Discovery™ CT750 HD

Product Description

Discovery CT750 HD offers a new system that puts you on the leading edge of CT and positions you at the forefront of diagnostic care.

With technology that re-imagines tomographic clarity and safety, the Discovery CT750 HD enables world’s first High Definition CT.

Discovery CT750 HD achieves this technological leap forward through a revolutionary scintillator material.

The Discovery CT750 HD with its Gemstone™ imaging chain bring clinicians and referring Physicians up to 47% improvement in image quality, up to 50% dose reduction across the entire body and exceptional Spectral Imaging capabilities.
The leading edge of CT clarity

Introduction

**Discovery CT750 HD** is the first head and whole body high definition imaging CT scanner. Major sub-systems of the scanner have been re-engineered to improve image quality enabling the visualization of greater anatomical detail and to provide the capability of reducing the radiation dose required for diagnostic studies. Discovery CT750 HD achieves this technological leap forward through a exceptional re-design of the imaging chain. The Discovery CT750 HD scanner delivers up to 33% improvement in spatial resolution for body scan modes and up to 47% improvement in spatial resolution for cardiac scan modes, allowing the scanner to accurately quantify stenosis in coronary and vascular vessels.

Equally important, the Discovery CT750 HD offers a revolutionary advanced reconstruction algorithm that requires very low mA settings, resulting in dramatically reduced dose by up to 50% compared to predecessor CT systems. The Discovery CT750 HD is optionally capable of other advanced application techniques such as dynamic and spectral imaging. Both these advanced imaging techniques offer potential to enhance cardiovascular and vascular, body perfusion, brain, lung and liver imaging. Gemstone Spectral Imaging provides image contrast optimization, material decomposition, and monochromatic spectral images with up to 101 individual selectable energy levels. Gemstone Spectral Imaging has a 0.5 msec temporal resolution with near-perfect registration between the two data sets taken at different energy levels. The Discovery CT750HD’s Dynamic Imaging can cover anatomical volumes of up to 312.5mm for 4D-CTA exams, more than enough coverage for any internal organ in the human body. Built on the award winning LightSpeed platform with balanced system design, Discovery CT750 HD is a breakthrough in CT scanner coverage, speed, resolution, dose management, and clinical performance.

The Discovery CT750 HD system includes: gantry, table, operator console with peripherals, power distribution unit and an assortment of accessories.

Indications for use

The Discovery CT750 HD Computed Tomography X-ray system is intended to produce cross-sectional images of the body by computer reconstruction of x-ray transmission data taken at different angles and planes, including Axial, Cine, Helical (Volumetric), Cardiac, Spectral, and Gated acquisitions for all ages. These images may be obtained with or without contrast. This device may include signal analysis and display equipment, patient and equipment supports, components and accessories.

This device may include data and image processing to produce images in a variety of trans-axial and reformatted planes. Further the images can be post processed to produce additional imaging planes or analysis results in CT.

The Discovery CT750 HD CT Scanner System is indicated for head, whole body, cardiac and vascular X-ray Computed Tomography applications.

The device output is a valuable medical tool for the diagnosis of disease, trauma, or abnormality and for planning, guiding, and monitoring therapy.

If the Spectral Imaging option is included on the system, the system can acquire CT images using different kV levels of the same anatomical region of a patient in a single rotation from a single source. The differences in the energy dependence of the attenuation coefficient of the different materials provide information about the chemical composition of body materials. This approach enables images to be generated at energies selected from the available spectrum to visualize and analyze information about anatomical and pathological structures.

Primary Benefits

**See more**

**Higher Spatial Resolution:**

The Discovery CT750 HD Scanner delivers up to 33% improvement in spatial resolution for body scan modes and up to 47% improvement in spatial resolution for cardiac scan modes relative to previous GE Products. The HD Scanner demonstrates best-in-class spatial resolution of 0.23mm for scanning modes up to 2m in coverage. The improvement in spatial resolution provides the capability to accurately quantify stenosis in coronary and vascular vessels.

**Adaptive Statistical Iterative Reconstruction:**

The Discovery CT750 HD Scanner includes a new reconstruction technique Adaptive Statistical Iterative Reconstruction (ASIR) that enables reduction in image noise and improvement in contrast detectability (LCD) and image quality. The ASIR reconstruction algorithm can be used to reduce the image noise in diagnostic images and thereby reduce the dose required for routine imaging. The Discovery CT750 HD Scanner delivers up to 40% improvement in LCD and improves the image quality at 50% lower dose.

**Know more**

**Gemstone Spectral Imaging**: Gemstone Spectral Imaging (GSI) is a novel dual energy application that uses rapid kV switching to acquire the dual energy samples almost simultaneously to generate material density data that can be used for the separation of materials and derivation of monochromatic spectral images. GSI uses a single source and the new GE patented Gemstone detector to derive 128 slices per rotation for the identification of materials such as calcium, iodine and water. The feature leverages up to 1968 views per rotation and
acquires the data by alternating two kV energies at a rate of 0.5 msec with sub-millimeter Z-Axis registration – the temporal registration is over 165 times faster than previous dual energy technology. The advantage of the single source architecture is the ability to generate material decomposition images over the full 50cm field of view. GSI provides up to 50% improvement in beamhardening artifact due to bone and metal and other high contrast materials such as iodine. GSI imaging has the ability to detect very small concentrations of iodine, up to 0.5% in density accurately and also delivers non-contrast like images by subtracting the detected iodine from the images.

**Volume Helical Shuttle:** Volume Helical Shuttle (VHS) is a dynamic imaging technique that leverages the scan-control architecture of the GE Discovery CT750 HD scanner. VHS has the ability to acquire data continuously by moving the table between two locations helically. The feature has the capability to acquire 312.5mm of data (equivalent to 500 slices) enabling whole-organ perfusion and vascular assessment capability.

**Less dose**

| Non-HDCT, routine dose | HDCT, 50% reduced dose, ASIR |

**SnapShot™ Pulse:** 5-Beat diagnostic cardiac scan with significantly less dose (up to 83% less) and improved image quality utilizing prospective gating. 40mm of high-resolution coverage and table control to complete the scan via step-and-shoot mode.

**5-Beat Cardiac™:** The Discovery CT750 HD Scanner carries forward the capability to perform 5-Beat Cardiac Acquisitions, with the ability to acquire the data with improved spatial resolution and image quality.

**Triple RuleOut™:** The Discovery CT750 HD Scanner carries forward the ability to complete ECG-gated studies of the chest in a single breathhold, in order to assist in the diagnosis of coronary artery disease, aortic dissection, and pulmonary embolism.

**Stroke WorkUp:** 40 mm coverage in a single rotation for evaluation of cerebral perfusion defects. **VolumeShuttle™:** The Discovery CT750 HD Scanner carries forward the Volume Shuttle acquisition mode that delivers up to 80mm coverage for neuro perfusion studies including angiographic information while lowering the dose up to 24% relative to a Cine acquisition.

The **Gemstone** Detector enables high definition CT imaging with a brand new, extremely fast scintillator. The scintillator material is an isotropic ceramic with cubic structure – highly uniform and translucent (Cubic structures offer better transparency to that of Gadolinium Oxysulfide (GOS) which has a hexagonal lattice). The scintillator material is built to deliver consistent quality, is chemically stable and ease of manufacturability. Detector properties are closely tied to Image Quality and the Gemstone Detector has the following advantages:

- Fast primary speed: The scintillator is over 100 times faster than scintillators available on other competitive products.
- Exceptional afterglow performance: The afterglow is 4 times lower than scintillators available on competitive products.

The relative speed of the scintillator enables High Definition technologies such as High Resolution imaging capability, with less noise and the ability to perform Gemstone Spectral Imaging:

- 98% detection efficiency (@ 120kVp).
- Radiation Damage is 20 times less than the Radiation Damage of the scintillator used by the detectors in competitive systems (Gadolinium Oxysulfide).
Volara™ HD Digital Data Acquisition System (DAS):
Discovery CT750 HD scanner enhances the Volara DAS technology that enables true high definition acquisitions with an 8-to-1 miniaturization delivering dramatic reduction in electronic noise reducing artifacts and improving image quality using lower dose. Image quality is further enhanced by the Volara HD DAS by its ability to image fast sampling rates. The HD DAS uses up to 2,496 views per rotation for improvement in spatial resolution and improved image quality across the entire field of view, which is over 2.5 times greater than previous products.

The Power to Perform: Performix™ HD X-Ray Tube enables improved spatial resolution via dynamic in-plane focal spot deflection and independent control of the focal spot size in both X and Z-axes optimizing the focal spot to deliver consistent image quality across the full dynamic range. The X-ray tube’s exceptional Smart Cathode technology delivers increased power capability for the small focal spot along with 100kW/835mA peak power performance for image quality at fast rotation speeds and for larger patients.

HD Reconstruction breaks through existing limits on speed, image quality and flexibility to provide an optimized volumetric workflow solution from acquisition to final report. At the core of Discovery CT750 HD, is a new reconstruction engine and an operator’s console that delivers up to 16 frames per second reconstruction at full resolution.

- Direct MPR enables automated protocol-driven axial, sagittal, and coronal reformats. Reformatted images may be routed to multiple network destinations, eliminating the need to transfer and store all thin-slice data.

Full 3D Volumetric Reconstruction. True cone beam reconstruction combined with true 64x0.625mm acquisition reduces artifacts from z-interpolation.

44 msec cardiac temporal resolution with 0.35 second rotation and SnapShot scan algorithm. Discovery CT750 HD not only offers fast acquisition speed, it builds on GE’s exclusive variable speed technology that has now been expanded for cardiovascular imaging to include 0.35, 0.37, 0.40, 0.42, 0.45, 0.47 and 0.50 second scans – so you have the power to customize rotation speed to your patients’ heart rates.

GE Healthcare’s OptiDose™ philosophy is extended with Discovery CT750 HD to provide additional dose reduction capabilities:

- 40mm Volume CT coverage reduces over beaming percentage by a factor of four compared to 16-slice systems.
- Bowtie filters to optimize imaging of the head and body in pediatric, small, medium, and large patients.
- V-Res Backlit Diode technology has 100% active area, and Volara HD reduces electronic noise for improved low dose performance.
- Cardiac image processing filters reduce noise providing substantial dose reduction while maintaining image quality and spatial resolution.

**VT Patient Positioning System** sets the standard for comfort, function and form. With its award winning Industrial Design, the VT (Volume CT Table) is designed for the needs of today and tomorrow:

- 500lb (227kg) patient weight capacity, with full cradle extension
- Two configurations, with up to 2000* mm scannable range (or 1700mm), for longer runoff studies, flexible patient positioning, and easy room siting.
- Fast motion with smooth acceleration and deceleration as demanded by next generation Volume CT scanners.
- True vertical motion, without translation in z, improves patient positioning and productivity for biopsies.
- Two LCD color monitors for operator console

The Discovery CT750 HD delivers this level of performance through a balanced design that focuses on image quality, dose optimization, coverage, spatial resolution, temporal resolution, and scan speed.

**Family Main Features**

- Discovery CT750 HD leverages volume CT capabilities while extending the following features of today’s GE Healthcare’s scanners.

  - Exceptional Vascular & Cardiac Image Quality: Small lesion and small vessel assessment – pancreas, liver or Circle of Willis, renal arteries, coronary arteries and peripheral vascular arteries.

- 0.35mm microVoxel™ imaging improves 3D and reformatted 2D resolution through the optimum choice of sub-millimeter slice thickness and reconstructed voxel size.

- Routine use of sub-millimeter slices without image noise or coverage compromise.

- GE Healthcare’s OptiDose philosophy provides the following built-in dose reduction capabilities:
  - 3D Dose Modulation utilizing SmartmA™ and AutomA. Having this kind of volumetric knowledge before you scan allows you to easily personalize dose protocols and minimize dose for every patient – large and small. During the scan, real-time, 3D dose modulation helps deliver consistent image quality because it automatically accounts for the changing dimensions of your patient’s anatomy.
  - ECG Dose Modulation: For cardiac applications, prospective ECG dose modulation automatically adjusts the mA to minimize the patient's exposure to x-rays – reducing dose during systolic phases of the cardiac cycle. This provides clear images and allows you to reduce dose primarily in the systolic phases of the cardiac cycle – yet gives you enough power to obtain quality images for functional analysis.
- **Cardiac Image Filters** provides users the capability to filter angio graphic data using specially designed and optimized 3D filters to achieve dose savings while maintaining image quality. May be prospectively applied with Application Auto-Launch.

- **Compact system design** of the Discovery CT750 HD allows for installation in a space as small as 24.3m² (261 square feet).

### Options:

- **SmartScore Pro Complete** provides ECG-gated hardware for both prospective and retrospective gating along with software on the Advantage Workstation for coronary artery calcium scoring.

- **Cardiac acquisition with Segment, Burst and Burst Plus** enables you to scan patients with heart rates from 30 to 200 BPM and provide for temporal resolution up to 44 msec.

- **SnapShot Imaging** provides software and hardware to perform retrospective helical ECG-gated reconstructions of the heart with three SnapShot imaging modes.

  - **SnapShot Segment** is a single sector protocol using information from one heart cycle to generate an image with temporal resolution of 175 to 200msec.
  
  - **SnapShot Burst** is a multi-sector protocol using up to two sectors from two different heart cycles to produce an image with temporal resolution of 88 to 100msec.

- **SnapShot Burst Plus** is a multi-sector protocol using up to four sectors of data from four different heart cycles to produce images with temporal resolution of 44 to 50msec.

- **SnapShot Pulse** is a prospective axial ECG-gated cardiac acquisition protocol that utilizes 40mm of high-resolution coverage and real-time control to complete the scan via step-and-shoot mode with significantly less dose (up to 83% less) with improved image quality and temporal resolution of 175msec.

- **Advanced Software Applications** (AW only): Autobone Removal, Advanced Lung Analysis, CT Colonography, Advanced Vessel Analysis, Brain and Body Perfusion, Cardiac Analysis, Cardiac Function, Cardiac Electrophysiology, Coronary Calcium Scoring, AutoBone, DentaScan, Advantage 4D CT, Bone Mineral Densitometry, and Advantage Sim.

- **ECG Waveform on the Console** allows users to visualize the ECG waveform directly on the CT scanner console during the scan. The waveform data can be viewed to determine where prospectively created images are located with respect to the heart cycle to better understand and avoid motion artifacts like blurring or mis-registration.

- **ECG Viewer/R-Peak Editor** provides users the capability to view and retrospectively adjust triggers for cardiac cycles based on ECG waveform displayed on the console.
Interactive CT embodies a variety of design choices all striving to enhance operator and department productivity. A truly interactive CT system will:

- Provide a user interface beyond “intuitive” to become purely “natural” - from the screens to the console hardware itself;
- Allow users to review cases side-by-side, with minimal interference;
- Supply a truly multi-tasking environment where even advanced image processing can take place quickly and simultaneously with other processes underway;
- Operate with a very high degree of automation, yet allow patient-specific changes to be easily made, with virtually no restrictions;
- Be as self-teaching as possible, and have on-line access to tutorials as needed.

One key element of this design is to combine some of the best features from several product families into one state-of-the-art CT system. For example, the Discovery CT750 HD combines:

- SmartTools productivity software to automate every step of the examination, critical for ensuring the highest productivity and throughput possible with the Discovery CT750HD;
- Large screen interface for controlling scan acquisition easily, with virtually everything at a single glance;
- Excellent simultaneity and multi-tasking performance;
- Completely protocol-driven scan control with a exceptional reduction in number of screens;
- Highly flexible editing tools that allow easy tailoring of the exam to the patient;
- Large, 1024 color display;
- Leading edge, real-time image processing (MPR, MPVR, Volume Viewer Plus*);

In summary, primary benefits of Interactive CT include:

- A natural scan control user interface
  - Reduction in the number of screens; only 2 screens to set up first scan and 1 screen for real-time monitoring while scanning;
  - Easier and more flexible protocols
  - Flexible and intuitive graphic prescription process with a 1024 Localizer;
  - View/Edit Wizard™ intuitively adjusts dependent parameters automatically in response to operator-initiated changes and highlights them for quick review; also alerts the operator to incompatible dependencies requiring operator intervention;
  - DynaPlan Plus™ full screen display illustrates scan status pictorially, with real-time feedback.

- Large color screen
  - Extensive use of picture icons and color cues enhance ease of use;
  - Large on-screen controls and attractive color palette provide comfortable viewing over extended periods.

- Enhanced multi-tasking allows operators to review more than one exam simultaneously, independently - even with AutoView and AutoFilm on
  - BrightBox™ dedicated controls for image next, prior, manual paging and trackball W/L helps make two person image review practical;
  - Up to four 512x512 images from four different exams can be viewed on a large 1024 color display.

- SmartmA User Interface - automatically optimizes mA to maintain constant image noise when collimation/detector configuration, scan mode, scan rotation speed, table speed, or image thickness changes. It takes the guesswork out of setting scan technique when changing parameters (note: user must select initial Noise Index as well as minimum and maximum mA settings). Noise Index enable image quality reproducibility from one patient to another and from one user to another.

- Protocol Pro™ protocol manager - provides operator control of automated features (like AutoFilm, AutoStore, and AutoTransfer) on per exam, series or image basis.

- Patient demographics and exam protocols can be pre-programmed in advance of patient arrival through the Schedule Patient feature. Common inputs for new patient include: physician radiologist, technologist, exam description and contrast type (oral and iv).

- A preprogrammed selection of AutoView and Image Review Layouts allow simple customization of the image presentation to match the anatomical area of interest - without the complexity of free-form “windows”.


- Background filming allows use of the full screen for AutoView and image review/processing without interruption when auto or batch filming. Special “one-touch” controls provide on-screen viewing of camera progress during AutoFilm without disrupting other image processes in progress.

- ProView™ visualization algorithms available to enhance anatomical structures without additional image reconstruction time.

- Application Auto-Launch for Neuro 3D Filters provides the ability to prescribe the automatic application of the prescribed filter prior to the scan acquisition.

- Operator console convenient to place in suite.
  - Computer, image processor and image reconstruction hardware completely integrated in base of console - no separate computer cabinet to site;
  - Split console table top allows unrestricted patient viewing while still supporting 2 large color LCD monitors;
  - Front and back work surfaces can be set during installation within a range of vertical heights that help accommodate a variety of siting requirements - especially surrounding the height of the console relative to the window into the scanning suite.

Direct network connection means a multi-suite Ethernet card is not required for a gateway out of the suite - saving costs and simplifying installation.
Scan Modes

The Discovery CT750 HD system can perform virtually any clinical application due to its wide variety of scan modes.

**High Definition Scan Modes:**
- Cardiac Helical and Cine (for cardiac)
- Axial Mode, 32x0.625 Aperture
- Helical, 64x0.625 - Pitch 0.9:1
- Helical, 32x0.625 - Pitch 0.5:1

**Helical:**
- Continuous 360° scanning with table incrementation and no interscan delay.
- Scans can be acquired in a wide variety of speeds.

**Axial:**
- Up to 40 mm of contiguous axial coverage acquired simultaneously with each 360° rotation, with the time between scans set by the user selected interscan delay (ISD) or intergroup delay (IGD).
- Scans may be easily clustered in groups to allow multiple scans in a single breath hold.
- Minimum scan-to-scan cycle time of only 1.0 second with table moves of ≤ 10 mm (any scan time).

**Cine:**
- Up to 40 mm of contiguous axial coverage acquired simultaneously with each 360° rotation.
- Minimum scan-to-scan cycle time of only 1.0 second with table moves of ≤ 10 mm.
- Half-scan imaging and segmented reconstruction is supported with acquisitions times of 0.65 times that of the scan speed.

**Scout™:**
- Single radiographic plane for scan localization and graphical prescription of prospective reconstruction.
- Extended range matches helical scannable range.

Typical scan protocols include (with VT2000 Table):

<table>
<thead>
<tr>
<th>Coverage (mm)</th>
<th>Chest/Ab/Pelvis</th>
<th>Peripheral Run-Off</th>
<th>High-Res Chest</th>
<th>ECG Gated Cardiac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotation (s)</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.35</td>
</tr>
<tr>
<td>Mode (mm)</td>
<td>64 x 0.625</td>
<td>64 x 0.625</td>
<td>64 x 0.625</td>
<td>64 x 0.625</td>
</tr>
<tr>
<td>Pitch</td>
<td>1.375:1</td>
<td>1.375:1</td>
<td>1.375:1</td>
<td>0.22:1</td>
</tr>
<tr>
<td>mA</td>
<td>525</td>
<td>700</td>
<td>550</td>
<td>571</td>
</tr>
<tr>
<td>mAs</td>
<td>210</td>
<td>280</td>
<td>220</td>
<td>200</td>
</tr>
<tr>
<td>Speed (mm/s)</td>
<td>137.5</td>
<td>110</td>
<td>137.5</td>
<td>25.1</td>
</tr>
<tr>
<td>Scan Time (s)</td>
<td>4.36</td>
<td>12.8</td>
<td>1.45</td>
<td>4.8</td>
</tr>
</tbody>
</table>

The net result is that in many cases, helical scans are up to 4 times faster than 16-slice CT systems. With the Discovery CT750HD, users can routinely use a 0.40 second, or 0.35 second scan speed for cardiac, and nominal 0.516:1, 0.984:1, and 1.375:1 helical pitches. This added performance, at the same image quality, may allow you to perform better thin-slice CT angiography exams, use thinner slices for most exams, and perform longer helical exams without tube cooling delays.

**Biopsy Mode:**
Simplified prescription for single or multiple axial scans around an arbitrary table position aids biopsy and interventional studies.

**Helical Scans**

**Helical Multi-Slice Modes**

Simplified scan prescriptions and easy-to-use default protocols make the Discovery CT750 HD fast and efficient in patient set up. Multi-slice acquisitions and short intergroup delays significantly reduce potential mis-registration between scans by increasing the number of scans possible in a patient breath hold.

Helical protocols are almost identical to “classical” axial scan protocols. At the beginning of a study, the operator selects the type of exam with the anatomical programmer, and indicates the desired scan range - either manually, or from a Scout.

After completing the prescribed exam, the system remains ready to continue with additional helical scans or a set of axial scans.

The operator may reconstruct helical scans prospectively with up to 90% overlap, and retrospectively, at any arbitrary table location in 0.1 mm increments.
Prospective Multiple-Thickness Reconstruction

For all helical scan modes, the operator can choose to reconstruct images prospectively in any of the defined nominal slice thicknesses. In addition to the initial reconstructed slice thickness, the operator has the option to prospectively specify additional images to be reconstructed from a single raw data set. These images can be reconstructed at any of the defined nominal slice thicknesses available for a given table speed and scan mode.

This effectively facilitates later, more detailed image analysis without additional patient scans and subsequent dose and image registration concerns.

<table>
<thead>
<tr>
<th>Helical Pitch</th>
<th>Permitted SFOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.531</td>
<td>All Head and Body</td>
</tr>
<tr>
<td>0.969</td>
<td>All Head and Body</td>
</tr>
<tr>
<td>1.375</td>
<td>Body Only</td>
</tr>
<tr>
<td>0.516</td>
<td>All Head and Body</td>
</tr>
<tr>
<td>0.984</td>
<td>All Head and Body</td>
</tr>
<tr>
<td>1.375</td>
<td>Body Only</td>
</tr>
</tbody>
</table>

Helical Scan Parameters

Scan Speeds: Full 360° rotational scans in 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0 seconds; Cardiac application speeds: 0.35, 0.37, 0.40, 0.42, 0.45, 0.47, 0.50

Helical Pitch (nominal): 0.516:1, 0.984:1, 1.375:1

Cardiac Pitch: 0.16:1 to 0.24:1 for 0.35 second gantry speed. Up to 0.325:1 for slower gantry speeds.

Scan Technique:
- kVp: 80, 100, 120, 140
- mA: 10 to 835, 5mA increments
- Power: 0.8 to 100kW
- Focal Spot Selection @140kVp:
  - Small spot for up to 68.6 kW
  - Large spot for greater than 68.6 kW

Single Acquisition: 60-second scan maximum.

Multiple Acquisition Maximum Scan Time: Multiple scans may be acquired in one series to produce up to 3,000 contiguous helical images. Up to 3,000 rotations helical coverage is possible in multiple series.

Minimum Inter-Group Delay (IGD): 5 seconds between adjacent helical scans

Maximum Scan Fields of View:
- 32cm for pediatric head
- 32cm for pediatric body
- 32cm for head, small
- 32cm for head
- 32cm for body, small
- 50cm for body, medium & large
- 32cm for cardiac – small
- 36cm for cardiac – medium
- 50cm for cardiac – large

Helical Image Reconstruction

Reconstruction Algorithms: Soft, Standard, Detail, Chest, Bone, BonePlus, Lung, and Edge

High Resolution Reconstruction Algorithms: HD Standard, HD Detail, HD Bone, HD Bone Plus, HD Edge

Cardiac Reconstruction Algorithms: Soft, Standard, Lung, Detail, Bone

Cardiac High Resolution Reconstruction Algorithms: HD Standard, HD Standard +, HD Detail, HD Detail +, HD Edge

Reconstruction Matrix: 512 × 512

Display Matrix: 1024 × 1024

Display FOV: Freely variable center/off-center, prospective/retrospective target selection.

CT Number Scale: -1024 to 3072 (normal range) and -31743 to 31743 (extended range)

Helical Reconstruction Times:
- Reconstruction time as fast as 16 images per second

Minimum DFOV: 5 cm

Minimum Pixel Size: 0.1875 mm

Helical Scan Enhancements

Full simultaneity allows complete image display, processing and analysis, as well as image archival and filming, concurrent with scanning and reconstruction - even when acquiring helical images in a multi-slice mode.

Confirm Rx to X-Rays on: < 18 seconds for any state of tube and gantry, < 10 seconds with the gantry rotating.

Anatomical Programmer: a ten-region anatomical selector allows quick and easy access to 90 user-programmable protocols per region. Separate selector for adult and pediatric exams. There are four selection tabs to select: GE, User, Service and Most Recent Patient. Copy/Paste is supported for easy modification and copying of protocols.

Ten user-defined regions, each with one default protocol displayed with the anatomical selector for very fast access to most commonly used protocols.

Protocols include preset scan time, kVp, mA, scan mode, slice thickness and spacing, table speed, scan FOV, display FOV and center, recon algorithm and special image acquisition and processing options.

Any scan parameters may be edited for each scan or all scans - either before or during an exam. The number of scans may also be easily changed.

AutoScan™: Fully automates longitudinal table movement and start of each scan.

AutoVoice™: 3 preset and 17 user-defined messages automatically deliver patient breathing instructions with a programmable delay; especially useful for multiple helical scanning.

Preset messages are supported in 9 different languages: Chinese, English (Male/Female), French, German, Italian, Japanese, Korean, Spanish, and Mexican Spanish.

Trauma Patient: Allows patient scans and image display/analysis without entering patient data before scanning.

Advanced Artifact Reduction (AAR) Filter significantly reduces streaking artifacts when highly absorbent objects are in the field of view - ie: large shoulders.
Queue Recon: Requests will be processed continuously and simultaneously with other processes on the system including scanning. Prospective recon will be prioritized over retrospective recon.

Images annotated to indicate continuous scan acquisition with table increments: HE (helical) + Pitch, Table speed

Prospective Multiple Reconstruction (PMR): Up to 3 sets of reconstructions can be pre-programmed as part of the scan protocol prior to acquisition. The operator can select different start/end location, slice thickness, interval, reconstruction algorithms and display fields of view for each reconstruction. This frees the operator from sitting at the console and directly contributes to increased productivity.

Prospective Recon: Operator may initiate full recon at any table location in increments of 1/10th the image thickness; image thickness remains constant. The user is aided by graphic prescription to visually verify targeting and centering of anatomy of interest.

Retrospective Recon: Operator may initiate full recon at any table location in 0.1 mm increments; image thickness remains constant. The user is aided by graphic prescription to visually verify targeting and centering of anatomy of interest.

Retrospective Image Decomposition: The operator has the option to retrospectively decompose the original raw data set and reconstruct additional images at any of the defined nominal image thickness available for a given table speed and scan mode.

Helical Scan Protocols

Helical Scan Protocols

Multi Slice CT

HDCT

All protocols assume 120kVp scans under typical clinical conditions.

Single Helical Scans:

<table>
<thead>
<tr>
<th>Scan Time (s)</th>
<th>Maximum mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>800</td>
</tr>
<tr>
<td>10</td>
<td>790</td>
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<tr>
<td>20</td>
<td>645</td>
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<td>30</td>
<td>620</td>
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<tr>
<td>40</td>
<td>510</td>
</tr>
<tr>
<td>50</td>
<td>510</td>
</tr>
<tr>
<td>60</td>
<td>485</td>
</tr>
</tbody>
</table>

Helical Scan Image Quality

The Discovery CT750 HD is a sub-millimeter isotropic CT scanner making it possible to leverage coronal and sagittal reformats that have axial plane like image quality.

The optimized x-ray source (focal spot shape & dynamics as well as reduced off focal radiation) allows for improved measurement methods to fully characterize the limiting resolution of the Discovery CT750 HD system design.

High-resolution modes:
The Discovery CT750 HD scanner delivers up to 33% improvement from predicate GE systems in spatial resolution for body scan modes.
The Discovery CT750 HD scanner delivers up to 47% improvement from predicate GE systems in spatial resolution for cardiac scan modes.
The Discovery HDCT Scanner delivers 0.23mm resolution (calculated using 0% MTF) for scanning modes of up to 2.0m in scan range.

For details of scan techniques and tolerances, please refer to the Technical Reference Manual.

1. Visual Measurement:
Reformatted resolution is demonstrated on the Catphan™ High Contrast Resolution Insert Module CTP528.

0.35 ± 0.05mm voxel size is seen in the reformatted plane.

2. High Contrast Spatial Resolution:
Typical MTF is demonstrated on a 0.05mm tungsten wire and a 1.0mm x 0.025mm gold foil phantom for in-plane and z-plane, respectively.

Typical in-plane MTF is demonstrated on a 0.05mm tungsten wire. In-plane Spatial Resolution Performance for full scan Axial, Helical and Cine Scans.

3. Low-Contrast Detectability:
On 8 inch (20cm) CATPHAN phantom, 5mm slice thickness:
The GE Discovery CT750 HD Scanner improves the Low Contrast Detectability (LCD) by up to 40%. This may allow for improved visualization of smaller low contrast structures.

4. Image Noise – Full Scan Helical Scans
Image Noise is demonstrated on the AAPM 20cm Water Phantom or the GE Quality Assurance Phantom for head protocols.

0.45% ± 0.05% at 18.8 mGy CTDIvol with the Standard Reconstruction Algorithm and a 5mm Slice Thickness.

0.45% ± 0.05% at 9.1 mGy CTDIvol with the Standard Reconstruction Algorithm, 5mm Slice Thickness and ASIR Reconstruction Algorithm.

5. CTDI:
Both high resolution and normal scanning modes: On CTDI Head and Body Dose Reference Phantoms:
CTDI expressed in mGy/100 mAs (0.984:1 Pitch):

<table>
<thead>
<tr>
<th>Reconstruction Mode</th>
<th>Object Size</th>
<th>% Contrast</th>
<th>Dose Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Algorithm, 5mm Slice Thickness</td>
<td>5mm</td>
<td>0.3%</td>
<td>15 mGy CTDIvol</td>
</tr>
<tr>
<td>3mm</td>
<td>0.3%</td>
<td>44 mGy CTDIvol</td>
<td></td>
</tr>
<tr>
<td>2mm</td>
<td>0.3%</td>
<td>90 mGy CTDIvol</td>
<td></td>
</tr>
<tr>
<td>Standard Algorithm with ASIR Reconstruction, 5mm Slice Thickness</td>
<td>5mm</td>
<td>0.3%</td>
<td>9 mGy CTDIvol</td>
</tr>
<tr>
<td>3mm</td>
<td>0.3%</td>
<td>27 mGy CTDIvol</td>
<td></td>
</tr>
<tr>
<td>2mm</td>
<td>0.3%</td>
<td>54 mGy CTDIvol</td>
<td></td>
</tr>
</tbody>
</table>
Axial Scans
Multi-slice acquisitions and short interscan delays significantly reduce potential missed registration between scans by increasing the number of scans possible in a patient breath hold.

Axial Multi-Slice Prescription
Simplified scan prescriptions and easy-to-use default protocols make the Discovery CT750 HD fast and efficient in patient set-up. Axial protocols are nearly identical to helical scan protocols.

Axial Multi-Slice Modes
The Discovery CT750 HD acquires 40 mm of axial coverage in one 360° rotation.

For each rotation of the gantry, the Discovery CT750 HD collects up to 40mm of scan data. There are seven reconstruction modes available for creating images from the multi-slice scan data (1i, 2i, 4i, 8i, 16i, 32i, 64i).

By using 1i, 2i, 4i, 8i, 16i, 32i reconstruction modes, scan data can be combined prior to image reconstruction to create slices with reduced partial-volume artifacts. This is particularly useful for posterior-fossa imaging.

Biopsy Mode: Simplified prescription for single or multiple axial scans around an arbitrary table position aids biopsy studies.

SmartStep*: Interventional mode providing step-and-shoot imaging with in-room viewing and manual x-ray control.

Axial Scan Parameters
Scan Speeds:
- 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, and 2.0 second full scans (360° acquisition), Cardiac application: 0.35

Scan Technique:
- kVp: 80, 100, 120, 140
- mA: 10 to 835, 5mA increments
- Power: 0.8 to 100kW
- Focal Spot Selection @140kVp:
  - Small spot for up to 68.6kW
  - Large spot for greater than 68.6kW

Scan Plane Geometry:
- ± 30° gantry tilt, 0.5° increments
- Longitudinal positioning in 0.1 mm per slice increment. Gantry display in 0.5 mm increments.

Interscan Delay (ISD):

Table Movements Minimum ISD
- 0 to 10 mm 1.0s
- 10 mm to 20 mm 1.3s
- 20 mm to 30 mm 1.6s
- 30 mm to 40 mm 1.7s
- User-selectable.

Inter Group Delay (IGD):
- Minimum IGD is the same as minimum ISD; also user-selectable.

Scan-to-Scan Cycle:
- Minimum scan-to-scan cycle of 1.5 seconds possible for 0.5 seconds scan speed with minimum ISDs.

Maximum Scan Fields of View:
- 32cm for pediatric head
- 32cm for pediatric body
- 32cm for head - small
- 32cm for head
- 32cm for body - small
- 50cm for body - medium & large

Scan with no table incrementation, contiguous image location, or skipped image locations are possible. Overlapped axial scans are not possible.

Axial Image Reconstruction
Reconstruction Algorithms: Soft, Standard, Detail, Chest, Bone, BonePlus, Lung, and Edge

High Resolution Reconstruction Algorithms: HD Standard, HD Detail, HD Bone, HD Bone Plus, HD Edge

Cardiac Reconstruction Algorithms: Soft, Standard, Lung, Detail, Bone.

Cardiac High Resolution Reconstruction Algorithms: HD Standard, HD Standard +, HD Detail, HD Detail +, HD Edge

Reconstruction Matrix: 512 x 512
Display Matrix: 1024 x 1024
Display FOV: Freely variable center/off-center, prospective/retrospective target selection.

CT Number Scale: -1024 to 3072 (normal range) and -31743 to 31743 (extended range)

Prospective Multiple Reconstruction (PMR): Up to 3 sets of reconstructions can be pre-programmed as part of the scan protocol prior to acquisition. The operator can select different reconstruction algorithms and display fields of view for each reconstruction. This frees the operator from sitting at the console and directly contributes to increased productivity.

Similarly, additional reconstruction supports partial-volume artifact reduction by reconstructing images with 2, 4, or 8 times the acquisition image thickness.

These reconstruction features effectively facilitate later, more detailed image analysis without additional patient scans and subsequent dose and image registration concerns.

The following table illustrates the retrospective reconstruction image thicknesses available for each acquisition thickness and mode:

<table>
<thead>
<tr>
<th>Scan Mode</th>
<th>Slice Thickness</th>
<th>Recon Slice Thicknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>64 slices / 40mm</td>
<td>0.625</td>
<td>64i - 0.625mm (retro only) 32i - 1.25mm (retro only) 16i - 2.5mm 8i - 5mm</td>
</tr>
<tr>
<td>32 slices / 20mm</td>
<td>0.625</td>
<td>32i - 0.625mm 16i - 1.25mm 8i - 2.5mm 4i - 5mm</td>
</tr>
<tr>
<td>16 slices / 10mm</td>
<td>0.625</td>
<td>16i - 0.625mm 8i - 1.25mm 4i - 2.5mm 2i - 5mm</td>
</tr>
<tr>
<td>8 slices / 5mm</td>
<td>0.625</td>
<td>8i - 0.625mm 4i - 1.25mm 2i - 2.5mm 1i - 5mm</td>
</tr>
<tr>
<td>4 slices / 2.5mm</td>
<td>0.625</td>
<td>2i - 1.25mm</td>
</tr>
<tr>
<td>2 slices / 1.25mm</td>
<td>0.625</td>
<td>1i - 1.25mm</td>
</tr>
</tbody>
</table>
Axial Scan Protocols
All protocols assume 120kVp scans under typical clinical conditions.

Standard Scans:

<table>
<thead>
<tr>
<th>Scan Time (s)</th>
<th>ISD(s)</th>
<th>mA</th>
<th>Number of scans</th>
<th>Total Acquisition Time(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>800</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>750</td>
<td>28</td>
<td>55</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>700</td>
<td>41</td>
<td>81</td>
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<td>1</td>
<td>1</td>
<td>650</td>
<td>57</td>
<td>113</td>
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<td>1</td>
<td>600</td>
<td>78</td>
<td>155</td>
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<tr>
<td>1</td>
<td>1</td>
<td>550</td>
<td>104</td>
<td>207</td>
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<td>1</td>
<td>1</td>
<td>500</td>
<td>140</td>
<td>279</td>
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<td>1</td>
<td>1</td>
<td>450</td>
<td>196</td>
<td>391</td>
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<tr>
<td>1</td>
<td>1</td>
<td>400</td>
<td>248</td>
<td>495</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>300</td>
<td>368</td>
<td>735</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>250</td>
<td>448</td>
<td>895</td>
</tr>
</tbody>
</table>

Axial Scan Image Quality
For details of scan techniques and tolerances, please refer to the Technical Reference Manual.

1. High Contrast Spatial Resolution:
Typical in-plane MTF is demonstrated on a 0.05mm tungsten wire. In-plane Spatial Resolution Performance for full scan Axial, Helical and Cine Scans

2. Low-Contrast Detectability
Low Contrast Detectability Performance on the Standard Algorithm and the ASIR reconstruction:

3. Noise:
Image Noise is demonstrated on the AAPM 20cm Water Phantom or the GE Quality Assurance Phantom with 5mm slice thickness equivalent for head protocols:

| 0.45% ± 0.05% at 18.8 mGy CTDIVOL with the Standard Reconstruction Algorithm and 5mm Slice Thickness |
| 0.45% ± 0.05% at 9.4 mGy CTDIVOL with the Standard Reconstruction Algorithm, a 5mm Slice Thickness and ASIR Reconstruction Algorithm. |

Scout Scans
ScoutView™ scans provide excellent detail for anatomical localization in conjunction with scan prescription.

Scan locations may be prescribed at the operator console either graphically (via mouse), or explicitly (keyboard entry) from a Scout scan.

Prescription of scans with multiple gantry angles is also available on a single Scout.

Scout Scan Parameters
Aperture: 8 x 0.625 mm effective aperture
Table speed: 100 mm/s
Scout range: 50 to 1900* mm
Maximum Display FOV: 50 cm
Scouts longer than 1,000 mm are auto minified to fit the display.

Scan Technique:
- kVp: 80, 100, 120, 140
- mA: 10 to 835, 5mA increments
- Power: 0.8 to 100kW

Orientation: AP, RLAT, PA, LLAT (preset); or any angle from 0° - 359° (manually selected).

Axial scan prescription lines indicate scan location to nearest 1 mm table position.

User Interface
The Discovery CT750 HD Operator Console utilizes a computer workstation with the following user interface features:

- Two 19-inch LCD monitors
  - Scan/recon monitor for scan and recon control with no image display
  - Image monitor for image display, analysis, processing, and management
- Each monitor provides a 1280 x 1024 high resolution, flicker-free display
- Scan control keyboard assembly with intercom speaker, microphone and volume controls
- Three button mouse with mouse pad
- BrightBox (trackball assembly)
- Two wide work surfaces

All these devices are freestanding and can be easily moved to accommodate a large variety of working conditions and individual operator preferences.

Split tabletop allows unrestricted patient viewing while still supporting 2 LCD monitors. Each work surface can be adjusted at installation to help accommodate a variety of siting requirements.

Desktop Overview
The user interface utilizes the paradigm of managed work environments for a more intuitive clinical workflow.

Virtually, all clinical operations are managed through three “virtual desktops” or applications managers: Exam Rx, ImageWorks and Learning Solutions. Operators can effortlessly move back and forth between these environments simply by clicking on an icon. HD technology enhances multi-tasking architecture and maintains simultaneously all processes so no work is lost or disrupted as desktops are switched.
Exam Rx:
The Exam Rx desktop environment provides the clinical tools necessary for comfortable, efficient control of patient studies.
These tools include patient scheduling and data entry, exam protocol selection, protocol viewing and editing, scan data acquisition, image reconstruction, image display and routine analysis, AutoFilm or manual filming, AutoStore and AutoTransfer.

ImageWorks:
ImageWorks is a desktop environment designed to take advantage of the Discovery CT750 HD System computer and image processor.
Standard features include archive, network and manual film control, as well as some advanced image processing such as multi-planar reformatting (MPR), multi-projection volume rendering (MPVR), and MR image display. It also has optional add-on application packages for Volume Viewer Plus* and CT Perfusion 3*.
The ImageWorks desktop also provides a gateway for DICOM image transactions, either through a local area network, or via DICOM-formatted MOD media.

GSI Viewer*: (Gemstone Spectral Imaging) This viewer allows the user to scroll between the full spectrum of KV energies to visually confirm the ideal energy that frames the desired anatomy density of interest.

Learning Solutions:
The Discovery CT750 HD includes a comprehensive operator’s manual containing all system functionality and description.
The GE Healthcare Institute offers optional “hands-on” CT Technologist training course.

Exam Rx

Patient Scheduling
Patient demographics and exam protocols can be pre-programmed in advance of patient arrival by selecting Schedule Patient from the scan/recon monitor. This productivity enhancement allows entry of all or some of a patient’s demographic data, as well as pre-selection of the exam protocol.
This feature is available any time a patient exam is not currently underway.
This feature uses the same interface as New Patient selection for simplified, consistent programming.
Patient information can be easily recalled to set up an immediate exam via List/Select Scheduled Patient on the scan/recon monitor. Pre-programmed patient exams can also be recalled from the New Patient screen automatically by entering the patient ID number.

Patient Data Entry
Patient data can be entered as part of New Patient set-up, or can be recalled from the list of pre-scheduled patients. Common inputs for new patient include: physician, radiologist, technologist and contrast type (oral and IV).
Trauma Patient ID allows patient scans and image display/analysis without entering patient data before scanning.

Exam Protocol Selection
One of the main contributions of the Discovery CT750 HD to department productivity is its simplified exam set-up.

- Exam parameter set-up has been simplified through the exclusive use of protocols
- Protocols can be easily selected in one of three convenient ways:
  - A large, graphical Anatomical Programmer located on the New Patient screen
  - A default list of the “top 10” most commonly used protocols located near the anatomical programmer
  - A numerical entry
- Two Anatomical Programmers - one for adults and one for pediatrics - provide quick and easy access to 8,460 user-programmable protocols (total). Each programmer has ten anatomical regions with 90 protocols for each region
- Default protocols have been expanded through Protocol Pro - a “behind the scenes” protocol manager - that allows preselection of automated features like AutoVoice, AutoFilm, AutoStore and AutoTransfer on a per exam, series or image basis.
- Protocol Pro also provides preselection of two different window/level settings per image for AutoFilm and can automatically display the 1024 Localizer each time a new series is requested.
- Default protocols also include preset scan time, kVp, mA, slice thickness, scan mode, table speed, image interval, gantry tilt, scan field-of-view, display field-of-view and center, recon types, and breath timing parameters.
- Any scan parameter can be edited for each scan or all scans either before or during an exam. Scans can be easily added or removed from the prescription.
- Scan/recon control uses only 2 screens to set up first scan - New Patient and Protocol View/Edit.

Protocol View/Edit

- A single, full screen View/Edit table allows fast and easy examination and modification of exam parameters before scanning begins.
- Exam parameters can be changed for one scan or all scans in a series
- When used in conjunction with the 1024 Localizer, changes made in the View/Edit table that affect the number of scans, image interval, starting/ending locations, tilt, or display FOV are automatically shown on the 1024 Localizer.
- Any changes made directly on the 1024 Localizer display using the mouse and the on-screen cursor controls are also reflected automatically in the View/Edit table
- View/Edit Wizard intuitively adjusts dependent parameters automatically in response to operator-initiated changes and highlights them for quick review. It also alerts the operator to incompatible dependencies requiring operator intervention.
- Tab card groupings for Timing, Recon and Filming help organize the large number of parameters available within each protocol.
- As many as 8,460 protocols can be stored on the Operator Console.

Scan Data Acquisition
- Full-screen DynaPlan Plus illustrates scan status graphically, with real-time feedback while the exam is underway. Scans, programmed delays (prep, breathing, inter-group), and even AutoVoice announcements are clearly shown before and during scanning.
- AutoScan: Fully automates longitudinal table movement and the start of each scan
- AutoVoice: Preset and user-recorded messages automatically deliver patient breathing instructions, especially useful for multiple or multi-pass helical scans
- Full Simultaneity allows scan and recon to work concurrently with image display, processing and analysis including computationally intensive features such as MPR, MPVR and 3D*/MIP) while still running image archival, filming and networking processes.
Dose Computation, Display & Reporting

CTD\textsubscript{vol} (CTD volume), DLP (Dose Length Product), and Dose Efficiency computation and display during scan prescription provides dose information to the operator.

CTD\textsubscript{vol} is a dose index defined by IEC 60601-2-44. This index is computed automatically by the Discovery CT750 HD System and reported on the Exam Rx screen. CTD\textsubscript{vol} is a single number consisting of 2/3 of the CTD100 peripheral dose plus 1/3 of the CTD\textsubscript{100} central dose that is divided by the helical or axial pitch factor.

CTD100 is a dose index based upon CTDI measurements over a 100 mm volume, as defined in IEC 60601-2-44.

Dose Product (DLP) is given in mGy*cm and is computed and displayed for each group prior to the scan. Additionally, an accumulated DLP is displayed for the entire exam, as the exam prescription progresses. The final exam accumulated DLP provides a convenient measure for maintaining patient or procedure dose management statistics.

Dose Efficiency is automatically computed and displayed on the Exam Rx screen. The geometric dose efficiency is a measure of how much of the Z-axis x-ray beam is used by the system, as defined in IEC 60601-2-44.

Dose Reporting saves the CTD\textsubscript{vol}, DLP, and phantom type in a cumulative exam values are saved. Saved values can be networked, filmed and archived.

AutoView Layouts

- Eight powerful AutoView layouts provide exceptional flexibility in tailoring the 1024 image display to the user or the application at hand - without the complexity of free-form “windows.”

- AutoView Layouts include:
  - 1024 AutoView image
  - 768 AutoView image [matches the image size shown on the HiSpeed Advantage 2.X Series OC monitor]
  - 512 AutoView image + 512 Localizer Scout with cut lines automatically showing the location of the AutoView image on the Scout
  - Two 512 AutoView images (same image but at different window/level settings) + 512 Localizer Scout with cut lines automatically showing the location of the AutoView images on the Scout
  - 512 AutoView image + 512 AutoFilm image
  - Last two & four 512 AutoView images
  - AutoLink which links the current series to a view port

- Basic image review features such as window/level, magnification and flip/rotate are available for AutoView images.

- Any window not used for AutoView is available to independent, simultaneous review of other exams.

- Special BrightBox, a three-button trackball device, provides independent control of image next, prior, manual paging and trackball window/level for any review images in focus. This helps make two-person operation practical.

- Regardless of the AutoView Layout used, AutoFilm viewing is available anytime via an on-image selection - without disrupting other image processes in progress. Background filming allows full use of the image display monitor for AutoView and image review/processing without interruption during AutoFilm.

Image Review Layouts

- Five flexible Image Review Layouts are provided for those applications where greater than 512-image display may be desired and AutoView is not required.

- Image Review Layouts include (Note - uses short notation for screen options):
  - 1024 single image display
  - 768 single image display
  - Two 512 image display, horizontal format
  - Two 512 image display, vertical format
  - Four 512 image display

- Each image display window can be further subdivided into four more images, increasing the total number of images that can be displayed at once to 16.

- BrightBox image control is also available for Image Review Layouts.

Image Access

- Point and click interface along with a pictorial directory (browser) allows for easy selection by exam, series or image.

Routine Image Display

- Image display features provided within Exam Rx:
  - Zoom/Room
  - Explicit Magnify
  - Flip/Rotate
  - ProView
  - Display Normal
  - List/Select
  - Ellipse ROI
  - Measure Distance

- ProView visualization algorithms are available to enhance anatomical structures without additional reconstruction time:
  - Four Selections for enhancement of high contrast objects where fine detail is required without aliasing (such as lungs)
  - Three Selections for modifying perceived levels of noise and low contrast discrimination

- Three ways are provided to adjust window/level of images in focus in order to meet a variety of clinical work environments and user preferences:
  - Six user-programmable keys on the scan control keyboard (F6 - F11), plus one key for returning to prior setting (FS)
  - On-image through middle mouse button
  - BrightBox trackball

Routine Measurements

- Image measurement features provided within Exam Rx:
  - ROI: Box, Ellipse, Trace
  - Measure Distance
  - Measure Angle
  - MIROI (Multiple Image ROI) - Grid On/Off
  - Measure Distance - Erase
  - Report Pixels
  - MIROI (Multiple Image ROI) - Screen Save
  - Measure Distance - Gray Scale Enhancement

Display Preferences

- Display settings available to tailor the overall display (settings apply to all images in all exams):
  - Annotation Levels
  - Inverse Video
  - Next/Prior Each View Port
  - Next/Prior Series Binding
  - Continuous Report Cursor
  - Large font for patient name, patient ID, and accession number

Auto Image Management

The Exam Rx work environment conveniently provides for selection of AutoFilm, AutoStore (to local or remote MOD), and AutoTransfer (across a network).

An AutoFilm Composer provides a simple programming interface for automated filming set-up.

Batch Filming is accomplished through a single keystroke that automatically prints an entire series at a time.
Manual Image Filming
- On-screen filming is available for any analog or digital camera using a 3M-952 protocol.
- Images may be individually filmed manually via “drag and drop” to the on-screen Film Composer.
- Print Series permits automatic printing of an entire series with one keystroke.
- Page filming permits creation of an entire film with one keystroke.
- Multiple image formatting allows filming of multiple images in a single film frame.
- Film formats supported are 1:1, 2:1, 4:1, 6:1, 8:1, 9:1, 12:1, 15:1, 16:1, 20:1, 24:1 and 35-mm slide

Important note: The Discovery CT750 HD comes standard with a DICOM Print Interface configurable for multiple DICOM Print destinations. Connections with cameras that do not support DICOM Print are not supported.

To save further filming cost, the Operator Console can directly print to a postscript printer such as the GE Color Printer available as an option.

ImageWorks

ImageWorks software is designed to take advantage of the Discovery CT750 HD computer and image processor. This desktop environment includes image management and networking.

Because some of the image analysis and display features of ImageWorks replicate those in Exam Rx, the next section describes only features that are incremental or significantly different.

Image Analysis

Multi-Projection Volume Reconstruction (MPVR): Quick and easy way to generate volumetric images for CT angiography without thresholding data or removing unwanted anatomy. An entire volume is used to generate images in any plane, creating real-time frames of reference at the same time;
- Clinical utility is extended via two additional modes:
  - MIP - enhances contrast and improves visualization of calcifications
  - Average - generates 2D radiographic images
- Multi-planar Reformation (MPR): Provides real-time assessment of anatomy in offaxis planes. Sagittal, coronal, oblique and curved planar reformations available;
- Batch reformatting can also be defined and executed for later viewing if desired;
- Image Addition and Subtraction: Includes image addition of more than two images at a time;
- Direct MPR allows customer to move from routine 2D review to prospective 3D image review of axial, sagittal, coronal, and oblique planes while enabling automated protocol-driven batch reformats to be created and networked to their desired reading location, reducing total exam time and increasing technologist and radiologist productivity.

Exam Split provides customers with the capability to “split” a series of patient images into separate groups. These new smaller image groups can then be networked to desired reading stations for multiple “reads” and multiple billings on select patient exams. Virtual mode provides ability to send window level values, flip & rotate images, and compatibility with MPPS.

Data Export provides CT scanner customers with a stand-alone tool to convert clinical images into PC-friendly formats like .jpeg, .mpeg, and .avi, creating more flexible report creation for both referring physicians and patients. Images can then be saved using Data Export tool to CD or transferred (FTP) to an IP destination.

Image Display

- Magnifying Glass allows quick 2X magnification window that can be moved over an image.
- Image Scroll moves an image within its’ own window.
- Groupings allow application of window level values; magnification/minimized; image scroll or flip and rotate to a user-defined image set.
- Save State stores user-selected image orientation and window/level with each data set.
- Window/Level values may be:
  - Preset to provide six on-screen instant window/level settings
  - Set independently for up to 16 images on the screen
  - User-modified in discrete or variable steps
  - Adjusted real-time on-image by holding down the middle mouse button and moving the mouse
- Cine mode provides paging in up to 4 view ports of up to 128 previously stored CT or MR images at full selected display frame rate. For more than 128 images, display frame rate may be reduced.
- Cine mode also provides temporal, spatial or manual playback loops.
- Text Page displays patient scan information

Image Annotation

- Image annotation and cursor are shadowed to permit ease in reading.

Image Management

- Images may be saved, stored and retrieved via Magnetic Optical Drive (MOD) media using DICOM format. This allows interchange with other imaging systems supporting DICOM MOD media. Not all vendors implementation of DICOM are identical, so please check with the manufacturer for compatibility. Images may also be save to a CD-R or DVD-R with DICOM Interchange.

Direct MPR

- Direct MPR enables automated protocol-driven axial, sagittal, and coronal reformats. Reformatted images may be routed to multiple network destinations, eliminating the need to transfer and store all thin-slice data.
- Direct MPR provides an interactive axial review mode that can change the slice thickness reconstruction instantaneously.
- The user selects the volume to be specifically analyzed and chooses the slice thickness to be displayed as axial, sagittal, coronal and oblique images. The user can then save a number of recon images sets, viewing a large number of slices for pure axial or multi-planar review and filming.
- Batch film can typically enable you to reduce filming images by 50%, thickening the slab from 0.625 to 1.25mm or 1.25 to 2.5mm with no information loss.
Image Networking

Exams can be selected and moved between the Discovery CT750 HD and any imaging system supporting the DICOM protocol for network send, receive and pull/query. 

NOTE: Because the Discovery CT750 HD creates images in pure DICOM format, exams cannot be moved from the Discovery CT750 HD to MR Signa Advantage, CT HiSpeed Advantage or the Advantage Independent Console systems.

Image transfer time using DICOM protocols is 16fps on a 1000baseT network.

DICOM Interchange allows the saving of any image from the database, along with a PC viewer using Internet Explorer, to a CD-R or DVD-R without marking the exam/series or image as archived for exam transfer between stations that are not networked or pass along to referring physicians or patients.

DICOM Conformance Standards

For detailed information, please reference DICOM conformance statement.

- DICOM Storage Service Class
- DICOM MOD Media Service Class on 1.2- and 2.3-GB MOD media
- Service Class User (SCU) for image send
- DICOM Storage Commitment Class Push
- Service Class Provider (SCP) for image receive
- DICOM Modality Worklist
- Service Class User (SCU) for storage commitment
- DICOM Modality Performed Procedure Step
- DICOM Query/Retrieve Service Class
- DICOM Print

Filming Protocol

- 3M-952 Standard

System Components

**Gantry**

Advanced slip ring design continuously rotates generator, tube, detector and data acquisition system around the patient.

- Aperture: 70 cm
- Tilt: ± 30°
- Tilt Speed: 1°/s
- Focus to Detector: 95 cm
- Focus to Isocenter: 54 cm
- Maximum SFOV: 50 cm
- Rotation Speeds: 360° in 0.35, 0.375, 0.4, 0.425, 0.45, 0.475, 0.5, 0.6, 0.7, 0.8, 0.9, 1 and 2 sec
- Remote Tilt from Operator’s Console
- Breathing lights and countdown timer
- Cardiac gating indicator light
- Start scan button with countdown to x-ray on
- Scan plane toward front of gantry for improved positioning access.

Biopsy and interventional studies have been facilitated through a more streamlined gantry shroud, and bilateral table/gantry controls and gantry display that maximize maneuverability while working next to the gantry.

Laser Alignment Lights:

- Define both internal and external scan planes to ± 1 mm accuracy
- Operate over full range of gantry tilt; activated any time during exam (with tube stationary)
- Coronal light remains perpendicular to axial light as gantry tilts.

Visual readout is easy to read from the tableside or from the operator console.

Gantry tilt controls are located on the side of the gantry.

**Table**

- Single table, cantilever design with wide height range
- Vertical Range: 43 cm to 99.1 cm
- Vertical Scannable Range: 78.5 cm to 99.1 cm
- Elevation Speeds: 15 mm/s and 30 mm/s
- Horizontal Range: 203 cm
- Horizontal scannable range (metal free) varies with table configurations:

<table>
<thead>
<tr>
<th>Table</th>
<th>Axial</th>
<th>Helical</th>
<th>Scout</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT2000</td>
<td>200cm</td>
<td>187cm</td>
<td>190cm</td>
</tr>
<tr>
<td>VT1700</td>
<td>170cm</td>
<td>154cm</td>
<td>160cm</td>
</tr>
</tbody>
</table>

- Horizontal Speed: Up to 137.5 mm/s
- Table Load Capacity: 227 kg (500 lb) maximum allowed with ± 0.25 mm positional accuracy in the z-direction.
- Controls on gantry for elevation and cradle incrementation. Foot pedals on both sides of table for fast elevation. Cradle position controlled from OC for prescribed scans.
- IV Pole integrated at the foot-end of the table helps to prevent IV lines from becoming crossed and tangled, and helps keep lines in place during patient table travel.

**x-Ray Tube**

Performix HD is an anode-grounded, metal-ceramic x-ray tube. A new innovative electrostatic electron beam collimation supports higher resolution imaging in both the x and y planes making it the most innovative CT tube offered today. Just like its predecessor Performix Pro VCT 100 tube, the design is optimized for exams requiring a large number of scans without tube cooling.

- Maximum Power: 100kW @ 120kVp or 140kVp

<table>
<thead>
<tr>
<th>Maximum mA for each kVp selection:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Scan Mode</th>
<th>kVp</th>
<th>Small Focal Spot</th>
<th>Large Focal Spot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80kV</td>
<td>620</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>100kV</td>
<td>680</td>
<td>800</td>
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<tr>
<td>120kV</td>
<td>570</td>
<td>835</td>
<td></td>
</tr>
<tr>
<td>140kV</td>
<td>490</td>
<td>715</td>
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</table>
Axial/Cine Tube Scanning Performance

<table>
<thead>
<tr>
<th>Scan Time (s)</th>
<th>ISD (s)</th>
<th>MA</th>
<th>Number of Scans</th>
<th>Total Acquisition Time (s)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>800</td>
<td>17</td>
<td>33</td>
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<tr>
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<tr>
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<td>700</td>
<td>41</td>
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<td>650</td>
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<td>895</td>
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<tr>
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<td>1</td>
<td>200</td>
<td>600</td>
<td>1199</td>
</tr>
</tbody>
</table>

- Heat Storage Capacity: 8 MHU
- Heat Dissipation:
  - Anode (max) >2100 KHU/min
  - Casing (cont) 378 KHU/min (4.5kW)
- Beam collimated to 56° fan angle
- Average time to replace tube: < 10 hours

High Voltage Generation
- High-frequency on-board generator. Continuous operation during scans.
- kVp: 80, 100, 120, 140
- Power: 100kW
- mA: 10 to 835, 5mA increments
- Alternates two kV energies at a maximum rate of 0.5 msec.

Data Acquisition System
- 58,368 available input channels
- 7,131 Hz maximum sample rate
- Effective analog to digital conversion range greater than two million to one.

Scan/Control Unit

Host Computer
- 2x Intel® Dual Core Xeon 2.00GHz 5130 Processors
- 8GB FB-DIMMs ECC PC5300
- 1333MHz Front Side Bus
- 2x 147GB 15000rpm 3.0Gb/s SAS Hard Disk Drive
- nVidia FX1500 Graphics Card

Software Architecture
- Software architecture based on industry standards and client-server design

Peripheral Components
- 21in 1280x1024 Monitor
- 104-Key USB 2.0 Keyboard
- 3-Button USB 2.0 Mouse
- 3-Button USB 2.0 Trackball
- Sony SMO-F551-SD Magneto-optical Drive
  - 5.25in Cartridge Form Factor 15,000 RPM
  - 5.2GB Capacity
  - 10MB/s
- Panasonic Matashita SW-9576-C DVD-RAM
  - 5.25in Cartridge Form Factor
  - 9.4GB Capacity
  - 480Mb/s
- DVD-R/CD-R
  - 5.25in DVD Form Factor
  - Capacity 480Mb/s
- Scan Control Intercom Module (SCIM)
  - Table Control
  - Gantry Tilt Control
  - Intercommunications
  - Emergency Stop
- USB 2.0 Port for External Hard Disk Drive Connectivity
- Modem (option to standard broadband Insite connectivity)

Image Networking
- Exam Transfer up to 16 frames per second on dedicated 1 Gbit connection
- Standard auto-configuring Ethernet (UTP connection) - 1000/100/10 BaseT
- Direct network connection; multi-suite ethernet card not required for gateway out of suite
- Protocols supported:
  - DICOM network send (one IP address at a time) and receive, pull/query, and storage commitment push
  - InSite point-to-point

Standard, Selectable Items
- VT Patient Positioning System
- Keyboard: English, French, German, Scandinavian or International (with overlays for English, French, German, Italian, Japanese, Mandarin, Portuguese, and Spanish)
- Cable Set
- ConnectPro HIS/RIS Interface with Performed Procedure Step
Compatible Options
The following options are available on the Discovery CT750 HD and HD console. See Advantage Workstation (AW) product data sheet for list of available AW options.

- Volume Viewer Plus
- SmartScorePro
- CardIQ Xpress Pro or Plus
- SnapShot Pulse
- CardEP
- ECG Monitor
- Advantage 4D CT
- Color Printer
- Bar Code Reader
- Uninterruptible Power Supply
- Customer Marketing Kit
- SmartStep with or without in-room monitor
- ECG Gating HW and SW
- CT Perfusion 3 Multi-Organ, Neuro
- VolumeShuttle

Siting Requirements
For siting requirements, see Pre-Installation Manual

Industry Standards
The Discovery CT750 HD complies with a wide variety of industry standards to facilitate more rapid adoption of features and performance improvements as the computing and medical imaging industry evolves.

Warranty
The published Company warranty in effect on the date of shipment shall apply. The Company reserves the right to make changes.

General Electric Company reserves the right to make changes in specifications and features shown herein, or discontinue the product described at any time without notice or obligation.

Regulatory Compliance
This product is designed to comply with applicable standards under the Radiation Control for Health and Safety Act of 1968.

This product complies with the performance standards of 21 CFR, sub-chapter J, and the applicable IEC 60601-1 series.

Laser alignment devices contained within this product are appropriately labeled according to the requirements of the Center for Devices and Radiological Health.

This product is a CE-compliant device that satisfies regulations regarding Electro-Magnetic Compatibility (EMC) and Electro-Magnetic Interference (EMI), pursuant to IEC-60601-1-2.

Discovery CT750 HD may not be available in all markets.

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Healthcare Re-imagined

GE is dedicated to helping you transform healthcare delivery by driving critical breakthroughs in biology and technology. Our expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, and biopharmaceutical manufacturing technologies is enabling healthcare professionals around the world to discover new ways to predict, diagnose and treat disease earlier. We call this model of care “Early Health.”

The goal: to help clinicians detect disease earlier, access more information and intervene earlier with more targeted treatments, so they can help their patients live their lives to the fullest.

Re-think, Re-discover, Re-invent, Re-imagine.

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Buckinghamshire,
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