nanoScan® MRI 3T and 7T

High-end MRI with the most robust cryogen-free superconducting magnet on the market

Mediso

Founded
1990

Offices
7

Employees
300+

Publications
3200+

Countries
100+

Preclinical systems
300+

Clinical systems
1350+

About us

Mediso works in the field of **medical imaging for 30+ years** with a profile of development, manufacturing, selling and servicing standalone and multi-modality imaging devices. The company offers complete solutions from hardware design to evaluation and quantification software for clinical patient care and preclinical research.

Mediso has a leader position in the preclinical imaging market with **over 300 commissioned systems** around the world. Beyond the market leading **nanoScan®** **PET/CT** and **SPECT/CT**, Mediso also offers standalone **MRI** and integrated **PET/MR**I systems based on a cryogen-free magnet with 3T or 7T field strength and a PET insert for simultaneous PET/MRI imaging. Products are sold directly or through a distribution network in 100+ countries worldwide

1990
Mediso founded

1994
Introduction of the first Mediso gamma camera

2000
Nucline™ X-ring/4R, 4-head dedicated brain SPECT

2006
Launching the first Mediso preclinical system the NanoSPECT/CT

2010
Launch of nanoScan® PET/CT, world's first ever sub-mm resolution preclinical PET/CT

2013
Mediso USA founded

2014
MultiScan® LFER 150, world's first sub-mm resolution mobile PET/CT

2015
AnyScan® TRIO SPECT, introduction of triple SPECT detector family

2016
Introducing the nanoScan® PET/MRI 3T world's first superconducting preclinical PET/MRI

2018
Installation of the 100th nanoScan® PET system

2022
Installation of the 300th preclinical imaging system

2023
Launch of the nanoScan® MRI 7T and the PET Insert

Key features

3T AND 7T FIELD STRENGTH

100% Cryogen-free magnet

- No liquid helium or nitrogen
- Closed loop – no need to top-up helium

Wide-range of

- RF Coils
- Sequences

Compact design:

- **Small** footprint
- **Marginal** fringe field
- 480 / 970 kg (3T / 7T)

Powerful gradient

for DWI applications (up to 1050 mT/m)

Low-vibration, **rear mounted**

PulseTube Cryocooler for artefact free DWI-EPI

SmartMagnet™

- **Eco-friendly Idle Mode**
- **Active Quench Protection**

Upgrade possibility with 2-types of completely integrated PET systems

Designed for **dynamic studies**

- Freely accessible animal during the scan
- Minimized dead space for dynamic imaging
- Start dynamic acquisitions from touch screen (i.e. DCE),

Animal monitoring up to 3 animals

Easily accessible RF connection plate for surface coils with industry standard 50Ω connectors

User friendly hardware design

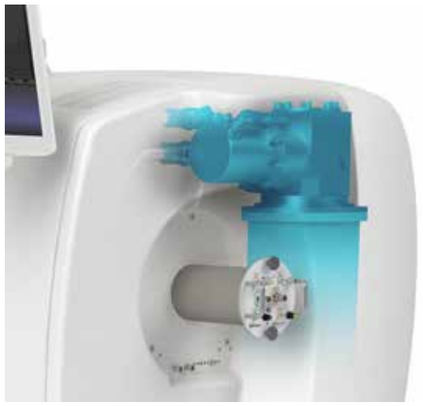
- Touchscreen can be used for tuning and matching
- Effortless RF coil removal
- Rear mounted PulseTube type cryocooler
- PET Insert integrated with the RF coil

Easy to use, high-performance MRI platform

100% Cryogen-free magnet

The core of the nanoScan® MRI systems is the most robust **100% cryogen-free** superconducting magnet ever built for preclinical applications. It utilizes **conduction cooling** and **does not contain liquid helium or any other liquid cryogens** in any amount.

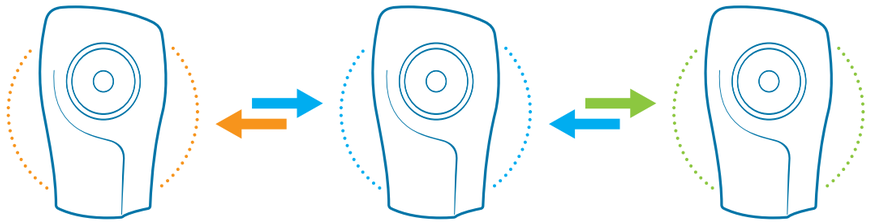
- It's base is a NbTi solenoid with multiple corresponding coils to maximize homogeneity and shielding thus reaching state-of-the-art homogeneity of **±0.1 ppm** @ 50 mm DSV and negligible fringe field outside the cryostat.
- Uniquely it features a **back mounted cryocooler to significantly reduce conducted vibrations** and to make maintenance easier.
- All electrically conductive cylindrical parts of the magnet were designed to minimize the residual eddy current after strong gradient pulses, this way achieving high-quality DWI images.



Unique back mounted cryocooler significantly reducing vibrations

SmartMagnet™ – Self-monitoring and management system

The patented* SmartMagnet™ technology enables one-click selection between different magnet modes.



WARM MAGNET

- **Long breaks**
- Installation, relocation mode

COLD MAGNET

- **Fully operational** daily usage
- **Active quench protection** during usage through **self-supervision**

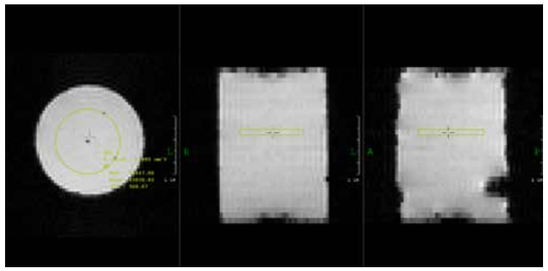
IDLE MODE

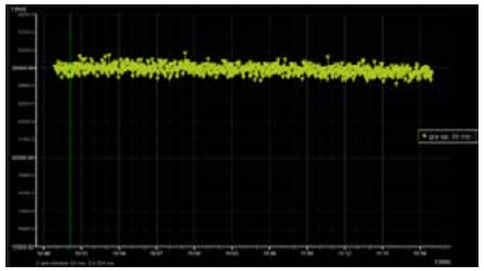
- Ideal for planned short breaks
- **Reducing operating costs**
- Low electricity consumption
- **Fast recovery time**
- Prolonging coldhead lifetime

*Discharge Controlled Superconducting Magnet and Superconducting Magnet Operating In Occasional Idling Mode

Vibration-free imaging

The system uses a h**igh-end pulse tube type cryocooler** that has significantly reduced mechanical vibrations compared to other cryocoolers due to the lack of moving mechanical components. This also results in **extended lifetime**. The cryocooler is mounted on the back of the magnet and mechanically decoupled to further minimize vibrations inside the cryostat and therefore deliver ghost free EPI images.





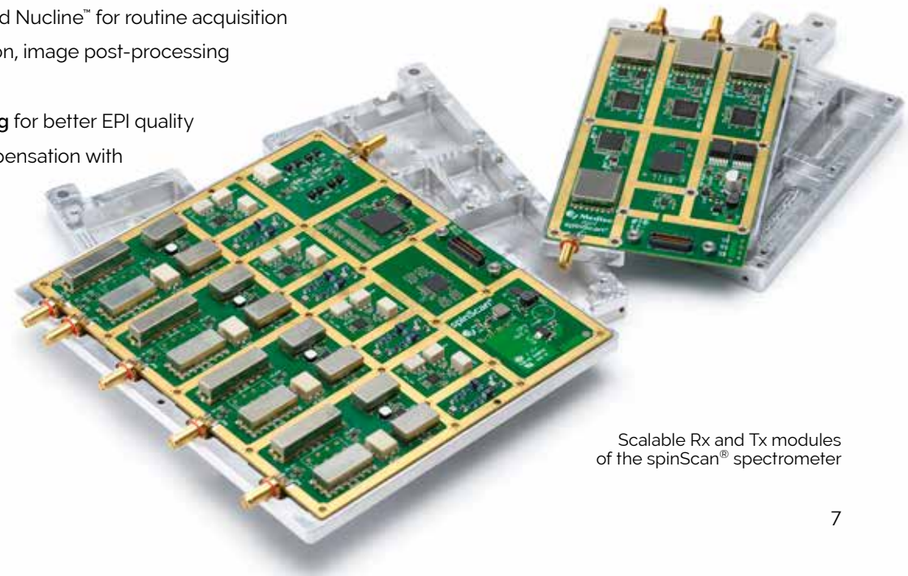
2h long intensity stability measurement with single shot GRE-EP

spinScan® next generation MRI spectrometer

The new Mediso spectrometer was **optimized for MRI applications** delivering an **ultra-low-noise** expandable **RF front-end** and **real-time dynamic shimming.**

The spectrometer is interfaced with three Mediso developed software to deliver a complete MRI workflow: the **Sequence Development Platform** for absolute control over the pulse sequences and reconstruction algorithms, the **FDA approved** and clinically validated **InterView™** FUSION and Nucline™ for routine acquisition planning, reconstruction, image post-processing and evaluation.

- **Dynamic shimming** for better EPI quality
- Eddy current compensation with **digital cross-term pre-emphasis**
- Highly expandable Rx and Tx channels
- Full **phased** array and **parallel Tx** support
- Continuous gradient monitoring
- Microsecond gradient resolution, for precise synchronization



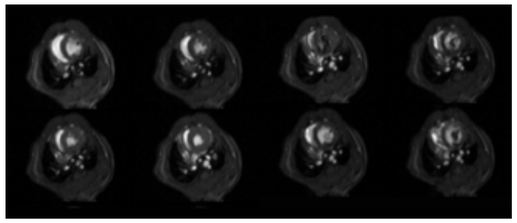
Scalable Rx and Tx modules of the spinScan® spectrometer

High-end MRI applications made easy

Comprehensive pulse sequence library organized in application packages

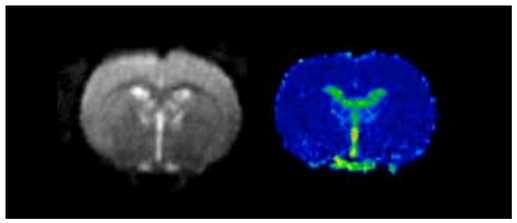
The nanoScan® MRI systems are equipped with an extensive range of **continuously expanding, readily optimized protocols** for mice and rats including the most common MRI techniques as well as state-of-the art pulse sequences and methods.

- **Basic anatomy:** Quick Localiser, Gradient Echo 2D&3D, Spin Echo, Fast Spin Echo 2D&3D, Inversion Recovery option for SE and FSE, One Pulse, Field Map Based Shimming, Iterative shimming, FLAIR, MPRAGE, MP2RAGE, FISP, bSSFP, SS-FSE, GRASE, etc.
- **Cardiology:** Flow Compensated Gradient Echo, Phase Contrast MRA, CINE cardiac Black / Bright blood, Gating option, etc.



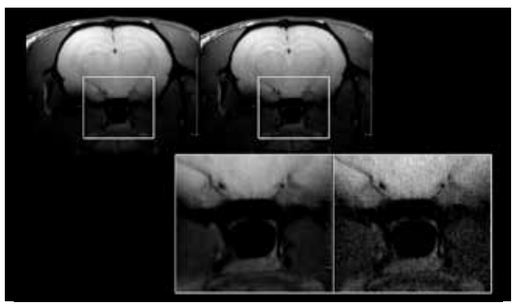
Mouse, CINE Cardiac bright blood imaging

- **Angiography:** TOF-MRA 2D/3D, Phase Contrast MRA, SWI, etc.
- **Spectroscopy:** Localised single voxel PRESS, EPSI, STEAM, LASER, semi-LASER, ISIS, Chemical-shift imaging CSI
- **Diffusion:** Spin Echo DTI, EPI DTI, single- and multi-shot options, SPIRAL DTI, EPI DWI, ADC Mapping, etc.



7T Rat brain, Single-shot SE EPI, 3 diffusion directions, b0 and corresponding ADC map

- **Relaxation and Fat Water Imaging:** Multi-Echo Gradient Echo, Multi Inversion Recovery SE and FSE, Multi Echo Spin Echo, Multi FlipAngle GRE 3D, T1 EPI, Quantitative T1/T2/B1 mapping, Relaxation curve fitting, 2/3-point DIXON, Fat chemical shift corrected images, etc.
- **Parallel Imaging:** GRAPPA reconstruction option for selected sequences
- **Short Echo Time:** UTE, ZTE with SPIRAL/ RADIAL/PROPELLER readout
- **CEST:** GRE 2D with SSFP readout
- **Dynamic imaging (fMRI and DCE):** Dynamic Gradient Echo EPI, DCE Gradient Echo with keyhole option, Compress sensing, CBF, etc.
- **ASL:** FAIR Fast Spin Echo, FAIR EPI, FAIR bSSFP
- **AI-based Denoising Reconstruction Package:** denoising MRI reconstruction for rodent brain images.

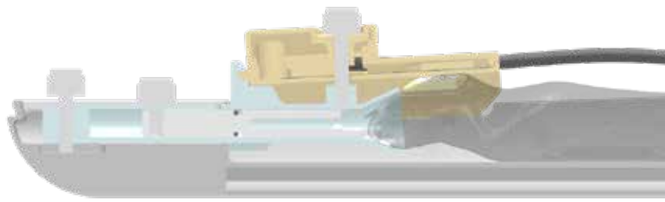


Rat brain, Black-Blood FSE 2D, with AI Denoising reconstruction and original acquisition

Achieving perfect SNR in every region with wide range of RF coils

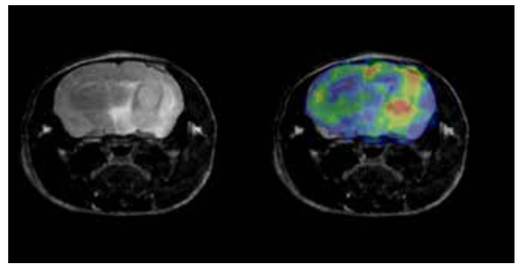
Mediso offers a wide range of highly shielded, low noise RF coils designed to deliver the **best possible SNR**. The coils are **fully integrated** with the MultiCell™ system enabling precise animal positioning in relation to the coils, ensuring reproducible, quantitative results.

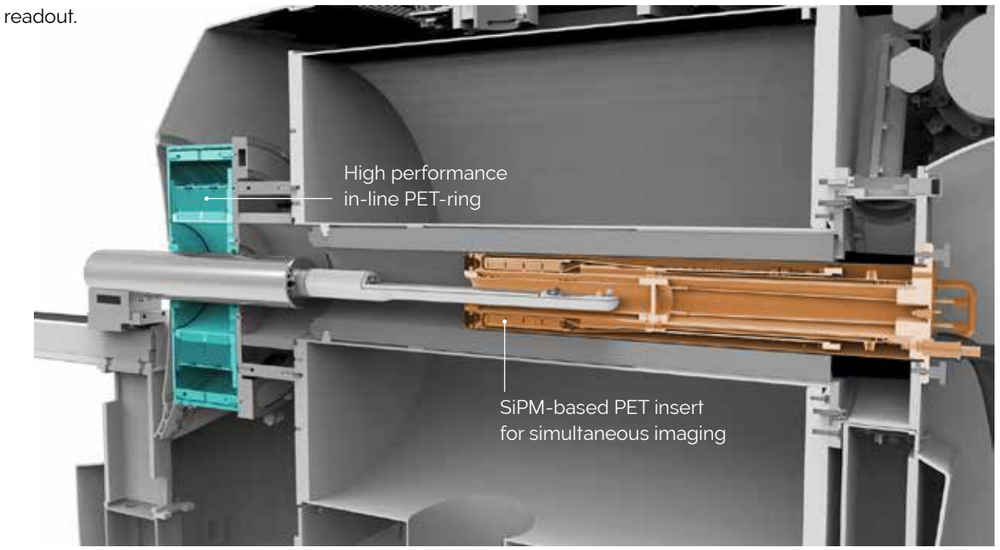
- **Transmit/receive volume coils** for **total body** imaging of up to obese rats or marmosets
- **Dedicated mouse and rat brain volume coils** with special imaging chambers
- **Flexible surface coils** of various diameters delivering excellent image quality and enhanced SNR
- **Phased array coils** with **multiple receiver channels** enabling parallel imaging for brain, heart or abdomen



Field upgradeable with best in-class PET systems

- **Full-scale PET-ring** on the front guaranteeing:
  - » unlimited quantitative imaging regardless the amount of radioactivity, acquisition time or animal size
  - » high-throughout by multiple-animal imaging capabilities, exploiting the large field-of-view
- **SiPM-based PET insert** ensures simultaneous PET/MRI studies without any interference between the PET and MRI readout.

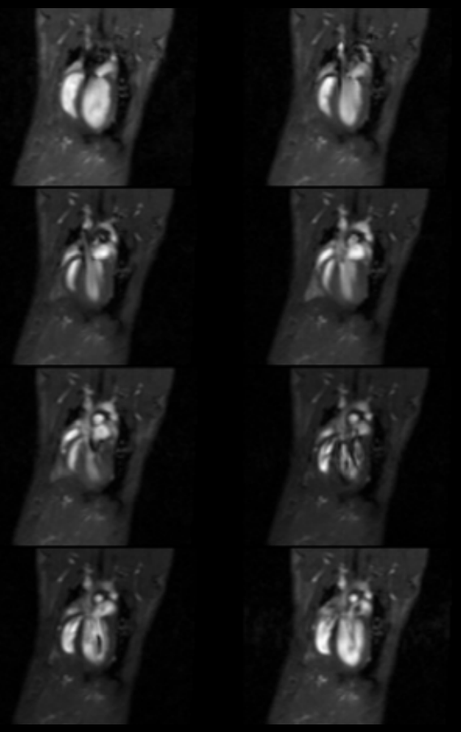




MRI Applications

CINE Cardiac bright blood imaging

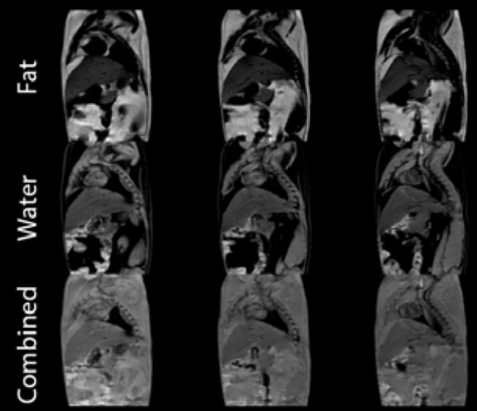
Cardiac imaging can be realized with bright/black blood CINE



ANIMAL MODEL: BALB/c mice
MRI ACQUISITION: CINE Cardiac Bright Blood, TR: 11.2ms, TE: 2.9ms,
RF COIL: 42mm Quadrature Tx/Rx volume coil

Fat-water imaging

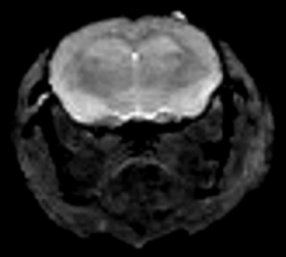
Fat-water separation based on Multi-Echo Gradient Echo sequence



ANIMAL MODEL: : Wistar rat
MRI ACQUISITION: Multi-Echo Gradient Echo, Matrix size: 256x256, FOV: 70mm x 50mm, TH: 1mm, NEX: 2, Acq. time: 10min
RF COIL: 72mm Quadrature Tx/Rx volume coil

Multi-Shot Spin Echo EPI at 7T

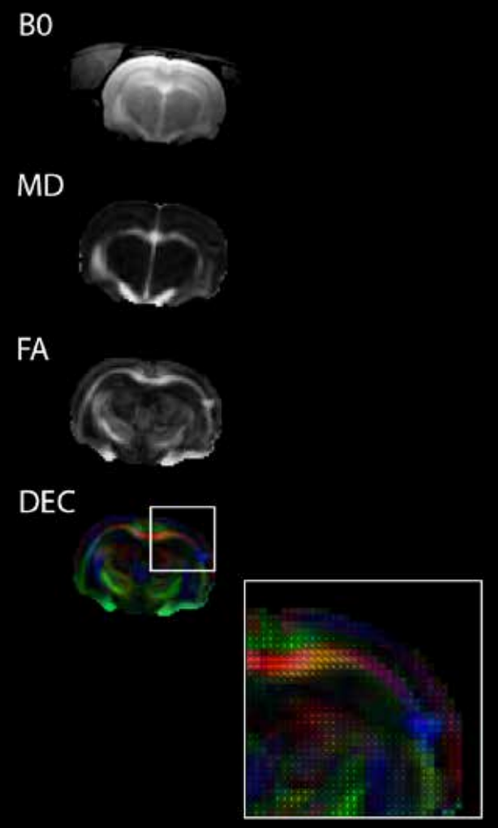
Multi-Shot (segmented) EPI imaging can achieve better resolution images by combining multiple EPI segments.



ANIMAL MODEL: BALB/c mouse
SEQUENCE: Multi-Shot EPI, TR:4000ms, TE: 35ms, FOV: 16mmx16mm, Matrix: 80x80, TH: 0.8mm
COILS: 36 mm Tx/Rx volume coil

Diffusion Tensor Imaging at 3T

Single Shot DTI EPI in rat brain at 3T.



ANIMAL MODEL: : Wistar rat
SEQUENCE: Single Shot DTI EPI, Matrix size: 96x96, Diffusion directions: 120, b-value: 500, TH: 1 mm
COILS: 72 mm Tx/Rx volume coil for transmission and, 30 mm flexible surface coil for signal reception

High-resolution ToF MRA at 3T

With the nanoScan® MRI 3T and 7T exceptional quality ToF MRA images can be acquired without the need of any contrast agents. Even at 3T the ACA (Anterior Cerebral Artery), MCA (Middle Cerebral Artery) and CoW (Circle of Willis) is clearly visible.

ANIMAL MODEL: : Wistar rat
SEQUENCE: 2D ToF MRA, In-plane resolution: 107um, Slice Thickness: 100um, FOV: 32 mm × 30 mm × 28 mm, TR: 70 msec, TE: 5.7 msec
COILS: 42mm Quadrature Rat brain coil and dedicated brain imaging chamber

Complete MRI workflow

Perform routine scans with the clinical validated **Nucline**™ acquisition software

Nucline acquisition software has been developed for **multimodal** medical imaging devices and is used in **clinical and preclinical** systems as well. It provides the same easy-to-use, integrated framework and main features for all the different modalities **(PET, SPECT, CT and MRI)**. It integrates wide range of functionalities of acquisition, calibration, data management, reconstruction and visualization. Nucline has been developed with focus on **clean and user-friendly interface,** while complying to **industry standards** (CFR11, DICOM) and high level **cybersecurity** expectations.

1 PERSONALIZED ACCESS LEVELS

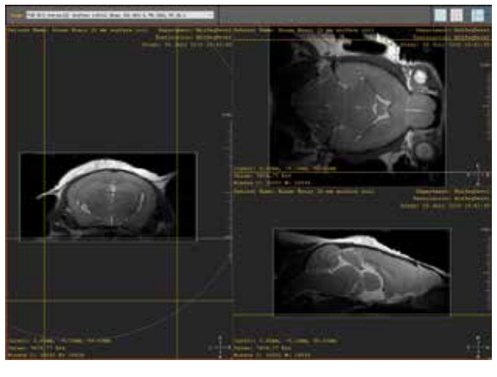
- **Routine:** A **couple of clicks** and the system is ready to run a study-specific, **optimized protocol.** Only geometry is to set: **error-free scanning guaranteed.**
- **Advanced:** Several acquisition and reconstruction parameters are editable providing the possibility of **further optimizing the protocols** for the study.
- **Research: Access to all system parameters** for researchers with significant experience

2 FOCUS ON QUALITY

- **Automatic,** quick **daily QC** protocols
- **Real-time diagnostic** feedback
- Logged diagnostic data

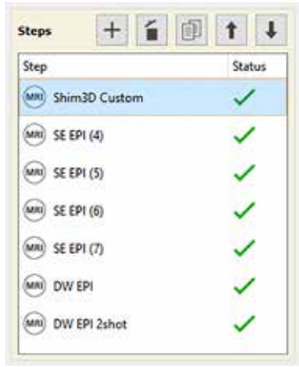
3 INTUITIVE GEOMETRIC PLANNER

- **Designing scans graphically** based on scout image or even any previous scan
- Setting up **advanced features** like shim box, saturation bands etc.
- **Real-time MRI signal** (selectable Real, Imaginary, Magnitude) during scan
- **Multi-Sequence monitor** to on-the-fly track progress of dynamic/gated/multi-series sequences
- **Easy-to-use image viewer** to quickly check the result image before next step



4 PREDEFINED, CONFIGURABLE PROTOCOLS

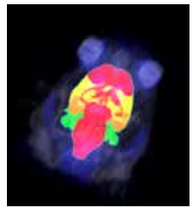
- Multimodality multi-step pre-saved **factory protocols** optimized for various applications
- Factory protocols can be copied, **edited, fine-tuned** by the User
- Study-optimized **User protocols** can be saved and loaded easily assuring **quick, reliable scanning**
- Protocols include **automated calibrations** (e.g. shim, RF, frequency etc.)
- Protocol steps can **run automatically** one by one
- Parameters are **validated** automatically



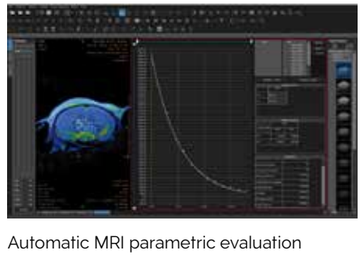
Analyze your quantitative data with the FDA approved **InterView**™ **FUSION** visualization and evaluation software

The FDA approved and clinically validated InterView™ FUSION multi-modal post-processing software is an essential part of system. It provides a wide range of functionalities to evaluate PET/SPECT/CT/MRI preclinical data for example:

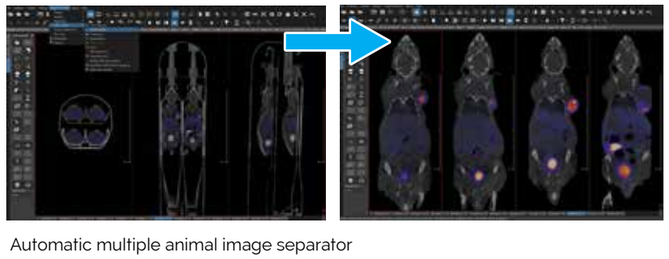
- **Automatic MRI parametric evaluation,** e.g. T1, T2 and ADC map creation
- **AI-based MRI Denoising** reconstruction
- **Automatic multiple animal image separator**
- **Brain atlas**
- Wide range of 2D and 3D image viewers and rendering for visualization including 3D MIP and 3D Volume Rendering
- 3D and 4D data fusion via all image viewers and visualization of them over time frames
- Large variety of ROI/VOI tools
- **Time activity Curves (TAC)** of multiple ROIs/VOIs **over 4D dynamic data** with multiple statistics (min, max, mean, stdev, sum, etc.)
- Automatic co-registration procedures (rigid, affine and non-linear)
- Advanced segmentation methods
- Wide range of data input/output/export capabilities including video formats



Brain atlas



Automatic MRI parametric evaluation



Automatic multiple animal image separator

Complete MRI workflow

Have absolute control over your experiments with the **Sequence Development Platform**

The Sequence Development Platform enables you to **create your own sequences** or **modify the existing** ones.

With the intuitive GUI, programming and testing a new sequence is very easy and straightforward. A built-in tool helps you to test out various, freely customizable reconstruction and post-processing algorithms and adding new ones. Sequences can be directly run from this SW or exported to Nucline™ for routine scanning.

- Fully **interactive** Pulse-Sequence-Diagram
- RF and gradient pulse visualization with **unlimited custom shapes**
- Access to **factory sequence source codes,** GIT versioning

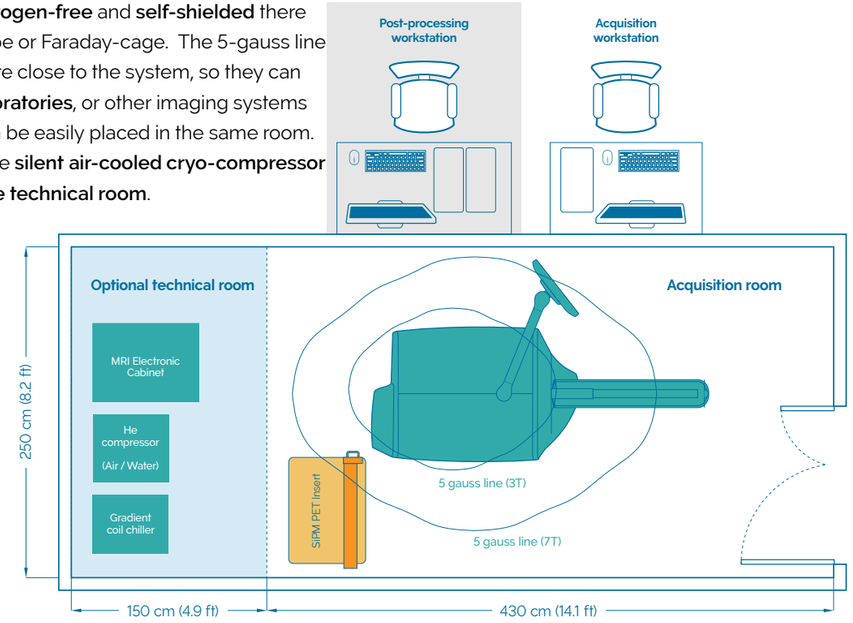
- Full access to raw data, K-space visualization
- Customizable **JAVA based code** for calculations and timing
- User defined **Python and MATLAB scripts** are executable as a reconstruction steps

- **Spectroscopy** module with advanced corrections
- Peak-picking and automatic curve fitting
- A variety of spectra visalization modes

Minimal installation requirements

The **compact** and **light-weighted** nanoScan® MRI systems can be **installed** and run practically in **any laboratory** due to their low installation and maintenance requirements.

As the systems are **100% cryogen-free** and **self-shielded** there is no need of any quench pipe or Faraday-cage. The 5-gauss line for both 3T and 7T models are close to the system, so they can be placed in really **small laboratories**, or other imaging systems like PET/CT or SPECT/CT can be easily placed in the same room. Moreover, in case of using the **silent air-cooled cryo-compressor** there is **no need for separate technical room**.

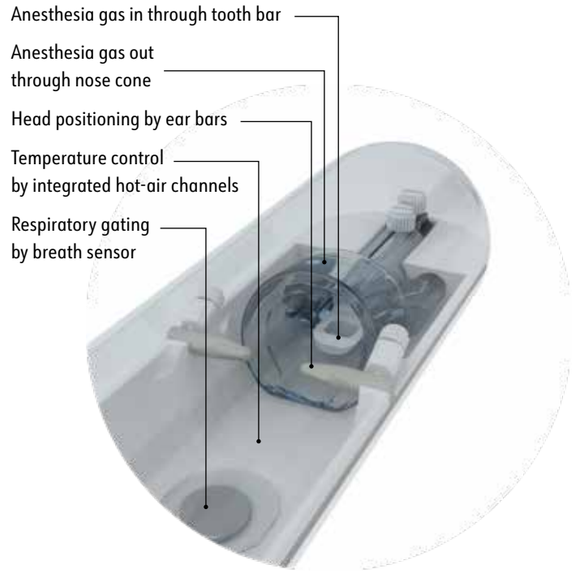


- **Light-weighted systems with small footprint**
  480 kg / 970 kg (3T / 7T)
  1050 / 2140 lbs (3T / 7T)
  250 cm x 80 / 100 cm
- **Optional technical room** – In case of air-cooled cryo-compressor no separate technical room is needed
- Post-processing workstation – can be next to the acquisition workstation or at the researcher's room.
- SiPM PET insert – Optional upgrade for both 3T and 7T MRI systems.

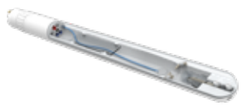
nanoScan® MRI 7T reference installation with every system component (magnet, workstation, electronic cabinet, He-compressor, chiller) located in the same imaging room.

Animal handling

MultiCell™ imaging chambers

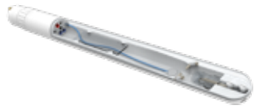


Mouse M



Inner space: 134×26 mm
Outer dimension: 463×32 mm
Up to 40 g

Mouse L (Standard)



Inner space: 141×31 mm
Outer dimension: 466×40 mm
Up to 80 g
Also available in BSL3 version

Rat L (Standard)

Inner space: 249×60 mm
Outer dimension: 580×70 mm
Up to 600 g

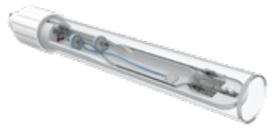
Rat Dual

Inner space: 240×60 mm
Outer dimension: 590×70 mm
Up to 2×200 g

Mouse Triple

Inner space: 144×26 mm
Outer dimension: 488×70 mm
Up to 3×30 g

Mouse BSL-3



Inner space: 141×31 mm
Outer dimension: 578×60 mm
Up to 80 g

Monitoring and gating

- » ECG monitoring and triggering
- » Respiration monitoring and triggering
- » Temperature monitoring and control module
- » Accesibble from touchscreen and workstation

Respiration and body temperature monitoring even up to four animals

PrepaCell™

Supporting complete animal preparation before the scan, setting of:

- » Anaesthesia
- » Heating
- » Vital function monitoring

Eases workflow and increases throughput

The imaging chambers are fully compatible with all Mediso manufactured imaging systems providing one-click connection for easy and fast workflow.

nanoScan® MRI RF coils

Volume coil 34mm

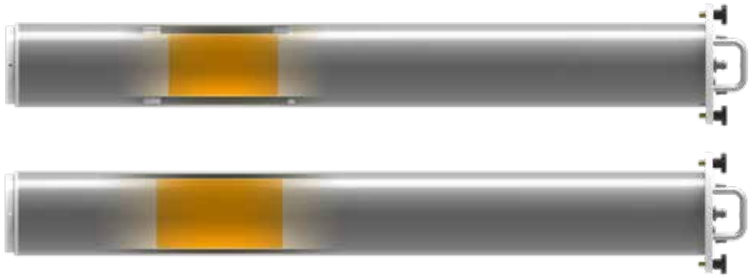
Compatible with PET insert only
Available for 3T and 7T MRI systems
Inner diameter: 34mm

Volume coil 42mm

For mouse chambers
Available for 3T and 7T MRI systems
Inner diameter: 42 mm
X-nuclei versions also available

Volume coil 72 and 82 mm

For chambers available with MRI systems
Available for 3T and 7T MRI systems
Inner diameter: 42 mm
X-nuclei versions also available



Integrated brain and cardiac array coils

Compatible with 3T and 7T MRI systems
Compatible with mouse and rat MultiCell™ chambers
Available in 2 and 4 channel versions

Multifunctional flexible surface coils

Compatible with 3T and 7T MRI systems
Compatible with any MultiCell™ chambers
Available diameters: 10, 20, 30 mm

nanoScan® MRI 3T/7T

High-end MRI with the most robust cryogen-free magnet on the market

MRI

100% CRYOGEN-FREE • ROBUST MAGNET

- **3T** and **7T** field strength
- **100% Cryogen-free** magnet
  - » No liquid helium or nitrogen
  - » Closed loop – no need to top-up helium
- Wide-range of **RF Coils and Sequences**
- Compact design:
  - » Small footprint
  - » Marginal fringe field
  - » **480 / 970 kg** (3T / 7T)
  - » **1050 / 2140 lbs** (3T / 7T)
- Powerful Gradient: **(up to 1050 mT/m)** for DWI application
- Low-vibration, rear mounted PulseTube cryocooler for artefact free DWI-EPI
- SmartMagnet™
  - » **Eco-friendly idle mode**
  - » **Active quench protection**
- Upgrade possibility with 2-types of completely integrated PET systems

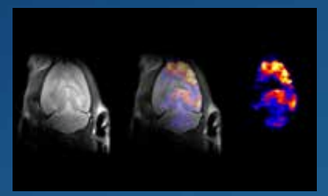
nanoScan® PET/MRI 3T and 7T

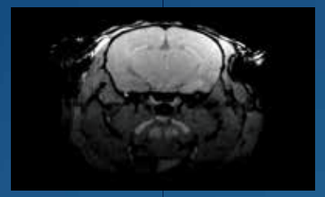
Full-scale, quantitative PET combined with a robust, cryogen-free MRI

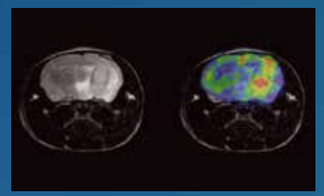
SPECT

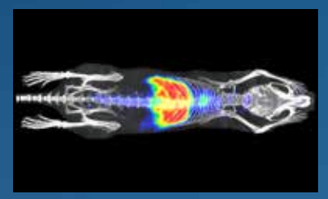
HIGH SENSITIVITY • HIGH RESOLUTION • OUTSTANDING THROUGHPUT AT THE SAME TIME

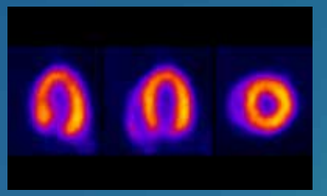
- High resolution **(0.3 mm *in vivo*)** and high sensitivity **13 000 cps/MBq**
- Largest field of view for large and multiple-animal imaging
- High-throughput
- Largest installation base **150+**
- Highest **flexibility:**
  - » Wide isotope energy range, single or multiple: **20 keV – 1 MeV**
  - » Various applications – **optimized multi-pinhole collimators** (e.g. MDP bonescan, dynamic, cardiac gated etc.)
  - » Animal models from **tiny mouse up to large rabbit** (6.5 kg)
  - » Different imaging schemes: helical, circular, full-stationary, 2D
  - » **Parallel-hole collimators** for imaging large animals
  - » List-mode acquisition

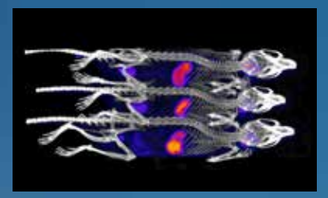


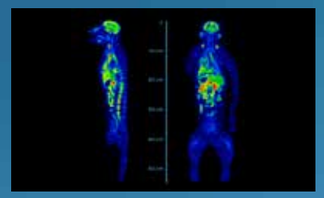


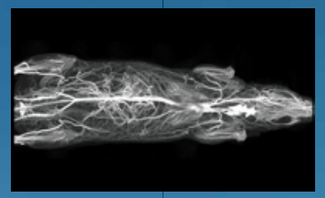


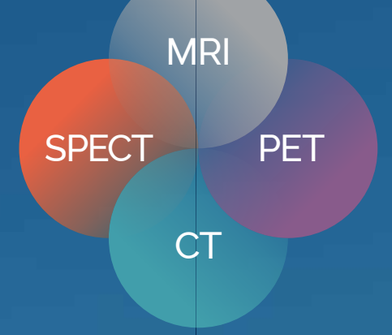












nanoScan® SPECT/CT

Versatile SPECT/CT with absolute quantification and full-stationary dynamic imaging

nanoScan® SPECT/CT/PET

Versatile SPECT with Real dynamic PET with absolute quantification

CT

HIGH POWER • HIGH RESOLUTION • LARGE FIELD OF VIEW

- High-resolution **(30 µm)**
  - – Small voxel size **(10 µm)**
- Up to **x7.6 zoom**
- Variable transaxial field of view: **2–12 cm**
- Highest power: **80 W** X-ray tube for
  - » Large animals
  - » Better image quality
  - » Fast scanning
  - » *Ex vivo* samples
- Ultra-low dose protocol (**<1 mGy** for whole-body mouse)
- Real-time FBP and iterative reconstruction
- Respiration and cardiac gated reconstruction

PET

BEST COUNT RATE PERFORMANCE • HIGHEST RESOLUTION WITH FREE ACCESS TO THE ANIMALS

- Highest resolution **(< 0.7 mm)**
- Largest transaxial field of view **(12 cm)**
- Largest axial field of view (up to **15 cm**)
- Highest count rate performance **(**up to **1300 kcps @ 80 MBq)** supporting quantitative imaging in
  - » **Radiotracer development**
  - » Imaging of **short half-life isotopes** (e. g. ^{11}C, ^{13}N, ^{15}O)
  - » **Multiple-animal** imaging
- **Free access** to the animal supporting dynamic imaging
- **Best NEMA sensitivity** up to **10.5%** (250-750 keV) and best Minimal Detectable Activity (MDA)
- Excellent quantification
- Largest installation base: **150+**

nanoScan® PET/CT

Real dynamic PET-system designed for quantitative studies

MultiScan™ LFER 150 PET/CT

The ultimate tool for PET imaging in primates and medium sized animals

Specifications | nanoScan® MRI 3T and 7T

Magnet
Cryogen-free superconducting

Field strength
3T / 7T

Homogeneity
±0.1 ppm @ 50 mm DSV

Bore size
17 cm

Gradient coil inner diameter
101 mm

Gradient strength
Up to 1000 mT/m

Cryocooler
Back-mounted PulseTube

Quench protection
Yes, with SmartMagnet™

Faraday cage needed?
No, the system is self-shielded

Quench pipe needed?
No, the system is
100% cryogen-free

Rampable
Yes

350+ preclinical systems in 34 countries

nanoScan® **PET/CT** | nanoScan® **SPECT/CT** | nanoScan® **MRI 3T/7T** | nanoScan® **PET/MRI 3T and 7T** | nanoScan® **SPECT/CT/PET** | MultiScan™ **LFER150 PET/CT**

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