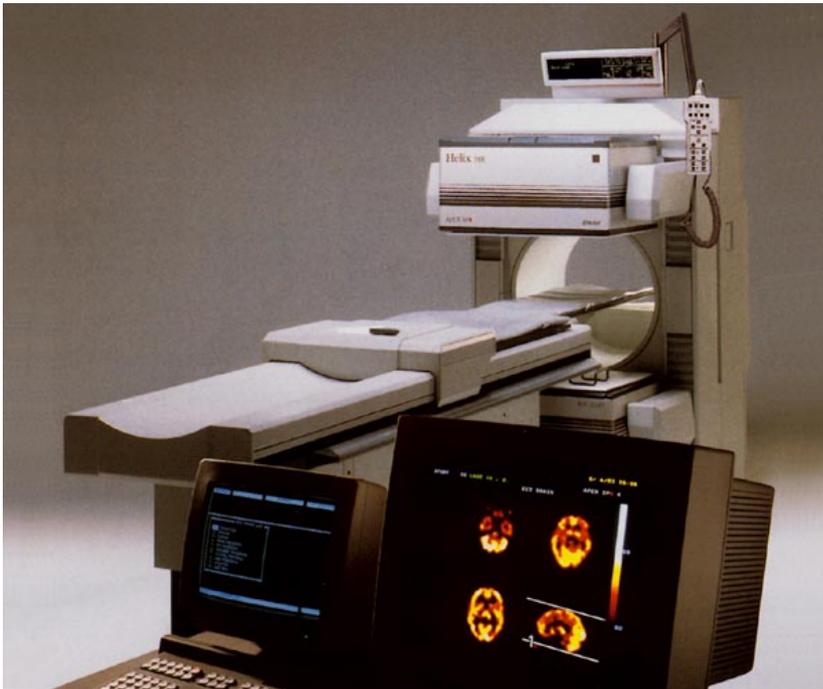


## Helix

*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 (<sup>67</sup>Ga): 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)
<b>FWHM(mm)</b> without scatter	6.9	7.4	9.0
<b>FWTM(mm)</b> without scatter	12.9	13.9	16.9
<b>system sensitivity**</b> counts/min/ $\mu$ 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, 128<sup>2</sup> 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 512<sup>2</sup>, 16 x 256<sup>2</sup>, 64 x 128<sup>2</sup>, 256 x 64<sup>2</sup>, 1024 x 32<sup>2</sup> or combinations thereof.
- Cine, windowing and baseline settings can be handled independently for each image in formats of 4 x 256<sup>2</sup> and 16 x 128<sup>2</sup>, 64 x 128<sup>2</sup>
- special modes: 2 x 512<sup>2</sup> + 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 (60x64<sup>2</sup> matrix);

0.68 sec/slice (60x128<sup>2</sup> 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 <sup>201</sup>Tl tomographic studies, including comparisons to the Cedars-Sinai normal data base

**ACSP-2**

"CEQUAL" - Cedars-Emory Quantitative Analysis. <sup>99m</sup>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**

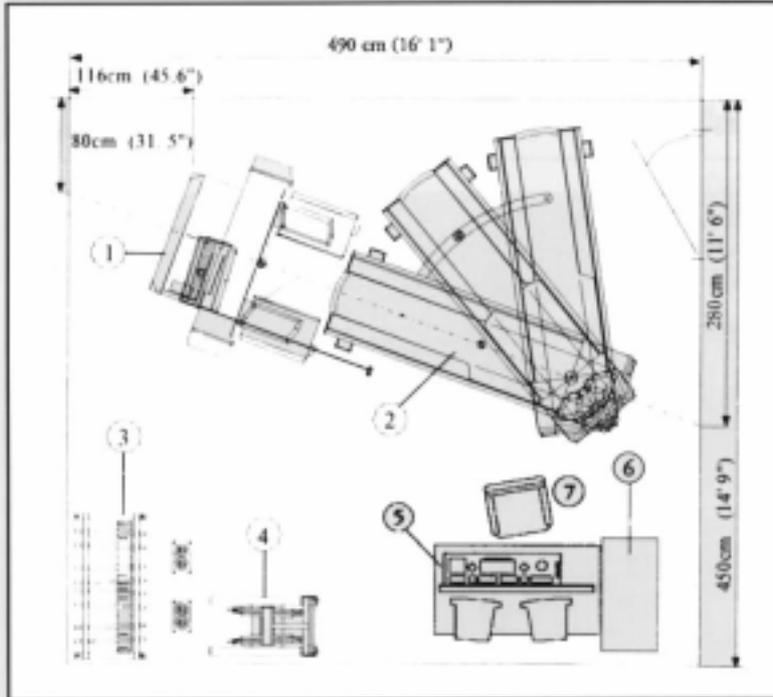
Digital color printer with dye sublimation (additional networking server, ACM-14, is required)

**Shinko CHC-S443**

Mitsubishi Video color printer with dye sublimation

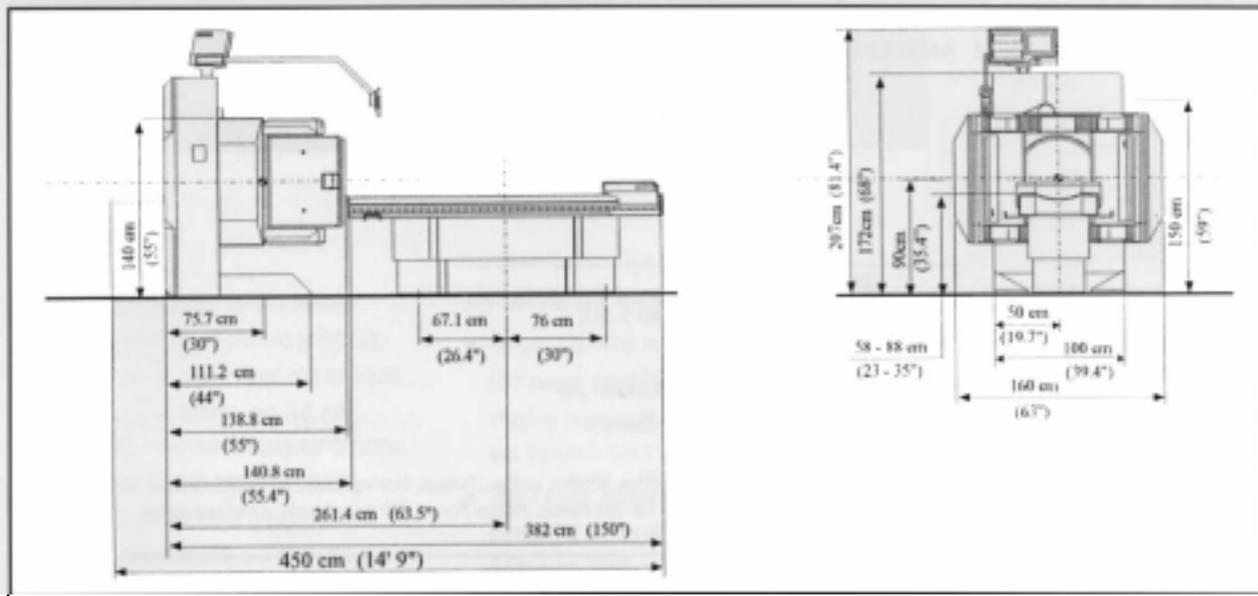
**COLLIMATOR SPECIFICATIONS\*\*\***

Name	Application	Energy keV	Septal Penetration %	Geometric Res.FWHM (mm)		System Res.FWHM (mm) @100 mm	Sensitivity Counts/min/μCi
				@0	@100		
<b>HPC-1</b> LEUHS	Cardiac 1st Pass	140	2.6	4.9	19.1	19.2	1520
<b>HPC-3</b> LEHS	Thallium & Multi-gated	140	2.3	2.9	10.1	10.5	430
<b>HPC-35K</b> LEGP	General applications	140	0.8	2.1	8.4	8.6	295
<b>HPC-45K</b> LEHR	Bone scans	140	0.3	2.0	6.7	7.1	195
<b>HPC-46K</b> LEUHR	Brain SPECT	140	0.1	2.0	6.0	6.6	145
<b>HPC-5</b> MEGP	<sup>67</sup> Ga studies <sup>111</sup> In studies	300	2.0	4.0	9.0	9.4	160
<b>HPC-6</b> HEGP	<sup>131</sup> I studies	360	2.0	4.9	10.0	10.5	190
<b>HUFB-75</b> LEUHR	Brain SPECT (Fan beam)	140	0.1	2.0	5.5	6.3	220
<b>HFB-73</b> LEGP	Cardiac SPECT (Fan beam)	140	0.8	2.2	9.4	9.7	490
<b>HPC-8</b> HEGP Pinhole	Thyroid (3 inserts)	360	- - -	- - -	- - -	3.8 6.7 12.0	34 136 374
<b>HPC-93</b> 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 cm<sup>2</sup> area  
(at maximal detectors rotational speed with  
assymetric detectors positioning)

**OPERATING ENVIRONMENT**

**temperature**

18°C-27°C (64°F-80°F)

**maximum temp. gradient**

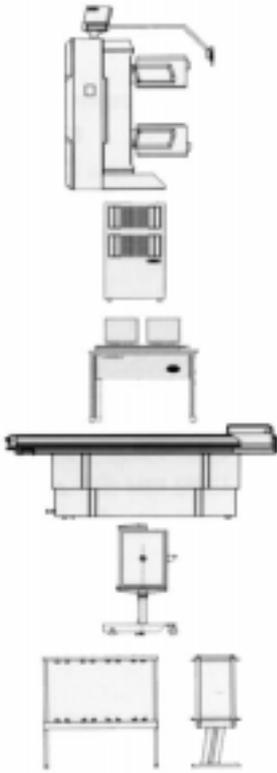
3°C (5°F) per hour

**humidity**

40%-60%, non-condensing

**standards**

Designed to meet UL544  
IEC-601.1 certified.



## DIMENSIONS &amp; WEIGHTS

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

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