

Helix

Dual-Head, Multi-Purpose, Slip-Ring, Digital Gamma Camera



Product Data

The Helix multi-purpose camera features continuous rapid SPECT orbiting using Slip-Ring technology for both routine and advanced applications. Helix features two 3.8 mm resolution 540 x 400 mm rectangular detectors. Digital processing ensures a high fidelity image. The advanced Helix design ensures unsurpassed image quality and throughput in SPECT studies, Whole Body scans and other planar imaging procedures. Superior diagnostic power is provided by an array of 12 dedicated microprocessors featuring 74 MIPS, ranging from 50MHz 24-bit digital signal processing to 32-bit data processing. Raw computer power, a 1416 x 1168 resolution display*, and validated APEX software result in superior clinical reliability and exceptionally high throughput.

Key features and options include:

- Unique Slip-Ring technology enabling continuous, rapid SPECT orbiting for novel imaging procedures such as Evolving Images*, and Dynamic-SPECT.
 - Two 3.8 mm resolution rectangular detectors combining the benefits of full 540 mm Whole-Body-scan-width and 400 mm axial-length-SPECT scans of large organs with superior, uniform imaging performance across the entire UFOV.
 - The digital front-end electronics yields high precision event positioning using digital correction maps. Distortion-free signal processing yields inherent stability, superior uniformity and unmatched resolution.
 - Ultra-flared micro-cast fan-beam collimation* featuring better than 6.2 mm SPECT resolution
- and four-fold sensitivity over conventional imagers. It yields superior image quality and unsurpassed imaging efficiency.
- Simultaneous dual-head, Whole-Body or SPECT scanning, permits the use of higher resolution collimators with increased sensitivity. Combined with fully automated on-line body contoured* scans, Helix provides unsurpassed Whole Body and SPECT lesion detectability.
 - Superior ergonomic design features automatic "home" positioning of both gantry and patient-handling-system, simultaneous dual-collimator exchange for higher operator convenience, patient comfort and departmental throughput.
 - High-performance integrated workstation featuring Intel's leading edge processors, 1416 X 1168 resolution 21" color monitor*

and a true multi-tasking operating system, ensures superior clinical diagnostic power.

- Continuity, compatibility, connectivity - all guaranteed from first day - ensure easy integration with current APEX or other vendors' systems. Combining the benefits of both data and clinical software compatibility with earlier APEX models yields immunity from data and clinical software obsolescence.
- Multi-task environment allows simultaneous acquisition, processing, and networking* for increased patient throughput.
- Outstanding PACS, featuring full archival unification throughout the network to ensure instant data access to any of its systems, or high performance laser multi-imagers or digital printers. Extended connectivity packages provide multi-standard ETHERNET networking* platforms, including TCP/IP* and ISO/OSI.
- A comprehensive clinical software package, including the full range of applications from automatic cardiac ventriculography analysis to quantitative SPECT. CLIP*, Elscint's unique clinical macro-programming language, with over 600 modular and linkable clinical functions ensure both clinical versatility today and immunity from future software obsolescence.

BASIC CONFIGURATION

detectors

Two high-resolution detectors, each featuring 3/8" NaI(Tl) crystal, 59 high quantum efficiency photomultiplier tubes, and a rectangular 540 x 400 mm UFOV (21.25" x 15.75"), optimally shielded for imaging at 40-520 keV energy range.

gantry

A fixed gantry supports the two detectors. High capacity power transmission to the rotating module is facilitated via a Multi-Channel Slip Ring. High speed data transmission from the detectors is afforded by an ultra-fast optronic data link.

patient handling system

A cantilevered scanning table capable of automatic "home" positioning, fast vertical motion and pallet translation.

integrated workstation

An acquisition and processing station, based on 32/64-bit multi-processor array comprising Intel's main processor, an acquisition dedicated array processor, a 21" color monitor with 1416 x 1168 resolution display*, 340 Mbyte magnetic hard disk, 800 Mbyte optical disk* and a 5¼ ", 1.2 Mbyte flexible (floppy) disk.

software

The standard APEX clinical software repertoire, includes SPECT, Gated SPECT*, 3D display* package, CLIP programming* and ISO/OSI networking* protocols.

INTEGRATED WORKSTATION computer architecture

The SPX integrated computing system, Apex's 3rd generation, accelerates processing by a factor of 450% while maintaining software compatibility with thousands of existing Apex clinical programs. Unprecedented raw computer power is integrated on-board the camera; a 12-processor array ranges from HI-RES 50MHz, 24-bit digital signal processing; through 64-bit AMD acquisition-dedicated array processor; to Intel's 32-bit computing power. These capabilities yield 74 MIPS cumulative peak performance including 500,000 cps count-rate and real-time correction of nuclear events.

operator console

The integrated workstation includes an ergonomically-designed operator console featuring a 21" 1416 x 1168 high-resolution image color display*, a 14" alpha-numeric control monitor, and an extended keyboard with both standard and functional keypads. The functional keypad includes 96 keys-24 of which are user-programmable; a highly sensitive trackball and positional keys for interactive graphics control; two control knobs enabling fine digital tuning of the display; and a cine-rate adjustment knob.

SYSTEM PERFORMANCE

PLANAR IMAGING

NEMA performance specifications**

shielded energy range 40 - 520 keV

intrinsic spatial resolution

CFOV:	FWHM	≤3.8 mm
	FWTM	≤7.5 mm
UFOV:	FWHM	≤3.9 mm
	FWTM	≤7.6 mm

intrinsic energy resolution ≤9.8%

intrinsic linearity

CFOV:	Absolute	≤0.4 mm
	Differential	≤0.1 mm
UFOV:	Absolute	≤0.5 mm
	Differential	≤0.1 mm

flood field uniformity

CFOV:	Integral	≤3.0 %
	Differential	≤2.1 %
UFOV:	Integral	≤3.8 %
	Differential	≤2.5 %

point source sensitivity ≤2.5 %

maximum count rate # 500,000 cps

performance at high count rate #

maximum with 20% window: >	320,000 cps
observed	incident
20% loss >	180,000 cps
maximum with 30% window: >	400,000 cps
observed	incident
20% loss >	220,000 cps
	275,000 cps

intrinsic spatial resolution (at 75 Kcps)

FWHM: 4 mm; FWTM: 7.8 mm

flood field uniformity (at 75 Kcps)

CFOV:	Integral	≤3.6 %
	Differential	≤3.0 %
UFOV:	Integral	≤4.8 %
	Differential	≤3.2 %

multiple window spatial registration

Max. displacement (⁶⁷Ga): 1.5 mm

calibration

DIGITAL GUARD™, a high-speed, automatic optronic detector stabilization package

system imaging performance

system resolution	LEUHR collimator (HPC-46K)	LEHR collimator (HPC-45K)	LEGP collimator (HPC-35K)
FWHM(mm) without scatter	6.9	7.4	9.0
FWTM(mm) without scatter	12.9	13.9	16.9
system sensitivity## counts/min/ μ C	290	390	590

SPECT imaging

Measurements were taken using HPC-46 collimator, 120 views, 3° per view, 15 cm radius-of-scan, acquisition magnification factor x2, Ramp-filtered back projection, 128² frame size:

reconstructed system spatial resolution (mm)

Tangential FWHM	6.2
Radial FWHM	8.7
Central FWHM	8.8

Note: Corrections for center of rotation, isotope decay, sensitivity and scanning velocity are implemented before the reconstruction procedure.

MECHANICAL PERFORMANCE gantry

All gantry movements are programmable, enabling sequential multi-spot or fully automated* body- contoured scans and automatic "home" positioning.

detector "brain reach": 6.9 cm (2.7")

radial motion

head travel: 10-30 cm, (4"-12")

setup speed (per min): 30 or 75 cm (12" or 29")

scan speed (per min): 5 to 75 cm (2" to 29")

rotational motion

Velocity: 0.025 to 3 rpm

Modes: Continuous, Step & Shoot

Range: Unlimited, CW/CCW

scan step: 1,2,3,4,6,9 (deg)

detector tilt (electrical*)

Range: 0 to 90°

Setup velocity: 0.5 or 1.2 (rpm)

patient handling system

A low-attenuation Carbon-Fiber cantilevered table, with an all-purpose pallet.

Patient-length-entry via TouchRuler*.

attenuation: < 10% (140 Kev)

max. load: 200 kg (440 lbs)

horizontal motion

scan modes: Continuous, Step & Shoot

travel range: 10 to 200 cm (4" to 80")

scan length: 0 to 200 cm (0" - 80")

setup velocity (per min): 100 / 300 cm (39"/117")

scan velocity (per min): 5 to 150 cm (2" to 59")

vertical motion

setup velocity (per min):

30 or 150 cm (12" or 59")

travel range: 55 to 85 cm (22" to 33")

lateral slanting: Manual, 0° to 60°

ACQUISITION

Helix can acquire images in Static, Dynamic, Multi-Gated, List mode, SPECT, Gated SPECT*, and Whole Body acquisition modes.

- Simultaneous acquisition processing and networking
- Acquisition termination by preset time, preset count, overflow or manual stop
- User-definable preset protocols for easy acquisition set-up
- Up to four isotopes/peaks enabling multi-isotope or multi-peak (summed)
- Continuous-range off-center magnification
- Rotated and reflected acquisition modes (in steps of 1°)
- 512 channel PHA display

static acquisition capacity

matrix	single isotope or 2 peak summing	dual isotope	quad isotope
512x512	8 bits	-----	-----
256x256	8 or 16 bits	8 or 16 bits	8 bits
128x128	8 or 16 bits	8 or 16 bits	8 or 16 bits
64x64	8 or 16 bits	8 or 16 bits	8 or 16 bits
32x32	8 or 16 bits	8 or 16 bits	8 or 16 bits

dynamic acquisition

list mode

- Simultaneous acquisition: up to two peaks
- Time markers, resolution 1 msec
- List of R-wave time markers, acquisition of digital ECG or other physiological signals
- Resolution 256x256 for single isotope; 128x128 for up to four isotopes
- Data reframing and curve generation using list mode data

frame mode

Up to five frame rate intervals per study.

acquisition frame rates

matrix size	max. frames/sec	
	16 bit	8 bit
256	1	3
128	6	12
64	25	50
32	100	200

whole body scanning

- Continuous and sequential multi-spot scanning modes
- Fully-automated* real-time body-contoured scanning
- Simultaneous two-view posterior/ anterior scans
- 1024x256 acquisition matrix
- Scanning area: 54x200 cm with parallel hole collimators

SPECT imaging

- Evolving Images*: on-line display of tomographic slices acquired in multiple, complete, fast SPECT sequences
- Parallel and fan-beam* imaging
- Circular and body-contoured* orbiting
- Continuous orbiting (3 rpm)
- Step-and-Shoot orbiting (1, 2, 3, 4, 5, 6 and 9 degrees angular view resolution)
- Gated tomography* with real-time multi-buffered beat rejection
- Matrix size: 64x64 or 128x128

multi-gated acquisition

- Equi-time and equi-phase gating modes
- Dual-buffer acquisition for accurate irregular beat-rejection
- ECG display during acquisition
- On-line R to R histogram display
- Live cine display during acquisition

multi-gated acquisition capacity

matrix	max. frames/cycle
256x256x16	2
256x256x8	4
128x128x16	8
128x128x8	16
64x64x16	32
64x64x8	64

ARCHIVING

Management of clinical data flow and storage within the system and through the ApexNet. Access to clinical data by patient name, patient I.D., date or study label. Archive data includes images, curves, ROIs, markers, reports and alphanumeric information. The following table represents archive storage capacity available on the standard 340 Mbyte disk:

standard fixed disk capacity

matrix	capacity
512x512	1000 frames
256x256	4000 frames
128x128	16000 frames
64x64	64000 frames
32x32	256000 frames

DISPLAY

display matrix

- Standard 708 x 584 pixels resolution (non-interlaced) 256 gray levels
- Optional High Definition Display featuring:
 - 21" high resolution color monitor (1416 x 1168 graphic pixels)
 - Simultaneous display of both acquired data and concurrent data-processing activity
 - High resolution (1416 x 1168 pixels) hard copy

High Definition Display* formats

- 4 x 512², 16 x 256², 64 x 128², 256 x 64², 1024 x 32² or combinations thereof.
- Cine, windowing and baseline settings can be handled independently for each image in formats of 4 x 256² and 16 x 128², 64 x 128²
- special modes: 2 x 512² + 2 x 256 x 1024 for simultaneous data processing and hole Body scan viewing; 4 x 256 x 1024 for Whole Body scan reports

color tables

- 256 shades.
- Virtually unlimited number of color tables can be created interactively by user.

zoom factors

- 2, 4, 8
- Real-time interpolated zoom during cine

PROCESSING

image processing

Smoothing, normalization, interpolation, background subtraction, magnification, inter-frame arithmetic, non-linear contrast enhancement, grouping, cyclic addition, isocontour display, profile display.

regions of interest

Simultaneous display of up to 250 ROIs of any shape, including duplication, reflection, motion, and automatic edge detection.

curve management

Up to 64 curves displayed side-by-side or overlaid, featuring curve scaling, smoothing, normalization, interpolation, inter-curve arithmetic, fitting, deconvolution, integration, and differentiation in various display formats.

clinical protocols

Apex clinical software includes dozens of clinical packages in the following categories:

- Cardiac First Pass
- Cardiac gated equilibrium
- Planar myocardial perfusion
- Tomographic myocardial perfusion
- Cedars-Sinai Quantitative SPECT*
- Gated tomography*
- 3D interactive display*
- Renal analysis
- Tomographic HMPAO and dynamic uptake brain studies
- Planar cerebral perfusion
- Lung ventilation/perfusion
- Thyroid uptake
- Gastric emptying

ECT data processing

normalization

Sensitivity correction for collimator non-uniformities. Corrections of rotation speed, center of rotation (on line possibility), isotope decay.

attenuation correction

Chang method.

reconstruction

Modes: Interactive or batch mode transaxial, coronal, sagittal and oblique reconstruction.

Transaxial Reconstruction Time:

0.22 sec/slice (60x64² matrix);

0.68 sec/slice (60x128² matrix).

Other planes reconstructed in real-time.

Format:

64x64 (up to 64 slices) or 128x128

(up to 128 slices).

back projection filters

Based on user-defined parameters: Hanning, Hamming, Butterworth, Parzen, Shepp-Logan and Ramp. Adaptive: Metz and Wiener.

display formats

- Standard two dimensional multi-plane tomograms
- Interactive and dynamic 3D* display in surface and volume rendering modes

NETWORKING**ApexNet communication***

- Local area network to all APEX systems (ISO/OSI Ethernet standard). TCP/IP link available through ApexView or ACM-14
- Modem networking available through ApexView
- The APEX SPX Series is software compatible, data compatible and connective through the ApexNet with existing APEX systems.

CLINICAL PROGRAMMING***powerful clinical programming**

Apex software awards its users with a wide array of clinical software packages and powerful programming tools. Used in over ten million procedures, they fall into the following categories:

- CLIP Programming; A simple, friendly "Basic" type interpreter language capable of invoking any of the APEX functions (more than 600), and linking them together into a clinical program.

- PLM-86 high level programming language along with comprehensive libraries of modules interfacing user-generated code to APEX software.
- A large selection of user-friendly editors enabling modifications in the dialogs, menu windows, user-generated programs and acquisition protocols available in the standard APEX software.

This powerful clinical programming toolbox guarantees both high clinical versatility today and immunity from software obsolescence in the future.

advanced clinical software

Strong cooperation with APEX users and CLIP's advanced programming tools make APEX clinical software extremely modular and highly efficient. The clinical programs fall into three categories:

- Built-in CLIP programs covering the widest spectrum of nuclear medicine processing protocols.
- More than 600 modular and linkable APEX functions, each optimized to handle a specific processing task. These functions are used as building blocks for the CLIP programs.
- An ever-growing number of user-generated CLIP programs which are not included in standard APEX software versions.

operational simplicity

APEX operator interface is designed to match both routine operation and advanced processing requirements.

- Multi-Operational Modes; APEX software may be activated by single key, by clinically driven menu windows or by command lines.
- Friendly Dialogs; Parameters may be entered via an interactive simple-format series-of-queries, called dialog.
- Help Menus; APEX built-in Help Menus minimize operator dependence on documentation. They are available any time on any level of the interaction for any command.

The advanced human interface of APEX software is a built-in guarantee of operational simplicity without compromising clinical diagnostic power.

OPTIONS**SCANNING ATTACHMENTS****RSCN-1 (OptiTrack)**

Fully automated on-line body contoured scanning

HTILT-1

Motorized single detector tilt

HTILT

Motorized dual detector tilt

HTR

Touch-ruler for easy scan-length setting

HDST

Head support attachment (for brain scan)

HLS

Leg-support attachment (table extension)

HARM

Arm support attachment

HI-511 (Not for sale in the U.S.A.)

511 keV Imaging package (including collimators)

ACCESSORIES**DISPLAY-HD**

High definition display (1416 x 1168 pixels), including 21" color monitor (in lieu of the 14" monitor)

AXM-14

Auxiliary 14" persistence image monitor

AEG-1A

ECG amplifier/synchronizer

ATC-15

Extended cable terminal to electronics cabinet

HCART

Dual collimator cart

HSTOR

Collimator storage cabinet

DATA STORAGE DEVICES**MINIMAX 3000S**

0.8 Gbyte optical disk (two cartridges included)

ODC-3

3 MINIMAX-3000S optical disk cartridges

CLINICAL PACKAGES**EVLV-1**

Evolving images acquisition and processing

GSPECTS

Gated ECT acquisition and processing

A3D-1

Interactive 3D display of tomographic studies

ACSP-1

Cedars-Sinai polar mapping package for ²⁰¹Tl tomographic studies, including comparisons to the Cedars-Sinai normal data base

ACSP-2

"CEQUAL" - Cedars-Emory Quantitative Analysis. ^{99m}Tc MIBI SPECT package (including normal patients data base).

ASFI-1

Scatter-free imaging package

PROGRAMMING LANGUAGES**CLIP**

Clinical macro programming language

APL-1-PLMS

PLM-86 programming language

NETWORKING and DATA TRANSFER**ACM-22S**

Single port fast Ethernet link (with thin cable connector)

TCM-12S

Thick cable Ethernet transceiver

ACM-2A

Thick cable for Ethernet network

ACM-2B

Thin cable for Ethernet network

ACM-14

Multiple port TCP/IP networking server communication link

ADT-1

Data transfer to/from "Non-ELSCINT" computers via 5¼ " diskette

AAN-1

Analog X, Y, Z-output

HARDCOPY DEVICES**Helios 810**

Polaroid Digital Laser Imager with dry development (additional networking server, ACM-14, is required)

Agfa Drystar/N

Networked color or black and white multi-imager with dry processing (additional networking server, ACM-14, is required)

VisiplexLR

Video multi-imager multifomat (1, 4) with conventional film processing, including one 8x10" film cassette

Codonics NP-1600

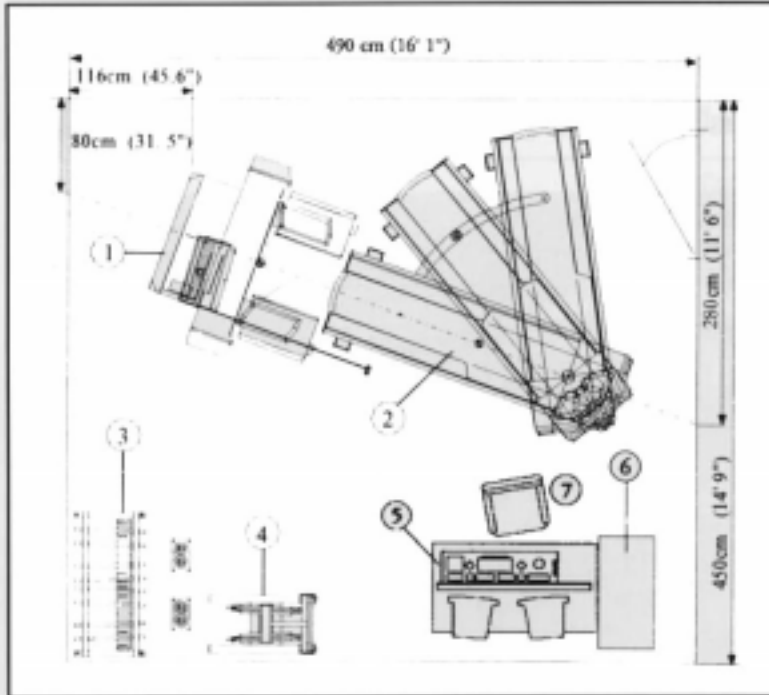
Digital color printer with dye sublimation (additional networking server, ACM-14, is required)

Shinko CHC-S443

Mitsubishi Video color printer with dye sublimation

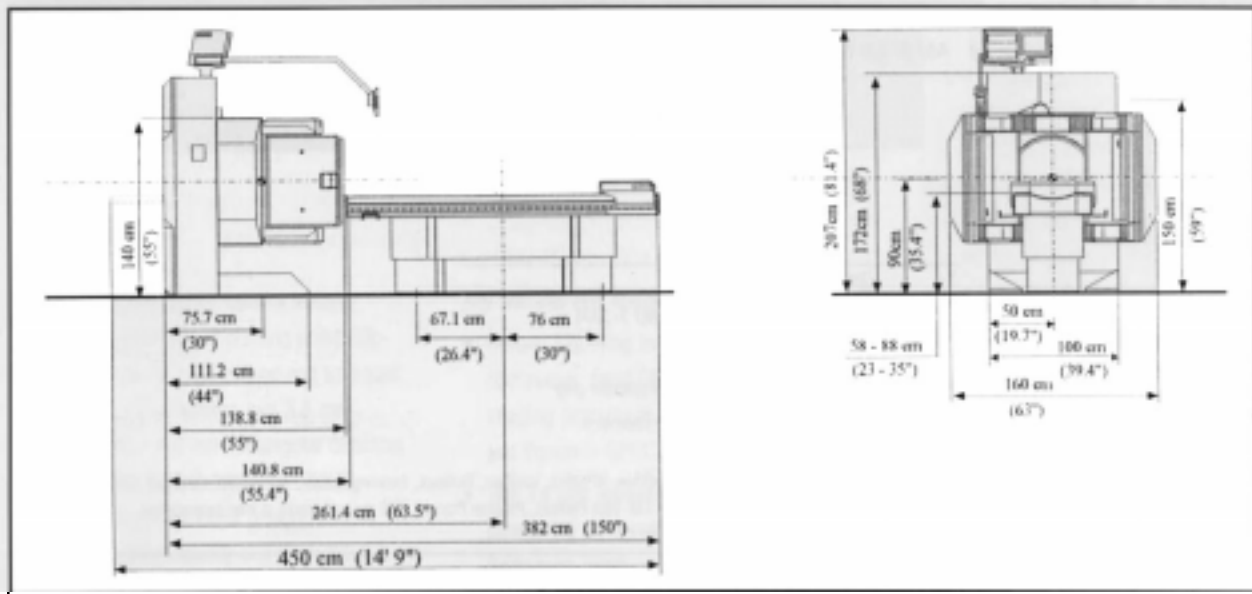
COLLIMATOR SPECIFICATIONS***

Name	Application	Energy keV	Septal Penetration %	Geometric Res.FWHM (mm)		System Res.FWHM (mm) @100 mm	Sensitivity Counts/min/μCi
				@0	@100		
HPC-1 LEUHS	Cardiac 1st Pass	140	2.6	4.9	19.1	19.2	1520
HPC-3 LEHS	Thallium & Multi-gated	140	2.3	2.9	10.1	10.5	430
HPC-35K LEGP	General applications	140	0.8	2.1	8.4	8.6	295
HPC-45K LEHR	Bone scans	140	0.3	2.0	6.7	7.1	195
HPC-46K LEUHR	Brain SPECT	140	0.1	2.0	6.0	6.6	145
HPC-5 MEGP	⁶⁷ Ga studies ¹¹¹ In studies	300	2.0	4.0	9.0	9.4	160
HPC-6 HEGP	¹³¹ I studies	360	2.0	4.9	10.0	10.5	190
HUFB-75 LEUHR	Brain SPECT (Fan beam)	140	0.1	2.0	5.5	6.3	220
HFB-73 LEGP	Cardiac SPECT (Fan beam)	140	0.8	2.2	9.4	9.7	490
HPC-8 HEGP Pinhole	Thyroid (3 inserts)	360	- - -	- - -	- - -	3.8 6.7 12.0	34 136 374
HPC-93 UHE	Ultra High Energy applications	-	3.5	5.9	12.3	12.9	95



TYPICAL ROOM LAYOUT

- 1. Gantry
- 2. Patient handling system
- 3. Collimator storage
- 4. Collimator cart
- 5. Operator's console
- 6. Electronics cabinet
- 7. Operator's chair



PHYSICAL CHARACTERISTICS

ELECTRICAL REQUIREMENTS

power consumption

7kVA

heat dissipation

13,320 BTU/H

mains

208/380 Vac (three phases) 17/10 A per phase
star

GANTRY FLOOR LOAD

3000 kg dynamic weight on a 103x96 cm² area
(at maximal detectors rotational speed with
assymmetric detectors positioning)

OPERATING ENVIRONMENT

temperature

18°C-27°C (64°F-80°F)

maximum temp. gradient

3°C (5°F) per hour

humidity

40%-60%, non-condensing

standards

Designed to meet UL544
IEC-601.1 certified.



DIMENSIONS & WEIGHTS

	HEIGHT cm (in)	WIDTH cm (in)	DEPTH cm (in)	WEIGHT Kg (lb)	HEAT DISSIPATION (BTU/H)	POWER CONSUMPTION (WATTS)
GANTRY	175 (69)	100 (39)	130 (51)	2300 [§] (5060)	6500	1905
ELECTRONIC CABINET	70 (28)	40 (16)	88 (35)	70 (154)	3740	1100
OPERATOR'S CONSOLE	123 (48)	80 (31)	90 (35)	40 (88)	1020	300
PATIENT HANDLING SYSTEM	98 (39)	83 (33)	240 (95)	400 (880)	Included in "GANTRY" specifications (above)	
COLIMATOR CART	130 (51)	50 (20)	85 (33)	70 [§] (154)	-	-
COLIMATOR STORAGE	130 (51)	130 (51)	60 (24)	100 [§] (220)	-	-

§ Add 80-220 kg (176-484 lb) when collimators are mounted

* *Optional*

** *Based on NEMA publication NU 1-1994*

*** *Nema class standard*

"Fast" acquisition mode, single detector only

combined performance of both detectors

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