IMAGING FOR SCIENCE

nanoScan® PET

Preclinical Imaging Systems

nanoScan® PET/MRI
nanoScan® PET/CT

High performance systems optimized
for absolute quantification
and high throughput scanning

Mediso
Medical Imaging Systems

Preclinical imaging systems

nanoScan® Family

With the **nanoScan®** Family concept Mediso provides a unique and flexible solution for the demands of your imaging facility. Members of the **nanoScan®** Family share the user friendly **Nucline™** acquisition software platform for all modalities, with intuitive workflow and effortlessly customizable protocols.

Both post-processing programs of **InterView™** FUSION and **VivoQuant™** are able to co-register and analyze multiple images across all modalities.

MultiScan LFER 150 PET/CT

The MultiScan Family aims to provide imaging tools for non-human primate, large animal and dedicated clinical research. The LFER 150 PET/CT, specifically designed for non-human primate imaging, supports both recumbent and sitting positions. The scanner features 20 cm transaxial and 15 cm axial field of view and 1 mm PET resolution.

nanoScan® PET subsystems

Main advantages

- **More than 100 installed PET-based cameras worldwide:**
  - ensuring reliable systems with matured technology
  - supported by proven and experienced service and application network
- **Highest PET resolution** (using the industry's most advanced pixelated modular LYSO detectors)
- **Exceptionally high count rate** tolerance supporting **high activity studies** of multiple animals or short half-life isotopes
- State-of-the-art **Tera-Tomo™** 3D PET image reconstruction engine
- Easy access to the animal from both the front and the back of the PET/CT gantry
- High imaging throughput by large bore size and large field-of-view in both axial and transaxial directions
- No trade-off between resolution and sensitivity: high resolution images are reconstructed from large field-of-view, high-sensitvity data acquisitions
- One-click **MultiCell™** animal anesthesia / imaging chamber
- Extremely fast, parallel workflow of data acquisition, image reconstruction and image quantitation
- Fully automated calibrations

	PET 122S	PET 82S	Benefit
Single Axial FOV	10 cm	10 cm	Enabling whole-body mouse scan in one FOV
Number of rings*	2	2	
Transaxial FOV	12 cm	8 cm	122S: Enabling marmoset, guinea pig and rabbit studies
Gantry opening	16 cm	11 cm	
LYSO Crystal size	1.12x1.12x13 mm	1.51x1.51x10 mm	122S: Super-fine crystal needles resulting in excellent resolution
Total number of crystals	36 504	13 456	
Spatial Resolution with 3D OSEM	0.7 mm	0.9 mm	Highest resolution on the market providing best available image quality
Spatial Resolution with FBP	1.25 mm	1.4 mm	
Sensitivity [250 - 750 keV]	8%	7%	High sensitivity for fast and high quality imaging
NEC for mouse	850 kcps @ 60 MBq	460 kcps @ 45 MBq	High count rate supporting high activity studies with various isotopes (^{11}C, ^{15}O)
NEC for rat	230 kcps @ 60 MBq	130 kcps @ 38 MBq	
Temporal resolution	1.2 ns	1.0 ns	For efficient corrections supporting high quantitation accuracy and good resolution
Energy resolution	19%	14%	
Combination with CT	Yes	Yes	High resolution and low dose CT imaging
Combination with MRI 1T	Yes	Yes	Improved soft tissue contrast, cost-effective MRI
Combination with MRI 3T	Yes	No	Translational field, excellent image quality

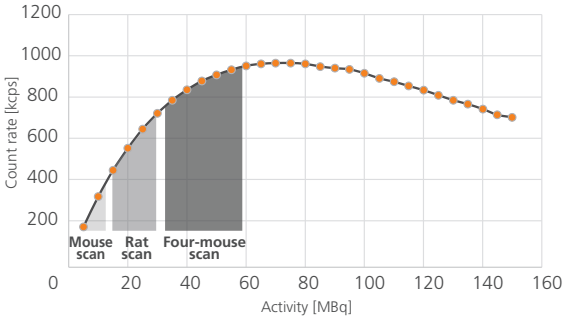
*Both models are available in single-ring configuration upon request

nanoScan® PET subsystems

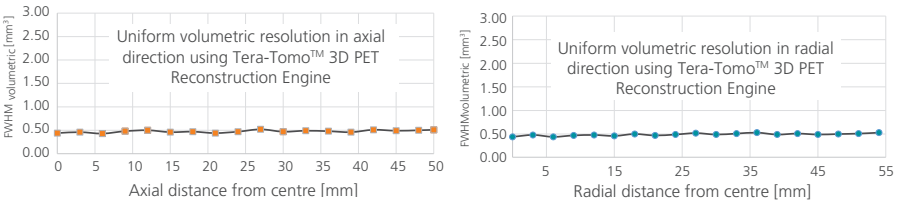
Tera-Tomo™ 3D PET reconstruction engine

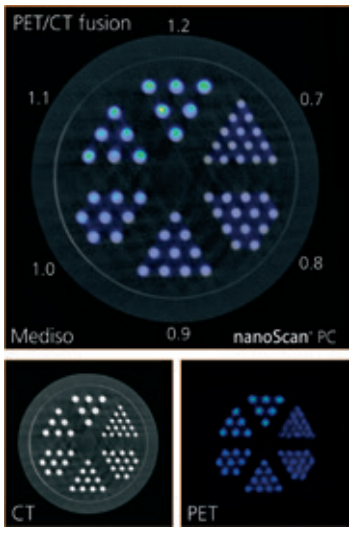
Modelling of detector geometry → Monte Carlo based full detector modelling and DOI estimation → Advanced corrections for energy, position, time, random deadtime etc. → CT/MRI-based attenuation, scatter and positron range correction → Optimized reconstruction protocols for various applications

PET performance



Noise equivalent count rate curve for the PET 122S system, showing the best available performance on the market





*Imaging performance with **Tera-Tomo™** 3D PET Reconstruction Engine using 10 MBq ^{18}F-FDG in an ultra micro-Derenzo phantom*

NEMA Image Quality Phantom Evaluation

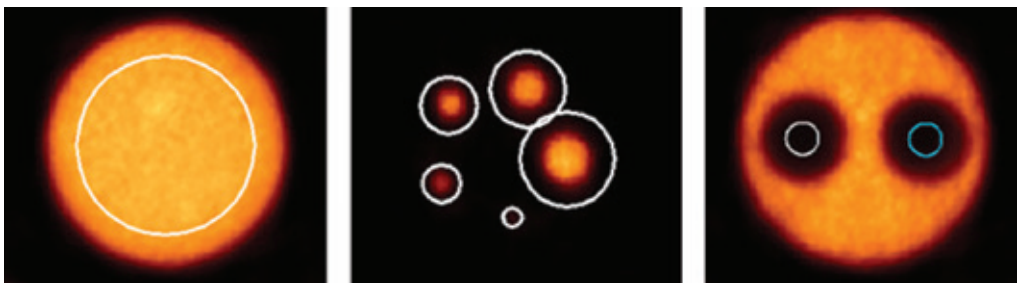


*Image quality phantom evaluation reconstructed with **Tera-Tomo™** 3D PET Reconstruction with Full detector modelling*

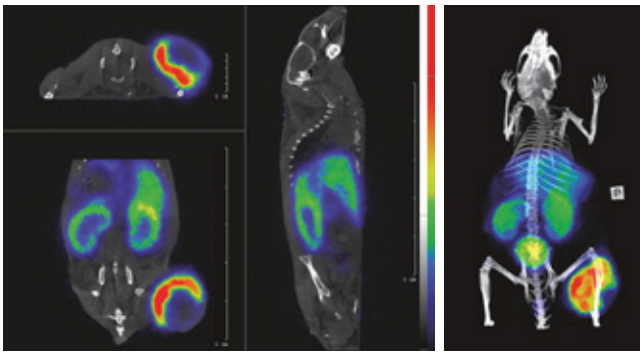
Uniformity	4%	Spill over ratio Air/Water		0.04 ±0.004	0.05 ±0.004
Recovery Coefficient values	5 mm	4 mm	3 mm	2 mm	1 mm
	0.98	0.98	0.97	0.87	0.37

*NEMA Image quality phantom results with **Tera-Tomo™** 3D PET Reconstruction with Full detector modelling*

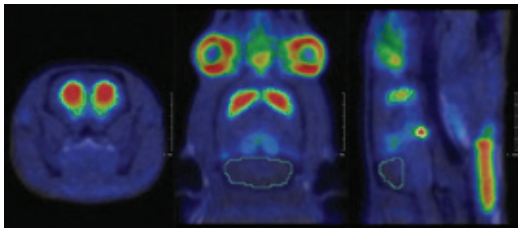
nanoScan® PET-system evaluated in peer reviewed scientific article: Nagy et al, Journal of Nuclear Medicine 2013; 54; 1-8

nanoScan® PET subsystems

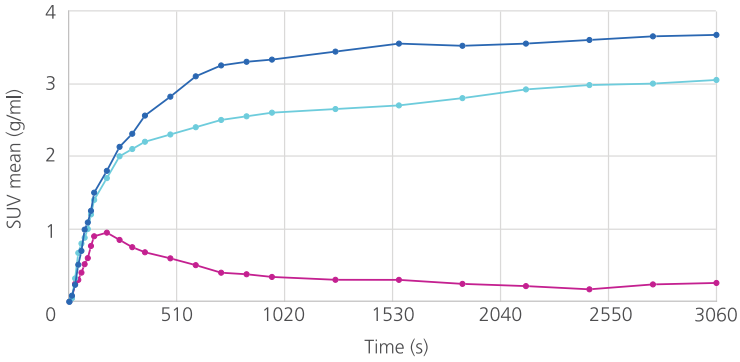
Exclusive PET imaging performance



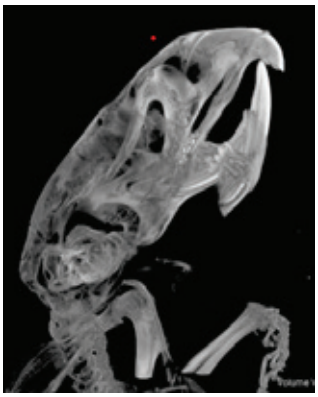
Three plane sections of a nude mouse bearing FaDu xenograft tumor. 34 MBq of ^{64}Cu-labelled antibody fragment injected i.v., imaging 24 h post injection.Note the accumulation in kidney cortex and the tumor uptake inhomogeneities. MIP image of the same nude mouse.



^{18}F-Fallypride (D2/D3 receptor antagonist) uptake in rat brain. PET/MRI image and corresponding Time Activity Curve of the accumulation. Injected activity 11.7MBq.



CT subsystem



High resolution reconstruction of mouse head 20 µm voxel size 70 kV 750 µA

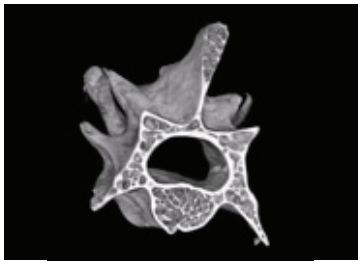
To complement the **nanoScan®** PET's exceptional qualities Mediso designed unique combination of low dose, high resolution and high speed CT with real time reconstruction to further improve the throughput of the system.

The large bore size of the CT allows even larger rodents to be examined such as rabbits or small monkeys.

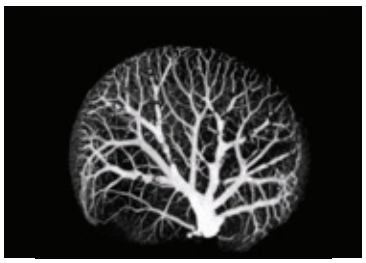
Advantages of the CT subsystems

Available in different configurations to further tailor the system to the researchers needs. For detailed information please contact your local sales representative.

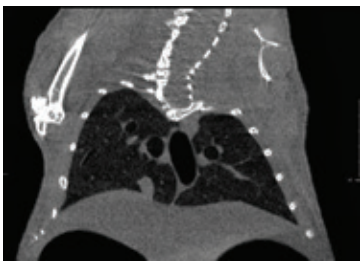
- Large bore size
- Variable zoom (up to x 7.6 magnification)
- Real time CT reconstruction
- Low animal dose
- Fast speed (whole body mouse less than 36 sec)
- Large bore transaxial field of view (up to 12 cm)



High resolution reconstruction of mouse vertebra 10 µm voxel size, 35 kVp, 1000 µA



High resolution ex-vivo scan of mouse liver 20 µm voxel size, 35kVp, 1000µA



Mouse lung CT imaging 50 µm voxel size 50 kV 750 mA

MRI subsystem: 3T cryogen-free or 1T permanent

High imaging performance

3T MRI – Excellent resolution with high sensitivity on translational 3T field strength

Mediso accepts no compromises in the imaging performance of the **nanoScan®** PET/MRI 3T system. Due to tailor-made shielding, developed as an integral part of the specially designed and shimmed, low fringe field cryogen-free magnet, the supreme performance of the well-established PET subsystem remains intact.
The **nanoScan®** MRI 3T system delivers images with excellent resolution together with high sensitivity. Thanks to its clinical magnetic field of 3T, the system enables translational in-vivo imaging of small animals and benefits from the same main clinical applications.

1T MRI – High soft tissue contrast, cost-effective solution

The compact system with high-performance magnet is optimized to perform fast (seconds to minutes) routine studies with high resolution soft tissue contrast.

Easy-to-use workflow

The ease of use of the MRI subsystems matched with their powerful imaging capabilities, makes it simple to correlate functional PET data with anatomical morphology.

Smart® Superconducting Magnets – Cost-effective operation

- Cryogen-free system (no need for liquid Helium)
- Idle mode operation when the magnet is not being used, to save energy.
- Optional proprietary Thermal Storage Modules to allow magnets to remain charged during power outage.

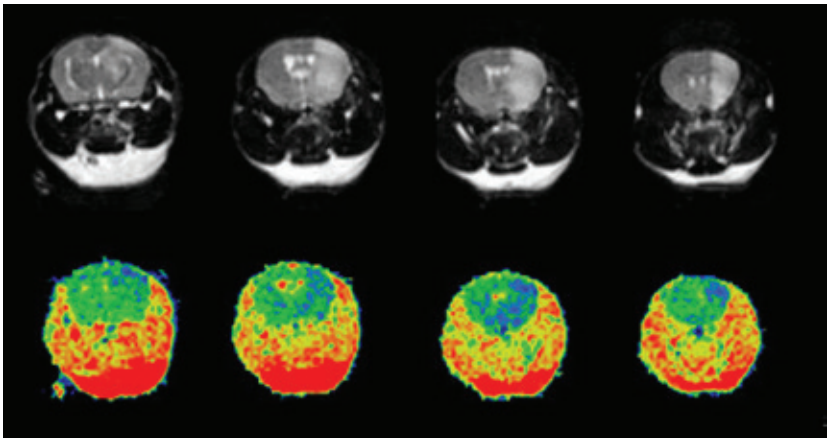
Angiography - MIP of Mn-based contrast media
Images courtesy of CROMed, Budapest

Available RF coils

- Whole-body mouse
- Whole-body rat
- Dedicated coils for mouse brain (optional)
- Dedicated coils for rat brain (optional)
- Coils for various isotopes (optional)
- Surface coils (optional)

Several 2D and 3D pulse sequences

- 3D Localiser
- Quick sagittal Localiser for ultrafast anatomical reference
- Spin Echo (SE) 2D and 3D
- Fast Spin Echo (FSE) 2D and 3D
- Gradient echo 3D (GRE)
- Inversion Recovery – Spin and Gradient Echo (IR-SE, IR-GRE)
- Angiography with contrast agent
- Fat-water imaging (Dixon-method)
- Perfusion imaging
- T1, T2 and T2-mapping
- Several multi-field-of-view sequences with up to 240 mm extended axial FOV



Stroke model – Extension of induced perfusion defect, visualized by T2 weighted FSE sequence and by Apparent Diffusion Coefficient map obtained from DWI sequence
Images courtesy of CROMed, Budapest

Animal handling

Available **MultiCell**™ imaging chambers

PET/CT

PET/MRI

Mouse Standard
Inner space: 36 x 290 mm
Outer dimensions: 40 x 460 mm
Up to 80 g

Rat Standard
Inner space: 65 x 440 mm
Outer dimensions: 70 x 540 mm
Up to 600 g

Two-Mouse
Inner space: 2 x 24 x 260 mm
Outer dimensions: 56 x 470 mm
Up to 2 x 35 g

Four-Mouse
Inner space: 4 x 30 x 194 mm
Outer dimensions: 85 x 524 mm
Up to 4 x 60 g

Rat - XXL
Inner space: 102 x 510 mm
Outer dimensions: 110 x 650 mm
Up to 1.5 kg

Rabbit
Inner space: 150 x 600 mm
Outer dimensions: 160 x 760 mm
Up to 6.5 kg

PrepaCell™ Preparation station

- Two one-click docking stations
- Closed, temperature controlled system (up-tight container) with transparent removable cover
- Vital function monitoring
- Embedded anesthesia connection to any isoflurane system
- Closed circuit tubes integrated into the wall of the imaging chamber delivering anesthetic gas to the mouse/rat nose cone
- Integrated ear bars for ultra-precise and reproducible stereotactic animal head positioning
- Fully compatible with all **nanoScan**® and **MultiScan** Family systems

Under the hood **PET/MRI**

MRI Magnet

3 Tesla cryogen-free
- Gradient strength: > 450 mT/m
- +/- 0.5 ppm over 50 mm DSV
- Stability: <0.05 ppm/hour
- ≤ 50 µm spatial resolution
- Integrated RF and magnetic shielding – low floor space requirement and no need of a dedicated room

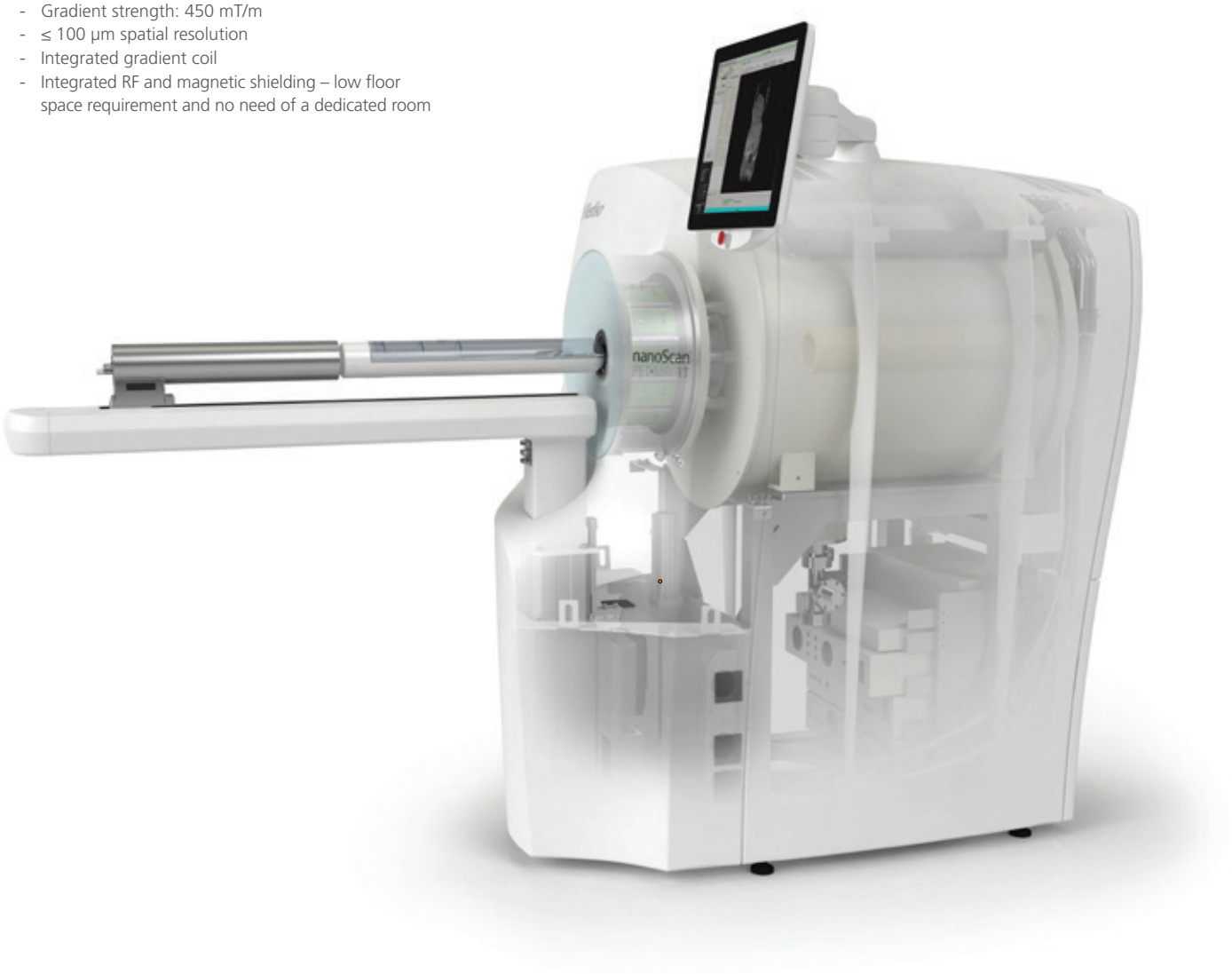
1 Tesla permanent magnet
- Gradient strength: 450 mT/m
- ≤ 100 µm spatial resolution
- Integrated gradient coil
- Integrated RF and magnetic shielding – low floor space requirement and no need of a dedicated room

PET Detector

- LYSO crystal full ring geometry
- Up to 12 cm transaxial FOV
- Aperture: up to 16 cm
- Up to 0.3 mm^3 spatial resolution by **Tera-Tomo™** 3D PET reconstruction engine

Touchscreen interface

- Shared interface for PET and MRI
- Imaging chamber movement control through touchscreen interface or from the acquisition workstation
- Continuous physiological monitoring
- PET persistence scope function



Animal handling

- Direct access to the animal during scan
- Zero dead space: easy manipulation of the animal (injection, blood sampling, etc.)
- Automated imaging chamber positioning
- Integrated heating and gas anesthesia possibility
- Physiological monitoring
- ECG/respiratory gating

Fast, Easy Instrument Installation

- Compact size
- No need for liquid cryogen
- Negligible magnetic fringe field
- No need for additional RF shielding or MRI compatible tooling in the lab

RF Coils

- Volume coils for whole body mouse imaging
- Volume coils for whole body rat imaging
- Back door access for easy coil exchange
- Multiple coils available
- Custom coils available upon request

Under the hood PET/CT

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High Precision Gantry

- Precise and robust rotational bearing and drive
- Exceptionally stable gantry with 3 axis movements
- Large bore size up to 160 mm
- Touchscreen interface
- Vibration free rubber pads

X-Ray CT System

- 80 W X-ray tube power
- Up to 1 mA tube current
- <10 mGy exposure CT dose
- 2-12 cm variable TFOV
- Up to x 7,6 zoom
- ≤ 10 µm isotropic voxel size

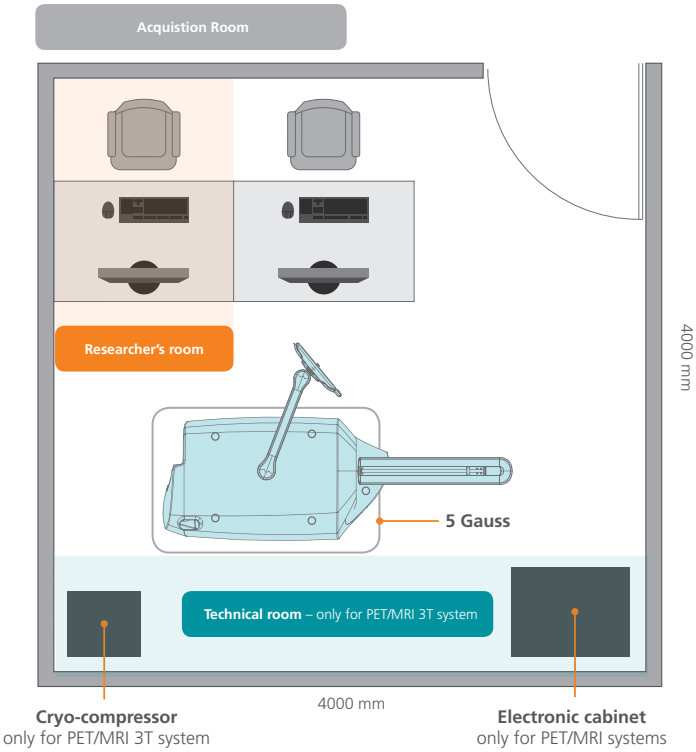
Operating hardware

PET/CT → PET/MRI 1T → PET/MRI 3T

Room requirements

All **nanoScan®** PET-based systems

- Minimum acquisition room size: 10 m²
- Single phase operation 115 / 230 V
- No additional RF shielding required
- No additional magnetic shielding required – self shielded systems



System specific parameters

nanoScan® PET/CT

- Size (W x D x H): 1350 x 1760 x 1680 mm
- Weight: 650 kg

nanoScan PET/MRI 1T

- Size (W x D x H): 1300 x 1910 x 1590 mm
- Weight: 1210 kg
- No cryogen or water cooling required
- Standard air conditioning is sufficient

nanoScan® PET/MRI 3T

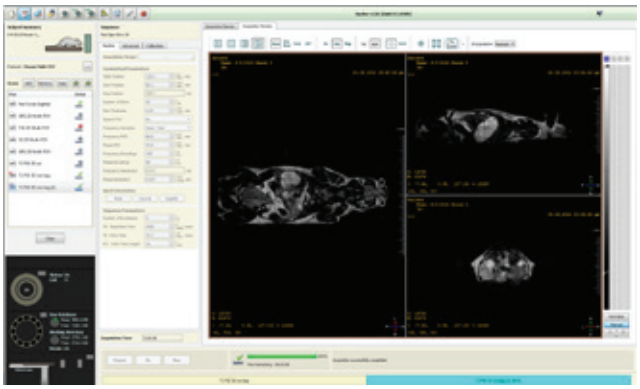
- Size (W x D x H): 1330 x 2350 x 1630 mm
- Weight: 500 kg
- Minimum 5 m² technical room required with
  - Three-phase power supply (7 kW)
  - Water access for the cryo-compressor

Software solutions

Nucline™ all modality acquisition software

Nucline™ is an easy to use and intuitive interface for high throughput workflow across all the **nanoScan®** Family systems - there is no need to learn different software solutions. In a 21CFR Part 11 compliant data management environment predefined and customizable acquisition protocols make experiments daily routine.

The integrated gantry with common coordinates gives the opportunity to seamlessly co-register images allowing for accurate image quantification. Furthermore, list mode data collection provides wide range of flexibility in data analysis according to study requirements.



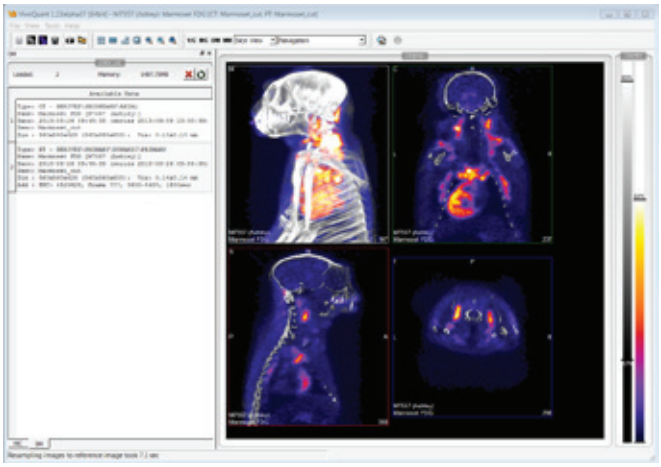
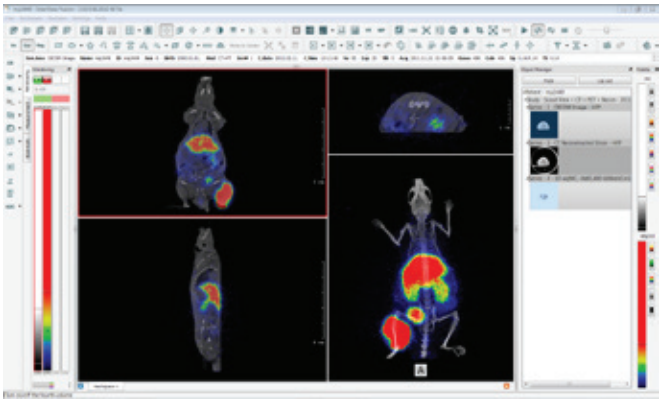


Image processing and quantification by **VivoQuant™** software

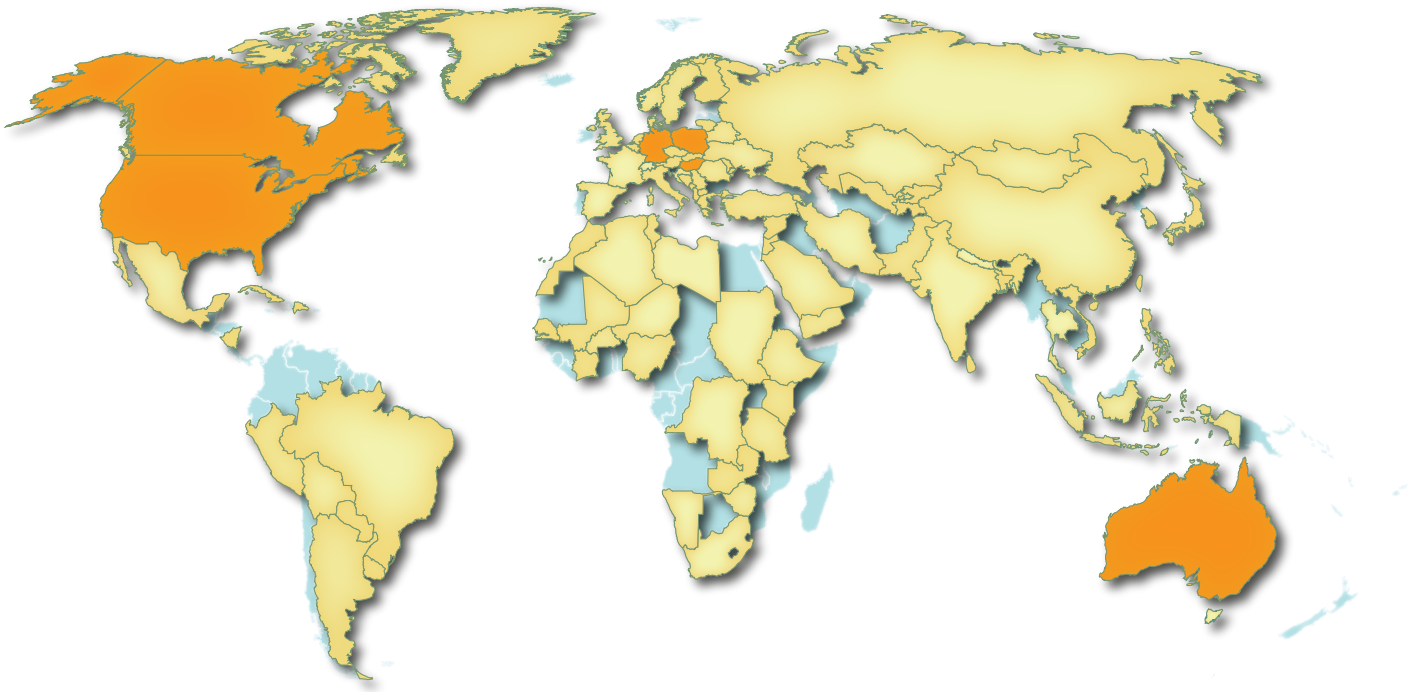
VivoQuant™ is an image viewing, processing and analysis software suite from inviCRO, LLC., supporting data from both nuclear medicine and magnetic resonance imaging systems. Advanced co-registration, viewing, processing and quantification of data with plug-in modules dedicated to neurology and oncology applications address the challenging bottlenecks imaging laboratories face in day-to-day operations.

Post-processing by **InterView™ FUSION** software

InterView™ FUSION developed by Mediso, is a multi modal application and essential part of system. A wide range of functionalities are provided to evaluate PET, SPECT, CT and MRI preclinical data. 2D single, orthogonal and tiled, as well as 3D MIP and Volume Rendering viewers represent fast and flexible visualization techniques built on GPU acceleration. Viewers provide dual, triple and quadruple fusion to accurately compare and enhance multi-modal single and follow-up studies. Dynamic PET images together with CT or MRI can be fused and PET images can be studied over time.



More than 1250+ clinical and 250+ preclinical Mediso manufactured single and multimodality imaging systems were distributed in 98 countries of the world.



Conformance Statement

Quality management system operated by Mediso complies with Council Directive 93/42/EEC Annex II.

Product design, development, production and services comply with EN ISO 13485 and EN ISO 14971.

Safety labels are attached to appropriate places on equipment and appear in all operation manuals.

The supplied software complies with DICOM standard.

The technical information provided here is not a detailed specification.

For details and up to date information please contact your local distributor or Mediso.

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