this state until the user capacity has gone back up to 2% or higher. The low voltage alarm will continue to be active in this state.

### Predictive scanning

Before each scan, battery usage for that scan is predicted based on the selected load factors (for example, kV, mA, time, and so on), and is compared against the available user capacity. In the case that there is not enough user capacity to scan, a popup appears on the workstation screen. The user can cancel the scan at that time or continue the scan, with the understanding that the scan may abort due to a low-power fault.

The percentage of the tube capacity required for a scan = ((kV x mA x scan time(s))/180000) x 100%. Approximately 0.11% capacity is regained each second during cooling.

### Under voltage protection

When the **system battery voltage** drops below the low-voltage cutout-level while unplugged, a system power-down sequence is initiated (turns off various sub-components, including the internal power sources).

#### *Recovering the system*

1. Make sure the system is plugged into an operational wall outlet.

| | |
|---|---|
| **Note** | If the scanner's LCD (touch screen) does not automatically appear, use **Reset** to reboot.<br><br>You can insert a paperclip in the right pinhole (that is labeled **Reset**) to reboot the base computer. |

WARNING ***Do not*** use the left-base, power-supply pinhole under the LCD (touch screen). Pressing this will adversely affect the system.

| | |
|---|---|
| **Note** | The system will not boot up fully until the system reaches 10% charge. This can take up to 2 hours. Full charge can take up to 8 hours. |

2. If the system does not resume normal operation as the batteries recharge, there is likely a fault in the battery system; contact NeuroLogica for service.

### Workstation

**Acquisition** (on the workstation) shows an indication of battery capacity, which is identical to the above-referenced LCD (touch screen). Placing the mouse pointer over the battery icon will show the capacity of the battery, ranging from 0 to 100%. The main screen also displays an icon for when the scanner is plugged in and charging. This screen is only active if the workstation is connected to an operational scanner. The user should always check the touch screen to verify the status of the batteries.


Figure 7: Workstation battery capacity icon

| **Note** | The system screen provides a way to verify that the scanner is plugged in and charging. If the touch screen is black, the system is not charging and/or the batteries are permanently damaged. A service call is required. |
|---|---|

The battery system is designed to be replaced by authorized and trained NeuroLogica service personnel, *only*.

**CAUTION** The workstation will not report the proper battery capacity and status if a network connection is not made.

**CAUTION** The system can only be charged from a correctly rated wall outlet. A rating information plate is located on the product-marking plate (lower backside panel or lower left side panel, see Figure 8 and Figure 9).

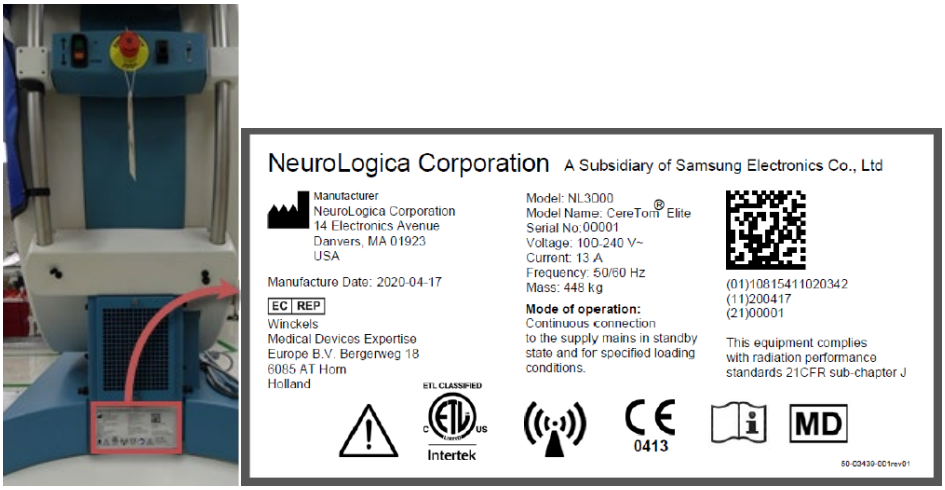
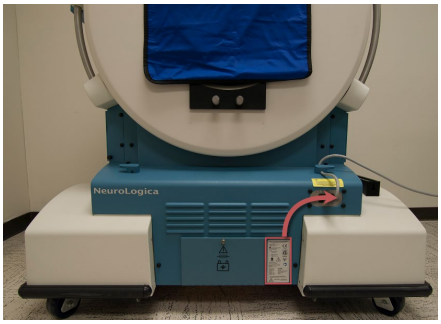



Figure 8: Product-marking plate on side of scanner



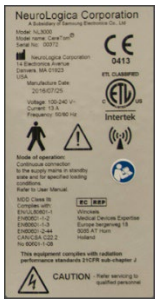




Figure 9: Product-marking plate on back of scanner

**Note** Systems manufactured on or after September 24, 2016 will have the product-marking plate shown in top left picture affixed on the system as shown in top right picture. Systems manufactured before September 24, 2016 will have the product-marking plate shown in bottom left picture affixed on the system as shown in bottom right picture.

CAUTION The system (including the workstation) should be plugged in at all times when not in **Transport** mode, being transported or in scanning use, to help maintain battery life and proper system operation. Failure to do so could result in permanent battery damage, which will require a service technician to repair.

CAUTION The system may not complete a scan when below 25% battery capacity while unplugged.

CAUTION If the system is unplugged and battery capacity reports to be 0%, permanent battery damage can occur.

CAUTION The system can be charged only from a correctly rated wall outlet.

CAUTION The power cord selection must not be less than 220v/16A, made of 2.08mm (diameter) copper wire in accordance with local power supply cable standards.

**Note** Medical grade power cords should be used at all times.

## Maintenance and service

WARNING Equipment maintenance of non-medical electrical equipment should not be performed in the patient environment.

WARNING Maintenance checks and all service must be performed by NeuroLogica trained technicians. Service personnel use Service manual (1-NL3000-062) to effectively perform needed service and preventive maintenance and inspection on the system. See "Contact information" for NeuroLogica's contact information.

WARNING The only calibration performed by the user on this system is called **daily calibration** and is described in detail later in this user manual. All other calibration needs that arise must be performed by trained technicians at NeuroLogica Corp. See "Contact information" for NeuroLogica's contact information.

CAUTION Service personnel must complete training at NeuroLogica Corp. for the system and its accessories prior to conducting any service activities.

Users are not to perform service or maintenance on the system at any time. This includes battery maintenance.

**Note** NeuroLogica recommends that a six-month preventive maintenance be conducted by NeuroLogica's service personnel/trained facility bio-engineer.

NeuroLogica recommends a semi-annual service contract.

Instructions for replacing serviceable parts are identified in the Service Manual (1-NL3000-062)

## Cleaning the system

Keep the equipment clean. Remove body fluids to prevent a health risk and damage to internal parts.

**Note** NeuroLogica recommends a solution of ⩾99% pure Isopropyl Alcohol (IPA) to sufficiently clean the equipment.

When the system is between uses, NeuroLogica recommends keeping it clean as described below.

**WARNING** Do not use flammable or potentially explosive disinfecting sprays, since resultant vapor could ignite, causing personal injury and/or damage to the equipment.

**WARNING** In order to prevent short-circuiting or possible electrical shock, do not spray cleaning agents or spill liquid cleaning agents directly onto the machine.

**WARNING** Always electrically isolate this equipment from the main electrical supply before cleaning and disinfecting it to prevent short-circuiting or possible electrical shock.

**CAUTION** The unit surfaces may be cleaned with a soft cloth and the recommended solution or a similar mild non-abrasive cleaning solution. General purpose liquid disinfectant may also be used as necessary. Apply the cleaning solution to the cloth, not directly to the unit.

**CAUTION** To help maintain good working conditions for the system, be sure to keep dust and like debris from collecting in the area. This will keep the cooling fans and filters used throughout the system free of clogging and promote optimum use of the system.

## Cybersecurity

**WARNING** Upon detection of a cybersecurity threat to the system or workstation, do the following:

- Immediately contact Technical Support.
- Discontinue use of system (enabling the **EMERGENCY-STOP** if needed).
- Remove any ethernet and/or wireless connection that has been made with the facilities' IT-network.

Continued use of the system can occur after Technical Support has assessed the siutation and provided the go-ahead to do so.

**Note** NeuroLogica Corp. recommends the customer facility utilize an IT-network that provides sufficient means of cybersecurity control to help maintain the requirements of HIPAA.

# Contraindication(s)

There are no contraindications associated with CT x-ray scanning.

# Personnel privileges and terminology

## Qualified operator

The operator (for example, technologist, radiologist, and so on) as determined by the healthcare facility and assigned by a user with administrative privileges – who by their education, certification, experience and training, are sufficiently qualified to competently perform clinical scans on the particular model of CT system which they are to use. See "Understanding the types of users" on page 91 for a description of the types of users.

## Operator of record

The operator of record is an operator or health care professional currently logged onto the CT system with a unique username and password identifier.

## Scanning privileges

Scanning privileges are granted to a qualified operator, assigned by a user with administrative privileges, to conduct clinical scans on the particular model CT system which they are to use. This privilege level allows use of all clinical protocols to properly scan the patient.

## Protocol privileges

Protocol privileges are granted to a qualified healthcare professional (for example, radiologist, technologist, physicist), as determined by the healthcare facility and assigned to users with administrative privileges, who by their education, certification, experience and training, is sufficiently qualified to competently save clinical protocols (either new or modified) on the particular model CT system they working on. A healthcare professional with protocol privileges does not necessarily have to have scanning privileges on the particular CT system.

## Administrative privileges

Administrative privileges are granted to qualified healthcare professionals (for example, radiologist, technologist, physicist, department administrator, etc.) as determined by the healthcare facility who by their education, certification, experience and training, is sufficiently qualified to competently assign, maintain, and oversee the assignments of personnel to scanning privileges and/or protocol privileges on the particular CT system which they administer. In addition, qualified healthcare professionals are authorized and qualified to pull system logs associated with this standard for quality assurance review. Healthcare professionals with administrative privileges do not necessarily have to have scanning privileges or protocol privileges on the particular CT system.

## Clinical operation

CT system operation that involves scanning live humans and/or creating or editing protocols intended for use on live humans.

## Clinical scanning

CT system operation that involves scanning of live humans.

## Clinical protocol

A protocol on the system intended for use on live humans.

# Chapter 2 System Overview

To understand general aspects of the system, this chapter gives a brief, initial overview of the parts of the system. For example, it provides basic skills for powering on and off the scanner, familiarizing yourself with the LCD (touch screen) when the scanner is on**,** as well, how to locate and use **E-STOP** and the Rocker-Switch-Lift **UP** and **DOWN** buttons that let you initiate mobility of the scanner.

After you are familiar with basic parts of the system, you can learn how to use the scanner, the workstation, and the **Scanner Drive System** (**SDS**) – if the SDS was purchased – in subsequent chapters.

| **Note** | Whether you turn on the scanner or the workstation first (see Chapter 4) does not matter; however, ***it is advised*** to power up the NL3000 CereTom Elite system hardware (first), to allow time for the scanner (hardware) to warm up. |
|---|---|

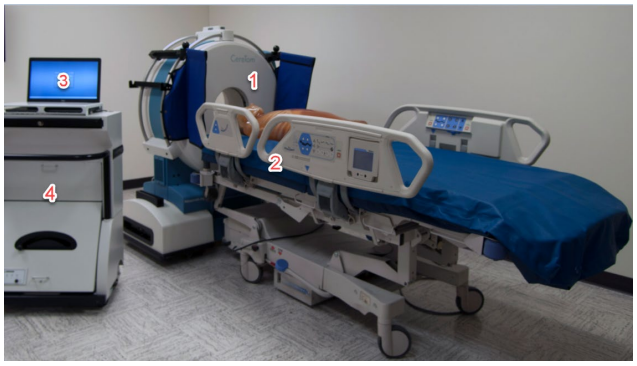
The NL3000 CereTom Elite CT system lets you scan patients in a room or ward, an **Intensive Care Unit** (**ICU**), an **Emergency Room** (**ER**), a medical satellite facility, an **Operating Room** (**OR**), and a private office or clinic.

## NL3000 CereTom Elite system

The NL300 CereTom Elite is an 8-slice, portable, battery-operated CT scanner and software system with **Axial**, **Helical**, and **Dynamic**, capabilities. It has eight rows of 1.25mm detectors in the Z axis; with each rotation, the scanner covers 10mm of anatomy. Total coverage is 640mm.

The CereTom Elite core system consists of the scanner, scan board, bed adapter, QA phantom, interface cables, lead (shielding) curtains, and the CereTom Elite workstation. Consider the following:

- The scanner and workstation communicate using a wireless connection. They also communicate using an ethernet connection, if necessary.
- The CereTom Elite workstation is a computer with custom software that allows the user to employ pre-defined system protocols or devise unique protocols for performing that user's patient studies. It also allows the user to update patient information and store images. The viewing portion of the CereTom Elite workstation allows the user to view images in more detail and includes tools to help facilitate diagnosis by a physician.
- The scanner uses a minimum, slice-thickness: 1.25mm and a maximum coverage: 640mm. The maximum scout length is 640mm.
- Scan boards are a headboard that supports the patient's head and neck while the patient undergoes a scan or study.




1 CereTom or gantry
2 Bed with patient on scan board / bed adapter near bore
3 CereTom workstation
4 Scanner Drive System (SDS)

Figure 10: CereTom Elite system configuration

# The LCD touch screen

The **Liquid Crystal Display** (**LCD**) screen is a touch screen that is located to the side of the scanner. The touch screen displays patient information, machine-positioning buttons (for a scan), and scanner-status information.

The touch screen contains two tabs that show different information, actions, options, and buttons to activate: the **Main** and **Options** tabs. The **Main** tab and the **Options** tab are blue when active. An inactive tab appears gray. To make a tab active, and to see what actions you can perform from the tab's panel, press the tab.


Figure 11: Main and Options tabs on the touch screen

The **Main** and **Options** tabs are described later in this user manual. See "Overview of the scanner's LCD touch screen" on page 72.

# The shielding curtains

The shielding curtains diminish radiation to those around the patient.

To learn more about the US and European findings regarding the scatter radiation measurements with opened or no curtains and with closed curtains, see "Scatter radiation" on page 212. To learn how to use the shielding curtains, see "Using the curtains for shielding" on page 87.

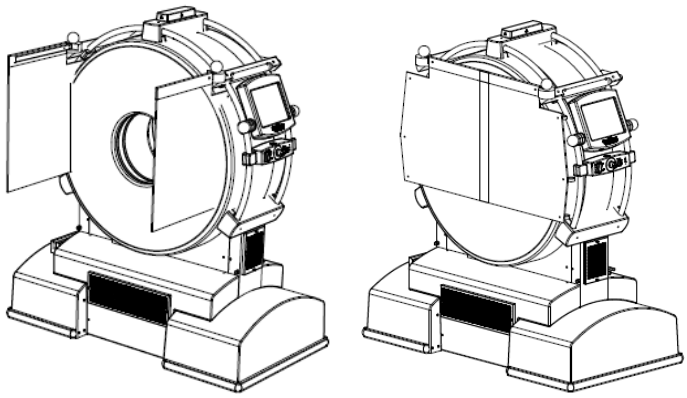


Figure 12: Shielding curtains: opened and closed

# The workstation

The workstation is an accompanying part of each scanner; it is the control unit that operates all respective functions of the system. All basic information related to the workstation (for example, operating distance, warnings and cautions, connectivity, functionality, and so on) appears in Chapter 4 .

## Laptop

Figure 13: CereTom Elite workstation

The workstation is a special laptop, set up either wirelessly or hardwired to the scanner. The hardwire setup uses an ethernet cable to connect the workstation to the scanner.

The administrator makes sure wireless is enabled when creating a wireless connection between the workstation and the scanner (with **System Configuration > Scanner Setup**, using the workstation). See "Assigning the remote support setup" on page 119.

| Note | Wireless connections can be slower than a hardwired (ethernet) setup. If an unexpected delay or disconnection (due to environmental/bandwidth interference) occurs when using wireless, it is recommended to hardwire an ethernet cable to the scanner for continued communication. |
|---|---|

CAUTION ***Do not*** connect or use equipment beyond what is specified by NeuroLogica Corp.; this practice may lead to a reduced level of system safety.

The recommended distances, provided in Figure 14, relate *only* to distances specified by IEC 60601-1 and ***do not*** relate to specific distances required for ionizing radiation and/or stray radiation protection for operators and bystanders.

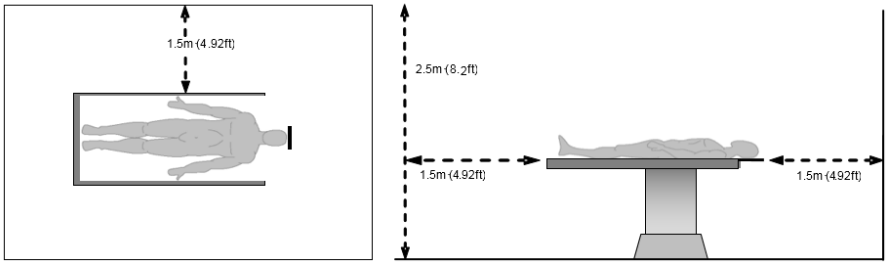



Figure 14: Workstation safe distance location (two views)

## Keyboard and mouse

The workstation comes with a keyboard and a mouse (**1** for left-mouse button; **2** right-mouse button).


Figure 15: Workstation keyboard and mouse

# Scanner Drive System

The NEU-CT-Gen III Scanner Drive System (SDS) is a self-contained, rechargeable, battery-powered, transportation system that is designed to transport the CereTom Elite x-ray CT scanner.

Figure 16: Scanner Drive System

## SDS Overview

The NEU-CT-Gen III SDS, through mechanical, pneumatic, and electrical components, gives the scanner mobility, when attached to the scanner (in the docking position to an on-site location).

You will learn later in this user manual how to dock the SDS into the scanner for mobility.

The joystick, identified earlier in this user manual, is attached to a programmable module that operates the two independent drive motors, which lets you control and drive the SDS.

CAUTION Failure to heed CAUTION warnings may cause injury to the user (administrator, or limited or restricted operator), to others, or damage to the equipment.

## SDS considerations before use and when stored

Before using the SDS, consider the following:

- If a problem is detected with the SDS, make sure repairs or adjustments have been made to the SDS ***before*** using it.
- Make sure the SDS operates easily and freely and all parts work smoothly.
- Check for excess noise, vibration, or a change in ease-of-use. Noise, vibration, or change in ease-of-use can be signs of a problem and a need for servicing.
- During scanner storage or non-use: undock the drive system ***before*** storing the CereTom Elite scanner to prevent damage to the drive wheels; failure to detach the drive unit from the scanner during extended storage time will result in flat spots on the wheels where they contact the floor.

- Store the scanner in a dry, well-ventilated, climate-controlled area. When not in use, plug the scanner into a 120V (or other compatible) outlet to charge the batteries. Make sure the scanner is locked (see "Locking and unlocking the scanner" on page 76). Store the SDS in Transport mode.
- Docking height: the docking mechanism does not automatically adjust to match the scanner and must match the scanner docking-adapter height; the height is set during installation by NeuroLogica; the mechanism should engage without forcing.

See "Chapter 14 Scanner Drive System" on page 337 for more specific information.

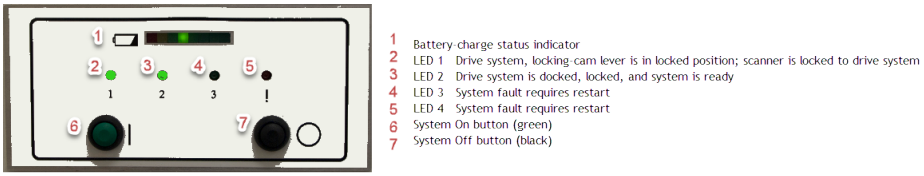



Figure 17: SDS control panel

## The joystick

The joystick, is attached to a programmable module on the scanner that operates the two independent drive motors, which lets you control and drive the **Scanner Drive System** (**SDS**). See "Joystick features" on page 339 for information on REM421 and REM35 joystick models.

Figure 18: SDS joystick

# The silhouette scan board and universal transfer board

A scan board is supplied with the system. The silhouette scan board is always used with an adapter; the universal transfer board is always used with mattress stiffeners.

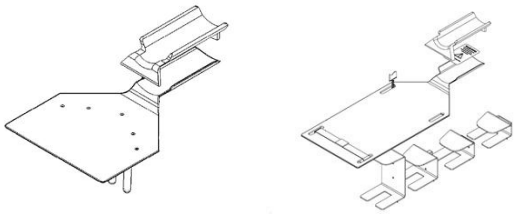


Figure 19: Silhouette scan board and universal transfer board

## Parts that potentially come into contact with the patient

While you (the operator) use the system, be mindful that the patient may come into contact with the following parts:

- The CereTom Elite system, especially the painted, external surfaces of the system's scanner covers
- Neonate scan platform
- Pediatric scan board
- Silhouette scan board
- Universal transfer board

# Chapter 3 Basic Scanner Operations

Basic scanner skills include powering on and off the scanner, learning how to use and navigate the use of the touch screen, how to use **E-STOP,** and how to use the Rocker-Switch-Lift **UP** (green) and **DOWN** (red) buttons to lift and lower the scanner.

Scanning basics you should know before you scan a patient include how your system should be setup, how to position the scanner and the patient before the scan, and how to perform a scan from the touch screen.

**Note** CT Angiography, CT Perfusion, and other optional packages may or may not be activated depending on the system.

## Powering on and off the CereTom Elite system

The CereTom Elite is not intended to turn on and off; however, if the system should lose power, ***it is advised*** to power on the CereTom Elite scanner (*first)*, to allow time for the scanner (hardware) to power up.

Consider the following:

- Make sure the scanner is properly plugged in, whenever possible; be sure the outlet(s) provides the required power.

  Plugging in the electrical cord into the wall powers on the system and charges the batteries; the batteries are the power source for what makes the scanner operational**.**

- When plugging in the scanner, make sure the cable lays flat on the floor to ensure the safety of hospital personnel. In addition, make sure that the floor behind the scanner is free of any obstructions or debris that could interfere with the centipedes during scanning.

## Overview of the scanner's LCD touch screen

The LCD touch screen appears on the side of the scanner. The touch screen lets you (the operator) set up and activate a scan; however, there are functions that are not available when scanning from the touch screen. After the patient is registered (using the workstation to register the patient), you can select a protocol from the touch screen and scan a patient. In an emergency situation, you can register a patient directly from the touch screen. See "Registering an emergency patient from the touch screen" on page 229.

Keep the following in mind ***before*** performing a scan, using the touch screen.

- **Scouts** cannot be performed from the touch screen.
- Scouts, protocols with bolus tracking, or **AEC** protocols cannot be uploaded to the scanner.

- Protocols must be uploaded to the scanner to scan from the touch screen.
- Scanning from the touch screen is not possible if **Dose Check** is enabled. See "Setting Dose Check" on page 136.
- To determine where personnel should stand during a scan, consult with the hospital physicist.

| | |
|---|---|
| **Note** | NeuroLogica recommends that an air calibration is performed every 6-8 hours. If the air freshness falls below 50%, or the scanner is moved to an area with a dramatic change in humidity or temperature, perform another air calibration to ensure optimum image quality during patient scanning. See "Performing a daily (air) calibration from the LCD touch screen" on page 190 to learn more.<br><br>If room-temperature fluctuations have occurred, you may need to perform more than one air calibrations. In addition, scanners can drift out of alignment; make sure you perform a **Quality Test** with the test phantom ***before*** scanning a patient. |

## The Main and Options tabs

The touch screen (LCD) contains two tabs: **Main** and **Options**. To make a tab active, press the tab with your finger. Each tab contains buttons, icons, text boxes, and status indicators to perform actions. There are some items that remain on both tabs: **Current Pos/Settings**, **Battery** and **Tube capacity** status, Patient information, **Lift** status, and **Daily Cal** status.

### Active and inactive buttons

In general, buttons that appear on the **Main** and **Options** tabs are active when blue. Inactive buttons are gray (or dim).

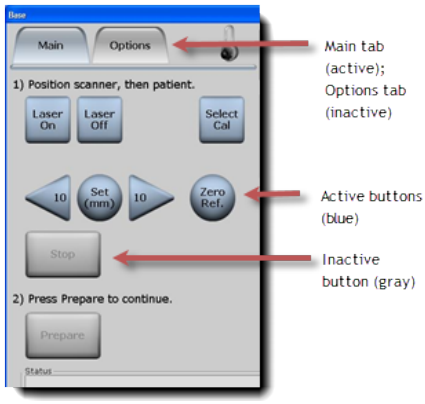



Figure 20: Button status

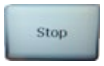
### Main tab

The **Main** tab contains various buttons, symbols, and information to perform actions; see the figure and table below for a brief overview.


Figure 21: Main tab

Table 15: Main tab buttons and actions

| Button | Description | Action |
|---|---|---|
|  | **Laser On** and **Laser Off** | Turns on and off the laser.<br>The scanner must be in **Scan** status before the **Laser On** and **Laser Off** buttons are active. |
|  | **Select Cal** | Performs a daily calibration and QA. Daily calibration is required before beginning a scan if the system has not been used within a 12 hour period. Be sure to close the lead (shielding) curtains (if fitted) before starting the daily calibration.<br>A QA is performed to verify the system's state and to perform image-quality verification.<br>See "Performing a daily (air) calibration from the LCD touch screen" on page 190.<br>See "Starting Quality Assurance from the touch screen" on page 193; "Starting Quality Assurance from the workstation" on page 196; and "Scanning from the touch screen" on page 245. |
|  | Directional arrows | Controls the movement of the scanner (in mm) in either direction and lets you determine how far the scanner will move (with the directional buttons).<br>See "Moving the scanner for manual transport" on page 81. |
|  | **Zero Ref** | Sets the scanner to zero before starting a scout or scan. |

| Button | Description | Action |
|---|---|---|
|  | **Stop** | Stops the current movement. |
|  | **Prepare** | Starts a protocol. |

## Options tab

The **Options** tab contains various buttons, icons, and information; see the figure and table below for a brief overview.

Figure 22: Options available when Dose Check is enabled and not enabled

Table 16: Options tab buttons and actions

| Button | Description | Action |
|---|---|---|
|  | **Scan Delay** | Adjusts the scan (start) countdown. |
|  | **Transfer** | Transfers a previous scan's images from the Recon computer to the workstation or the USB. |
|  | **Emergency Patient** | Registers an emergency patient to allow scanning if there is no patient registered from the workstation.<br>Dose Check cannot be enabled to see this button. |
|  | **Finalize** | Completes the current patient and clears current patient information from the scanner.<br>Dose Check cannot be enabled to see this button. |
|  | **Training Mode On** and **Off** | Toggles between having the scanner in or out of **Training** mode, which lets you use the scanner without activating the x-ray.<br>See "Using Training mode to simulate a scan for training purposes", on page 251. |

### Dialog and toggle buttons

**Dialog** buttons (see Figure 22) that include an ellipsis (three dots (...)) indicate that a popup appears after the button is pressed. For example, press the **Scan Delay**... button (**Options** tab); it displays several **scan-delay times** to select.

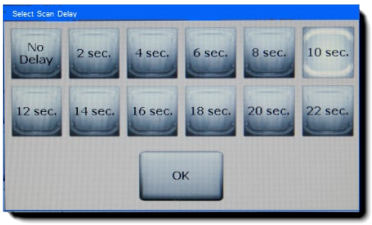



Figure 23: Select Scan Delay times popup

**Toggle** buttons are buttons that, when pressed, act one way and then when pressed again, have the opposite or different action.

### The five icons that remain constant on the Main and Options tabs

There are five icons that appear on both the **Main** and **Options** tabs in the same location: at the top-right corner of the touch screen.

Table 17: Constant icons on Main and Options tabs on touch screen

| Icon | Description |
|---|---|
|  | **Lock** mode |
|  | Machine-system state |
|  | Plugged-in status |
|  | USB-connected status |
|  | Workstation-connection status |

The inactive and active modes are pictured in Figure 24, below; inactive items are gray and active items are in color.


Figure 24: Touch screen's inactive icons (left) and active icons (right)

#### *Locking and unlocking the scanner*

You can lock the touch screen if the scanner will be unattended. Locking the touch screen removes any patient data from view.

The last scan with the relevant patient's information shows in the **Patient Information** boxes.

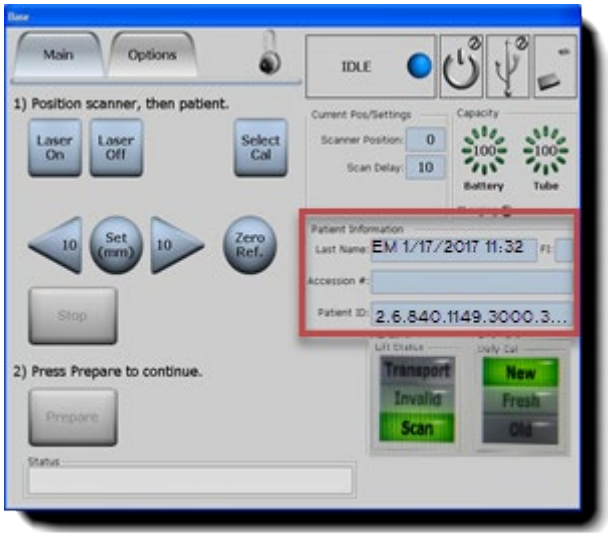



Figure 25: Patient information

1. Press the **Lock** or **Unlock** button (**Main** tab).

   The numeric keypad popup appears.


Figure 26: Numeric keypad popup

2. Enter the three digit code: 911.

   The padlock represents whether the scanner is in unlocked mode (dim) or locked mode (color).

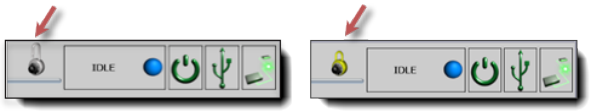



Figure 27: Unlocked and locked padlock

### *Identifying the scanner's mode*

This orb changes color depending on the state the system is in. See Table 19 to learn more about all the system states that exist and the color of the orb associated with each system state. This gives you a quick way to identify what the system may be doing.


Figure 28: Scanner's mode in Idle mode

### *Identifying if the system is plugged in or not*

If the system is plugged in, the following shows:


Figure 29: System plugged in (left) or not plugged in (right)

Check that the system plug is properly inserted in a wall socket.

### *Identifying if the system is using a USB connection*

If there is a USB connection, the following shows:


Figure 30: System USB connected or not connected

Check that the USB is properly inserted in the USB port.

### *Identifying if the workstation is connected to the scanner*

If the workstation is connected to the scanner, the following shows:


Figure 31: Workstation connected or not connected

Check that the workstation is properly connected (wirelessly or by an ethernet cable).

The administrator makes sure wireless is enabled when creating a wireless connection between the workstation and the scanner (with **System Configuration > Scanner Set U**p, through the workstation). See "Assigning the remote support setup" on page 119.

| **Note** | Wireless connections can add lag time as compared with a hardwired (ethernet) setup. If an unexpected delay or disconnection (due to environmental/bandwidth interference) occurs when using wireless, it is recommended to hardwire an ethernet cable to the scanner for continued communication. |
|---|---|

## Current Pos/Settings

The **Current Pos/ Settings** (**Pos** means **Positional**) option is shown in the figure below; which includes the scanner's position and the scan delay (the countdown (in seconds) before a scan begins).


Figure 32: Current Pos/Settings

## Capacity battery status

The **Battery** icon indicates the amount of battery-capacity (by percentage) remaining for a scan. See "Battery safety and information" on page 58. Below the **Battery** icon is the **Charging** icon, which lights up when the battery is charging.


Figure 33: Battery capacity percentage and Charging icon

### Capacity tube status

The **Tube** icon indicates the amount of tube-capacity (by percentage) remaining.


Figure 34: Tube capacity and percentage

### Patient information

The patient information that appears on the touch screen is there to help you double-check that the correct patient information will appear on the scan you perform. To learn more about how to enter patient information, see "Registering the patient" on page 223.

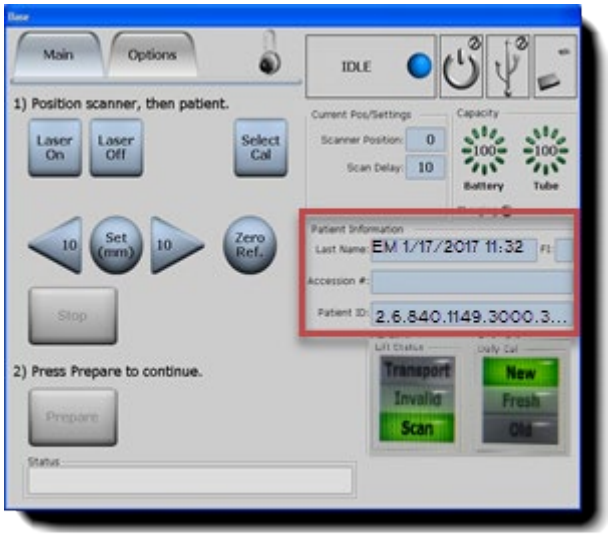



Figure 35: Patient information

### *Lift status and Daily Cal status*

The **Lift** status indicates if the scanner is in either **Transport**, **Invalid**, or **Scan** mode. The **Daily Cal** status gives the status or freshness of the daily (air) calibration: **New**, **Fresh**, or **Old**. See "Moving the scanner" on page 81 for more information on **Lift** status. See "Performing a daily (air) calibration from the LCD touch screen" on page 190.

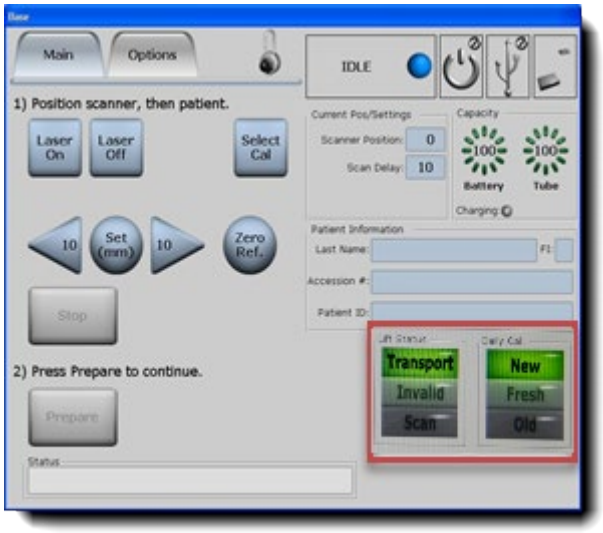



Figure 36: Lift and Daily Cal status

## Moving the scanner for manual transport

The Rocker-Switch-Lift **UP** (green) and **DOWN** (red) buttons are located on the side of the scanner, near the touch screen. These **UP** and **DOWN** buttons prepare the scanner to move up for transporting or down for positioning the scanner for scanning a patient.

1. Press and hold the Rocker-Switch-Lift **UP** button to raise the scanner for transport.

   Notice the touch screen: the **Lift Status** changes from **Scan**, up through **Invalid**, and then to **Transport** mode. When the **Lift Status** is in **Transport**, you can move the scanner, manually.

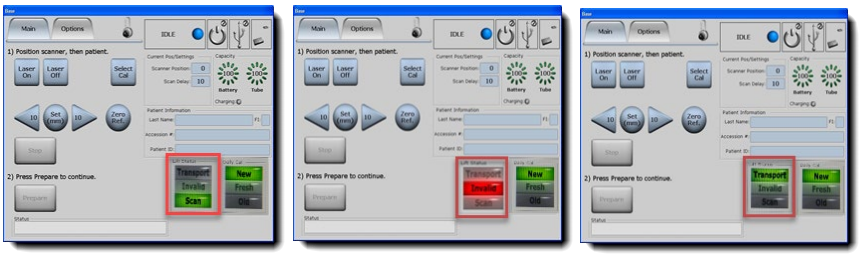


Figure 37: Lift Status: Scan, Invalid, and Transport modes

2. Manually position the CT scanner, using the double-curved handles on the sides of the device, so the back of the scanner's largest opening rests at least 1 foot (30cm) from a wall.

   The device will move away from the patient as it performs the scan.

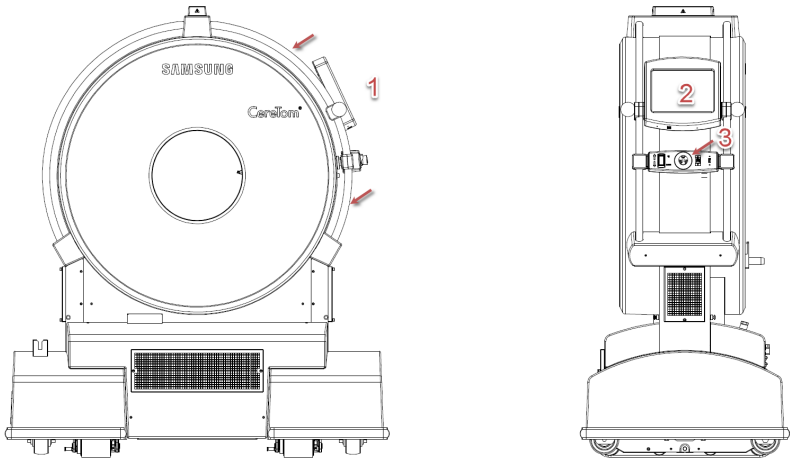



Figure 38: CereTom Elite scanner

## Positioning the scanner before a scan

1. Press and hold the Rocker-Switch-Lift **DOWN** (red) button until it lowers the scanner and reaches **Scan** status.

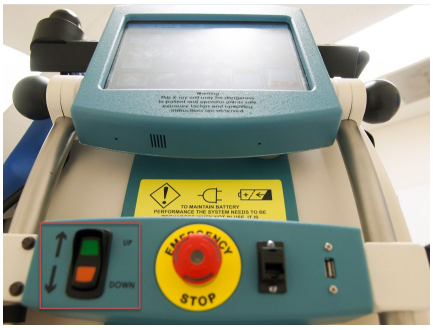



Figure 39: Rocker-Switch-Lift Up and Down buttons

Notice on the touch screen: the **Lift Status** changes from **Transport**, down through **Invalid** and then to **Scan**. Wait for the **Lift Status** to be in the **Scan** status before you begin a scan.

The 

buttons are activated.


Figure 40: Active Left and Right buttons, and Set (mm) button

2. To change the distance the scanner will move, perform the following:

   - Press 

(**Set** (**mm**)).

     A numeric keypad popup appears.

   - Enter the value to indicate how far to move the scanner forward or backward (in mm).

   - Press the 

(**Enter** button) to set the movement distance.

3. Do one of the following:

   - Press 

to electronically move the scanner forward the distance indicated (step 2).

   - Press 

to electronically move the scanner backward the distance indicated (step 2).

4. Press the 

(**Stop**) button to stop the scanner's movement.

# Positioning the scanner using the laser light

The scanner provides a rotating laser light to guide you to properly position the patient. The laser indicates the center of the scan plane. The laser light is centered on the actual x-ray beam at all times. For multi-slice protocols, this means that the laser light will indicate the middle position of all simultaneous tomograms being acquired. There is no offset between the laser light plane and the actual scan plane. The accuracy of the position of the laser plane, with respect to the scan plane, is +/- 2mm.

## To activate the laser light on the touch screen

1. Press 

(**Laser On** button) on touch screen as indicated, in Figure 41.

Figure 41: Phantom with laser light

The laser will automatically shut off, 30 seconds after pressing the **Laser On** button to activate the laser. Alternatively, you can terminate the laser by clicking the **Laser Off** button.

See the precautions regarding the laser in "Laser safety" on page 52.

2. If the patient is conscious, request the patient remain still with eyes closed throughout the entire scan.

3. If the patient is unconscious, secure the patient.

4. Follow the appropriate facility guidelines when scanning unconscious patients if the patient's eyes remain open.

**Note** If the patient becomes nauseated or is unable to be still (motionless), stop the scanner immediately using the **E-STOP** button located under the touch screen, and release the patient from the head support.

## Positioning the patient

**WARNING** Prior to scanning, properly position the patient to ensure that extremities, hair, life support equipment, and so on have sufficient clearance to prevent patient injury with the scanner itself and/or when used with accessories/options.

**WARNING** Ensure the patient support is properly positioned (height and alignment) to prevent injury during scanning.

**WARNING** Make sure the foot pedal brake on the patient support/bed is engaged to prevent it from moving during the scan.

**WARNING** ***Never*** raise or lower (using the Rocker-Switch-Lift (**UP** and **DOWN**) buttons located near the touch screen) on the scanner when a patient is positioned into the system's bore. ***Always*** slide the patient support away (by disengaging its brake) from the system ***before*** raising or lowering the system itself.

**CAUTION** The following-instructions for patient positioning should be performed in accordance with NeuroLogica Corp.'s clinical training.

| **Note** | To determine where personnel should stand during a scan, consult with the hospital physicist. NeuroLogica recommends a distance of 8-10 feet. |
|---|---|

5. Attach bed adapter to the bed.

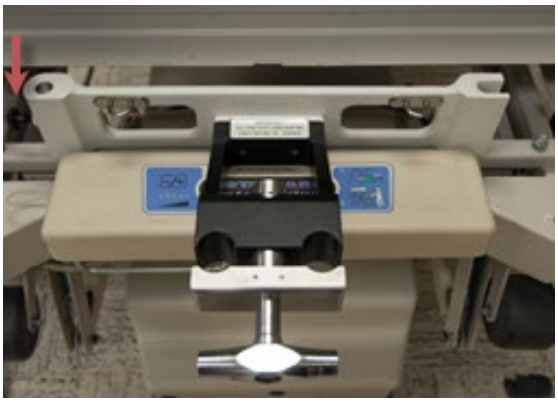


Figure 42: Bed adapter without posts insertion

6. Attach the silhouette scan board to the bed adapter.

Figure 43: Bed adapter with T-square

7. When attaching the scan board with the bed adapter to the patient's bed, insert the scan board into the adapter block.

Figure 44: Attaching the scan board with bed adapter to patient's bed

8. Position the patient until the patient's head rests on the pad of the scan board as shown below.

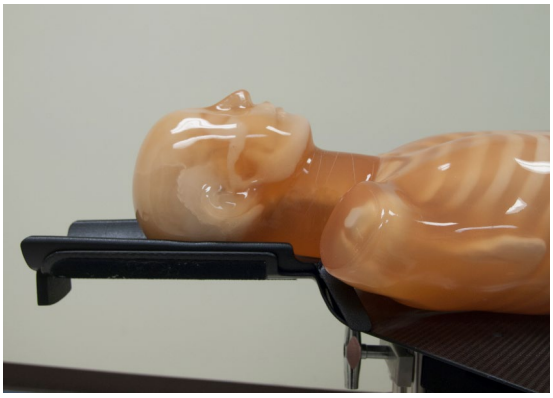


Figure 45: Positioning the patient on the bed

9. Position the patient in front of the scanner opening. The patient's shoulders should rest flat against the face of the device.

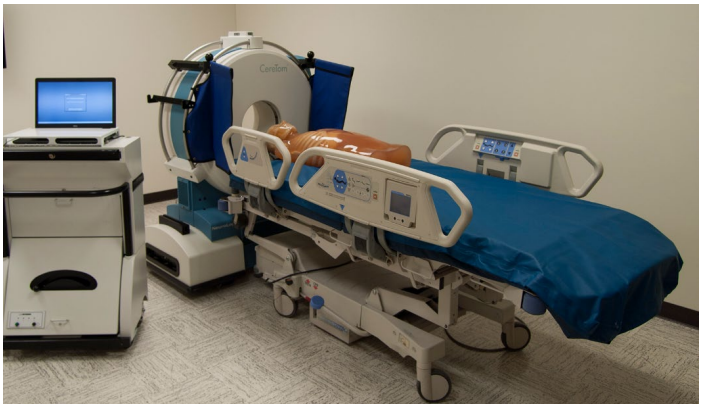


Figure 46: Positioning the scanner over the patient

10. Make sure the patient is centered in the scanner bore.

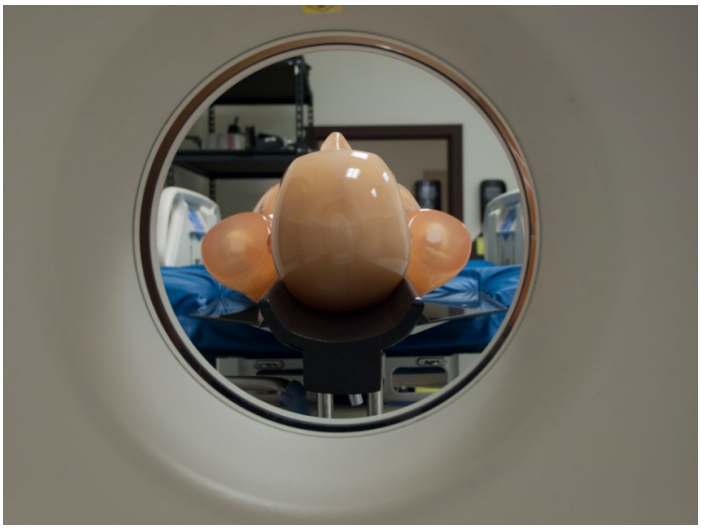


Figure 47: Ensuring placement of patient's neck directly under rotating laser light

11. Lock the gurney or bed wheels before proceeding with scan.

## Using the curtains for shielding

Using shielding curtains is recommended when performing equipment calibrations and patient scans, to ensure maximum efficiency and patient safety.

1. Unroll the back curtain ensuring that the curtains lie flat against the back of the scanner.

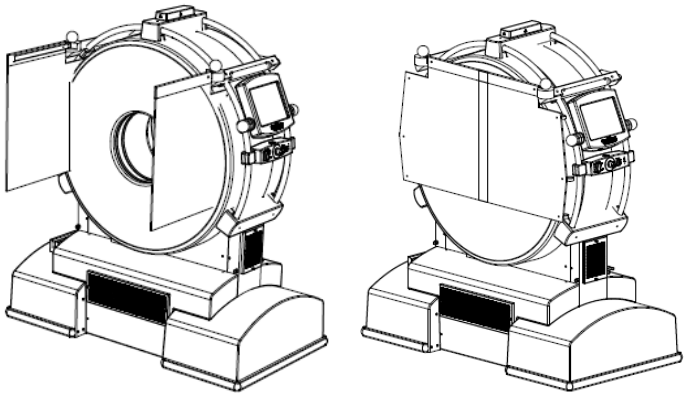


Figure 48: Shielding curtains open and then laying flat

2. Check to ensure that the patient is properly positioned and comfortable.

3. Position the front curtains, using the adjustment knobs, as close to the patient as possible to minimize the space between them.

> **Note** For calibrations, the curtains should be completely closed against the front of the scanner.

The lead (shielding) curtain minimum thickness is 0.5mm.

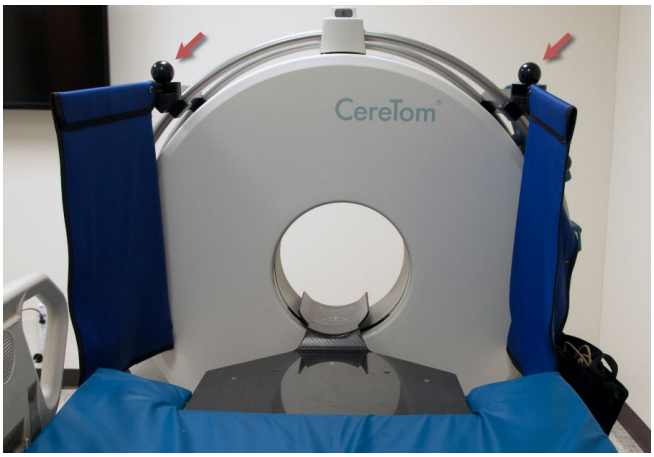



Figure 49: Shielding curtains positioned with knobs

4. Before scanning the patient, check to ensure that nothing interferes with the patient's life support or other external medical devices.

# Operating the E-STOP button

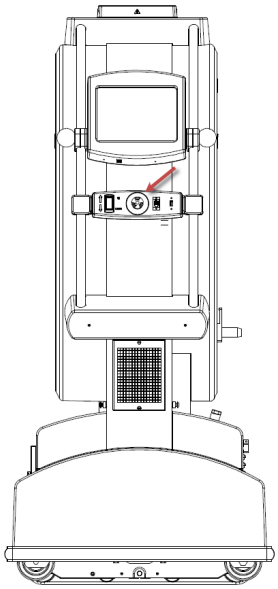


Figure 50: NL3000 CereTom Elite E-STOP location

## Using E-STOP to stop the system

1. Press the **E-STOP** button to perform the following:
   - Stop the system (for example, if it loses control).
   - Stop all system motion and x-ray.
   - Remove power to the gantry drives and x-ray system.
   - If the CereTom Elite starts to move unexpectedly.

**Note** When **E-STOP** is activated, the moving gantry may overrun by less than 10mm.

## Restoring the system with E-STOP

If you have pressed **E-STOP** to stop the system, follow these steps to restore the system, using **E-STOP.**

1. Twist the **E-STOP** button clockwise until the button pops out to restore the system.
2. Make sure any hazard is removed.

## Rebooting the system

If your scanner needs to be rebooted (for example, if it is no longer connecting with the workstation), unwind a paperclip and gently insert the clip into the **right** side (pin-hole), underneath the touch screen, to reboot the system. Look for the **Reset** label and arrow on the side of the touch screen.

| **Note** | You can insert a paperclip in the right pinhole (that is labeled **Reset**) to reboot the base computer. |
|---|---|

WARNING ***Do not*** use the left-base, power-supply pinhole under the touch screen. Pressing this will adversely affect the system.

# Chapter 4 Basic Workstation Operations

Basic workstation information includes understanding the different kinds of user access, learning how to power on and off the workstation, and getting familiar with the workstation screen, and menus and tabs.

| Note | Whether you turn on the scanner or the workstation first (see Chapter 4) does not matter; however, ***it is advised*** to power up the NL3000 CereTom Elite system hardware (first), to allow time for the scanner (hardware) to warm up. |
|---|---|

## Understanding the types of users

There are three types of users for the workstation: administrator, limited operator, and restricted operator. Each user type has a username and password; each user is tied to a specific user type. The following are the types that permit different access levels:

- **Administrator** Full access permission (rights) to the system and its configuration. Can create protocols, user names and passwords, and all functions of the system.
- **Limited operator** Modified access permission (rights); can modify protocols during system use but cannot create and save protocols; has no access to system configuration.
- **Restricted operator** No access to create, modify, save, or delete protocols; has no access to system configuration.

## Powering on and off the workstation

1. Press the **Power on** button on the workstation (laptop computer).

Figure 51: Workstation's Power on button (in this illustration, workstation mounted in SDS)

| Note | Depending on the workstation, the **Power on/off** button may not be in this location. |
|---|---|

The workstation will boot up and the **Login** popup appears.


Figure 52: Login popup

## Logging in to the workstation

To gain access to the workstation application, you must provide the system with credentials. These credentials consist of a **user identification** (**ID**) and **password**. Make sure you have a valid user ID and password before you log into the system.

If you do not have a valid user ID and password, ask your supervisor or administrator for one.

1. Enter your user ID in one of two ways:
   - Click the **User ID** dropdown list, and click the appropriate access level.


Figure 53: User ID dropdown box

   - Select the **User ID** from the dropdown.

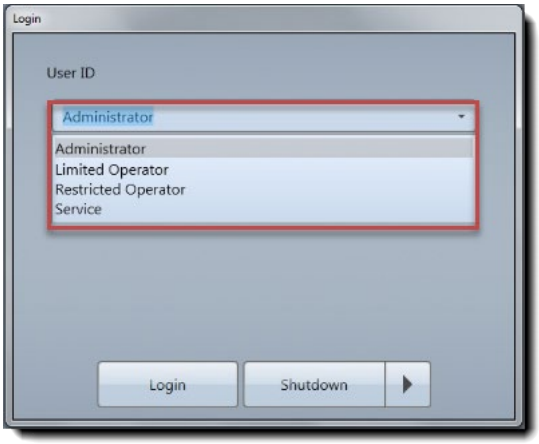



Figure 54: User ID dropdown list

2. Click in the **Password** field and enter (type) your password in the field.

   All (created) passwords must contain at least one uppercase, lowercase, numeral and symbol; the entire password must be a minimum of 8 to 12 characters. Passwords are case sensitive. Make sure to turn off the **Caps Lock** key.


Figure 55: Password text box

3. Click the **Login** button.

   If the user ID and/or password are invalid, a prompt appears to re-enter the information.

**Note** You have a limited amount of login attempts before the system locks the account. An administrator can perform unlocking the account. See "System and User Configuration and Setup" on page 107 for more details about unlocking an account.

When the user ID and password are verified, you are logged into the system.

The main screen to the workstation software appears with the **Patient Registration** tab open (active).

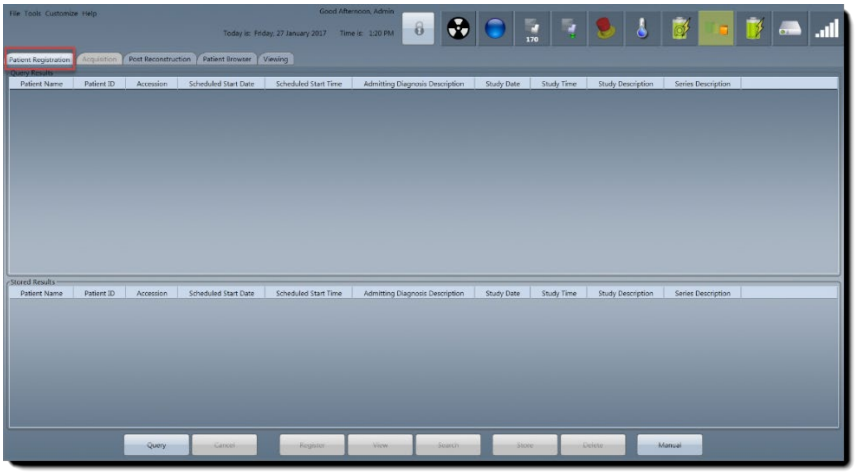


Figure 56: Patient Registration tab

4. Verify that the correct user name appears at top and center portion of the screen.

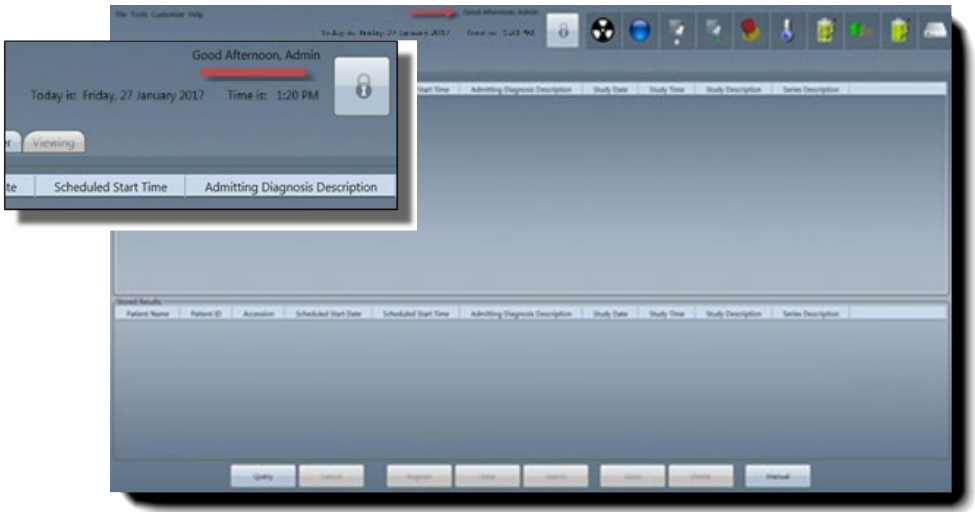



Figure 57: User name, current date, and time

If the correct user name ***does not*** appear, contact your supervisor or administrator user to verify the account.

## Locking and unlocking your workstation system

The **Lock** button indicates whether your system is in lock or unlocked mode. This button is a toggle; in other words, if the workstation is locked, the **Unlock** button shows; however, if the workstation is unlocked, the **Lock** button shows. To protect your work you can lock your workstation or you can log off.

To guard your work while you are away from the workstation computer; that is, to lock out unwanted users, you should lock your workstation if you intend to walk away for any period of time. When you lock the workstation, it remains **on**, but no one can access the workstation without your username and password.

## Using Lock to protect your work if you need to step away from the workstation

1. Click the **Lock** button located at top-and center of the workstation screen.


Figure 58: System Lock button

The **Lock/Unlock System** popup appears.


Figure 59: Lock/Unlock System popup to lock the workstation

2. Enter the user ID and password by selecting the option from the dropdown and entering information in the **Password** field.

3. Do one of the following:

   - Click the **Lock** button to lock your system.

     If you (the administrator, operator, or restricted operator) select this option, the **Lock** button changes on the workstation screen.

   - Click the **Cancel** button to return to your work.

## Using Unlock to view your work


Figure 60: Unlock button


Figure 61: Lock/Unlock System popup to unlocked the workstation

1. Click the **Unlock** button.
2. Enter the user ID and password by selecting the options from the dropdown options.
3. Do one of the following:
   - Click the **Unlock** button to lock your system.

     If you select this option the button changes to the **Lock** button.
   - Click the **Cancel** button to return to your work.

## Navigating around the workstation's main screen

The workstation screen shows similar information, regardless if the screen elements change when you perform different actions. These constant screen elements are as follows:

- **Main menu options** — Appear in the top left corner of the screen that shows the **File**, **Tools**, **Customize**, and **Help** commands.
- **User, date, and time** — Appear in the center of the screen that displays a greeting for the user, the signed-in user's name, the current date, and time.
- **Scanner and workstation status** — Appear in the top right corner of the screen that displays status information for both the scanner and workstation.

The main screen to the workstation software always opens with the **Patient Registration** tab open.

The next figure shows where to verify that the (your) correct **user name** appears at top and center portion of the screen.

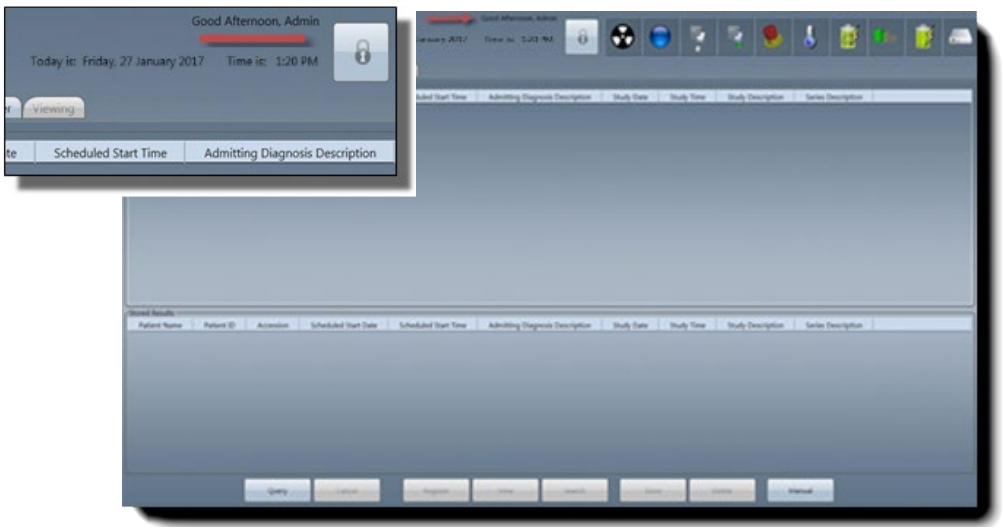



Figure 62: User name, current date, and time

# Brief overview of the main menu

The main menu provides you access to the basic functions from the commands: **File**, **Tools**, **Customize**, and **Help**.

The main menu appears on every screen and is always located in the same location, regardless of what you are doing.


Figure 63: Main menu

| **Note** | To select commands, click the first command and the subsequent commands. For example if you see **Customize > System** that means, click **Customize** from the main menu and then click **System**. |
|---|---|

## Brief overview of the File menu

When you log off, restart, or shutdown the application and/or the computer (workstation), you must use your username and password to get back in.

### Logging off the system

1. Click **File** from the main menu.


Figure 64: File menu


Figure 65: File > Log Off

2. Click **Log Off** from the dropdown to shut down the software (only) and not to shut down the workstation computer.

   The **Login** popup appears.

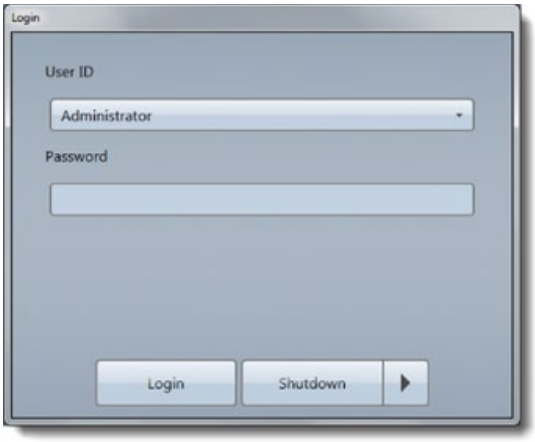



Figure 66: Login popup

   This is also the login and shutdown portal. In other words, you can login or shutdown the workstation from this popup.

3. Click the **Shutdown** button.

   The workstation application will exit the system and shut down (turn off) the workstation.

### Restarting the workstation (application) or restarting the computer

You can restart the workstation in two ways: restarting the application only (and not turning off the (laptop) computer) or restarting both the application and the workstation.

1. Click **File** from the main menu.

Figure 67: File dropdown menu

2. Perform one of the following:

   - Click **Restart Application** from the dropdown to shut down the application, only.
   - Click **Restart Computer** to shut down the application and the workstation (laptop computer).

   The following **Restart Application** or **Restart Computer** popup appears.


Figure 68: Restart Application or the Restart Computer popup

3. Perform one of the following:

   - Click the **Yes** button to restart the workstation (computer).
   - Click the **No** button to return to the screen.

## Shutting down the workstation (laptop computer)

You can restart the workstation in two ways: restarting the application only (and not turning off the (laptop) computer) or restarting both the application and the workstation.

1. Click **File** from the main menu.


Figure 69: File dropdown menu

2. Click **Shutdown Computer** from the dropdown.

   The **Shutdown Computer** popup appears.

3. Perform one of the following:

   - Click the **Yes** button to shutdown the workstation.
   - Click the **No** button to return to the screen.

## Brief overview of the Tools menu

This menu provides you with tools to store and print, set up protocols (for various actions), and test your system to ensure it is operating at optimum performance.


Figure 70: Tools dropdown menu

1. Click **Tools** from the main menu.

2. Click one of the following from the dropdown:

- **Store/Print Queue**

  The **Store/Print Queue** screen shows the operator the status of the images that are selected for archive. The screen can be configured (by the administrator) to automatically appear when selecting Archive or by using **Tools > Store/Print Queue**. You will learn more about how to store and print various media and data later in this user manual; see page 107.

- **Protocol Manager**

  Where new protocols are created, updated, deleted, and uploaded to the scanner by the administrator. You (the administrator) will learn more about how to use Protocol Manager (which gives you tools to create, update, delete and upload protocols) later in this user manual; see page 162.

- **Quality Assurance**

  The tool (a wizard) that is provided with the system to ensure the system is performing as expected. You will learn more about how to test the system to ensure the system is at its optimum performance; see page 190.

## Brief overview of the Customize menu

This menu provides you with tools to set up system and define user profiles.


Figure 71: Customize dropdown menu

1. Click **Customize** and click one of the following sub commands from the drop-down list:

- **System**

  Lets the administrator customize site-related settings; see "Chapter 5 System and User Configuration and Setup" on page 107.

| Note | You must have administrative access privileges to access system customization.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

- **User** — Lets the user customize layouts in the system as well as set the password. See "User configuration" on page 155.

## Getting Help from the Help menu

NeuroLogica Help includes an online user manual and information about the system. It also provides remote support from NeuroLogica technical support for file transfer, remote upgrades, or system review and support. When you enter a six-digit number (on the screen), technical support will take control of the system to retrieve files or review the issue in question.

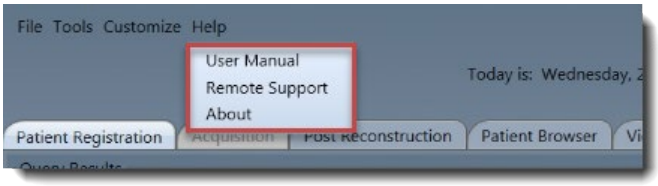



Figure 72: Help dropdown menu

### Getting an online user manual

To open a .pdf version of this user manual perform this procedure.

1. Click **Help** from the main menu.
2. Click **User Manual** from the dropdown list.

   The version of this user manual opens (in .pdf format) for an online user manual version.

### Getting remote support

1. Click **Help** from the main menu.
2. Contact NeuroLogica Technical Support.

   See "Contact information" on page 26.
3. Click **Remote Support** from the dropdown list.

   The **Support Connection** window appears.

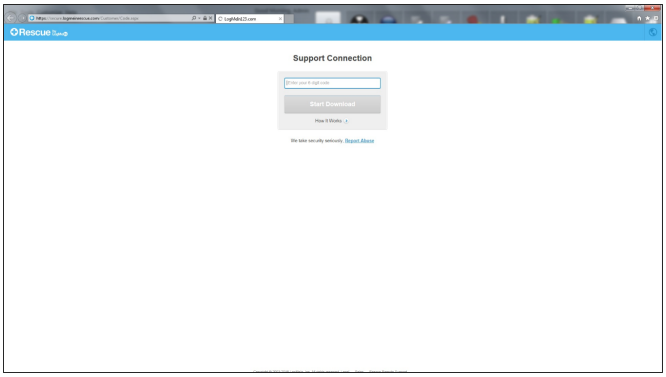



Figure 73: Support Connection browser window

When connected to **Remote Support**, a NeuroLogica Technical Support representative will supply a six-digit code to start a remote support session, which allows the support representative to review your (the user's) system and troubleshoot the issue.

## Getting information about the product and NeuroLogica

To get additional information about the product and NeuroLogica, perform these steps.

1. Click **Help** from the main menu.

2. Click **About** from the dropdown list.

   The **About Us** popup appears.


Figure 74: About Us popup

The following information is found:

| | |
|---|---|
| **Version(s)** | Identifies the current software versions for the system. |
| **Licensed To** | Identifies the information about to whom the product is licensed. |
| **Station AE Title** | Identifies the title for your workstation (for **PACS** purposes). |
| **Licensed Packages** | Identifies **Helical**, **Scout**, **Noise Reduction**, **CT Perfusion**, and **CT Angiography**. |

## Getting to know the status bar

The status bar appears in the top-right portion of the screen. The status bar gives you a quick view of what state the system is. The following identifies the status bar:

Figure 75: Scanner and workstation status bar

Table 18: Status bar identification

| Status bar icon | Status bar icon name | Status description |
|---|---|---|
|  | **X-ray status** | Identifies x-ray as on or off.<br>The icon changes from a gray/black icon (when x-ray is off) to an animated (rotating) yellow/black icon when x-ray is on. |
|  | **System state** | Identifies the current system's state.<br>The orb changes color depending on the state the system is in.<br>See Table 19, for what different orb colors mean and what different system states they identify. |
|  | **System position** | Identifies the current system's position relative to its zero reference; the position is displayed in the icon. If you hover the mouse over the icon, additional, position detail appears. |
|  | **System centipede status** | Identifies whether the scanner centipede status is engaged or disengaged for transport:<br>Green centipedes are engaged.<br>Red centipedes are disengaged. |
|  | **System E-STOP status** | Identifies (by **E-STOP** icon brightens) when **E-STOP** is engaged. The icon will flash when **E-STOP** is pressed. |

| Status bar icon | Status bar icon name | Status description |
|---|---|---|
|  | **System tube capacity status** | Identifies the system capacity; each color in the tube represents the particular capacity percentage:<br>Blue 100% - 51%<br>Yellow 50% - 15%<br>Red 14% - 0% |
|  | **Workstation battery capacity status** | Identifies the battery capacity of the workstation; each color represents the particular capacity percentage:<br>Green 100% - 21%<br>Yellow 20% - 11%<br>You will be prompted to plug the workstation into an outlet to charge if the battery capacity is low; a scan cannot complete with low battery levels at the red capacity:<br>Red 10% - 0%<br>When the workstation reaches the red capacity range, the system will shut down. A message appears to inform the limited and restricted operator that the system will shut down due to low battery capacity.<br>The lightning bolt (icon that appears on the battery) signifies that the system is currently charging and goes away when unplugged. |
|  | **System air freshness status** | Identifies the air freshness status; each colored bar represents the freshness percentage:<br>Green 100% - 51% (new)<br>Yellow 50% - 25% (fresh)<br>Orange 24% - 0% (old)<br>After calibration it returns to 100%. |
|  | **System battery capacity status** | Identifies the system's battery capacity; each color represents the capacity percentage:<br>Green 100% - 51%<br>Yellow 49% - 25%<br>Red 24% - 0%<br>The charge icon appears at the top left corner when the system is plugged into an outlet. The lightning bolt appears when the battery is being charged. |

| Status bar icon | Status bar icon name | Status description |
|---|---|---|
|  | **Workstation free disk space status** | Identifies the available (free) disk space left; each color represents the free disk-space percentage:<br>Green 100% - 51% free space<br>Yellow 50% - 20% free space<br>Red 19% - 0% free space |
|  | **Wireless signal indicator** | Identifies the wireless signal strength for the scanner to the workstation. |

The system performs numerous actions and while doing so, is in various states. The following table indicates what state the system is in and the colored orb that correlates to that state.

Table 19: System state orbs

| Orb | Color | State |
|---|---|---|
|  | Dark gray | The system is in an unknown state: not connected to the scanner; no communication is present. |
|  | Light gray | The system is powering up or down. |
|  | Dark purple | The system is busy. |
|  | Purple | The system is completing air calibration. |
|  | Light purple | The system is archiving. |
|  | Blue | The system is idle. |
|  | Green | The system is ready. |
|  | Light yellow | The system is planning. |
|  | Dark yellow | The system is preparing. |
|  | Light orange | The system is in reconstruction. |

| Orb | Color | State |
|---|---|---|
|  | Dark orange | The system is scanning. |
|  | Pink | The system is not ready. |
|  | Red | The system is in fault. |

## The Workstation tabs

To perform a patient examination, you will use the following five workstation tabs:

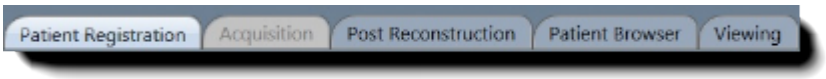



Figure 76: Workstation tabs to perform a patient examination

These five tabs include active (blue) tabs and inactive (gray) tabs, initially. The active tabs are **Patient Registration**, **Post Reconstruction**, and **Patient Browser**. The **Acquisition** tab is inactive. You may see that the **Viewing** tab is also dim. Steps must be performed to activate tabs, for example, you must register the patient (or query and identify a patient), scan the patient, and so on before you can acquire or view scans (images).

Each tab represents the following kinds of actions:

- **Patient Registration** Allows you to register a patient from hospital's database sites, for example **HIS/RIS.**
- **Acquisition** Allows you to perform the examination. This tab is inactive until the patient is registered.
- **Post Reconstruction** Allows you to manipulate the raw data in different parameters and settings after you scanned.
- **Patient Browser** Allows you to view, manipulate, and archive scans already performed.
- **Viewing** Allows you to view the patient scan. This tab is inactive until a study is loaded into Viewer.

In the following chapters, you will learn how to perform necessary steps to conduct a patient examination and learn how to manipulate and store the data you acquire.

# Chapter 5 System and User Configuration and Setup

You (the administrator) sets up the CereTom Elite system configurations for other users (limited and restricted operators). System configuration, overall, is how the CereTom Elite scanner is set up to meet site-specific needs. Most windows contain self-explanatory instructions and refer to elements that are known to you (the administrator) with radiological education and training. Additional, brief instructions are provided to you to aid in completing those sections with more detail.

Configuration includes setting up user permissions (or access privileges) to manage users, as well as servers, what appears (what is available) through settings, presets, and so on for the use of the system at a site. Many system configurations are permissible to the administrator, *only*. While other configurations are permissible to operators (users) without administrator access (or administrator permission).

**Note** You must have administrative access privileges and be logged in as an administrator to set configurations for the site.

Incorrect changes to the system configuration may make the system inoperative.

The following table shows all the **System Configuration** tabs that appear when you (the administrator) click **Customize** (from the main menu), and then click **System**. The table below defines these tabs briefly for an overall understanding of what settings are available on each tab.

Table 20: System Configuration tabs

| Tab name | Description |
|---|---|
| **General Settings** | Allows the administrator to set system configurations such as hospital name, wireless settings, and dose report settings. **General Settings** is the initial tab that is a constant tab. |
| **User Accounts** | Allows the administrator to create and edit user accounts and permissions. |
| **DICOM Servers** | Allows the administrator to set up **DICOM** servers for archiving, such as **PACS** or **HIS/RIS**. |
| **DICOM Setting** | Allows the administrator to view and configure **DICOM** tags for **HIS/RIS**, **MPPS**, and Patient, Study, Series, and Image modules. |
| **Dose Configuration** | Allows the administrator to set up dose notifications, dose alerts, and configure dose limits for specific scans. |
| **Windowing Presets** | Allows the administrator to view and modify kernel, and window and level presets. |
| **Audit Trail Viewer** | Allows the administrator to view and log all changes as well as actions in the system, which include logins, patient registrations, and series updates. |
| **Image Orientation** | Allows the administrator to view and modify how images are oriented in the system. |

# Setting user accounts

The administrator, *only*, can update another user's account, add a new user, delete a user, and lock or unlock a user's access.

1. Click **Customize** > **System** from the main menu.

   This means, click **Customize** from the main menu and then click **System** from the dropdown list.

   The **System Configuration** dialog box appears.

2. Click the **User Accounts** tab.

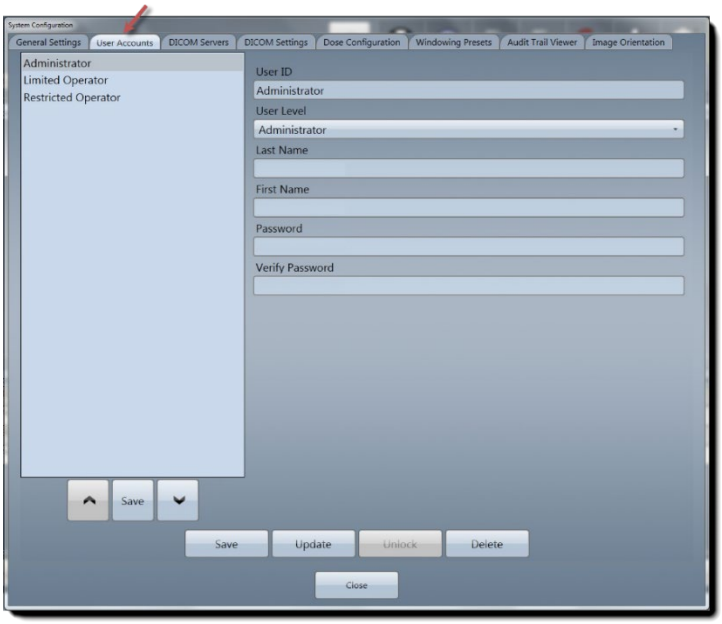



Figure 77: User Accounts tab

3. For the **User ID** field, enter the user ID name.

4. For the **User Level** field, enter one of the following user levels:

   - **Administrator** — Full access permission (rights) to the system and its configuration. Can create protocols, user names and passwords, and all functions of the system.
   - **Limited operator** — Modified access permission (rights); can modify protocols during system use but cannot create and save protocols; has no access to system configuration.
   - **Restricted operator** — No access to creating or deleting protocols; has no access to system configuration.

5. For the **Last Name** field, enter the user's last name.

6. For the **Enter First Name** field, enter the user's first name.

7. For the **Password** field, enter the user's password.

**Note** The password must contain 8 to 12 characters, and must include one number, one symbol and one letter.

8. For the **Verify Password** field, re-enter the user's password to confirm the password.

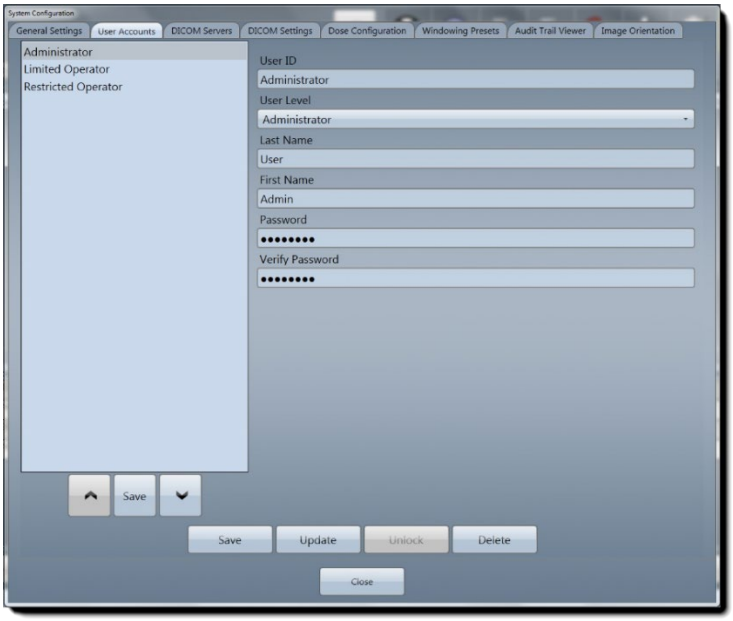



Figure 78: User account fields filled in

9. Click the **Save** button.

   The user is added to the list.

10. Click the **Close** button to exit.

## Setting or updating the user's information

1. Click **Customize > System**, from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **User Accounts** tab.

3. Select a user from the list of users.

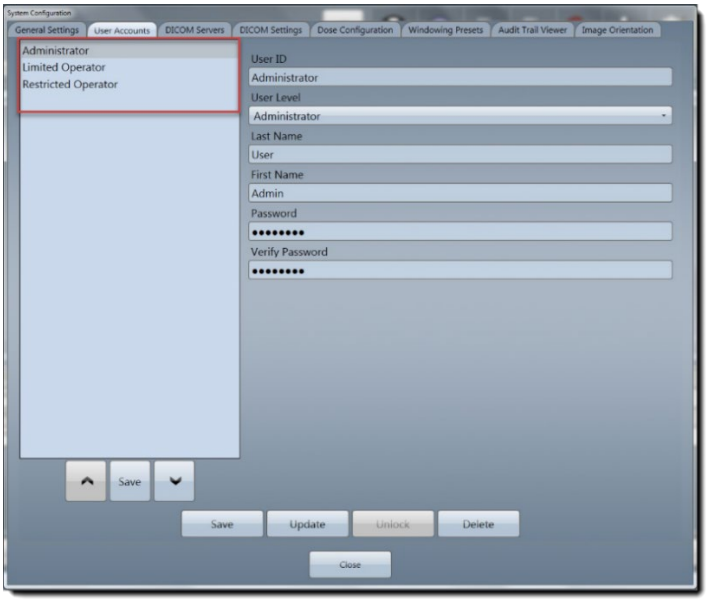



Figure 79: List of users

4. Modify the user's information; for example, password, or user's first and last name.

   The password must be 8-12 characters and include at least a letter, number, and symbol.

   The user's changes take effect after clicking the **Update** or **Save** button. It is recommended that you log off and log back on and check that the password is working.

5. Click the **Save** button to keep the change(s).

   The **Save Aborted** popup appears if your password does not meet the rule for passwords that the password include a letter, number, and symbol. If this is the case, return to the step above, and fulfill the password rule.


Figure 80: Save Aborted popup message – Password requirements

6. Click the **Close** button to exit.

## Unlocking the user

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **User Accounts** tab.

3. Select the user to unlock from the list of users in the panel.

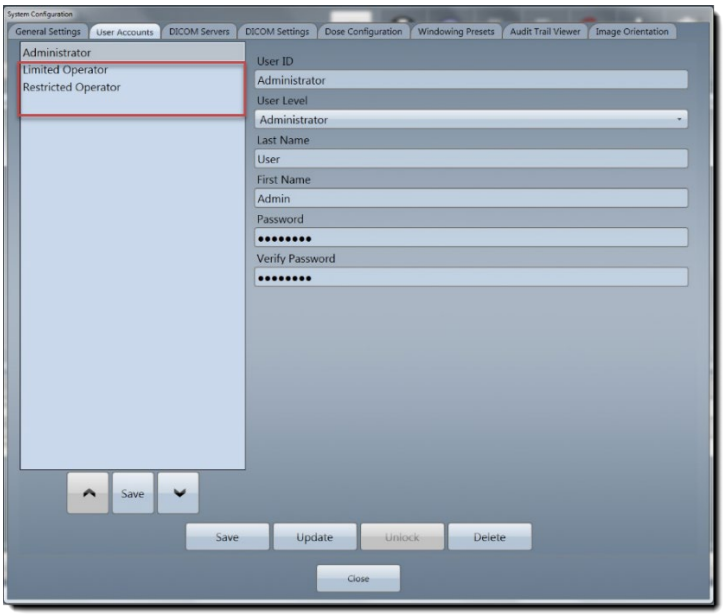



Figure 81: List of users not selected

4. Click the **Unlock** button.

   The user's changes take effect after clicking the **Update** or **Save** button. It is recommended that you log off and log back on and check that the password is working.

## Deleting the user

**Note** The administrator user cannot be deleted.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **User Accounts** tab.

3. Select the user to delete from the list of users.

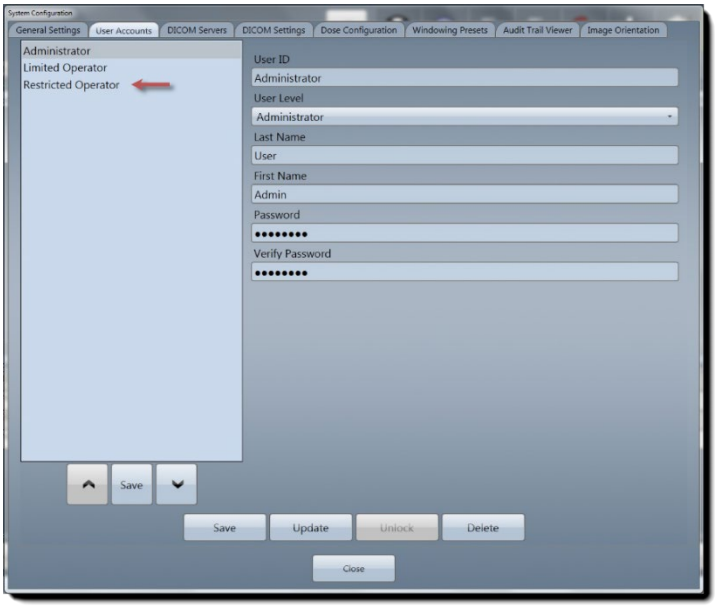



Figure 82: List of all available users

4. Click the **Delete** button.

   A confirmation popup appears, declaring that the action was successful.

5. Click the **Ok** button in the **Action Succeeded** popup.

6. Click the **Close** button to exit.

## Modifying the order of the user in the accounts list

1. Click **Customize > System**.

   The **System Configuration** dialog box appears.

2. Click the **User Accounts** tab.

3. Select the user order to modify from the list of users in the panel.

4. Click the **Down** (arrow) button to move the user down the list.

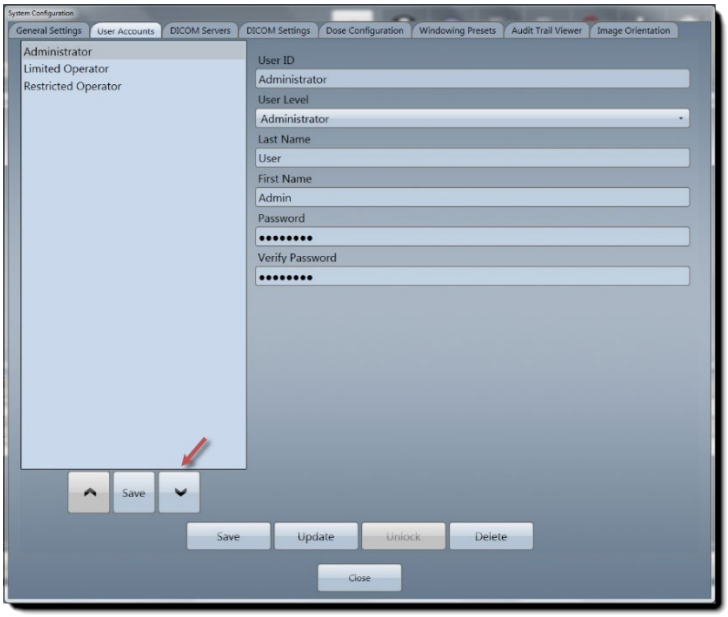



Figure 83: Down (arrow) button

5. Click the **Up** (arrow) button to move the user up the list.

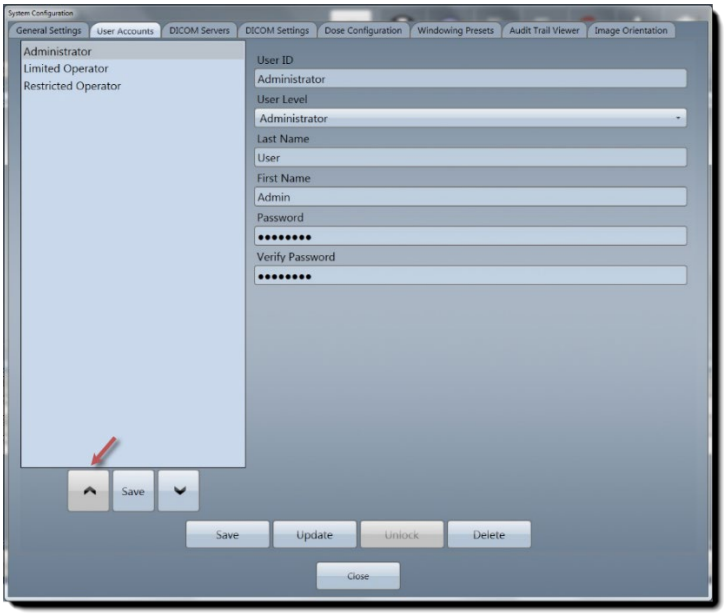



Figure 84: Up (arrow) button

The **Up** (arrow) button will not activate until you move down the list of users from the top-of-the-list.

6. Click the **Save** button to keep the new user-list order.

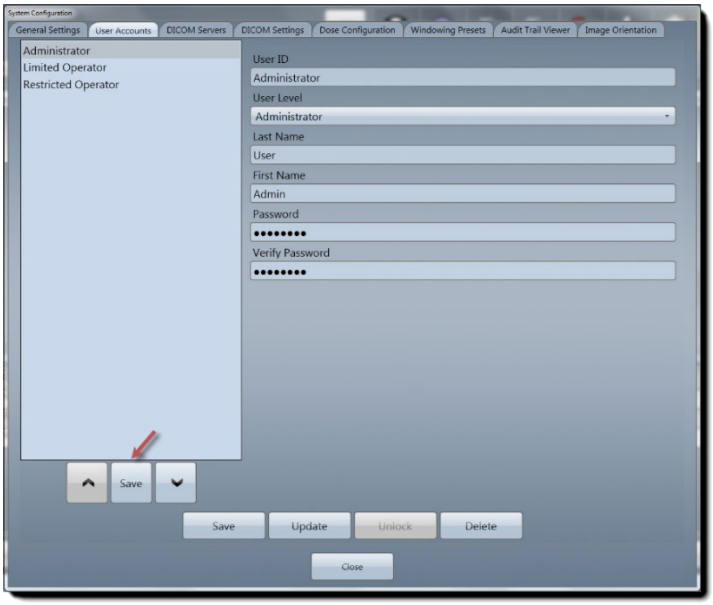



Figure 85: Save button for list order

7. Click the **Save** button next to the **Update** button to keep other changes.

8. Click the **Close** button to exit.

## Assigning general settings

Perform the following to set how the hospital, application, scanner, and remote support are configured.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

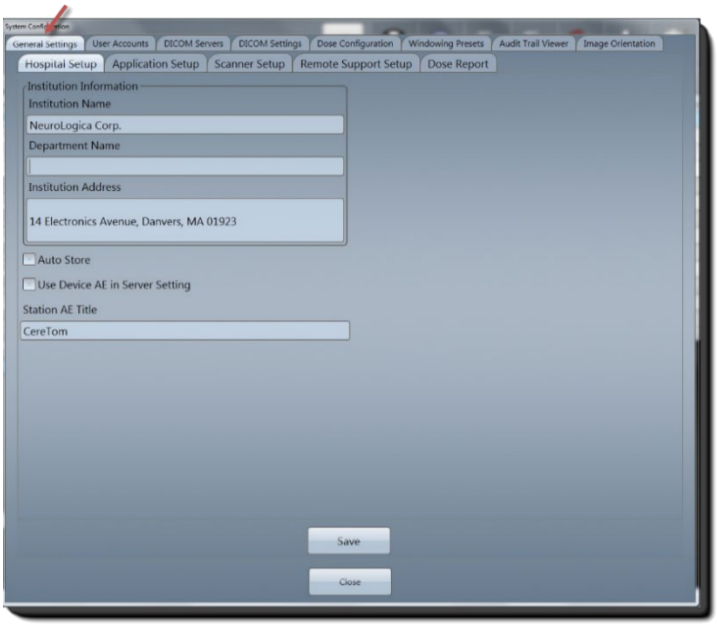



Figure 86: General Settings tab

The following tabs are available to the administrator, *only*:

- **Hospital Setup** Sets up hospital information specific to the hospital site.
- **Application Setup** Sets up the application information the user will experience, such as default protocols to pediatric.
- **Scanner Setup** Sets up scanner information that incudes IP address specific to the site.
- **Remote Support Setup** Sets up information like static IP setup and servers specific to the site.

3. Go to the sub sections, below, in this user manual, to learn about what options exist on the **General Settings** tabs.

## Assigning the hospital setup

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

3. Click the **Hospital Settings** sub tab.

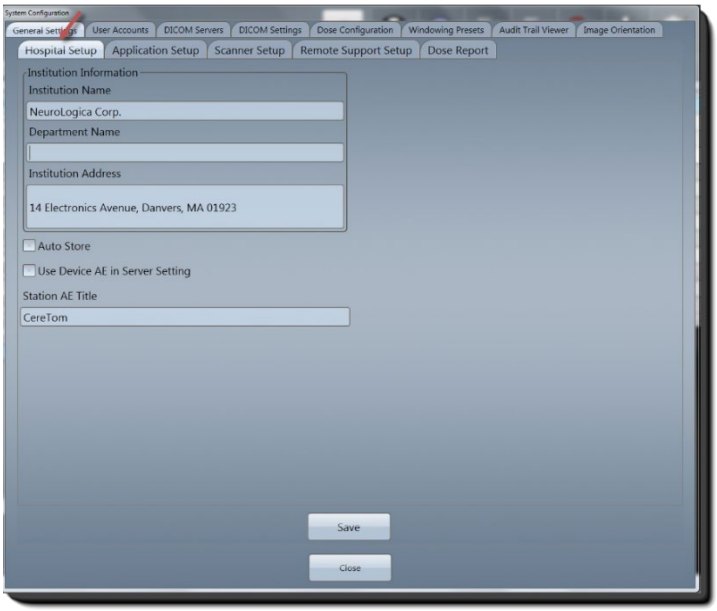



Figure 87: General Settings > Hospital Setup tab

4. Enter the institution name in the **Institution Name** field.

| **Note** | The name appears on all images. |
|---|---|

5. Enter the department name in the **Department Name** field.

6. Enter the institution address in the **Institution Address** field.

7. Click the following options that are applicable:

   - Click the **Auto Store** option that stores the **PACS** list to multiple servers; make sure **PACS** server is the default server (see **System Configuration >DICOM Servers > Servers**, and **Default Server** option).

     If **Auto Store** is selected, when you finalize an exam (scan), the system will automatically send the images to the previously defined **PACS** server(s) on the **DICOM Servers** tab. In the bottom right of the screen in **Patient Browser**, the status of your export appears.

   - Click the **Use Device AE in Server Setting** option to apply the CereTom Elite AE title tag to **DICOM** when the operator archives the image data to **PACS**.

     If enabled when sending images to **PACS**, this option will include the CereTom Elite AE setting as a **DICOM** tag.

8. Enter the system name (for example CereTom Elite) in the **Station AE Title** field.

9. Click the **Save** button to keep your changes.

   The **Save Successful** popup appears.

10. Click the **Ok** button in the **Save Successful** popup.

11. Click the **Close** button to exit.

## Assigning the application setup

1. Click **Customize** > **System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

3. Click the **Applications Setup** sub tab.

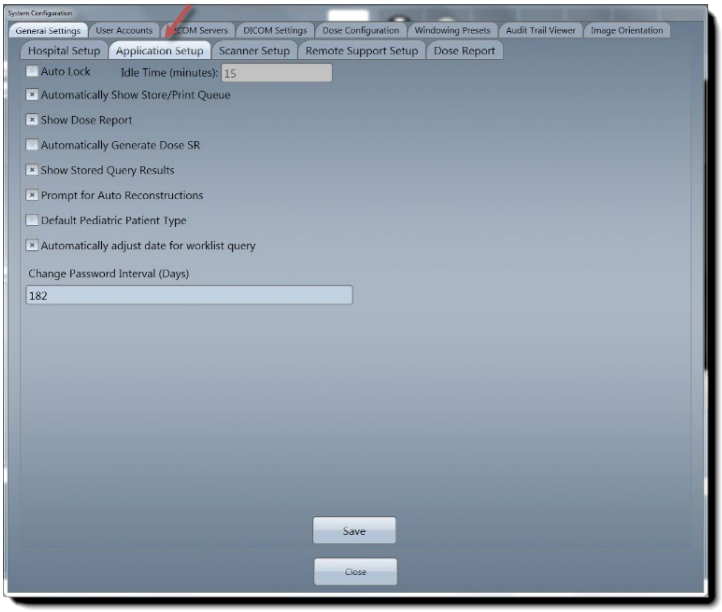



Figure 88: General Settings > Application Setup tab

4. Click and/or enter information for the following options that apply:

- **Auto Lock**

  Sets an auto lock, after the specified number of minutes of idle time set; when the idle time is reached, the workstation screen enters a locked state; the administrator sets the number of idle minutes in the **Idle Time (minutes)** text box.

- **Automatically Show Store/Print Queue**

  After selecting a series for archive, displays the **Store/Print Status** pop-up.

- **Show Dose Report**

  Displays the **dose report** on the screen when the **Finalize** button is clicked (or pressed).

  A dose report for a scan or series of scans will not be generated until the scan is complete and the operator clicks the **Finalize** button on the **Acquisition** tab.

- **Automatically Generate Dose SR**

  Generates a **Dose SR** (Structured Report) along with the dose report when the **Finalize** button is clicked (or pressed).

- **Show Stored Query Results** — Displays the **Stored Results** at the bottom of **Patient Registration**.
- **Prompt for Auto Reconstruction** — Allows the operator (user) to select whether to run the attached reconstructions or not after the exam is completed.
- **Default Pediatric Patient Type** — If selected, the **Protocol Manager** will default to the pediatric protocols instead of adult.
- **Automatically adjust date for worklist query** — Sets the query date to the current date, by default.
- **Change Password Interval (Days)** — Sets the number of days to pass before a password change is required.

5. Click the **Save** button to keep your changes.
6. Click the **Close** button to exit.

## Assigning the scanner setup

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.
3. Click the **Scanner Setup** sub tab.

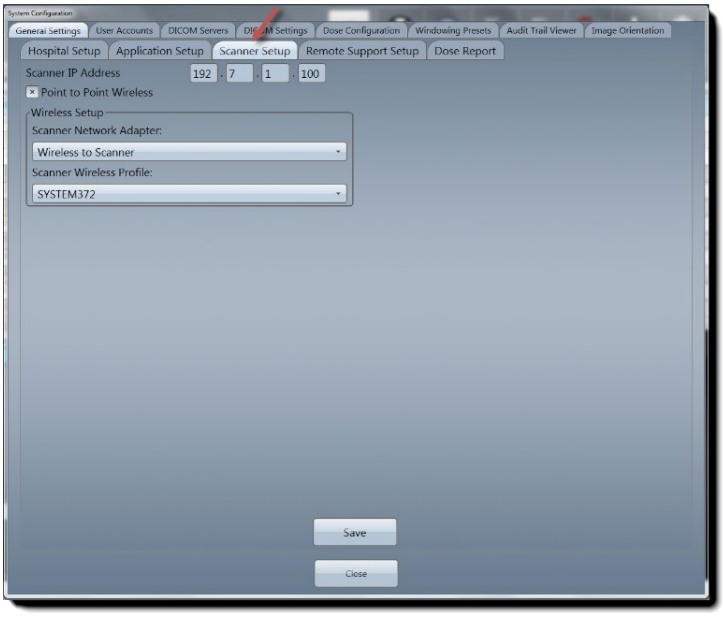



Figure 89: General Settings > Scanner Setup tab

4. Click and/or enter information for the following options that apply:
   - **Scanner IP address** — Sets the scanner's IP address in the field(s).

- **Point to Point Wireless** Sets up wireless information regarding the connection from the workstation to the scanner.
  - For **Scanner Network Adapter**, enter the adaptor, for example, Wireless to Scanner.
  - For **Scanner Wireles Profile**, enter the wireless identifier in the field.

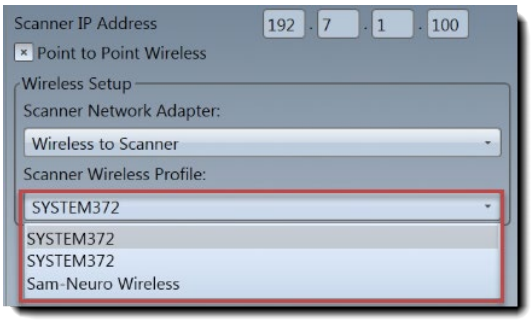



Figure 90: General Settings > Scanner Wireless Profile dropdown

5. Click the **Save** button to keep your changes.

6. Click the **Close** button to exit.

## Assigning the remote support setup

1. Click **Customize** > **System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

3. Click the **Remote Support Setup** sub tab.

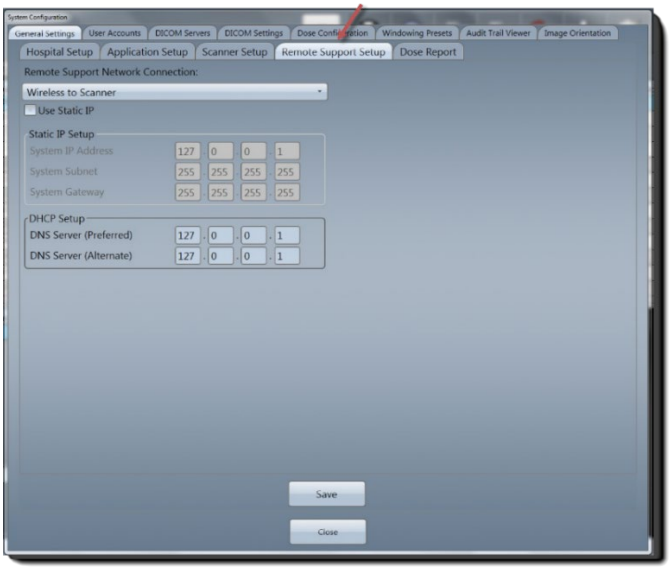



Figure 91: General Settings > Remote Support Setup tab

4. Click the **Remote Support Network Connection** dropdown to select one of the following network connections:
   - **Wireless to Scanner**
   - **Wired to Network**

5. Enter the **Static IP Setup** data for the following:
   - **System IP Address**
   - **System Subnet**
   - **System Gateway**
   - **Use Static IP**
   - **Static IP Setup**
   - **DHCP Setup**

6. Enter the **DHCP Setup** to enter IPs for the following:
   - **DNS Server (Preferred)**
   - **DNS Server (Alternate)**

7. Click the **Save** button to keep your changes.

8. Click the **Close** button to exit.

## Managing DICOM servers

**Digital Imaging Communication in Medicine** (**DICOM**) is the definition of the acronym **DICOM**. **DICOM** servers are used, in this case, to let you (the administrator) exchange (import and export) data. The **System Configuration** tab information lets the administrator access all connected server data created in the system.

See **DICOM** standards on the **NEMA.org website** for a full description of settings (and actions) that are available.

| **Note** | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

**DICOM** servers are set up by the **field service engineer** and the appropriate IT person at the hospital

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

3. Click the **DICOM Servers** tab.

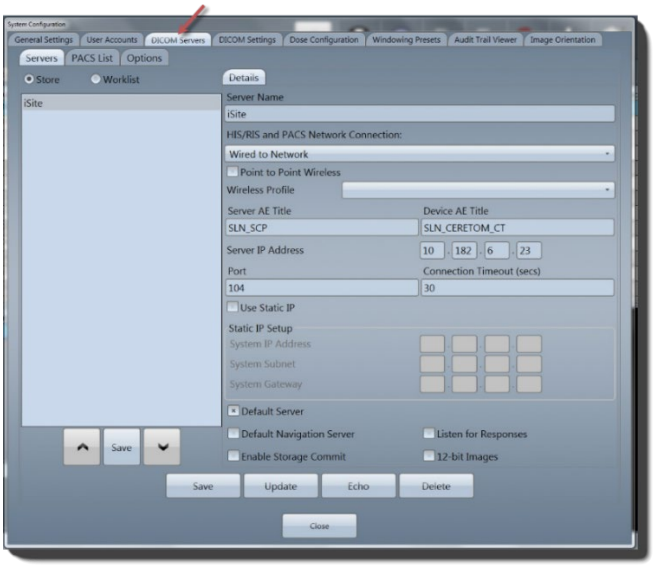



Figure 92: DICOM Servers tab

The three following tabs appear:

- **Servers** — Lists existing servers based on type: **Store** or **Worklist**. Also displays server details and options, with controls for saving, updating, deleting, and echoing servers.
  - **Store** — Identifies a storage server.
  - **Worklist** — Identifies servers in a database you can query from.
- **PACS List** — Displays a list of **PACS** by server name, type, and In List – to send to by default (for archiving purposes).
- **Options** — Displays controls for **PACS Options** and **HIS/RIS Options**.

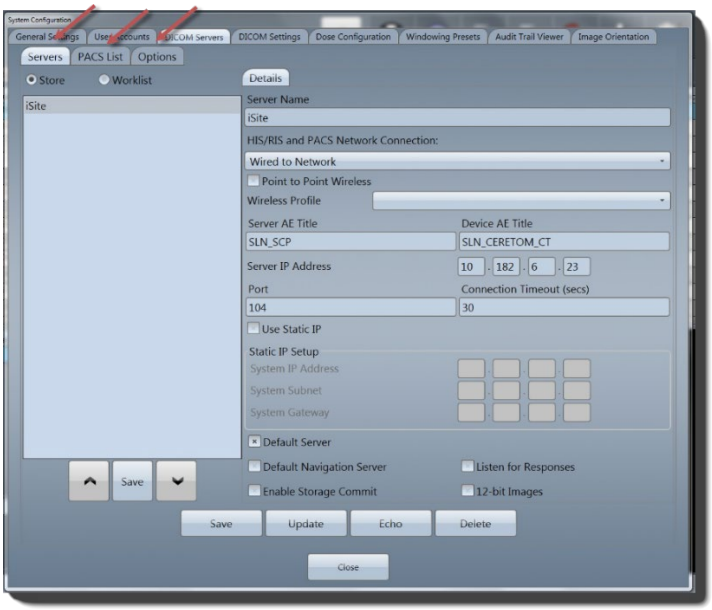


Figure 93: DICOM Servers tabs

4. Go to the following sections to assign specific actions to the **DICOM** server.

## Assigning a server as a store or worklist server

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

   The **Servers** tab is active.

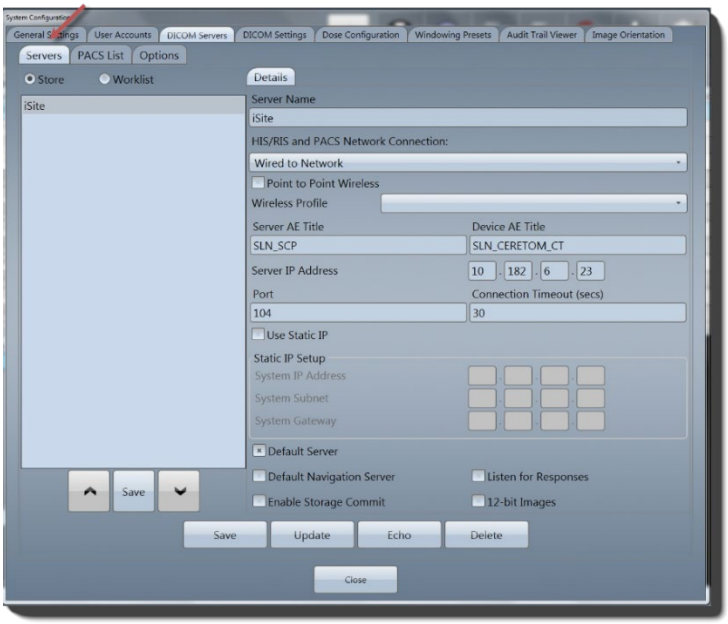



Figure 94: DICOM Servers > Servers tabs

3. Click one of the following options:

   - **Store** — A storage server, typically a **PACS** server that archives images and patient information for storage purposes. It is partly a backup and partly a waypoint for transferring data from the system the scans were acquired on to another system for viewing.
   - **Worklist** — A database of patient information that is able to be queried to generate a list of patients based on name, modality, procedure date, and other variables. These patients are usually hosted on a server within the facility and the information can be pulled from the server when trying to acquire all of a patient's information before a procedure is run. This eliminates the need to manually enter patient information at the time of the procedure.

4. Under **Details**, enter the server name in the **Server Name** text box.

5. For the **HIS/RIS** and **PACS Network Connection**, click the dropdown to identify the following:

- **Wireless to Scanner**
- **Wired to Network**

6. Click the **Point to Point Wireless** check box, if it applies.
7. Click the **Wireless Profile** dropdown to select the appropriate profile.
8. In the **Server AE Title** text box, enter the server AE title.
9. In the **Device AE Title** text box, enter the CereTom Elite AE title.
10. In the **Server IP Address** text boxes, enter the server IP address.
11. In the **Port** text box, enter the port identifier.
12. In the **Connection Timeout (secs)** text box, enter the number of seconds before the connection timeout is activated.
13. Click the **Use Static IP** option to identify the following:
    - **System IP Address**
    - **System Subnet**
    - **System Gateway**
14. To set the server as a default server, click the **Default Server** check box.
15. To set the server as the default surgical navigation server, click the **Default Navigation** check box.
16. To enable the storage commitment, click the **Enable Storage Commit** check box to send a message back to system that confirms the storage was successful; it is an extra confirmation from **PACS** that the images were received.
17. To gather responses, click the **Listen for Responses** check box.

    For every image that is sent, the system will wait for acknowledgement before sending the next image.
18. To gather 12-bit images, click the **12-bit Images** check box.
19. Click the **Save** button, to keep your work.

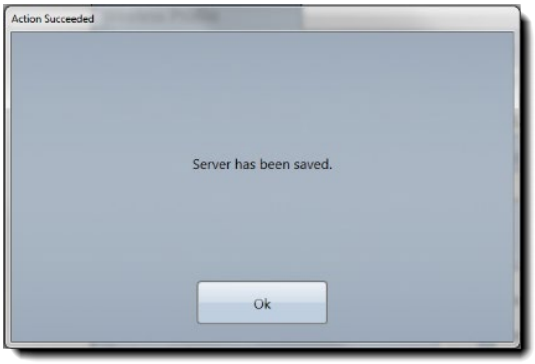



Figure 95: Action Succeeded popup message – Server saved

The new server should appear in list box to the left.

20. Click the **Ok** button.

21. Click the **Close** button to exit.

## Modifying a server

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click server type: **Store** or **Worklist**.

4. Select a server from the list.

5. Modify the parameters.

   See "Assigning a server as a store or worklist server" on page 122.

6. When all your changes are made, click the **Update** button.

   A message appears that explains the update was successful and includes the update(s).

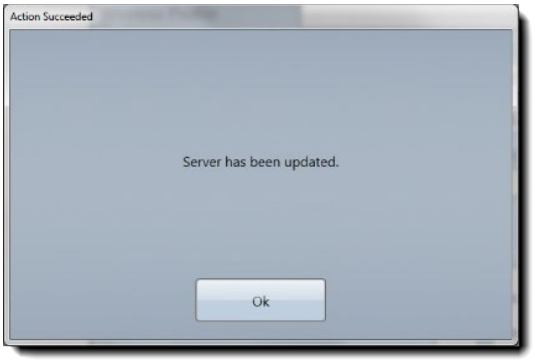



Figure 96: Action Succeeded popup message – Server updated

7. Click the **Ok** button.

8. Click the **Close** button to exit.

## Echoing a server

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click a server type: **Store** or **Worklist**.

4. Select the server to echo from the list.

5. Click the **Echo** button.

   The status of the server (popup message) appears.


Figure 97: Echo Successful and Echo Failed popup messages

6. Click the **Ok** button.

   If the echo was unsuccessful, determine why and repeat step 5 until you are successful.

7. Click the **Close** button to exit.

## Deleting a server

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click a server type: **Store** or **Worklist**.

4. When the server you want to remove is available, click the server from this list.

5. Click the **Delete** button.

   The server is removed from the list; the **Action Succeeded** popup appears.

6. Click the **Ok** button.

7. Click the **Close** button to exit.

## Moving a server up and down the server list

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click a server type: **Store** or **Worklist**.

4. Select the server to move up or down the list.

5. Click the **Up** (arrow) button to move the server up the list; click the **Down** (arrow) button to move the server down the list.

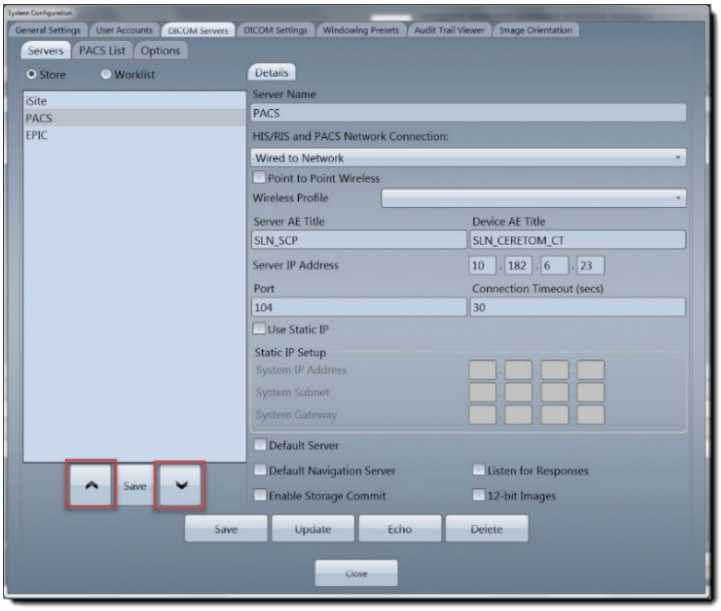



Figure 98: Up and Down (arrow) buttons to move up and down server list

6. Click the **Save** button to save the server order.

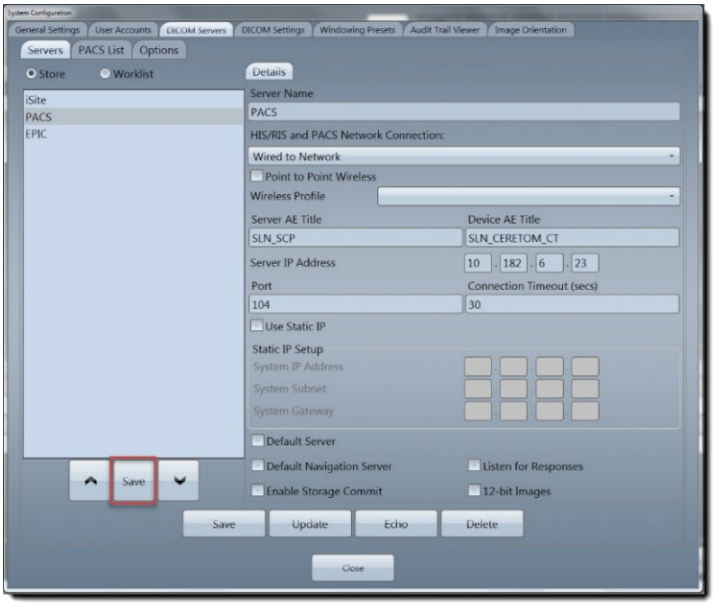



Figure 99: Save button

The **Action Succeeded** popup appears.

7. Click the **Ok** button.

8. Click the **Close** button to exit.

## Saving DICOM servers to a PACS list

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click the **PACS List** tab to view available servers.

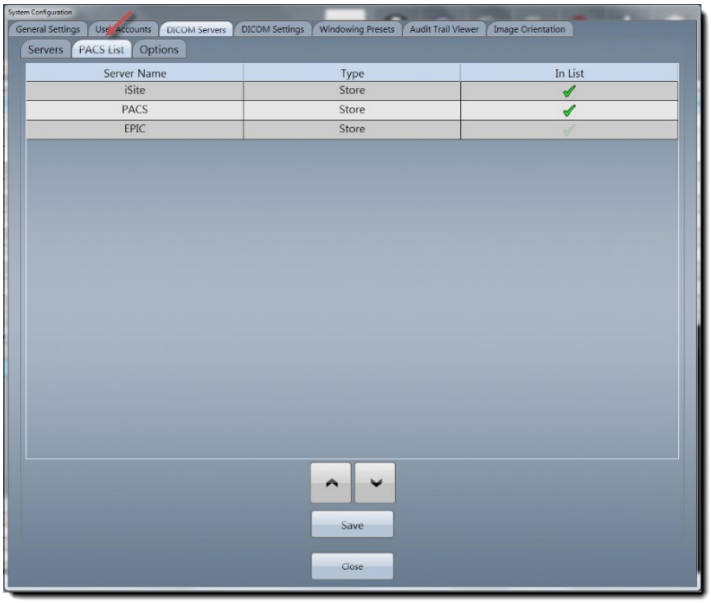



Figure 100: DICOM Servers > PACS List tab

4. Double-click the light-gray checkmark under **In List**.

   Each checkmark adds the server to the **PACS** listing. The checkmark turns green when active.

5. Click the **Save** button.

   The **PACS List Saved** popup appears.

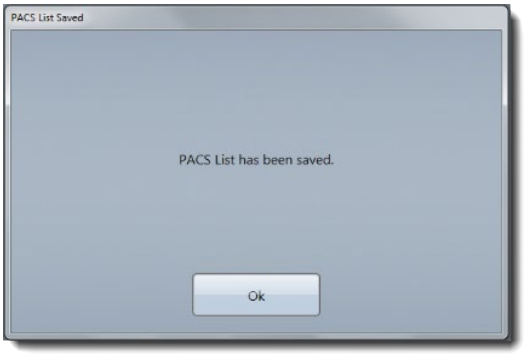



Figure 101: PACS List Saved popup message – PACS saved

6. Click the **Ok** button.

7. Click the **Close** button to exit.

## Selecting PACS options

**PACS** is **Picture Archiving and Communication System.**

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Servers** tab.

3. Click the **Options** tab.

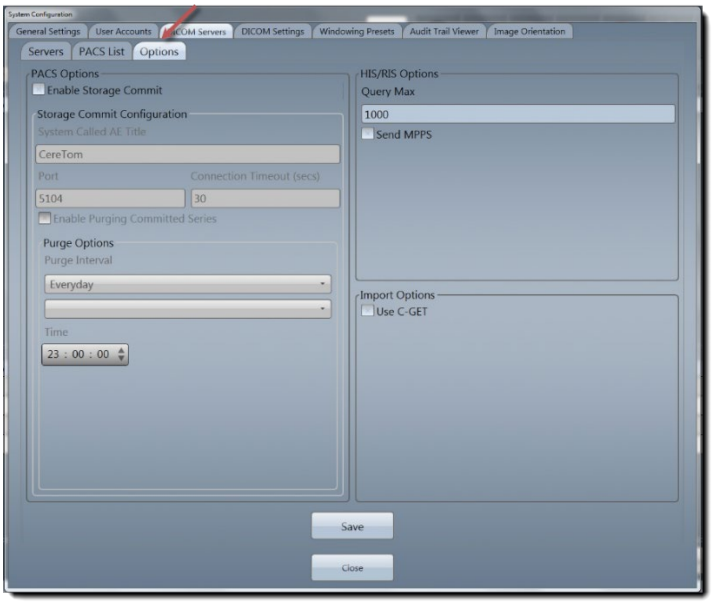



Figure 102: DICOM Servers > Options tab

4. Under **PACS Options**, click the **Enable Storage Commit** to verify that patient information and data archived to the **PACS** server was received.

   - If **Enable Storage Commit** is not selected, it is assumed and accepted that the data was received. No check is made; skip to step 6.
   - If **Enable Storage Commit** is selected, the workstation sends a request to the **PACS** server to verify that the data was received.

5. If the **Enable Storage Commit** check box is selected, perform the following:

   - Enter the appropriate title in the **System Called AE Title** text box.
   - Enter the port identifier in the **Port** text box.
   - Enter the number of seconds before a connection timeout in the **Connection Timeout (secs)** text box.

     Enter 30 seconds or 60 seconds.

6. Under **Purge Options**, make selections based on the understanding that any studies archived to the **PACS** server are deleted from the workstation on a regular basis, depending on the selected interval; identify the following:

   - **Purge Interval** — Selects one of the following from the dropdown: **Everyday**, **Weekly**, or **Monthly.**

     When you select the first **Purge Interval** dropdown and select **Weekly** or **Monthly**, the inactive dropdown is active to let you select the day of the week or the first of the month.

- **Time** Changes the hour, minute, and second interval; Use the buttons to increase those time elements.

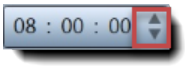



Figure 103: Time (increase and decrease time) arrows

7. Under the **HIS/RIS Options**, enter the maximum number of results sent back from a query worklist in the **Query Max** text box.

   There is no maximum limit.

8. Click the **Send MPPS** check box to apply a service that allows a modality to better coordinate with image storage servers by giving the server a list of objects to send before or while actually sending such objects.

9. Under **Import Options**, click the **Use C-GET** check box to pull information from a **PACS** server when importing ***from*** the server (as opposed to archiving to it).

   The administrator sets this to pull from **PACS** from anywhere, so the machine does not have to be set up as a reliable destination on the **PACS** machine. (**PACS**, typically needs to equate a computer's IP address with an AE Title; however, **C-GET** accepts that the calling IP is a legitimate device.)

   The NeuroLogica CereTom Elite scanner automatically uses **C-Move** (**DICOM** operation) when importing from **PACS**. If the operator wants to use **C-GET** instead, the user can select **C-Get** (**DICOM** operation).

10. Click the **Save** button.

    The **PACS List Saved** popup appears.

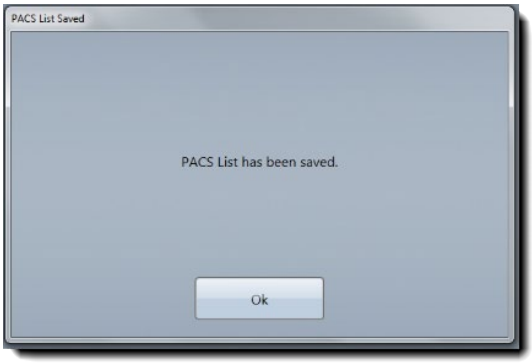



Figure 104: PACS List Saved popup

11. Click the **Ok** button.

12. Click the **Close** button to exit.

# Assigning DICOM settings

**DICOM** settings include many different kinds of settings. The administrator can add or remove optional information to be displayed using actions described in this section.

See **DICOM** standards on the **NEMA.org** website for a full list and description of **DICOM** tags.

| **Note** | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **DICOM Settings** tab.

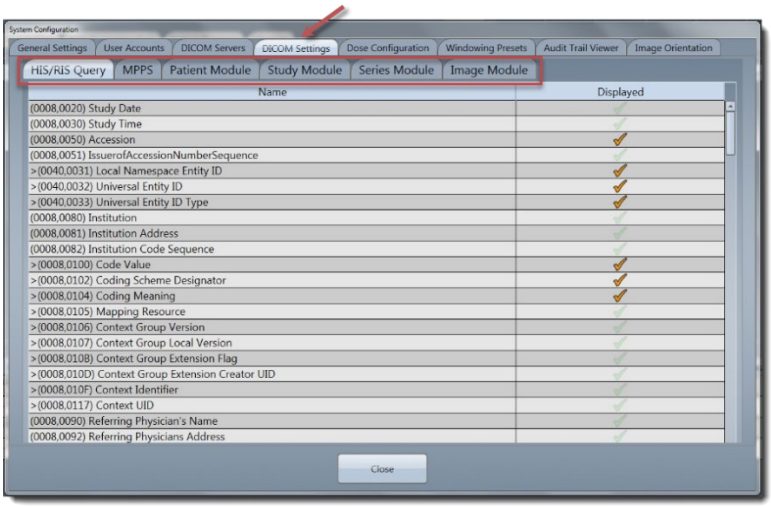



Figure 105: DICOM Settings tabs (six)

3. Click the **HIS/RIS Query** tab to apply what tabs (and kinds of **HIS/RIS** query information) the operator (user) will see.

   See "Selecting PACS options" and go to step 6, for more information.

| **Note** | Even numbered **DICOM** tags are public **DICOM** tags as per the **DICOM** standard. Odd numbered **DICOM** tags are vendor specific.<br><br>Green checkmarks are 'optional' **DICOM** tags and orange checkmarks are 'required' per the **DICOM** standard, and cannot be modified. |
|---|---|

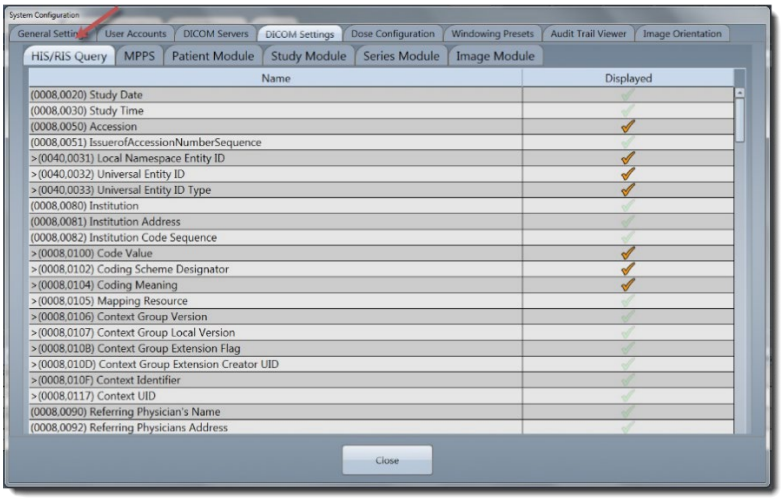



Figure 106: DICOM Settings > HIS/RIS Query

4. Click the **MPPS** tab to apply what tabs (and kinds of **Modality Performed Procedure Step** (**MPPS**) information) the operator (user) will see.

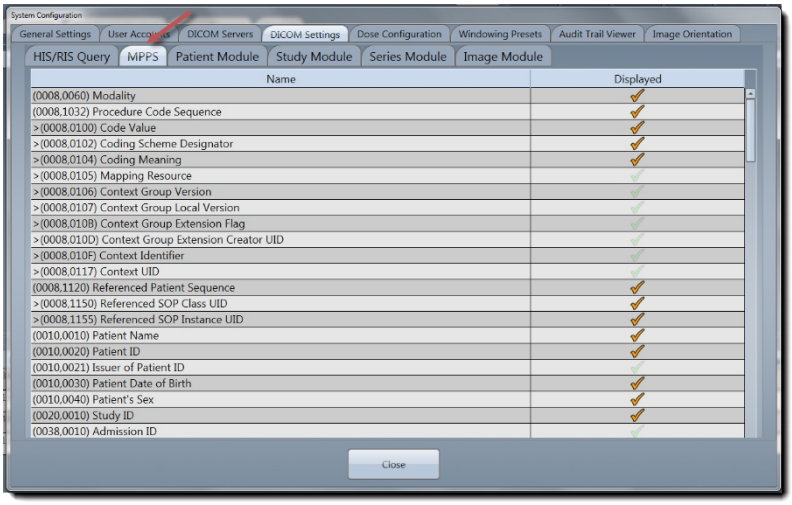



Figure 107: DICOM Settings > MPPS

5. Click the **Patient Module** tab to apply what tabs (and kinds of patient-module information) the operator (user) will see.


Figure 108: DICOM Settings > Patient Module

6. Click the **Study Module** tab to apply what tabs (and kinds of study-module information) the operator (user) will see.

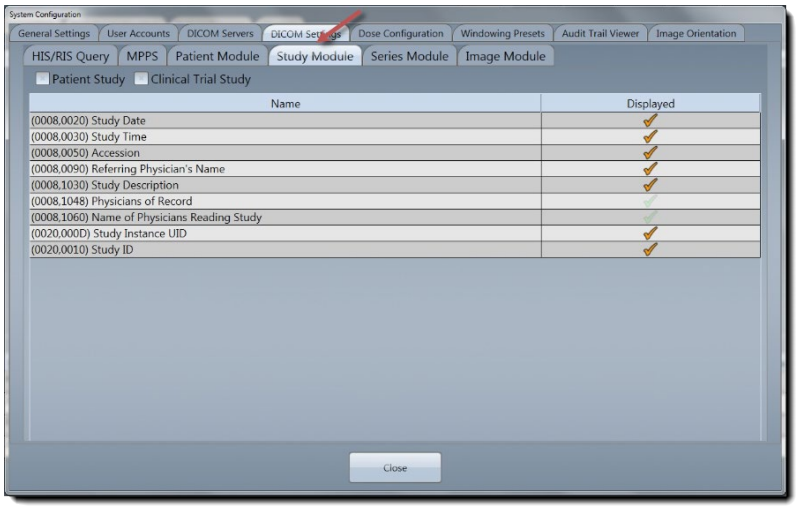



Figure 109: DICOM Settings > Study Module

7. Click the **Series Module** tab to apply what tabs (and kinds of series-module information) the operator (user) will see.

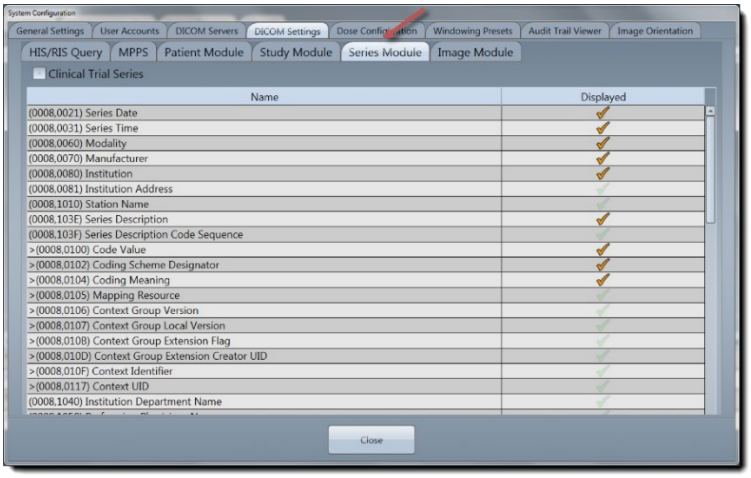



Figure 110: DICOM Settings > Series Module

8. Click the **Image Module** tab to apply what tabs (and kinds of image-module information) the operator (user) will see.

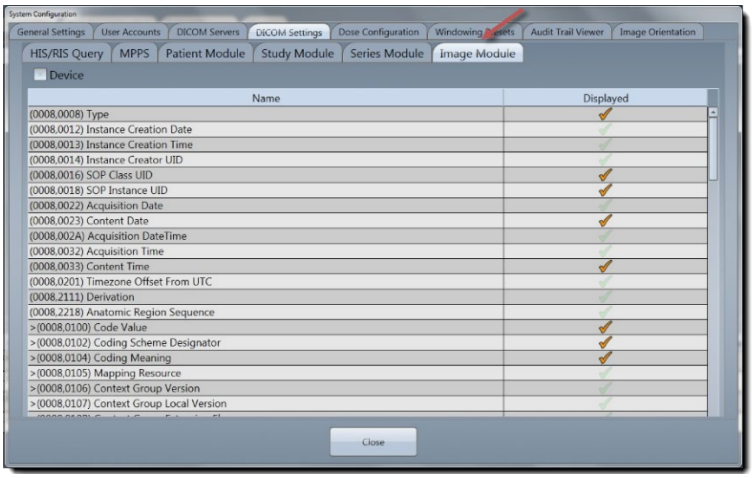



Figure 111: DICOM Settings > Image Module

9. Click the **Close** button to exit.

## Assigning dose report

The **dose report** is created at the end of the scan and can be customized to include **DICOM** specific tags.

| | |
|---|---|
| **Note** | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |

1. Click **Customize > System** from the main menu.

The **System Configuration** dialog box appears.

2. Click the **General Settings** tab.

3. Click the **Dose Report** tab.

   The **Dose Report** tab is active.

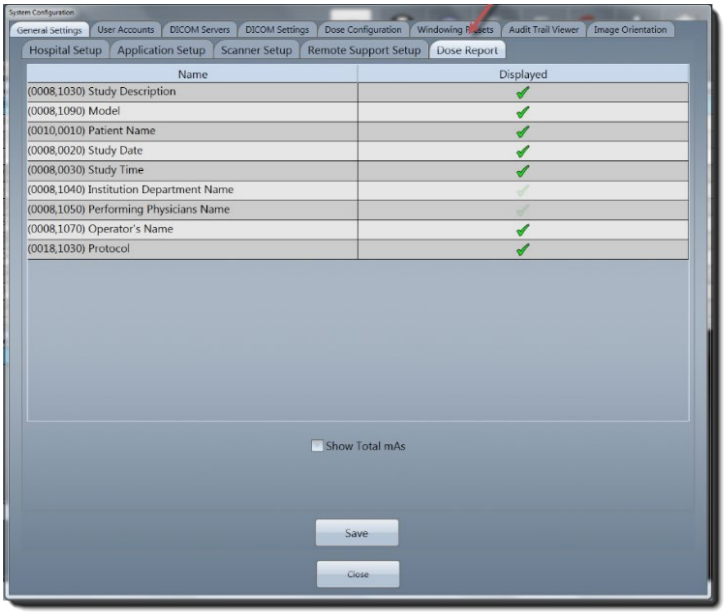



Figure 112: Dose Report tab

4. Click those **DICOM** tags you want to see in the **dose report** after a scan.

   A **dose report** is generated after the image is created; the black area includes dose report information similar to the following after the operator acquires a scan.

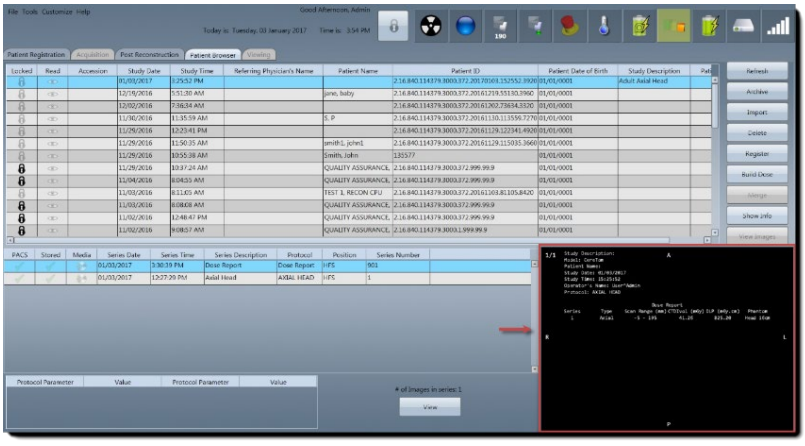


Figure 113: Generated dose report

5. Click the **Save** button.

6. Click the **Close** button to exit.

# Applying dose configuration

| Note | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

**Dose configuration** is visible *only* when the **Dose Check** feature is enabled.

## Setting Dose Check

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Dose Configuration** tab.

3. Click the **Dose Check** tab.

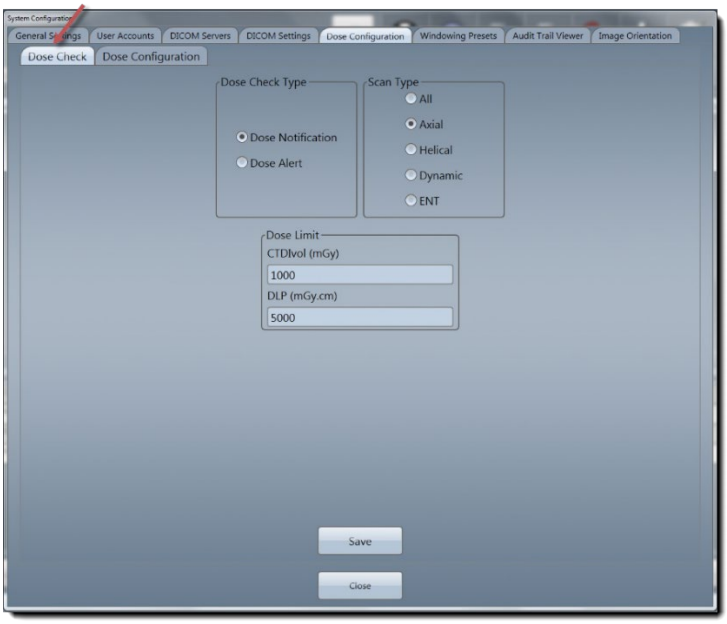



Figure 114: Dose Configuration > Dose Check

4. Click one of the following **Dose Check Type** options:

| | |
|---|---|
| • **Dose Notification** | Notifies the operator that the programed dose for each acquisition, exceeds the limit set by the administrator for a particular exposure. |
| • **Dose Alert** | Sets alerts if the dose amount exceeds the set limit by total accumulation. **Dose Alert** applies to the entire scan (series and scouts). Warns the operator that they will exceed the total dose for a series or exam set by the administrator. |

| Note | When you (the administrator) enable the **Dose Alert**, the system will prevent the patient from receiving any possible deterministic effects due to excess dose because the default limit of 1 Gy CTDI is set. |
|---|---|

5. Click one from the following **Scan Type** options.
   - **All** Identifies ***all*** scan types.
   - **Axial** Identifies **Axial** (step and shoot) scan types, *only*.
   - **Helical** Identifies **Helical** scan types, *only*.
   - **Dynamic** Identifies **Dynamic** scan types, *only*.
6. Define the **Dose Limit** by entering the following:
   - Enter the **CTDIvol (mGy)** value in the text box.
   - Enter the **DLP (mGy.cm)** value in the text box.
7. Click the **Save** button.

   The **Save Successful** popup appears.
8. Click the **Ok** button.
9. Click the **Close** button to exit.

## Assigning dose configuration to a patient protocol

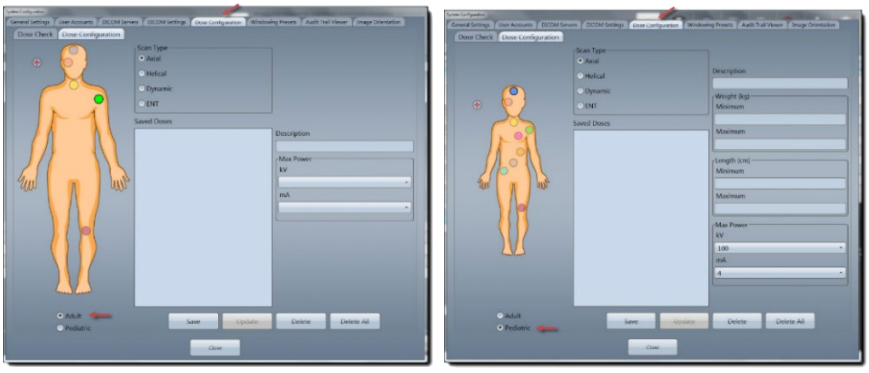


Figure 115: Dose Configuration > Dose Configuration for Adult and Pediatric

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.
2. Click the **Dose Configuration** tab.

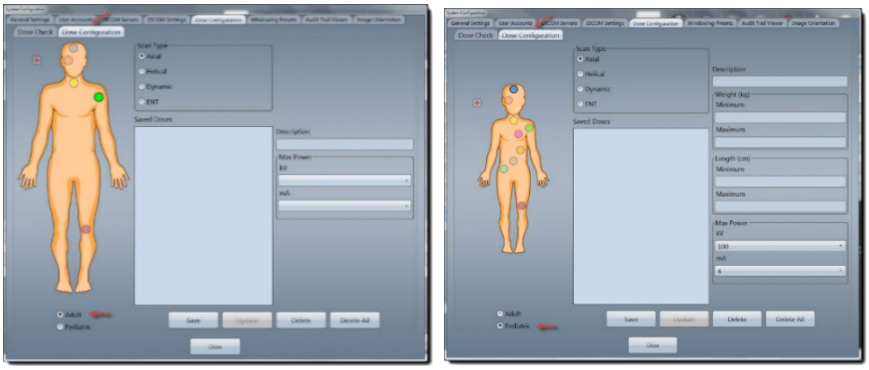
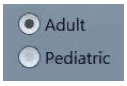


Figure 116: Dose Configuration > Dose Configuration for Adult and Pediatric

3. Click one of the following:

- **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
- **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
- **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.




By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

4. Hover the mouse pointer over the colored orb on the **Adult** or **Pediatric** body to identify the body part.

   A description above the **Adult** or **Pediatric** options shows the body part at the foot of the patient body.

5. Click the body region (colored orb) that marks the anatomical region to apply the dose to.

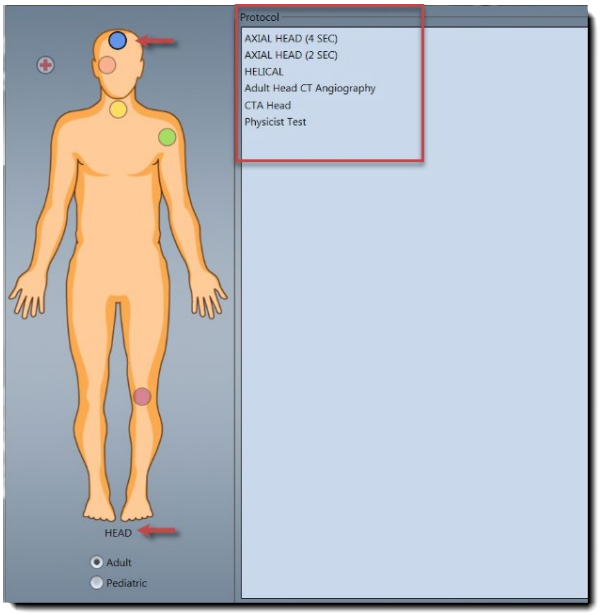



Figure 117: Anatomical orbs; orb definition below the body and related-to-orb protocols in list

6. Click a scan type from the following list:
   - **All** — Identifies ***all*** scan types.
   - **Axial** — Identifies **Axial** (step and shoot) scan types, *only*.
   - **Helical** — Identifies **Helical** scan types, *only*.
   - **Dynamic** — Identifies **Dynamic** scan types, *only*.

7. Enter a description of this dosage configuration in the **Description** text box.

8. For **Pediatric** (*only*), enter the **Weight (kg)** and **Length (cm)** information for the **Minimum** and **Maximum** (amounts not to exceed) in the text boxes.

9. Click the **kV** dropdown box to select the amount not to exceed, under **Max Power**.

10. Click the **mA** dropdown box to select the amount not to exceed.

11. Click the **Save** button to save your work.

    If the level overlaps an existing level, you are prompted to make adjustments.

Figure 118: Invalid Parameter popup message – Dose setting kV already exists

If the save is successful the **Save Successful** popup appears.

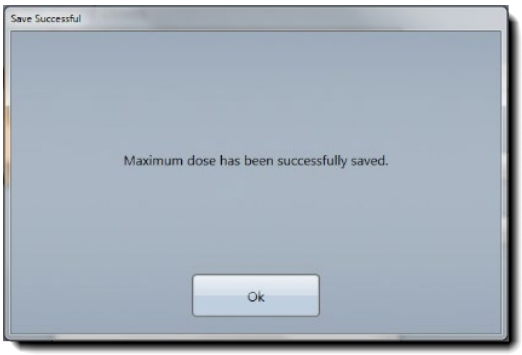



Figure 119: Save Successful popup message – Maximum dose saved

12. Click the **Ok** button.

13. Under the **Saved Doses** list box, check that your dose configuration appears; if so go to the next step.

14. Click the **Close** button to exit.

## Updating saved dose

This section presumes you (the administrator) made changes that are not yet saved. See page 136 and/or 137 to set or assign dose configuration to the patient.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Dose Configuration** tab.

3. Select a saved dose by clicking one under **Saved Doses**, in the list.

4. Make your changes to the fields that are relevant.

   The **Update** button is active.

5. Click the **Update** button.

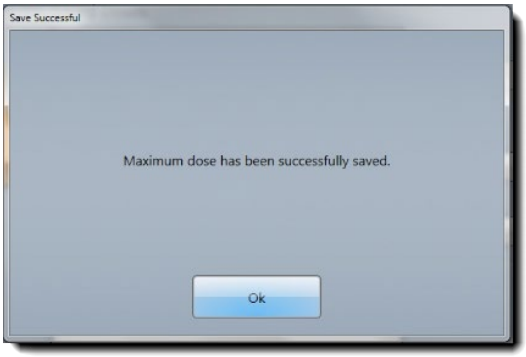



Figure 120: Save Successful popup message – Maximum dose saved

6. Click the **Ok** button.

7. Click the **Save** button to save your work.

> **Note** If the level overlaps an existing level, you are prompted to make adjustments.

8. Click the **Close** button to exit.

## Deleting a saved dose limit

This section presumes you (the administrator) made changes to delete. See page 136 and/or 137 to set or assign dose configuration to the patient.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Dose Configuration** tab.

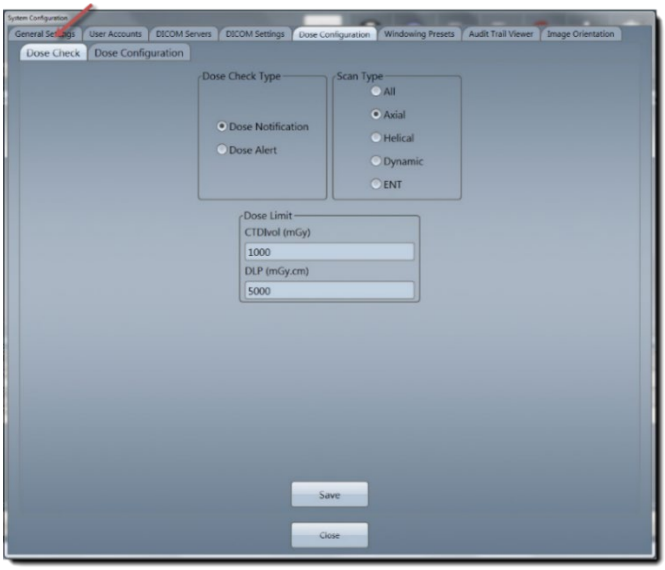



Figure 121: Dose Configuration > Dose Check tab

3. Click an already-saved dose, under the **Saved Doses** list.

4. Perform one of the following:

   - To delete a saved dose from the **Saved Doses** list and clear the restriction, select the dose and click the **Delete** button.
   - To delete all the saved doses in the **Saved Doses** list and clear all restrictions saved, click the **Delete All** button, which returns all settings for that particular selection to the maximum scanner default.

| **Note** | If there are no saved doses or limits, the operator will be able to scan at full power (140kV and 7mA) for the CereTom Elite.<br><br>The limits are used to prevent operators from using a max technique on pediatrics, for example. |
|---|---|

5. Click the **Save** button.

   The save success message appears and, because the **CTDIvol (mGy)** and **DLP (mGy.cm)** are empty, there is no longer a limit applied.

   The **Save Successful** popup appears.

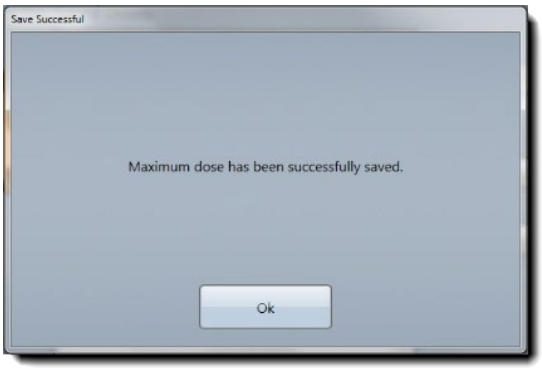



Figure 122: Save popup message – Maximum dose saved

6. Click the **Ok** button.

7. Click the **Close** button to exit.

# Setting windowing presets

A preset lets you (the administrator) set window width and window center.

| **Note** | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

The administrator can find or delete existing windowing presets, update an existing windowing preset, or create and save a new windowing preset.

## Editing kernel presets

| Note | Kernel presets are pre-installed in the system; kernel presets can be set and modified by you. |
|---|---|

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Windowing Presets** tab.

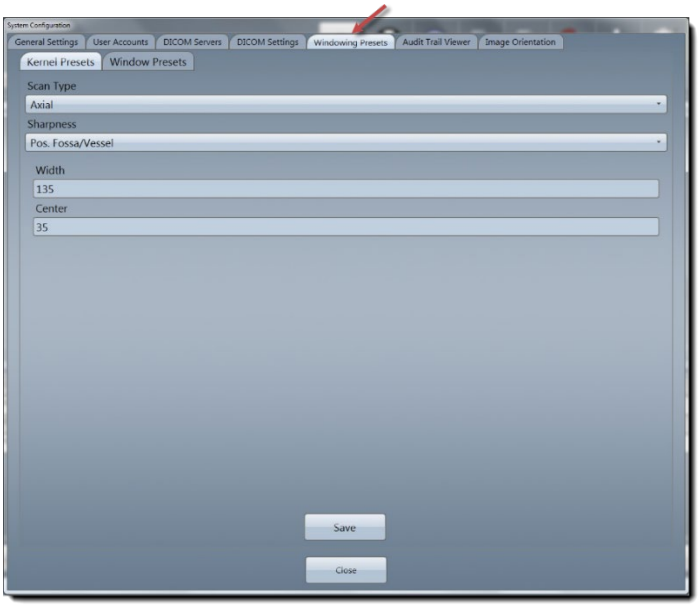



Figure 123: Windowing Preset tab

3. Click the **Kernel Presets** tab.

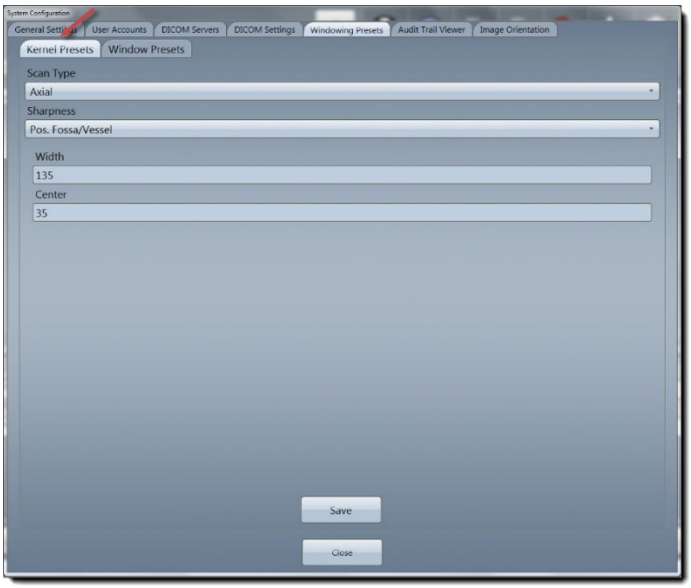



Figure 124: Windowing Presets > Kernel Presets tab

4. Click the **Scan Type** dropdown to select one of the following scan types:
   - **Scout**
   - **Axial**
   - **Helical**
   - **ENT**

5. Click the **Sharpness** dropdown to select a sharpness from the list.

   Sharpness is a reconstruction algorithm.

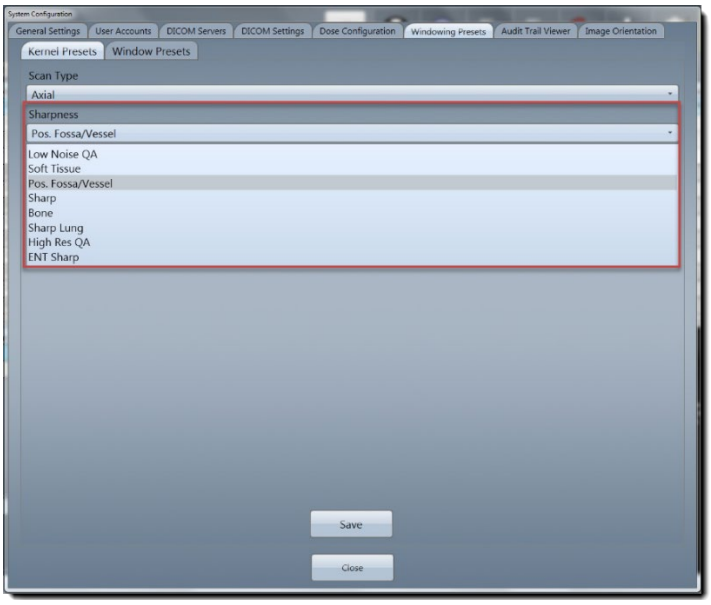



Figure 125: Sharpness dropdown

6. Enter the window width in the **Width** text box.

**Window width** describes the range of Hounsfield units displayed across the image. The maximum width possible is usually ~2000, but human eyes are not capable of seeing this many shades. Humans can only distinguish about 16 shades of gray. The window width is divided by 16; each group of Hounsfield values is converted to one of the 16 shades of gray. The lowest Hounsfield numbers in the window range are shown in black and the highest in white.

7. Enter the window center in the **Center** text box.

   **Window center** describes the Hounsfield number in the center of the window width.

8. Click the **Save** button to save your work.

   The **Action Succeeded** popup appears.

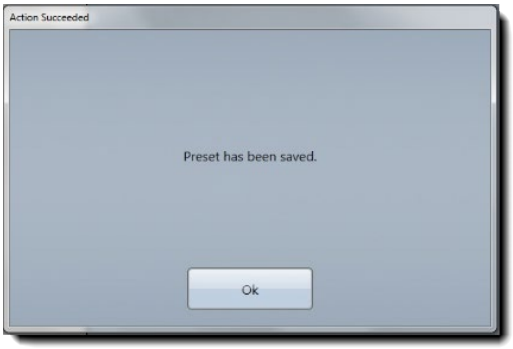



Figure 126: Action Succeeded popup message – Preset saved

9. Click the **Ok** button.

10. Click the **Close** button to exit.

## Setting window presets

Window presets allow the operator to define window level and window center presets for specific anatomical sites, such as bone, brain, lung, and soft tissue.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Windowing Presets** tab.

3. Click the **Window Presets** tab.

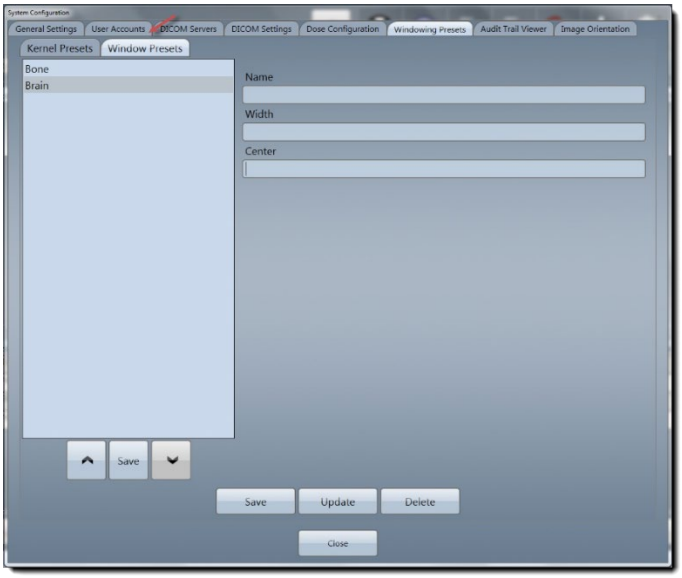



Figure 127: Window Presets tab

4. Enter the name of the window preset in the **Name** text box.

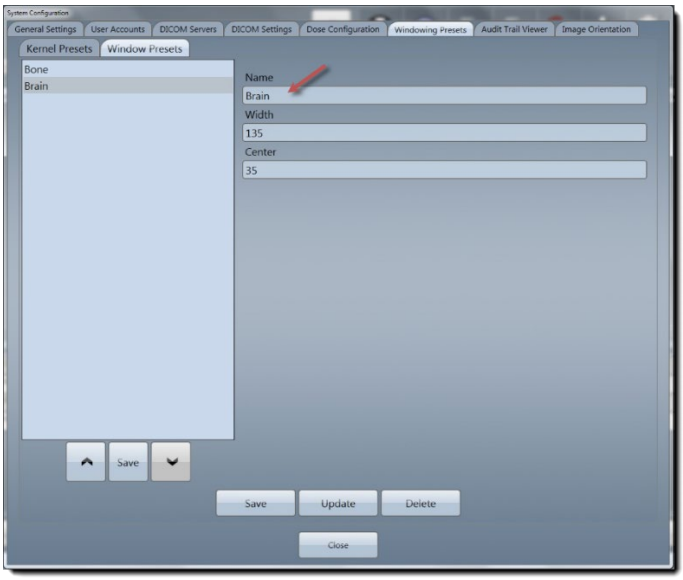



Figure 128: Window Presets > Name

5. Enter the width of the window preset in the **Width** text box.

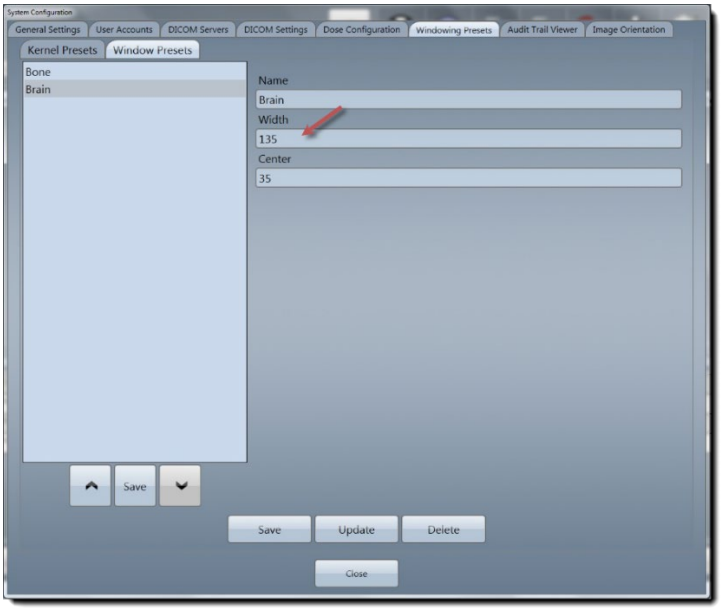



Figure 129: Window Presets > Width

6. Enter the center of the window preset in the **Center** text box.

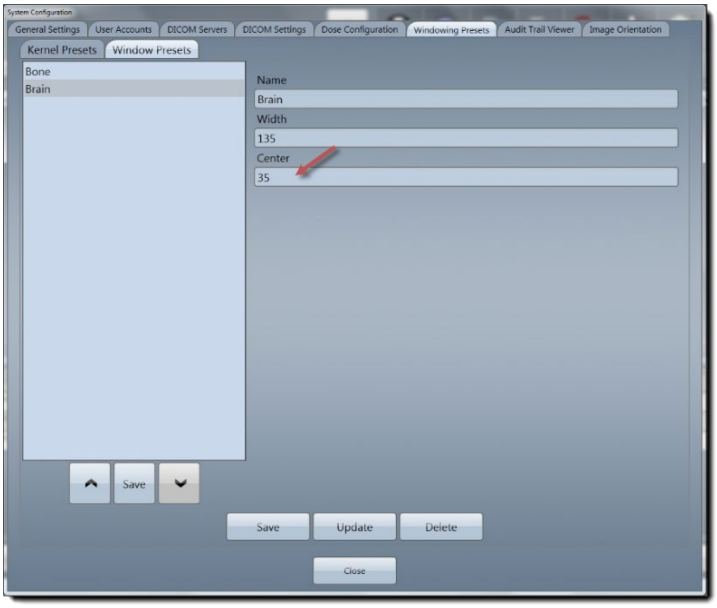



Figure 130: Window Presets > Center

7. Click the **Save** button to save your work.

   The **Action Succeeded** popup appears.

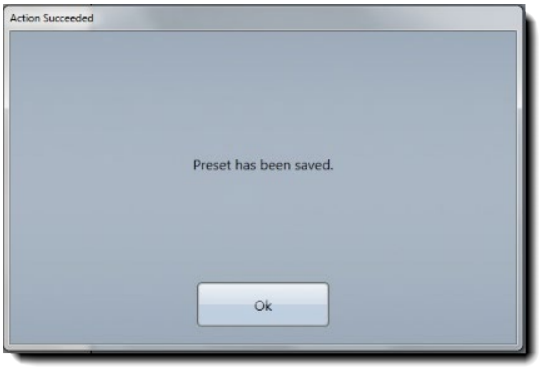



Figure 131: Action Succeeded popup message – Preset saved

8. Click the **Ok** button.

9. Click the **Close** button to exit.

## Editing a window preset

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Windowing Presets** tab.

3. Click the **Window Presets** tab.

4. Click a preset that exists in the **Window Presets** listing.

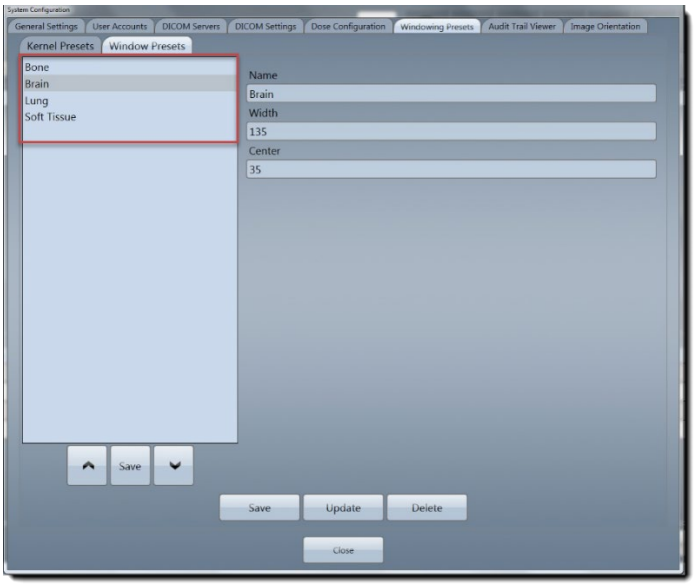



Figure 132: Listing update

5. To edit the preset, make your changes in the **Name**, **Width**, and/or **Center** text boxes.

6. To delete a preset, click the **Delete** button.

7. Click the **Save** button to save your changes.

   The **Action Succeeded** popup appears.

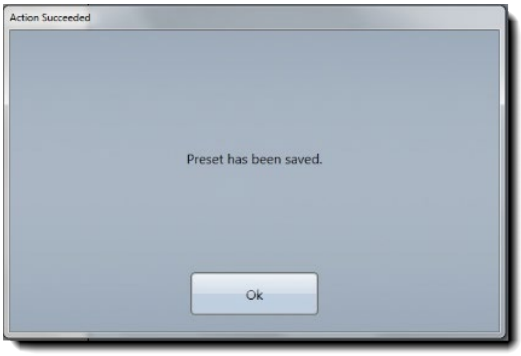



Figure 133: Action Succeeded popup message – Preset saved

8. Click the **Ok** button.

9. Click the **Close** button to exit.

## Saving a preset

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Windowing Preset** tab.

   The **Window Width and Window Center** appears.

3. Enter the preset name in text field.

4. Enter the width and center values.

5. Click the **Save** button.

   The **Action Succeeded** popup appears.

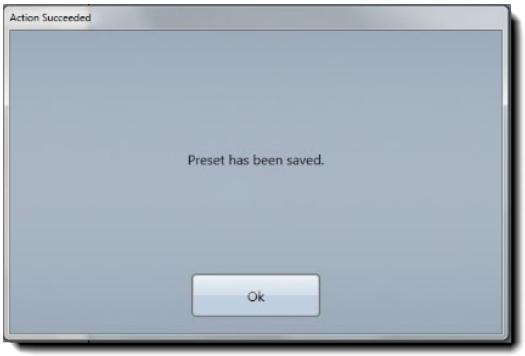



Figure 134: Action Succeeded popup message – Preset saved

6. Click the **Ok** button.

7. Click the **Save** button to exit.

### Deleting a preset

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Windowing Presets** tab.

3. Select the preset.

4. Click the **Delete** button.

   The **Action Succeeded** popup appears.

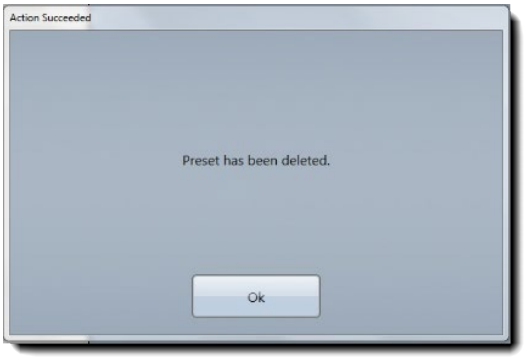



Figure 135: Action Succeeded popup message – Preset deleted

5. Click the **Ok** button.

6. Click the **Save** button to exit.

## Setting up the Audit Trail Viewer

The administrator sets up the **Audit Trail Viewer** to build an audit trail, which monitors and/or reports changes that are made – from all users who logged in, changed presets, and so on. These users include operator, administrator, or service-related users that make changes to the system.

| | |
|---|---|
| **Note** | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Audit Trail Viewer** tab.

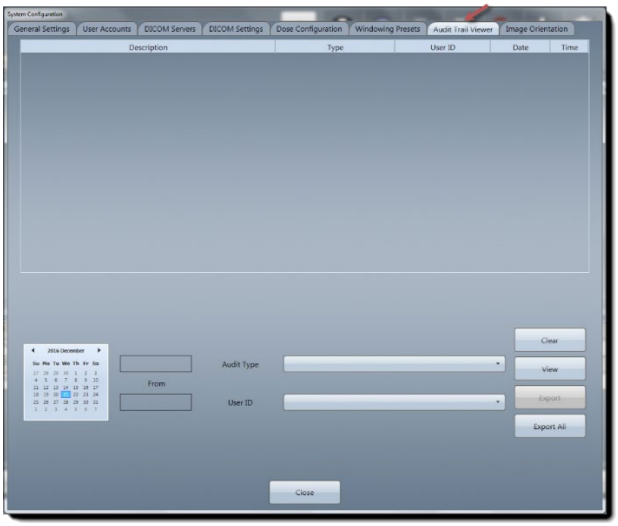



Figure 136: Audit Trail Viewer tab

3. From the **Audit Trail Viewer** tab, select a date or date range with the calendar to show when changes were made.

   - To select a single date, position the mouse pointer in the top box and click the date on the calendar to find audits for that date. See the calendar in the next figures.
   - To select a span of time, position the mouse pointer in the top box and click the start date (on the calendar) and then move the mouse pointer to the **From** box and click the end date on the calendar. This approach lets you select a range of audits done in a specified span of time. See the text boxes to the right of the calendar; the top text box is where the start date will show when you select a start date on the calendar; the bottom text box is where the end date will show when you select an end date on the calendar.

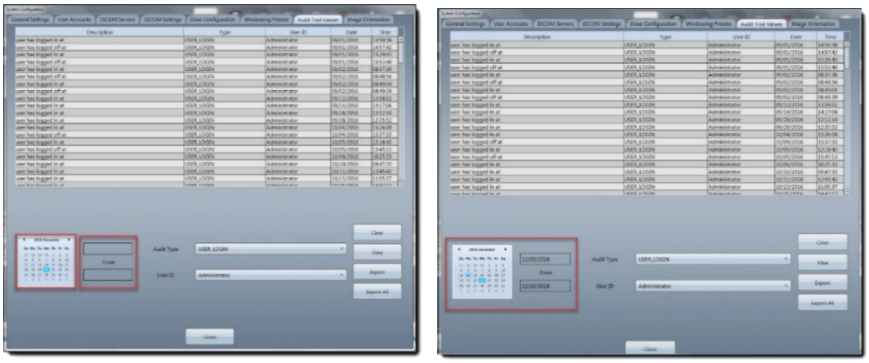


Figure 137: Adding a date or a date span

4. Click the **Audit Type** dropdown to select the kind of audit you are searching.

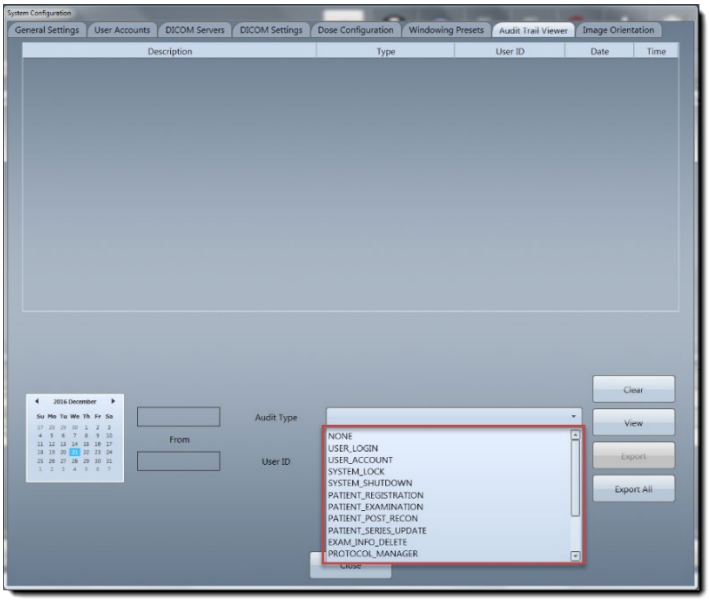



Figure 138: Audit Trail Viewer > Audit Type dropdown

5. From the **User ID** dropdown, click the type of user to track.

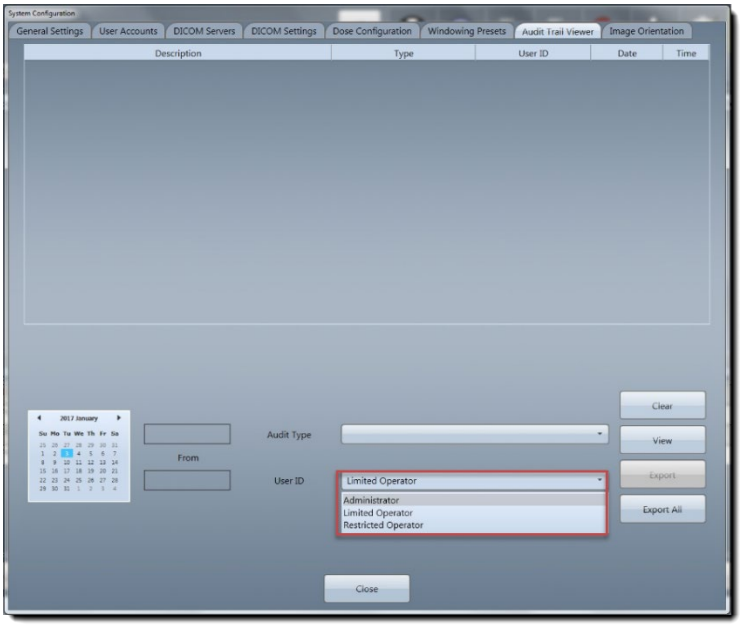



Figure 139: Audit Trail Viewer > User ID dropdown

6. Click the **View** button to see the result of audits that met your criteria.

   The results appear.

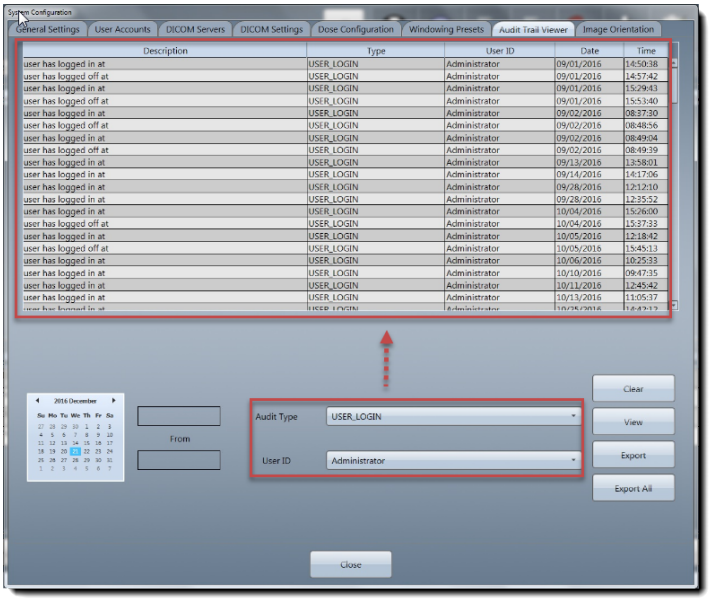



Figure 140: Audit results

7. Perform one of the following:

   - Click the **Clear** button to remove the audit results.
   - Click the **Export** button to export the audit result that you selected to the audit backup file on the system.
   - Click the **Export All** button to export all the audit trails that appear to the audit backup file on the system. Files will export to the audit backup file on the system.

8. Click the **Close** button to exit.

## Setting image orientation

NeuroLogica takes the view when describing patient orientation as if the viewer were standing at the foot of the patient's bed – for the anatomical position. In other words, if the patient is lying face up (on the patient's back) with the patient's head in the gantry, the view of the patient shows the patient's right side to the viewer's left. If the patient's feet are going into the gantry first and the viewer is standing at the back of the gantry, the viewer sees the patient's right side to the viewer's left side.

**Note** You must have administrative privileges to access this area in the application.

You must be logged in as an administrator to perform this procedure.

Incorrect changes to the system configuration may make the system inoperative.

1. Click **Customize > System** from the main menu.

   The **System Configuration** dialog box appears.

2. Click the **Image Orientation** tab.

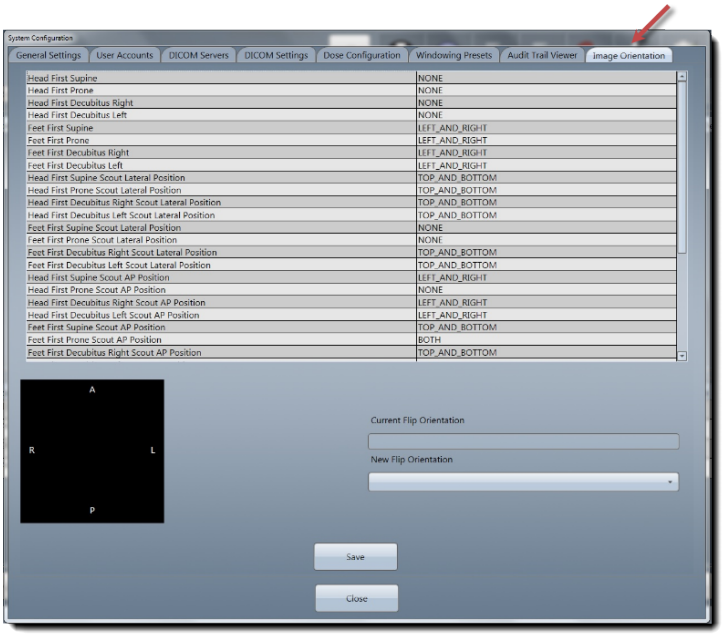



Figure 141: Image Orientation tab

The top half of the **Image Orientation** screen shows all the possible subject patient orientations. The black square represents the viewing area and shows, by an abbreviated letter, four different orientation locators: **A** = anterior, **L** = left, **P** = posterior and **R** = right. If you do not see these letters in the black (image orientation) box, select an image orientation from the list.

3. Select the appropriate orientation from the list.

   For example, select, **Head First Supine**. In the example in the figure below, the highlighted selection shows the current orientation in the **Current Flip Orientation** field (which is not changeable); however, the **New Flip Orientation** (the location where you can change the orientation) lets you change the orientation.

4. Click the **New Flip Orientation** dropdown to select one of the following new-flip orientations:
   - **NONE**
   - **LEFT_AND_RIGHT**
   - **TOP_AND_BOTTOM**
   - **BOTH**

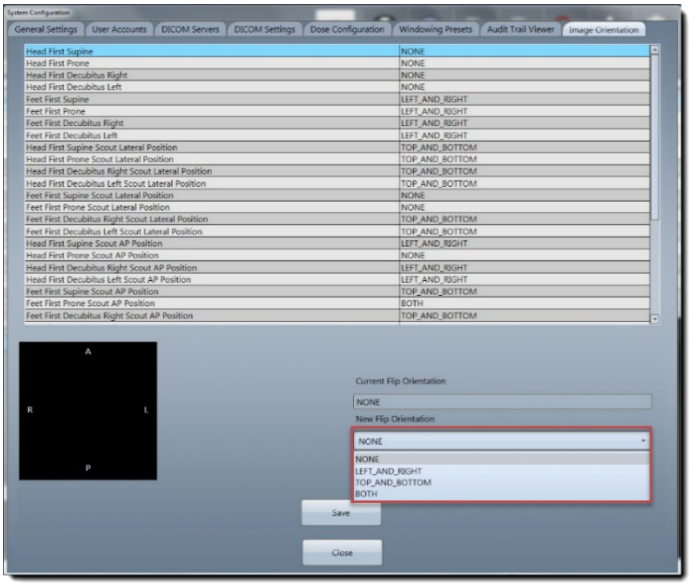



Figure 142: Image Orientation > New Flip Orientation dropdown

5. Click the **Save** button to save changes.

   The **Settings Saved** popup appears saying the "Image orientation settings have been saved."

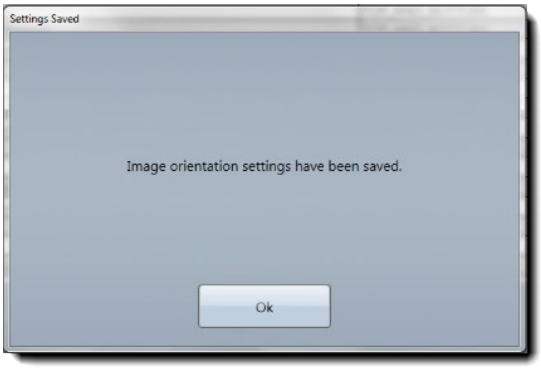



Figure 143: Settings Saved popup message – Image orientation settings saved

6. Click the **Ok** button.

7. Click the **Close** button to exit.

# User configuration

User configuration allows all users (administrator, limited operator, and restricted operator) to change their password for their own account.

## Updating your user account

1. Click **Customize > User** from the main menu.

The **User Configuration** dialog box appears.

| Note | You (the limited operator) cannot alter **User ID** and **User Level**; you must have administrative privileges to make these customizations.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

The **Update Accounts** tab is the default selection.

2. Modify the following fields associated with your user account by entering relevant information:

   - **Last Name**
   - **First Name**
   - **Password** (and re-enter the new password in **Verify Password** to validate).

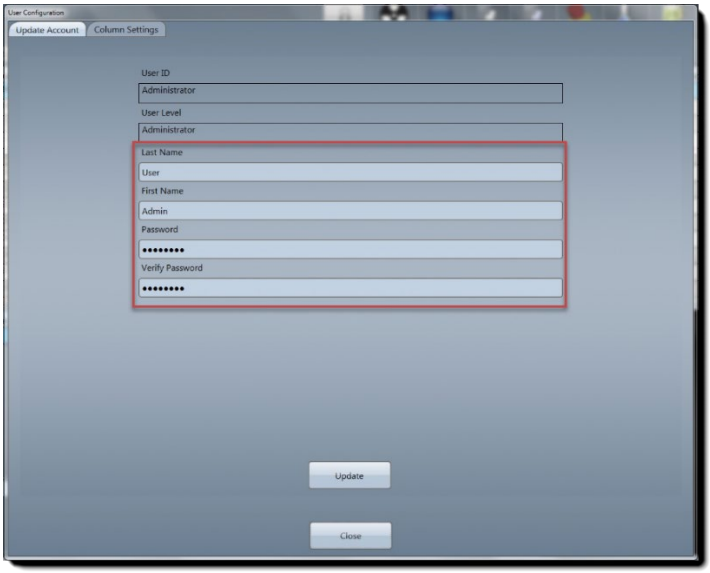



Figure 144: Last Name, First Name, Password, and Verify Password fields

3. Click the **Update** button.

The **Update Succeeded** popup appears.


Figure 145: Update Succeeded popup message – Account updated

4. Click the **Ok** button.

5. Click the **Close** button to exit.

### Applying column settings to HIS/RIS Query

Allows the user to customize what columns of information will appear when viewing the **HIS/RIS** (**Hospital Information System** (**HIS**) and/or **Radiology Information Systems** (**RIS**)) information that is queried.

All users (administrators, limited operators, and restricted operators) can access user configuration and make changes to the column settings; however limited and restricted operators cannot make their changes to the column headings the default. Only the administrator can make column settings a default (with the **Make Default** option). When the administrator logs in and makes column settings a default, the change is the default for the administrator's log in, only.

| **Note** | Administrators and limited operators can make these changes; restricted operators cannot apply column settings as a default. |
|---|---|

1. Click **Customize > User** from the main menu.

   The **User Configuration** dialog box appears.

2. Click the **Column Settings** tab.

   There may be no entries that appear, initially.

   | **Note** | When an option is selected (for example **HIS/RIS Query** or **Patient Browser**), a table is created that lists the columns, along with a check box to indicate whether it will be displayed within the table. Required columns ***cannot*** be unchecked and are colored orange instead of the default green. |
   |---|---|

3. Click the **HIS/RIS Query** option.

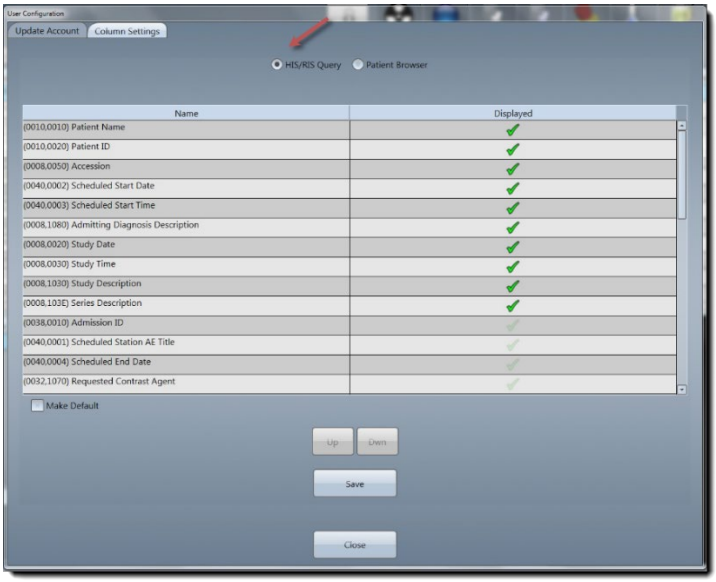



Figure 146: Column Settings dialog box with HIS/RIS Query option

4. Click a row to select a column settings.

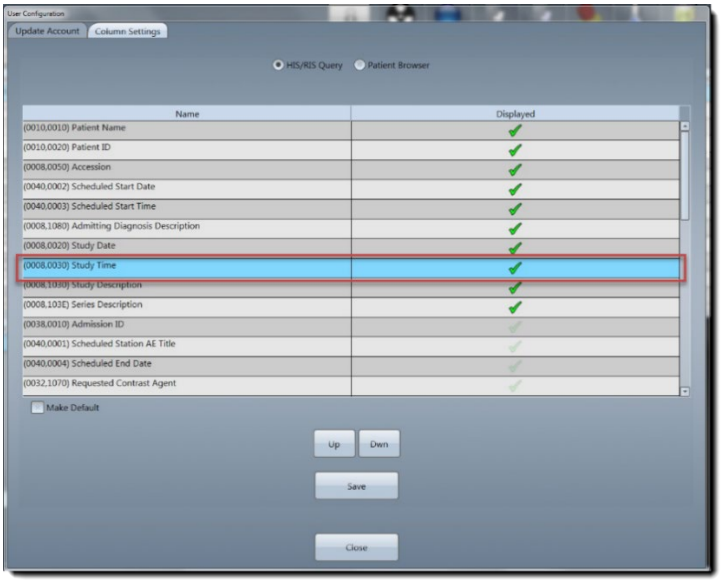



Figure 147: Column Settings with a selected query in HIS/RIS

5. Notice that the **Up** and **Dwn** buttons are active when you make a selection.

6. Click the **Up** button to move **HIS/RIS Query** option up the list; click the **Dwn** button to move **HIS/RIS Query** option down the list.

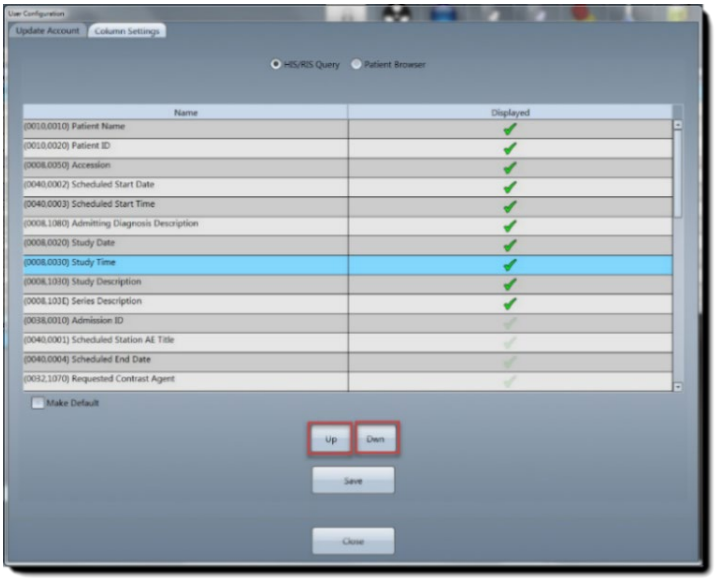



Figure 148: Column Settings with HIS/RIS Query option using Up and Dwn buttons

7. If you have administrative privileges, click the **Make Default** option to make the selected column display the default for all user accounts that do not override the default with a unique setting.

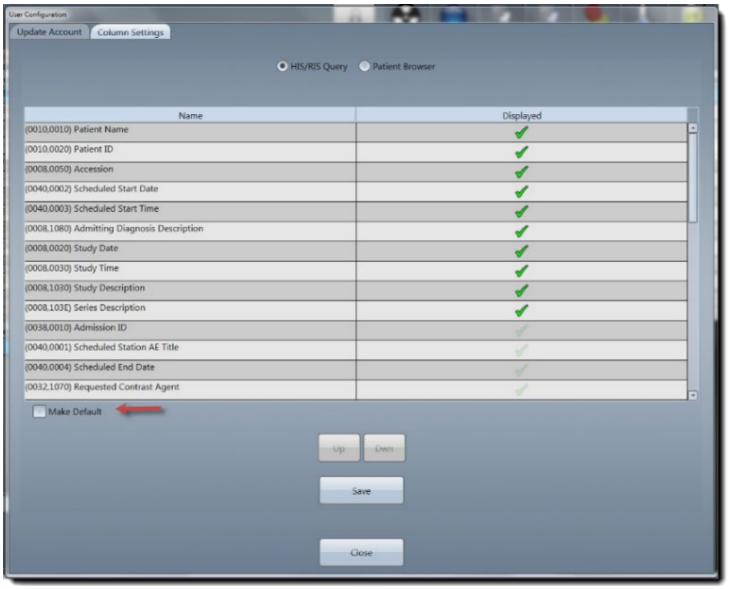



Figure 149: Make Default option

8. Click the **Save** button to keep changes.

9. Click the **Close** button to exit.

## Applying column settings to Patient Browser

**Note** Administrators and limited operators can make these changes; restricted operators cannot apply column settings as a default.

1. Click **Customize > User** from the main menu.

   The **User Configuration** dialog box appears.

2. Click the **Column Settings** tab.

   Column settings allows the all users to display what appears in the **HIS/RIS Query**, **Patient Browser**, **Patient/Study**, and **Series**.

3. Click the **Patient Browser** option.

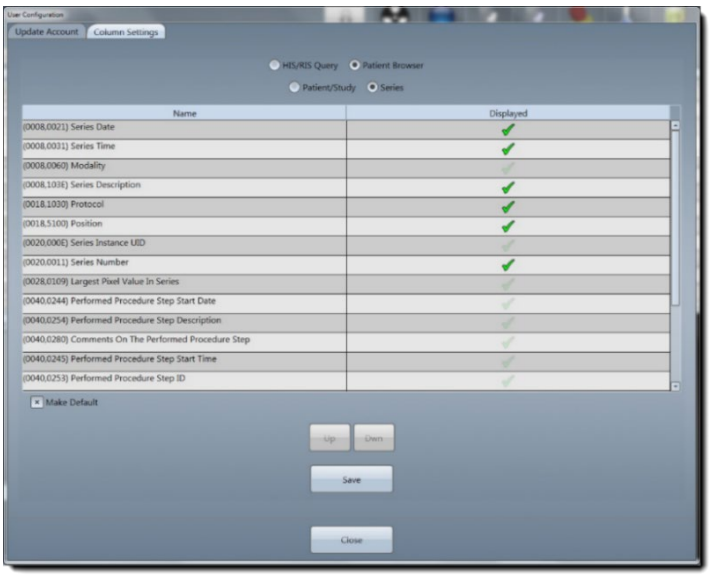



Figure 150: Column Settings with Patient Browser option

**Patient Browser** lets you configure the columns of information (such as, Name, Date, DOB, Referring Physician) – columns seen in the **Patient Browser**.

4. Click one of the following options:

   - **Patient/Study** Information that appears on the top portion of the **Patient Browser** (tab) that defines patient specific information.
   - **Series** Information that appears on the lower portion of the **Patient Browser** (tab) that defines the scan (or series) specific information.

5. Click a row to select a column setting.

6. Notice that the **Up** and **Dwn** buttons are active when you make a selection.

7. Click the **Up** button to move **Patient Browser** option up the list; click the **Dwn** button to move **Patient Browser** option down the list.

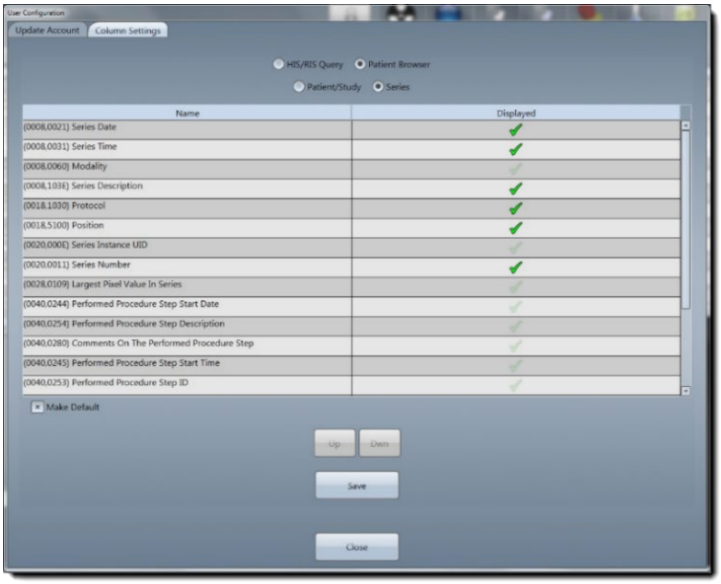



Figure 151: Column Settings with HIS/RIS Query option – using Up and Dwn buttons

8. If you have administrative privileges, click the **Make Default** option to make the selected column settings (display) the default for all users.

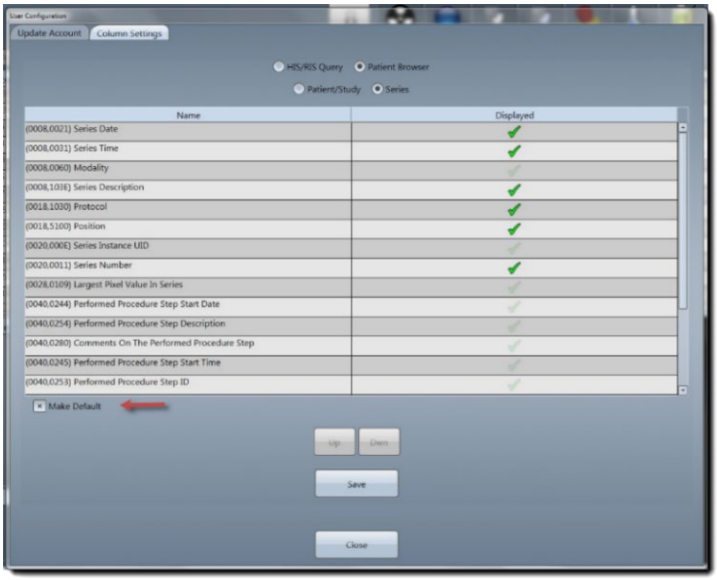



Figure 152: Make Default option

9. Click the **Save** button to save the list.

10. Click the **Close** button to exit.

# Chapter 6 Protocol Manager

| Note | You must have administrative privileges to access this area in the application.<br><br>You must be logged in as an administrator to perform this procedure.<br><br>Incorrect changes to the system configuration may make the system inoperative. |
|---|---|

**Protocol Manager** lets you (the administrator, only) set how the limited and restricted operator uses protocols. **Protocol Manager** also provides three patient options: **Adult, Pediatric,** or ⊕ (**Trauma**) patient**.**

## Creating a new protocol

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog appears.

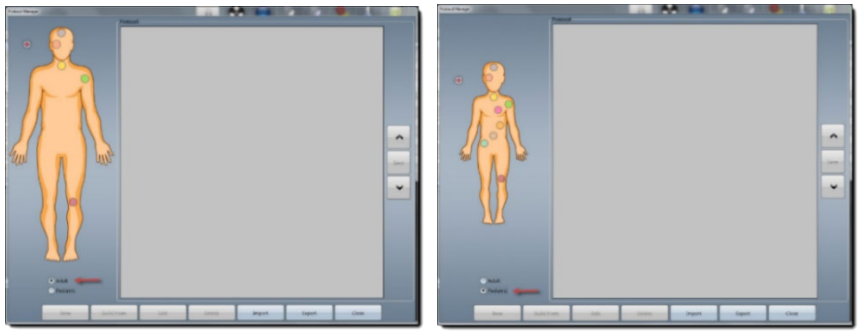


Figure 153: Protocol Manager for Adult and Pediatric

2. Click one of the following:

   - **Adult** — To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** — To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** — To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕ ) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.


   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

**Note** Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance.

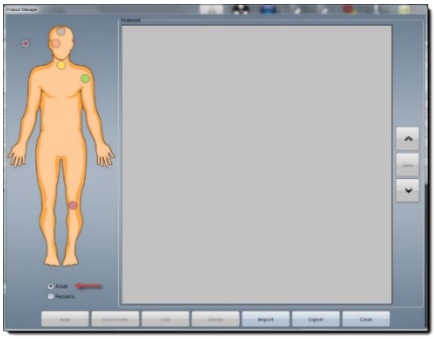
This scanner comes with preset protocols for pediatric patients that vary according to age or weight. These protocols are meant to be a guide for routine scanning. An individual patient may require higher or lower doses than in the routine preset to achieve the diagnostic goals for the pediatric patient's medical condition. These preset pediatric protocols were established as a reduction from the adult protocols to achieve the same image signal to noise. At this time there is no agreement among scientific and medical organizations as to what the proper protocol is for pediatric patients. It is the responsibility of the user to decide whether these protocols are adequate for achieving their diagnostic goals on a patient-by-patient basis.

The user can modify any of the existing CT scan protocols on the machine and/or create new protocols as deemed needed. To create these protocols, Administrator privileges are required.

**WARNING** Any modification to an existing protocol, or any new protocol created should be reviewed and approved by a radiology administrator and residing medical physicist. Failing to do so could cause a pediatric patient to receive excessive and/or unnecessary dose of ionizing radiation.

Resources for radiation protection of pediatric patients appear below and are referring physicians with a focus on radiation exposure:

- American Academy of Pediatrics (AAP), https://www.aap.org: search for radiation risk to children from Computed Tomography
- Federal Drug Administration (FDA), https://www.fda.gov: search for guidelines for pediatricians regarding medical radiation safety
- American College of Radiology (ACR), https://acsearch.acr.org/list: Appropriateness Criteria® guidelines
- Image Gently® and CT scans
- Image Gently/FDA Digital Radiography Safety Checklist: https://www.imagegently.org/Portals/6/Procedures/Attachment%20D.CR.DR%20%20checklist.pdf



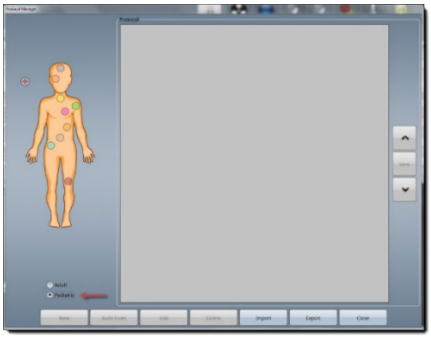


Figure 154: Protocol Manager for Adult and Pediatric

3. Click the colored orb corresponding to the appropriate body part.

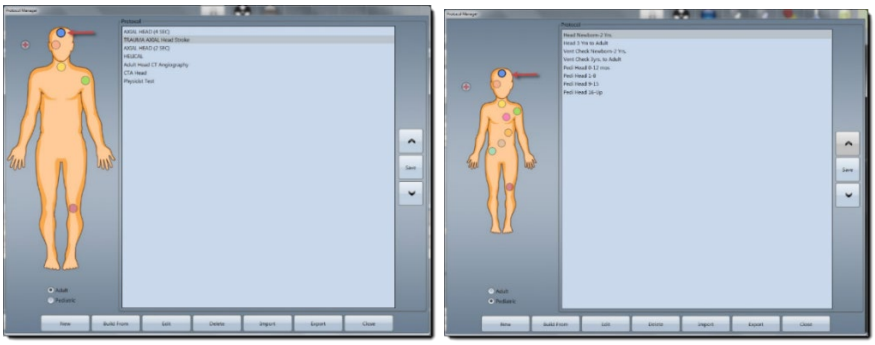


Figure 155: Adult and Pediatric anatomical orbs, in this case the head orb

The **New** button and others (depending on what was done previously) are active ***after*** you click a colored orb corresponding to the body part and then click the protocol that shows in the **Protocol** list. Existing protocols appear in the **Protocol** list box, as shown, in the figures below.

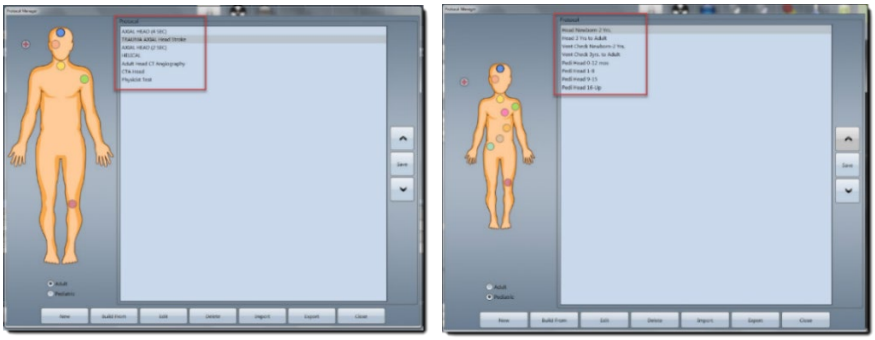


Figure 156: Adult and Pediatric protocol lists

4. Click the **New** button to create a new protocol.

   The **New Protocol** dialog box appears.

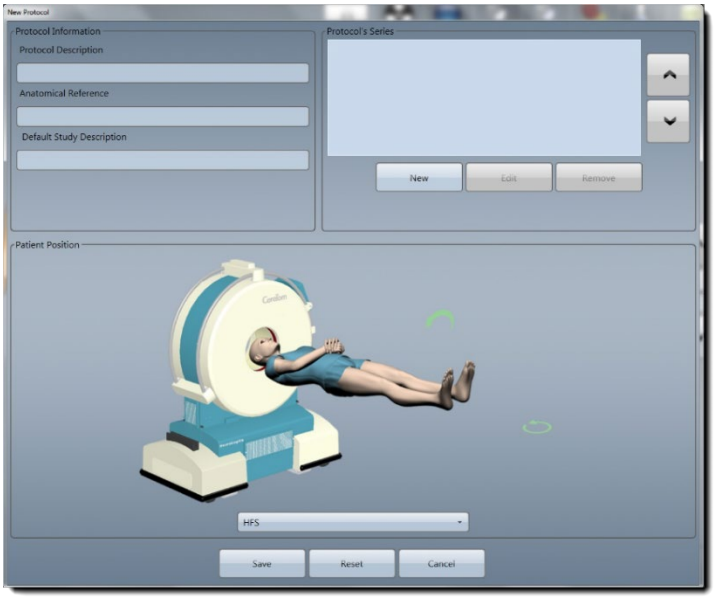



Figure 157: New Protocol dialog box

The **Protocol Information** and **Protocol's Series** areas are ***empty***. The **Patient Position** settings are identical whether it is for an adult, pediatric, or emergency patient.

5. For **Protocol Information**, enter your information in the following text boxes:

| | |
|---|---|
| • **Protocol Description** | What name of the protocol you assign (as it will be listed); for example, **Axial** head or **Helical** head. |
| • **Anatomical Reference** | References what part of the anatomy will be scanned; for example, head or chest. |
| • **Default Study Description** | What appears as the **DICOM** image tag; if entered, this description will also appear in **PACS** as a **Study Description DICOM** tag (00081010). |
| • **For Pediatric, Weight (kg) and Length (cm)** | Where you enter the weight and length of the pediatric patient. |

6. Under **Patient Position**, select one of the following scanning positions from the dropdown:

- **HFS** Head First-Supine
- **HFP** Head First-Prone
- **HFDL** Head First-Decubitus Left
- **HFDR** Head First-Decubitus Right
- **FFS** Feet First-Supine
- **FFP** Feet First-Prone
- **FFDL** Feet First-Decubitus Left
- **FFDR** Feet First-Decubitus Right

You can also move the rotating positional handles (by hovering the mouse pointer over the handle and left-mouse clicking) to select a position. The arrows at the feet rotate the patient orientation from head first to feet first. The arrow above the patient rotates the patient orientation from **Supine** to **Prone** to **Decubitus**.

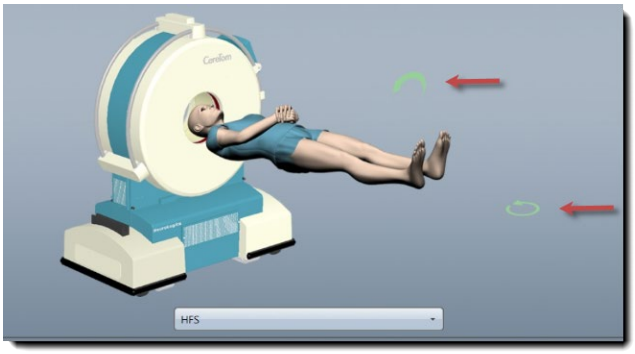



Figure 158: Patient position handles

7. Under **Protocol's Series**, click the **New** button.

   The **New Series** dialog box appears.

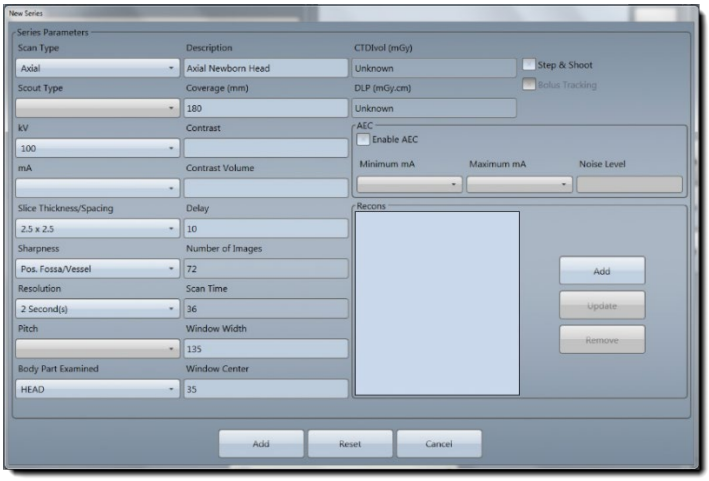



Figure 159: New Series dialog box

8. For **Scan Type**, select one of the following:
   - **Axial**
   - **Helical**
   - **Dynamic**
   - **Reference**
   - **Scout**

9. For **Scout Type**, select one of the following:
   - **AP**
   - **PA**
   - **Lateral**

   **Scout Type** is not available for **Axial**, **Helical**, **Dynamic**, and **Reference** scan modes.

10. For **kV** (scan voltage), select one of the following:
    - 100 To set the range to 100.
    - 120 To set the range to 120.
    - 140 To set the range to 140.

    **kV** is not available for **Dynamic** scan mode.

    The highest scan-current obtainable from the x-ray tube can range from 1 to 7 mA based on available heat capacity of the x-ray tube. At a nominal scan voltage of 120 kV, a maximum output power of 1 kW is maintained by the x-ray tube for at least 4 seconds if the current heat capacity of the tube does not exceed 80%.

    See "Identifying load factors" on page 201.

11. For **mA** (scan current), select the appropriate selection (1 to 7 mA with an increment of 1) from the dropdown.

    The maximum scan voltage can range from 100 to 140 kV based on available x-ray tube heat capacity. X-ray tube power of any scan combination is computed as the product of the scan voltage and the scan current.

    The scan time is determined by the x-ray tube's current heat capacity.

    *Scan Power = Scan Voltage (kV) x Scan Current (mA)*

12. For **Slice Thickness/Spacing**, select the appropriate following options:
    - In **Axial** scan mode, **slice thickness** is the same as slice spacing.
    - In **Helical** scan mode, the slice spacing can be different from slice thickness, based on pitch.
    - **Slice Thickness/Spacing** is not available for **Scout** scan modes.

13. For **Sharpness**, select the image reconstruction kernel from the following list of kernels:
    - **Low Noise QA**
    - **Soft Tissue**
    - **Pos. Fossa/Vessel**
    - **Sharp**
    - **Bone**
    - **Sharp Lung**
    - **High Res QA**

**Sharpness** allows *only* **Soft Tissue** for **Reference** scan mode and *only* **Pos. Fossa/Vessel** for **Scout** scan mode. **Pos.** is abbreviated for **Posterior**.

14. For **Resolution**, select one of the following appropriate scan times:

    - 2 Second(s)
    - 4 Second(s)
    - 6 Seconds(s)

    **Resolution** is available for **Axial** and **Reference** scan mode, *only*.

15. For **Pitch**, select one of the following travel times (per scanner rotation):

    - 1; the scanner is moving at 10mm per second.
    - 1.5; the scanner is moving at 15mm per second.

    **Pitch** describes a scanner's travel and how fast the scanner is moving per rotation; **Pitch** is available for **Helical** scan mode, *only*.

16. For **Body Part Examined**, select one of the following anatomical parts being scanned:

| | | | | |
|---|---|---|---|---|
| HEAD | CEREBELLUM | EAR | MAXILLA | PHARYNX |
| HEADNECK | FACE | IAC | TMJ | THROID |
| SCALP | EYE | CHEEK | PAROTID | ESOPHAGUS |
| SKULL | CORNEA | NOSE | NECK | TRACHEA |
| ZYGOMA | SCLERA | MOUTH | CAROTID | |
| BRAIN | ORBIT | TONGUE | SUBMANDIBULAR | |
| CIRCLEOFWILLIS | EYELID | JAW | LARYNX | |

17. For **Description**, enter the defined study description.

18. For **Coverage (mm)**, enter the total scan distance.

    **Coverage** is not available for **Dynamic** and **Reference** scan modes.

19. For **Contrast**, enter the type of contrast given for example Omnipaque 300; for **Contrast Volume**, enter the amount of the contrast given, for example 80ml.

    **Contrast** is not available for **Reference** and **Scout** scan modes.

20. For **Delay**, enter the delay time that will occur after clicking the **Start Scan** button and before the scan begins.

21. For **Number of images**, if applicable, the calculated number appears here, depending on other selections.

    The number of images is calculated based on the slice thickness and length of the scan.

22. For **Scan Time**, if applicable, the calculated number appears here, depending on other selections.

The scan time is automatically calculated based on the parameters each operator chose, for example resolution, pitch, and so on.

**Note** Dynamic scan time must be between 30 and 45 seconds.

23. For **Window Width**, enter the range of CT numbers (maximum and minimum) that are distributed over the viewable gray scale of the display device or film.

24. For **Window Center**, enter the CT number in the center of the viewable gray scale.

25. For **CTDIvol (mGy)**, if applicable, the calculated number appears here, depending on other selections.

    **CTDIvol (mGy)**, applies an unknown to **Axial** and **Dynamic** scan modes; it applies 12.6 for **Helical** and 50.4 for **Reference**.

    **CT Dose Index Volume (CTDIvol)** represents the dose for a specific scan protocol, which takes into account gaps and overlaps between the radiation-dose profiles from consecutive rotations of the x-ray source. The CT Dose Index Volume is noted as $CTDI_{vol}$. The CTDIvol is calculated differently for both the **Axial** and the **Helical** modes:

    - For **Axial** scan mode: CTDIvol = [ (N x T)/I ] x CTDIw
    - For **Helical** scan mode: CTDIvol = 1/pitch x CTDIw

26. For **DLP (mGy.com)**, enter the **DLP (mGy.com)** to apply an unknown to **Axial** and **Dynamic** scan modes; it applies 12.6 for **Helical** and 50.4 for **Reference**.

    The **Dose Length Product** (**DLP**) is the measure of ionizing radiation exposure during the entire acquisition of images. Therefore, DLP (mGy.cm) = CTDIvol (mGy) x irradiated length (cm).

27. Select the following options, if applicable:

    - **Step & Shoot** — Allows you to manually start the **Axial** scan acquisition from the workstation when scanning a patient who is unable to remain still – moves erratically; available for **Axial**, *only*.
    - **Bolus Tracking** — A CT angiography technique that allows you to monitor the administration of contrast to initiate scan at peak performance.

28. Select the **Enable AEC** option, if applicable.

    - **Enable AEC** — Allows you to automatically adapt the tube current or tube potential according to the patient's body habitus in order to achieve the specified image quality at the lowest possible dose.

    **AEC** (**Automatic Exposure Control**) is a scanner feature that automatically initiates a prescribed noise level in the image(s) taken, by adjusting the delivered mA to the patient based on density.

    When centering the patient in the gantry, it is ***vital*** to accurately use **AEC. AEC** aims to deliver the specified image quality across a range of patient sizes. The use of **AEC** may change the planned CTDIvol and DLP values. It tends to increase CTDIvol for large patients and decrease CTDIvol for small patients – relative to a reference patient size.

| Note | Ensure patient is accurately centered in gantry.<br><br>Do not use **AEC** when any type of metal is going to be scanned.<br><br>Do not use **AEC** with a small **FOV**, that is, tiny neonatal pediatrics.<br><br>Only 1 **Axial** or **Helical** series is allowed within an **AEC** protocol.<br><br>An automatic adjustment of the tube current cannot occur when the tube potential is changed. |
|---|---|

| Note | **AEC** is an option for low resolution sharpness kernels (**Helical** (soft tissue kernels) or **Axial** (low noise QA, soft tissue, Pos Fossa/Vessel, sharp kernels). |
|---|---|

29. Under **AEC**, click the **Minimum mA** dropdown to set the minimum allowed mA value used for scanning.

30. Under **AEC**, click the **Maximum mA** dropdown to set the maximum allowed mA value for scanning.

    The minimum mA on the CereTom Elite is 1 and the maximum mA is 7. When using **AEC**, the limited and restricted operator defines the minimum and maximum mA for that particular scan, for example, 2 to 6.

31. Under **AEC**, click the **Noise Level**- to set the standard deviation of noise value for the completed scan.

    The noise range is 1-200.

32. To add a secondary reconstruction for the protocol, click the **Add** button in the **Recons** section.

    This is applicable for **Axial** (**Step & Shoot**) and **Helical** scans.

    The **New Reconstruction** popup appears.

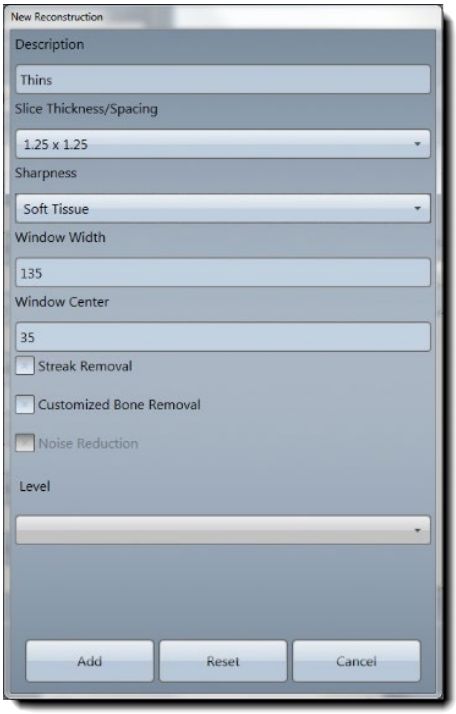



Figure 160: New Reconstruction popup

33. Complete following in the **New Reconstruction** popup:
    - Enter a description in the **Description** text box to identify the new reconstruction.
    - Click the **Slice Thickness/Spacing** to select a slice thickness and spacing.
    - Click the **Sharpness** dropdown to select a sharpness from the list.
    - Enter the window width in the **Window Width** text box.
    - Enter the window center in the **Window Center** text box.
    - Click the **Streak Removal** check box to eliminate streaks.
    - Click the **Noise Reduction** check box to reduce noise.
    - Click the **Level** dropdown to select **Low** or **High**.
34. Perform one of the following:
    - Click the **Add** button to add the reconstruction protocol to the list.
    - Click the **Reset** button to reset the fields to their original (or former) data.
    - Click the **Cancel** button to remove your changes and return to the previous dialog box.

      The dialog box closes; your changes are added to the **Recons** area.
35. Click the **Update** button in the **Edit Series** dialog box.

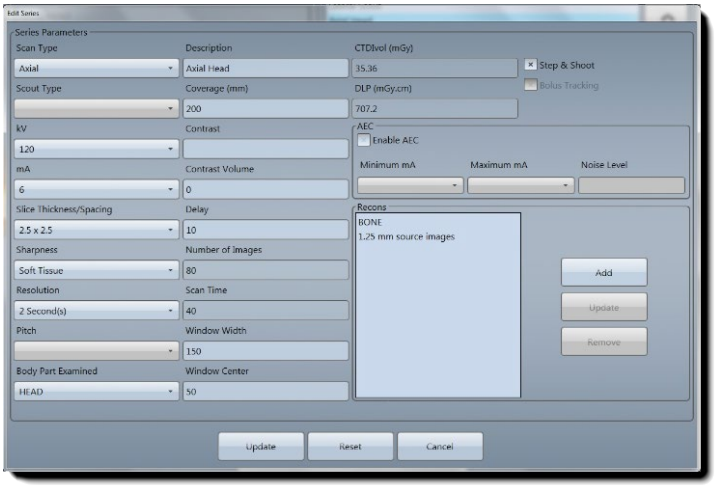



Figure 161: Edit Series dialog box

36. Click the **Update** button in the **Edit Protocol** dialog box.

37. Click the **Close** button to exit.

## Building from or editing an existing protocol

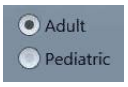
Using the **Build From** button is used in **Protocol Manager** when the operator wants to create a protocol from an already existing protocol. Using the **Edit** button is used in **Protocol Manager** as well as during a scan acquisition to edit a protocol.

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog appears.

2. Click one of the following:

   - **Adult** — To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** — To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** — To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.

   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

| **Note** | Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance. |
|---|---|

3. Click the colored orb corresponding to the appropriate body part.

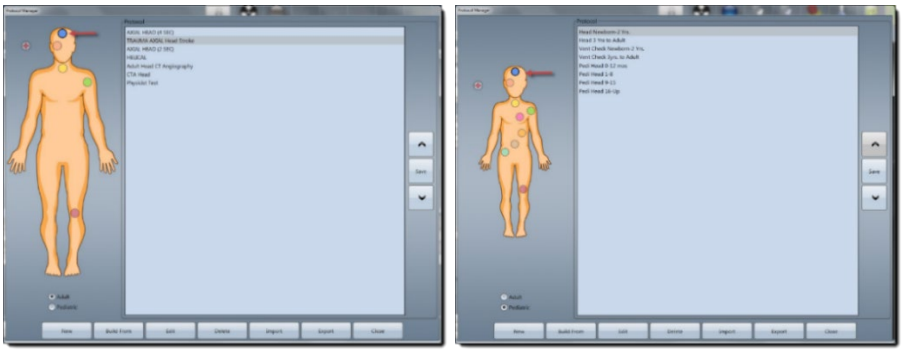


Figure 162: Anatomical orbs, in this case the head orb

4. Click the protocol you will build from or edit in the **Protocol** list.

   All the buttons, along the bottom of the dialog box, become active ***after*** you click a colored orb; each colored orb corresponds to a body part in the **Protocol** list. The colored orb's anatomical description (body location) appears under the **Adult** or **Pediatric** figure after it is selected, for example, hover over the colored orb at the knee and see **EXTREMITY** appear.

5. Perform one of the following:

   - To build from an already existing protocol, click the **Build From** button.

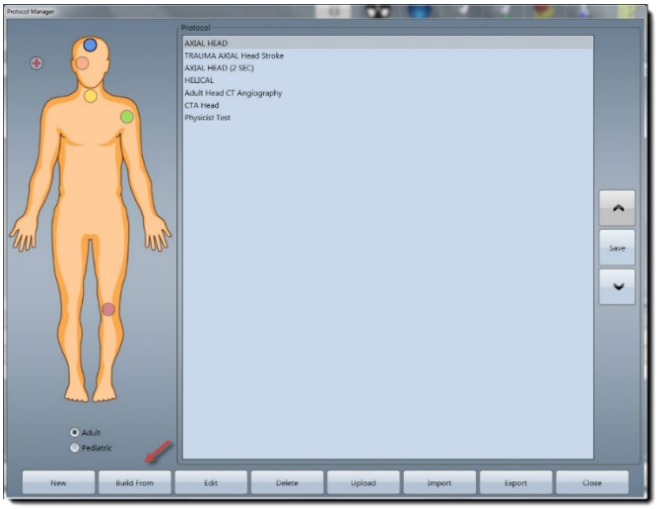



Figure 163: Build From button

The **New Protocol** dialog box appears.

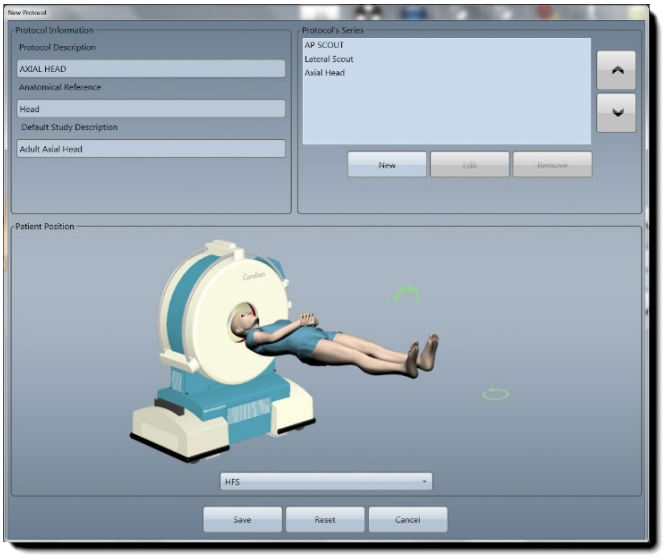



Figure 164: New Protocol dialog box

- To modify an existing protocol, click the **Edit** button.

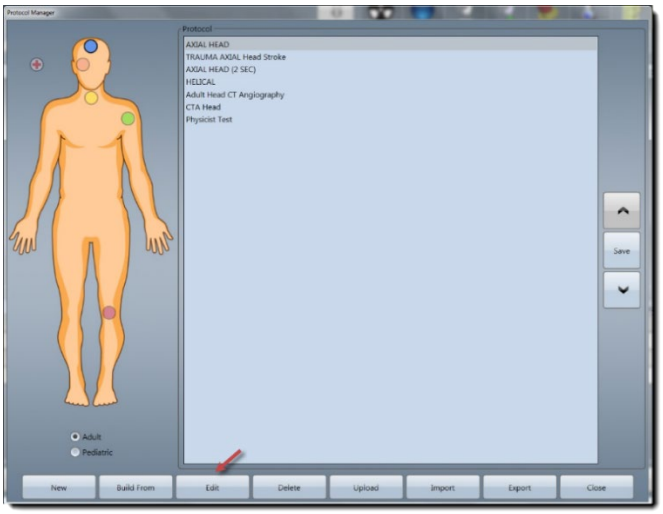



Figure 165: Edit button

The **Edit Protocol** dialog box appears.

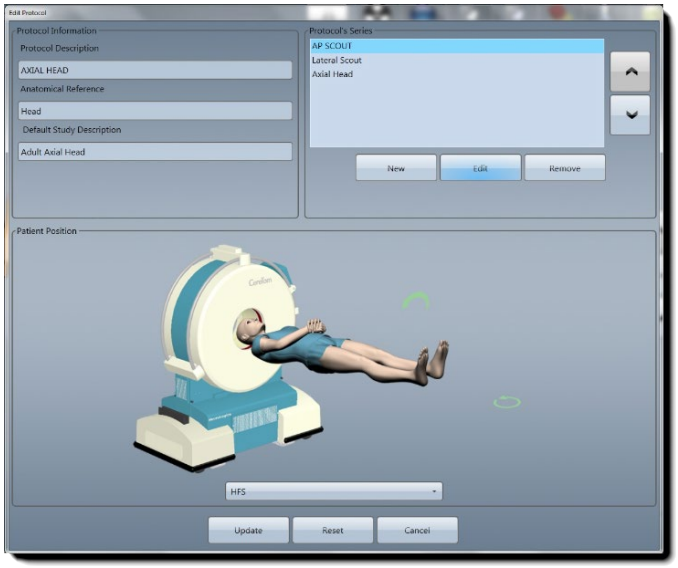



Figure 166: Edit Protocol dialog box

6. Make your changes.

   See "Creating a new protocol" on page 162 to learn how the fields and options perform to make informed choices on what to change.

| **Note** | Be sure to assign the **Build From** protocol a new name (**Protocol Description**) before you make your additional changes. |
|---|---|

7. Perform one of the following:

   - If you clicked the **Build From** button and see the **New Protocol** dialog box, click the **Save** button to save your changes.

     The **Successfully Saved** popup appears.

     - Click the **Ok** button in the **Successful Saved** popup to return to the **Protocol Manager** dialog box.

   - If you clicked the **Edit** button and see the **Edit Protocol** dialog box, click the **Update** button to save your changes to the existing protocol and click the **Update** button, again, to the **Protocol Manager**.

   - Click the **Reset** button to remove any changes and return the previously filled in fields and selections.

   - Click the **Cancel** button to return to the previous dialog box.

8. Click the **Close** button to exit.

# Copying and pasting protocols

To copy and paste protocols into the **Trauma** orb (quickly) or any other protocol section, copy and paste already created protocols from **Adult** and **Pediatric** to paste for **Trauma** protocols.

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog appears.

2. Click one of the following:

- **Adult** — To scan adult patients. Set adult protocols are stored by anatomical area, here.
- **Pediatric** — To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
- **Trauma** — To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.


By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

**Note** Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance.

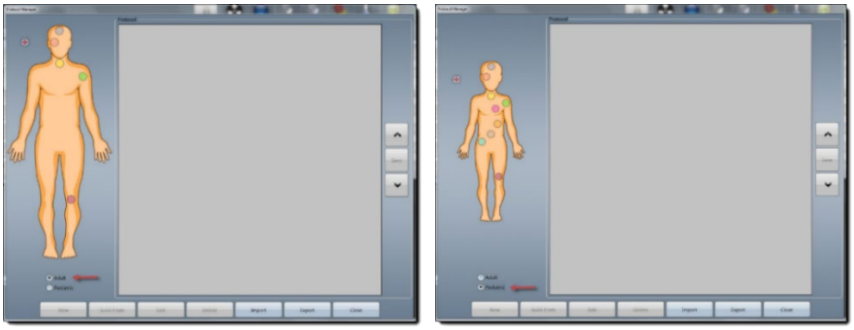


Figure 167: Protocol Manager for Adult and Pediatric

3. Click the colored orb corresponding to the appropriate body part.

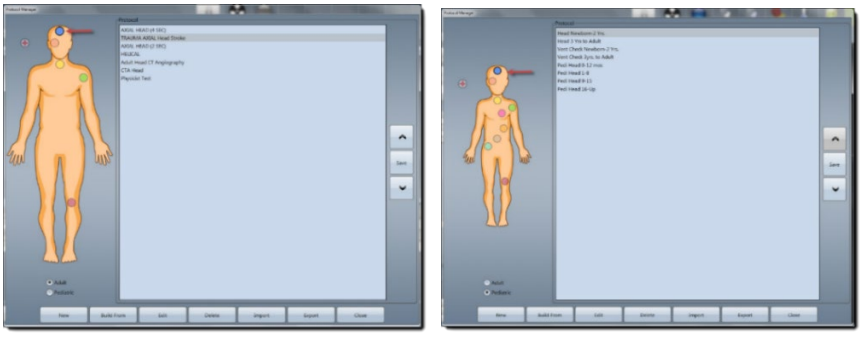


Figure 168: Anatomical orbs, in this case the head orb

4. Review those protocols you will copy.

5. Highlight the protocol, right-click to see the dropdown, and click **Copy**.

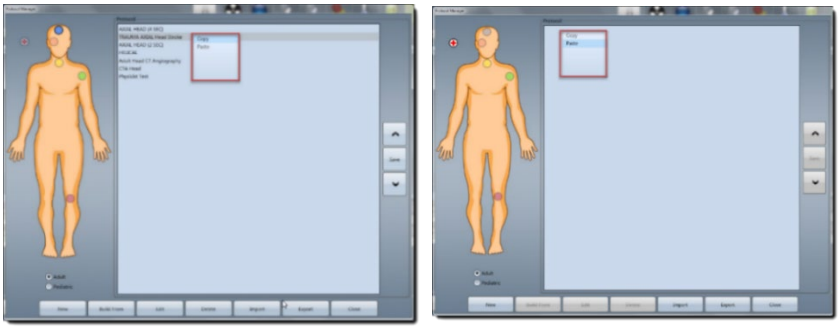


Figure 169: Copy and Paste right-click menus

6. Go to the trauma protocol listing.

7. Click (**Trauma**) or the orb you selected to copy the protocol to.

   This lets you create trauma-specific protocols.

8. Right-click to see the dropdown and click **Paste**.

9. Click the **Edit** button to change the name of the protocol.

10. Change the name of the protocol to reflect it is a trauma protocol for either an adult or pediatric listing; for example change the protocol name `AXIAL Head Stroke` to `TRAUMA AXIAL Head Stroke` to identify it as a trauma protocol.

11. Click the **Update** button.

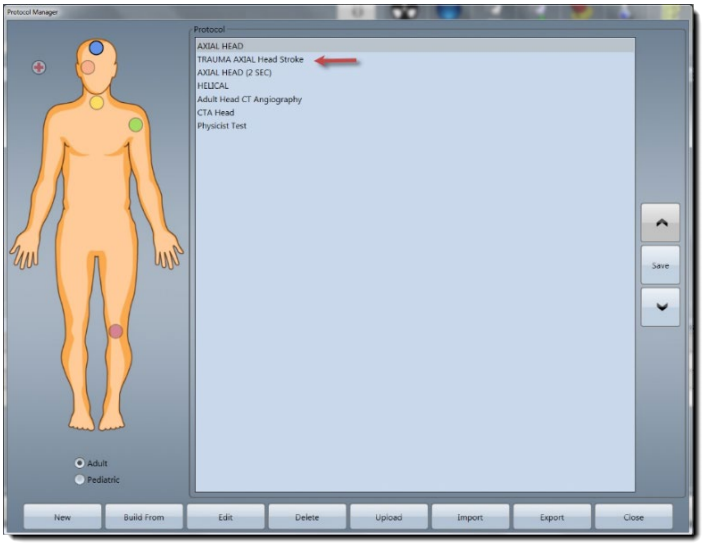



Figure 170: Created, trauma-specific protocol

12. Click **Close** button to exit.

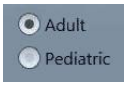
# Deleting a protocol

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog box appears.

2. Click one of the following:

   - **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕ ) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.

   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

| **Note** | Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance. |
|---|---|

3. Click the colored orb corresponding to the appropriate body part.

   Select the protocol from list to be deleted.

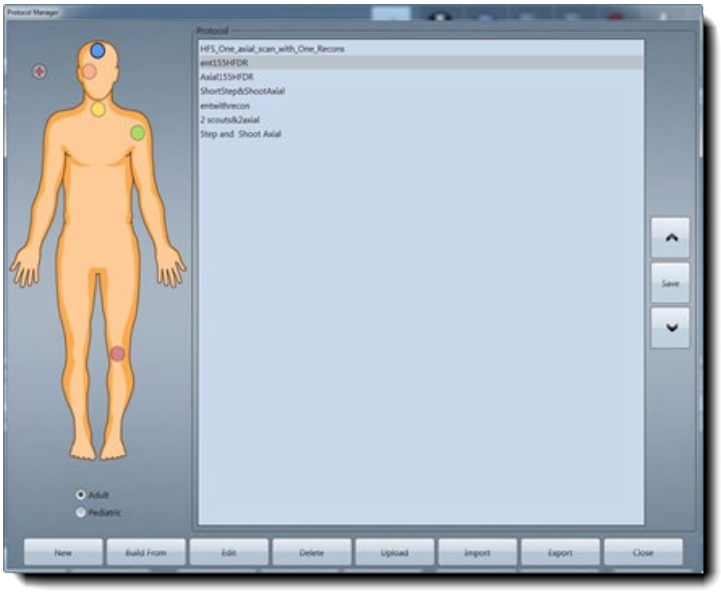



Figure 171: Protocol Manager with a protocol selected

4. Click the **Delete** button.

   The **Delete Confirmation** popup appears.

5. Perform one of the following in the **Delete Confirmation** popup:

   - Click the **Yes** button to delete the selected protocol.
   - Click the **No** button to return to the **Protocol Manager** dialog box.

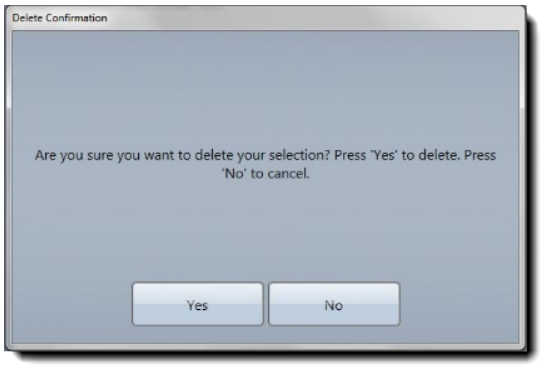



Figure 172: Delete Confirmation popup message – Yes or no to delete selection

The **Delete Confirmation** dialog box disappears and the **Protocol Manager** dialog box appears.

6. Click the **Close** button to exit.

# Uploading a protocol to the scanner

**Note** If **Dose Check** is enabled on the workstation, you cannot upload protocols to the scanner; the user will not see the **Upload** button.

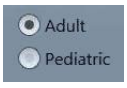
Uploading protocols to the scanner is necessary to scan patients from the touch screen.

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog box appears.

2. Click one of the following:

   - **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.

   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

**Note** Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance.

3. Click the colored orb corresponding to the appropriate body part.

4. Click the **Upload** button.

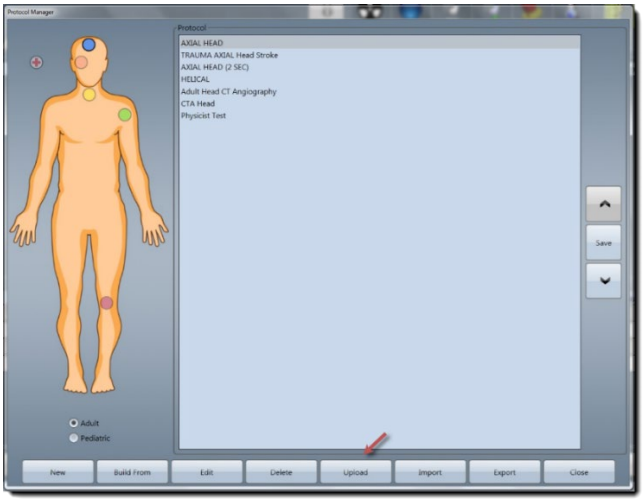



Figure 173: Upload button

The **Upload Protocols to Scanner** dialog box appears.

5. Select an exam from the **Exams** list.

   The newly selected protocol(s) appears in the **Protocols** list.

   Scouts, protocols with bolus tracking or **AEC**, and duplicate protocols ***cannot*** be uploaded to the scanner.

   If you select them, the following **Error** popup appears; click the **Ok** button to create alternative protocols.

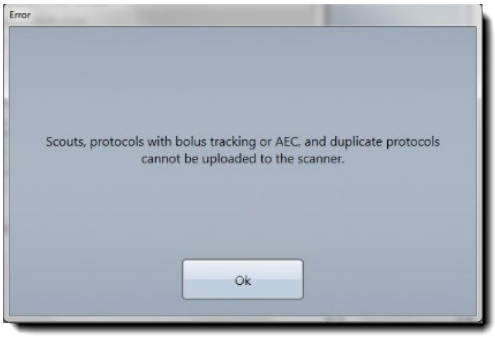



Figure 174: Error popup message – Scouts, protocols with bolus tracking or AEC, and duplicate protocols not uploaded

6. Select the protocol(s) from the **Protocols** list to upload.

7. Click the **Add** button.

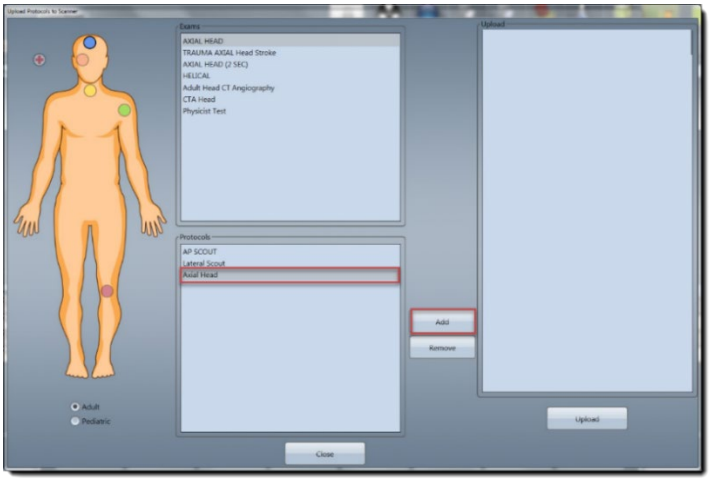



Figure 175: Selected Protocols to add

The protocols selected appear in **Upload** list.

8. Select the new, uploaded protocol(s).

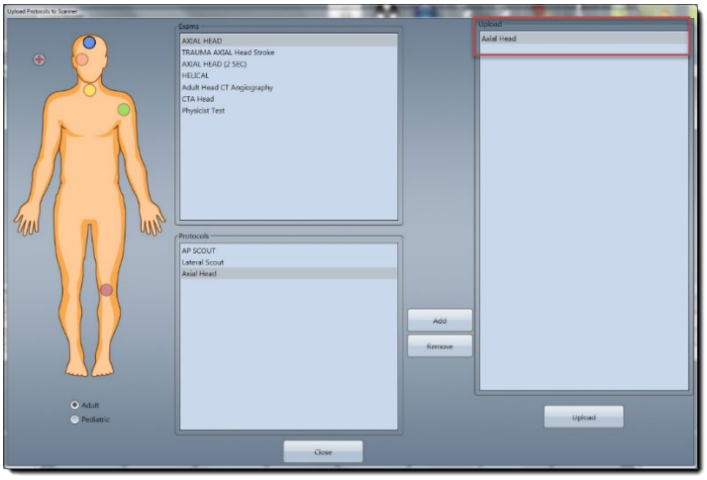



Figure 176: New protocols in Upload list

9. Click the **Upload** button.

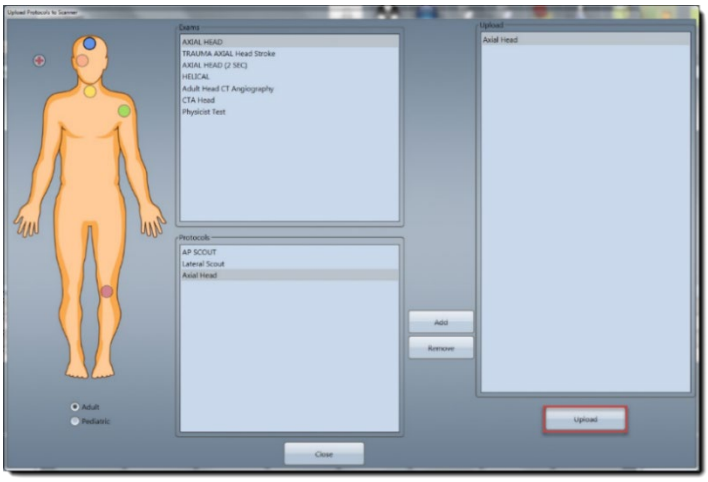



Figure 177: Upload protocols to scanner

The **Protocols Updated** popup appears to inform you that the protocols are successfully uploaded.

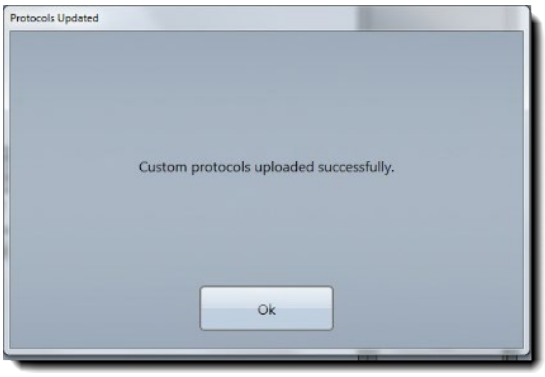



Figure 178: Protocols Updated popup message – Custom protocols uploaded

10. Click the **Ok** button to close the **Protocols Updated** popup.

11. Click the **Close** button to exit.

**Note** You ***cannot*** upload protocols from any other vendor's scanner.

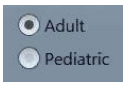
## Importing protocols from various media

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog box appears.

2. Click one of the following:

   - **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.

   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

**Note** Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance.

3. Click the colored orb corresponding to the appropriate body part.

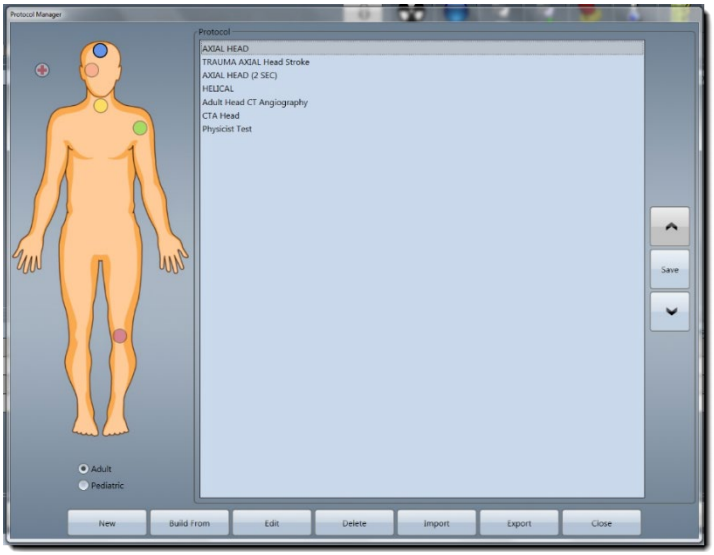



Figure 179: Protocol Manager with Adult protocols showing

4. Click the **Import** button.

   The **Select File** popup appears.

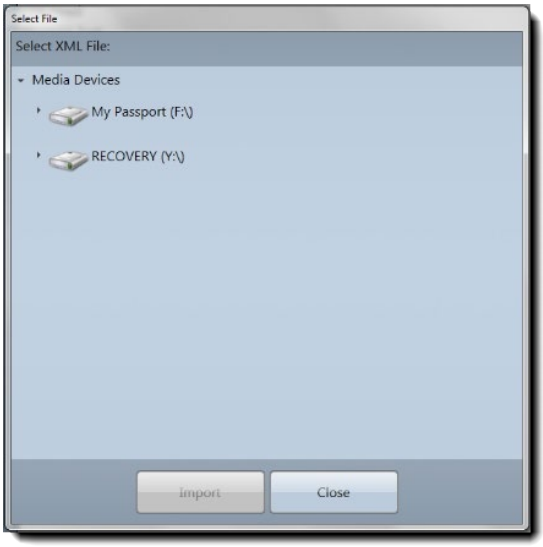



Figure 180: Select File popup

| Note | **You can import** images or studies from USB or CD for comparison to **Patient Browser**. |
|---|---|

5. Click the path from where you want the import files to go.

6. Click the file(s) to import.

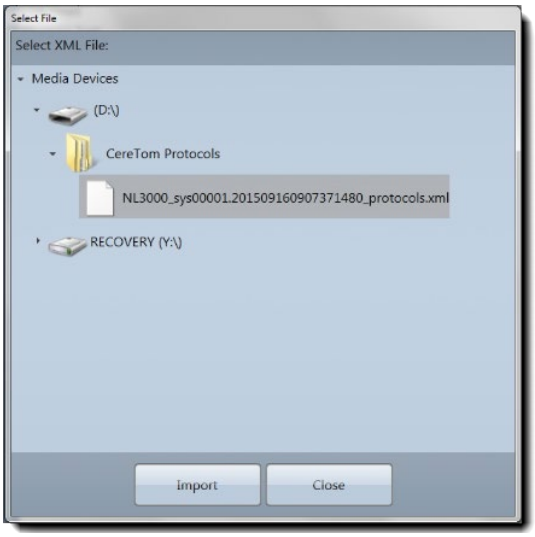



Figure 181: Import button active in Select File when file(s) selected

7. In **Select File** popup, click the **Import** button.

   The **Protocols Imported** popup appears.


Figure 182: Protocols Imported popup message – Protocols imported

8. Click the **Ok** button.

9. Check that the imported files are imported.

10. Click the **Close** button to exit.

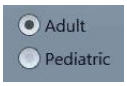
## Exporting protocols to various media

1. Click **Tools >Protocol Manager** from the main menu.

   The **Protocol Manager** dialog box appears.

2. Click one of the following:

   - **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
   - **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
   - **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕ ) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.

   By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

| **Note** | Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance. |
|---|---|

3. Click the colored orb corresponding to the appropriate body part.

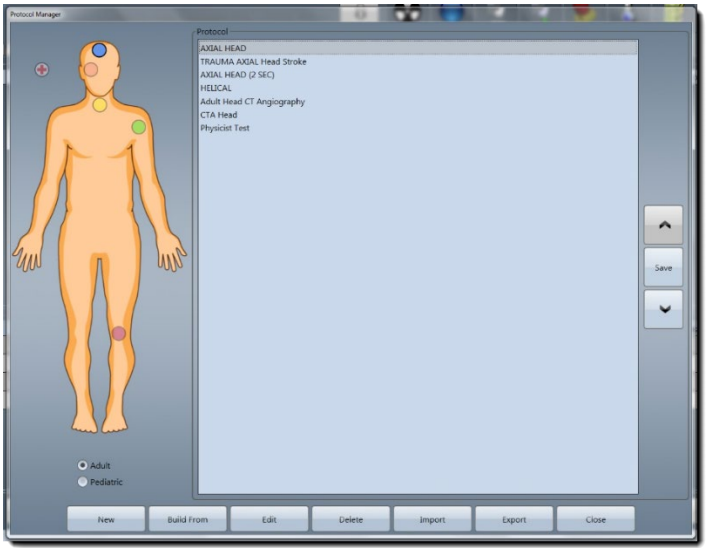



Figure 183: Protocol Manager with Adult protocols showing

4. Click the **Export** button.

   The **Select Directory** dialog box appears.

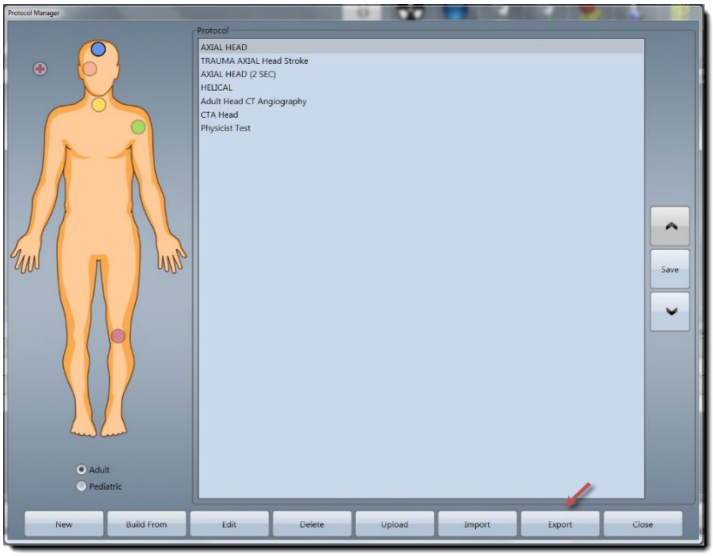



Figure 184: Export button enabled

5. Select the file(s) to export.

6. Click the path, to where you want to export files.

   When you select a path, the **Select** button is active.

7. Click the **Select** button in **Select Directory** popup.

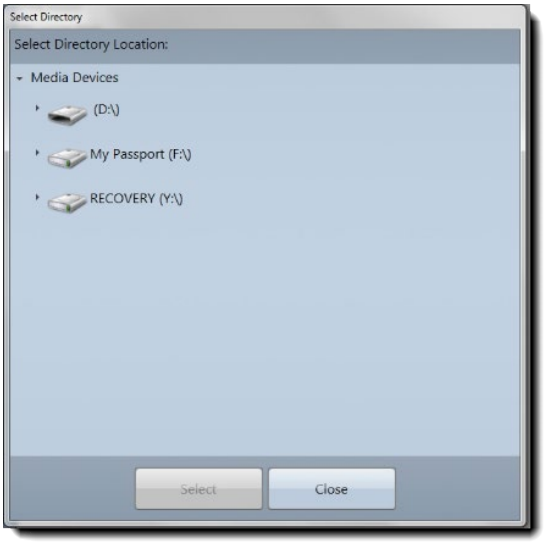



Figure 185: Select Directory popup

8. Click the **Select** button to confirm the files to export.

   The **Protocols Exported** popup appears.

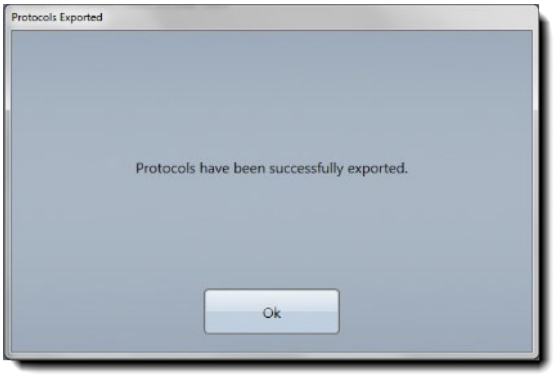



Figure 186: Protocols Exported popup message – Protocols exported

9. Click the **Ok** button.

10. Check that the exported files are exported.

11. Click the **Close** button to exit.

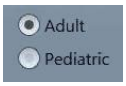
## Changing the order of protocols in the list

1. Click **Tools > Protocol Manager** from the main menu.

   The **Protocol Manager** dialog box appears.

2. Click one of the following:

- **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
- **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
- **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.




By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

3. Click the colored orb corresponding to the appropriate body part.

   The **New** button and others (depending on what was done previously) are active ***after*** you click the colored orb corresponding to the body part you will scan. You can then click the protocol that shows in the **Protocol** list. Existing protocols appear in the **Protocol** list box, as shown, below.

4. Click the protocol to move up or down the list.

5. Click the **Up** (arrow) button to move the protocol up the list; click the **Down** arrow to move the protocol down the list.

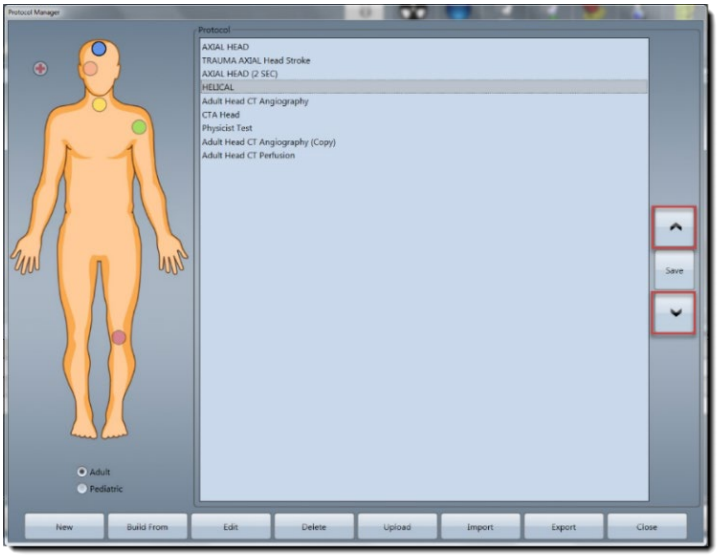



Figure 187: Changing protocol order with Up and Down (arrow) buttons

6. When you are finished ordering your protocols, click the **Save** button to save the new ordered list.

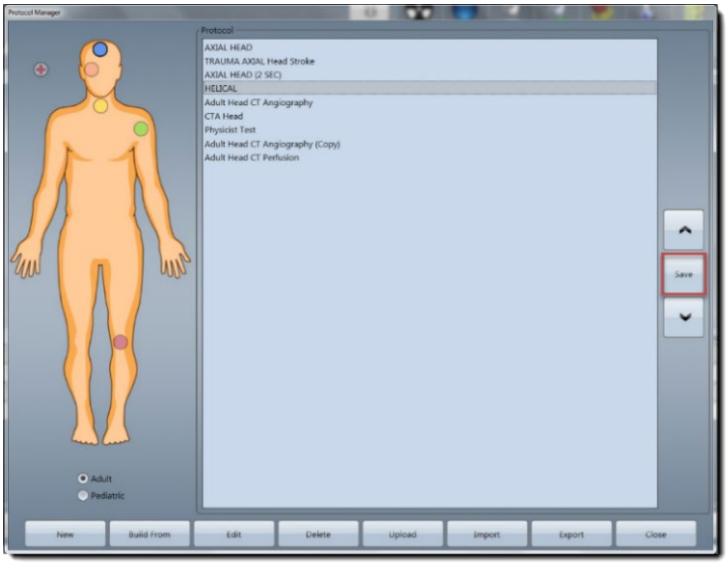



Figure 188: Protocol Save button

7. Click the **Close** button to exit.

# Chapter 7 Daily Calibration and Quality Assurance

You will learn how to perform a daily air calibration and use the **Quality Assurance** (QA) tool (a wizard) that verifies the system is at its optimum performance – in this chapter.

Keep in mind that ***before*** using the CereTom Elite system, you ***must*** conduct a **Quality Assurance (QA)** test to verify the system is at its optimum performance.

## Performing a daily (air) calibration from the LCD touch screen

**Note** NeuroLogica recommends that an air calibration is performed every 6-8 hours. If the air freshness falls below 50%, or the scanner is moved to an area with a dramatic change in humidity or temperature, perform another air calibration to ensure optimum image quality during patient scanning.

If room-temperature fluctuations have occurred, you may need to perform more than one air calibrations. In addition, scanners can drift out of alignment; make sure you perform a **Quality Test** with the test phantom ***before*** scanning a patient.

It is recommended that the scanner is on for at least 60-90 minutes prior to performing the air calibration.

Be sure that nothing is in the bore before the daily (air) calibration takes place.

1. Make sure the shielding curtains (if fitted) are fully closed before beginning.
2. On the touch screen, press the **Select Cal** button on the **Main** tab.

   The screen will then display a list of protocols from which to choose (on the left).


Figure 189: Select Cal button on the Main tab

3. Press the **Daily Cal** button.


Figure 190: Daily Cal button

4. Press the **Accept Protocol** button to continue.

5. Press **Start Daily Cal** to begin daily calibration.

   The **Daily Cal** has a built-in delay of ~10 seconds. The calibration takes ~ 4.5 minutes. The progress of the daily calibration appear on the workstation.

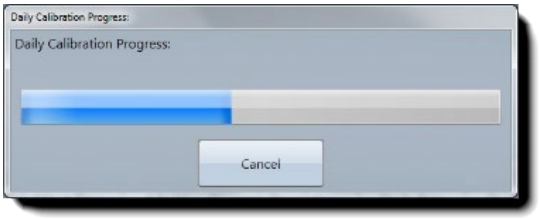



Figure 191: Daily Calibration Progress popup

To stop the scan, press the **Cancel** button.

The **Daily Cal** icon will change to green when it reaches a 100% air freshness.

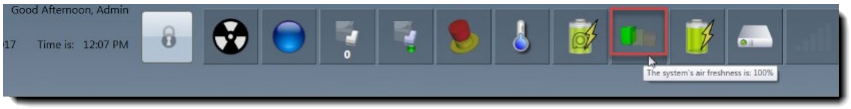



Figure 192: Air freshness icon changes as the air quality drops from green to yellow to red

## The QA phantom overview

The **QA phantom** is a device that measures parameters that completely characterize image quality; these parameters are as follows:

- Uniformity

- Noise
- High-contrast resolution
- Slice width
- Low-contrast resolution
- Sensitometry (contrast scale)

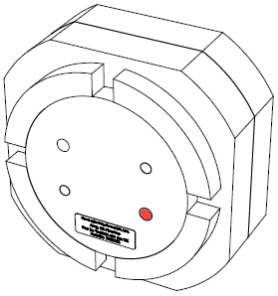


Figure 193: QA phantom

The **QA phantom** is a 20cm diameter disk consisting of a substrate made of **poly methyl methacrylate** (**PMMA**), and containing specific inserts. The uniform area of the disk is used to measure uniformity and noise. Four other parameters are measured by the inserts in the substrate.

The disk is encapsulated in a foam casing that enables it to be correctly positioned in the scanner. In this user manual, when the phantom is referenced, the foam casing is also implicitly referenced.

The **Axial** resolution wire, also called the **Modulation Transfer Function** (**MTF**) wire, is intended for measuring resolution in the **Axial** plane. Resolution is defined as the ability to distinguish small objects. It is expressed in line pairs per millimeter.

The **slice width wires** are the two inclined wires. They are intended to determine scanner resolution along the Z axis, that is, in the direction that is perpendicular to the **Axial** plane. Resolution along the Z axis is expressed in terms of slice width in millimeters. Although one wire is sufficient to measure the Z axis resolution if its position is accurately known, a second wire is included to confirm the alignment. If the alignment was incorrect, the results of the slice width test would not be accurate.

The low-contrast insert is a compound insert. It is made of two half cylinders of different materials with a known contrast difference between them. The low-contrast insert is intended to measure the contrast resolution of the scanner. The contrast resolution is the ability to measure small differences in x-ray attenuation.

The sensitometry inserts are an air bore and cylinder made of different materials. They are intended to measure the contrast scaling of the scanner.

The QA scan protocols appear in the following table.

Table 21: Scan protocols used by the QA

| | CereTom Elite |
|---|---|
| Scan voltage | 140 kV |
| Scan current | 7 mA |
| Scan time | 6 seconds |
| Kernel | PostFossa |
| Slice thickness | 10mm |

## Starting Quality Assurance from the touch screen

To ensure the system is at its optimum, factory-specifications level, the workstation provides QA tools to verify the system's state and to perform image-quality verification.

Before you begin this section, be sure to run a fresh **Daily Calibration** on the system using the touch screen. See "Performing a daily (air) calibration from the LCD touch screen" on page 190.

The QA protocol is shipped with the system and appears when you click **Quality Assurance** from the main menu (on the workstation) or if the **QA protocol** is selected on the touch screen. You (the operator) cannot customize or modify the QA protocol.

**Note** The QA test should be conducted per the local (hospital) requirements; scanning the QA phantom is done daily, weekly, or monthly, typically.

Before beginning the **QA protocol**, make sure a **QA phantom** is available and ready to install in the bore.

1. Place the phantom in the bore.

   The phantom label should face the front of the scanner and be positioned at the bottom – as shown in the figure below. The red insert should be on the operator's right when facing the scanner. The position of the phantom will greatly affect the QA results.

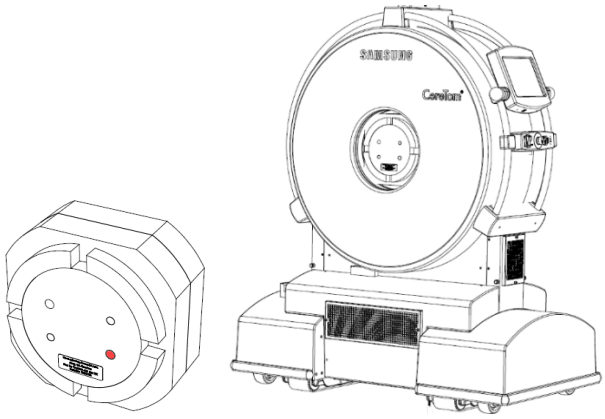


Figure 194: Phantom and phantom in bore

2. On the touch screen, press the **Laser On** button.

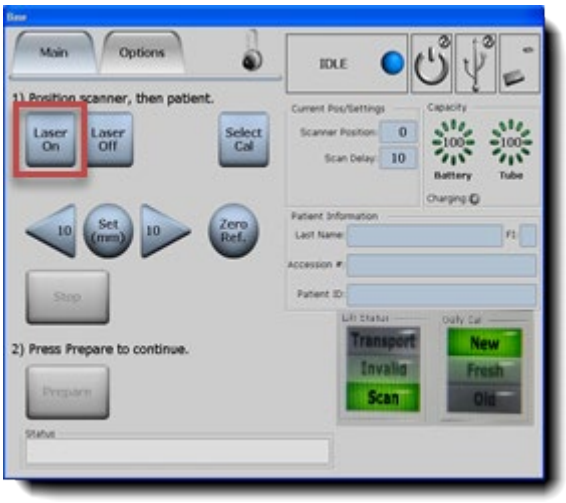



Figure 195: Laser On button

3. Align the phantom by lining the QA phantom's etching (line(s)) with the laser light.

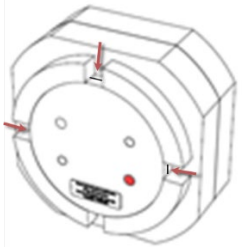


Figure 196: Phantom's etchings appear on top and sides

4. Make sure the **shielding curtains** are fully closed before starting the QA.

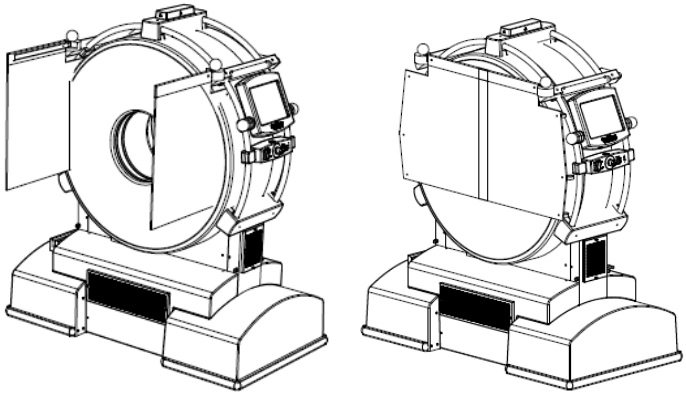


Figure 197: Shielding curtains, opened and closed

5. Align the center of the phantom with the laser light.

   The laser will automatically shut off 30 seconds after pressing the **Laser On** button.

   See the laser precautions in "Laser safety" on page 52.

6. Press the **Select Cal** button on the touch screen.

7. Press the **QA** button.

8. Press the **Accept Protocol** button.

   Wait for the **Scan** button to be activated.

9. Press the **Scan** button to initiate the scan.

   To cancel the scan, press the **Cancel** button to return to the **Main** tab and abort the QA.

10. Press the **Start** button.

11. Wait for the QA to appear.


Figure 198: QA results

| **Note** | Items in red are failed results; reposition your phantom to perform another scan. Often positional issues cause the failure. If you try multiple times and failures persist, call your service representative. |
|---|---|

12. Review the results.

13. Click the **Close** button on the **QA Results** popup when finished reviewing.

    The image of the phantom appears.

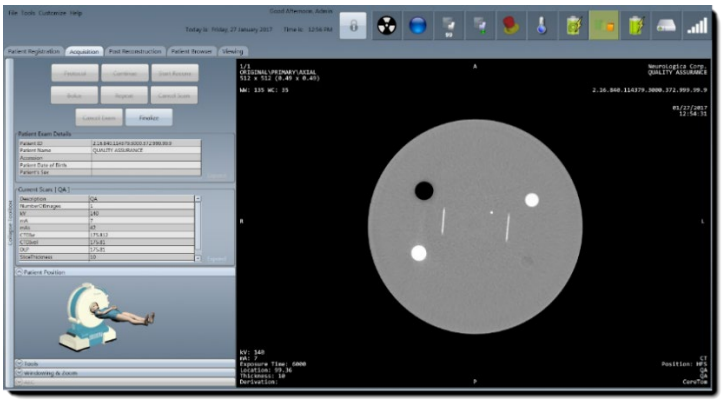


Figure 199: Phantom image

14. Click the **Finalize** button on the workstation to exit the protocol.

    The QA appears in the **Patient Browser**; however, it is locked.

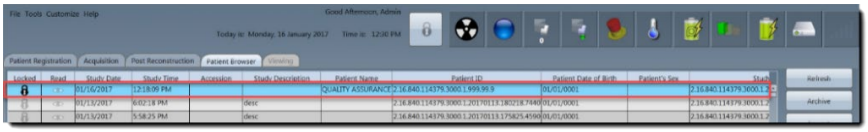


Figure 200: Locked QA results in Patient Browser

| Note | The results appear in **Patient Browser** and are locked (and cannot be deleted). Please see your service representative to remove the results. |
|---|---|

## Starting Quality Assurance from the workstation

1. Perform steps 1 through 5 in the procedure "Starting Quality Assurance from the touch screen" on page 193.

2. Click **Tools > Quality Assurance** from the workstation main menu.

   The **Quality Assurance** (QA) appears.

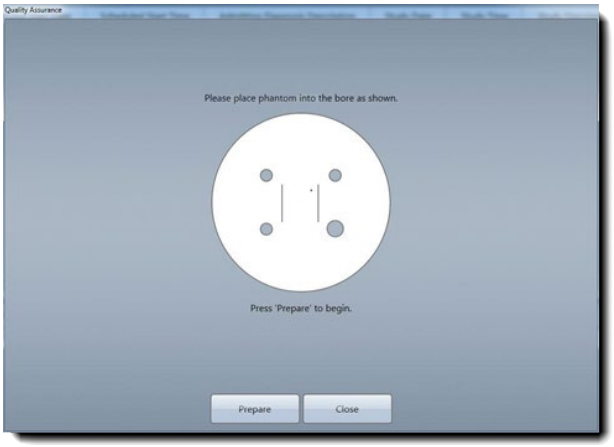



Figure 201: QA phantom orientation

3. Click the **Prepare** button to begin the **Quality Assurance** test to run.

   Alternatively, click the **Close** button to return to the previous screen.

4. Wait for the **Quality Assurance** test to run.

   The system state orb will change color from  (preparing the protocol to the system) to  (ready to scan). The **System Ready to Scan** popup appears.


Figure 202: System Ready to Scan popup message – System is ready to begin

5. From the workstation, perform one of the following:

   - To cancel the scan, perform the following:
     - Click the **Cancel Scan** button on the workstation screen.
     - Click the **Ok** button on the **Exam Canceled** popup.
     - The scan will end and the remaining steps are not required to perform.
   - To continue to scan, go to the next step.

6. Go to the touch screen (on the scanner) and press the **Start** button.

   You cannot start the scan from the workstation. The system will scan the phantom. Results for the QA image appear.


Figure 203: QA results of QA image

| **Note** | Items in red are failed results; reposition your phantom to rescan again. Often positional issues cause the failure. If you try multiple times and failures persist, call your service representative. |
|---|---|

7. Review the results.

8. Click the **Close** button on the results popup when finished reviewing.

9. Click the **Finalize** button on the workstation to exit the protocol.

   The QA appears in the **Patient Browser**; however, it is locked.

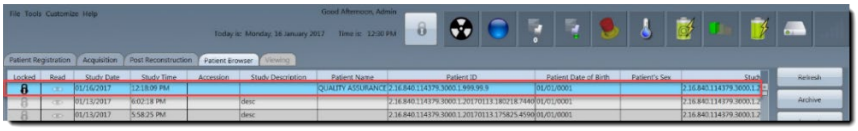


Figure 204: Locked QA results shown in Patient Browser

| **Note** | The results appear in **Patient Browser** and are locked (and cannot be deleted). Please see your service representative to remove the results. |
|---|---|

# Ensuring good image quality

In order to produce consistent image quality over the system's lifetime, you should (and it is strongly advised) establish and maintain a regular **Quality Assurance** (QA) program. QA results are stored in the Patient Browser (workstation). Please contact your local service representative to delete QA results.

1. Scan a known material (usually a phantom) under a prescribed set of conditions.

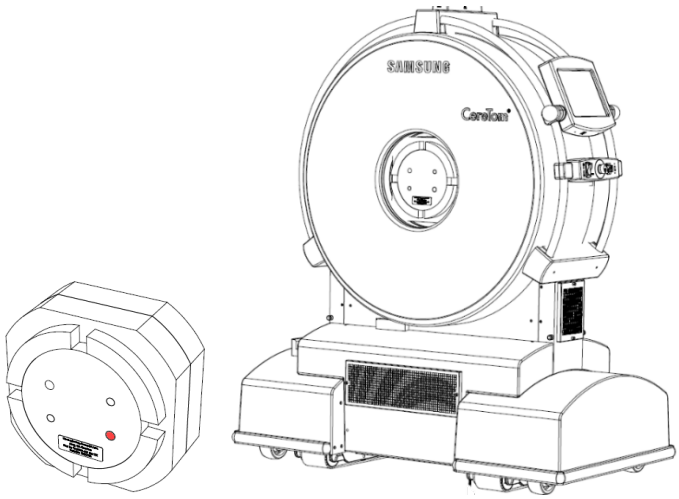



Figure 205: Phantom and phantom in bore

2. Compare the results to previous or optimum values and repeat these tests on a regular basis to detect changes in image quality values ***before*** any problem becomes visible.

| **Note** | If you notice degradation in image quality or a change in QA values, schedule a site visit and let service person or imaging physicist run more detailed tests.<br><br>Early intervention could prevent a major breakdown. |
|---|---|

QA begins with baseline performance data that is acquired during system installation or after the repair or replacement of an x-ray generator-assembly, collimator, detector, **Data Acquisition System** (**DAS**) or main power circuitry.

3. Compare subsequent QA results against the baseline.

Baseline images can be saved for a visual comparison with QA checks, but measurement values provide a more objective way to monitor quality.

There is a single fixed collimator tested as part of the MonoBlock assembly for proper alignment.


Figure 206: Results of QA image after the QA test

## Using Axial plane to determine image resolution

The method to determine resolution in the **Axial** plane is to measure the modulation-transfer function of the scanner. A planar section of the **MTF** wire provides a point, called an **impulse**. The impulse is blurred by the imaging system, and the measurement of the blur quantifies the resolution. The blur is quantified by the **MTF** amplitude, which provides a measure of gain for a given object size in line pairs per centimeter (lp/cm).

The **MTF** is measured in two directions, called **radial** and **tangential** directions. The radial direction is along the line that joins the wire to the scanner isocenter. The tangential direction is perpendicular to the radial direction. The **MTF** along each direction produces a curve. The points at which each curve's amplitude is 50% and 10% of its amplitude at zero lp/cm are reported.

The expected results are given below.

Table 22: Modulation Transfer Function direction

| Direction | 50% | 10% |
|---|---|---|
| Radial | 4.7 | 7.2 |
| Tangential | 4.7 | 7.2 |

## Using slice width

The method for determining the slice width for the **Axial** mode QA is to take an image of the inclined wire. The scanned section of the inclined wire is a line segment. The scanner blurs a scanned object in the **Axial** plane as well as in the direction perpendicular to it. The image of the inclined wire includes both the **Axial** plane blurring (**MTF**) of the scanner as well as the blurring in the z-direction. The slice width is determined by removing the component of in-plane blurring, by measuring the length of the wire segment and by using the known angle of wire inclination.

Table 23: Slice width

| | CereTom Elite |
|---|---|
| Slice width | 10.0 ±1mm |

## Measuring noise

**Noise** is measured as the standard deviation of pixel values in a 1cm **Region of Interest** (**ROI**) at the center of the phantom. The **ROI** selection is automatic. The $CTDI_{100}$ center dose in a standard CTDI head phantom is 145 mGy for this scanning technique. The CereTom Elite noise is measured in a 10mm slice.

Table 24: Noise

| | CereTom Elite |
|---|---|
| Noise | 2.3 ±0.4 |

## Measuring low contrast

**Low-contrast resolution** is measured as the difference between the mean CT values in each half of the low-contrast insert. An **ROI** is automatically selected around the low-contrast phantom and is automatically segmented into halves. Within each **ROI**, the mean pixel value is computed. The two mean values are subtracted.

The expected difference in the mean values is given in the electronic report. The low contrast should be: 5.0 ±1.0 HU.

## Finding uniformity

A **ROI** is automatically selected in each of five locations in the phantom. One **ROI** is at the center. Four outer **ROI**s are 60 to 70mm from the center of the phantom and spaced 90 degrees apart. A mean value is calculated in each **ROI**. The maximum difference between the means is calculated. The maximum allowable difference between the means is 3 HU.

Separate, independent measurements of the CT numbers of Air, Teflon, and Acrylic (see "Identifying CT contrast scale" on page 201 below) ensure that the overall CT number-scaling of the system is in order. If the uniformity portion of the QA protocol passes (maximum difference less than or equal to 3 HU), but the mean values of the five **ROI**s are all uniformly high or low in CT number, it is expected that the tests for air, Teflon, and/or acrylic will fail.

## Identifying CT contrast scale

Contrast scale represents the attenuation scaling of the scanner. The mean CT numbers of each of the sensitometry objects is calculated and reported.

Table 25: Values of the CT numbers

| | Typical | Range |
|---|---|---|
| Air | -1000 | -1010 to -970 |
| Teflon | 974 | 944 to 984 |
| Acrylic | 111 | 80 to 120 |

# Using performance phantoms

The phantoms (in the following sections) were used for measurement of dose and imaging performance.

## Measuring dose

The dose is measured using the standard CTDI head phantom.

### Identifying load factors

Table 26: Load factors

| kV | Current (mA) | Time (secs) | mAs | Dose exposure (Rad) | Dose exposure (mGy) | Number of scans to achieve 1Gy |
|---|---|---|---|---|---|---|
| | **Axial** | | | | | |
| 100 | 3 | 1 | 3 | 0.55 | 5.45 | 183.49 |
| | 4 | | 4 | 0.75 | 7.3 | 136.99 |
| | 5 | | 5 | 0.9 | 9.1 | 109.89 |
| | 6 | | 6 | 1.1 | 10.95 | 91.32 |
| | 7 | | 7 | 1.3 | 12.75 | 78.43 |
| | 3 | 2 | 6 | 1.1 | 10.9 | 91.74 |
| | 4 | | 8 | 1.5 | 14.6 | 68.49 |

| kV | Current (mA) | Time (secs) | mAs | Dose exposure (Rad) | Dose exposure (mGy) | Number of scans to achieve 1Gy |
|---|---|---|---|---|---|---|
| | 5 | | 10 | 1.8 | 18.2 | 54.95 |
| | 6 | | 12 | 2.2 | 21.9 | 45.66 |
| | 7 | | 14 | 2.6 | 25.5 | 39.22 |
| | 3 | | 12 | 2.9 | 21.9 | 45.66 |
| | 4 | | 16 | 2.9 | 29.2 | 34.25 |
| | 5 | 4 | 20 | 3.6 | 36.4 | 27.47 |
| | 6 | | 24 | 4.4 | 43.7 | 22.88 |
| | 7 | | 28 | 5.1 | 51 | 19.61 |
| | 3 | | 18 | 3.3 | 32.8 | 30.49 |
| | 4 | | 24 | 4.4 | 43.7 | 22.88 |
| | 5 | 6 | 30 | 5.5 | 54.7 | 18.28 |
| | 6 | | 36 | 6.6 | 65.6 | 15.24 |
| | 7 | | 42 | 7.7 | 76.5 | 13.07 |
| | 1 | | 1 | 0.9 | 2.95 | 338.98 |
| | 2 | | 2 | 0.6 | 5.85 | 170.94 |
| | 3 | | 3 | 0.9 | 8.8 | 113.64 |
| | 4 | 1 | 4 | 1.15 | 11.7 | 85.47 |
| | 5 | | 5 | 1.45 | 14.65 | 68.26 |
| | 6 | | 6 | 1.75 | 17.6 | 56.82 |
| | 7 | | 7 | 2.05 | 20.5 | 48.78 |
| | 1 | | 2 | 0.6 | 5.9 | 169.49 |
| 120 | 2 | | 4 | 1.2 | 11.7 | 85.47 |
| | 3 | | 6 | 1.8 | 17.6 | 56.82 |
| | 4 | 2 | 8 | 2.3 | 23.4 | 42.74 |
| | 5 | | 10 | 2.9 | 29.3 | 34.13 |
| | 6 | | 12 | 3.5 | 35.2 | 28.41 |
| | 7 | | 14 | 4.1 | 41 | 24.39 |
| | 1 | | 4 | 1.2 | 11.7 | 85.47 |
| | 2 | 4 | 8 | 2.3 | 23.4 | 42.74 |
| | 3 | | 12 | 3.5 | 35.2 | 28.41 |

| kV | Current (mA) | Time (secs) | mAs | Dose exposure (Rad) | Dose exposure (mGy) | Number of scans to achieve 1Gy |
|---|---|---|---|---|---|---|
| | 4 | | 16 | 4.7 | 46.9 | 21.32 |
| | 5 | | 20 | 5.9 | 58.6 | 17.06 |
| | 6 | | 24 | 7 | 70.3 | 14.22 |
| | 7 | | 28 | 8.2 | 82 | 12.20 |
| | 1 | | 6 | 1.8 | 17.6 | 56.82 |
| | 2 | | 12 | 3.5 | 35.2 | 28.41 |
| | 3 | | 18 | 5.3 | 52.7 | 18.98 |
| | 4 | 6 | 24 | 7 | 7.03 | 142.25 |
| | 5 | | 30 | 8.8 | 87.9 | 11.38 |
| | 6 | | 36 | 10.5 | 105.5 | 9.48 |
| | 7 | | 42 | 12.3 | 123.1 | 8.12 |
| | 1 | | 1 | 0.4 | 4.15 | 240.96 |
| | 2 | | 2 | 0.85 | 8.35 | 119.76 |
| | 3 | | 3 | 1.25 | 12.5 | 80.00 |
| | 4 | 1 | 4 | 1.65 | 16.7 | 59.88 |
| | 5 | | 5 | 2.1 | 20.85 | 47.96 |
| | 6 | | 6 | 2.5 | 25 | 40.00 |
| | 7 | | 7 | 2.9 | 29.2 | 34.25 |
| | 1 | | 2 | 0.8 | 8.3 | 120.48 |
| | 2 | | 4 | 1.7 | 16.7 | 59.88 |
| 140 | 3 | | 6 | 2.5 | 25 | 40.00 |
| | 4 | 2 | 8 | 3.3 | 33.4 | 29.94 |
| | 5 | | 10 | 4.2 | 41.7 | 23.98 |
| | 6 | | 12 | 5 | 50 | 20.00 |
| | 7 | | 14 | 5.8 | 58.4 | 17.12 |
| | 1 | | 4 | 1.7 | 16.7 | 59.88 |
| | 2 | | 8 | 3.3 | 33.4 | 29.94 |
| | 3 | 4 | 12 | 5 | 50 | 20.00 |
| | 4 | | 16 | 6.7 | 66.7 | 14.99 |
| | 5 | | 20 | 803 | 83.4 | 11.99 |

| kV | Current (mA) | Time (secs) | mAs | Dose exposure (Rad) | Dose exposure (mGy) | Number of scans to achieve 1Gy |
|---|---|---|---|---|---|---|
| | 6 | | 24 | 10 | 100.1 | 9.99 |
| | 7 | | 28 | 11.7 | 116.8 | 8.56 |
| | 1 | | 6 | 2.5 | 25 | 40.00 |
| | 2 | | 12 | 5 | 50 | 20.00 |
| | 3 | | 18 | 7.5 | 75.1 | 13.32 |
| | 4 | 6 | 24 | 10 | 100.1 | 9.99 |
| | 5 | | 30 | 12.5 | 125.1 | 7.99 |
| | 6 | | 36 | 15 | 150.1 | 6.66 |
| | 7 | | 42 | 17.5 | 175.1 | 5.71 |
| | Helical | | | | | |
| 100 | 1 | 1 | 1 | 0.2 | 1.8 | 555.56 |
| | 2 | | 2 | 0.4 | 3.6 | 277.78 |
| | 3 | | 3 | 0.5 | 5.5 | 181.82 |
| | 4 | | 4 | 0.7 | 7.3 | 136.99 |
| | 5 | | 5 | 0.3 | 9.1 | 109.89 |
| | 6 | | 6 | 1.1 | 10.9 | 91.74 |
| | 7 | | 7 | 1.3 | 12.7 | 78.74 |
| 120 | 1 | | 2 | 0.9 | 2.9 | 344.83 |
| | 2 | | 4 | 0.6 | 5.9 | 169.49 |
| | 3 | | 6 | 0.9 | 8.8 | 113.64 |
| | 4 | | 8 | 1.2 | 11.7 | 85.47 |
| | 5 | | 10 | 1.5 | 14.7 | 68.03 |
| | 6 | | 12 | 1.8 | 17.6 | 56.82 |
| | 7 | | 14 | 2.1 | 20.5 | 48.78 |
| 140 | 1 | | 4 | 0.4 | 4.2 | 238.10 |
| | 2 | | 8 | 0.8 | 8.3 | 120.48 |
| | 3 | | 12 | 1.3 | 12.5 | 80.00 |
| | 4 | | 16 | 1.7 | 16.7 | 59.88 |
| | 5 | | 20 | 2.1 | 20.9 | 47.85 |
| | 6 | | 24 | 2.5 | 25.0 | 40.00 |

| kV | Current (mA) | Time (secs) | mAs | Dose exposure (Rad) | Dose exposure (mGy) | Number of scans to achieve 1Gy |
|---|---|---|---|---|---|---|
| | 7 | | 28 | 2.9 | 29.2 | 34.25 |
| | CT perfusion | | | | | |
| 100 | 1 | 30 | 30 | 5.5 | 54.6 | 18.32 |
| | 2 | | 60 | 10.9 | 109.2 | 9.16 |
| | 3 | | 90 | 16.4 | 163.8 | 6.11 |
| | 4 | | 120 | 21.8 | 218.4 | 4.58 |
| | 5 | | 150 | 27.3 | 273.0 | 3.66 |
| | 6 | | 180 | 32.8 | 327.6 | 3.05 |
| | Dynamic (Xenon perfusion) | | | | | |
| 100 | 1 | 16 | 16 | 2.9 | 29.1 | 34.36 |
| | 2 | | 32 | 5.8 | 58.2 | 17.18 |
| | 3 | | 48 | 8.7 | 87.4 | 11.44 |
| | 4 | | 64 | 11.6 | 116.5 | 8.58 |
| | 5 | | 80 | 14.6 | 145.6 | 6.87 |
| | 6 | | 96 | 17.5 | 174.7 | 5.72 |
| | 7 | | 112 | 20.4 | 203.8 | 4.91 |

**CAUTION** When conducting multiple or repeat scans, ensure that the total exposure does not exceed 1Gy CTDI.

**Notes** The **Number of scans** column in Table 26 denotes the exact quantity of scans that result in reaching 1Gy. Be sure to round the value down to its whole number if this column is referenced for any respective reason.

The highest x-ray tube voltage is 140kV and the highest x-ray tube current selection at this voltage is 7mA.

The highest x-ray tube current is 7mA and the highest x-ray tube voltage selection at this current is 140kV.

The nominal x-ray output power is 0.84kW when operating at an x-ray tube voltage of 120kV and x-ray current of 7mA for 4 seconds.

The x-ray tube voltage/current tolerance is ±10%.

The nominal x-ray tube voltage is 140kV with 100cfm minimum cooling flow.

# The CereTom Elite dose information (21 CFR 1020.33 c)

For a technique of 7.0 mA, 1 second and 120 kV the expected $CTDI_{100}$ center dose is 16.6 mGy. The $CTDI_{100}$ surface dose is 21.8 mGy. The weighted $CTDI_{100}$ dose is 20.1 mGy. For other scanning voltages, these $CTDI_{100}$ values are multiplied by the factors given in the following table.

Table 27: CereTom Elite $CTDI_{100}$ values

| $CTDI_{100}$ Center (C) | $CTDI_{100}$ Surface (S) | CTDIw (W) |
|---|---|---|
| 16.6 | 21.8 | 20.1 |

Table 28: Scan voltage weighting factors for dose calculations

| kV | $CTDI_{100}$ Center (C) | $CTDI_{100}$ Surface (S) | CTDIw (W) |
|---|---|---|---|
| 140 | 1.45 | 1.40 | 1.41 |
| 120 | 1.0 | 1.0 | 1.0 |
| 100 | 0.63 | 0.66 | 0.65 |
| 80 | 0.33 | 0.38 | 0.37 |

$$CTDI_w = \left(\frac{2}{3}\times S + \frac{1}{3}\times C\right)\frac{mGy}{s}$$

For allowed scanning techniques NeuroLogica uses the following formula.

$$CTDI_w(kV) = \left(W(kV)\frac{m}{7.0}S\right)CTDI_w\left(120_{kV}\right)_{mGy}$$

Where $W$ is the $kV$ relative dose ratio $m$ $m$ is the x-ray tube current in mA, and $S$ $S$ is the scanning time in seconds. For **Helical** scans we report, consider the following:

$$CTDI_{vol} = \frac{CTDI_w}{Pitch}$$

The dose-length product (DLP) is defined as the product of the $CTDI_{vol}$ multiplied by the scan length.

$$DLP = CTDI_{vol} \times Scan\ Coverage$$

The $CTDI_{vol}$ is measured in mGy and the DLP is measured in mGy.cm.

## The CereTom Elite dose in air

The dose in air for typical head scan of 120 kV, 6 mA, 4 seconds is 101 mGy. For a maximum technique of 7.0 mA, 4 seconds dose in air values are given by the following table.

Table 29: kV vs. dose in air

| kV | Dose in air (mGy) |
|---|---|
| 140 | 160.78 |
| 120 | 117.06 |
| 100 | 79.95 |
| 80 | 49.63 |

**Note** All measurements are averages from ten trials and all measurements were within ±10% of the mean.

## Dose linearity with tube voltage and current

The dose or radiation output of the tube is linear with the tube current. The exposures are measured at two different scan at isocenter with and without a CTDI phantom. The following table shows the exposure in the CTDI head phantom.

Table 30: Exposure at two different mAs

| 120 kV, 20 secs, head CTDI | Exposure at iso (mR) |
|---|---|
| 4 mA | 2.22 |
| 7 mA | 3.87 |

Table 31: Exposure at two different mAs

| 120 kV, 4 secs, in air | Exposure at iso |
|---|---|
| 6 mA | 1.154 |
| 7 mA | 1.346 |

Two linearity factors are computed. The first is the ratio of the exposure at different scan currents; ***F= Exposure (I1)/Exposure (I2).*** The linearity factor is then compared to the current ratio. The F linearity factor should be within 10% of the scan current ration.

$$L_1 = \left| \frac{E(I_1)}{E(I_2)} - \frac{I_1}{I_2} \right| \leq 0.1 \frac{I_1}{I_2}$$

Table 32: Linearity calculations (mGy)

| | CTDI head phantom | Air |
|---|---|---|
| $E_1/E_2$ | 1.743 | 1.1663 |
| $I_1/I_2$ | 1.75 | 1.1667 |
| $L_1$ | 0.007 | 0.0004 |
| Linearity Test (< 0.1) | 0.0004 | 0.00034 |

The second linearity factor is computed as described in the IEC 60601-2-44 standard.

$$L_2 = \left|\frac{E(I_1)}{I_1} - \frac{E(I_2)}{I_2}\right| < 0.2\,\frac{\left|\frac{E(I_1)}{I_1} + \frac{E(I_2)}{I_2}\right|}{2}$$

Table 33: Linearity calculations in accordance with IEC (mGy)

| | CTDI head phantom | Air |
|---|---|---|
| E1/I1 | 0.555 | 0.1923 |
| E2/I2 | 0.553 | 0.1922 |
| (E1/I1+E2/I2)/2 | 0.554 | 0.19225 |
| L2 | 0.002 | 0.001 |
| Linearity test (< 0.2) | 0.0036 | 0.0052 |

The radiation output is not linear with respect to the scan voltage; however, it is approximately linear with respect to scan voltage to the power of 2.3, that is $E \propto kV^{2.3}$.

**Note** Actual results on installed units can vary +20% due to machine and test tolerances.

# QA measurements

The QA phantom is typically used to monitor the scanner on site; however, the following phantoms can be used for measuring the imaging performance of the scanner.

## Identifying high-contrast resolution

The high-contrast-resolution phantom is a wire placed at the center of a uniform disk. The wire provides an impulse function in the **Axial** plane when it is placed parallel to the scanner-gantry axis-of-rotation. The high-contrast resolution is measured from the **Modulation Transfer Function** (**MTF**). Typical **MTF** curves are shown in the following figures. Variations of 10% may occur in measurements due to phantom placement error and measurement inaccuracies.

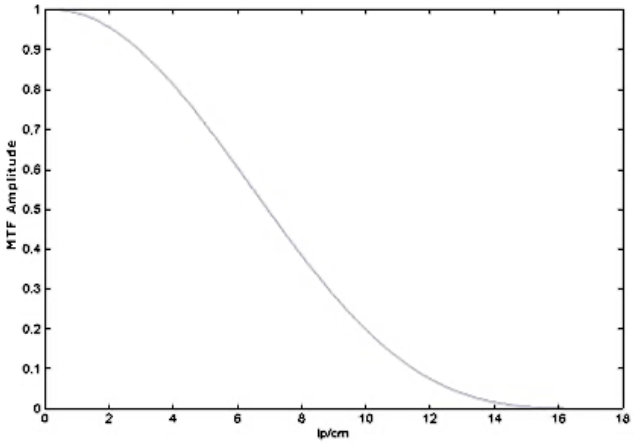



Figure 207: MTF at isocenter, shown for high resolution

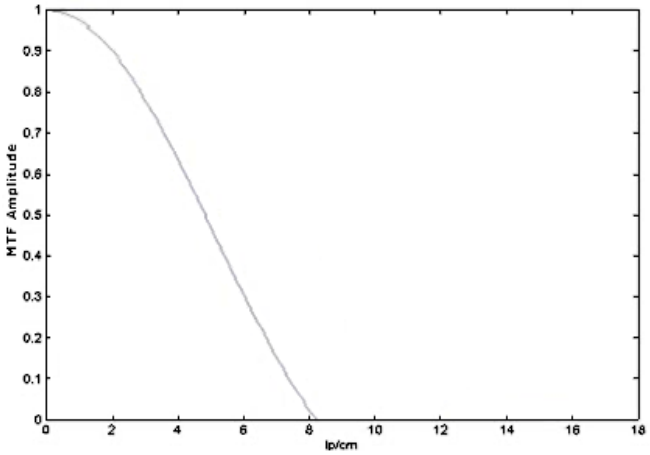



Figure 208: MTF at standard kernel

## Noise, uniformity, and mean CT number of water

One of two phantoms may be used in these tests. These are Catphan® 412 or a cylindrical 20cm diameter water cylinder.

### The CereTom Elite noise

**Noise** is measured as the standard deviation at isocenter. The value is 2.1 ±.2 HU when the imaging protocol is 140 kV, 42 mAs and standard kernel. This protocol gives a $CTDI_{100}$ center dose of 160 mGy.

## Uniformity and mean CT number

The mean CT number of air is -1000 HU and that of water is 0 HU. The tolerance of the mean CT number will be ±3 HU. For mean CT numbers measured at different points of the water phantom, the maximum difference in the means will be less than 4 HU.

## Low-contrast resolution

The phantom used for low-contrast-resolution measurement is Catphan 412.

### The CereTom Elite low-contrast resolution

The **low-contrast resolution** is 3mm at 0.3% contrast when the center $CTDI_{100}$ dose is 160 mGy. The imaging protocol is 140 kV, 42 mAs, 10mm slice thickness, and the standard reconstruction kernel.

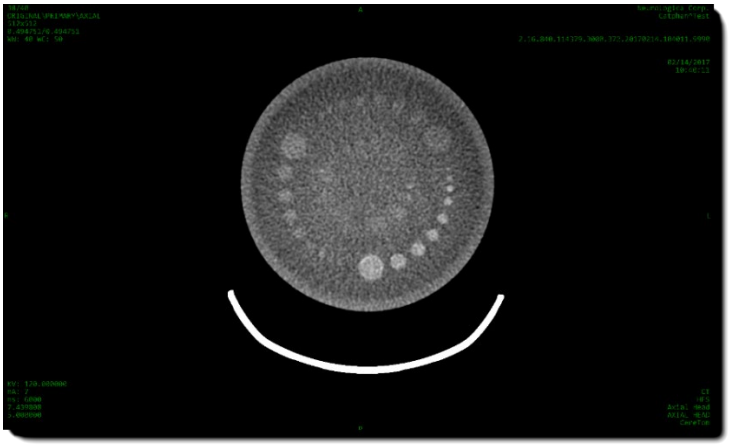


Figure 209: Catphan 515 using 120kV, 7mA, 6 secs, and 5mm slice

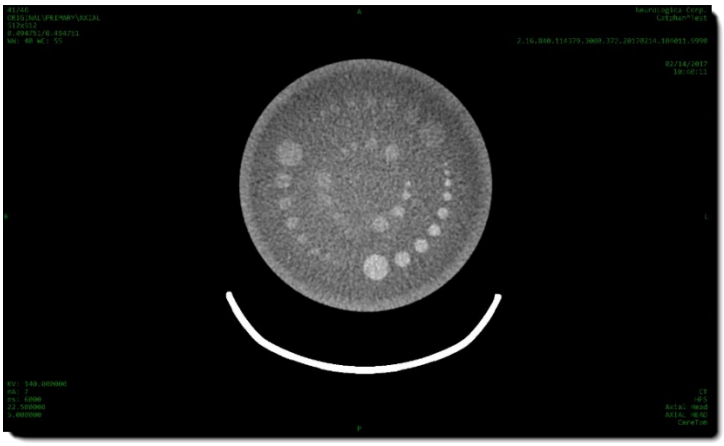


Figure 210: Catphan 515 scanned using 140kV, 7mA, 6 secs and 5mm slice

## Geometric efficiency in the Z axis direction

This is the ratio of the integral of the dose profile integrated over the detector width in Z divided by the total $CTDI_{100}$. The geometric efficiency is 70%.

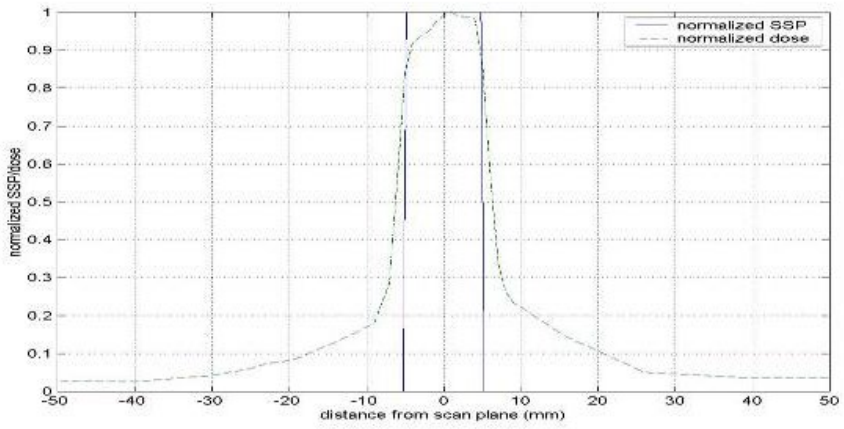



Figure 211: CereTom Elite dose profile

## Half-value layer

The half-value layer is the same for both the CereTom Elite.

Table 34: Half-value layer

| Scan voltage | 100 | 120 | 140 |
|---|---|---|---|
| Half value | 4.9 | 6.0 | 6.8 |

## Allowable variations

The following are allowable variations:

- **Dose** — A ±5% variation in dose may occur due to variations between systems and measurement differences. The maximum variation is ±10%.
- **High Contrast Resolution** — The variation in values on the **MTF** curve may be ±10%. These will occur mainly due to phantom placement errors, measurement inaccuracies and system variations.
- **Noise** — The variation in standard deviation may be ±10% due to variations between systems.
- **Uniformity** — The maximum difference between **ROI** means in an image is 4 HU. The maximum error in the CT number of water is ±3 HU.

## Scatter radiation

**WARNING** Exposure to secondary radiation can be harmful, and CereTom Elite usage should only be done under the direct supervision of the facility's qualified **Radiation Safety Officer** (**RSO**) in compliance with site, local, mode, provincial, and national regulations. Only this RSO can perform the calculations necessary to determine what additional safety precautions are necessary, such as shielding, personal protections, and so on.

**Note** The CereTom Elite scanners are compatible with IRR1999 and EU Directive 96/29/EURATOM.

### US charts - curtains opened

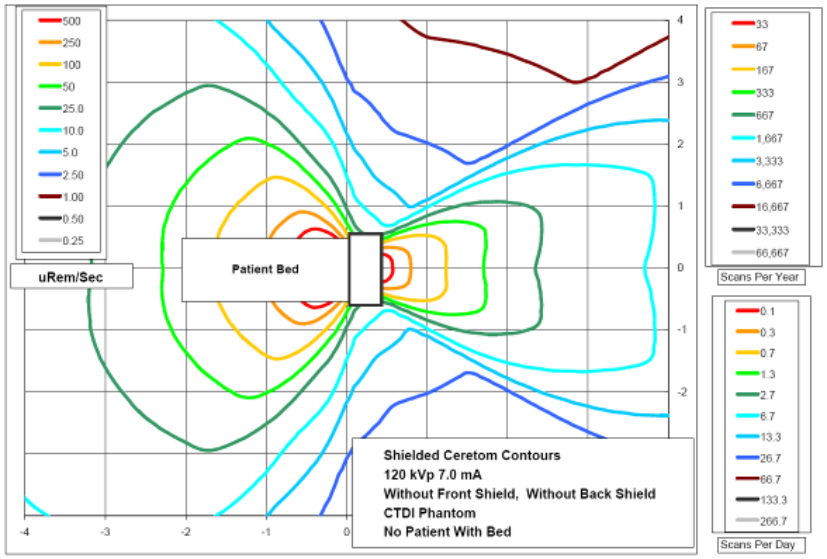
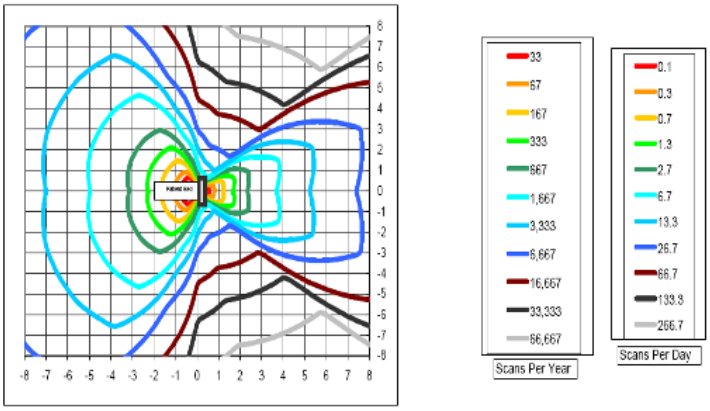



Figure 212: US charts – opened or no curtains chart

Chart measurements represent the horizontal and vertical plane, with open or no curtains.

**Note** In compliance with IEC 60601-2-44:2009, section 203.11, the previous figure shows the scatter radiation measured at the edge of the gantry in the tomographic plane is ≅20% of the scatter radiation measure at the same distance along the axis of rotation in the horizontal plane.




| CereTom CT Scatter Radiation at 1,2 and 3 meters from the isocenter. | | | | | |
|---|---|---|---|---|---|
| Scan / Position | Dose Rate uRem/sec | sec / slice | dose/scan uRem | scans / year | scans/day |
| 1 meter at 45 deg | 300.58 | 2.00 | 9017 | 55 | 0.2 |
| 2 meter at 45 deg | 74.95 | 2.00 | 2248 | 222 | 0.9 |
| 3 meter at 45 deg | 34.48 | 2.00 | 1034 | 483 | 1.9 |
| 1 meter at side | 21.59 | 2.00 | 648 | 772 | 3.1 |
| 2 meter at side | 5.78 | 2.00 | 173 | 2886 | 11.5 |
| 3 meter at side | 2.61 | 2.00 | 78 | 6393 | 25.6 |

| Assumptions - NeCT1 |
|---|
| Scans per year and scans per day are based upon a total yearly dose of 0.5 Rem |
| Dose numbers are air dose and thus more representative of skin dose (not organ dose). |
| Assumes no lead vest |
| Scatter rates were measured with a CTDI phantom in the beam |
| Based upon 250 work days per year |
| Scan is at 120 kVp 7.0 mA 15 Slices - Technique is at 14 mAs per slice. |
| Scan is Without Back Shield,Without Front Shields,Without Estimated Patient Absorption |

Figure 213: US charts – opened or no curtains data

Chart measurements represent the horizontal and vertical plane with open or no curtains.

### US charts - curtains closed

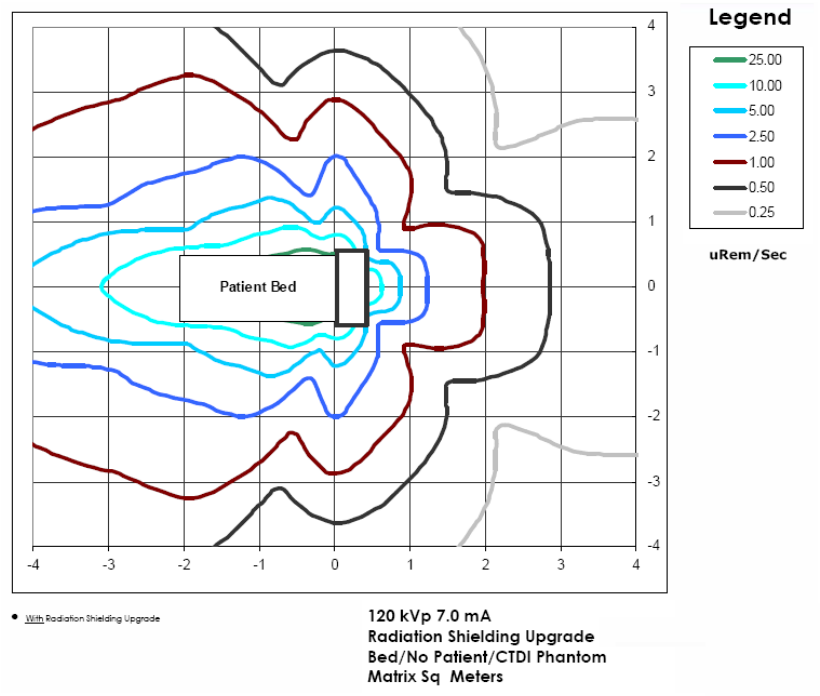
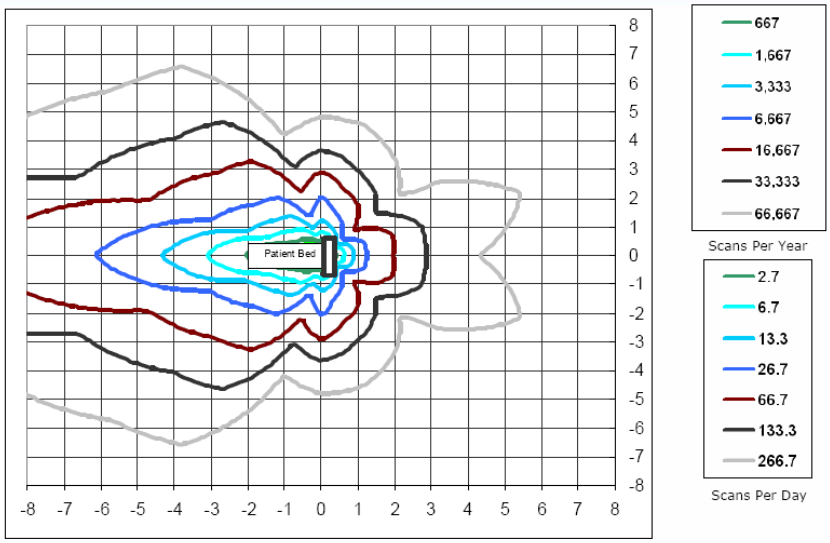



Figure 214: US charts – closed curtains chart and data

Chart measurements represent the horizontal and vertical plane with completely closed curtains.




CereTom CT Scatter Radiation at 1,2 and 3 meters from the isocenter.

| Scan / Position | Dose Rate uRem/sec | sec / slice | dose/scan uRem | scans / year | scans/day |
|---|---|---|---|---|---|
| 1 meter at 45 deg | 14.30 | 2.00 | 429 | 1166 | 4.7 |
| 2 meter at 45 deg | 4.01 | 2.00 | 120 | 4154 | 16.6 |
| 3 meter at 45 deg | 1.85 | 2.00 | 56 | 8997 | 36 |
| 1 meter at side | 6.75 | 2.00 | 202 | 2471 | 9.9 |
| 2 meter at side | 2.54 | 2.00 | 76 | 6552 | 26.2 |
| 3 meter at side | 0.90 | 2.00 | 27 | 18,557 | 74.2 |

**Assumptions - NeCT1**

Scans per year and scans per day are based upon a total yearly dose of 500 mRem

Dose numbers are air dose and thus more representative of skin dose (not organ dose).

Assumes no lead vest

Scatter rates were measured with a CTDI phantom in the beam

Based upon 250 work days per year

Scan is at 120 kVp 7.0 mA 15 Slices - Technique is at 14 mAs per slice.

Scan is With Back Curtain,With Front Curtains,Without Estimated Patient Absorption

Figure 215: US charts – closed curtains chart and data

Chart measurements represent the horizontal and vertical plane with completely closed curtains.

### European charts - curtains open

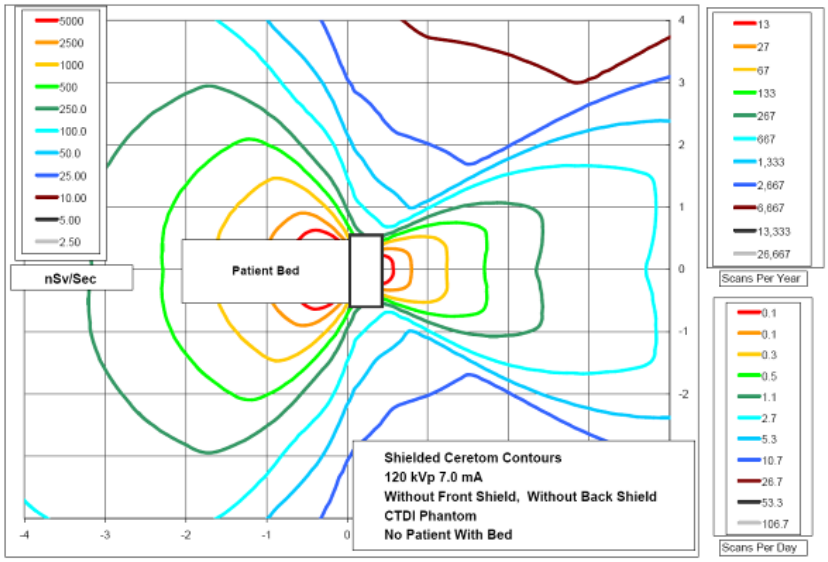
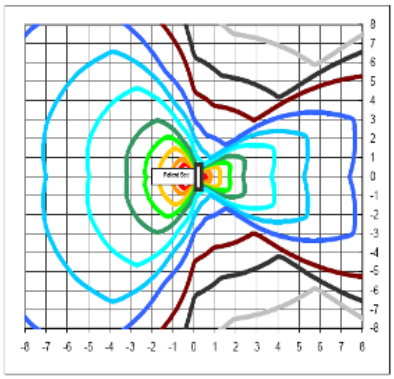
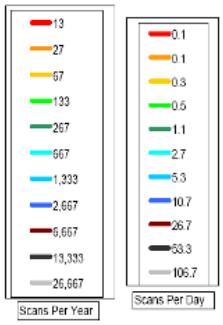



Figure 216: European charts – opened or no curtains chart

Chart measurements represent the horizontal and vertical plane with open or no curtains.

| **Note** | In compliance with IEC 60601-2-44:2009, section 203.11, the previous figure shows the scatter radiation measured at the edge of the gantry in the tomographic plane is ≅20% of the scatter radiation measure at the same distance along the axis of rotation in the horizontal plane. |
|---|---|






| CereTom CT Scatter Radiation at 1,2 and 3 meters from the isocenter. | | | | | |
|---|---|---|---|---|---|
| **Scan / Position** | **Dose Rate nanoSv/sec** | **sec / slice** | **dose/scan nanoSv** | **scans / year** | **scans/day** |
| 1 meter at 45 deg | 3005.81 | 2.00 | 90174 | 22 | 0.1 |
| 2 meter at 45 deg | 749.49 | 2.00 | 22485 | 89 | 0.4 |
| 3 meter at 45 deg | 344.80 | 2.00 | 10344 | 193 | 0.8 |
| 1 meter at side | 215.85 | 2.00 | 6476 | 309 | 1.2 |
| 2 meter at side | 57.76 | 2.00 | 1733 | 1154 | 4.6 |
| 3 meter at side | 26.07 | 2.00 | 782 | 2557 | 10.2 |

| **Assumptions - NeCT1** |
|---|
| Scans per year and scans per day are based upon a total yearly dose of 2.0 mSv |
| Dose numbers are air dose and thus more representative of skin dose (not organ dose). |
| Assumes no lead vest |
| Scatter rates were measured with a CTDI phantom in the beam |
| Based upon 250 work days per year |
| Scan is at 120 kVp 7.0 mA 15 Slices - Technique is at 14 mAs per slice. |
| Scan is Without Back Shield,Without Front Shields,Without Estimated Patient Absorption |

Figure 217: European charts – opened or no curtains chart and data

Chart measurements represent the horizontal and vertical plane with open or no curtains.

### European charts - curtains closed

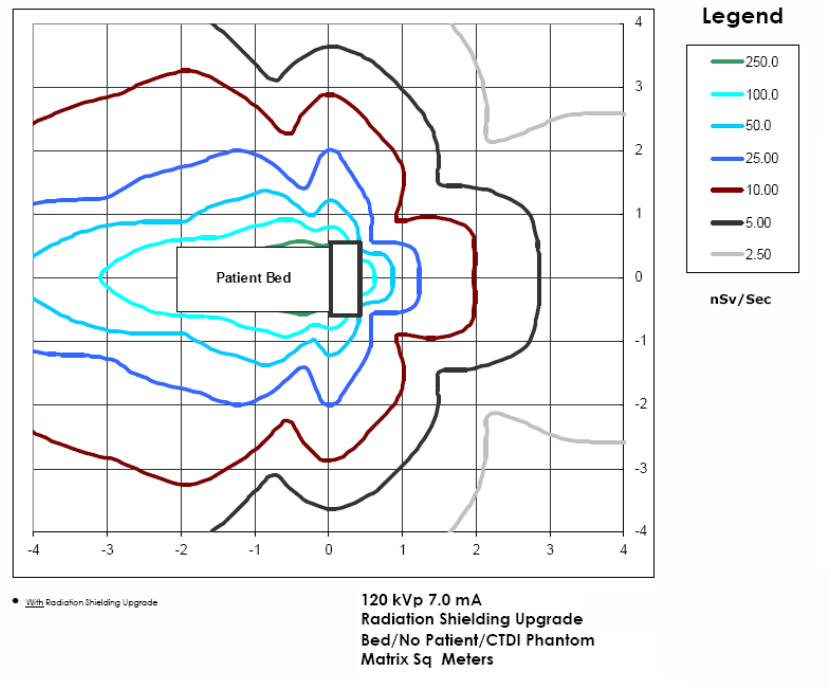
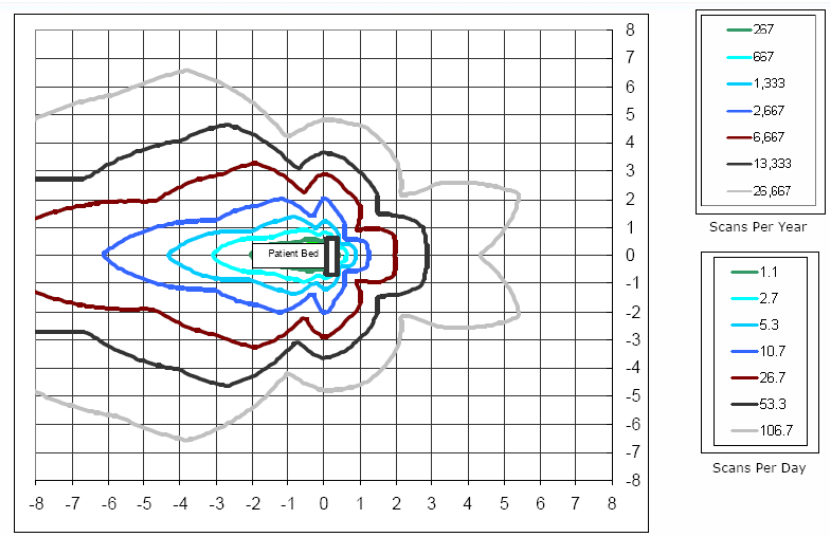



Figure 218: European charts – closed curtains chart

Chart measurements represent the horizontal and vertical plane with completely closed curtains.




CereTom CT Scatter Radiation at 1,2 and 3 meters from the isocenter.

| Scan / Position | Dose Rate nanoSv/sec | sec / slice | dose/scan nanoSv | scans / year | scans/day |
|---|---|---|---|---|---|
| 1 meter at 45 deg | 142.99 | 2.00 | 4290 | 466 | 1.9 |
| 2 meter at 45 deg | 40.12 | 2.00 | 1204 | 1662 | 6.6 |
| 3 meter at 45 deg | 18.52 | 2.00 | 556 | 3599 | 14.4 |
| 1 meter at side | 67.46 | 2.00 | 2024 | 988 | 4.0 |
| 2 meter at side | 25.44 | 2.00 | 763 | 2621 | 10.5 |
| 3 meter at side | 8.98 | 2.00 | 269 | 7423 | 29.7 |

**Assumptions - NeCT1**

Scans per year and scans per day are based upon a total yearly dose of 2.0 mSv

Dose numbers are air dose and thus more representative of skin dose (not organ dose).

Assumes no lead vest

Scatter rates were measured with a CTDI phantom in the beam

Based upon 250 work days per year

Scan is at 120 kVp 7.0 mA 15 Slices - Technique is at 14 mAs per slice.

Scan is With Back Curtain, With Front Curtains, Without Estimated Patient Absorption

Figure 219: European charts – closed curtains chart and data

Chart measurements represent the horizontal and vertical plane with completely closed curtains.

### mAs vs. traditional fixed CT scanners

The CereTom Elite scanners are small-bore scanners designed primarily to scan small anatomy, such as the head and neck. There are significant x-ray geometry and filtration differences that result in a lower x-ray tube current (milliampere-second, mAs) for equivalent patient dose. Because the x-ray tube is closer to the patient than in the large bore scanners, there is a factor of approximately 6x to 7.5x on mAs. The system x-ray filtration is optimized for smaller anatomy and thus there is a 2x factor. Combining the above factors there is approximately a 12x to 15x factor on mAs for equivalent mAs.

## CTDI measurements

This section contains a detailed measurement of the $CTDI_{100}$. The dose is measured using a typical scan of 4 seconds at 7mA. The following table lists the center and the surface dose for all scan voltages.

Table 35: The $CTDI_{100}$ for different scan voltages

| Scan voltage | $CTDI_{100}$ center | $CTDI_{100}$ surface | $CTDI_{100}$ weighted |
|---|---|---|---|
| 140 | 104.62 | 131.44613 | 122.5 |
| 120 | 73.037 | 94.72125 | 87.49 |
| 100 | 45.414 | 61.61775 | 56.22 |
| 80 | 24.303 | 36.311625 | 32.31 |

The center $CTDI_{100}$ is measured at the center of the CTDI head phantom. The surface dose is the average of surface doses measured at the four different surface locations of the CTDI head phantom. The following table lists the various measurements of the $CTDI_{100}$ surface dose.

Table 36: Surface $CTDI_{100}$ measurements

| Scan voltage | Top (0°) | Right (90°) | Bottom (180°) | Left (270°) | $CTDI_{100}$ surface |
|---|---|---|---|---|---|
| 140 | 130.71 | 134.02 | 129.93 | 131.10 | 131.44 |
| 120 | 96.87 | 95.52 | 92.56 | 96.92 | 94.72 |
| 100 | 61.73 | 61.59 | 61.46 | 61.68 | 61.61 |
| 80 | 36.19 | 36.06 | 36.80 | 36.19 | 36.31 |

## Additional scatter measurements

Additional scatter measurement along the perpendicular plan were also taken using the CTDI head phantom with the back curtain closed and the front curtains partially closed to simulate a real scan; however, it should be noted that the scatter measured with the CTDI phantom *only* is typically higher than the actual scatter radiation from a real patient. Due to the scanner height, the measurements were done at the positions noted in the next figure, which shows how to set up the system for scatter measurements.

The scatter measurements were done using the RadCal survey meter and the 1800cc probe.

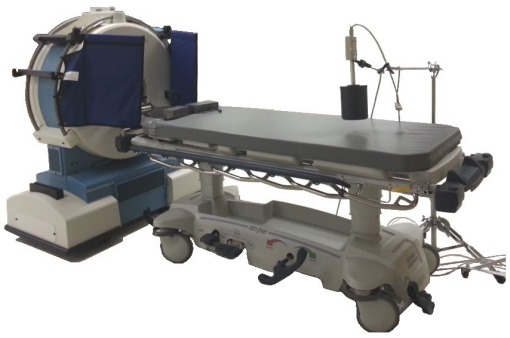


Figure 220: System setup for scatter measurements

The scatter was measured using the following scan protocol: 140 kV, 7 mA, 10 seconds. The following table lists the measured scatter per seconds in the back of the scanner.

Table 37: Scatter in vertical parallel to axis of rotation (µRem/s)

| | Distance from iso. (cm) | | |
|---|---|---|---|
| | 75cm | 125cm | 175cm |
| 50cm below iso | 16.8519 | 7.1688 | 4.06725 |
| At iso | 19.20525 | 8.61735 | 4.52835 |
| 50cm above iso | 10.94025 | 6.6729 | 3.9759 |
| 75cm above iso | 2.36205 | 4.6719 | 3.64095 |

Table 38: Scatter in vertical plane on patient side (mRem/s)

| | Distance from iso. (cm) | | |
|---|---|---|---|
| | 75 cm | 125 cm | 175 cm |
| At iso | 0.428 | 0.155 | 0.075 |
| 50cm above iso | 0.375 | 0.149 | 0.069 |
| 75cm above iso | 0.274 | 0.140 | 0.070 |

**Note** By design, this scanner's frame (about the bore) provides the primary shielding in the vertical plane perpendicular to the axis of rotation, therefore scatter radiation is negligible in this plane.

# Chapter 8 Patient Registration

**Patient Registration** is the first step in the patient scan process.

You can register a patient in the following ways:

- Manually register a (new) patient for examination from the **Patient Registration** tab.
- Perform a query to acquire already-entered patient data from the hospital (**Hospital Information System** (**HIS**)) or radiology system (**Radiology Information System** (**RIS**)).
- Register an emergency patient using the touch screen.

It is assumed that the workstation is connected to the site's information system, **HIS/RIS**. If you are not connected, you can always manually register the patient.


Figure 221: Active Patient Registration tab

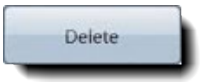
## Navigating the Patient Registration screen

Make sure the **Patient Registration** tab is selected; click it if necessary.

Notice the buttons at the bottom-of the **Patient Registration** dialog box. Many of these buttons are active *only* if you are already connected to the site's **HIS/RIS** or if you clicked the **Query** button (to query for patients and the list of patients populated in the **Query Results** list). When a patient is selected, the buttons are active.

Table 39: Patient Registration buttons

| Patient Registration button | Action |
|---|---|
|   | Searches the **HIS/RIS** server for scheduled patients. The population of patients could take several minutes to appear, depending on the number of patient entries the query populated (after you clicked the **Query** button). |
|   | Cancels the current query. Entries retrieved prior to cancellation appear in the **Query Results** list and (if the user moves them) to **Stored Results**. |
|   | Registers the selected patient and then takes you to the **Acquisition** tab to acquire the data for an examination (scan). |

| Patient Registration button | Action |
|---|---|
|   | Shows selected patient details. |
|   | Searches queried patient entries for specific information. |
|   | Selects patient(s) from query results and moves them into **Stored Results** list. |
|   | Deletes patient(s) (and accompanying data) from the **Stored Results** list. |
|   | Manually enters a new patient and, when completed, takes you to the **Acquisition** tab to acquire the data for an examination (scan). |

# Registering the patient

The following procedures show you how to enter patient information into the system before scanning the patient.

## Querying patient information

1. If necessary, click the **Patient Registration** tab on the main screen.

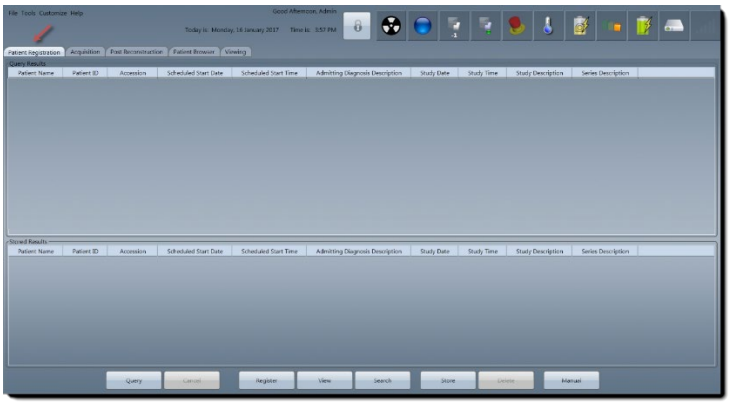


Figure 222: Patient Registration tab

2. Click the **Query** button at the bottom of the screen.

   The **Query Information** dialog box appears.

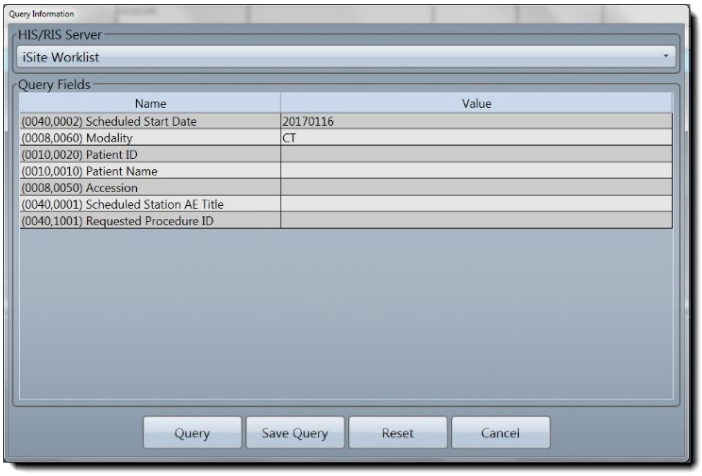



Figure 223: Query Information dialog box

3. Click the **HIS/RIS Server** dropdown and select the worksite to pull data from.

   The default worksite appears at the top. If there is no list, see your site administrator to set it up.

4. Double-click any of the named **Query Fields** you would like to use to query for patients by entering the value in the **Value** column to query.

   A popup associated with the **Query Field** you are setting a value for appears. For example, if you double-click the **Scheduled Start Date** value row, the **Edit Value** popup appears. Enter the (new) date for the start. Another example would be to click the **Patient Name** value row. Again the **Edit Value** popup appears; however, this time **Patient Name** text boxes are provided to help you narrow down a search for patient data using a first and/or last names, and so on. Click any of the **Value** rows to fill in data to help query the patient you are searching. You can enter as much or as little information as needed. If no information is available, leave the value blank.

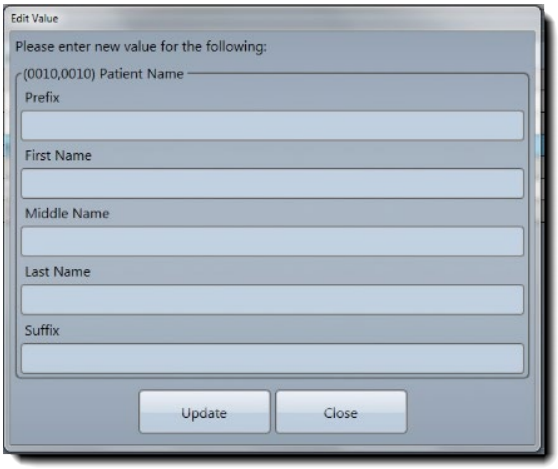



Figure 224: Edit Value popup for Name

5. Perform one of the following:

   - Click the **Update** button to query based on the newly entered data to help narrow down your search.

- Click the **Close** button to remove any changes and return to the previous **Query Information** popup.

6. When you are finished filling in query selections, perform one of the following:

   - Click the **Query** button to populate your new query criteria.
   - Click the **Save Query** button to save the query values you will use in your query request.
   - Click the **Reset** button to change the query back to the former query.
   - Click the **Cancel** button to remove the changes you made.

   A list of patients matching your selected criteria variables populates in the **Query Results** list on the **Patient Registration** tab.

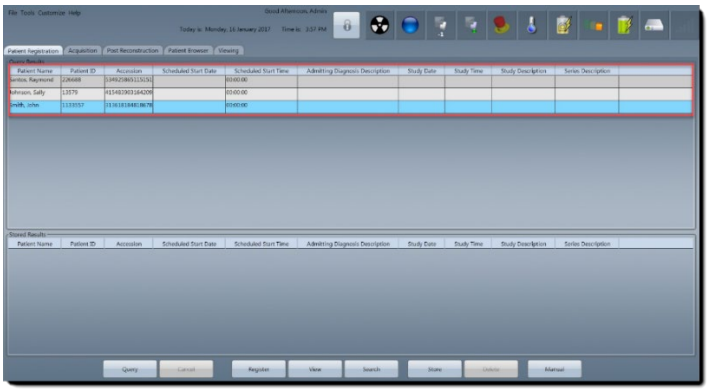


Figure 225: Patient Registration Query Results table

7. Select a patient and click the **Register** button to register the patient for the exam.

   The system enables and opens the **Acquisition** tab. To perform the acquisition steps, see "Scanning from the workstation" on page 237.

## Storing patients in the Stored Results list

This list is helpful when multiple patients need to be scanned and connection to a worksite like **HIS/RIS** is unavailable at the exam location.

1. If necessary go to the **Patient Registration** tab to query the patients(s).

2. Perform steps 2 through 5 in "Querying patient information" on page 223.

3. Quick the **Query** button.

   Let the criteria you selected populate into the **Query Results** list area.

4. Highlight (select) one or more patient entries from the **Query Results** list.

   Select patients in the following ways:

   - To select one patient, click anywhere in the patient's row.

- To select more than one patient at a time, press and hold the **Ctrl** key (on the workstation keypad) and click any patients until finished and then release the **Ctrl** key.
- To click all the patients, press and hold the **Shift** key (on the workstation keypad) and click the first patient in the list and then click the last patient to highlight all patients between the first patient selected and the last.

5. Click the **Store** button.

   The patients and subsequent patient information you selected appear in the **Stored Results** list at the bottom of **Patient Registration**.

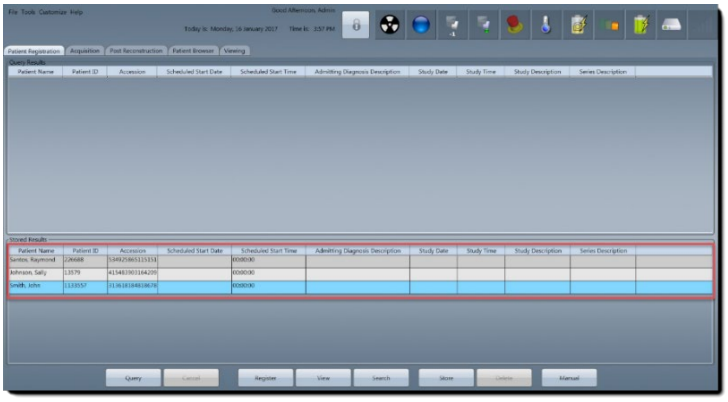


Figure 226: Patient Registration Stored Results table

6. Click the patient(s) you want to select from the **Stored Results** table.

7. Click the **Register** button to register the stored procedure in order to perform an examination.

The system enables and opens the **Acquisition** tab. To perform the acquisition steps, see "Scanning from the workstation" on page 237.

## Manually registering a patient

You manually register a patient for examination when the **HIS/RIS** server is unavailable, the patient cannot be found, and/or was never entered into the system.

1. If necessary go to the **Patient Registration** tab.

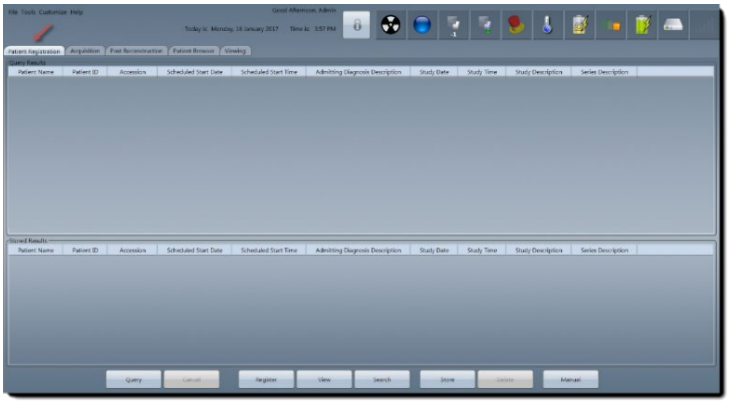


Figure 227: Patient Registration tab

2. Click the **Manual** button at the bottom of **Patient Registration**.

   The **Exam Information** dialog box appears with the **Patient** tab open.

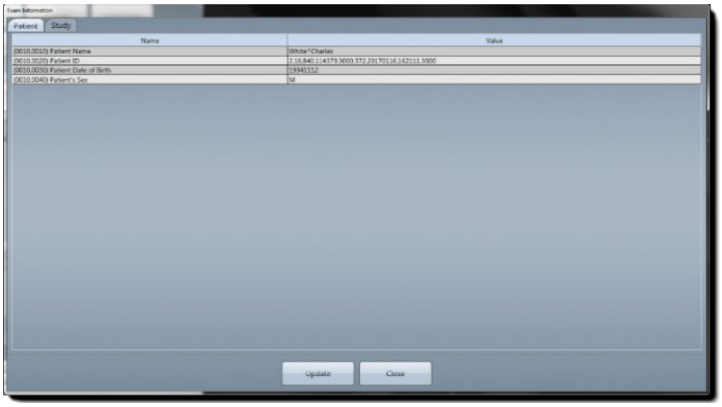


Figure 228: Exam Information dialog box

3. For **Patient Name**, double-click the **Patient Name** value.

   The **Edit Value** dialog box appears with patient name fields.

4. Enter patient name information in the fields provided and click one of the following buttons:

   - Click the **Update** button to save your entries and close the **Edit Value** dialog box.
   - Click the **Close** button to close the **Edit Value** dialog box ***without*** saving your work.

     Notice that the value appears with the last name first, separated by ^, the first name next, separated by ^, the middle name (if you supplied that information), and any other information you entered.

| **Note** | The **Patient ID** is automatically generated by the system; you can replace this automated identifier with your patient's hospital ID number. |
|---|---|

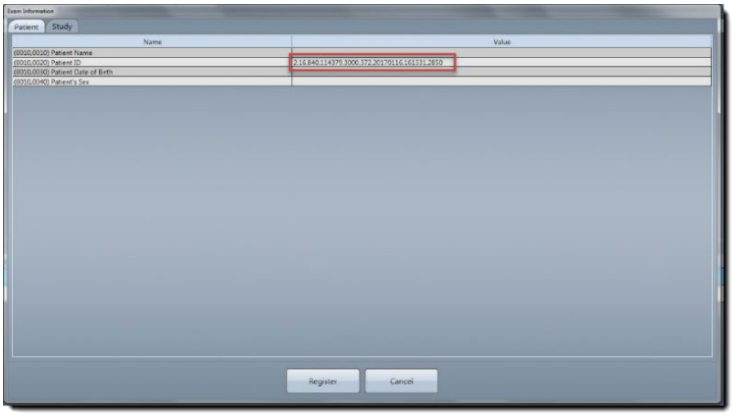



Figure 229: Patient ID field

5. For the **Patient Date of Birth**, perform the following:

   - Double-click the **Patient Date of Birth** field.
   - Enter the patient's birth date in the **Patient date of birth** field.

     Be sure to move the cursor to the far left to make sure two digits are included for the month and the day; four digits are required for the year.
   - Perform one of the following:
     - Click the **Update** button to save your work and close the **Edit Value** dialog box.
     - Click the **Close** button to close the **Edit Value** dialog box without saving your work.

6. For the **Patient's Sex**, perform the following:

   - Double-click the **Patient's Sex** field.
   - Enter the patient sex in the field by entering the appropriate letter to apply for one of the following:
     - **F** for Female
     - **M** for Male
     - **O** Other
   - Perform one of the following:
     - Click the **Update** button to save your work and close the **Edit Value** dialog box.
     - Click the **Close** button to close the **Edit Value** dialog box without saving your work.

7. Perform one of the following:

   - Click the **Register** button to register your patient data.
   - Click the **Cancel** button to exit without entering your data.

   When you click the **Register** button, the system enables and opens the **Acquisition** tab. To perform the acquisition steps.

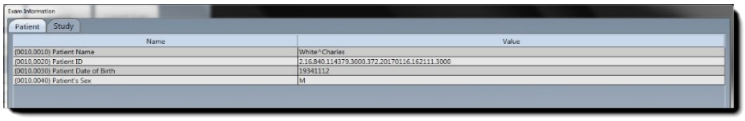



Figure 230: Patient data filled in

8. After your patient is registered, view the **Patient Exam Details** to ensure your data is correct.

   If it is not correct, go to the next step to make the necessary changes.

9. Click the **Expand** link.

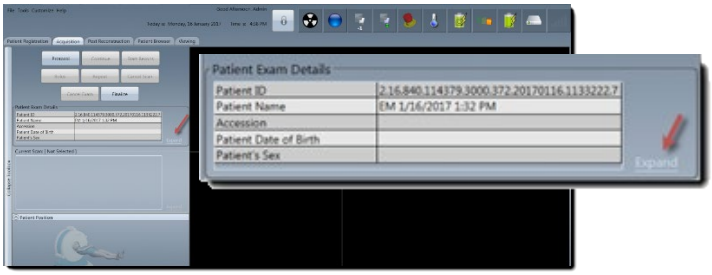



Figure 231: Expand link in context and close up

   The **Exam Information** popup appears.

10. Make your changes in the **Exam Information** popup.

11. Click the **Update** button to save changes.

## Registering an emergency patient from the touch screen

This allows you (the operator) to register an emergency patient (quickly) if that patient is not already in the system.

| Note | If **Dose Check** is enabled on the workstation you will not be able to register an emergency patient at the touch screen. |
|---|---|

1. Go to the touch screen on the scanner.

2. Click the **Options** tab.

3. Click the **Emergency Patient** button.

4. Review the **Patient Information** section on the touch screen.

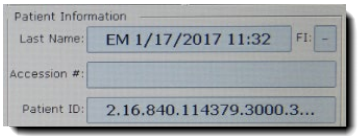



Figure 232: Show emergency patient and ID in section on touch screen

   The **Acquisition** tab will automatically appear (on the workstation).

You can add additional information or changes to the patient information by clicking the Expand link (on the workstation).

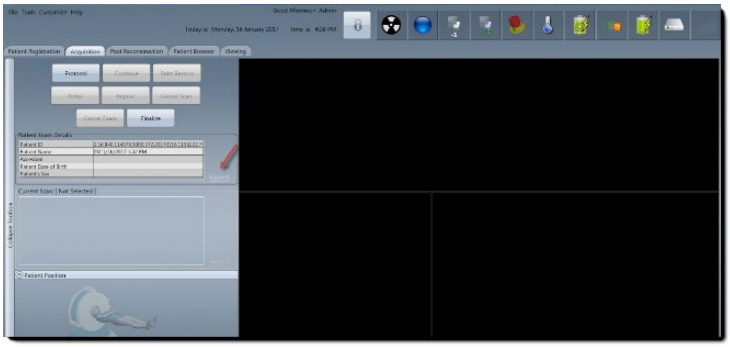


Figure 233: Expand link location

5. Click the **Expand** link.

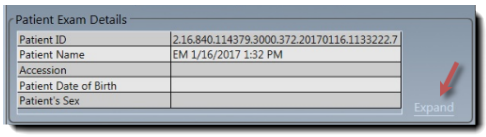



Figure 234: Expand link next to Patient Exam Details

The **Exam Information** popup appears.

6. Make your changes in the **Exam Information** popup.

7. Click the **Update** button to save the changes.

## Viewing patient information

This procedure lets you view (but not change) the patient information.

1. If necessary, click the **Patient Registration** tab on the main screen.

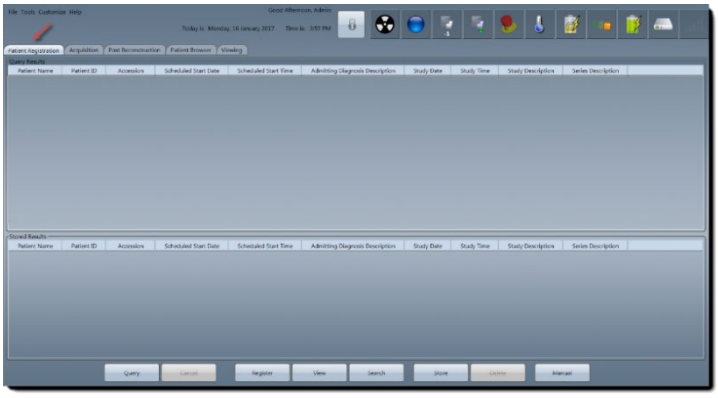


Figure 235: Patient Registration tab

2. Select a patient from the **Query Results** list or the **Stored Results** list.

3. Click the **View** button.

4. Review the patient's information.

   This popup presents static information that you cannot change.

5. Click the **Close** button to exit the **View Entry Information** popup.

## Storing queried patients to the Stored Results list

1. If necessary, click the **Patient Registration** tab on the main screen.

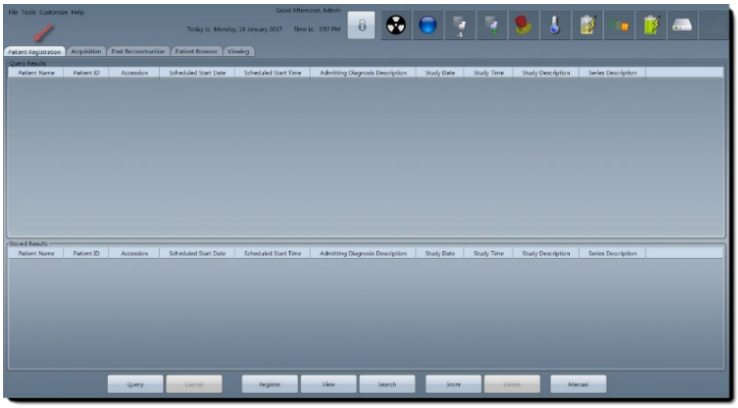


Figure 236: Patient Registration tab

2. Perform a query to find patients.

   See "Querying patient information" on page 223 to learn how.

3. Select the patient(s) that you want to store from the **Query Results** list.

   Select patients in the following ways:

   - To select one patient, click anywhere in the patient's row.
   - To select more than one patient at a time, press and hold the **Ctrl** key (on the workstation keypad) and click any patients until finished and then release the **Ctrl** key.
   - To click all the patients, press and hold the **Shift** key (on the workstation keypad) and click the first patient in the list and then click the last patient to highlight all patients between the first patient selected and the last. The **Store** button will be activated.

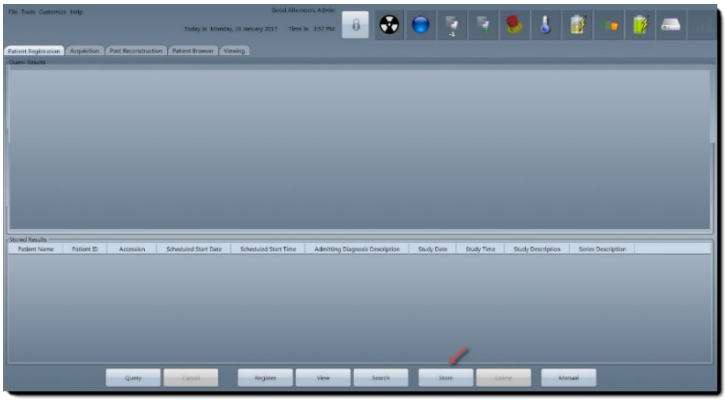


Figure 237: Store button active

4. Click the **Store** button.

   The patients you selected in step 2 appear in the **Stored Results** list and remain there unless you delete the patient(s).

| **Note** | If you have already stored a patient and you click on the same patient in the **Query Results** list, that patient appears in the **Stored Results** list twice. |
|---|---|

## Deleting patient(s) from a Stored Result list

You cannot delete patients from the **Query Results** list; you can only delete patients from the **Stored Results** list.

1. If necessary go to the **Patient Registration** tab.

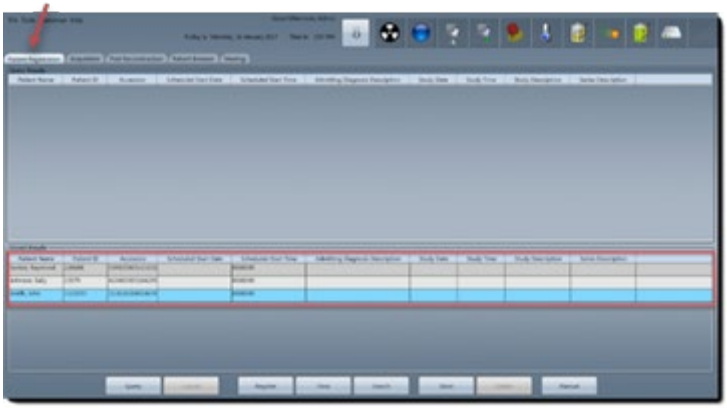


Figure 238: Patient Registration tab

2. Click (highlight) one or more patients from the **Stored Results** list to delete.

   Select patients in the following ways:

   - To select one patient, click anywhere in the patient's row.

- To select more than one patient at a time, press and hold the **Ctrl** key (on the workstation keypad) and click any patients until finished and then release the **Ctrl** key.
- To click all the patients, press and hold the **Shift** key (on the workstation keypad) and click the first patient in the list and then click the last patient to highlight all patients between the first patient selected and the last.

3. Click the **Delete** button.

   The patients you selected are removed from **Stored Results** list.

# Chapter 9 Patient Scanning

After you register the patient, the **Acquisition** tab is enabled and automatically opens. The **Acquisition** tab lets you check that the selected patient information is accurate before you perform the examination (scan). The **Acquisition** tab is also where you can set protocols for the scan before you scan the patient. A protocol lets you assess how you will capture the image you scan during the patient examination.


Figure 239: Active Acquisition tab

**Note** NeuroLogica recommends that an air calibration is performed every 6-8 hours. If the air freshness falls below 50% or the scanner is moved to an area with a dramatic change in humidity or temperature, perform another air calibration to ensure optimum image quality during patient scanning. See "Performing a daily (air) calibration from the LCD touch screen" on page 190 to learn more.

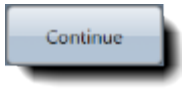
If room-temperature fluctuations have occurred, you may need to perform more than one air calibrations. In addition, scanners can drift out of alignment; make sure you perform a **Quality Test** with the test phantom ***before*** scanning a patient.

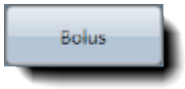
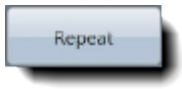
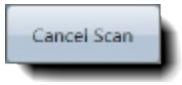
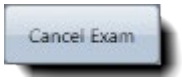
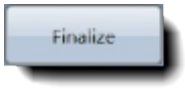
After the protocol is selected, you can scan the patient. You can scan the patient in two ways: initiate the scan using the workstation or scan directly from the touch screen. See the benefits of each in "Scanning from the workstation" on page 237 and "Scanning from the touch screen" on page 245.

The following figure and table that follow give you introductory information on what the **Acquisition** tab presents: the buttons and what they are used for. Later you will learn how to set protocols to determine more specificity for the scan.

**CAUTION** When conducting multiple or repeat scans, make sure the total exposure does not exceed maximum limit of 1Gy.

Table 40: Acquisition buttons

| Acquisition button | Action |
|---|---|
|   | Selects an existing protocol for the current study. |
|   | Authorizes the scanner to move to the next step (if applicable). |

| Acquisition button | Action |
|---|---|
|   | Begins any post-reconstructions that were defined during the protocol setup. |
|   | Appears during **Bolus Tracking** protocol, *only* to identify bolus tracking settings. |
|   | Repeats the last scan that was performed. |
|   | Cancels the current scan within a protocol. |
|   | Cancels the entire protocol exam. |
|   | Completes the examination. |

# Identifying protocol types

Protocol types identify how to capture an image during a scan. The following are protocol types you can select from.

## Axial

This protocol type lets you scan in **Transverse** plane. Data is acquired as the x-ray tube rotates around the patient. It is also referred to as **step and shoot**.

## Helical

This protocol lets you acquire data continuously as the x-ray tube rotates around the patient; the scanner translates over the patient in the Z axis.

### *Helical scan coverage*

**Helical** scan coverage is typically truncated by 1.25cm to cover a half rotation at each end. Figure 240 shows the exposure using a radiographic film. The film shows exposure of the **Helical** scan-type coverage of 60mm. X-ray was on for 60mm. It took the scanner one extra second to completely stop after x-rays turned off (see Figure 240); also shows exposure length to be 60mm.

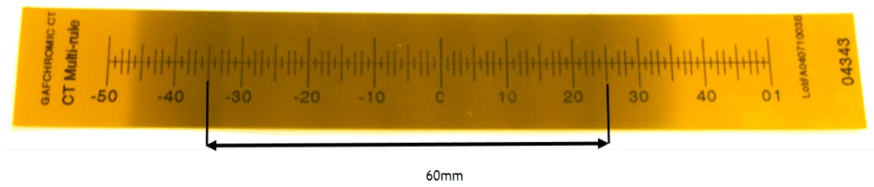



Figure 240: Radiographic film of the ~60mm scan coverage

The number of 1.25mm slices generated is 49, which covers about ~60mm. The scanner parallel images start at the laser location and ends where the scan ends. Figure 241 shows the scan markers as described above. For a typical **Helical** scan with 23cm coverage, excess dose is 5.4% of scan dose.

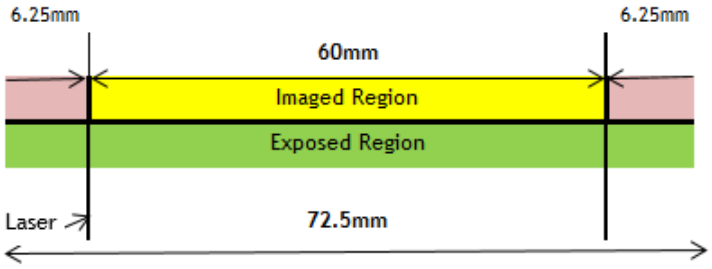



Figure 241: Scan coverage and imaged region for a true coverage of 60mm

### Dynamic

This protocol lets you acquire image data at multiple time points over the same anatomic location while the scanner remains stationary; x-ray exposure can be continuous or intermittent.

### Reference

This protocol lets you acquire a single 10mm slice to review anatomical position or place the **Region of Interest** (**ROI**) for **Bolus Tracking** scans. **Reference** scanning can only be used in conjunction with **Helical** / **Dynamic** scanning during a CTA protocol or perfusion.

### CT Perfusion

This protocol gives you a quantitative collection of dynamic **Axial** data during an arterial and venous phase injection.

### Scout

This protocol lets you acquire data continuously as the x-ray tube remains stationary at a designated angle; the scanner translates over the patient in the Z axis. The resulting **2D** projection is used during examination planning.

# Scanning from the workstation

It is assumed you have registered the patient to scan. You cannot complete this procedure without a registered patient. It is also assumed the **Acquisition** tab is active and the scanner is connected.

**Note** If the scan needs to be stopped perform the following:

**For an immediate or hard stop**, press the **E-STOP** button. This stops x-ray, centipede movement, and gantry rotation immediately.

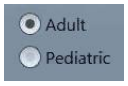
**For a controlled stop,** press the **Cancel Scan** button.

1. From the workstation, go to the **Patient Registration** tab to assign the patient to the scan in one of the following ways:
   - Query an already existing patient from the **HIS/RIS**.
   - Manually register the patient.

     See "Chapter 8 Patient Registration" on page 222.

     The **Acquisition** tab will be activated when the patient is registered.
2. From the **Acquisition** tab, click the **Protocol** button to open the **Exam Planner** dialog box.
3. Click the appropriate option:

- **Adult** To scan adult patients. Set adult protocols are stored by anatomical area, here.
- **Pediatric** To scan pediatric patients. Set pediatric protocols are stored by anatomical area, here.
- **Trauma** To scan emergency patients (adult or pediatric). Set trauma (emergency) protocols are stored to ⊕. The **Trauma** orb (⊕) lists those trauma protocols previously copied, pasted, and saved for a quick access to commonly used emergency or trauma protocols.




By selecting either an **Adult** or **Pediatric** patient, the corresponding list of saved protocols becomes available.

**Note** Adult and pediatric protocol parameters are customized to meet your requirements in conjunction with local and nationally recognized published guidelines. These protocols ***must be*** approved by your facility physicist ***before*** the system's acceptance.

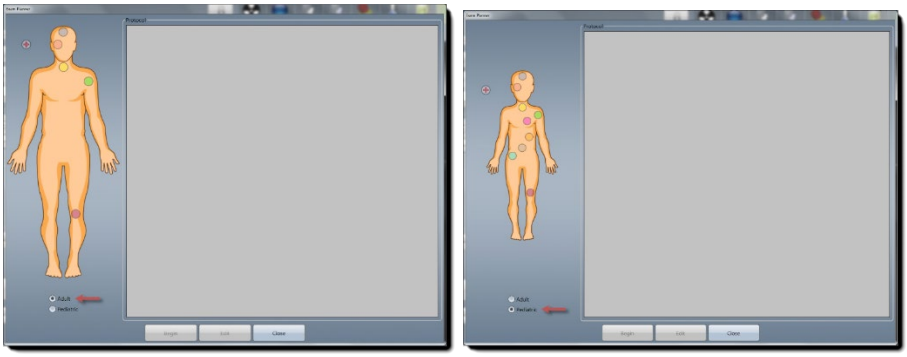


Figure 242: Exam Planner for Adult and Pediatric

4. Click the colored orb corresponding to the appropriate body part you will scan.

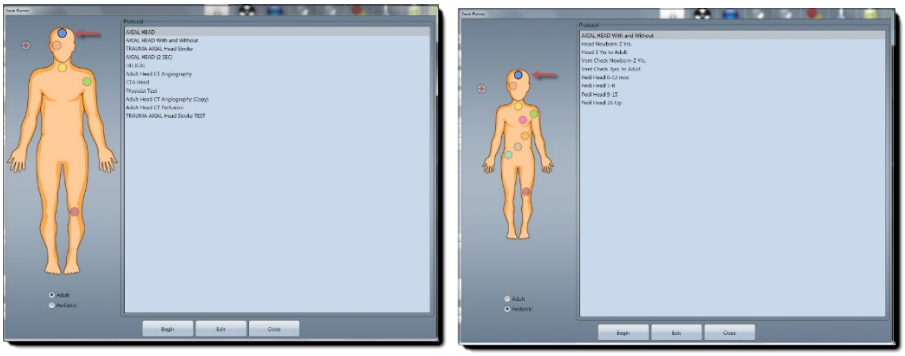


Figure 243: Anatomical orbs, in this case the head orb for Adult and Pediatric

5. Click the appropriate protocol from the list.

6. Click the **Edit** button to review the selected protocol.

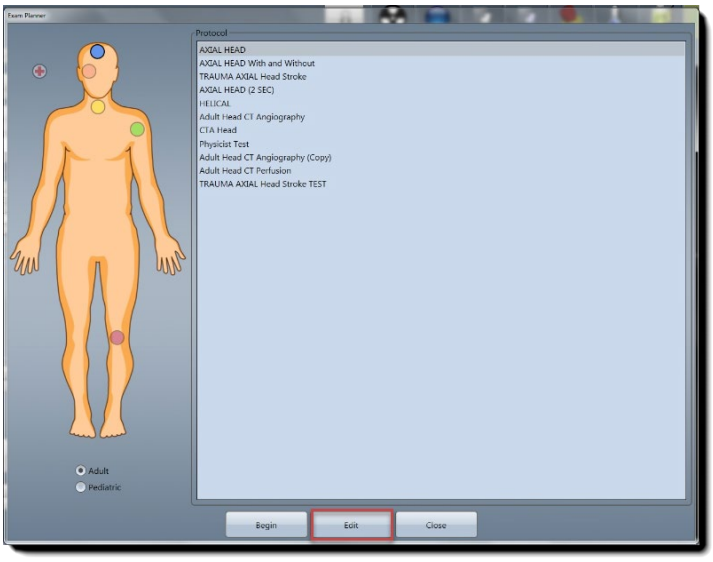



Figure 244: Protocol selected and Edit button active

The **Edit Protocol** dialog box appears.

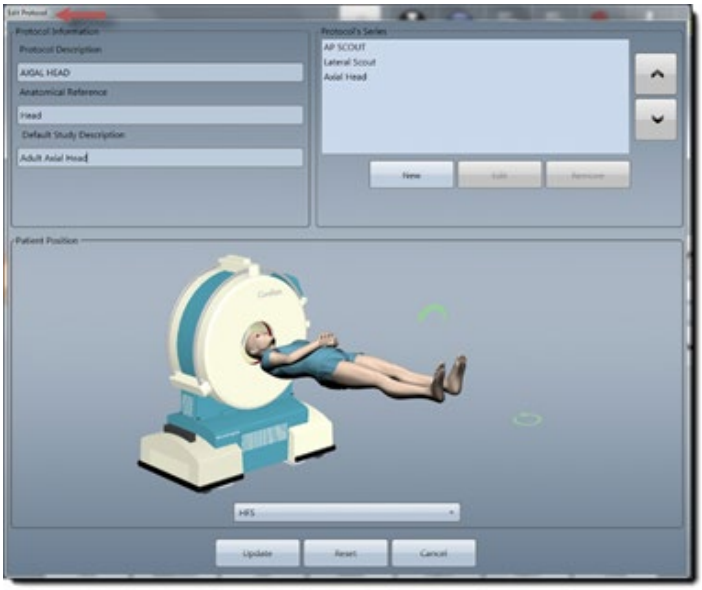



Figure 245: Edit Protocol dialog box

The **Protocol Information** and **Protocol's Series** areas show those protocols already created. The **Patient Position** appears identical whether it is for an adult, pediatric, or trauma patient.

| | |
|---|---|
| **Note** | You can modify a protocol; however, changes you make from **Acquisition** will not be saved permanently. Permanent changes to protocols can only be made by the administrator in Protocol Manager.<br><br>You can modify protocol parameters such as, kV, mA, and scan length at the time of the scan, but the modifications will not be saved. |

7. To edit an existing protocol, perform the following:

   - In the **Edit Protocol** dialog box, go to the **Protocol's Series** list box and select a protocol series.
   - To edit an existing protocol, click the **Edit** button.

     The **Edit Series** dialog box appears.

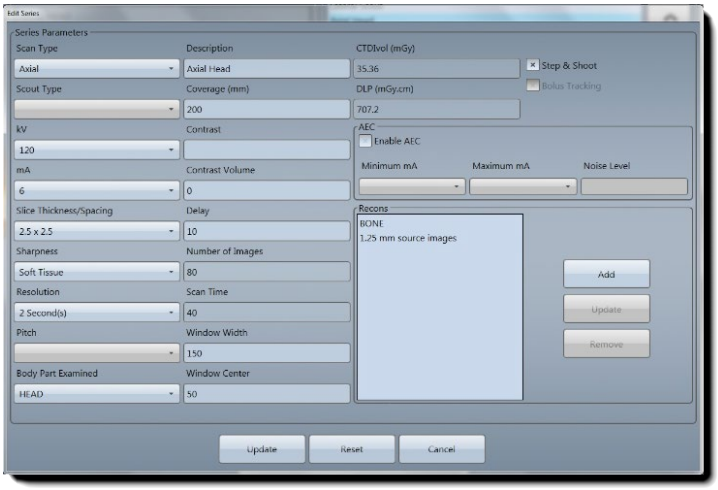



Figure 246: Edit Series dialog box

- Click the **Add** button in the **Recons** section of the **Edit Series** dialog box.

  The **New Reconstruction** dialog box appears.

- Enter a description and any other appropriate changes for your protocol.
- Click the **Add** button.
- Click the **Update** button in the **Edit Series** dialog box.
  - Alternatively, click the **Reset** button to remove any changes.
  - Alternatively, click the **Cancel** button to return to the previous dialog box.

8. Click the **Update** button on the **Edit Protocol** dialog box.

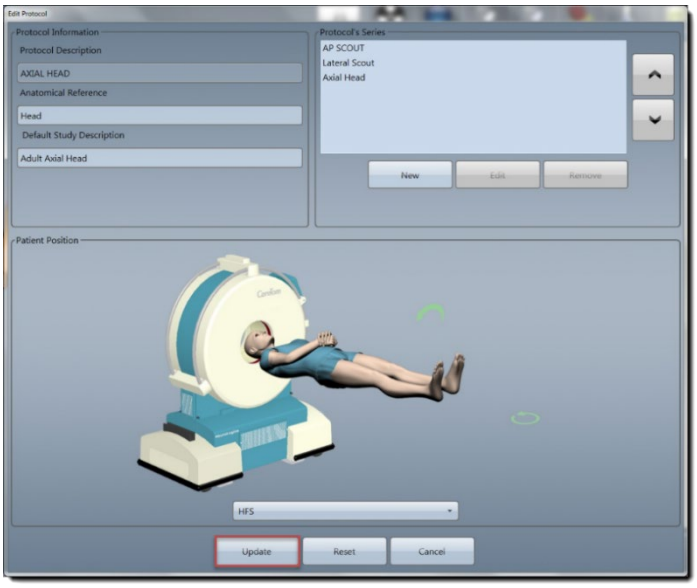



Figure 247: Update button

9. Set up the patient and scanner.

See "Positioning the patient" on page 85.

10. Make sure the scanner is in **Scan** mode.

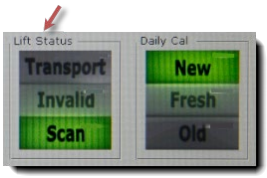



Figure 248: Scan mode

11. On the touch screen, press 

(**Laser On** button) to turn on the laser.

12. Move scanner and align patient as needed.

See "Positioning the scanner before a scan" on page 82.

13. Press  (**Zero Ref** button) on the touch screen to zero the scanner.

14. Click the **Begin** button (on the workstation) from the **Exam Planner** dialog box.

The system state orb will change color from  (preparing the protocol to the system) to  (ready to scan). The **System Ready to Scan** popup appears.


Figure 249: System Ready to Scan popup

15. Press **Start Scan** from the touch screen to acquire your scout(s) and/or scan.

The **Start Scan** screen appears.

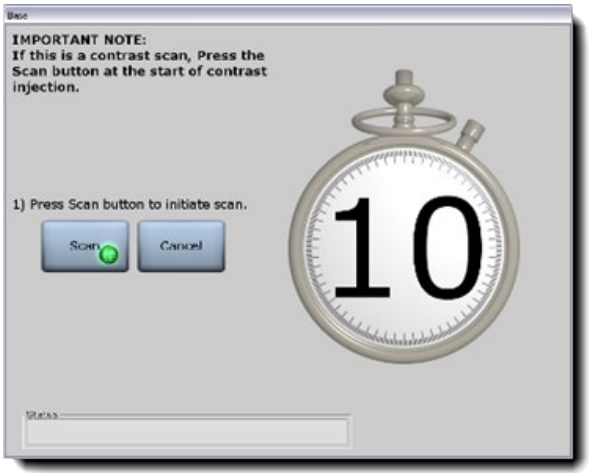



Figure 250: Starting Scan

| Note | If a second scout is defined in your protocol, press the (start) **Scan** button when ready. |
|---|---|

16. If applicable, set your parameters and **Field Of View** (**FOV**) on your scouts.

| Note | **FOV** can only be adjusted when two scouts are acquired. |
|---|---|

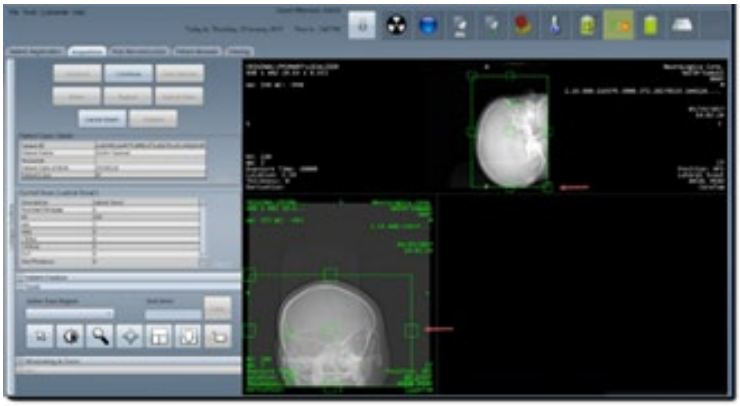


Figure 251: Scouts and FOV button

Scout parameters can be modified by selecting the drag boxes and adjusting the lines, and can be centered by clicking on the small green circle and dragging it.

| Note | During the scan, observe the following:<br><br>A yellow light on top of the scanner, indicates x-rays are emitted; an audible beep identifies that radiation is being emitted.<br><br>The scanner moves slowly away from the patient.<br><br>The patient's scan results appear; ~ one image per second. |
|---|---|

17. Click the **Continue** button (on the workstation) to acquire the scan.

    The **Pending Scanning Movement** popup appears.


Figure 252: Pending Scanner Movement popup message

18. Click the **Continue** button to scan.

    - Click the **Cancel** button to cancel the scan.

      - If you clicked the **Continue** button, the **Positioning Scanner** popup appears.

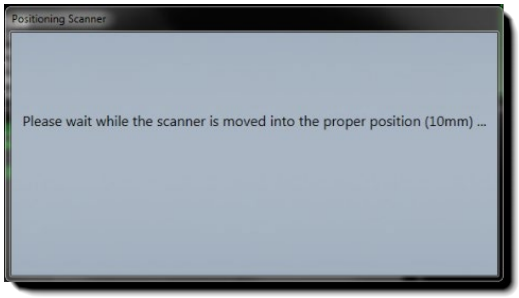



Figure 253: Positioning Scanner popup message – Wait for scanner to move to position

The **System Ready to Scan** popup appears.


Figure 254: System Ready to Scan popup message – System is ready to begin scan

19. Go to the scanner and press the **Scan** button to initiate the scan.

    The **Perform Reconstructions** popup appears.

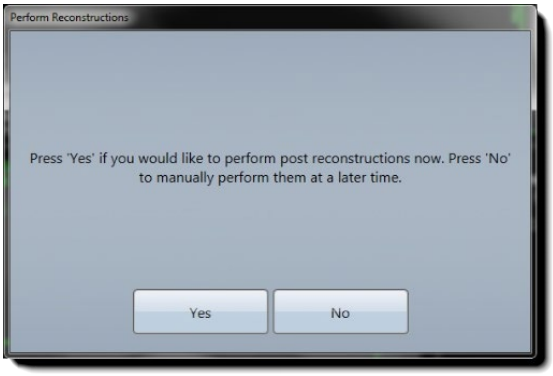



Figure 255: Perform Reconstructions popup message – To perform post reconstructions

20. Perform one of the following:

    - Click the **Yes** button to perform post reconstructions now.
    - Click the **No** button to manually perform a post reconstruction at a later time.
        - If you click the **No** button, the **Perform Reconstructions** popup appears.


Figure 256: Perform Reconstructions popup message – To perform post reconstructions

        - If you have reconstructions attached to your protocol, click the **Start Recons** button.

21. Use the **Viewing** tools to review the scan.

    See "Examining the scanned image with tools" on page 264.

22. Click the **Finalize** button when finished.

    The dose report (if enabled in **System Configuration**) appears.


Figure 257: Dose report

23. Make sure that the patient information that was in the **Patient Information** fields, is removed.

    When the scanned exam is completed, **Exam Details** will be saved.

## Scanning from the touch screen

Keep the following in mind ***before*** performing a scan, using the touch screen:

- Scouts or **AEC** protocols cannot be uploaded to the scanner.
- Protocols must be uploaded to the touch screen to scan from the touch screen.
- Scanning from the touch screen is not possible if **Dose Check** is enabled.

  See "Setting Dose Check" on page 136 to learn how the administrator enables **Dose Check**.

**Note** If the scan needs to be stopped perform the following:

**For an immediate or hard stop**, press the **E-STOP** button. This stops x-ray, centipede movement, and gantry rotation immediately.

**For a controlled stop,** press the **Cancel Scan** button.

1. From the workstation, go to the **Patient Registration** tab and perform one of the following methods to assign the patient to the scan:
   - Query an already existing patient.
   - Manually register the patient.

   See "Manually registering a patient" on page 226.

2. Go to the touch screen.


Figure 258: touch screen showing patient's information

3. Set up patient and scanner.

   See "Positioning the patient" on page 85.

4. Make sure the scanner is in **Scan** mode.

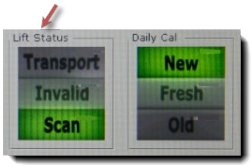



Figure 259: Scan mode

   See "Moving the scanner for manual transport" on page 81.

5. On the touch screen, press 

(**Laser On** button) to turn on the laser.

6. Move scanner and align patient as needed.

   See "Moving the scanner for manual transport" on page 81; "Positioning the scanner before a scan" on page 82, and/or "Positioning the patient" on page 85.

7. Press 

(**Zero Ref** button) on the touch screen to zero the scanner.

CAUTION Always check patient information on the **Main** tab in the **Patient Information** box to ensure patient data is accurate with patient.

8. Press **Select Protocol** (the **Main** tab) when ready to set up a scan protocol.

   The **Protocol Screen** opens. You can modify this list using the workstation to upload custom protocols. See "System and User Configuration and Setup" on page 107 for further explanation of how to perform an upload (if you have administrative access).


Figure 260: Protocol screen

9. Determine the type of scan required and then press the **Scan Protocol** button.

10. Select the protocol.

11. Press the **Accept Protocol** button.

    The **Patient Orientation** screen appears.

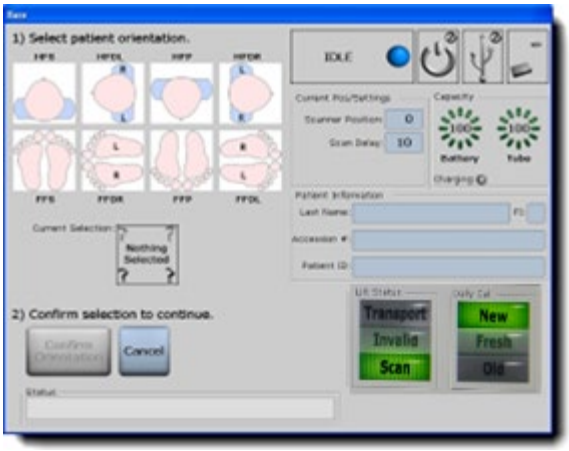



Figure 261: Patient Orientation screen

12. Select the patient orientation; verify the selection and then press the **Confirm Orientation** button to proceed.

    The **scan settings** screen opens.

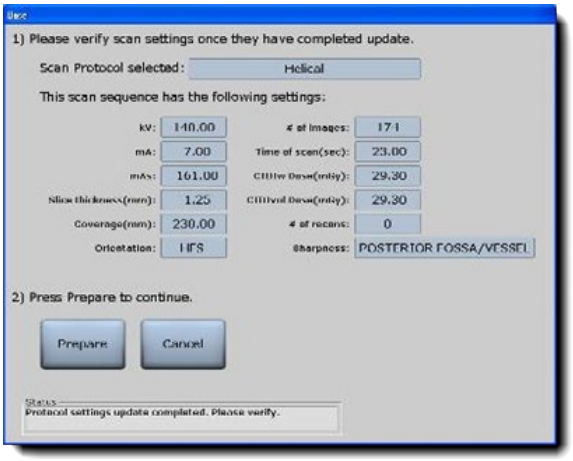



Figure 262: Prepare screen

The **Scan settings** displays the information found in the following table.

Table 41: Prepare screen information

| Scan settings screen | Comments |
|---|---|
| Scan Protocol selected | Scan type displays |
| kV | Kilovolts |
| mA | Milliamperes |
| mAs | Milliamperes-seconds |
| Slice thickness | Tomographic slice thickness |
| Coverage | Length of scan time |
| Orientation | Patient's orientation |
| # of images | Approximate number of scanned images to be generated in Helical scanning |
| Time of Scan | Length of scan |
| CTDIw Dose | Weighted Average Computed Tomography Dose Index |
| CTDIvol Dose | CTDIw averaged along the Z axis |
| # of recons | Number of reconstructions |
| Sharpness | Kernel applied to images |

**Note** Parameters cannot be changed, only accepted.

13. If parameters are as expected and correct, press the  (**Prepare**) button.

    The **Start Scan** screen appears.

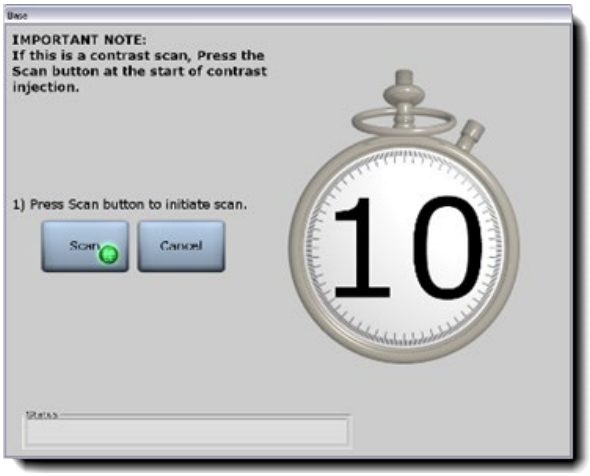



Figure 263: Start Scan screen

14. Remind the patient to remain still and to keep eyes closed.

15. Press the **Scan** button to initiate the scan.

    The **Timer** counts down to zero and then the scan begins.

| **Note** | Click the **Cancel Scan** button, at any time, to end the scan and return to the **Main** tab.<br><br>The scan delay is set on the **Options** tab.<br><br>If scan delay is set to zero, the counter will not be displayed and the scan will begin immediately. There will be no timer graphic displayed. |
|---|---|

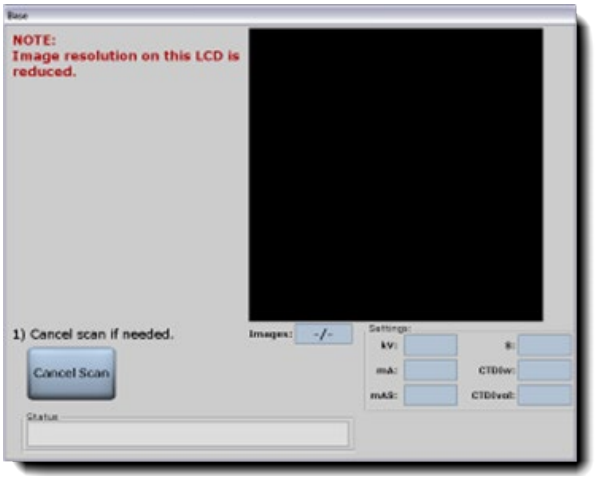



Figure 264: Scan screen

The **touch screen** displays the images while simultaneously transmitting them to the workstation.

When the scan completes, the **Main** tab automatically appears on the touch screen.

16. Click the **Finalize** button on the touch screen.

17. Make sure the patient's information is removed from the touch screen.

## Changing the scan delay default setting from touch screen

The scan-delay default setting is changed or accepted – ***after*** the patient and scanner are in position.

1. On the **Options** tab, press the **Scan Delay** button.

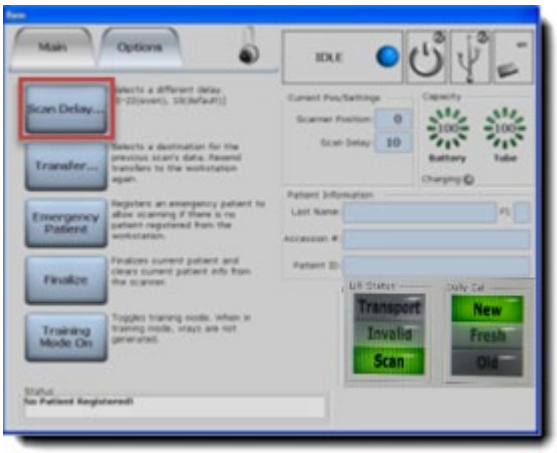



Figure 265: Scan Delay button

The **Select Scan Delay** popup appears.

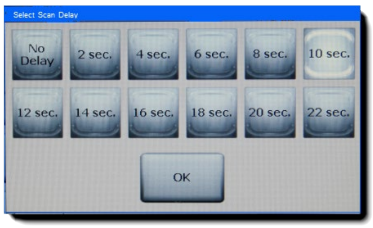



Figure 266: Select Scan Delay popup

2. Press the appropriate delay time you want to set (0 to 22 seconds).

3. Press **Ok** to set the delay time.

## Cancelling a scan from the touch screen

This procedure assumes you have started a scan.

See "Scanning from the touch screen" on page 245.

1. Press the **Cancel Scan** button on the touch screen – at any time during the scanning process – to cancel a scan.

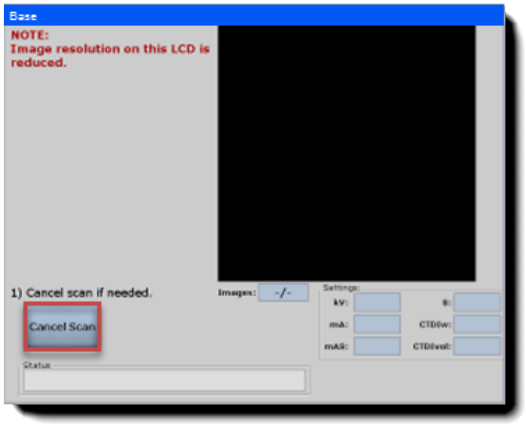



Figure 267: Cancel Scan button on the touch screen

After the **Cancel Scan** button is pressed, the system returns to the **Main** tab. The **Cancel Scan** button stops the scan; there may be a delay as the scanner goes through its abort process.

| **Note** | If the scan is canceled during an actual exposure, the scanner will stop at the end of that exposure. If you click the **Cancel** button after the scanner has completed its preparation, the scanner will make that exposure and then stop. |
|---|---|

## Using Training mode to simulate a scan for training purposes

The **Training Mode On** button lets you simulate a scan without emitting radiation.

1. On the touch screen, press 

(**Training Mode On** button).

   The **Training Mode On** button is a toggle button. If **Training Mode On** is showing and you press it, the button changes to **Training Mode Off**. When active, the text 'TRAINING MODE' appears at the lower, left corner of the touch screen as shown in Figure 268.

2. Check that the "TRAINING MODE" message appears to indicate the **Training** mode is active.

| **Note** | No x-rays are emitted while in **Training** mode. Use **Training** mode during short scans and from the touch screen (LCD), *only*. |
|---|---|


Figure 268: TRAINING MODE message to indicate Training mode on

3. To turn off **Training** mode, press 

(**Training Mode Off** button).

The "TRAINING MODE" message disappears and the **Training Mode On** button appears.

# Scanning with special features

The following features are available for use in protocols. Each feature is explained in the following sections.

## Using the step-and-shoot option

The **Step & Shoot** option in the protocol lets the user control the start of the scan acquisition. This is helpful in the case of an uncooperative or ill patient where motion is an issue.

1. Perform steps 1 through 6 in "Scanning from the workstation" on page 237.

2. If necessary, change the **Scan Type** to **Axial**.

3. Click the **Step & Shoot** option in the **Edit Series** dialog box.

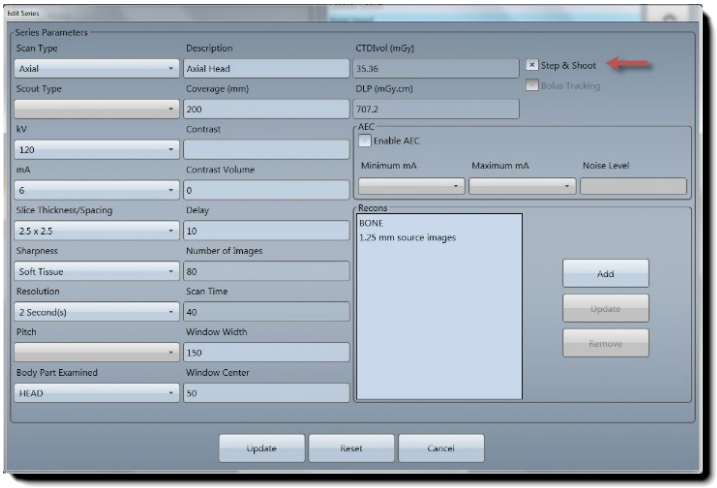



Figure 269: Step & Shoot option in the Edit Series dialog box

4. Click the **Update** button in the **New Series** dialog box.

5. Click the **Update** button in the **Edit Protocol** dialog box.

   See steps 9 through 14 in "Scanning from the workstation" on page 237.

6. Click the **Begin** button in the **Exam Planner** dialog box to begin the scan.

   The system state orb will change color from  (preparing the protocol to the system) to  (ready to scan). The **System Ready to Scan** popup appears.


Figure 270: System Ready to Scan popup

7. To continue the scan, go to the scanner and press the **Scan** button on the touch screen.

   The first set of images are acquired at this position.

   The **Step & Shoot** popup appears for you to control the next acquisition.


Figure 271: Step & Shoot popup

8. Click the **Shoot** button to start the scan.

   To cancel the scan, click the **Cancel** button.

9. Continue for the length of the scan.

10. Click the **Finalize** button when finished.

## Performing a scan with Automatic Exposure Control

| **Note** | Depending on system's configuration, not all functions may be available to perform this procedure. |
|---|---|

**Computed Tomography** (**CT**) is responsible for the largest contribution to the collective effective dose to patients in radiology. The challenge to radiologists and medical physicists is to establish adequate image quality with the lowest radiation exposure to the patient.

**Tube current** (**mA**) is one of the key technical scanning parameters for adjusting radiation dose in CT. To optimize radiation dose in CT, users can adjust mA either with manually selected values or with the application of **Automatic Exposure Control** (**AEC**). **AEC** refers to the automatic adaption of mA on the basis of user specified image quality and attenuation characteristics of the scanned body region.

In CereTom Elite, scout scans now provide a graph of mA values based on object density and desired noise level. A single **Axial** or **Helical** scan in the protocol can utilize **AEC**, limiting the mA value of each slice to the minimum necessary to achieve the desired image quality. This ability to modulate the mA throughout the scan to achieve the desired noise level can reduce patient dose.

**When centering the patient in the gantry, it is *vital* to accurately use AEC**. **AEC** aims to deliver the specified image quality across a range of patient sizes. The use of **AEC** may change the planned CTDIvol and DLP values. It tends to increase CTDIvol for large patients and decrease it for small patients relative to a reference patient size.

**Note** Ensure patient is accurately centered in gantry.

Do ***not*** use **AEC** when any type of metal is going to be scanned.

Do ***not*** use **AEC** with a small **FOV**, that is, tiny neonatal pediatrics.

Only 1 **Axial** or **Helical** series is allowed within an **AEC** protocol.

An automatic adjustment of the tube's current cannot occur when the tube potential is changed.

**Note** **AEC** is an option for low resolution sharpness kernels (**Helical** (soft tissue kernels) or **Axial** (low noise QA, soft tissue, Pos Fossa/Vessel, sharp kernels)).

1. Perform steps 1 through 6 in "Scanning from the workstation" on page 237.
2. If necessary, change the **Scan Type** to **Axial** or **Helical**.
3. Under **AEC**, click the **Enable AEC** option.

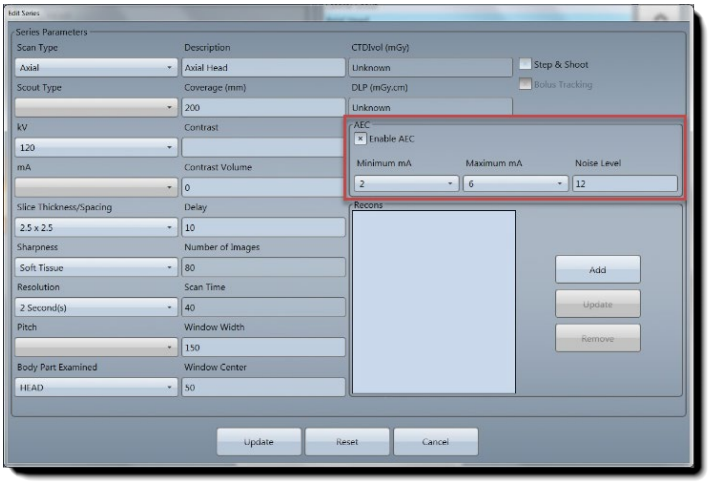



Figure 272: Edit Series dialog box with AEC options selected

4. Under **AEC**, click the **Minimum mA** dropdown to set the minimum allowed mA value used for scanning.

5. Under **AEC**, click the **Maximum mA**- to set the maximum allowed mA value for scanning.

   The minimum mA on the CereTom Elite is 1 and the maximum mA is 7. When using **AEC**, set the minimum and maximum mA for that particular scan, for example, 2 to 6.

6. Under **AEC**, click the **Noise Level**- to set the standard deviation of noise value for the completed scan.

   The noise range is 1-200.

7. Click the **Update** button in the **New Series** dialog box.

8. Click the **Update** button in the **Edit Protocol** dialog box.

9. Make sure your patient and scanner are positioned.

10. Click the **Begin** button in the **Exam Planner** dialog box to begin the scan.

11. To continue the scan, go to the scanner and press the **Scan** button on the touch screen.

12. After the scouts are acquired and the scan region is set, click the **AEC** tab.

13. Click the **Toggle Graph** button to view the graph on the scout.


Figure 273: Toggle Graph button

The graphs will now appear on the scout(s).

Figure 274: Graphs on the scout(s)

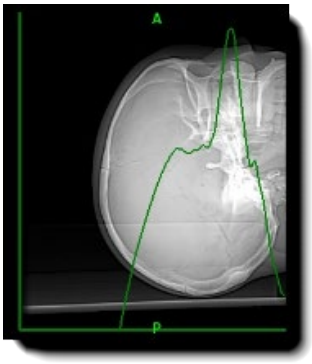



Figure 275: AEC modulation graph

14. To return to the scout parameter view, click the **Toggle Graph** button, again.

15. Modify maximum and minimum mA and noise as needed on the image.

16. When the desired level is achieved according to your department policy, select the **Continue** button to start the scan.

17. Press **Start Scan** from the touch screen.

| **Note** | While reviewing the scan you will see mA modulation as per your graphs. |
|---|---|

18. Click the **Finalize** button.

## Performing a CT angiography scan with bolus tracking

CT angiography is a technique that uses contrast to visualize arterial and venous vessels throughout the body. This ranges from arteries serving the brain to those bringing blood to the lungs, kidneys, arms, and legs.

1. Perform steps 1 through 6 in "Scanning from the workstation" on page 237.

2. If necessary, change the **Scan Type** to **Helical** or **Dynamic**.

3. Click the **Bolus Tracking** option.

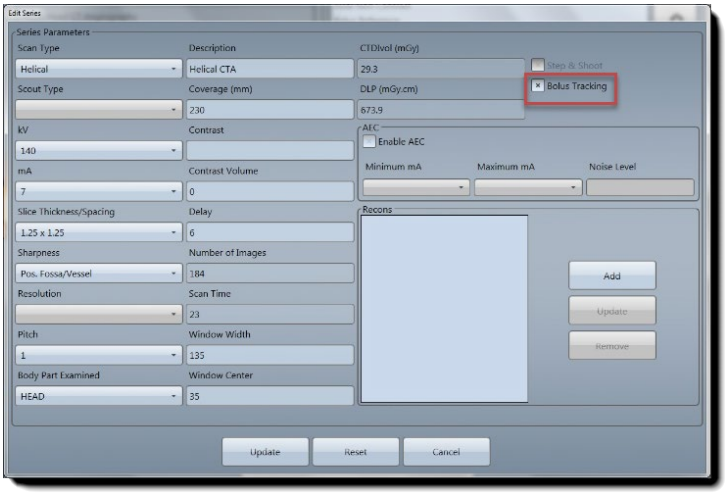



Figure 276: Bolus Tracking option

4. Click the **Update** button in the **Edit Series** dialog box.

5. Click the **Update** button in the **Edit Protocol** dialog box.

6. Click the **Begin** button to acquire the scout(s).

7. To continue the scan, go to the scanner and press the **Scan** button on the touch screen.

8. On the scout, set the scout (parameter) lines (blue).

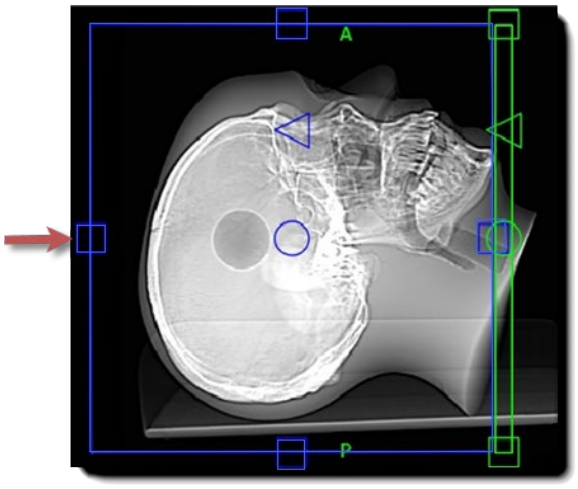



Figure 277: Scout line (blue)

9. Move the reference line (green) to where you will acquire a reference scan.

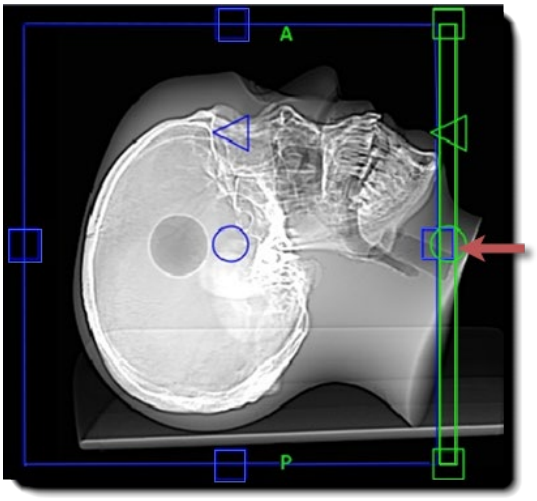



Figure 278: Reference line (green)

10. To move the scout or reference line go to the **Viewing** tools and select **Active Scan Region**.

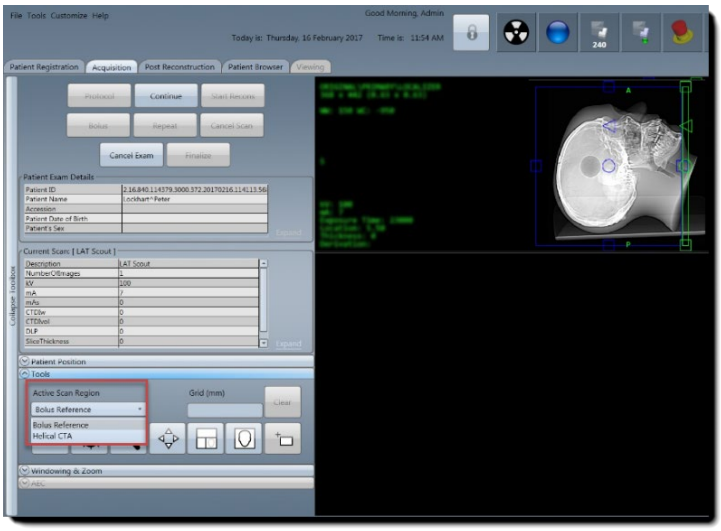



Figure 279: Active Scan Region – Bolus Reference or Helical CTA

11. Click the **Continue** button to acquire a 10mm reference scan.

    The scanner will move to the reference line noted on the scout.

12. Click the **Bolus** button to draw **ROI** on the reference scan.


Figure 280: ROI on the reference scan

13. Click the **Continue** button.

    The **Adjust Bolus Settings** popup appears.


Figure 281: Adjust Bolus Settings popup

14. Click the **Select Contrast Level/Iodine Content** dropdown to select your contrast level.

15. Click the **Auto Start** or **Auto Stop** options (measured in seconds).

    - **Auto Start** Begins the scan after the specified bolus scan time if no bolus is detected.
    - **Auto-Stop** Stops the scan after the specified bolus scan time if no contrast is detected.

16. Click the **Apply** button.

17. Press the **Scan** button on the scanner and initiate contrast.

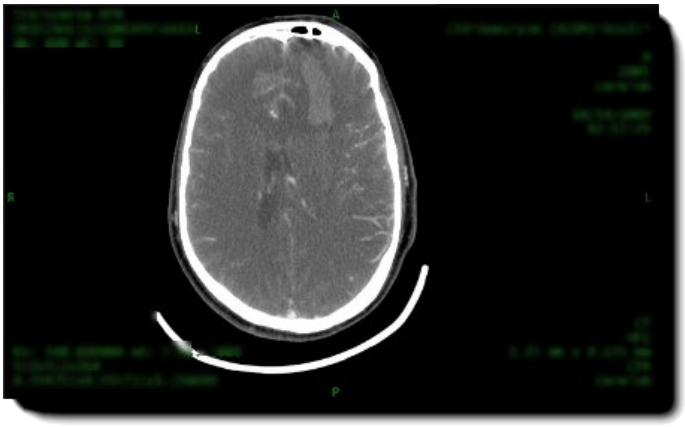


Figure 282: Completed scan with contrast

| Note | In the example above, the scan will start in 16 seconds or when it sees a difference of 100 HUs in the **Bolus Tracking ROI**. |
|---|---|

The scan starts based on what you selected above (Auto Start or Auto Stop). If contrast is detected, you can to start your scan manually by selecting the **Start Scan** button.

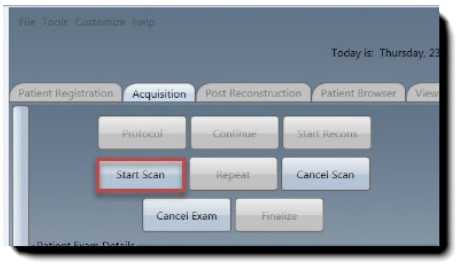



Figure 283: Start Scan button

18. Press the **Finalize** button when complete.

## Performing Test Bolus

Test Bolus performs a bolus-timing function.

1. Perform steps 1 through 6 in "Scanning from the workstation" on page 237.

   Select a chest or head CTA protocol.

2. If necessary, change the **Scan Type** to **Helical** or **Dynamic**.

3. Click the **Bolus Tracking** option.

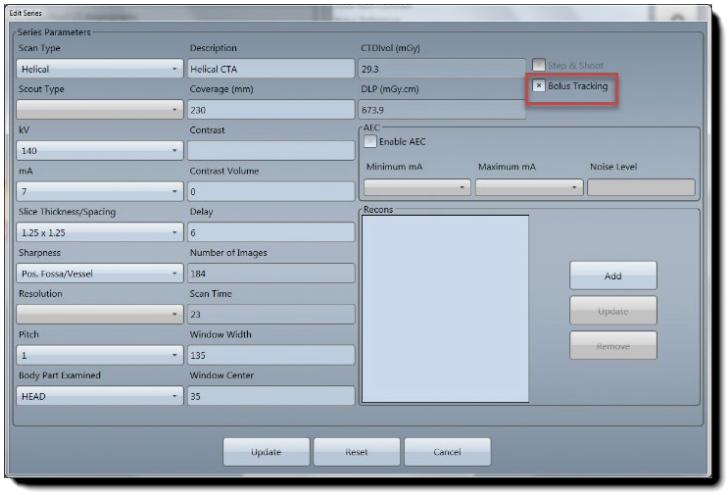



Figure 284: Bolus Tracking option

4. Click the **Update** button in the **Edit Series** dialog box.

5. Click the **Update** button in the **Edit Protocol** dialog box.

6. Click the **Begin** button to acquire the scout(s).

7. To continue the scan, go to the scanner and press the **Scan** button on the touch screen.

8. On the scout, set the scout (parameter) lines (blue).

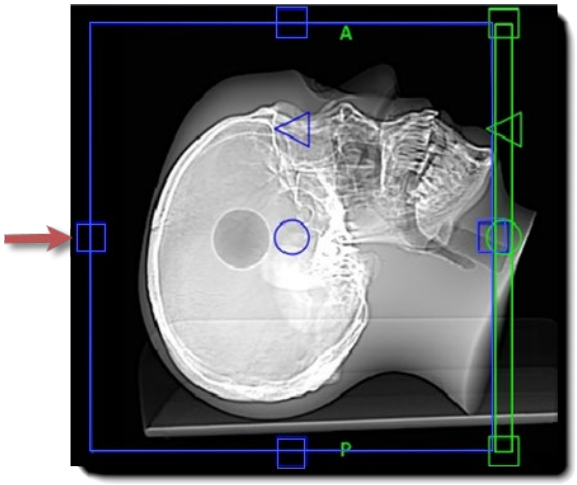



Figure 285: Scout line (blue)

9. Move the reference line (green) to where you will acquire a reference scan.

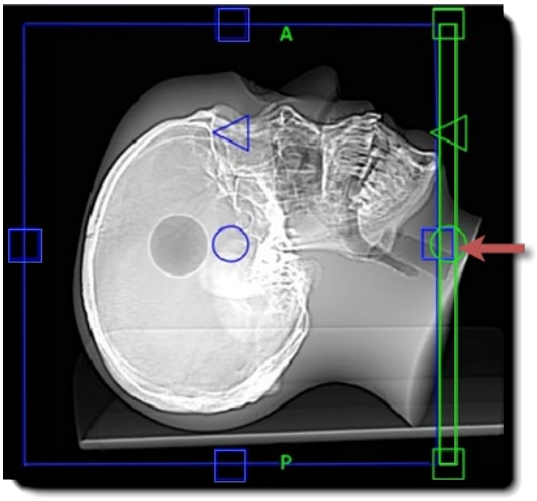



Figure 286: Reference line (green)

| **Note** | The distance between the reference and bolus tracking scans cannot be greater than 100mm. |
|---|---|

10. To move the scout or reference line go to the **Viewing** tools and select **Active Scan Region**.

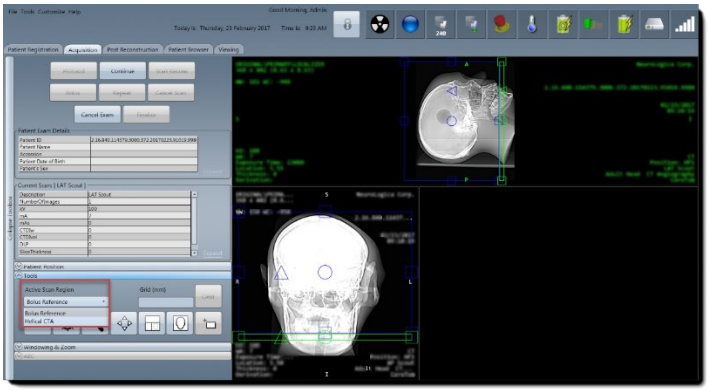


Figure 287: Active Scan Region – Bolus Reference or Helical CTA

11. Click the **Continue** button to acquire a 10mm reference scan.

    The scanner will move to the reference line noted on the scout.

12. Click the **Bolus** button to draw **ROI** on the reference scan.


Figure 288: ROI on a reference scan

13. Click the **Continue** button.

    The **Adjust Bolus Settings** popup appears.


Figure 289: Adjust Bolus Settings popup

14. Click the **Select Contrast Level/Iodine Content** dropdown to select your contrast level.

15. Click the **Test Bolus** option.

| | |
|---|---|
| • **Test Bolus** | Tests the timing of the contrast injected.<br>A small amount of contrast is injected and a timing graph is given after the specified bolus scan time. When the contrast is detected, the system stops scanning and a report on the recommended delay time for **Helical** and **CTP** protocols, appears. |

16. Click the **Apply** button.

17. Press the **Scan** button on the scanner and initiate contrast.

    Scan will trigger when bolus enters reference point and **ROI**. **Bolus Timing graph** appears and shows the calculated, bolus-tracking time.

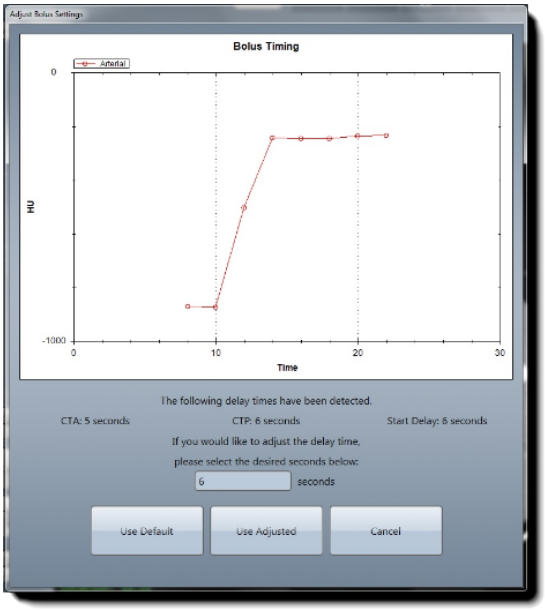



Figure 290: Bolus timing graph

18. Select from one of the following:

- **Use Calculated** Uses the bolus timing calculated from the Test Bolus scan.
- **Use Manual** Allows the user to select a manual timing of the bolus after the Test Bolus calculates a timing.
- **Auto Start** Begins the scan after the specified bolus scan time if no bolus is detected.
- **Auto Stop** Stops the scan after the specified bolus scan time if no contrast is detected.

19. Click the **Continue** button.

    Review completed scan.

20. Press the **Finalize** button when complete.

# Examining the scanned image with tools

You cannot work with image tools without a registered patient, the **Acquisition** tab enabled, and a scanned image showing. You can also use image tools from the **Patient Browser** tab – after you select a patient and open the associated image. In either case (from the **Acquisition** or the **Patient Browser** tab), the tools appear. Look for the **Tools** section on **Acquisition**; click **2D**, **3D**, and **MPR** dropdowns. **Patient Browser** provides more image tools.

From the **Acquisition tab**, you can zoom, pan, modify window width and level, and change layout; see the table below to understand the basics of what each tool looks like and how it performs.

## Using tools on the Acquisition tab

It is assumed you have registered the patient. You cannot use these tools without a registered patient and the **Acquisition** tab enabled.

The following table describes some of the tools available to you when the **Acquisition** tab is active. For a comprehensive list, see Table 46.

Table 42: Image tools

| Image tool | Tool name | Action |
|---|---|---|
|  | **Clear Active** | Resets the tool to the default pointer device. |
|  | **Change the Window Width Level** | Click and move pointer over image. Left-click and hold down the mouse button and drag in chosen direction to adjust image width and level. Width and level values appear in the **Width/Level** status display.<br>A pre-defined width level setting can also be selected.<br>Select preset from dropdown list below the **WL Preset** button.<br>Width and level presets can also be saved or deleted. |
|  | **Zoom** | Click and move the pointer over the image. Left-click the mouse and hold down the left mouse button and move in upward direction to zoom in (enlarge) and downward to zoom out (shrink). |
|  | **Pan** | Click and move pointer over image. Left-click and hold down the mouse button and drag the image in the chosen direction. Release mouse button to position image in new location. |
|  | **Toggle Scouts** | Removes scouts from **Acquisition**. |
|  | **Toggle Layout** | Changes the layout to 2x2. Repeat process to return to 1x1 (full screen prior to clicking). |
|  | **Scan Region Re-Draw** | If scout lines and the scan region is deactivated, allows you to reactivate. |

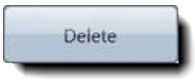
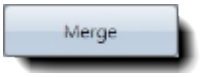
# Chapter 10 Patient Browser

Patient Browser lets you view patient information and the images (and series) associated with the patient information – after the patient's (scan) examination. It lets you access all the series stored on the workstation and enter additional patient information to patients already registered.


Figure 291: Active Patient Browser tab

The following table identifies those buttons found on the **Patient Browser**.

Table 43: Command buttons

| Button | Action |
|---|---|
|   | Selects the archive destination for selected information. |
|   | Imports the exam information from **PACS** or **Media**. |
|   | Deletes the selected exam information from the **Patient Browser** tab. |
|   | Reregisters a patient who is already in the system (**Patient Browser**). |
|   | Generates the dose for the particular patient. |
|   | Combines two different image sets. |
|   | Shows patient, study, series, and image information. |
|   | Views images. |

# Overview of Patient Browser

**Patient Browser** lets you perform tasks on existing series, for example archiving and printing the series. This section will introduce you to **Patient Browser** and identify the symbols, areas, and buttons you can use.

The **Patient Browser** can be broken down into the following sections:

- Exam table
- Series table
- Selected protocol table
- Patient Browser's (initial) active buttons
- Preview window

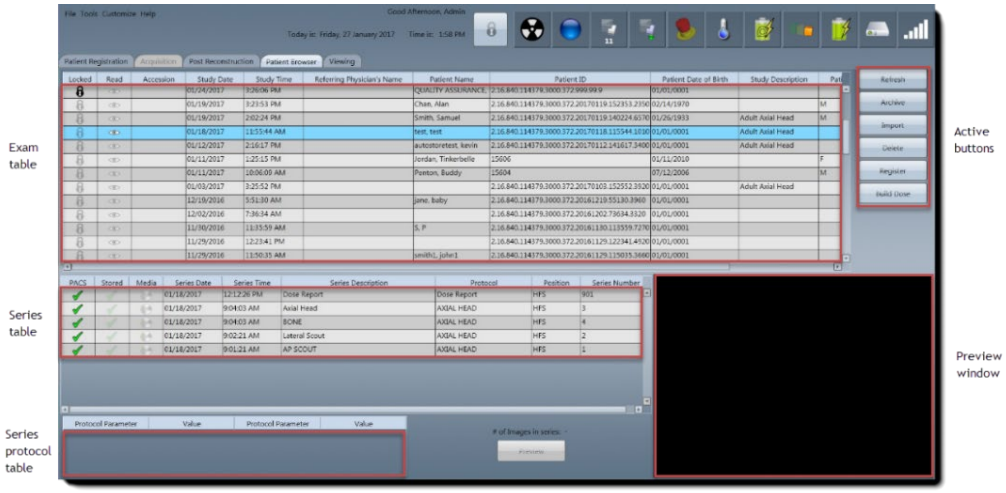



Figure 292: Patient Browser sections

## Identifying symbols on Patient Browser

Symbols may appear next to series in the exam and/or series tables. These symbols are more vivid (not dim) when active; they are identified below as active symbols.

- **Locked** Indicates the series is locked and cannot be deleted:
- **Read/Mark** Indicates the series is marked to be read or read by the physician:
- **PACS** Indicates the series has been sent to **PACS**:
- **Stored** Indicates the series has been sent to **PACS**; the archived series appear below the initial table:
- **Media** Indicates the series has been sent to a media device, for example USB:

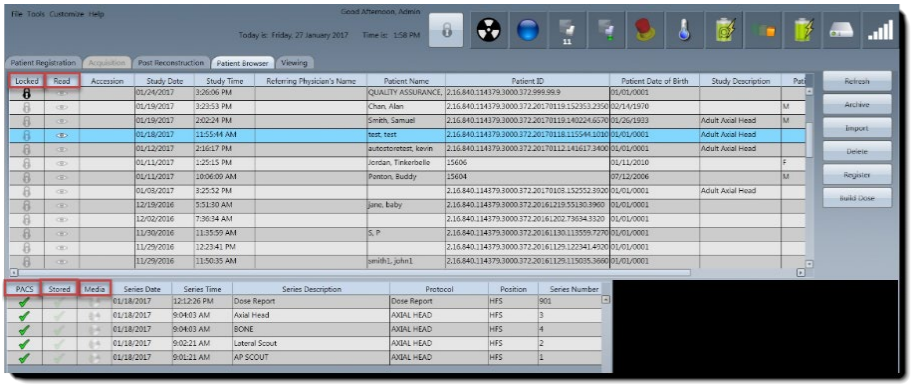


Figure 293 Patient Browser locked, read, PACS and Stored (archived), and media symbols

## Using the vertical and horizontal scroll bars on Patient Browser

Navigation scroll bars let you move up and down the list of patients and associated examination scans (in the exam table); horizontal scroll bars let you see all aspects of the image by moving the bar to view all columns of data.

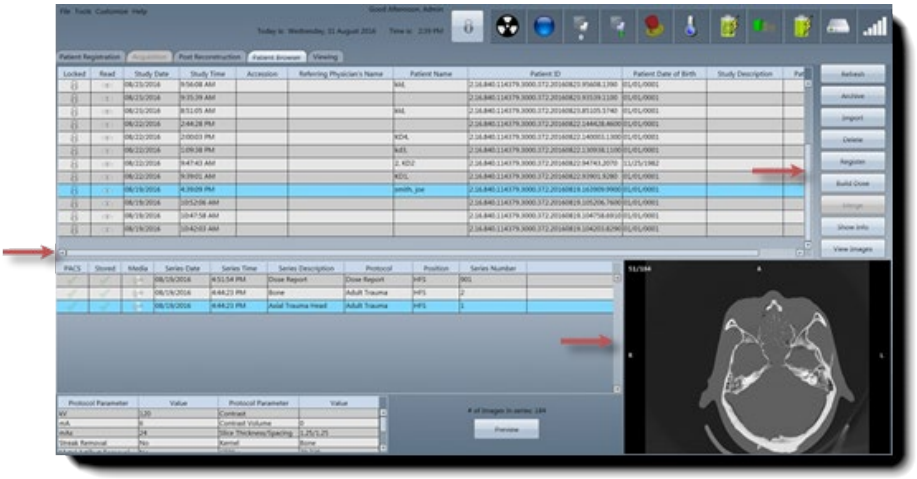


Figure 294 Patient Browser horizontal and vertical scroll bars

## Using the preview window

1. Click a patient in the exam table.
2. Click a series in the series table.
3. In the series protocol table, click the **QA Results** report.

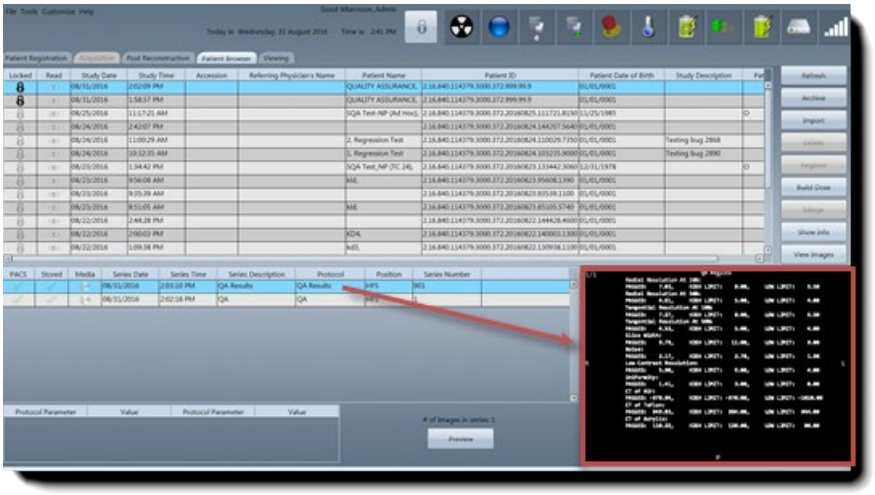


Figure 295: Patient Browser > QA Results report

The QA results report appears in the preview window.

4. To quickly preview the QA image, click the series and click the **Preview** button below the series table.

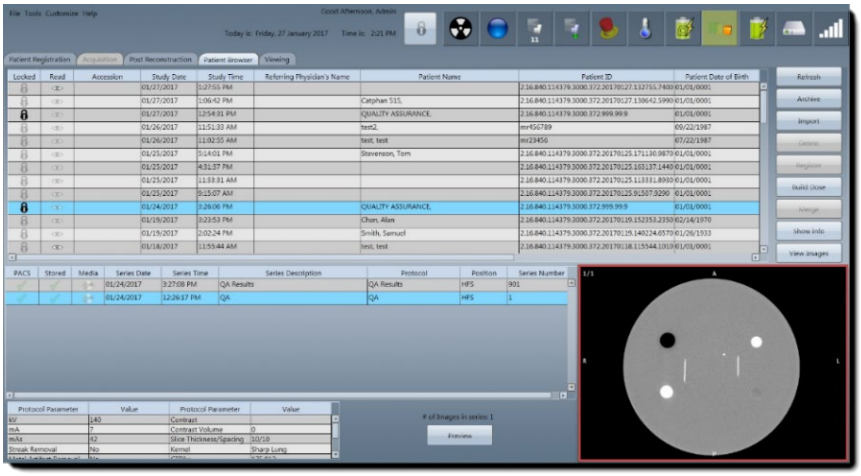


Figure 296: The QA image (phantom) appears in the preview window

## Registering a patient from Patient Browser

If additional scans will be performed on a patient that is already exists in the system, you can register within **Patient Browser**. A newly acquired series will be added to the existing patient's series table.

1. Click the **Patient Browser** tab, if necessary.

2. Select the required patient to register the patient for an examination.

3. Click the **Register** button.

The **Create New Study** popup appears.

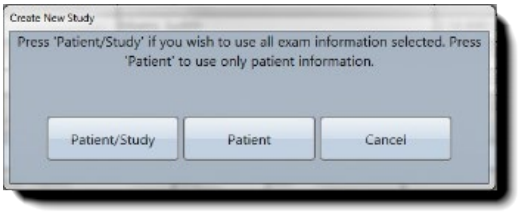



Figure 297: Create New Study popup

4. Perform one of the following:
   - Click the **Patient/Study** button (to use all exam information selected, including the accession number).
   - Click the **Patient** button (to use only patient information).
   - Click the **Cancel** button to exit the **Create New Study** popup.

## Building dose from Patient Browser

The **Patient Browser** tab presents, for any completed study, the **Build Dose** button. Clicking this button lets you build the **dose report** only or **dose report & dose SR** reports (together). Building **Dose Reports & Dose SR** appears in the **series table**.

1. Click the **Patient Browser** tab, if necessary.
2. Select the patient to build a dose report or a structured dose report.
3. Click the **Build Dose** button.

   The **Choose Dose Options** popup appears.

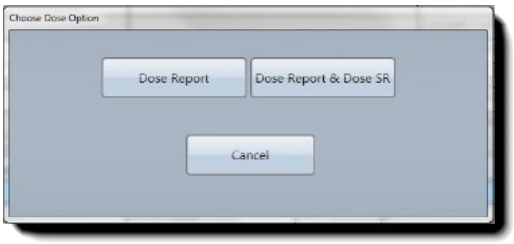



Figure 298: Chose Dose Option popup

4. Perform one of the following:
   - Click the **Dose Report** button to build the dose report.
   - Click the **Dose Report & Dose SR** to build the dose report and dose SR (Structured Dose) report.

     The **Please Wait** popup appears.

- Click the **Cancel** button to exit the **Choose Dose Option** popup.

5. To view the report, select the report and click the **Preview** tab.

| Note | Structured dose reports cannot be viewed in the CereTom Elite system; **Dose SR** can be viewed in **PACS** with the appropriate viewer. |
|---|---|

# Importing data

Importing data lets you store data (protocols) from devices such as a USB.

## Importing from PACS

1. Click the **Patient Browser** tab, if necessary.

2. Click the **Import** button to import data.

   The **Import Location** popup appears.


Figure 299: Import Location popup

3. Click the **PACS** button.

   The **Import from PACS** popup appears.

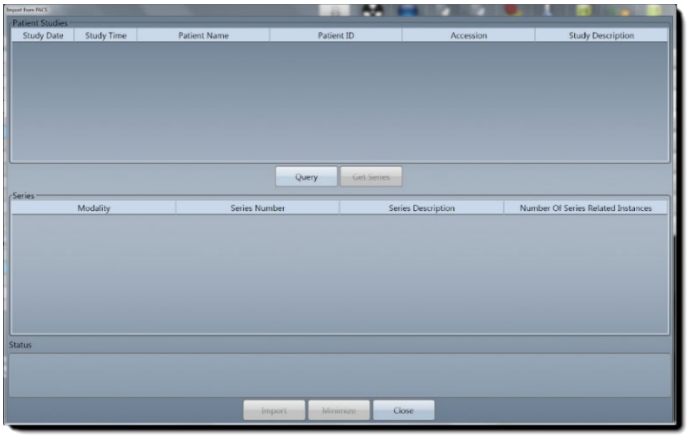



Figure 300: Import from PACS

4. Click the **Query** button to perform the following:

   - Select a **HIS/RIS** server from the dropdown.

- Set the values to search in your query.
- Click one of the following buttons:
  - Click the **Query** button to search for the values you set.

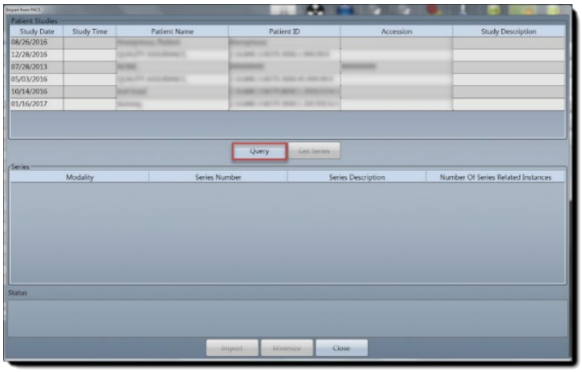


Figure 301: Import from PACS dialog box

  - Click the **Save Query** button (after your search is complete) to save the search results.
  - Click the **Reset** button to start over or query again.
  - Click the **Cancel** button to exit the Import Location popup.

5. With your query results, select a patient and click the **Get Series** button.

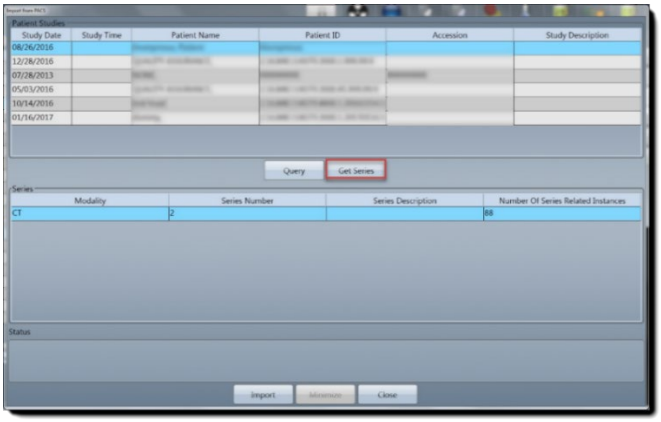


Figure 302: Import PACS dialog box with active Get Series button

6. Click the **Import** button.

7. Click the **Close** button to exit the **Import from PACS** popup.

## Importing from media

Studies can be imported into the **Patient Browser** from a USB (inserted into the workstation).

1. Click the **Patient Browser** tab, if necessary.

2. Click the **Import** button on **Patient Browser**.

   The **Import Location** popup appears.

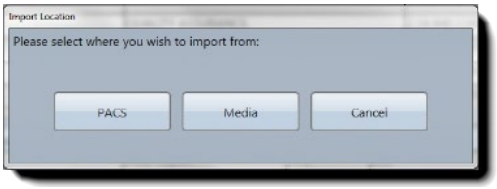



Figure 303: Import Location popup

3. Click the **Media** button.

   The **Import from Media** popup appears.

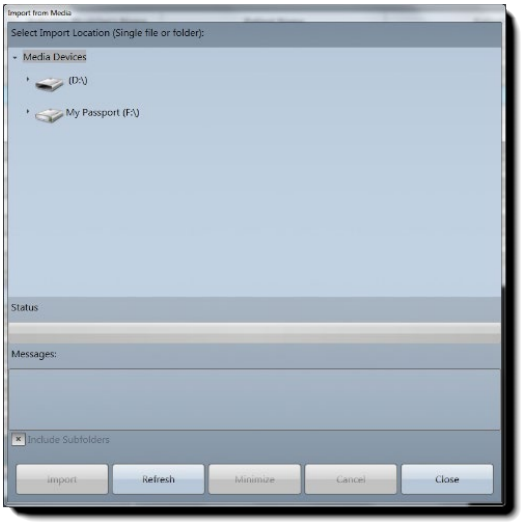



Figure 304: Import from Media popup

4. Click the drive and path from where you will import.

| **Note** | Select the file or folder from where to import; if necessary, click **Subfolders** to see the entire path.<br><br>To select a single **DICOM** image or a **DICOMDIR** file, click the **DICOMDIR** file to import all images related to that particular **DICOMDIR**. |
|---|---|

   The **Import** button is active.

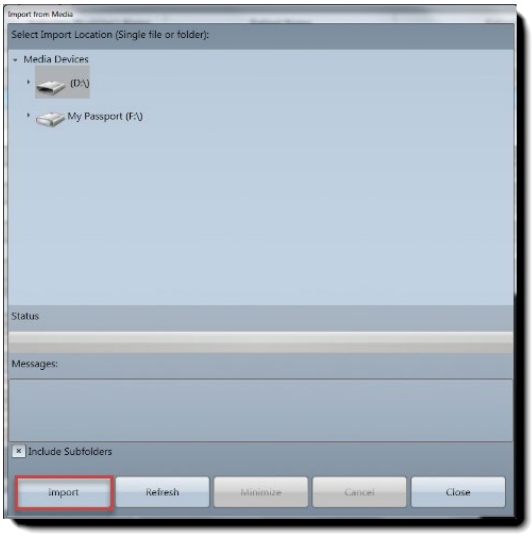



Figure 305: Active Import button

5. Click the **Import** button.

   The imported images appear in **Patient Browser**.

## Loading a series into view

1. Click the **Patient Browser** tab, if necessary.
2. Select the patient.
3. Select the series.
4. Click the **View Images** button or double-click the selected series.

   The **Viewing** tab opens and the series appears for viewing and manipulating.

## Using Show Info to view, update, and move a series

1. Click the **Patient Browser** tab, if necessary.
2. Select the patient.
3. Select the series.

   The **Show Info** button appears and is active.

4. Click the **Show Info** button.

   The **View/Update Information** dialog box appears.

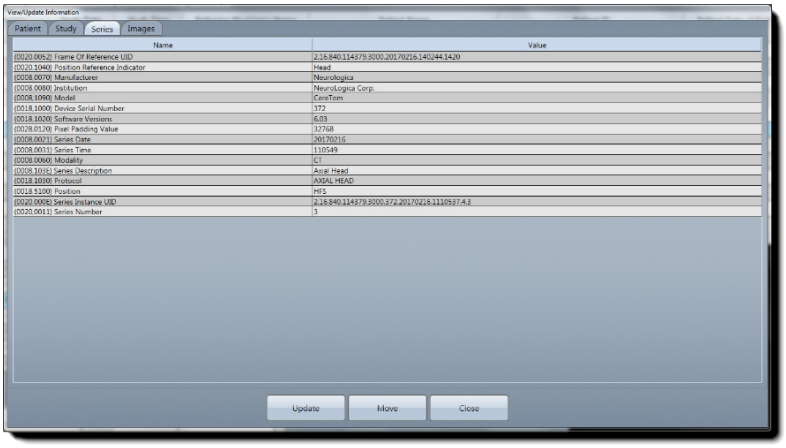



Figure 306: View/Update Information dialog box

The following tabs appear:

- **Patient** — Data about the patient, such as patient name, date of birth, and sex of patient.
- **Study** — Data about the study, such as date, time, and referring physician.
- **Series** — Data about the series, such as position reference indicator, model, pixel padding value, and series date and time.
- **Images** — Data about the image, such as the instance number (sequential), exposure time.

5. Click the tab(s) to review and update the necessary information.

6. Double-click any editable fields and make your change(s).

7. Click one of the following buttons

   - Click the **Update** button to save your changes.
   - Click the **Move** button to show the **Move Series** popup.

> **Note** The **Move Series** function is used when a scan has been acquired under the wrong patient file or to move a patient that was registered manually to the **Patient Registration** tab. Moving the patient to the **Patient Registration** tab will capture all of the patient's information.

   - Click the **Registration** button to move the patient into an existing patient or by manually creating a new patient using the **Patient Registration** process.
   - Click the **Cancel** button to exit the **Move Series** popup.
   - Click **Browser** to go to the **Patient Browser** tab and move the series.

- Click the **Move** button to confirm moving the series.
- Click the **Cancel** button to exit the **Patient Browser** tab and return to the **View/Update Information** popup.

8. Click the **Close** button to exit the **View/Update Information** popup.

## Modifying a series scanned under the wrong patient

If a patient has been scanned under the wrong identification, the series can be corrected.

1. Click the **Patient Browser** tab, if necessary.
2. Select the series that was scanned with incorrect patient identification to modify the data.
3. Click the **Show Info** button.

   The **View/Update Information** dialog box appears.

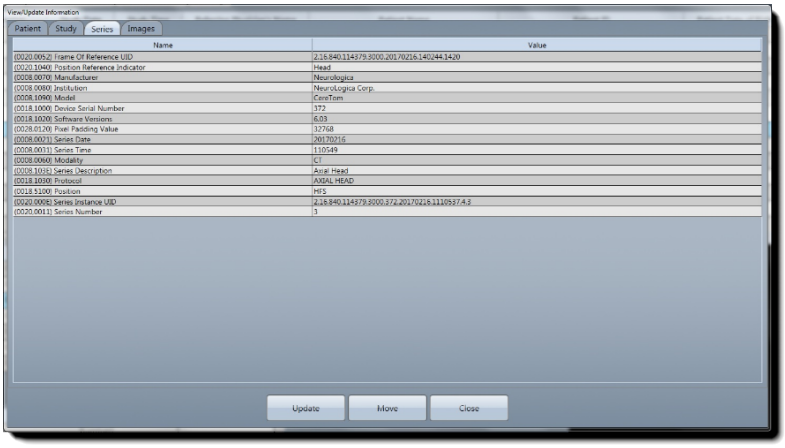



Figure 307: View/Update Information dialog box

4. Click the **Move** button.

   The **Move Series** popup appears, denoting where to retrieve patient information from.

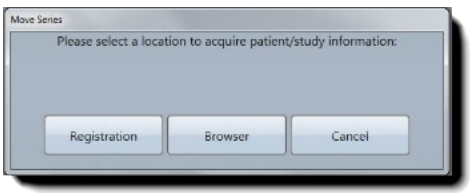



Figure 308: Move Series popup

The following defines what each button performs:

- **Registration** — If patient information is stored within hospital's **HIS/RIS** server, click the **Registration** button, which will open the **Register Patient** tab to let you choose patient/study information.
- **Browser** — If patient information is stored within system's browser, click **Browser** button, which show the **Patient Browser** tab information to let you select a series with correct patient information.
- **Cancel** — Returns you to the previous dialog box.

5. Perform one of the following:
   - If you clicked the **Registration** button in the previous step, go to the next step.
   - If you clicked the **Browser** button in the previous step, go to step 11.
6. Click the **Manual** button.

   The **Exam Information** dialog box appears.
7. Enter the corrected data in any of the fields.

   See "Registering the patient" on page 223.
8. Click the **Update** button to save the change(s).
9. Click the **Move** button

   A prompt appears to review changes made to the patient and/or series information in order for changes to take effect.
10. Click the **Ok** button and then the **Update** button.

    The corrected patient and moved data will appear in the **Patient Browser**.
11. If you selected the **Browser** button, the **Patient Browser** tab is showing; select the correct patient and series.
12. Click the **Move** button.

    A prompt appears to review changes made to the patient and/or series information in order for changes to take effect.
13. Click the **Ok** button.
14. Review the patient to ensure it is the proper one.
15. Click the **Update** button.
16. Click the **Cancel** button to return to the **Patient Browser**.

# Merging a series

The merge function is used to combine two different series for review.

**Note** Only series with same patient name, ID, and slice thickness can be merged.

1. Click the **Patient Browser**, if necessary.

2. Select the study to merge.

   The study must include several scans.

3. Select two series to merge by pressing and holding the **Ctrl** key and highlighting the two series.

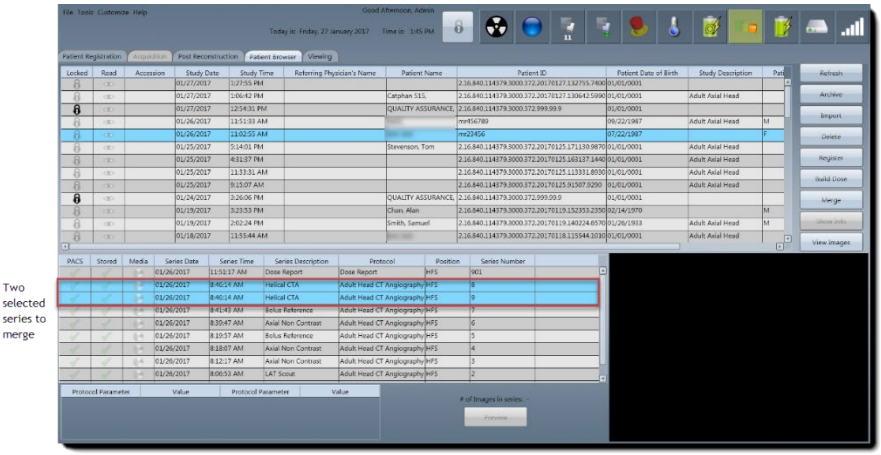



Figure 309: Two series selected to merge

The **Merge** button appears and is active.

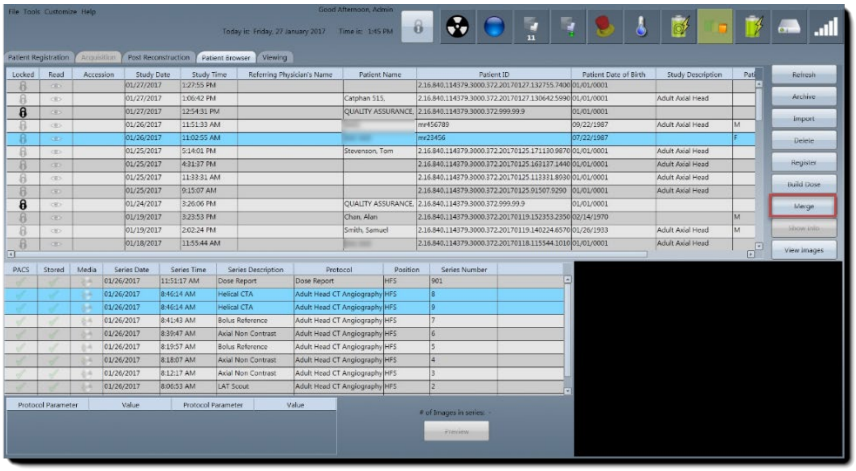


Figure 310: Active Merge button

4. Click the **Merge** button to merge the series.

| Note | To merge, the two series must have the same protocol slice thickness and spacing, kernel, and pixel spacing. |
|---|---|

A **Please Wait** popup appears while the application merges the set of series.

- When the **Merge** window appears, one selected series appears (on the left) and the other appears (to the right); both in scrollable (use the mouse-wheel) filmstrips.
- The bottom (to be selected images) filmstrip is empty when the window is first displayed. The following four image tools are available to use:

Table 44: Image tools

| Image tool | Tool name | Action |
|---|---|---|
|  | **Windowing Width and Level** | Adjusts window width and center of image. |
|  | **Zoom** | Magnifies the image. |
|  | **Pan** | Adjusts image on X or Y axis. |
|  | **Clear Active** | Resets the tool to the default pointer device. |

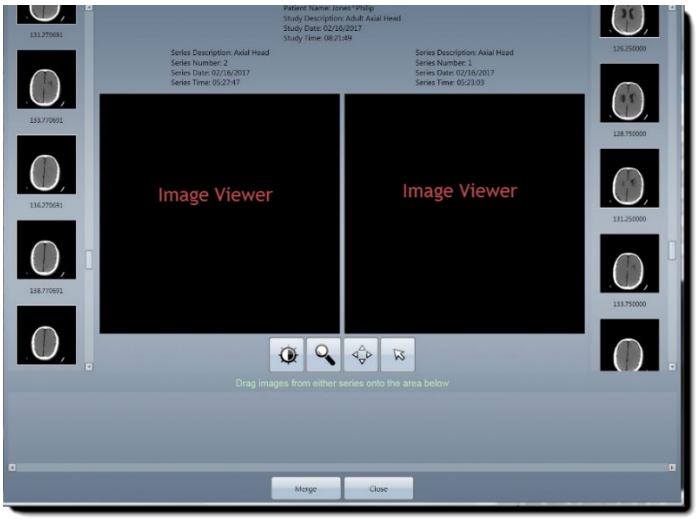



Figure 311: Image viewer without image(s) selected

5. After viewing images, drag each viewed image to the image viewer or the bottom of the filmstrip.

   A single selected image appears in a green outline. You can also perform the following:

   - To select a single image, click and drag the image.

- To select several images, press the **Ctrl** key, click the images, and drag the images.

  Alternatively, to select multiple images, right-click and click **Select All**.

- To deselect a single image, click the image – one time (image appears in white outline).

  Alternatively, to deselect all, right-click the filmstrip and click **Deselect All**.


Figure 312: Selecting images to move to image viewer or bottom filmstrip

6. To reorder bottom filmstrip, drag one or more images to the new location.


Figure 313: Finished filmstrip

7. When finished with bottom strip, click the **Merge** button.

   To stop the merge, click the **Close** button to return to the browser.

   The application generates a third series with those images. A **Series Saved** popup appears, informing of merge success or failure. When user returns to browser, it has already been refreshed to show new series. Series is marked as a merged series in its series description **DICOM** tag, which can be shown in the browser. Series is also marked as secondary, rather than primary series.

# Locking a series

1. Click the **Patient Browser** tab, if necessary.
2. Select the study to lock.
3. Right-click the mouse button.
4. Click **Lock** on the floating menu that appears.

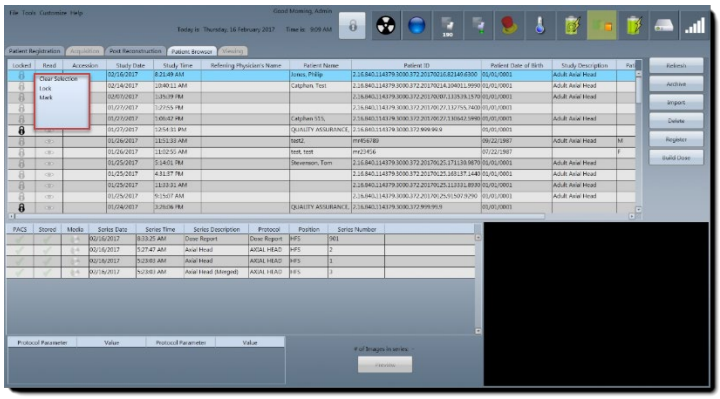


Figure: 314: Floating menu - Lock

The (**Lock** symbol) appears for any selected series.

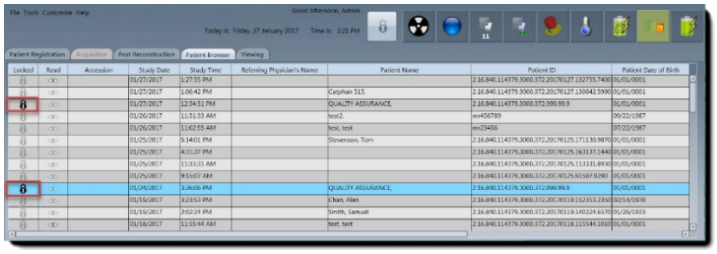


Figure: 315: Two locked series

A series cannot be deleted while in a locked mode.

5. To unlock right-click and click **Unlock**.

| **Note** | All QA series are locked to prevent deletion. The QA series can only be unlocked by your field service representative. |
|---|---|

# Marking a series to read

1. Click the **Patient Browser** tab, if necessary.
2. Select the study to mark.
3. Right-click the mouse button.

4. Click **Mark** on the floating menu.

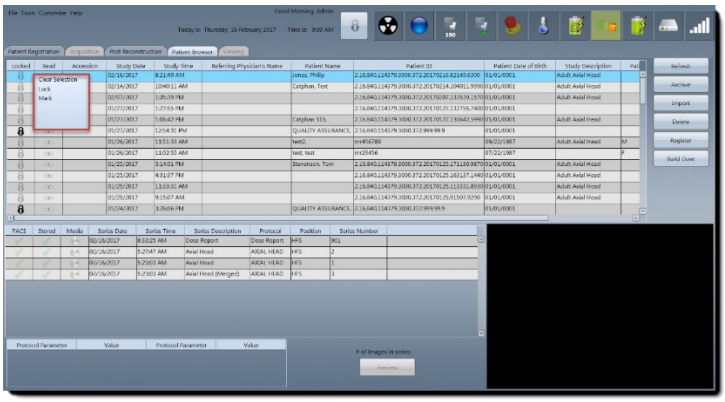


Figure: 316: Floating menu - Mark

The (**Mark** symbol) appears (brighter) for any selected series.

5. To unmark any series, right-click **Unmark**.

## Deleting a series

1. If necessary, click the **Patient Browser** tab, if necessary.
2. Select the study or the series to delete.
3. Click the **Delete** button.

## Archiving patient series

You can archive patients and studies (or series) to **PACS**, media (USB or CD), or using navigation during surgery.

### Archiving to PACS

1. If necessary, click the **Patient Browser** tab.
2. Select the patient study for **PACS** in the following way:
   - To select one patient and all associated series, click the patient, and click the **Archive** button.
   - To select specific series for a patient, click the **Ctrl** key, then select each series, and click the **Archive** button.
3. Click the **PACS** button.

   The **Archive to Server** popup appears.

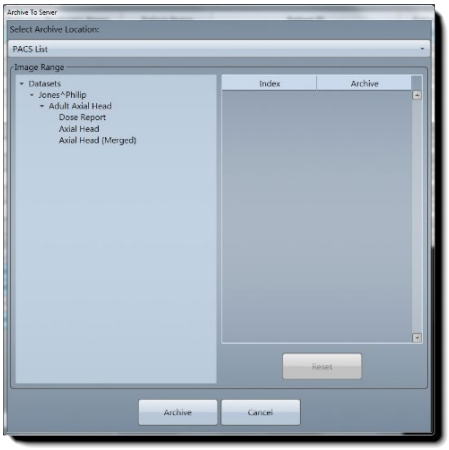



Figure 317: Archive To Server popup

4. Click the **Select Archive Location** dropdown and select a site.

5. Review the **Image Range** items to make sure all those items you selected in step 2 are captured.

6. Click the **Archive** button to begin the archive process.

   If enabled (in **System Configuration**) the **Store/Print Queue** dialog box will appear to show the status of your image transfer. You can also activate the **Store/Print Queue** dialog box by clicking **Tools > Store/Print Queue** from the main menu.

   Watch the status of each series: **Pending** informs you that the series is paused because you clicked the **Pause** button; **Connecting** informs you that the series is in process of archiving to its targeted location. Each series will move from the top portion of the popup to the bottom portion of the **Store/Print Queue** popup when it has been processed.

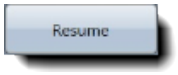
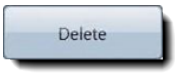
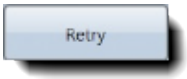
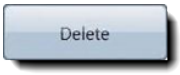
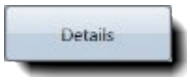
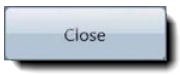
   If the series is not successfully stored to its targeted destination, the "Store Failed" message appears in the **Failure** column. This means the series was not successfully archived. If the series was successfully archived, no message appears in the **Failure** column.

   The following information is displayed:


Figure 318: Store/Print Queue dialog box

While the archiving process is in process, you can perform one of the following from the buttons in the **Store/Print Queue** dialog box. See the table below for a description of the buttons and their actions.

Table 45: Store/Print Queue buttons

| Store and Print Queue button | Action |
|---|---|
|   | When you select one or more series, temporarily stops the series from being stored. This is a toggle button with the **Resume** button. |
|   | When you select one or more series, continues to store previously paused series. This is a toggle button with the **Pause** button. |
|   | When you select one or more series, deletes either a series to be stored, or a series that failed to store. |
|   | When you select one of more series, tries to archive the selections. |
|   | When you select one of more series, deletes a (failed) series. |
|   | When you select one of more series, displays an explanation of why a series failed to store. |
|   | Closes the **Store/Print Queue** popup. |

If the job is sent successfully, the series disappears from the queue.

7. If there are failed archived series; click the **Retry** button to attempt to archive the series you selected.

> **Note** Any **Storing Failure** status appears in the bottom of the popup to inform you why the failure occurred. If an archive job fails, it will be sent to the **Failed Store/Print Jobs** list.

8. When the archiving is complete, click the **Close** button to exit the **Store/Print Queue**.

   You can also click the **Close** button and the archiving process will continue as you do other tasks.

## Archiving to Media

1. If necessary, click the **Patient Browser** tab.

2. Select the patient study you want to send to media in the following way:

- To select one patient and all associated series, click the patient and click the **Archive** button.
- To select specific series for a patient, click the **Ctrl** key, select each series, and click the **Archive** button.

| Note | To select more than one patient at a time, press and hold the **Ctrl** key (on the workstation keypad) and click any patients until finished and then release the **Ctrl** key.<br><br>To click all the patients, press and hold the **Shift** key (on the workstation keypad) and click the first patient in the list and then click the last patient to highlight all patients between the first patient selected and the last. The **Store** button will be activated. |
|---|---|

3. Click the **Archive** button.

   The **Archive Destination** popup appears.

4. Click the **Media** button.

   The **Archive to Media** popup appears.

5. If you are archiving media to a USB, insert the thumb drive into the USB port.

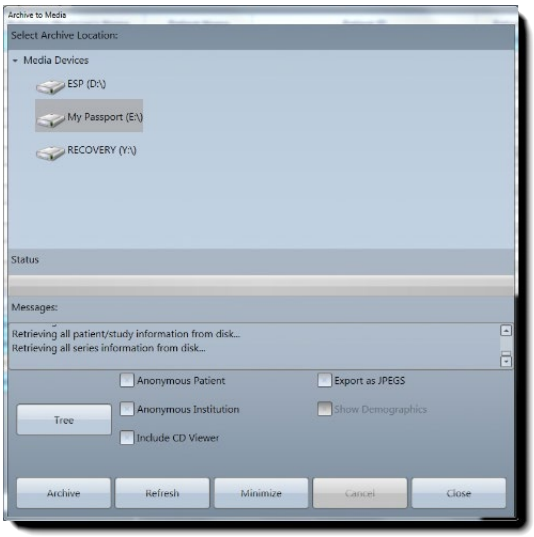



Figure 319: Archive to Media popup

6. Click (to select) the targeted drive and path destination for the archived study.

   The **Archive** button is active.

7. Click the **Tree** button to perform the following:

   The **Adjust Archive Tree** popup appears.

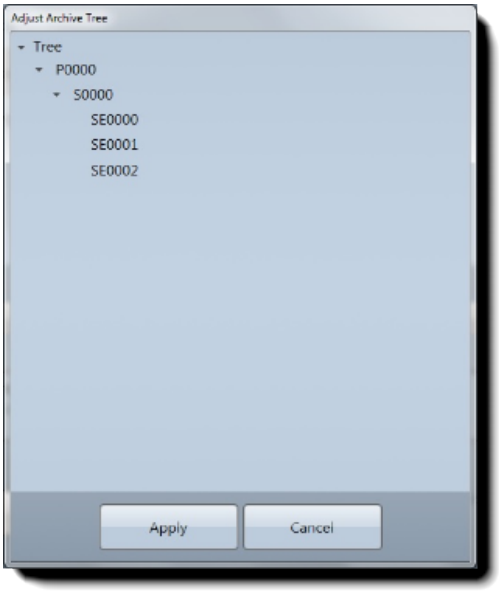



Figure 320: Adjust Archive Tree popup

- Select a specific path to archive the media to by clicking down the tree's path.
- Click **Apply** to select the new path.
- Click **Cancel** to exit the **Adjust Archive Tree** ***without*** saving your changes.

8. Click the appropriate check boxes for your archive process:

| | |
|---|---|
| • **Anonymous Patient** | Makes the patient's information anonymous for HIPAA standards. |
| • **Anonymous Institution** | Makes institutional information anonymous for HIPAA standards. |
| • **Include CD Viewer (requires CD viewer software installed)** | Includes a CD viewer application to view images from the media. |
| • **Export as JPEGS** | Exports image files in .JPG format. |
| • **Show Demographics** | Includes the demographic information in archive, if you clicked the Export as JPEGS check box. |

9. Perform the following:
   - Click the **Archive** button to begin the archive process.
     - The **Cancel** button is active after clicking the **Archive** button; click the **Cancel** button to stop the archive to USB or a drive.
   - Click the **Refresh** button to remove any messages that appear in the **Message** box.
   - Click the **Minimize** button to continue working in other areas while the archiving process runs. A disk appears at the bottom; click it to maximize the **Archive to Media** popup.

- Click the **Close** button to exit the **Archive to Media** popup after the archive process is complete.

## Archiving to Navigation

This procedure is used to archive images to surgical navigation systems during surgery.

1. If necessary, click the **Patient Browser** tab.
2. Select the patient study (or series).
3. Click the **Archive** button.
4. Click the **Navigation** button.
5. Click the **Select Archive Location** dropdown and select the location.
6. Under **Image Range**, select the image(s) you want to send to navigation.

   To return to the default selections, click the **Reset** button.
7. Perform one of the following:
   - Click the **Archive** button to send the image to Navigation.
   - Click the **Cancel** button to return to **Patient Browser**.

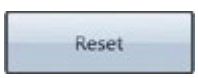
# Chapter 11 Viewing Images

**Viewing** lets you see already scanned images from previous examinations. To view images, select the patient in **Patient Browser** and then select the series to view. To open the image, click the **View Images** button or double-click the series.

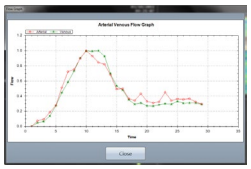

Figure 321: Active Viewing tab

The following table identifies the image tools (from the **Viewing** tab) that let you manipulate a scanned image. To see the following image tools, the **Viewing** tab must be enabled and open. Some image tools appear on specific viewing tabs, only. The view tabs are **2D**, **MPR**, **3D**, and (if enabled) **CTP**.

Table 46: 2D, MPR, 3D, and CTP image tools

| Image tools | Tool name | Action |
|---|---|---|
| Common tools | | |
|  | **Clear Active** | Resets the tool to the default pointer device. |
|  | **Windowing** | Adjusts window width and center of image. |
|  | **Zoom** | Magnifies the image. |
|  | **Pan** | Adjusts image on X or Y axis. |
|  | **Invert** | Inverts black to white and white to black. |
|  | **Capture** | Saves a screen capture of selected a viewport. |
|  | **Capture all Viewports** | Saves screen captures of all visible viewports. |
|   | **Reset** | Reverts all images back to their original mode. |

| Image tools | Tool name | Action |
|---|---|---|
| 2D and CTP tools | | |
|  | **Region of Interest (ROI)** | Defines a circular **ROI** and displays the **ROI** information (5mm diameter by default). |
|  | **Arrow** | Draws an arrow on the image, which can be repositioned. |
| 2D, CTP, and MPR tools | | |
|  | **Measure (Line)** | Draws a line on the image and displays length information. |
|  | **Angle** | Draws an angle on the image and displays the angle information. |
| CTP and MPR only tools | | |
|  | **Undo** | Reverses the most recent action taken (a successful copy, cut, delete, undo or paste action). |
|  | **Redo** | Restores the last text editing or resizing and positioning of controls – if no other action occurred since last time the **Undo** button was clicked. |
| 2D only tools | | |
|  | **Text (Annotation)** | Create text box for annotation. |
|  | **Reverse Image Stack** | Reverses the order in which images display. |
|  | **Flip Vertical** | Flips images up or down. |
|  | **Flip Horizontal** | Flips images right or left. |
|  | **Cine Backward** | Cine backward through the image. |
|  | **Cine Forward** | Cine forward through the image. |

| Image tools | Tool name | Action |
|---|---|---|
|  | **Stop Cine** | Stop the cine forward and backward. |
| **MPR only tools** | | |
|  | **Tilt** | Corrects a rotated image. |
| 3D only tool | | |
|  | **Rotate** | Rotates the image. |
| CTP Perfusion only tools | | |
|  | **Perfusion Artery/Vein Selection** | Select the artery and vein to be used for performing perfusion calculations. |
|  | **Calculate CBF, CBV, MTT Map** | Calculates the Cerebral Blood Flow (CBF), Cerebral Blood Volume (CBV) and Mean Transit Time (MTT) maps. |
|  | **Clear Perfusion Map** | Cancels the calculations and returns to **Calculation** mode. |
|  | **Show Artery/Vein Flow Graph** | Displays the Arterial Venous Flow graph.  |
|  | **Peak Image** | Displays the image that has the most visible contrast (based on arterial **ROI** placement). |

# Using keyboard shortcuts

Keys are a quick way to navigate around. The tables below provide navigation and quick (workstation) keyboard keys you can use to move around the information on the **Viewing** tab.

Table 47: Arrow key navigation

| Arrow keys | Action |
|---|---|
| ↑ (Up) and ↓(Down) | To scroll through images. |
| ← (Left) and → (Right) | To adjust the window level. |

| Arrow keys | Action |
|---|---|
| **PgUp** and **PgDown** | To quickly scroll through images. |

Table 48: Function keys

| Function keys | Action |
|---|---|
| **F5** | To view in **Abdomen** window. |
| **F6** | To view in **Brain** window. |
| **F7** | To view in **Lung** window. |
| **F8** | To view in **Mediastinum** window. |
| **F9** | To view in **Bone** window. |

## Setting window width and center

**Note** Any modifications you make are not saved to the image.

1. Select a patient from **Patient Browser**, select the series to view.

2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.

3. Click the **2D**, **MPR**, **3D**, or **CTP** (if enabled) tab to drop down the appropriate mode's panel.


Figure 322: 2D, MPR, and 3D mode tabs (CTP only shows (by itself) when it is enabled)

4. To adjust the window width and center (contrast) of the image, adjust the following:

   - To adjust with a preset, click the **Windowing** dropdown and click a preset: Lung, Brain, soft Tissue, and Bone.

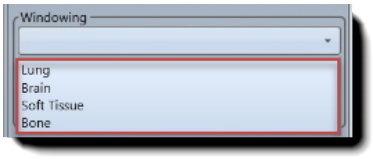



Figure 323: Windowing preset dropdown list

- To adjust the windowing width and center with the text boxes, enter the width and center values in the **Width** and **Center** text boxes, and click the **Apply** button.

| **Note** | Another way to view common tools is to move the mouse over the image and right-click. **2D**, **MPR**, **3D** and (if enabled) **CTP** tools appear. In this case, the **Activate Window Tool** appears in the list. |
|---|---|

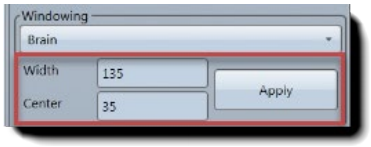



Figure 324: Windowing Width and Center text boxes, and the Apply button

5. Click the **Apply** button.

# Viewing images in 2D

**2D** lets you view scanned images in a **2-Dimensional** (**2D**) space. Standard **2D** mode is used when *only* one dataset is loaded. The default layout is a 2 x 2 grid.

| **Note** | Any modifications you make are not saved to the image. |
|---|---|

The **2D** viewer opens when you review a dataset from the **Patient Browser** component.

The **Viewing** tab must be open, which means a patient has been selected, a scan was performed, and the **Viewing** tab is enabled to see the following:

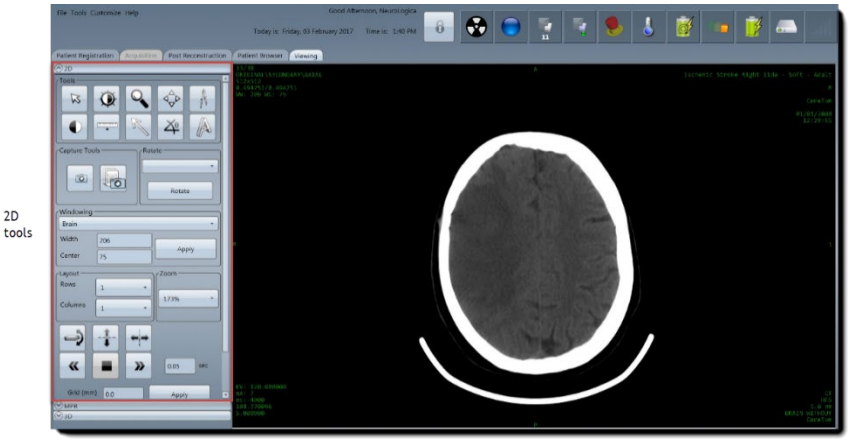



Figure 325: 2D tools

1. Select a patient from **Patient Browser**, select the series to view.

2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and the **2D** tab is open.

3. Use any of the image tools to view the image differently (zoom, pan, invert, flip, and so on) to manipulate your image.

| **Note** | Another way to view **2D** tools is to move the mouse over the image and right-click. The following right-click menu options appear:<br><br>**Activate Window Tool**, **Activate Zoom Tool**, **Activate Pan Tool**, **Activate Angle Tool**, **Activate ROI Tool**, **Activate Line Tool**, **Activate Arrow Tool**, **Activate Text Tool**, **Click to Invert**, and **Clear Tool**. |
|---|---|

4. Click the **Reset** button to reset images back to the original setting(s).

   You cannot undo this action.

## Comparing two images

| **Note** | You can compare two series from the same patient or two series from different patients. |
|---|---|

1. Select the patient in **Patient Browser**.

2. Select the first series from series window.

3. Right-click and click **Mark for Compare** from the menu.

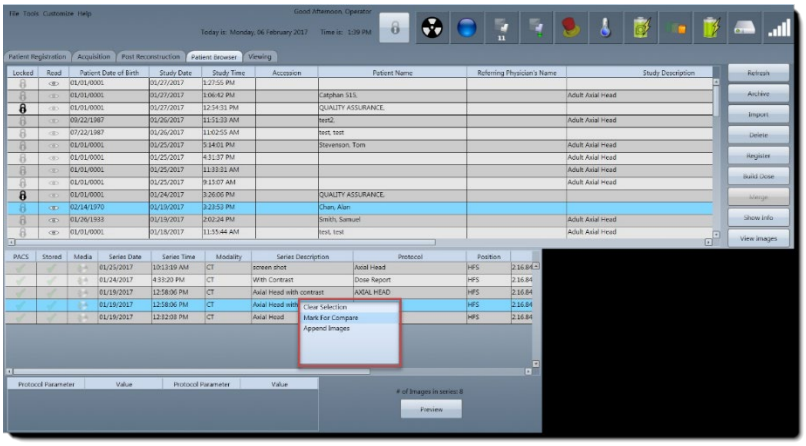


Figure 326: Mark For Compare on the menu

4. Select the second study (or second study from a different patient) to compare.

5. Right-click and then click **Compare With Selected Series** from the floating menu.

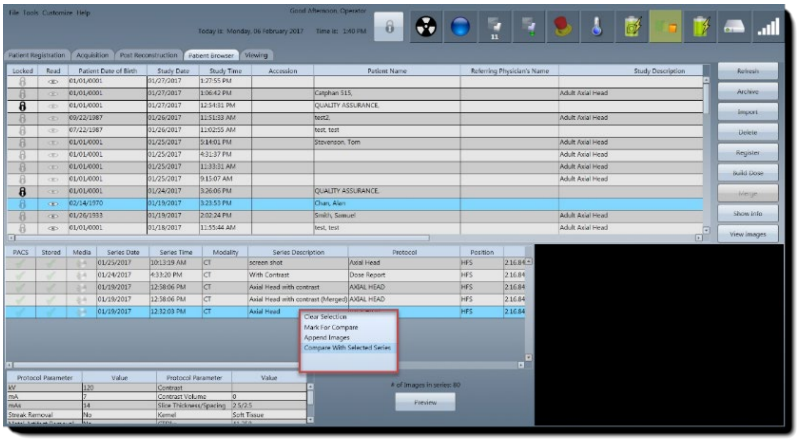


Figure 327: Compare With Selected Series floating menu

Both series are loaded into **Viewing** to compare.

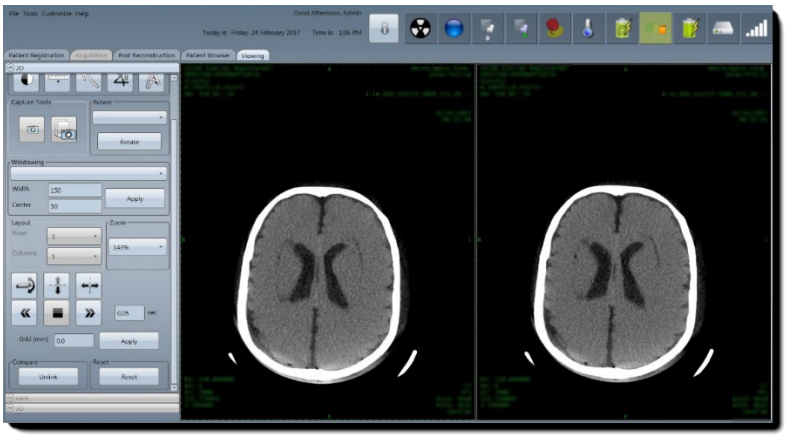


Figure 328: Compared series

6. Click the **Link** button to link both images together to view.


Figure 329: Link button

The **Unlink** button replaces the **Link** button.

7. Click the **Reset** button to reset images back to the original setting(s).

You cannot undo this action.

## Comparing a scout and a scan

1. Select a patient from **Patient Browser**.

2. Select a scout from the series window.

3. Press and hold the **Ctrl** key on the keyboard.

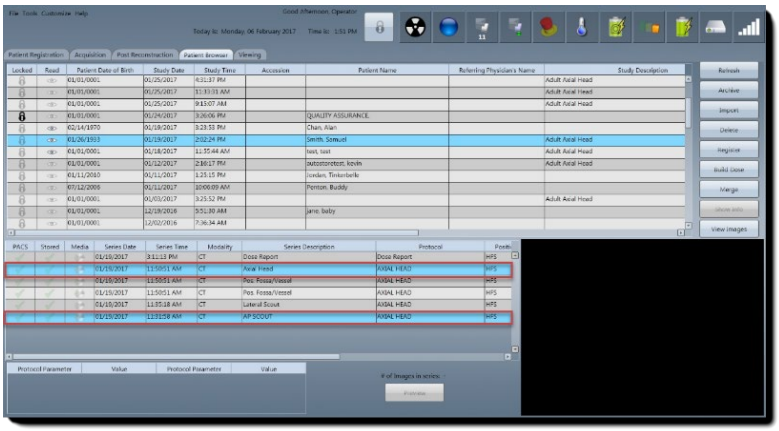


Figure 330: Scout and scan selected to compare

4. Select the scan from the series window.

Both images are highlighted.

5. Click the **View Images** button.

The scout and the scan appear side by side. The localizer (green line) appears on the scout.

6. Compare the scout to the scan.

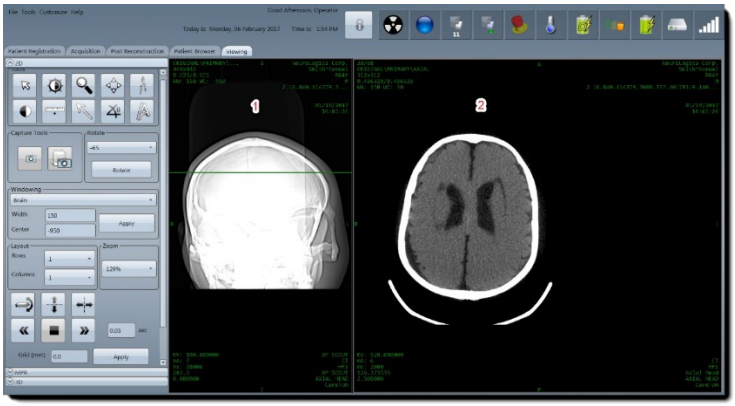



Figure 331: Comparing a scout (1) and a scan (2)

7. To remove the scout, right-click on the scout and click **Hide Scout Viewpoint**.

   To return the scout to view, right-click in the viewing window and click **Show Scout Viewport**.

## Using the ROI

1. Select a patient from **Patient Browser**, select the series to view.

2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and the **2D** tab is open.

3. Use any of the image tools to view the image differently (zoom, pan, invert, flip, and so on) to manipulate your image.

4. Click  (**Region Of Interest** (**ROI**).

5. Move the mouse pointer to the image and click where you want the **ROI** located.

6. Click and hold down the left mouse button as you drag the green circle (the **ROI** diameter).

   - To change the location of the **ROI** or the details of the **ROI,** click the circle (at any point of the circle) or anywhere in the description (mean, min, max, std. dev., area, and perimeter); the pointer changes to a hand and drag the yellow circle to move (the circle or details) to a new location. Click anywhere (not on the **ROI**) to make the **ROI** and details stick in place.

     The standard deviation and mean of HU units within region of interest is showing near the circle. Deviation and mean can be hidden and shown (by you, the operator). When you move the **ROI** to a different location, the deviation and mean are automatically adjusted based on the new location.

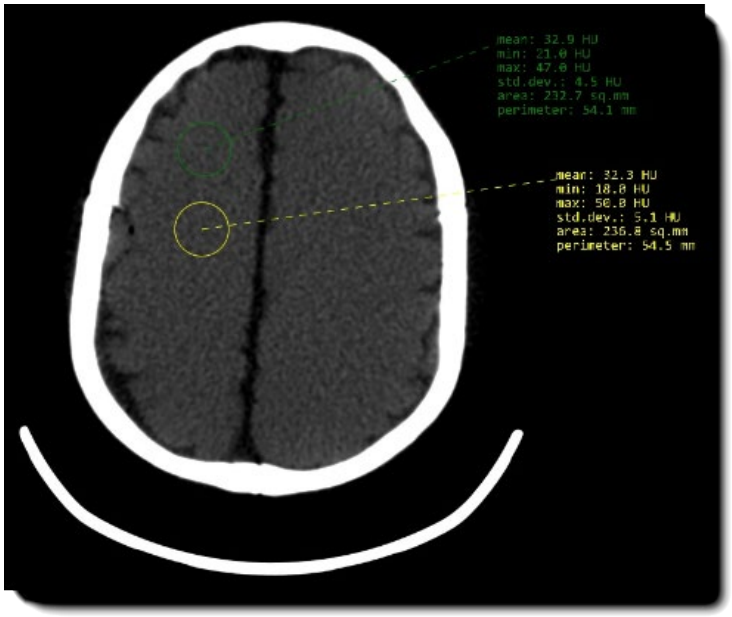



Figure 332: ROI

| Note | To remove the **ROI**, right-click the mouse to see the menu, click **Clear Tool**; left-click anywhere on the **ROI**, right-click to see the menu, and click **Delete Annotation**; alternatively, click on the **ROI** and when it turns yellow, press the **Delete** key on the keyboard. |
|---|---|

## Using Layout and Rotate in 2D view

**Layout** is available for **2D**, only. **Layout** lets you alter the number of images presented on the **Viewing** tab. **Rotate** lets you turn the image with an X plane.

| Note | Any modifications you make are not saved to the image. |
|---|---|

1. Select a patient from **Patient Browser**, select the series to view.
2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.
3. Click the **2D** tab to drop down the panel.
4. To adjust the layout of the image (that is, how many images appear in the viewing area, for example 1x1 up through 10x10), click the **Rows** and/or **Columns** dropdowns to select how many views of the image you want to show.

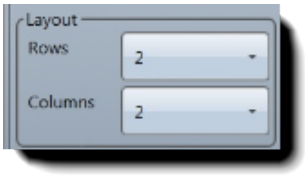



Figure 333: Layout (viewing tools)

| **Note** | The number of rows and columns determine how many images you will see at one time. |
|---|---|

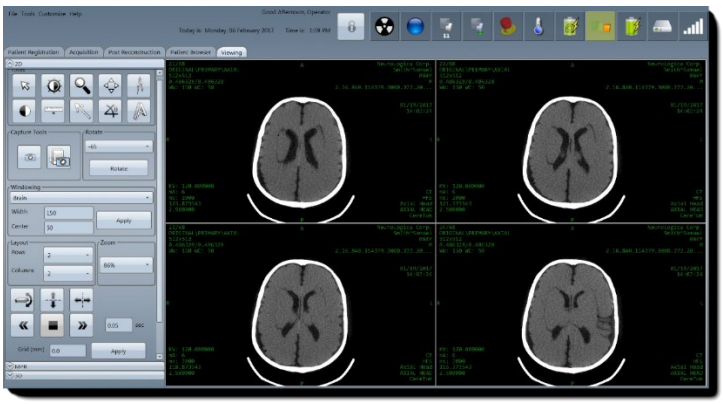


Figure 334: Windowing adjustment

5. To rotate the image, click the dropdown (under **Rotate**) to select the angle to rotate the image(s).

6. Click the **Rotate** button to see the image turn to the new (angle) position selected in the previous step.

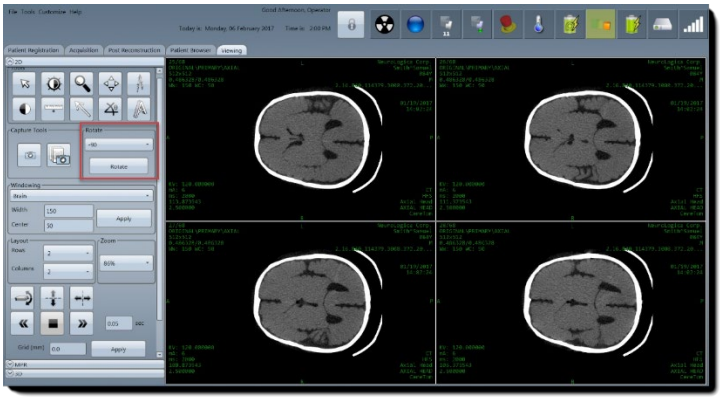


Figure 335: Rotate (viewing tools)

## Applying a grid to your image(s) in 2D

1. Select a patient from **Patient Browser**, select the series to view.

2. To open the image, click the **View Images** button or double-click the series.

The **Viewing** tab is enabled and the **2D** tab is open.

3. Change the size of the grid (in mm) in the **Grid (mm)** text box.

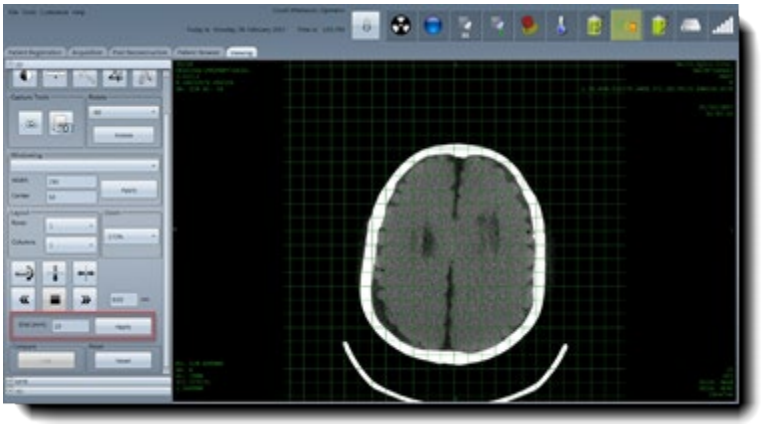


Figure 336: Grid (mm)

4. Click the **Apply** button to apply a grid over the image.

5. Perform one of the following to remove the grid:

   - Click the **Reset** button.
   - Enter 0 in the Grid (mm) text box and click the **Apply** button.

## Viewing images in MPR

**Multi-Planar Reformation** (**MPR**) displays views of the volume in an **Axial**, **Coronal**, and **Sagittal** plane, as shown in Figure 344.

**Viewer layout** is 2 x 2 in the figure below.

MPR tools

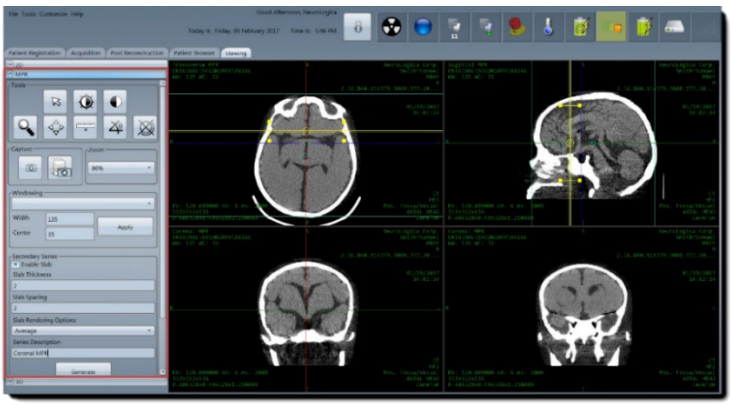


Figure 337: MPR tools

1. Select a patient from **Patient Browser**, select the series to view.

2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.

3. Click the **MPR** tab to drop down the panel.

4. Use any of the image tools to view the image differently (zoom, pan, invert, flip, and so on) to manipulate your image.

| Note | Another way to view **MPR** tools is to move the mouse over the image and right-click. The following right-click menu options appear:<br><br>**Activate Window Tool**, **Activate Zoom Tool**, **Activate Pan Tool, Activate Angle Tool, Activate Line Tool**, **Activate Arrow Tool**, **Activate Tilt Tool**, **Click to Invert**, and **Clear Tool**. |
|---|---|

5. Click the  (**Tilt**) tool to provide each view with a rotation marker.

   A white circle appears around the image(s).

6. Adjust the image angle by using left-mouse to move the circle clockwise or counter-clockwise.

7. Click the **Reset** button to reset images back to the original setting(s).

   You cannot undo this action.

## Understanding and using slab

**Multi-Planar Reformation** (**MPR**) allows images to be created from the original **Axial** plane in the **Coronal**, **Sagittal**, or **Transverse** plane. **MPR** is used to assess the extent of disease processes in the cranio-caudal direction. **MPR** is fast, uses all the attenuation values in the dataset, and can easily be performed at the workstation. **MPR** however, provides only a **two-dimensional** (**2D**) display of the image data.

Sliding slabs are an additional technique used to evaluate pulmonary vessels and airways, vertebral bodies, and cranial images among other applications. Through the reformation process, axial images are stacked creating a volume that can be dissected in different planes. The thickness and spacing of each dissection or slab can be varied to meet the needs of the viewer. Rather than collect data from a series of individual sections of equivalent thickness, a series of overlapping minimum and maximum intensity projections are combined in multiples or slabs to create a thicker image. The reformations can be displayed in a minimum, maximum, or average projection.

**MPR**s should be built from the .625mm or 1.25mm slices.

## Creating the slab

1. Select a patient from **Patient Browser**.

2. Select the thin data set to view.

3. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.

4. Click the **MPR** tab to drop down the panel.

5. Click the **Sagittal**, **Coronal**, or **Transverse** plane to create your slab.

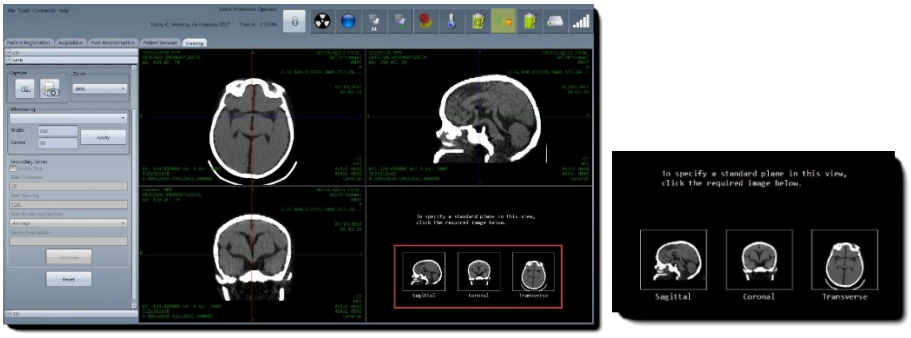



Figure 338: Image formats

The **Secondary Series** options are enabled.

6. Click the **Enable Slab** option to activate the slab controls panel.

   The **Enable Slab** option is inactive (dim) if no **MPR** view is selected.


Figure 339: Enable Slab option under Secondary Series

The following defines the options:

- **Slab Thickness** — The value that defines the thickness of the slab.
- **Slab Spacing** — The value that defines the space between the start of one slab and the next.
- **Slab Rendering Options** — Where you define what pixel values are displayed in each slab:

- **Maximum Intensity** — The highest pixel values for all slices within the slab is displayed.
- **Minimum Intensity** — The lowest pixel values for all slices within the slab is displayed.
- **Average** — The pixel values of all slices within the slab are added up and the average value for each pixel is displayed.
- **Series Description** — Text field for naming the series of images created after clicking the **Generate** button.
- **Yellow lines** — Define the slab thickness. The knobs at the end allow you to adjust the thickness using the standard mouse pointer.

  Changes made to the slab thickness using the markers are reflected in the value defined in the control panel.
- **Cyan lines** — Define the slab **FOV** and dictate the range of a new series when generated. The cyan lines are adjustable by clicking and dragging on the lines themselves; both lines (at one time) are moved by clicking and dragging the central circle marker.
- **Red, blue, and green lines** — Define the cross sections of the anatomy being viewed.
- **Generate** — Generates a new series with the name given in the **Series Description** field, based on the selected **MPR** view pane.

7. For the **Slab Thickness** (in mm) in the text box, enter the thickness or drag the yellow boxes on the image for a new-defined thickness.

8. Enter the **Slab Spacing** (in mm) in the text box.

9. Click the **Slab Rendering Options** dropdown to select the appropriate option.

10. Drag the cyan line(s) (the reference) to set the slab **Field of View** (**FOV**) range for the new series or drag the small cyan circle to move the **FOV**.


Figure 340: Use the blue line to set FOV

11. Preview the slab in the bottom-right window.

12. Enter the slab name and click the **Generate** button.

    A **Saving Series** popup appears followed by a **Capture Complete** popup.

    When the series is complete, the **Capture Complete** pop-up appears.


Figure 341: Capture Complete popup message – Series saved

The new **MPR** image(s) appear in the **Patient Browser** under the patient with the description (identifier) entered in the **Series Description** field.

## Using Virtual Tilt

1. Select a patient from **Patient Browser**.

2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.

3. Click the **MPR** tab to drop down the panel.

4. Click the  (**Tilt**) tool and move the mouse pointer over the white circle to modify your tilt.

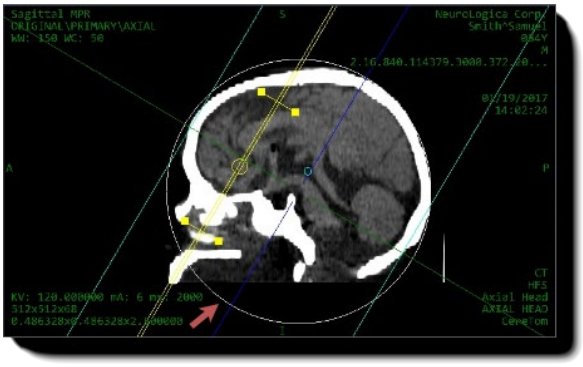


Figure 342: Tilt white circle

5. In the **Series Description** text box, enter the series after you set the **FOV** and slab thickness.

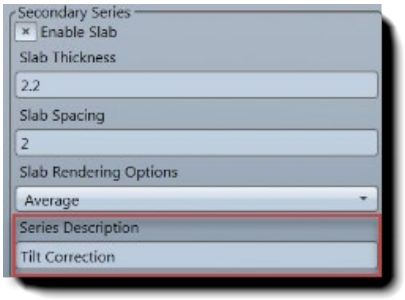



Figure 343: Series Description text box

## Viewing images in 3D

In **3D** viewing, a **3-Dimensional** image is created by stacking all the images of a scan on top of one another to create a 3-volume. The initial display shows the **3D** volume and a box appears around it. **MPR** planes also appear. You can use the box to adjust the view how the image appears.

On the image, when the pointer is double arrowed, you can expand or contract the box. When the pointer includes two circular arrows, you can rotate the image in the box.

**Note** Any modifications you make are not saved to the image.

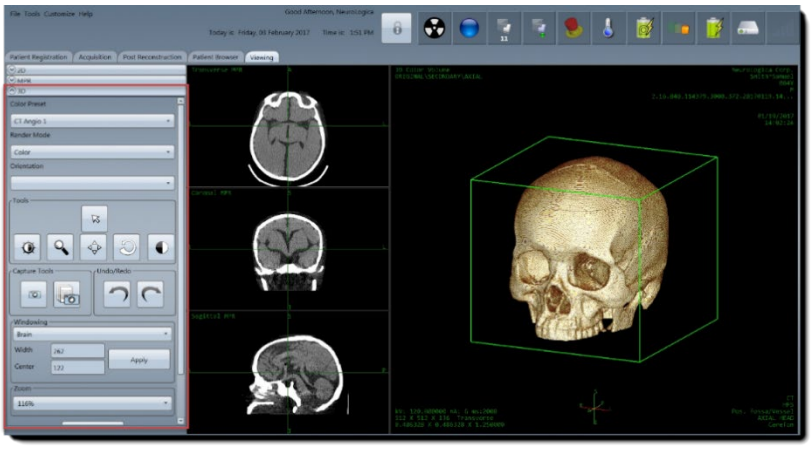



Figure 344: 3D tools

1. Select a patient from **Patient Browser** and select the series to view.
2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and open.
3. Click the **3D** tab to drop down the panel.
4. Use any of the image tools to view the image differently (zoom, pan, invert, flip, and so on) to manipulate your image.

5. To rotate the image up to 360°, click  (**Rotate**) and move the image with the mouse pointer to the rotation of choice.

> **Note** Another way to view **3D** tools is to move the mouse over the image and right-click. The following right-click menu options appear:
>
> **Activate Window Tool**, **Activate Zoom Tool**, **Activate Pan Tool, Activate Rotate Tool,** and **Clear Tool**.

6. Select a set of predefined, **3D**-color-volume preset, click the **Color Preset** dropdown list to make a selection.
   - **CT Angio 1**
   - **CT Angio 2**
   - **Circle of Willis**

7. To change the rendering mode of **3D** volume, click the **Render mode** dropdown list to make a selection.

| | |
|---|---|
| • **Color** | The particular colors given to ranges of HU units of the **3D** volume. |
| • **MIP** (**Maximum Intensity Projection**) | The **3D** volume consists of the highest intensity values. |
| • **Grayscale** | The volume is shown in grayscale instead of color. |

8. Click the **Orientation** drop-down box to assign an orientation: Inferior, Superior, Anterior, Posterior, Right, or Left, by selecting the plane in the dropdown.

9. Click the **Reset** button to reset images back to the original setting(s).

   You cannot undo this action.

## Viewing images in CTP

**Computed Tomography Perfusion** (**CTP**) is viewer software. The **CTP** viewer functionality is only possible if the optional perfusion package is set up and enabled on your system. The **CTP** viewer package enables your system to view dynamic scans. A scan must have been performed with perfusion protocols.

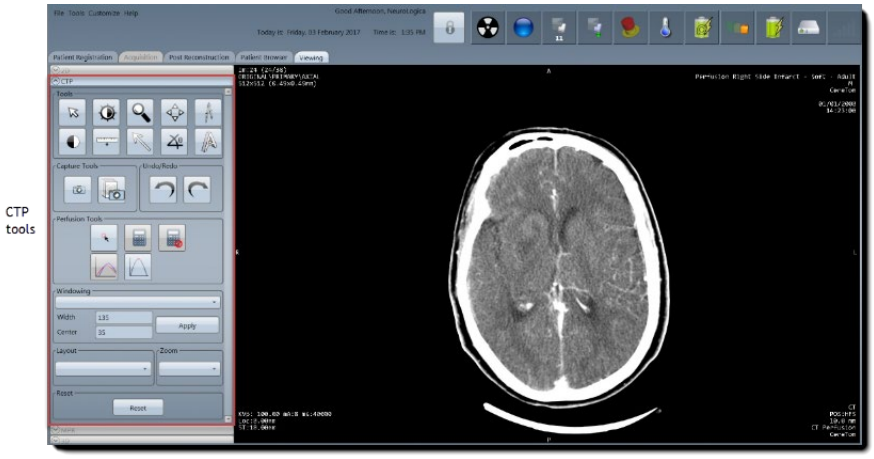



Figure 345: CTP tools

| **Note** | Any modifications you make are not saved to the image. |
|---|---|

## Calculating and creating perfusion maps

1. Select a perfusion patient from **Patient Browser**, select the series to view.
2. To open the image, click the **View Images** button or double-click the series.

   The **Viewing** tab is enabled and the **CTP** tab automatically opens.
3. Use any of the image tools (zoom, pan, invert, flip, and so on) to view the image differently.
4. Click the  (**Perfusion ROI**) tool.

   The calculations produce three maps and the perfusion image:

   - **Perfusion Images** Top, left corner
   - **Cerebral Blood Flow** (CBF) Top, right corner
   - **Cerebral Blood Volume** (CBV) Bottom, left corner
   - **Mean Transit Time** (MTT) Bottom, right corner

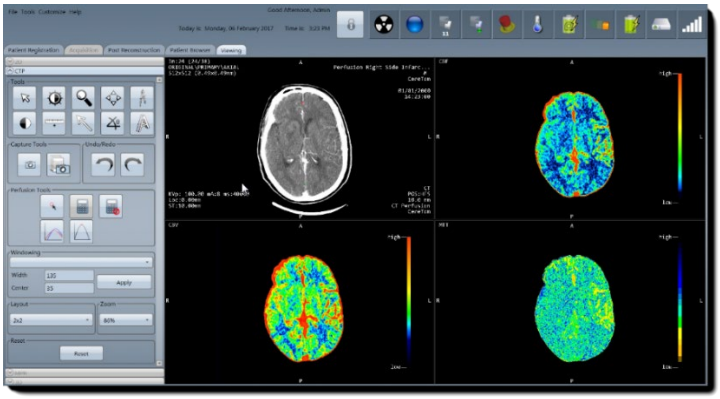


Figure 346: Perfusion maps

5. Click the  tool to display **peak image**.

   The peak image displays the image that has the most visible contrast (based on arterial **ROI** placement).

6. Click the  tool to display **Arterial Venous Flow Graph**.

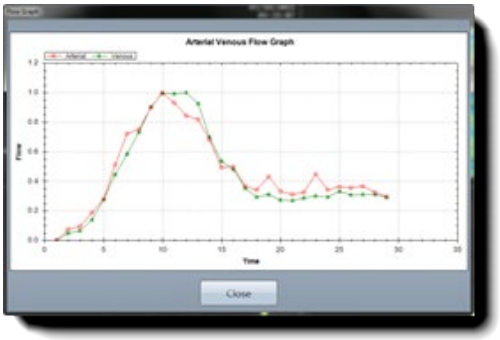



Figure 347: Arterial Venous Flow Graph

The graph displays flow of artery and vein with respect to time.

7. Click the  tool to cancel calculations and return to **Calculation** mode.

8. Click the **Reset** button to reset images back to the original setting(s).

   You cannot undo this action.

# Chapter 12 Post Reconstruction

The system stores multiple patient series of raw data to allow a post reconstruction – after patient examination has ended. **Post Reconstruction** lets you reconstruct the acquired data using different algorithms, slice thicknesses, or apply image enhancement algorithms, such as noise reduction and windmill correction. Raw data is used for this.


Figure 348: Active Post Reconstruction tab

The tools available to **Post Reconstruction** are identified in the table below.

Table 49: Viewing tool

| Image tools | Tool name | Action |
|---|---|---|
|  | **Stop** | Cancels the current, post-reconstruction request. All images are generated until you click the **Stop** button. |
|  | **Field Of View** | Adjusts the **Field Of View** (**FOV**) prior to reconstruction. |
|  | **Clear Active** | Resets tool to default pointer device. |
|  | **Windowing** | Adjusts the width and level of selected image. |
|  | **Zoom** | Magnifies the image. |
|  | **Pan** | Adjusts the image on X or Y axis. |
|  | **Reset** | Resets the display to default viewer settings. |

# Performing Post Reconstruction

The following figure identifies parts of **Post Reconstruction**:

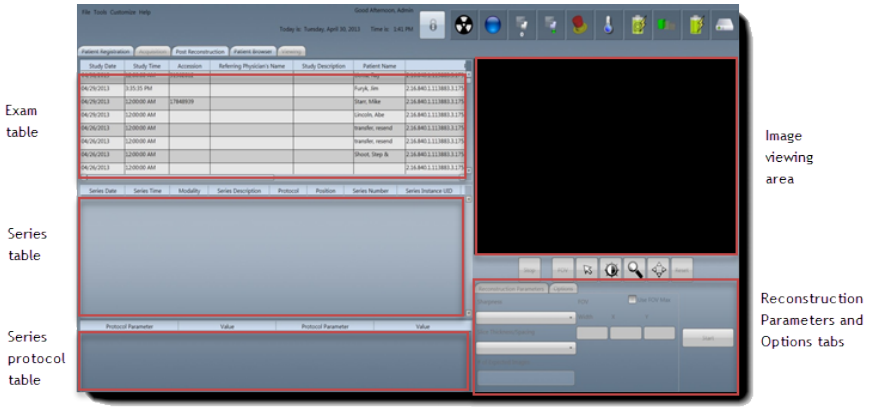



Figure 349: Post Reconstruction areas

1. Click a study in the exam table.

   Select a study that appears in the study table. When you select one, all of the scanned series for that study appear in the series table.

2. Click the series in the series table.

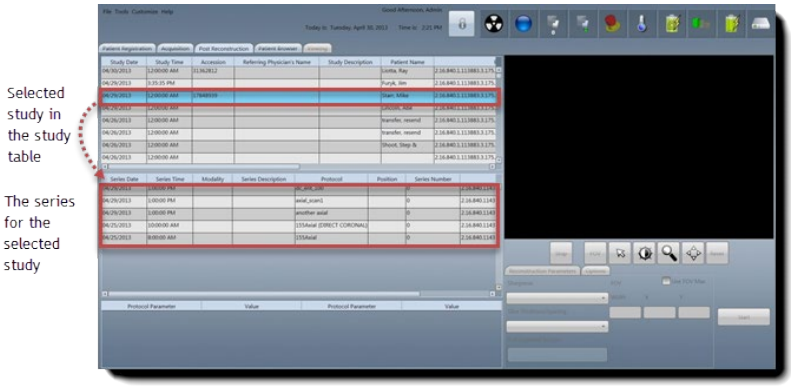



Figure 350: Post Reconstruction study and series tables

The scan or series will load into the viewer. The series protocol table and **Reconstrcution Parameters** and **Options** tabs are active.

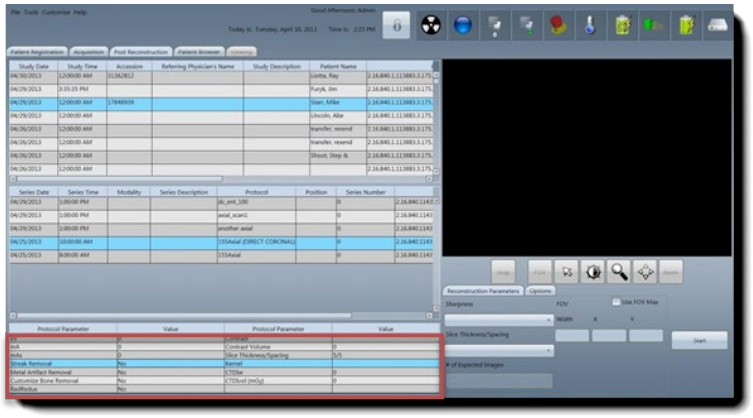



Figure 351: Post Reconstruction series protocol table

3. View the study in .the viewing pane.

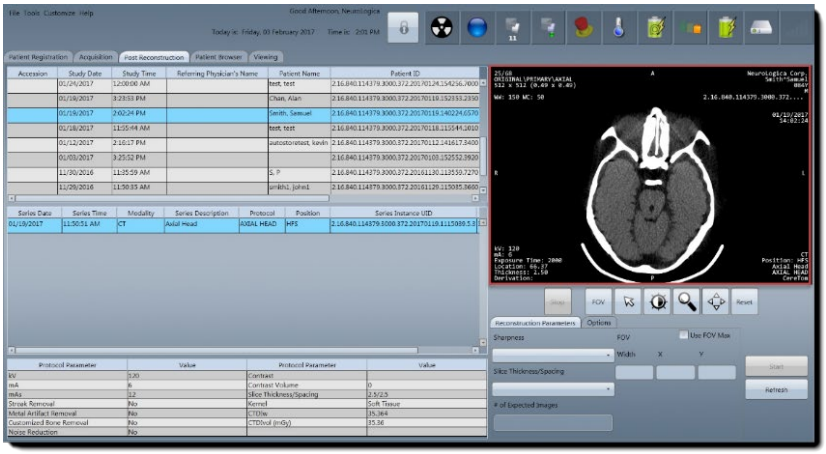



Figure 352: Post Reconstruction viewing image area

4. To modify the **FOV** (if needed), perform the following:

   - Click the  (**FOV** tool), click the image, and drag the mouse to form a square.

     The size of the square appears in mm. A circle appears in the middle of the square; this circle lets you move the field-of-view.

   - Click within the circle's boundary and drag to move the **FOV**.

   - Click one of the two drag boxes on the corners to adjust the size of box.

     The square dimensions are adjusted as the size changes. The **FOV** size cannot exceed the range of 50 - 250mm square. The width dimension changes in the **Width** text box when you change the size; however, you can enter a dimension instead.

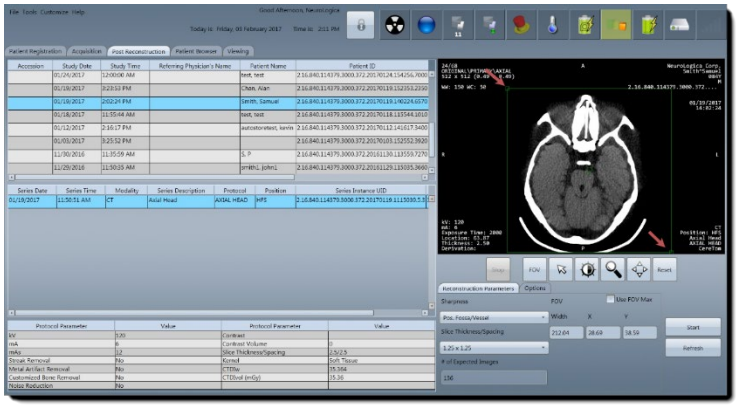


Figure 353: FOV resizing boxes

| **Note** | You can also enter a number in the Width (or X and Y box) to define a specific **FOV**.<br><br>Alternatively, click the **Use FOV Max** option to use the maximum **FOV** for the CereTom Elite. |
|---|---|

5. Click the **Sharpness** dropdown to select a reconstruction algorithm.

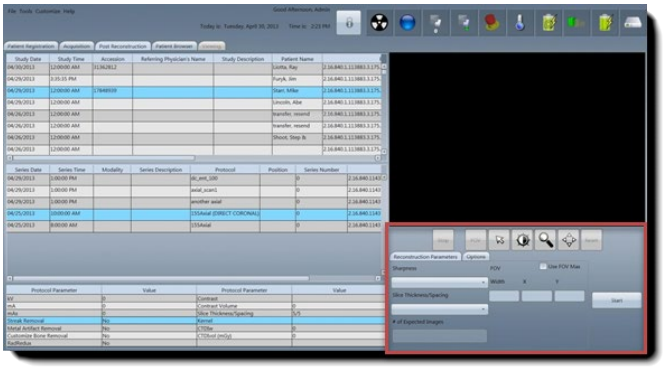



Figure 354: Post Reconstruction's Parameters and Options tabs

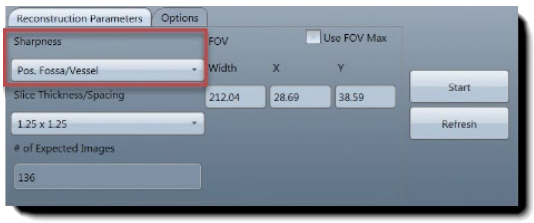



Figure 355: Reconstruction Parameters Sharpness dropdown

The sharpness is modified by using one of the following kernels:

- **Low Noise QA**
- **Soft Tissue**
- **Pos. Fossa/Vessel**

- **Sharp**
- **Bone**
- **Sharp Lung**
- **High Res QA**

6. Click the **Slice Thickness/Spacing** dropdown to make a selection.

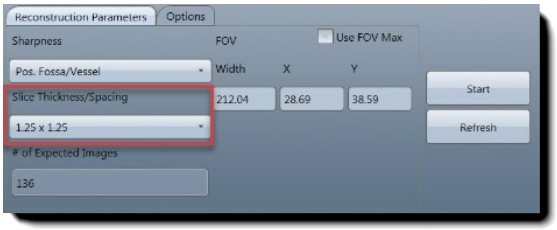



Figure 356: Reconstruction Parameters Slice Thickness/Spacing dropdown

The slice thickness and spacing are adjusted dependent on if you reconstruct an **Axial** or **Helical** scan:

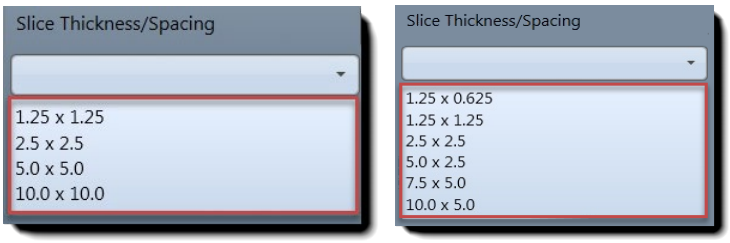



Figure 357: Axial (left) and Helical (right) scan slick thickness options

7. The **# of Expected Images** text box presents the system's number of images for expected ranges.

8. Click the **Options** tab.


Figure 358: Post Reconstruction Options tab

9. Click the **Customized Bone Removal** option.

The **Customized Bone Removal** is related to **Iterative Bone Correction** or **Second Pass Beam Hardening Correction**. The correction automatically adjusts the bone correction based on the size and density of the bone in the corrected image.

10. Click the **Noise Reduction** and **Streak Removal** options to correct these elements.

**Noise Reduction** is a semi-iterative reconstruction designed for the purpose of allowing low-dose scanning by decreasing the noise level in the reconstructed images. **Noise Reduction** is recommended for pediatric scanning and for scanning large patients. Currently, the option is only provided for post reconstruction.

**Metal Artifact Reduction (MAR)** is an optional feature that can be enabled during post reconstruction by the user.

Streak artifacts and beam hardening are often observed around metal leads, aneurysm clips, epilepsy probes or metal screws. Numerous factors contribute to these streaks including under-sampling, photon starvation, beam hardening, and scatter. The streaks can be reduced using metal artifact reduction (MAR). MAR removes the metal from the image to reconstruct the soft tissue only, and then adds it back, greatly reducing the artifacts.

The performance of the MAR depends on the interpolation methods used in both the metal replacement in the soft tissue images and the interpolation method used for correcting the sinogram.

The MAR correction is only recommended to be used if the streaks due to the metal are deemed to be very disruptive of the reconstructed images and if they are interfering with the anatomical feature of interest. It is our recommendation that MAR be used only with Filtered Back projection algorithm.

11. Click the **Level** dropdown to select a new noise level to **Low** or **High**.

12. Click the **Start** button to generate a new dataset; click the **Refresh** button to return to the tables and remove any work you have done.

    When you click the **Start** button, the reconstructed image appears in the viewing pane.

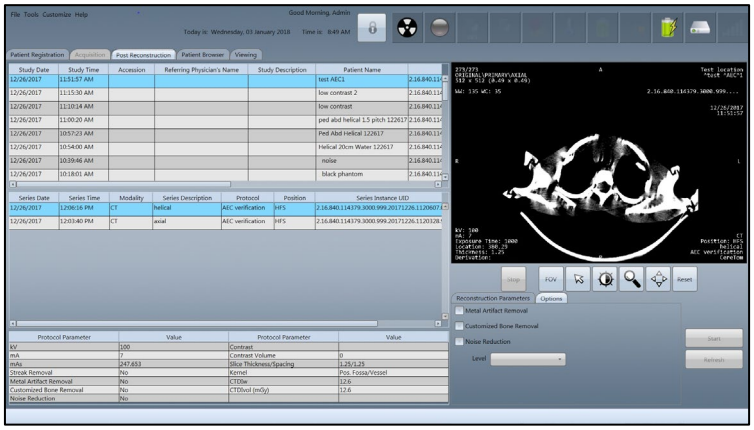


Figure 359: Please wait while the system performs data reconstruction message

When the reconstruction is complete, the image appears in **Patient Browser**.

# Chapter 13 Accessories and Options

You will learn how to convert a bed, stretcher, or any type of adjustable surface into a scanning platform through the use of bed adapters and scan boards, in this chapter.

To request the following catalog(s) to reference product descriptions/details and part numbers for the available accessories/options that are used with the respective scanner, see "Contact information" on page 26:

- **1-NL3000-158** U.S. CereTom Elite Product Catalog
- **1-NL3000-157** (CereTom Elite) International Product Catalog

When using a fixed scanner, keep in mind the table moves during the scan from one portion of anatomy to another while the gantry remains stationary. With the CereTom Elite, a scanning platform is created and remains stationary while the gantry or scanner translates from one point to the other to cover the anatomy. For example; when scanning the brain, the patient's head is placed in a head holder and the gantry travels from the base of the skull to the vertex at prescribed intervals to complete the scan.

A bed adapter is used as a secure mount to hold the silhouette scan board, which supports the patient's head. Different beds or scanning platforms require different adapters. NeuroLogica manufactures many different bed adapters to fit a wide variety of hospital beds, stretchers, and **Operating Room** (**OR**) tables. The majority of the bed and stretcher adapters are designed to hold a **silhouette scan board**.

The universal transfer board is used when no bed adapter is available for a particular bed. It is placed under the patient and secured to the bed or stretcher with straps. The board can be used on a bed, stretcher, or in the OR.

**WARNING** Some accessories require adjoining posts to be inserted into respective mounting holes to be assembled onto the scanner/patient support. Make sure the posts are inserted as straight as possible. If the posts are inserted at an angle, this may deform and/or wear the respective posts prematurely.

**WARNING** NeuroLogica Corp. recommends that the weight of the patient being positioned on the scan board cannot exceed the bed manufacturer's safe, recommended, operating patient load. Realizing patient safety is of the utmost importance, it is recommended that safe judgment be exercised at all times when it comes to the clinical care of patients. There are a number of varying factors, such as the condition of the bed being used, unique patient anatomy, as well as the proper scan board, adapter installations, and positioning of the patient, per NeuroLogica Corp.'s clinical training guidelines and product labeling. If any excessive wear or damage is noticed to any adapter or scan board, do not use it for a patient scan; contact a qualified service technician to assess, repair, and/or replace the device.

# Using bed adapters

Bed adapters are manufactured for specific bed models. Prior to installing the CereTom Elite at a facility, a precise survey is conducted to ascertain the type of bed used the most with the CereTom Elite.

Adapters are classified as follows:

- Adapters that ***do not*** have posts and fit onto the frame of the bed by attaching to existing posts (below, left).
- Adapters that ***do*** have posts and fit onto the frame by inserting the posts into an existing hole in the frame (below, right).
- Adapters for OR tables, used in surgical cases.
- Adapters for a neonatal scan platform for children.

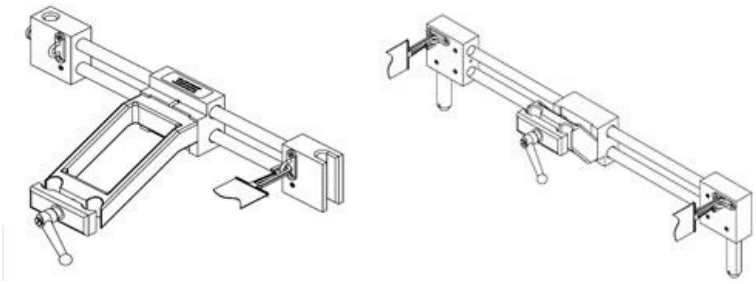


Figure 360: Bed adapter without posts (left) and bed adapter with posts (right)

## Using bed adapter safety straps

The bed adapter comes with two straps that attach to the rings on the adapter and can be used to secure the patient to the silhouette scan board.

Figure 361: Safety straps

1. Identify the rings on the bed adapter as highlighted on the Hill-Rom and Sytrker In Touch adapters below.

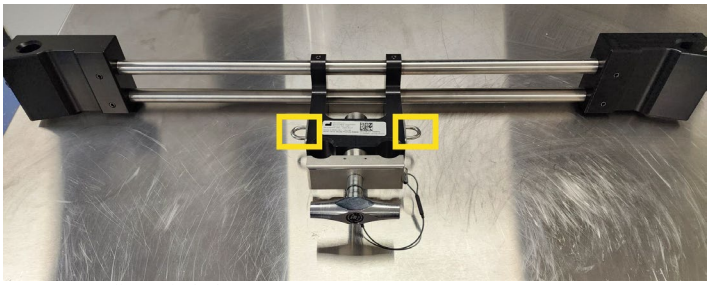


Figure 362: Hill Rom bed adapter

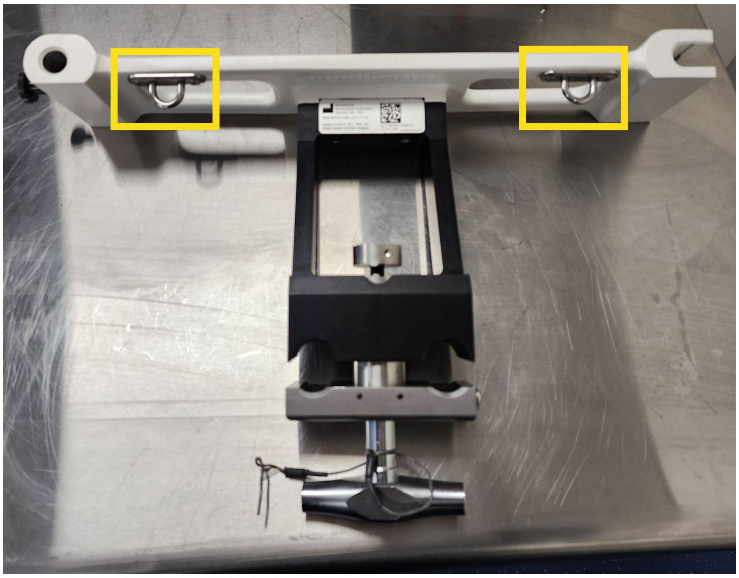


Figure 363: Stryker In Touch bed adapter

2. Connect the hooks on the straps to the rings on the bed adapter as seen below.

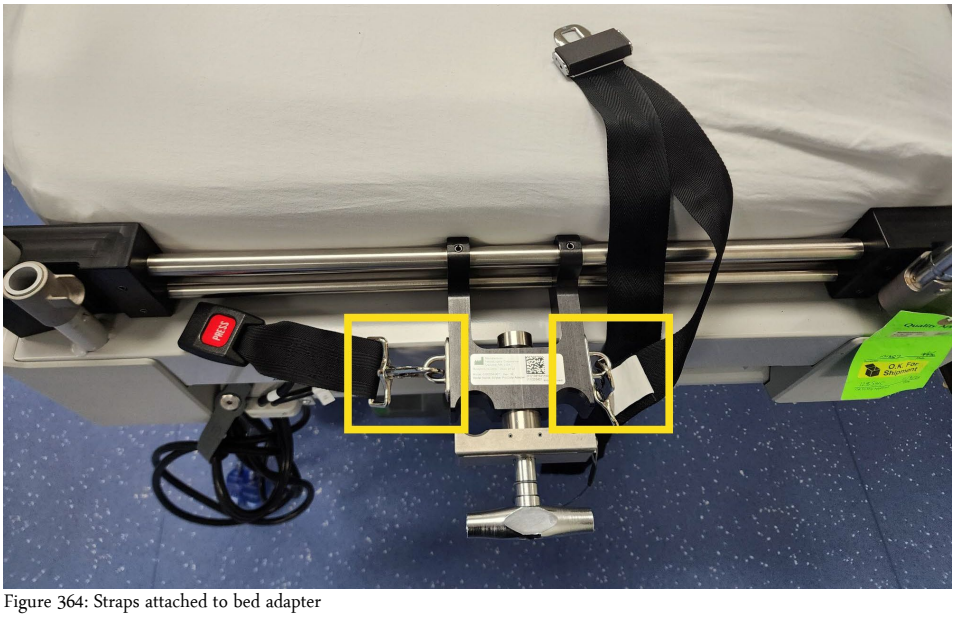



Figure 364: Straps attached to bed adapter

3. Attach the silhouette scan board to the bed adapter.

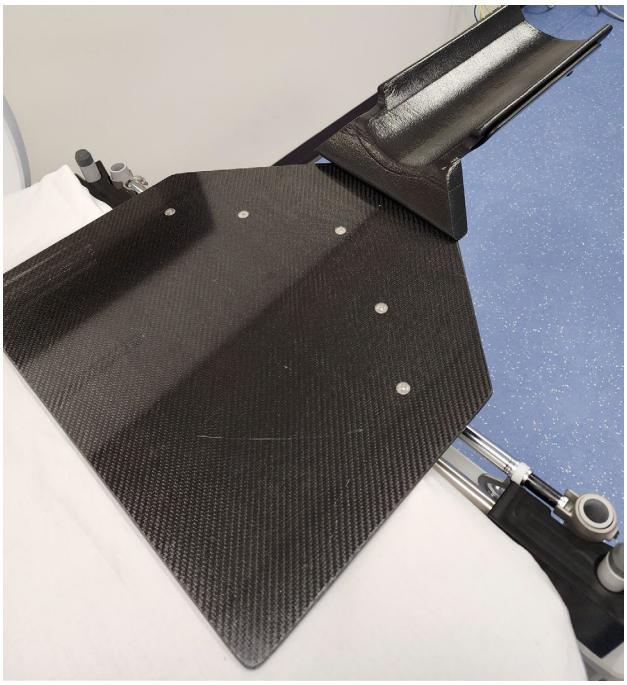


Figure 365: Silhoutte scan board attached to bed adapter

4. Position the patient on the Silthoutte scan board, and position the straps across the patients shoulders and upper chest to provide support and immobilization.

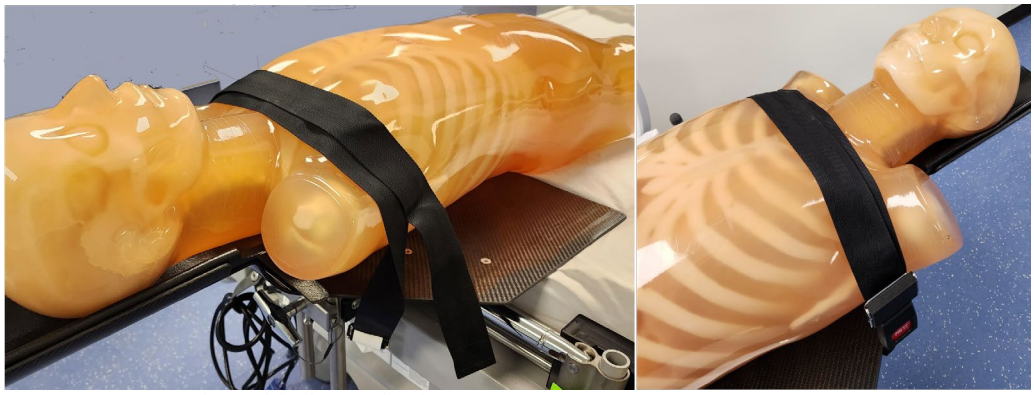


Figure 366: Patient properly immobilized on scan board

## Attaching bed adapter with or without posts

1. Check the bed adapter label and bed model to make sure the adapter is designed to fit the bed.
2. Remove the head board from the bed.
3. Insert the bed adapter ***without*** posts onto the posts on the bed frame.

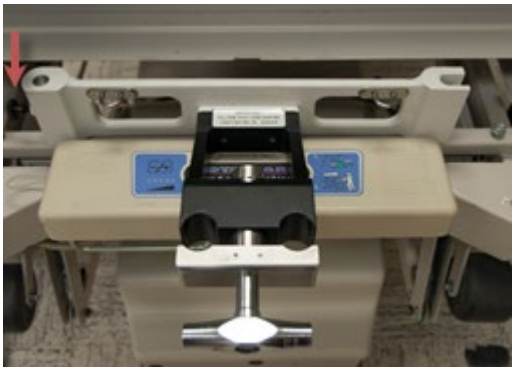


Figure 367: Bed adapter without posts insertion (setscrew showing under arrow)

4. Make sure the adapter is flush against the bed frame.

5. Secure the adapter to the posts by adjusting the setscrew (see Figure 367).

Figure 368: Bed adapter T-square

6. Insert the silhouette scan board into the T-square and tighten.

Figure 369: Bed adapter without posts shown being inserted into scan board

| **Note** | Ensure that the bed's IV pole does not obstruct or interfere with the Silhouette scan board.<br><br>Ensure T-square is properly tightened: listen for two clicks. |
|---|---|

7. Press down on the silhouette scan board while tightening the T-square.

8. Add the cushion to the head holder for the patient's comfort.

Figure 370: Silhouette with cushion shown on head holder

The head board is now ready to receive the patient.

9. Move the patient up into the head holder, making sure the patient is up and high enough in the head holder that the scanner can easily move to the patient's shoulders.

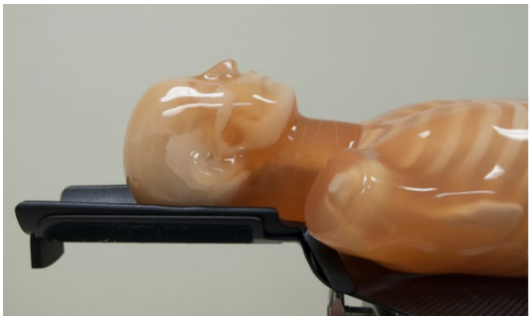


Figure 371: Phantom shown on head holder

10. While the scanner is in **Transport** mode, align the patient with the scanner.

11. Lower the scanner (in **Scan** mode) and position the scanner over the patient.

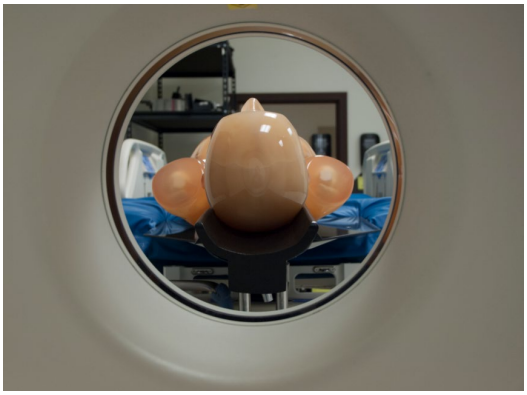


Figure 372: Patient position view from behind scanner

12. Make sure the head goes into the bore symmetrically.

The patient is now ready to be scanned.

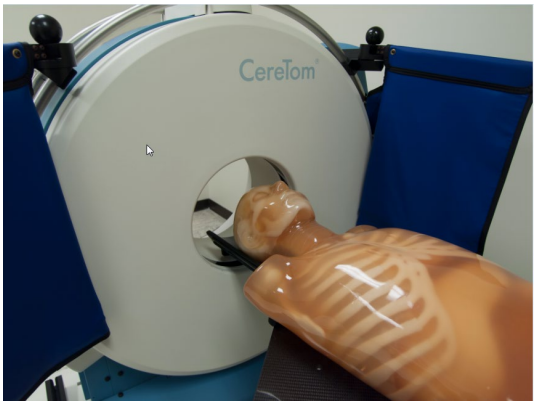



Figure 373: Patient ready to scan

## Transfer boards for adult, pediatric, and neonate patients

Scan boards are customized for adult, pediatric, and neonate patients. Universal transfer boards and silhouette scan boards are used for adults; pediatric and neonate scan boards, and platforms are designed for smaller patients.

Table 50: Scan boards and their weight-bearing restrictions

| Scan board / platform | Weight |
|---|---|
| Neonate scan platform | 7.5kg / 17lbs |
| Pediatric scan board | 40.8kg / 90lbs |
| Silhouette scan board | Weight limit of board is equal to the weight limit of the patient bed; weight limit on portion supporting patient head is 7.5kg / 17lbs |
| Universal transfer board | Weight limit of board is equal to the weight limit of the patient bed; weight limit on portion supporting patient head is 7.5kg / 17lbs |

See also "Parts that potentially come into contact with the patient" on page 71.

WARNING The weight limit for the superior portion of all scan boards (head) cannot exceed 7.5kg or 17lbs.

## Using the universal transfer board and pediatric scan board

The universal transfer board is a carbon-fiber, radiolucent board that is designed to work with any ICU bed or gurney. The carbon-fiber board comes with a 0.5in. (thick) head board and 2in.x5ft. straps to strap the board to the ICU bed or gurney. It also comes with 3in., 4in., 6in., and 12in. bed stiffeners.

You can use the universal transfer board on any bed, table, or stretcher (with the CereTom Elite) when a bed adapter and silhouette scan board cannot be used or do not exist for a particular surface occupied by the patient. Because you can attach the universal transfer board to almost any type of surface, it is used anywhere throughout the hospital including the ICU, OR, ER, and the pediatric ward. Instead of attaching an adapter to a bed, the universal transfer board is placed on the mattress and secured with a strap. The patient lies on the board with the patient's head in the head holder. The CereTom Elite is moved into position and the scan is performed.

Using the universal transfer board and the pediatric scan board on the bed use the same procedure; however, you can use the pediatric scan platform (instead of the bed). See the next section for instructions on using the pediatric scan platform.

**Note** Adolescents and young adults too large for scanning on the pediatric scan platform, and not in a bed that utilizes a bed adapter and silhouette scan board, can be scanned on the pediatric scan board.

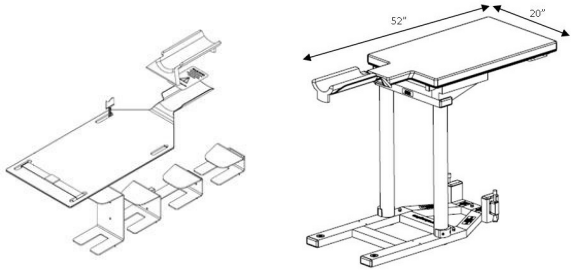



Figure 374: Universal transfer board and bed stiffeners (left), and pediatric scan board on a platform (center)

**Note** Tipping of the board is the major concern; therefore, the universal transfer board must be securely fastened to the surface prior to placing the patient on the board.

The universal transfer board and/or pediatric scan board are stored on the left side of the CereTom Elite for easy transport.

Figure 375: Universal transfer board storage

The scan boards require mattress stiffeners. Stiffeners provide a hard surface at the head of the bed to prevent the mattress from sagging when a scan is performed. There are usually four mattress stiffeners stored with the CereTom Elite for easy transport.

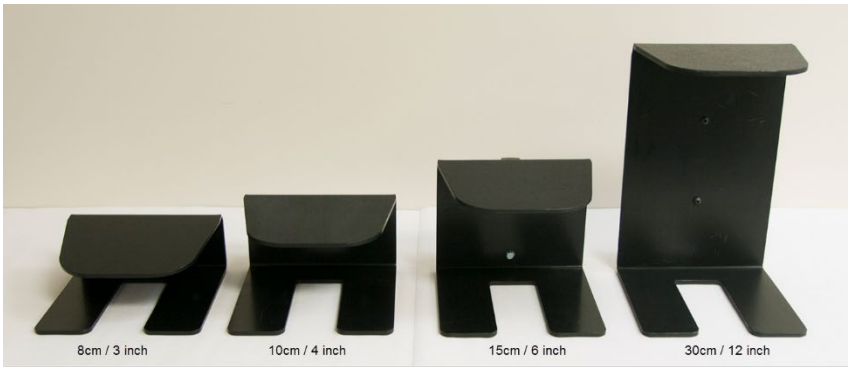



Figure 376: Four types of mattress stiffeners

1. Heed all warning labels when using the scan board.


Figure 377: Scan board warning labels

2. Select the appropriate mattress stiffener for the mattress size and insert.

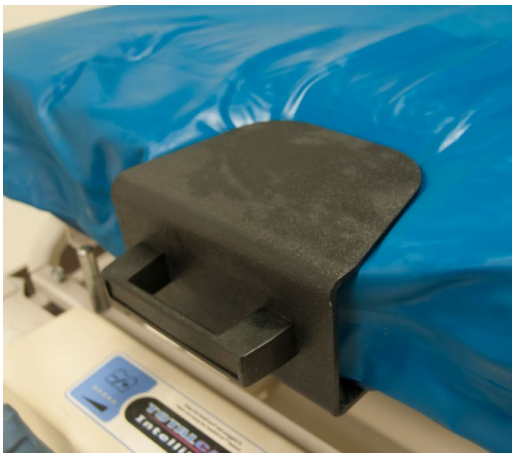


Figure 378: Mattress stiffener in place

The pediatric scan board requires mattress stiffeners that provide a hard surface at the head of the bed to prevent the mattress from sagging with the weight of the patient when a scan is performed.

There are four mattress stiffeners that can be stored on the CereTom Elite for easy transport. See Figure 376.

3. Remove the scan board from the side of the scanner.

4. With the proper mattress stiffener inserted, apply the scan board.

5. Place the scan board on the mattress stiffener.

6. Position the board in accordance with the yellow, safety-warning stickers to avoid a tipping hazard.

7. Place the pad on the scan board.

**Note** The pediatric scan board is used without a pad.

8. For the pediatric scan board, do not extend the board beyond the mattress for proper placement.

Figure 379: Pediatric scan board properly positioned on the bed on a bed stiffener

9. When the board is properly positioned on the bed, secure it by using the safety strap.

   The safety strap must be attached to the board, passed completely under bed, and secured on the other side.

Figure 380: Universal transfer board (left) and pediatric scan board (right) with safety strap installed

10. When the universal transfer board is securely fastened to the bed, transfer the patient to the bed, and secure the upper strap to the patient and the scan board.

11. When the patient is positioned and securely strapped in, position the patient in the scanner's bore.

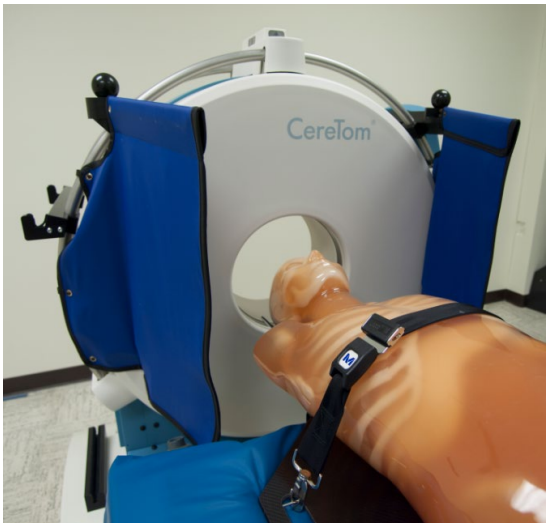



Figure 381: Phantom on universal transfer board, safety strap in place

12. Initiate the scan.

## Using the pediatric scan platform

| Note | Pediatric scan platform is used for larger children that cannot be supported by the infant/neonatal scan platform. |
|---|---|

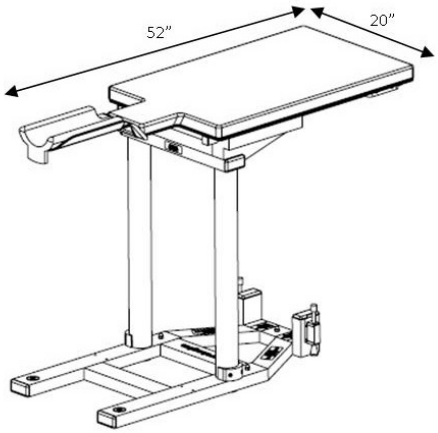



Figure 382: Pediatric scan board and platform

**WARNING** The pediatric scan platform is not a transportation device and should never be used to move a child from one location to another.

**CAUTION** Always secure the child to the scan platform with the safety strap as described below to prevent motion and falls.

**WARNING** ***Never*** leave the child unattended on the platform!

**CAUTION** Read and observe all warning labels.

**CAUTION** ***Never*** remove the scan board from the platform in order to use it separately.


Figure 383: Pediatric scan platform weight limit label

| **Note** | The pediatric scan board is used to scan heads only on adolescents too large to be scanned on the neonatal scan board, but too small to be scanned on their regular hospital bed (7.5kg/17lbs.). |
|---|---|

1. Place the child on the scan platform and secure with the safety strap.

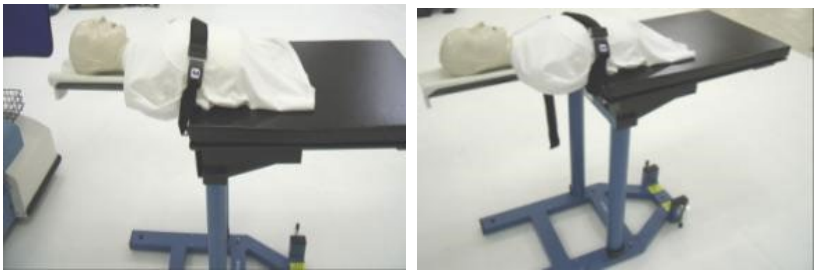


Figure 384: Child placed on pediatric platform with safety strap (two views)

2. Position the platform in the scanner and center the patient using the laser light as a guide.

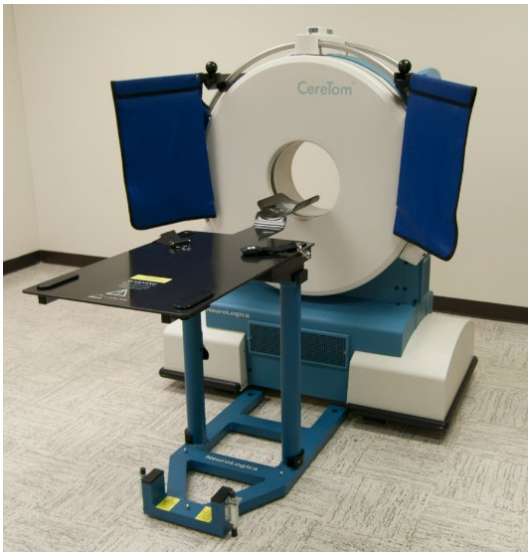



Figure 385: Pediatric platform positioned by the scanner

3. After the patient is properly positioned in the scanner, lock the platform in place by stepping down on plunger on both sides (see Figure 395).

4. When scan is completed, step on the silver tab to release the brake.

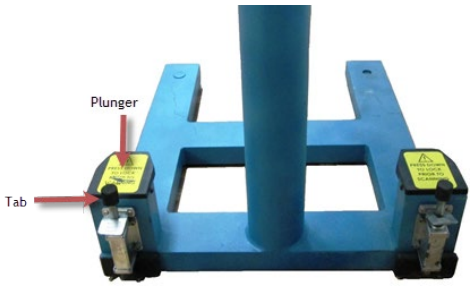



Figure 386: Platform brake

## Using the infant and neonate scanning platforms and adapters

Pediatric scanning is accomplished by using specifically designed products to safely cradle, support, and immobilize infants and children during a procedure.

Neonates and infants can receive head and body scans by using the infant/neonatal scan platform: Figure 387. It Includes 0.5in. thick foam pad and 1.55in. thick foam pad.

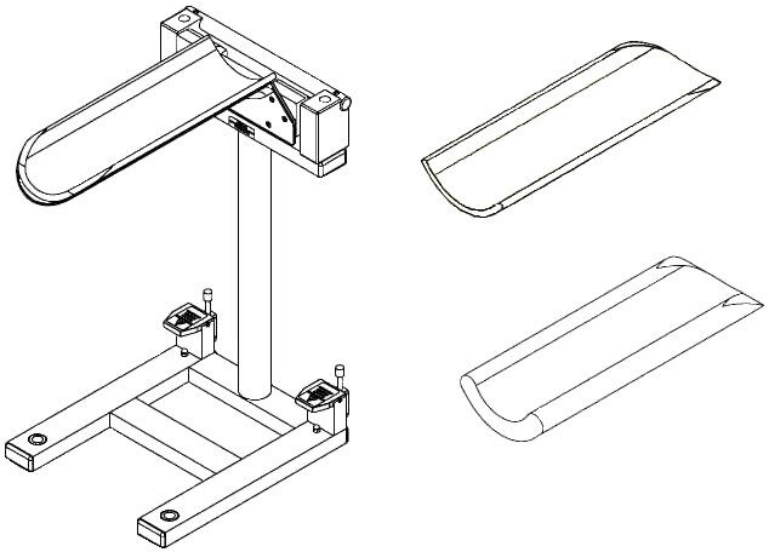


Figure 387: Infant and neonatal scan platform and pads (to the right)

**WARNING** The neonatal scan platform ***is not*** a transportation device and should ***never*** be used to move a child from one location to another.

**WARNING** Always secure the child to the scan platform with the pediatric strap – as described in the following procedure – to prevent the child's motion and falls.

**WARNING** ***Never*** leave the child unattended on the platform!

**CAUTION** Read and observe all warning labels.


Figure 388: Weight limit for neonatal

1. In addition to the pads, always use the pediatric strap, to secure the patient to the platform.

Figure 389: Pediatric strap

2. Drape the strap over the patient and secure one side around the patient with Velcro, then continue with other side, as shown.

Figure 390: Applying pediatric strap onto the platform (three views)

**WARNING** ***Never*** leave the child unattended on the platform!

3. Position the neonate or infant patient can be positioned on the platform head first for head scans, and feet first or head first for body scans.

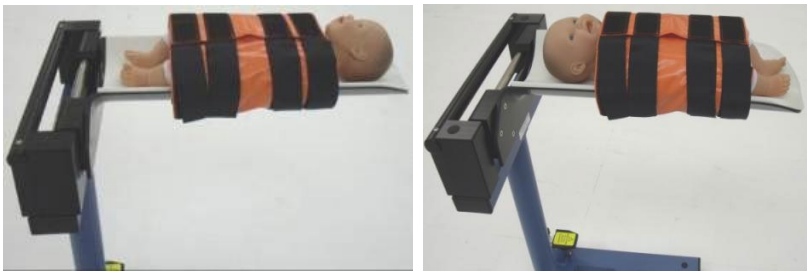


Figure 391: Proper position of neonate/infant for head scans (left) and body scans (right)

The patient is now ready to be placed in scanner.

**Note** The platform remains stationary during the scan while the scanner moves during the scan.

CereTom Elite is specifically designed for the platform base to fit under the scanner while it is free to travel the entire scan length.

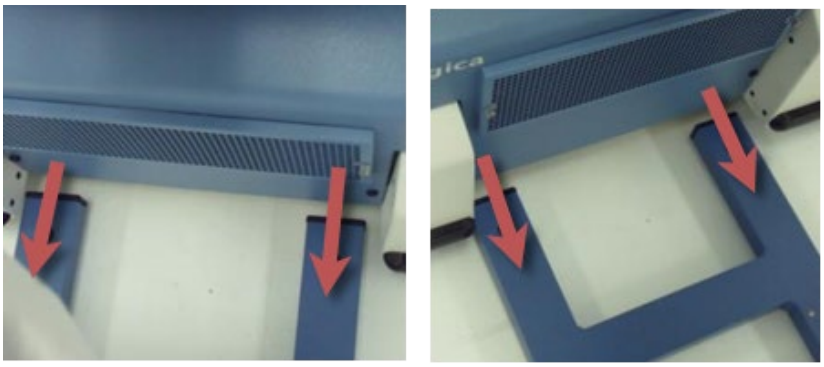


Figure 392: Scanner shown to (easily) slide over platform base (two views)

4. When preparing to scan of a neonatal patient's head, position the head first on the platform (as shown below) and slide platform into scanner opening, using laser light to properly position the patient.

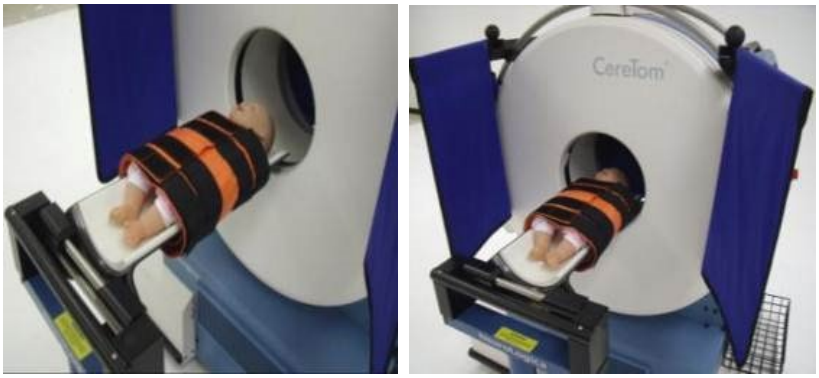



Figure 393: Neonate/infant insertion for head scan (two views)

| Note | Use the same process (in previous step) when you prepare to scan the neonatal patient's chest or abdomen. |
|---|---|


Figure 394: Neonate and infant insertion for body scan (two views)

5. When the patient is properly positioned in the scanner, lock the platform in place by stepping down on plunger on both sides.

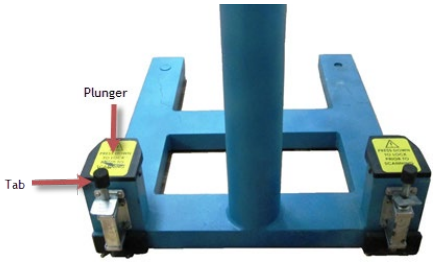



Figure 395: Neonate platform foot brake locations

6. When the scan is complete, step on the silver tab to release brakes.

## Using the CereTom Elite in the Operating Room

The three methods used to convert the operating table into a scanning platform are as follows:

- **An OR table adapter with the silhouette scan board**
- **Universal transfer board**
- **Doro® CereTom Elite intra-operative cranial stabilization system**

Each of the above mentioned devices are covered in the following sections. It is important to note that all of these devices are used pre, post, and intra-operatively.

## Using the Operating Room table adapter

The Operating Room (OR) table adapter functions in the same way as a bed adapter.

1. Attach the OR table and then the silhouette scan board to the adapter.

   The OR table adapter has two posts that fit into the adapter supplied by either the OR bed manufacturer or by Mayfield.


Figure 396: OR table adapter

2. Adjust the OR table adapter to the openings in the mount and attach it to the mount.

Figure 397: OR table adapter attached to mount

3. Attach the silhouette scan board to the OR table adapter.

4. Add the padding to the head holder and slide the patient onto the board.

   You can perform this step at scan time or before the start of surgery. If you perform it prior to surgery, the surgeon may choose to perform the surgery on the head holder.

5. Roll the scanner into place to start the study.

### Using the universal transfer board in the OR

The universal transfer board is a carbon-fiber, radiolucent board that is designed to work with any ICU bed or gurney. The carbon-fiber board comes with a 0.5in. (thick) head board and 2in.x5ft. straps to strap the board to the ICU bed or gurney. It also comes with 3in., 4in., 6in., and 12in. bed stiffeners.

In addition to using the OR adapter and silhouette board in the OR, the universal transfer board is often used in the OR. The universal transfer board is secured to the surgical table by placing the board under the table cushions (if used) and securing the safety strap to the table by passing the strap under it and securing it on the other side. The board is secured to the table prior to the patient's arrival. The patient is then placed on the table with the patient's head in the head holder. The surgery is performed with the patient on the universal transfer board. When a scan is needed, the CereTom Elite is wheeled into place over the patient's head and the scan is performed. A study performed on the universal transfer board in the OR include, but is not limited to, tansphenoidals and shunt placements. The universal transfer board is used for almost any non-invasive surgical procedure.

### Using the Doro CereTom Elite Intra-Operative Stabilization system

The skull clamp set is specifically designed for the CereTom Elite portable CT scanner. It offers exceptional stability with the freedom of fine adjustment for skull positioning. It also provides a secured three-point fixation for optimum patient-placement in the CereTom Elite scanner (gantry).

Figure 398: Doro CereTom Elite skull clamp

1. Remove the head board from the OR table.

2. With the head board removed and the park bench in hand, determine how much adjustment needs to be made in order that the bench can slide onto the surgical, table rails.

3. Remove the large Allen wrench from its holder on the side of the park bench to adjust the bench's width.

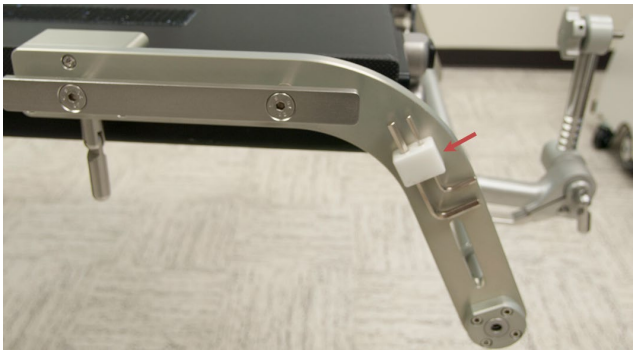


Figure 399: Doro park-bench adjustment using Allen wrench

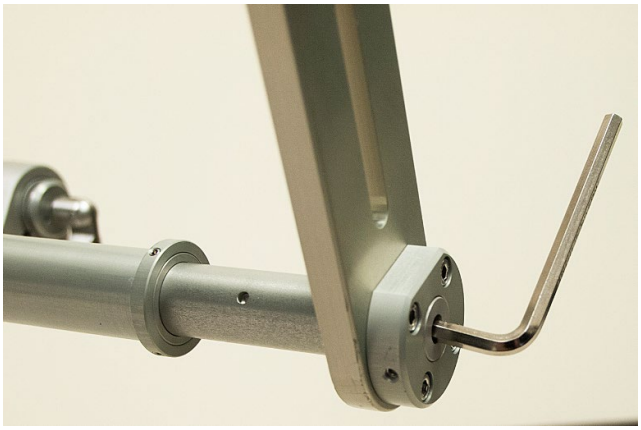


Figure 400: Doro bench adjustment with Allen wrench

**Note** Make adjustments evenly to both sides.

4. After making the adjustments, slide the park bench onto the surgical table.

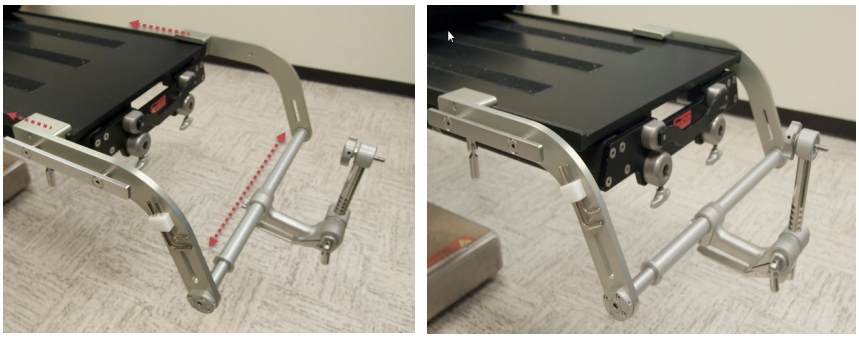


Figure 401: Doro park-bench adjustments and positioning on bed (two views)

5. Tighten the bench securely to both side rails.

   Use caution when tightening the screws to ensure you do not unscrew the setscrew.

**Note** Turn clockwise to loosen and counterclockwise to tighten.

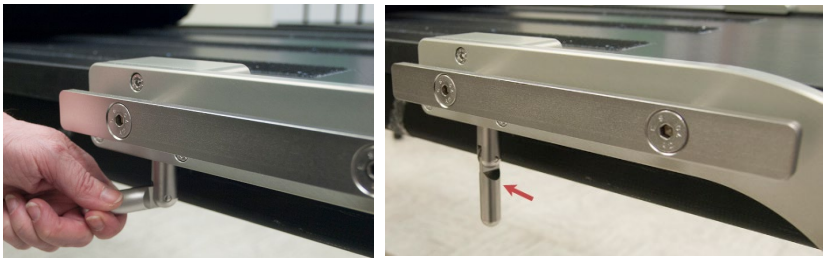


Figure 402: Doro securing rails (two views)

6. If not already attached, attach the spindle device.

| | |
|---|---|
| **Note** | Do not remove the spindle device routinely. Damage can occur to the clamping device if the clamp is secured and spindle device is not in place.<br><br>***Do not*** close the clamp when empty. |

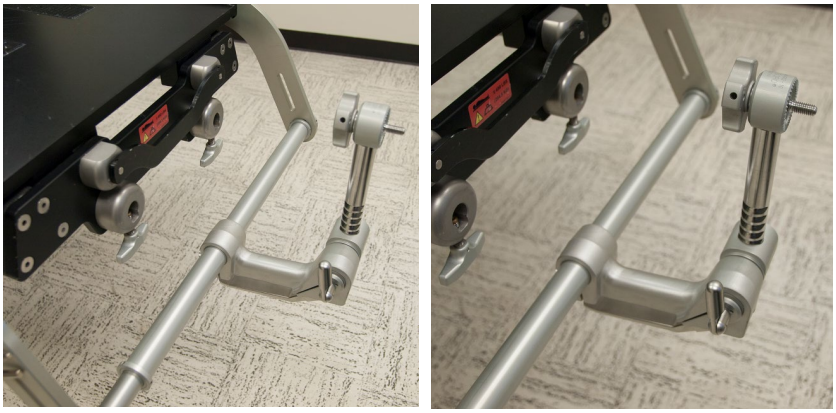


Figure 403: Doro; attaching spindle device (two views)

7. Assemble the skull clamp by attaching the radiolucent arms with the pin holders attached.

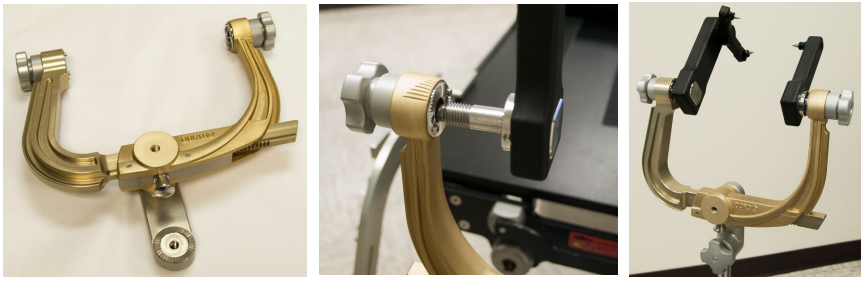


Figure 404: Doro skull clamp assembly (three views)

8. Adjust the arm angles, if necessary, determined by the surgeon.

   With the arms attached, you can place the clamp on patient's head.

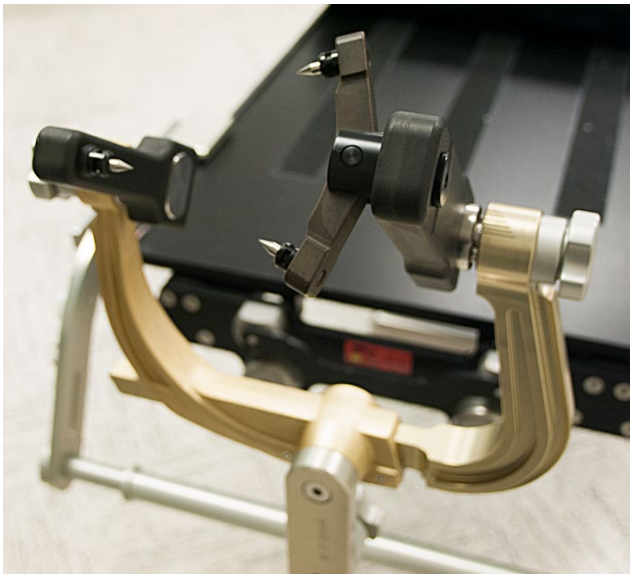


Figure 405: Doro skull clamp arm adjustment

9. With the skull clamp assembled and the pins in place, the surgeon aligns the pins and affixes the skull clamp to the patient's head.

10. When the clamp is attached to the patient's head, the surgeon tightens the locking-clamp tension-screw.

11. With the skull clamp secure to the patient's head, the surgeon supports the patient's head while the clamp is attached to the spindle of the park bench.

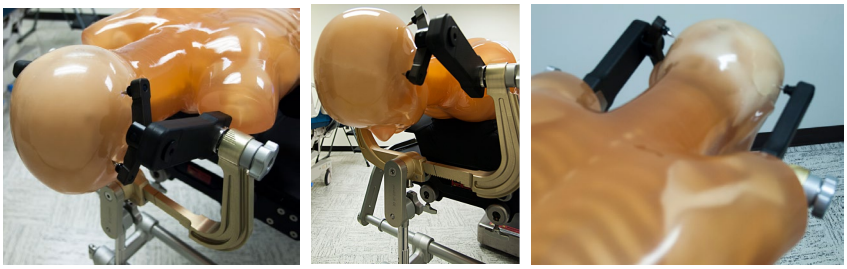


Figure 406: Doro skull-clamp assembly with spindle to receive patient (three views)

12. Ensure the patient is appropriately positioned for a scan.

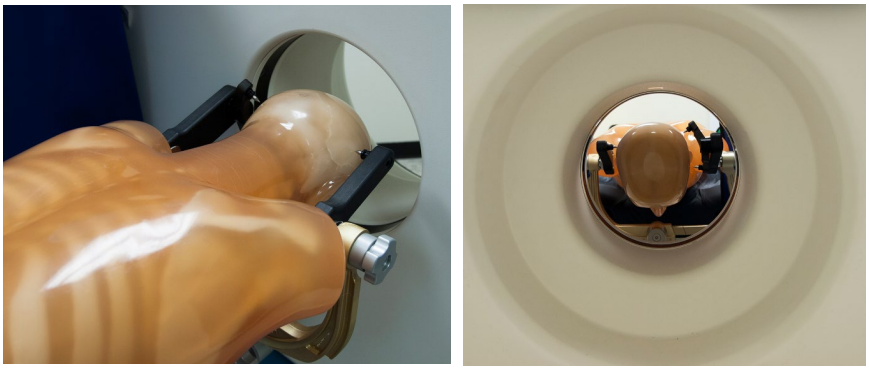


Figure 407: Patient in position for scan (two views)

| | |
|---|---|
| **Note** | The Doro CereTom Elite horseshoe comfort headrest (with gel pads) can also be used for positioning and attaching to the Doro park bench. |

Figure 408: Doro CereTom Elite horseshoe comfort headrest (with gel pads)

# Chapter 14 Scanner Drive System

The Scanner Drive System (SDS) enables you (a single operator) to easily move the CereTom Elite wherever you need it to go. The SDS is designed with an intuitive, variable,-speed joystick interface and a solid-state, electric drive that lets you navigate in and out of elevators, over doorway thresholds, or on any type of floor including carpet, with ease. In addition to providing transport, the SDS serves as a cart for the CereTom Elite workstation. The scanner must be docked to the SDS to move it.

Figure 409: Scanner Drive System

Be sure to read its warnings carefully and completely ***before*** using the NEU-CT-Gen III SDS. ***Do not*** attempt to service the SDS. Only skilled service people are permitted to service the SDS. See "Hazard Information" on page 50.

**CAUTION** Failure to heed these warnings may cause injury to the user, to others, or damage to the equipment.

**CAUTION** When the SDS is unplugged from the wall, there are no lights or charge status indicators. There is no level of charge status shown.

## SDS overview

Be familiar with this section before using the SDS.

### SDS considerations before use

Before using the SDS, consider the following:

- If a problem is detected with the SDS, make sure repairs or adjustments were made to the SDS ***before*** using it.
- Make sure the SDS operates easily and freely, and all parts work smoothly.
- Check for excess noise, vibration, or a change in the ease-of-use.

  Noise, vibration, or change in ease-of-use can be signs of a problem and a need for servicing.
- During scanner storage or non-use, undock the drive systems ***before*** storing the CereTom Elite scanner to prevent damage to the drive wheels; failure to detach the drive unit from the scanner during extended storage time will result in flat spots on the wheels where they contact the floor.
- Docking height: the docking mechanism does not automatically adjust to match the scanner and must match the scanner docking-adapter height; the height is set during installation by NeuroLogica; the mechanism should engage without forcing.
- If lock is on, all scanner functions are inactive.

## SDS control panel

Figure 410: SDS control panel and description of components

See the table below to identify the indicators.

Table 51: Battery charge, LEDs, and SDS On and Off buttons

| Number | Name | Description |
|---|---|---|
| **1** | Battery-charge status indicator | Shows the amount of charge remaining for the SDS. |
| **2** | LED 1 | Illuminates when drive system is properly docked (mated). |
| **3** | LED 2 | Illuminates when locking lever is engaged and system is locked. |
| **4** | LED 3 | Illuminates when drive system is docked, locked, and pressurized. |
| **5** | LED ! | Illuminates when an error condition occurs. |
| **6** | System On button | Illuminates (green) when the SDS is on. |
| **7** | System Off button | Not illuminated (black) when the SDS is off. |

## SDS features

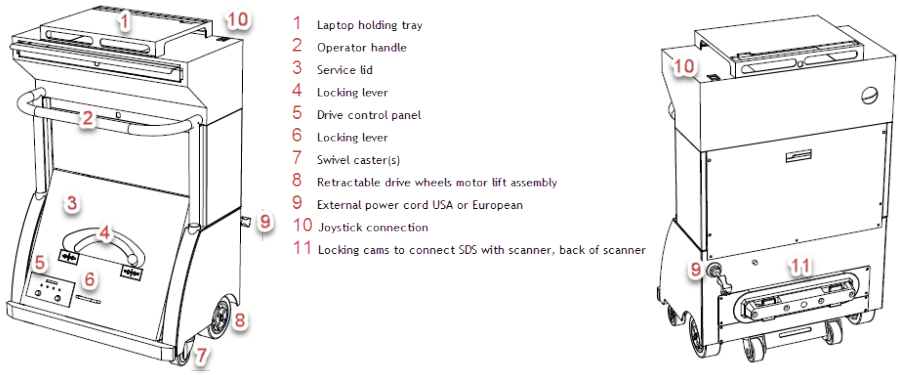
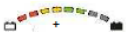
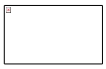



Figure 411: SDS features

## Joystick features

Figure 412: SDS joystick (REM421)

Table 52: REM421 joystick features

| Symbol | Feature | Action |
|---|---|---|
|  | **Battery gauge** | Identifies the battery usage of the SDS, which matches the battery indicator on the SDS control panel. |
|  | **On / Off** | Powers on and off the joystick. |
|  | **Speed up or down** | Specific drive setting to adjust speed of the SDS. |
|  | **Horn** | Sounds the horn. |
|  | **For service purposes, only** | Not for clinical use. |

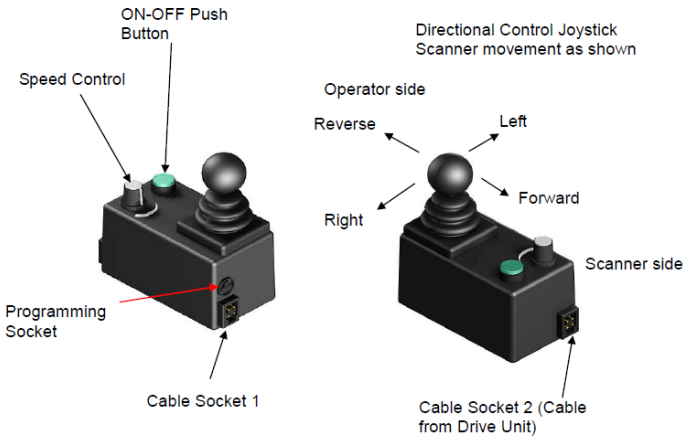



Figure 413: SDS joystick (REM35)

Table 53: REM 35 joystick features

| Symbol | Feature | Action |
|---|---|---|
|  | **On / Off** | Powers on and off the joystick. |
|  | **Speed up or down** | Specific drive setting to adjust speed of the SDS. |
|  | **Directional joystick** | Moves the scanner in the forward, left, reverse, or right direction. |

**Note** The joystick is modular and used on other production items; however, for Scanner Drive system (SDS), only basic features are needed to operate the joystick fully. Therefore, SDS is not be affected by some of the joystick's non-critical features.

Your joystick may not look exactly as the one shown in Figure 412; however, the same basic features described in Table 52 apply.

CAUTION The joystick must be programmed by trained personnel. Failure to do so may cause severe damage to equipment and personal injury.

## Retractable power cord

Consider the following:

- Retractable power-cord reel and plug location (back of SDS).
- Plug style will vary depending on factory installed elements based on geographic location and voltage requirements.

-  The warning that this uses hazardous voltage.

Figure 414: SDS retractable power cord –retracted (left) and not retracted (right)

CAUTION The system (including the workstation) should be plugged in at all times, when not in **Transport** mode, being transported or in scanning use, to help maintain battery life and proper system operation. Failure to do so could result in permanent battery damage, which will require a service technician to repair.

CAUTION If the system is unplugged and battery capacity reports to be 0%, permanent battery damage can occur.

| | |
|---|---|
| **Note** | Be sure to keep the workstation plugged in when it is not in use in order to charge the battery. Charge time while off is ~ (approximately) 2 hours; while in use, charge time is ~ 8 hours. |

## Locating the power-failure, pneumatic, emergency-release safety feature

The pneumatic emergency release is a power failure safety feature that prevents the wheels from retracting if there is a power failure. This manual (push) button will release the air pressure to the system in the event of a power failure.

Figure 415: SDS pneumatic emergency release

**WARNING** Electric shock may occur when plugging this device into wall outlet. Use *only* grounded or hospital grade outlets.

**CAUTION** When not in transport, the SDS should be left plugged in to best prevent its batteries from draining.

## Detachable parts and accessories

Attach the joystick cable to drive system by pushing connector into socket as shown.

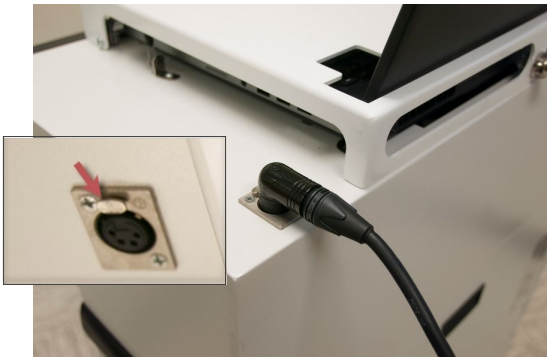


Figure 416: SDS joystick cable connected to SDS, arrow pointing to release button

## Identifying the collision detection bumper switches

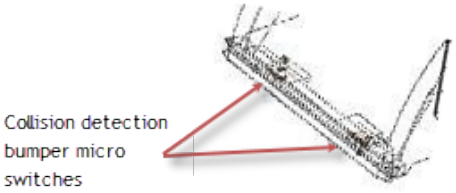



Figure 417: SDS collision detector micro switches

### Collision recovery

To recover from a bumper collision, press the joystick **On** and/or **Off** button to reset the system and drive, and/or remove any obstruction at the bumper. See "Joystick features" on page 339 for information on REM421 and REM35 joystick models.

# Docking the SDS to the scanner

Training for this equipment is provided by NeuroLogica Corp. or through a NeuroLogica authorized training program. Only authorized personnel are permitted to operate this equipment. See "Contact information" on page 26.

| | |
|---|---|
| **Note** | Never attempt to slide the locking lever to the unlocked position if the SDS is locked to the scanner, already.<br><br>Never position yourself between the SDS and the scanner when the SDS is connected to the scanner.<br><br>Never lower the scanner (to Invalid or **Scan** mode) while the SDS is connected to the scanner. |

1. Make sure the **drive unit** is unplugged from wall and the power cord is retracted completely into the unit; also be sure not to damage the ethernet cable if one is plugged in.

2. Make sure the locking lever is all the way to left side (in the unlocked) position.

Figure 418: Locking lever in unlocked position

3. Press the Rocker-Switch-Lift **UP** (green) button to put the scanner in **Transport** mode (raised) position.

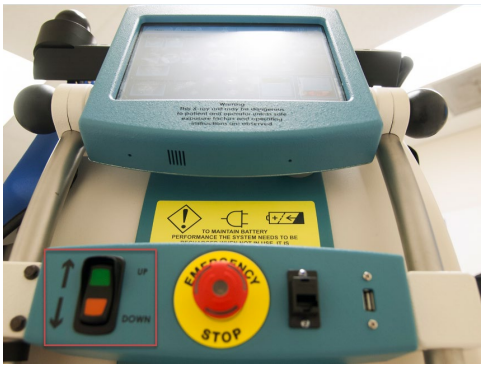



Figure 419: Rocker-Switch-Lift Up and Down buttons

**LED 2** turns off.

4. Dock the SDS to the scanner by physically pushing the SDS to the scanner until docking adapter on drive is fully engaged in scanner's docking adapter.

   When the adapter is successfully engaged in scanner's docking adapter, **LED 1** is no longer illuminated (turned off) on the **SDS** panel. See See the table below to identify the indicators.

   Table 51 on page 338 to identify the location of the **LED** and a description.

5. Slide the locking lever to right to put the SDS in the locked position (moving left to right).

   If the drive unit is properly locked, **LED 2** illuminates.

CAUTION Never stick any part of the body in the locking mechanism at the front of the SDS. This is a pinching point.

6. Push the **ON** (green) button on the **SDS** control panel.

   The tensioning cycle begins for a period no longer than 1 minute, 20 seconds, at which time the tension cycle ends and **LED 3** illuminates. When the pressurizing is achieved, **LED 3** illuminates.

7. Plug the joystick into the drive unit while the SDS is pressurizing.

Figure 420: Joystick plugged into SDS

8. Make sure the **speed adjust** on the joystick is turned to the slowest speed.

9. When the compressor stops, push the **ON** (green) button on the joystick.

   The **On** (green) button should remain illuminated (lit).

| **Note** | If there is a malfunction in docking, locking, or trouble with the SDS electronically, the right-most **LED !** will illuminate. **LED !** is the fault indicator; if **LED !** illuminates at any time, troubleshoot the situation. |
|---|---|

   The **SDS** is ready to move the scanner.

10. Set the **speed adjust** to ~ (approximately) half way on the jostick.

11. Use the joystick lever to control scanner motion (speed) and direction.

## Undocking the SDS to the scanner

1. Push the **Off** (black) button on **SDS** panel and wait for cycle to end.

   This may take 20 seconds. You will hear the system depressurizing.

2. Unplug the joystick cable and store on the joystick.

Figure 421: Joystick connector (attached and unattached)

3. When the system is fully depressurized, slide the locking lever to the unlocked position (moving it right to left). LED 2 will turn off at this time.

4. Wheel the SDS away from the scanner. LED 1 will turn off at this time.

CAUTION To prevent movement/steering problems caused by wheel flat spots, disconnect the SDS from the scanner when done transporting or moving the scanner. Do not store the system and SDS docked together.

## Workstation location on SDS


Figure 422: SDS and workstation (laptop computer) in locked storage tray

## Cleaning the SDS

NeuroLogica recommends to clean the SDS between uses as described in the sections below.

WARNING ***Before*** cleaning the drive system, be sure to disconnect the SDS from the wall outlet (power source). Failure to do so could result in electrical shock and cause severe injury to you and/or damage to electrical components.

CAUTION ***Do not*** allow electrical components to become wet. For eye and hand protection, it is important to wear safety glasses and rubber gloves respectively.

### Cleaning the outside of the SDS

1. Prepare detergent/disinfectant (regulated by EPA as hospital disinfectant) solution according to instructions on label for correct usage.
   - Use a basin or spray bottle (with product label).
   - Use a pump (usually on detergent/disinfectant containers) to dispense the concentrate in the basin or spray bottle, then fill with correct amount of tap water.
   - If using a spray bottle, empty and rinse out after use.

| Note | The stability of the solution is unknown after 24 hours; therefore a fresh preparation of cleaning solution must be prepared for each day of cleaning. |
|---|---|

2. Use swabs moistened with cleaning solution, clean and remove any dust, soil, or foreign matter; allow all components to air dry.

3. Wipe down and clean the frame of device, and allow to air dry; return to its storage area.

| Note | Wash (at 25°C) with neutral detergents, *only*; softening agents ***are not allowed***. |
|---|---|

The following recommended products are registered by the EPA as hospital disinfectant; these solutions are quaternary ammonium compounds and are used in environmental sanitation of non-critical surfaces:

- TB Quat™ is a cleaning solution manufactured by ABC Compounding Co.
- Wex-cide™ is a disinfectant manufactured by Wexford Labs, Inc., product number Wexcide128.

### Maintenance of the SDS

WARNING Maintenance checks and all service must be performed by technicians trained by NeuroLogica Corp. See page 26 for NeuroLogica contact information.

## SDS specifications

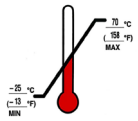
Table 54: SDS specifications

| | |
|---|---|
| Overall width | 26-5/8in. (26.6275cm) |
| Overall height | 42in. (106.68cm) |
| Overall length | 20-1/8in. (51.1175cm) |
| Height over handle | 32 ½in. (82.55cm) |
| Weight EST | 400lbs (151.44kg) |
| Battery power (2) 12 VDC (33 aH lead acid) | 800Wh |
| Max programmed speed fwd. | 1.6MPH |
| Max recharge time | 6.2hrs. |
| Max continuous operation | 8hrs. |
| Locking and unlocking cycles | 20 |
| Hrs transport over floors | 2hrs. |
| Hrs system locked no external power | 2hrs. |

| | |
|---|---|
| Max slope holding angle with scanner | 7° C (44.6° F) |
| Max doorway threshold | 1in. (2.54cm) |
| Max elevator threshold | ¾in. (1.905cm) |
| Height to locking adapter | 8.59in. - 8.69in. |
| Max/Min storage temperature | -25° C to 70° C (-13° F to 158° F) |
| Max/Min operating relative humidity | 95%/20% |
| Max/Min storage relative humidity | 85%/20% |
| Max/Min ambient operating temperature | 40° C/5° C (104° F/41° F) |

## Understanding the symbols and product-marking plate

Table 55: Symbols and product-marking plate

| Symbol | Description |
|---|---|
|  | Indicates alternating current. |
|  | Indicates protective earth (ground). |
|  | Indicates a caution: consult accompanying documents. |
|  | Indicates a caution: risk of electrical shock. |
|  | Indicates electrostatic sensitive devices. |
|  | Indicates a warning: high temperature. |
|  | Indicates temperature limits. |
|  | Indicates mechanical deactivation device. |
|  | Indicates a radiation precaution; may be affected by radiation from other sources; may produce interference that affects other equipment. |
|  | Crush warning. |

| Symbol | Description |
|---|---|
|  | Foot/toe crush warning when lowering machine. |
|  | Indicates a coil power cord. |
|  | Indicates a chain hazard could cause severe personal injury. |
|  | Indicates to keep away from rain for packaging. |
|  | Indicates a humidity limit for packaging. |
|  | Indicates a warning: battery charging. |
|  | Indicates fuse usage. |
|  | Indicates accompanying operating instructions in the user manual must be followed to safely operate equipment. |
|  | Legal Manufacturer Symbol |
| CE 2862 | CE Mark or Conformité Européenne |
| ETL CLASSIFIED C ETL LISTED US Intertek | Intertek ETL (Edison Testing Laboratories) Mark |
| EC REP | European Authorised Representative Symbol |
| MD | Medical Device Symbol |

**Note** Disregarding information on safety is considered ***abnormal use***.

## Listing of replacement parts for SDS

To ensure proper compliance requirements of replacement parts, (for example, cables and accessories), parts must be purchased through NeuroLogica Corp.

WARNING Using other manufacturer cables and accessories may affect EMC performance. Unauthorized use of these items will void warranty and may cause harm to patient, others and/or equipment.

Table 56: SDS parts and their part number

| Item name | Part number |
|---|---|
| Cord Reel | 165-200 |
| Battery | WKA12-33C |
| DX Unit | 165-101 |
| Compressor | 165-203 |
| Joystick CT | 165-202-CT |
| Joystick SP | 165-202-SP |
| 3-Way In-line Valve | 165-104 |
| Joystick Cable Internal | 154-402 |
| Joystick Cable Receptacle | 218-108 |
| Joystick Cable Detachable | 218-107A |
| Power Distribution PCB | 162-500 |

| Item name | Part number |
|---|---|
| I/O Controller PCB | 162-300 |
| User Interface PCB | 164-100 |
| Lever Arm Ball | 165-107 |
| Air Spring | 165-205 |
| Micro-switch | 165-106 |
| Wheel 3in. 500lbs | 165-220 |
| Casters and Wheel 3in. 500lbs | 165-221 |
| Drive Wheel 6in. | 165-200 |
| R.H. Motor | 20014 R |
| L.H. Motor | 20015 L |
| Bumper Assembly | 241-129 |

## Electromagnetic Comparability Test Report information

| | |
|---|---|
| Tested by | Intertek Testing Services NA, Inc., 70 Codman Hill Road, Boxborough, MA 01719 |
| Report Number | Intertek 100067600BOX-002a |
| Standards | IEC 60601-1-2:2004 |

# Glossary

## A

| | |
|---|---|
| algorithm | Mathematical filter applied to raw data during CT image reconstruction to remove blurring artifact inherent to back-projection. Also referred to as a kernel. |
| annotation | User comments or text added to an image. |
| anterior | Front of the patient's body |
| Application Entity (AE) | An end point of a DICOM information exchange, including the DICOM network or media interface software; that is, the software that sends or receives DICOM information objects or messages. A single device can have multiple AEs. |
| attenuations | The reduction in intensity of a radiation beam as it passes through a substance. |
| Automatic Exposure Control (AEC) | Software used to adjust or modulate the mA throughout an acquisition to reduce patient radiation dose to a minimum. |
| Axial scan mode | Data acquisition while the scanner remains stationary. The scanner position may be incremented between exposures to collect data over a longer Z axis range. Also referred to as step and shoot. |

## B

| | |
|---|---|
| beam hardening | The phenomenon whereby low energy photons are absorbed as the x-ray beam passes through an object, resulting in an increase in the average photon energy of the beam. |
| Bolus tracking | Monitors flow of contrast media in vessel and triggers scan at optimal timing. This is a scanner feature to automatically initiate a prescribed Axial, Helical or Dynamic scan when a threshold level of contrast enhancement is reached at a specified region of interest. |

# C

| | |
|---|---|
| center x, center y | Off-center reconstruction coordinates. |
| collimation | Restricts x-ray to only the selected anatomy, minimizing dose to patient and reducing scatter. |
| Computed Tomography Angiography (CTA) | A test that uses x-rays to provide detailed pictures of the heart and the blood vessels that go to the heart, lung, brain, kidneys, head, neck, legs, and arms. A CT angiogram can show narrowed or blocked areas of a blood vessel. |
| Computed Tomography Dose Index (CTDI) | An approximate measure of the radiation dose received in a single CT section or slice. |
| Computed Tomography Dose Index Volume (CTDIvol) | Represents the dose for a specific scan protocol, which takes into account gaps and overlaps between the radiation-dose profiles from consecutive rotations of the x-ray source. The CT dose index volume is noted as CTDIvol. The CTDIvol is calculated differently for both the Axial and the Helical mode:<br>• For Axial scan mode: CTDIvol = [ (N x T)/I ] x CTDIw<br>• For Helical scan mode: CTDIvol = 1/pitch x CTDIw |
| Computed Tomography Dose Index (CTDIw) weighted average | The measure of ionizing radiation exposure per slice of data acquisition. CTDI represents the integrated dose along the Z axis from one axial CT scan (one rotation of the x-ray tube). The CT Dose Index is noted as $CTDI_w$. |
| Computed Tomography (CT) number | Relative value assigned to each pixel to quantify the attenuation occurring in each voxel in comparison with the attenuation of water. The calculated CT number for a given pixel is given in Hounsfeld units (HU). |
| Computed Tomography Perfusion (CTP) | Evaluates cerebral perfusion or level of blood flow in the brain by monitoring the initial passing of iodinated contrast media through the vasculature of the brain. |
| contrast media | Used to improve sensitivity and specificity of clinical diagnoses. Three types are intravenous, oral, and intrathecal. |

| | |
|---|---|
| contrast resolution | The ability of a CT system to detect an object with a small difference in linear attenuation coefficient from the surrounding tissue. Also referred to as low-contrast detectability or sensitivity. |

# D

| | |
|---|---|
| Digital Imaging Communication in Medicine (DICOM) | Digital Imaging and Communications in Medicine, or DICOM, is a standard that helps people doing work in the field of radiology. The DICOM standard is designed to promote communication and integration between a variety of radiology imaging systems and equipment used in filmless radiology. |
| digital tilt | The ability to correct the image post acquisition and correct positional inaccuracies prior to sending to PACS. |
| dose | Amount of ionizing radiation absorbed by patient per unit mass. |
| Dose Length Product (DLP) | The measurement of dose for an entire series of CT images. DLP is equal to the calculated dose per section multiplied by the length of a CT acquisition along the Z axis. |
| Dynamic Host Control Protocol (DHCP) | A standardized network protocol used on Internet Protocol (IP) networks. The DHCP is controlled by a DHCP server that dynamically distributes network configuration parameters, such as IP addresses, for interfaces and services. |
| Dynamic scan mode (multiple detector widths) | Data acquisition at multiple time points over the same anatomic location(s). |

# E

| | |
|---|---|
| Electromagnetic Compatibility (EMC) | The branch of electrical sciences that studies the unintentional generation, propagation, and reception of electromagnetic energy with reference to the unwanted effects (Electromagnetic interference (EMI)) that such energy may induce. |
| Electromagnetic Interference (EMI) | A disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction. The disturbance may degrade the performance of the circuit or even stop it from functioning. |

# F

| | |
|---|---|
| Field of View (FOV) | The diameter of the acquired attenuation data displayed across the image matrix. |

# H

| | |
|---|---|
| Helical | A CT acquisition whereby an x-ray acquisition whereby the x-ray tube and scanner move continuously during scanning, yielding a data set in the form of a helix. Also referred to as spiral. |
| Hospital Information System/Radiology Information Systems (HIS/RIS) | A Radiology Information System (RIS) is the core system for the electronic management of imaging departments. The major functions of the RIS can include patient scheduling, resource management, examination performance tracking, examination interpretation, results distribution, and procedure billing. RIS complements Hospital information systems (HIS) and Picture Archiving and Communication System (PACS), and is critical to efficient workflow to radiology practices. |
| Hounsfield Unit (HU) | The unit of the CT number scale assigned to each pixel to quantify relative attenuation. |

# I

| | |
|---|---|
| interscan delay time | Minimum amount of time that must transpire between end of one scan and initiation of next scan. Interscan delay times include idle time between scans to allow tube cooling. |
| Iterative Bone Correction (IBC) | A feature build into the reconstruction software, which performs a correction on every single Axial image the scanner produces, including both primary series from a scan as well as secondary reconstruction images. Current IBC settings were chosen to provide optimal correction for standard medical imaging; however, the setting can be customized as needed. |

# K

| | |
|---|---|
| kernel | A mathematical filter applied to raw data during CT image reconstruction to remove blurring artifact inherent to back-projection. Also referred to as an algorithm. |

# L

| | |
|---|---|
| Liquid Crystal Display (LCD) | A form of visual display used in electronic devices in which a layer of a liquid crystal is sandwiched between two transparent electrodes. The application of an electric current to a small area of the layer alters the alignment of its molecules, which affects its reflectivity or its transmission of polarized light and makes it opaque. An LCD is used on the scanner and is a touch screen. |

# M

| | |
|---|---|
| mAs | Tube current-time product: The product of tube current and exposure time per rotation, expressed in units of milliampere seconds (mAs). |
| matrix | Two dimensional grid numbers arranged in rows and columns. |

| | |
|---|---|
| Maximum Intensity Projection (MIP) | The multiplanar reformation technique that displays only the maximum pixel value along a ray traced through the object to the viewers assumed perspective in front of the viewing monitor. |
| Mean Transit Time (MTT) | A common measurement during CT perfusion studies of the brain. Refers to the average transit time, in seconds, needed for blood to pass through a given region of brain tissue. |
| milli amperage (mA) | Tube current: the number of electrons accelerated across an x-ray tube per unit time, expressed in units of milliampere (mA). |
| Modality Performed Procedure Step (MPPS) | A mechanism for modalities to pass information about the imaging performed back to the HIS/RIS or PACS. |
| Modality Worklist Manager | Scheduled (but not yet scanned) patient list. |
| motion artifact | Voluntary and involuntary patient motion during CT scan, appearing as a streak artifact on image; ghosting or blurring of image. |
| Multiplanar Reformatting (MPR) | The process of displaying CT images in a different orientation from the one used in the original reconstruction. Allows for reconstruction of images in planes that would otherwise be difficult or impossible to acquire with CT. Requires only image data. Raw data is not utilized. |

# N

| | |
|---|---|
| noise | Random statistical variations in the signal. Can be quantum noise, electronic noise due to lost signal, or artifact noise. Manifests itself as overall graininess of the reconstructed image. |

# P

| | |
|---|---|
| partial volume artifact | Occurs when an object is only partly positioned within a voxel or is much smaller than the overall voxel volume. The object's attenuation is not accurately represented by the pixel value. Overlapping reconstructions further reduce partial volume artifacts. |

| | |
|---|---|
| patient coordinates | References are as follows:<br>• **X** left to right.<br>• **Y** anterior to posterior.<br>• **Z** head to feet. |
| Patient Browser, local database | Where the already-scanned patient list is stored. |
| peak kiloVoltage (kV) | The penetrating power of the photons coming from the x-ray tube. |
| Picture Archive and Communications Systems (PACS) | Stores medical information, including 2D images, and 3D medical images. All modern PACS setups will work with DICOM. |
| pitch | In Helical mode, refers to the speed of the scanner movement over the table as the scanner rotates. |
| pixel | A single, picture element of image matrix. |
| post reconstruction | Prescribing the reconstruction parameters after scan acquisition. |
| projection | View of anatomical cross-section from a particular vantage point. |
| prone | Patient lying on stomach. |
| protocol | Prescribing the reconstruction parameters prior to a scan acquisition. |

# Q

| | |
|---|---|
| Quality Assurance (QA) | Procedure of performing periodic specified tests or measurements to assure that a set quality level, as specified by system manufacturer, has not been compromised. |

# R

| | |
|---|---|
| Radiation Safety Officer (RSO) | The person within an organization responsible for the safe use of radiation and radioactive materials as well as regulatory compliance. |
| Radio Frequency Interference (RFI) | Also called Electromagnetic Interference (EMI), is an unwanted disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source. |

| | |
|---|---|
| raw data | A transmission measurements obtained by the detectors used to mathematically reconstruct the CT image. |
| reconstruction filter | Used to ensure accurate anatomy reconstruction. Also allows for either spatial resolution or low-contrast-resolution enhancement. |
| Region Of Interest (ROI) | Provides a quantitative analysis of the Hounsfield values of a specific anatomic area. A graphic outline in the shape of a circle is placed over an area on the image. Software calculates the average CT number in HU withering the ROI. |
| resolution | A scan time, per slice, in Axial mode, only. Resolution is meant to signify lower noise level and improved features – recognized in the scanned image. |
| retrospective reconstruction | Reconstruction performed after the initial prospective reconstruction. Multiple retrospective reconstructions of raw data are possible, with changes to display FOV, algorithm, image center, and so on. |

# S

| | |
|---|---|
| scan delay | The time between the initiation of contrast agent administration and CT data acquisition. The chosen scan delay determines the phase of contrast enhancement for a given CT acquisition. |
| scan protocol | A list of scanner-load parameters used to perform an x-ray exposure. |
| scan types | Axial, Helical, Dynamic, Reference, and Scout. |
| Scanner Drive System (SDS) | The self-contained, rechargeable, battery-powered transportation system is designed to facilitate transporting the CereTom Elite x-ray CT scanner. |
| scout | Digital survey radiograph acquired by the CT system for the purpose of prescribing the cross-sectional acquisition. Similar to a conventional radiograph, the scout is produced by translating the scanner over the patient without tube or detector rotation. Also referred to as topogram or scanogram. |
| series | A set of images acquired in a scan. |
| slice separation | The distance between the center of one CT slice and the center of the next slice. |
| slice thickness | The dimension of a constructed CT slice along the longitudinal direction of acquisition (Z axis). |

| | |
|---|---|
| spatial resolution | The ability of a CT imaging system to display fine details, separately. Given in units of line pairs per centimeter (lp/cm). |
| supine | Lying on back. |

# T

| | |
|---|---|
| temporal resolution | The ability of a CT system to freeze motion and provide an image – free of blurring. |
| Test Bolus | Scan mode used to measure the contrast transit time using a small injection of contrast media. |
| threshold | The CT number (Hounsfield Unit (HU)) where bolus tracking tool will trigger the system to begin the scan. |
| Time Attenuation Curve (TAC) | A graph of the contrast enhancement versus time. TAC is used to determine blood flow rate in seconds for contrast timing. |
| time delay | Monitoring delay: Time from injection to the start of monitoring scans. |
| Transverse plane | Perpendicular to direction of Z axis. |

# V

| | |
|---|---|
| Volume Rendering (VR) image or object | A 3D modeling technique that utilizes the entire acquired dataset but adjusts the opacity of the voxels included in the 3D image according to their tissue characteristics. |
| voxel | Abbreviation of volume element. Refers to the volume of tissue represented by a pixel in the matrix used to display the CT image. |

# W

| | |
|---|---|
| Window Level (WL) | The range of pixel values assigned a shade of gray in the displayed CT image. Window width controls the contrast of the CT image. The pixel value given in Hounsfield Units (HU) is at the center of the window width. Window center controls the brightness (density) of the CT image. |

# Appendix A MCS-140 Data Sheet

VAREX IMAGING

MCS-140

Stationary Anode X-Ray Tube

**Product Description**

The MCS-140 is a 140 kV, air cooled stationary anode metal ceramic x-ray source. This source is specifically designed for Imaging Applications.

**X-Ray Tube Specifications**

| | |
|---|---|
| Maximum Peak Voltage | 140 kV |
| Anode to Ground | 140 kV |
| Cathode to Ground | 140 kV |
| Focal Spot - IEC 60336 | |
| Small | 1.0 W x 0.8 L |
| Cooling Medium | Air |
| Maximum Continuous Rating | |
| Small | 900 W with 100 cfm min cooling flow |
| Target Material | Tungsten |
| Target Angle | 20° |
| Radiation Coverage | 72° |
| X-Ray Tube Assembly Permanent Filtration | 2.0 mm Be |

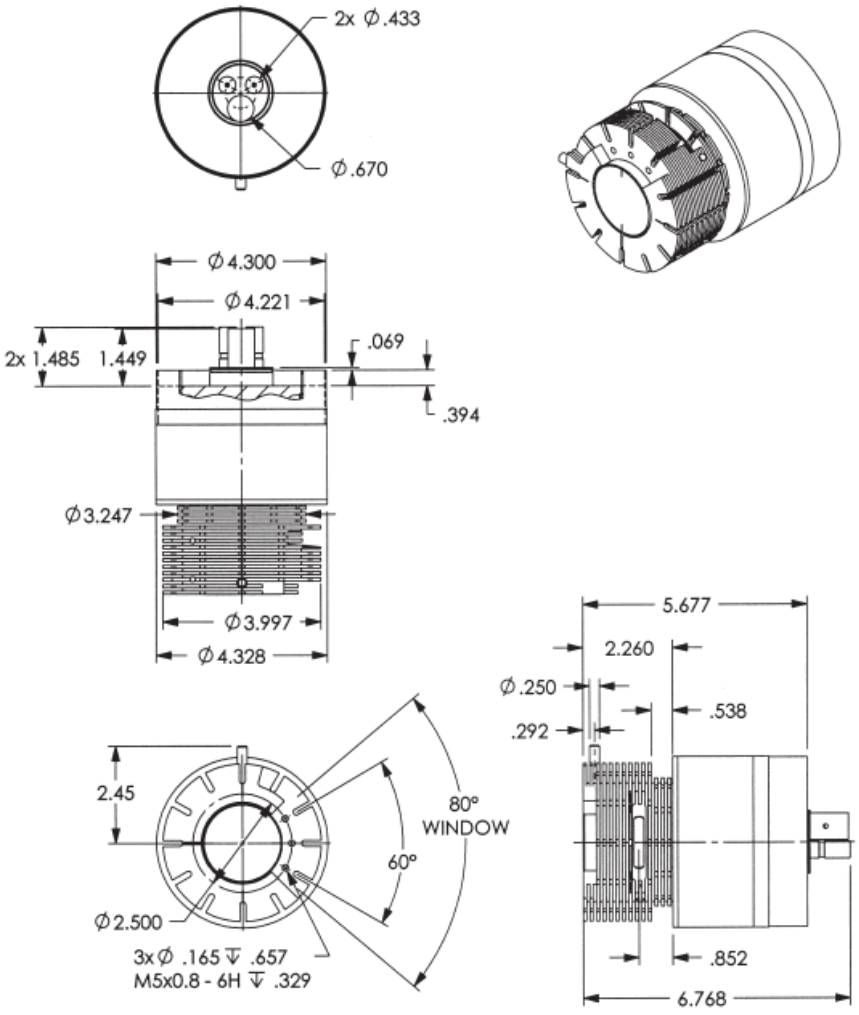
133404-000 Rev A 01/17

VAREX IMAGING

# MCS-140

Housing Outline Drawing

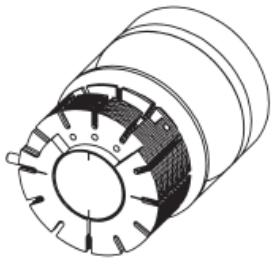
Dimensions are for reference only

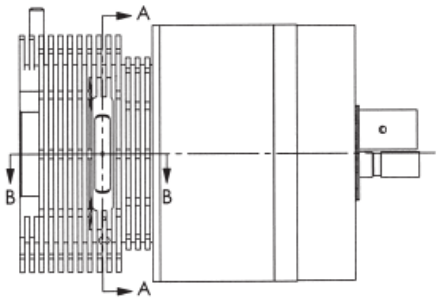


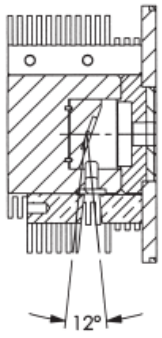
VAREX IMAGING

# MCS-140

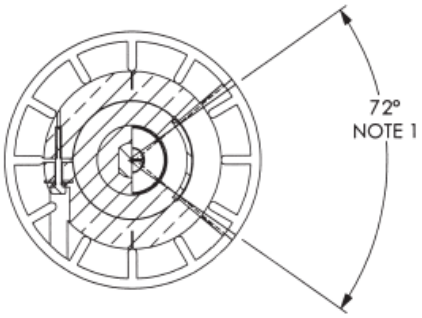
Beam Coverage






SECTION B-B




SECTION A-A

**NOTES:**

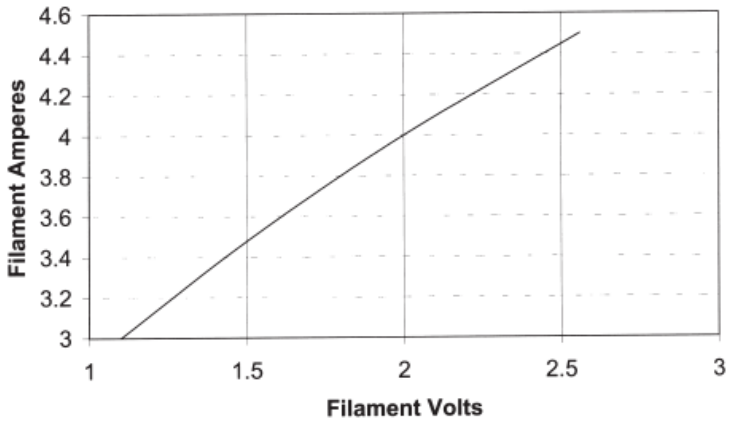
**1. FULL BEAM COVERAGE**

VAREX IMAGING

MCS-140

Rating Charts

## MCS-140 Filament Characteristics




**WARNING**

Beryllium windows transmit a very high level of long wavelength X-radiation, which can injure human tissue. Injury may occur from even very short exposures to the primary X-ray beam. Follow all precautions necessary to avoid radiation exposure to humans.

The radiation dose rate cannot be accurately measured with conventional radiation measurement instruments. Radiation intensity in each installation will vary, and calibration must include the effects of long wavelength X-radiation.

Fumes from beryllium metal (or its compounds) as well as dust can be hazardous if inhaled. During use, corrosion products may occur on the beryllium window, but these should not be scraped off, machined, or otherwise removed. Tube unit disposal should conform to federal, state, and local regulations governing beryllium.

VAREX IMAGING

Salt Lake City, UT 1-801-972-5000
Charleston, SC 1-843-767-3005
www.varexImaging.com

Manufactured by Varex Imaging Corporation

Specifications subject to change without notice.

# Appendix B Error Codes

Table 57: Error code list

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 0 | NO_FAULT | Success. No error occurred | N/A | N/A |
| 1 | ACQUISITION_TERMINATED | Not an error | Acquisition has terminated normally (or user clicked Cancel) | N/A |
| 2 | XRAY_TEMPERATURE_FAULT | Temperature fault was detected at x-ray tube | X-ray tube overheated | Allow time for x-ray tube to cool down |
| 3 | XRAY_ARC_FAULT | An x-ray tube arc was detected | An arc occurred in x-ray tube or the HV Generator | Contact Technical Support for service |
| 4 | XRAY_HIGH_MA_FAULT | Monoblock high mA condition detected | Beam current exceeds set value by more than 5% for 100 ms or more | Contact Technical Support for service |
| 5 | XRAY_LOW_MA_FAULT | Monoblock low mA condition detected | Beam current is less than 95% of set value for 100 ms or more | Contact Technical Support for service |
| 6 | XRAY_LOW_KV_FAULT | Monoblock low kV condition detected | X-ray tube voltage is less than 95% of set value for 100 ms or more | Contact Technical Support for service |
| 7 | XRAY_HIGH_KV_FAULT | Monoblock high kV condition detected | X-ray tube voltage exceeds set value by more than 5% for 100 ms or more | Contact Technical Support for service |
| 8 | XRAY_WATCHDOG_FAULT | Monoblock watchdog timeout condition detected | Watchdog timer was not refreshed at a high enough rate | Contact Technical Support for service |

[3] There may be multiple causes that require a trained service technician to conduct an analysis and repair.

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 9 | XRAY_POWER_LIMIT_FAULT | [Placeholder for power limit fault] | N/A | N/A |
| 10 | XRAY_INTERLOCK_FAULT | Interlock was de-asserted to generator | E-STOP was activated | Deactivate E-STOP |
| 11 | XRAY_BELOW_THRESHOLD | Reference detector values are reading less than threshold value | Indicates x-rays have been turned off (due to errors 2-10 above) | Contact Technical Support for service |
| 12 | CANNOT_WRITE_TRANSMIT_QUEUE | When Data Acquisition System (DAS) views are acquired to disk during a scan, they are sent to a Transmit Queue from which they are sent to Recon computer over socket interface (ethernet); if write of view to Transmit Queue fails, this error is flagged | Likely causes of failing this write is if downstream data path is not functioning correctly (ethernet unplugged, scanner app not connected, etc) during a scan, and transmit queue is full and won't allow any more writes | Contact Technical Support for service |
| 13 | INCORRECT_ROTATE_SPEED | Indicates disk detected a rotation speed error | Happens when a problem with tick fence, or has incorrect calibration parameters | Contact Technical Support for service |
| 14 | POSITION_ERROR | Centipedes did not move specified distance | Could be caused by incorrect calibration parameters, a centipede jam, an uneven floor | Contact Technical Support for service |
| 15 | VELOCITY_ERROR | Centipede velocity not as expected during a Helical scan | Could be caused by incorrect calibration parameters, a centipede jam, an uneven floor | Contact Technical Support for service |

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 16 | OFFSET_CAL_FAULT | Offset calibration (done typically at beginning of every scan) has failed | Due to bad view data from Disk Computer Assembly (DCA) | Contact Technical Support for service |
| 17 | AIR_CAL_FAULT | Air calibration failed | An object was in the bore | Remove obstacle and perform another air calibration |
| 18 | INVALID_PROTOCOL | [Placeholder for invalid protocol error] | N/A | N/A |
| 19 | INVALID_COMMAND | [Placeholder for invalid command error] | N/A | N/A |
| 20 | INVALID_COMMAND_SEQUENCE | An invalid command sequence was detected | Can happen when Disk Computer Assembly (DCA) receives Start Acq command from Scanner Control app, but is not in a READY mode. | Contact Technical Support for service |
| 21 | INVALID_PARAMETERS | [Placeholder for invalid parameter error] | N/A | N/A |
| 22 | XRAY_COMMUNICATION_ERROR | Disk has detected a problem with serial port connection to monoblock | HV generator fault, Disk Control Assembly (DCA) fault | Contact Technical Support for service |
| 23 | DCB_COMMUNICATION_ERROR | [Placeholder for DCB communication error] | N/A | N/A |
| 24 | SUBSYTEM_COMMUNICATION_ERROR | [Placeholder for subsystem communication error] | N/A | N/A |
| 25 | RECON_ERROR | Requested protocol has been rejected by Reconstruction app | Recon computer error | Contact Technical Support for service |

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 26 | INSUFFICIENT_TUBE_CAPACITY | When preparing for a scan, this error is flagged if tube capacity is lower than anticipated threshold value for that scan | X-ray tube too hot to perform prescribed procedure | Tube needs time to cool down before scan can be run |
| 27 | INSUFFICIENT_BATTERY_CAPACITY | When preparing for a scan, this error is flagged if battery capacity is lower than anticipated threshold value for that scan | Battery was not recharged per instructions | Battery needs to be recharged to minimum level by connecting it to AC outlet before scan can be run |
| 28 | ESTOP_INTERLOCK | ESTOP button has been activated | User depressed ESTOP button | After respective issue has been resolved accordingly, user can deactivate E-STOP |
| 29 | CENTIPEDE_INTERLOCK | Centipedes are not engaged | System is not positioned in Scan mode | Lower system using Up/Down Rocker-Switch-Lift to position it in Scan mode |
| 30 | SAFETY_INTERLOCK | [Placeholder for safety interlock error] | N/A | N/A |
| 31 | DAS_DATA_ERROR | Disk Computer Assembly (DCA) has detected a Data Acquisition System (DAS) data error from DCB device | Defective converter board assembly | Contact Technical Support for service |
| 32 | DAS_CALIBRATION_ERROR | Tick calibration data is invalid | Disk Computer Assembly (DCA) has detected a Data Acquisition System (DAS) data error from Disk Control Board (DCB) | Contact Technical Support for service |

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 33 | HOME_TICK_ERROR | Disk has detected a home tick error from DCB device (no home pulse detected) | Typically this is a dirty/dusty tick fence assembly or defective tick board assembly | Contact Technical Support for service |
| 34 | TICK_ERROR | Disk has detected a tick error from DCB device (incorrect number of ticks counted) | Typically this is a dirty/dusty tick fence assembly or defective tick board assembly | Contact Technical Support for service |
| 35 | ROTATE_CONTROLLER_ERROR | Rotate drive detected an error while performing homing operation | Base computer assembly interface with rotate motor controller has a fault | Contact Technical Support for service |
| 36 | AIR_CAL_WARNING | Result of air calibration was out of tolerance | When requesting a new scan, currently loaded air cal tables were generated from a previously failed air cal; requested scan will be allowed to continue, but images may have artifacts; a popup window to user is presented upon this condition | Contact Technical Support for service |
| 37 | RECON_BUSY | [Placeholder for recon busy error] | N/A | N/A |
| 38 | INSUFFICIENT_DISK_SPACE | Not enough disk space to store information on the Recon computer | Hard drive on Recon computer does not have enough space for image data | Contact Technical Support for service |

| Error-code number | Fault description | Explanation | Cause[3] | Resolution |
|---|---|---|---|---|
| 39 | XBT_Error (Disk HW related) | X-rays were terminated due to a software anomaly | Scans that result in x-ray Below Threshold (XBT) can result in missing images due to system being allowed to complete scan | Contact Technical Support for service |

# Appendix C Revision History

Table 58: Revision history

| Revision | ECO number and effective date | Author | Changes |
|---|---|---|---|
| 00 | ECO-000139 2006/03/17 | Mike Duffy | Release System BOM |
| 01 | ECO-000306 2006/07/26 | Matt Len | Releasing revision 01 of the user manual. |
| 02 | ECO-000311 2006/08/09 | Matt Len | Releasing revision 02 of the user manual. |
| 03 | ECO-000337 2006/08/22 | Matt Len | Release service manual and update user manual. |
| 04 | ECO-000399 2006/11/08 | Matt Len | Updating user, service and installation manuals for Australian certification. |
| 05 | ECO-000414 2006/12/11 | Matt Len | Releasing system version 04.00 and supporting documentation. |
| 06 | ECO-000495 2007/05/29 | Mike Duffy | UPDATE SYS RADIATION DOCS AND USER MANUAL |
| 07 | ECO-000759 2008/07/24 | Matt Len | Releasing updated NL3000 user manual. |
| 08 | ECO-000784 2008/09/09 | Matt Len | Updating manual to include NL3000 and NL3100. |
| 09 | ECO-000790 2008/09/16 | Matt Len | Releasing system version 05.00 software. |
| 10 | ECO-000817 2008/12/04 | Stephanie Fillion | RELEASING SYSTEM VERSION 05.01 SOFTWARE |
| 11 | ECO-000864 2009/02/04 | Kacey Oreal | RELEASING SYSTEM VERSION 05.02 SOFTWARE |
| 12 | ECO-000921 2009/04/04 | Don Fickett | USER MANUAL CERETOM |
| 13 | ECO-001103 2009/12/23 | Stephanie Fillion | UPDATING NL3XXX USER MANUAL |
| 14 | ECO-001164 2010/08/03 | David O'Leary | Release V05.05 CereTom/OTOscan SW |
| 15 | ECO-001405 2011/05/17 | Keith Almeida | Release V05.06 CereTom/OTOscan SW |

| Revision | ECO number and effective date | Author | Changes |
|---|---|---|---|
| 16 | ECO-001686<br>2012/04/12 | Christofer Krueger/Matt Dickman | Update to current user practice. Added formatting for all subject headers, figures, and tables. Added Chapter 13 for accessories, Appendix A for the SDS, and Revision History Table |
| 17 | ECO-001889<br>2012/12/05 | Christofer Krueger | Update to meet IEC 60601-1 3rd edition and HC requirements. Added Warnings/Cautions on contraindication, patient support stability, cleaning, PM, and calibration. New Configuration Manager, Main and Options Screen shots for v5.10. Product Catalog references and Battery Parameters were also added. |
| 18 | ECO-002008<br>2013/07/30 | Christofer Krueger | Added Caution modement Automatic Exposure Control (AEC) is not offered on this system" to page 17, Section 9. |
| 19 | ECO-002012<br>2013/09/05 | Keith Almeida | Added additional 3rd edition requirements from 60601-2-44 (warnings, cautions, load factors, focal spot, filtration, CTDI100 measurements, scatter measurements, vertical plane measurements). Updates to meet IEC 60825-1 also added. |
| 20 | ECO-002167<br>2014/05/15 | Keith Almeida | Updated to reflect changes made to software release V06.01 CereTom/OTOScan |
| 21 | ECO-002500<br>2015/10/09 | Keith Almeida | Updated to reflect: changes made to software release V06.02 CereTom/OTOScan (Automatic Exposure Control); Samsung additions; updates from Regulatory group |
| 22 | ECO-002746<br>2015/12/11 | William Dalphin | Updated to reflect: changes made to software release V06.02.01 CereTom/OTOScan; updates from Regulatory and Service groups |
| 23 | ECO-002802<br>2016/03/01 | Ninad Gujar | Updated to reflect the correct storage temperature. |
| 24 | ECO-002984<br>2016/08/23 | Courtney Poto | Incorporated MPR Slab. |
| 25 | ECO-003255<br>2017/04/13 | Cynthia Crow | Applied new template/styles, step-by-step procedures, and workflow for improved audience experience. |

| Revision | ECO number and effective date | Author | Changes |
|---|---|---|---|
| | | | OTOScan removed from the manual; OTOScan information will (moving forward) be documented in its own manual. |
| 25 | ECO-003317<br>2017/05/19 | Cynthia Crow | The latest release of Revision 25 (under ECO-003255) contains the changes as described above; however, ECO-003255 was never distributed. This submission (ECO-003317) includes two notes added to Revision 25 that address registrar concerns: external interlocks and the method of testing for dose-in-air results. |
| 26 | ECO-003616<br>2017/09/21 | Cynthia Crow | CereTom changed to CereTom Elite |
| 27 | ECO-003762<br>2017/12/20 | Christofer Krueger | Modified the Intended use to match revised 510(k) and info on Metal Artifact Reduction – update figures 359-360 |
| 28 | ECO-003794<br>2018/01/12 | Christofer Krueger | Table 54, row 20: From 50 C/5 C (122 F/41 F) to<br>40 C/5 C (104 F/41 F). Remove MFG symbol from table 55. Move I'National reps and Itended Use sections to the preface. |
| 29 | ECO-004219<br>2018/11/01 | Christofer Krueger | Adding a note abve Table 11 on EMC Characterisitics. Modified Table 12 to detail the correct standard parameters.<br>Changed title to include "NL3000 CereTom". Added "CereTom" to the "About this Manual" section |
| 30 | ECO-004754<br>2020/03/03 | Christofer Krueger | Added details to comply with IEC 60825-1, 3rd ed. Table 2 and Laser Safety section of Chapter 1. EU MDR updates: Added Serious Injury, Electronic Copy and Clinical Benefit notes to the preface |
| 31 | ECO-004919<br>2020/06/17 | Christofer Krueger | Add FDA Laser warning statement and updated the marking plate |
| 32 | ECO-005181<br>2021/01/12 | Gina Cunsolo | Added manufacturers symbol to page 3. Removed all reference of CereTom. Updated Symbols Table 2 to update the "Refer to instructions.." to the booklet symbol. Updated Symbols Table 2 and 55 to add all symbols currently on system label. |
| | | | |

| Revision | ECO number and effective date | Author | Changes |
|---|---|---|---|
| 33 | ECO-006215<br>2022/06/23 | Gina Cunsolo | Addition of new CE Mark; update to Brazil representatibe; correction of EU AR; update to electronic user manual information; updated figure 3 and removed previous marking plate label. |
| 34 | ECO-007246<br>2024/08/06 | Keith A. Kaser | Added Safety Strap information to Chapter 13 |
| 35 | ECO-007461<br>2025/03/12 | Keith A. Kaser | Added additional contact information related to adverse events to resolve Bug# 6322<br>Added Warning in Safety Information section related to decommissiong system to remove health software to resolve Bug# 6201 |