

## OCHRONA RADIOLOGICZNA

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### Pomieszczenie skanera CT/PET Gemini TF

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#### 8.10 Bezpieczna eksploatacja

Tylko odpowiednio przeszkolony personel może obsługiwać urządzenie, zgodnie z instrukcją obsługi.

#### 8.11 Przekazanie pracowni do eksploatacji

Warunkiem przekazania pracowni do eksploatacji, jest wykonanie prac budowlanych i instalacyjnych zgodnie z zaleceniami producenta i niniejszym „Projektem technicznym ochrony radiologicznej”, zaopiniowanym przez:

- Stację Sanitarno Epidemiologiczną w Warszawie,
- Departament Nadzoru Promieniowania Jonizującego PAA w Warszawie.

Odbioru pracowni dokonuje:

- Stacja Sanitarno Epidemiologiczna w Warszawie
- Inspektorzy Dozoru Jądrowego PAA.

## 9. Bibliografia

- |                  |  |
|------------------|--|
| 1) Gostkowska B. | Wielkości, jednostki i obliczenia stosowane w ochronie radiologicznej, CLOR 1991.                                    |
| 2) Hryniewicz A. | Dawki i działanie biologiczne promieniowania jonizującego – PAA, Instytut Fizyki Jądrowej, Warszawa – Kraków, 1993r. |

## GEMINI TF PET/CT with TruFlight Technology



# GEMINI TF

Perfect for every body

### Time-of-Flight has arrived!

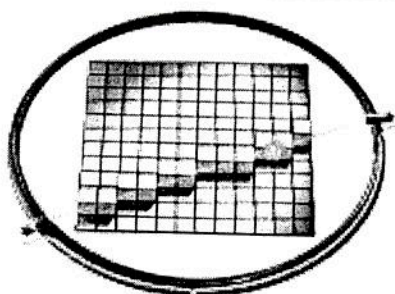
The real-world application of Time-of-Flight PET imaging has eluded research teams for many years. Until now.

By capturing the time difference between coincident photon detection, Philips' TruFlight technology acquires and processes data in a totally different way than conventional scanners. It helps you see more than ever.

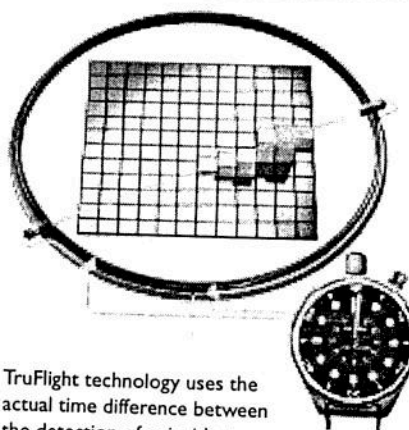
GEMINI TF delivers the unique benefits of TruFlight technology: faster scans, better image quality – especially with large patients, and the most advanced platform available for demanding Molecular Imaging applications.

In addition, GEMINI TF incorporates the patient and clinician benefits of Philips' patented OpenView open gantry design, a hallmark of the GEMINI family.

All this makes GEMINI TF **Perfect for every body.**



In conventional PET imaging, it's only possible to know that a coincident event has taken place on the line of response, but not the actual location of the event



TruFlight technology uses the actual time difference between the detection of coincident events to more accurately identify the origin of the annihilation. Better identification leads to a quantifiable improvement in image quality.

# PHILIPS



# EMINI TF PET Specifications

## System Overview

PET platform	TruFlight
CT platform	Brilliance
Patient port	70 cm PET and CT
Gantry cooling	Air-cooled
Attenuation correction	CT

## Patient Handling System

Maximum patient weight	195 kg (430 lbs)
Vertical travel	35.5 cm
Patient scan range	190 cm
Horizontal speed	150 mm/s (max)
Minimum table height	67 cm

## PET Detector Design

Detector design	PIXELAR with continuous light guide
Number of crystals	28,336
Crystal size	4 x 4 x 22 mm
Crystal material	LYSO
Number of detector rings	44
Hygroscopic	no
Number of PMTs	420
Ring diameter	90 cm
Transaxial FOV	57.6 cm
Axial FOV	18 cm
Coincidence window size	3.8 ns
Lower level discriminator	440 keV

## NEMA Performance Specifications <sup>(1)</sup>

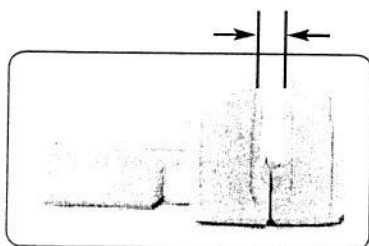
System sensitivity	7000 cps/MBq (center)
	7200 cps/MBq (10 cm)
Transverse spatial resolution @ 1 cm	4.7 mm
With LOR <sup>(2)</sup>	4.3 mm
Transverse spatial resolution @ 10 cm	5.2 mm
With LOR <sup>(2)</sup>	4.7 mm
Axial spatial resolution @ 1 cm	4.7 mm
With LOR <sup>(2)</sup>	4.3 mm
Axial spatial resolution @ 10 cm	5.2 mm
With LOR <sup>(2)</sup>	4.7 mm
Peak noise equivalent count rate - 1R (NECR)	105 kcps @ 16 kBq/ml
Clinical noise equivalent count rate (NECR) <sup>(3)</sup>	60 kcps @ 5.3 kBq/ml
Max trues	240 kcps
Scatter fraction	30%
System energy resolution	12%

## Time-of-Flight Performance

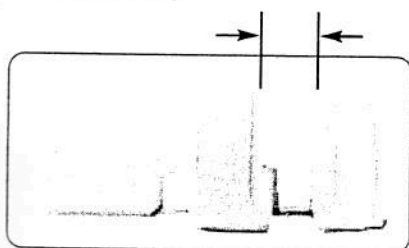
Timing resolution	650 ps
Sampling rate	25 ps
Sensitivity gain <sup>(4)</sup>	2 - 4x, depending on patient size
System sensitivity	>14000 cps/MBq (center)
	>14400 cps/MBq (10 cm)
Peak NECR	>210 kcps @ 16 kBq/ml
Clinical NECR <sup>(3)</sup>	>120 kcps @ 5.3 kBq/ml
Time-of-Flight localization accuracy	9.75 cm

## Exclusive OpenView Gantry:

- Designed to minimize claustrophobia for a better patient experience and less issues with patient movement
- Gantries further separate for improved access and other clinical applications



30cm opening



88cm opening in the separated position

## PET Acquisition and Reconstruction

- Fully 3D acquisition (no limit on acceptance angle)
- Static, dynamic, & gated acquisition
- List mode acquisition and reconstruction for all Time-of-Flight protocols
- Time-of-Flight reconstruction
- Fully 3D Line of Response (LOR) processing
- Distributed reconstruction architecture
- Concurrent acquisition and reconstruction
- CT attenuation correction, 2 & 4-segment algorithms

## PET Software Processing

- Comprehensive PET/CT review tools
- Automated registration with CT, MR and SPECT
- Automated 3D contouring
- Cardiac perfusion and viability analysis\*
- Quantitative brain analysis\*

\* Optional for all configurations

- PET Performance specifications represent average values measured following the methodology of NEMA standard publication NU 2-2001, unless otherwise noted.
- Incorporating the effects of Line of Response (LOR) reconstruction
- NEC at a 10 mCi clinical imaging dose for FDG whole body studies in an average patient (73 kg / 160 lbs)
- Effective sensitivity gain defined as a ratio between patient size and Time-of-Flight localization accuracy.



# GEMINI TF CT Specifications

## Generator

The Brilliance generator uses modern, low-voltage slip ring technology to provide a constant high voltage to the CT X-ray tube assembly.

	16-Slice	64-Channel
Output capacity	60 kW	60 kW
kV	90, 120, 140 kVp	80, 120, 140 kVp
mA	20-500 mA; 1 mA inc	20-500 mA; 1 mA inc

## MRC X-ray Tube

The exceptional heat management demands of multislice imaging calls for an exceptional tube. With its patented spiral groove bearing design, Philips MRC tube dissipates heat as rapidly as it is collected, with an effective heat storage capacity far superior to a conventional ball bearing design. Additional features include:

- Motion-free focal spot guarantees optimized image quality
- Absolute noiseless design calms patients
- 2nd generation of MRC tube technology built on proven record of performance and reliability

Effective heat storage capacity	26 MHU
Anode storage capacity	8.0 MHU
Anode max cooling rate	1,608 kHU/min
Focal spot (IEC)	Large: 1.0 mm x 1.0 mm Small: 0.5 mm x 1.0 mm
Anode diameter	200 mm
Anode rotation speed	105 Hz (6300rpm)
Target angle	7°
Focus-detector distance	1,040 mm
Focus-isocenter distance	570 mm

## Detector

Philips Medical Systems patented detector design is fundamental to the objective of acquiring high quality images while minimizing patient dose.

	Solid-State GOS	Solid-State GOS
Material		
No. of elements	16,128 (32,256 effective with DFS)	43,008 (86,016 effective with DFS)
Dynamic range	1,000,000 to 1	1,000,000 to 1
Slip ring	Optical - 1.1 Gbps transfer rate	Optical - up to 5.3 Gbps transfer rate
Data sampling rate	Up to 4,640 views/revolution/element	Up to 4,640 views/revolution/element
Slice collimation	2 x 0.6 mm, 16 x 0.75 mm,	2 x 0.5 mm, 16 x 2.5 mm, 32 x 1.25 mm, 64 x 0.625 mm
Slice thickness-spiral mode	0.65 - 7.5 mm variable	0.67 - 7.5 mm variable
Slice thickness-axial mode	0.6 - 12 mm	0.5 - 12 mm
Coverage	24 mm	40 mm
Scan field of view-diagnostic	250, 500 mm	250, 500 mm
Scan field of view-CTAC	600 mm	600 mm

## Image Quality

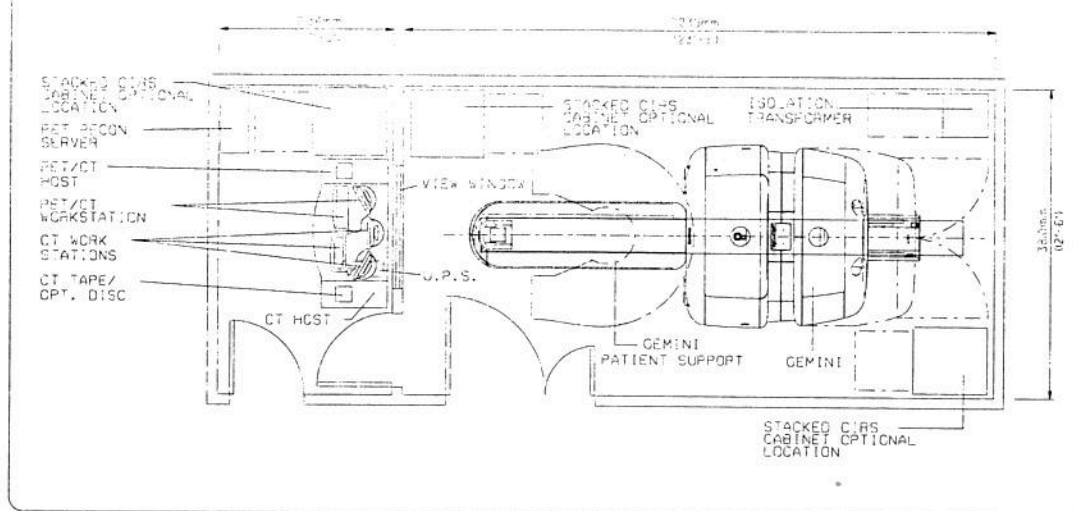
Spatial resolution	Ultra High mode: 24.0 Lp/cm @ cut-off High mode: 16.0 Lp/cm @ cut-off Standard mode: 13.0 Lp/cm @ cut-off
Noise	0.27% as measured on the Philips system phantom (21.6 cm water equivalent)
Low contrast resolution	4.0 mm @ 0.3% as measured on the 20 cm CATPHAN phantom
Absorption range	-1024 to +3072 Hounsfield units
Temporal resolution	As low as 53ms using 0.4 sec rotation and adaptive multicycle reconstruction
Scan times	0.4", 0.5", 0.75, 1, 1.5, 2 seconds for full 360° scans 0.28", 0.33" seconds for partial angle 240° scans
Reconstruction speed	Up to 20 images per second

## CTDI<sub>vol</sub> Dose Levels

Using IEC standard phantom		
Head	12.85 mGy/100mAs	11.0 mGy/100mAs
Body	6.54 mGy/100mAs	5.6 mGy/100mAs

# GEMINI TF Gantry & Site Planning

## Minimum Room Layout



## Environmental Requirements for General Equipment Locations

Throughout the PET/CT suite, the HVAC system must maintain the temperature between 15°C (59°F) to 24°C (75°F). Humidity must be between 35% and 70%, non-condensing. These requirements are 24 hours per day, 7 days per week.

### Power Requirements

<b>Main type</b>	Three Phase
<b>Room supply voltage</b>	200 - 500 VAC
<b>System voltage, PET/CT (after LM transformer or UPS)</b>	480 VAC +/- 10%
<b>Frequency</b>	50 or 60 Hz, nominal
<b>Power quality</b>	Refer to IEC 61000-4-4 and IEC 61000-4-5
<b>Distribution transformer</b>	100 kVA (minimum)

### Minimum Room Size

<b>Exam room</b>	7239 mm (23'-9") x 3810 mm (12'-6")
<b>Control room</b>	2134 mm (7'-0") x 3810 mm (12'-6")

### Scanner Characteristics

<b>Gantry dimensions (couch home), H x W x D</b>	213 x 225 x 549 cm (83.9 x 88.6 x 216 in)
<b>Weight</b>	
16 CT	4,141 kg (9,130 lbs)
64 CT	4,201 kg (9,262 lbs)
<b>Power requirements, PET/CT</b>	100 kVA (maximum)
<b>Heat load (all components)</b>	42,050 BTU/hr
<b>PET/CT system</b>	27,950 BTU/hr
<b>Reconstruction cabinet</b>	10,600 BTU/hr
<b>Control room computers</b>	3,500 BTU/hr

Detailed site planning requirements are documented in the Planning Reference Data (PRD) guide and available upon request.

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