



# Preclinical in vivo Imaging

- Nine modalities - Unlimited research capabilities



## The widest range of preclinical imaging modalities from a single source

- Delivering greater insights and productivity

Bruker's customers benefit from a wide range of possibilities for combining multiple modalities from a single source for seamless workflow and higher throughput. All our non-invasive *in vivo* imaging systems are designed to deliver greater scientific insights based on animal centric solutions.

Bruker is the only provider that offers nine different imaging modalities:

- PET – Positron Emission Tomography
- SPECT – Single Photon Emission Computed Tomography
- MRI – Magnetic Resonance Imaging
- micro-CT – Micro Computed Tomography
- X-Ray
- Fluorescence
- Luminescence
- Radioisotopic
- MPI – Magnetic Particle Imaging





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# Welcome to Bruker's world of multi-modality imaging

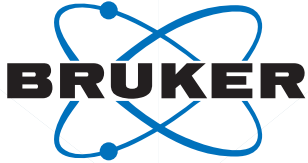
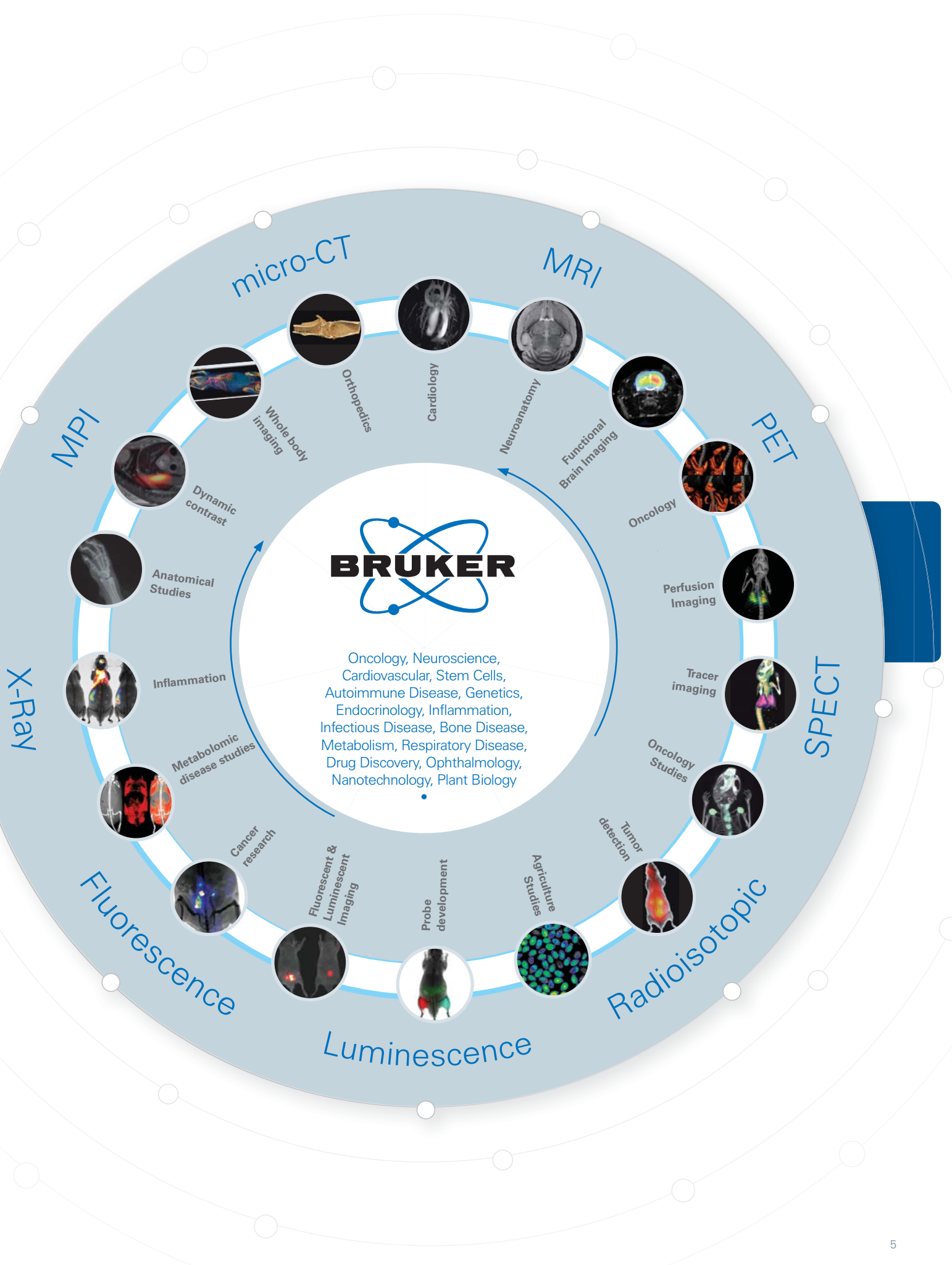
Nine imaging modalities from a single source

## ● Serving a wide spectrum of industries and research areas

For every imaging task Bruker has the optimum solution. An unmatched portfolio of instrument families and imaging modalities can be combined to expand and develop all manner of research programs and capabilities. Our flexible solutions provide customers with the versatility to set their own pace and agenda at the performance and budget levels they require. Whichever solution you choose, our complete personalized service will always go that extra mile for you, leaving you free to focus on what matters - your core business.

Bruker is able to provide its customers with unparalleled technical and scientific expertise gained at the forefront of innovation in the scientific communities for more than 50 years. This unique heritage word cut informs all design and development, ensuring the specific needs of research communities are met. Every year our customers go on to publish thousands of scientific studies, driving research to new levels of excellence.

We offer upgrade paths for all instruments and continually support our customers in extending the capabilities and functionalities of their systems, helping secure instrumentation funding and investment. Customers who become part of our network benefit from trusted service and support, as well as an extensive portfolio of products that perfectly complement each other.



Oncology, Neuroscience,  
 Cardiovascular, Stem Cells,  
 Autoimmune Disease, Genetics,  
 Endocrinology, Inflammation,  
 Infectious Disease, Bone Disease,  
 Metabolism, Respiratory Disease,  
 Drug Discovery, Ophthalmology,  
 Nanotechnology, Plant Biology

micro-CT

MRI

PET

SPECT

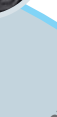
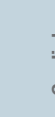
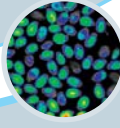
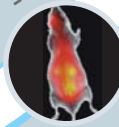
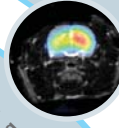
Radioisotopic

Luminescence

Fluorescence

X-Ray

MPI



Whole body imaging

Orthopedics

Cardiology

Neuroanatomy

Functional Brain Imaging

Oncology

Perfusion Imaging

Tracer imaging

Oncology Studies

Tumor detection

Agriculture Studies

Probe development

Fluorescent & Luminescent Imaging

Cancer research

Metabolomic disease studies

Inflammation

Anatomical Studies

Dynamic contrast





## A solution for a wide range of imaging application

- Bruker's products and modalities

Bruker's preclinical imaging systems enable our customers to detect, monitor and quantify disease models *in vivo*. From image acquisition to data analysis, our user-friendly workflow is designed for the requirements of preclinical researchers.

# 3D whole body anatomical, functional and molecular imaging

## High Field Magnetic Resonance Imaging

Bruker provides small animal MRI solutions for the emerging market of preclinical and molecular MR imaging. By combining latest MRI CryoProbe and gradient technology with ultra-high field magnets, our systems deliver high spatial resolution inside living organisms.



BioSpec/PhamaScan

BioSpec® and PharmaScan® are essential components of any research program in the life sciences that utilizes MRI/MRS for disease and metabolism studies. BioSpec systems are offered from 4.7 Tesla to 17.2 Tesla allowing for a wide range of research animal studies.



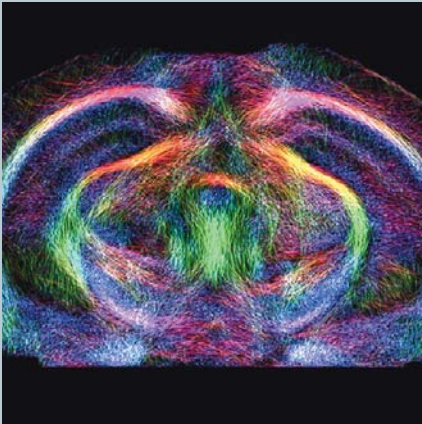
ClinScan

ClinScan is our clinically oriented MRI scanner offered at 7 Tesla. This system allows direct and rapid transfer of preclinical studies on animal models to clinical studies on humans. ClinScan uses Siemens clinical user interface syngo®MR with our advanced magnets, gradients, RF-coils, and animal handling solutions.

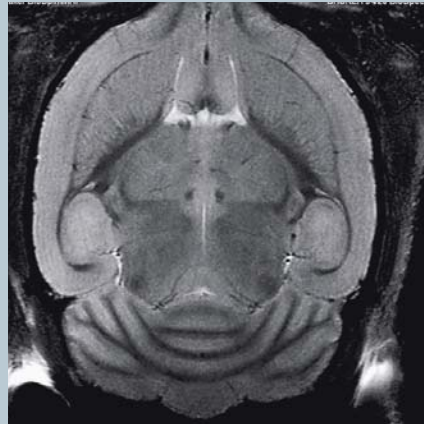




Oncology  
 Cardiology  
 Contrast / Molecular imaging  
 Diabetes and obesity  
 Neurobiology



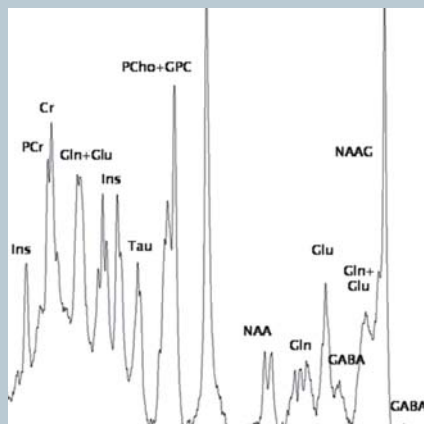
• **Diffusion Imaging**  
 Axial map of the major principle diffusion direction of a mouse brain enabling to investigate brain connectivity.  
 Courtesy: University Hospital Freiburg



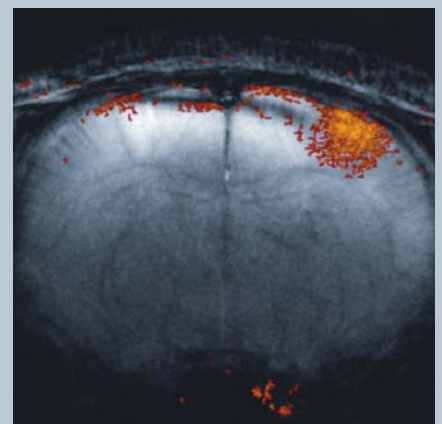
• **Neurology**  
 High resolution brain imaging at the microscopic level



• **Angiography**  
 Visualization of the vascular structure in the mouse brain



• **Spectroscopy**  
 Localized spectroscopy for metabolite analysis and metabolic imaging



• **Funtional Imaging**  
 BOLD imaging showing functional brain activation



# Powerful MRI, Simplified

## ● Compact Magnetic Resonance Imaging

The new compact-shielded, cryogen-free magnet design with its very small footprint has resulted in an easy-to-install MRI system with very low running costs. The ICON has a negligible magnetic fringe field – enabling safe siting of the system in any facility and the use by any individual. This compact MRI system has been designed to provide researchers with the most powerful MRI system in the most convenient form possible.

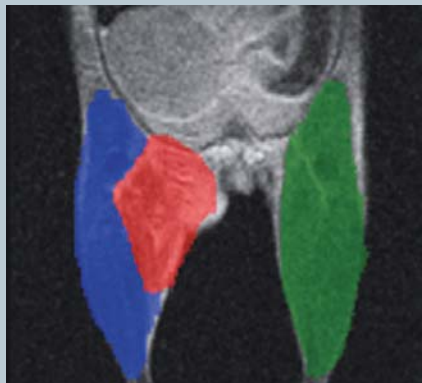
ICON™ • Compact whole body MRI

### Key Features Include:

- Permanent magnet with negligible fringe field
- Minimum operating and maintenance costs
- No dedicated facilities – all you need is 1.2m<sup>2</sup> for the footprint of the system and a power socket
- Easy-to-use Paravision® 6 software enabling everyone to achieve maximum efficiency
- Integrated easy animal handling and monitoring
- Unique portfolio of MR imaging methods for a wide range of pre-clinical applications



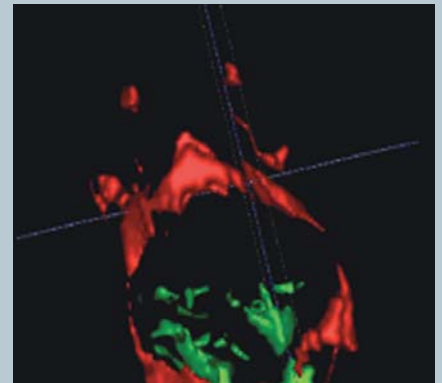
Oncology  
 Neurology  
 Cardiology  
 Inflammation  
 Diabetes and obesity  
 Infections



• **Inflammation**

Volume measurement of limb lesion in mouse demonstrating the change in intracellular/extracellular water balance.

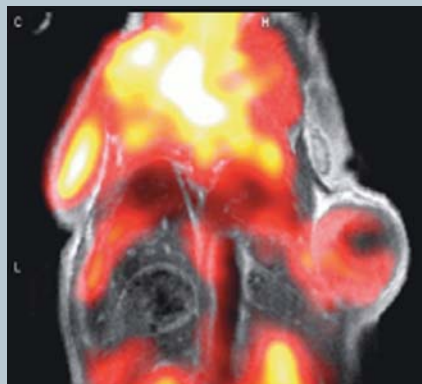
*Courtesy of J Zheng, STTARR (UHN), Toronto, Canada.*



• **Diet control**

Fat segmentation and volume measurement in high fat diet mouse, subcutaneous adipose tissue in red, abdominal adipose tissue in green.

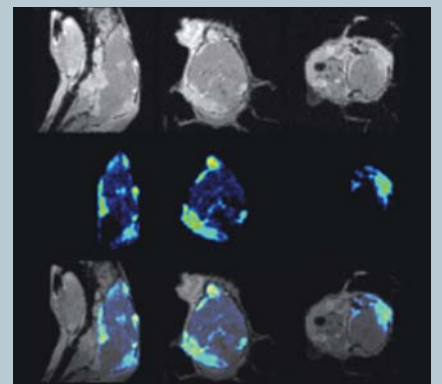
*Courtesy of S. Aime, the Molecular Imaging Center, University of Torino, Italy.*



• **PET/MRI**

PET/MR imaging of flank tumor in mouse: Correlation observed between metabolic tumor heterogeneity in PET and Anatomical heterogeneity in MRI during sequential acquisition.

*Courtesy of U. Mahmood, P Heidari and P. Habibollahi, MGH, Boston, US.*



• **MR/Optical**

MR/optical imaging of metastasis from human breast cancer cells in mouse brain: Both MR contrast enhanced images and optical images enable the visualization of metastasis, improving data consistency. *Courtesy Matthew Leevy, University of Notre Dame, Indiana, US.*

# 3D images down to the sub-micron level

● micro-CT

Bruker's SkyScan product line allows you to cut virtual sections or even fly through samples non-destructively. No preparation, coating or vacuum treatment is needed. Microtomography is available in a range of easy to use desktop instruments, which generate 3D images of your sample's morphology and internal microstructure with resolution down to the sub-micron level. Software for visualization and analysis in 3D is included with all SkyScan systems.

## SkyScan1176 *in vivo* micro-CT

The SkyScan 1176 is a high performance *in vivo* microCT scanner for preclinical research. The large format 11 megapixel X-Ray camera gives an unrivalled combination of resolution, image field size and scan speed – everything that is required

in a busy and demanding biomedical research laboratory. Image field width up to 68 mm allows full body mouse and rat scanning and distal limb scanning for big animals, such as rabbits.

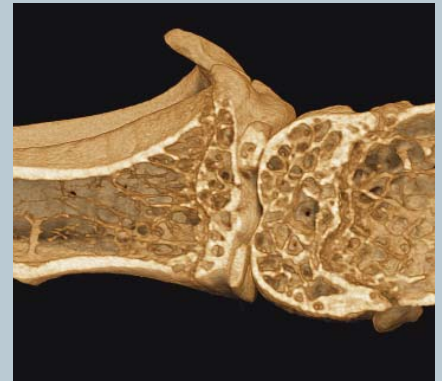
SkyScan1176 • *in vivo* micro-CT



Bone-Orthopedics  
Dental-Odontology  
Cardiovascular  
Pulmonary  
Oncology  
Metabolism-Obesity  
Renal-Hepatic-GIT



• **Cardiovascular**  
Full body *in vivo* scan of a mouse using contrast agent



• **Bone research**  
*In vivo* scan of mouse hindlimb (knee) with 9  $\mu\text{m}$  pixel size

### SkyScan1178 high-throughput micro-CT

The SkyScan 1178 is a fast micro-CT scanner with a scanning + reconstruction cycle of less than one minute for the entire volume. Static object position facilitates *in vivo* scanning of laboratory animals and industrial applications, such as quality control and process monitoring. Animal beds for rats and mice

made of carbon fiber are supplied on an interchangeable holder to combine with PET, SPECT, and optical imaging. A physiological monitoring subsystem can measure breathing and heartbeat in real time while also providing signals for gated acquisition.

# Albira: Small footprint, huge possibilities

PET/SPECT/CT

Albira combines PET, SPECT and CT imaging in a novel and extremely powerful way. The system's highly compact, modular design gives you the freedom to purchase what you need now and upgrade as your research needs evolve.

Albira's unique detector system uses an exclusive, patented combination of continuous crystal detectors, PSPMTs (position sensitive photo-multiplier tubes) and advanced electronics to deliver exquisite sensitivity with rapid acquisition of extremely high resolution, quantitative, precise and accurate PET and SPECT images.

Use Albira for precisely quantified in vivo studies including pharmacokinetics, pharmacodynamics, ADME, protein expression, metabolic studies, gene expression, toxicology, perfusion studies, cell tracking, receptor binding and more.

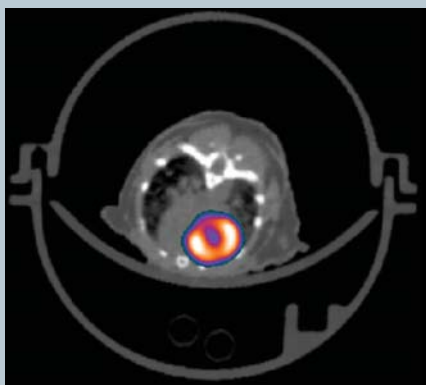
## Key Features Include

- Choice of seven configurations
  - Tri-modal
  - Bi-modal
  - Standalone
- Field upgradeable and customizable
- Compact footprint
- Novel gamma detector technology with continuous crystals
- Automatic co-registration and MR compatibility
- Powerful quantification & dynamic analysis
- High throughput - 4 mice at a time
- User friendly, state-of-the-art software

Albira • PET/SPECT/CT



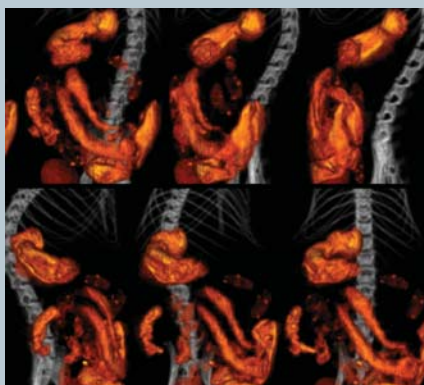
Oncology  
 Neurology  
 Cardiology  
 Metabolic disease  
 Drug Discovery  
 Bone Disease



• **Cardiology**

Transverse slice of a FDG PET CT overlay of the mouse heart

*Image courtesy of Dr. W. Matthew Leevy, NDIIF, University of Notre Dame, Indiana, US.*



• **Anatomical imaging**

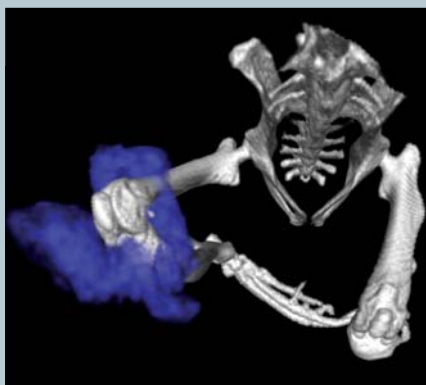
Use of barium sulfate contrast agent to image the GI tract with computed tomography



• **Perfusion imaging pulmonary studies**

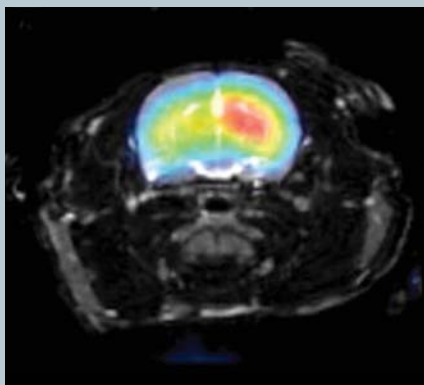
$^{99m}\text{Tc}$ -MAA imaging of lung perfusion in a mouse.

*Courtesy of Dr. W. Matthew Leevy, NDIIF, University of Notre Dame*



• **Oncology**

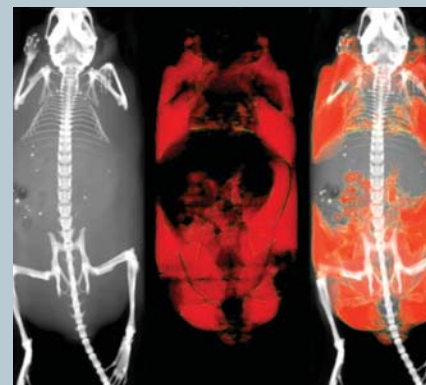
$^{18}\text{F}$ -FDG image of a prostate cancer tumor xenograft on a rat



• **Neurology: Functional brain imaging**

Imaging brain hypoxia in rats using  $^{18}\text{F}$ -FMISO

*Courtesy of Prof. M.A.Pozo Instituto Pluridisciplinar Universidad Complutense de Madrid*



• **Metabolic disease studies**

Segmentation of Adipose Tissue in Obesity Mouse Model



# In-Vivo Xtreme: Our most advanced preclinical Optical/X-ray imaging system

● Optical/X-Ray

Extremely sensitive, extremely fast and extremely versatile, the In-Vivo Xtreme is the ideal choice for complex preclinical imaging applications. This powerful system is designed for researchers with demanding requirements for high sensitivity luminescence, fluorescence, radioisotopic and radiographic imaging, and enables users to precisely match camera choice with their specific research needs, performance criteria and budget. Xtreme's unique modular architecture also allows users to upgrade their camera as new technology evolves and research requirements change - all within the same footprint.

## Key Features Include:

- Four imaging modalities in one system
  - Fluorescence
  - Luminescence
  - Radioisotopic
  - Radiographic (2D X-ray)
- Choice of front or back illuminated camera
- Industry-leading true microfocus X-ray (1 second X-ray capture)
- High throughput - up to five mice at a time
- 360 degree multimodal imaging
- Automatic co-registration

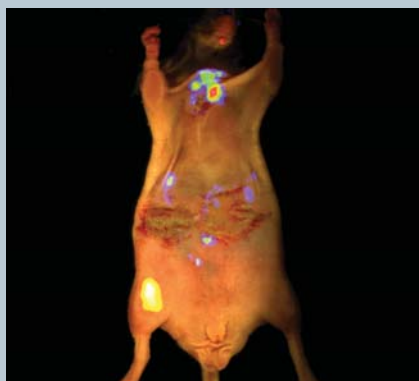
In-Vivo Xtreme • Optical/X-ray

Bruker's preclinical imaging systems are not licensed to perform certain optical imaging applications that involve the in vivo imaging in mammals of (i) genetically expressed bioluminescent or fluorescent protein or (ii) conjugates of cells and light generating molecules, such applications are covered by patents owned or controlled by Caliper Life Sciences, Inc. Such patents include the following: U.S. Patents Nos. 5,650,135; 6,217,847; 7,198,774; 6,649,143; 6,939,533; 6,916,462; 6,923,951; 6,890,515; 6,908,605; 5,824,468; 6,638,752; 6,737,245 and 6,867,348; U.S. Patent Application No. 11/818,208; European Patent No. 0861093 and European Patent Application No. 991246406; Japanese Patent Nos. 3786704 and 3786903; Canadian Patent No. 2237983; Singapore Patent No. 53708; Hong Kong Patent No. 1018747; and Chinese Patent No. 951980068.

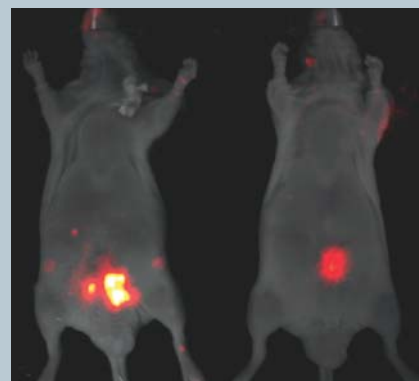




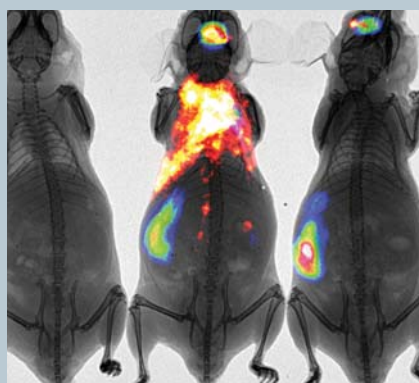
Oncology  
Neurology  
Inflammation  
Stem cells  
Infectious disease  
Bone disease



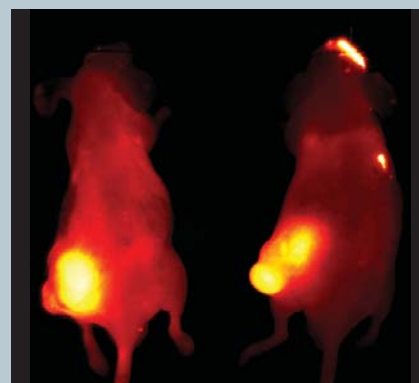
• **Inflammation**  
Multimodal fluorescence and luminescence image of a skin irritation model



• **Inflammation**  
Anatomical overlay showing luminescent detection of inflammation induced myeloperoxidase activity and NIR detection of trauma induced cell death



• **Inflammation and nutraceuticals**  
Non invasive imaging of inflammation induced myeloperoxidase activity by i.p. injection of nutraceuticals using luminol sodium salt



• **Oncology studies**  
Protease Activation in Tumors Using NIR Probe  
*Image courtesy of Dr. W. Matthew Leevy, NDIIF, University of Notre Dame*

# Classic benchtop optical/X-ray small animal imaging systems

## Optical/X-ray

The MS FX PRO was the first commercially available system to combine multi-wavelength fluorescence, luminescence, radioisotopic, high resolution X-ray imaging and spectral unmixing in one system.

Whether you need to develop fluorescent probes; track NIR fluorescent nanoparticles or peptides; quantify changes in localization and tumor burden; screen radioisotopic probes in multiple animals; study changes in bone density or perform ex vivo validation, the MS FX PRO drives your research to new levels of excellence.

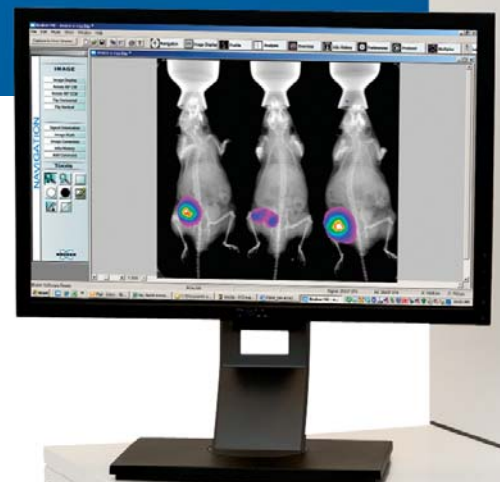
### Key Features Include

- Four imaging modalities in one system
  - Fluorescence
  - Luminescence
  - Radioisotopic
  - Radiographic (2D X-ray)
- Choice of zoom or fixed lens
- Fast, high resolution true microfocus X-ray (3 second X-ray capture)
- High throughput - 3+ mice at a time
- 360 degree multimodal imaging
- Automatic co-registration

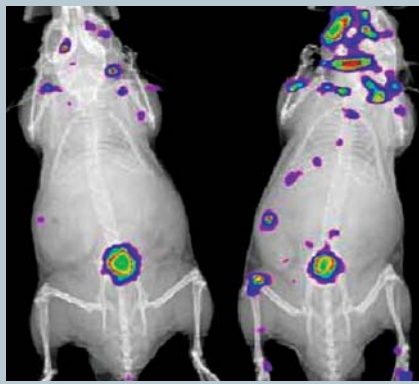
Other systems in the In-Vivo product family include the FX PRO, which offers four modalities without spectral unmixing; the F PRO, our entry-level small animal imager that combines fluorescence and luminescence with radioisotopic imaging; and the DXS PRO, our unique high resolution cabinet X-ray system that can be upgraded to include optical molecular imaging capabilities.

### In-Vivo MS FX PRO • *Optical/X-ray*

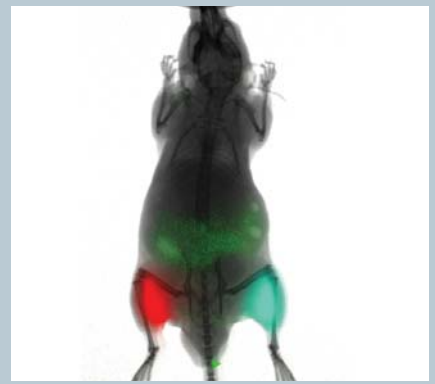
Bruker's preclinical imaging systems are not licensed to perform certain optical imaging applications that involve the in vivo imaging in mammals of (i) genetically expressed bioluminescent or fluorescent protein or (ii) conjugates of cells and light generating molecules, such applications are covered by patents owned or controlled by Caliper Life Sciences, Inc. Such patents include the following: U.S. Patents Nos. 5,650,135; 6,217,847; 7,198,774; 6,649,143; 6,939,533; 6,916,462; 6,923,951; 6,890,515; 6,908,605; 5,824,468; 6,638,752; 6,737,245 and 6,867,348; U.S. Patent Application No. 11/818,208; European Patent No. 0861093 and European Patent Application No. 991246406; Japanese Patent Nos. 3786704 and 3786903; Canadian Patent No. 2237983; Singapore Patent No. 53708; Hong Kong Patent No. 1018747; and Chinese Patent No. 951980068.



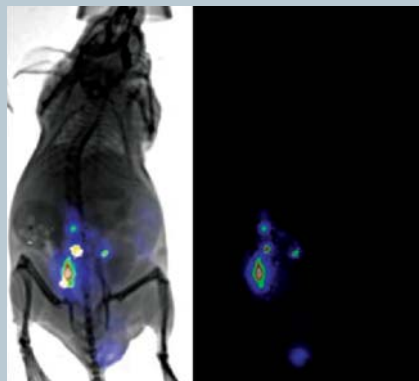
Oncology  
 Neurology  
 Probe & biomarker development  
 and Validation  
 Infectious disease  
 Agriculture



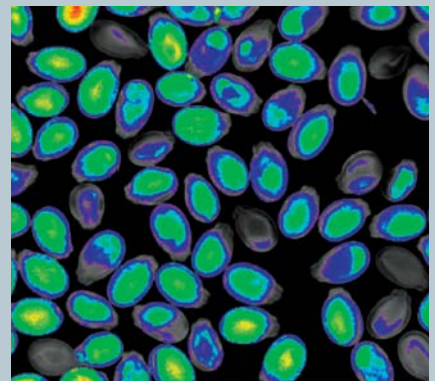
• **Infection imaging**  
 Detection of Inflammation induced myeloperoxidase activity after Microbial Infection. Luminescent Detection of Inflammation with X-Ray overlay



• **Probe development and validation**  
 Spectral unmixing of two NIR fluorescent probes (red and blue) and separation from gut autofluorescence (green)



• **Oncology: Interaction of tumors and inflammatory response**  
 Multi-modal anatomical and molecular image overlay of NIR fluorescent tumor cells and luminescent detection of inflammation induced myeloperoxidase activity



• **Agriculture studies**  
 Pseudocolored X-Ray Screening of Seeds for Viability





## Delivering optimum customer experience

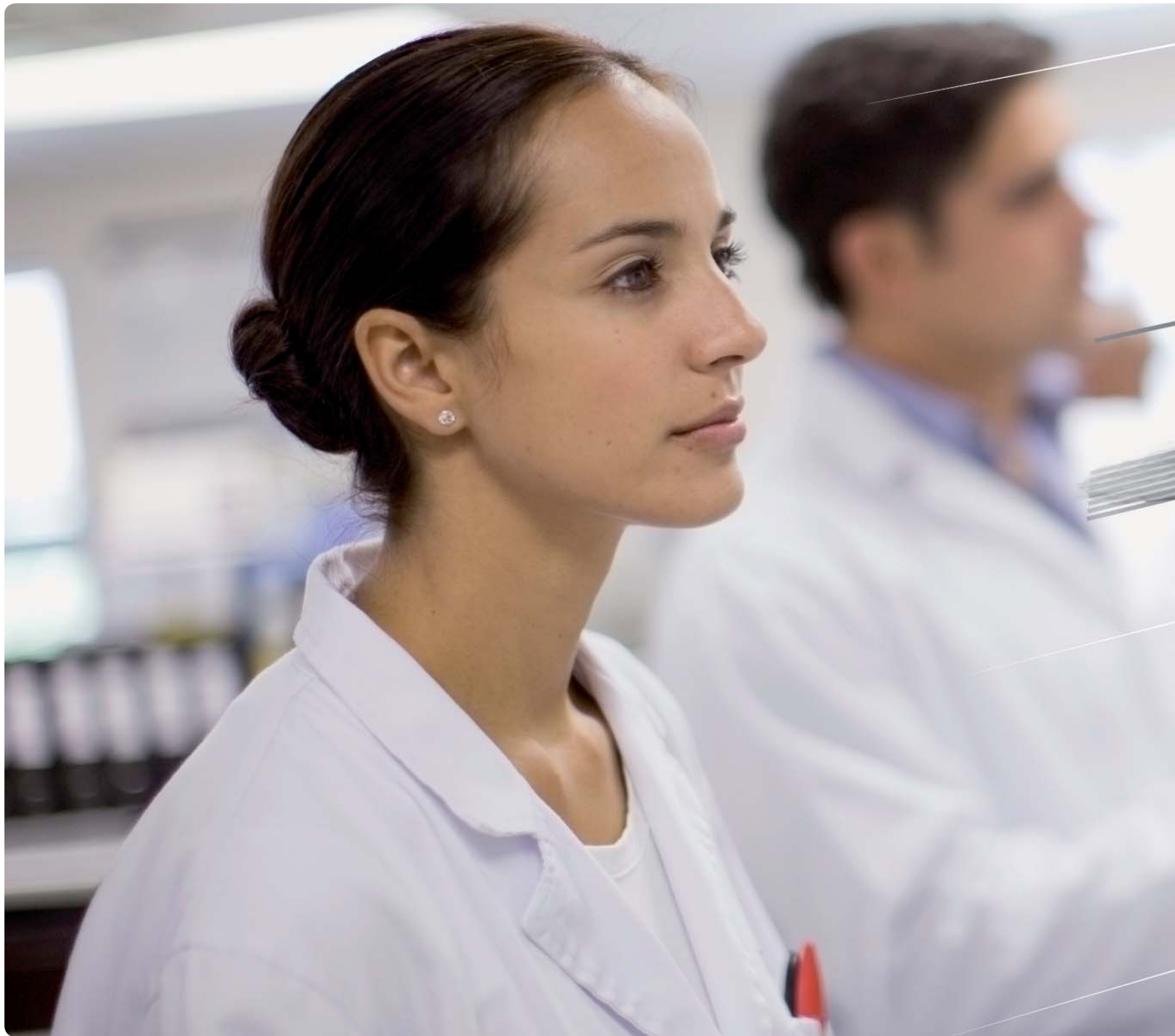
- Bruker's comprehensive service and support: reliability, expertise and performance

Bruker is strongly committed to provide the highest quality of service and support. Our comprehensive service portfolio ensures that customers are always supported by a global corporation with over 6,500 colleagues in over 100 offices worldwide.

Customers benefit from this widespread service network, our experience with installations and customer support around the world, our market share in preclinical imaging, our dedication to service, and much more.

### Bruker's comprehensive services at a glance

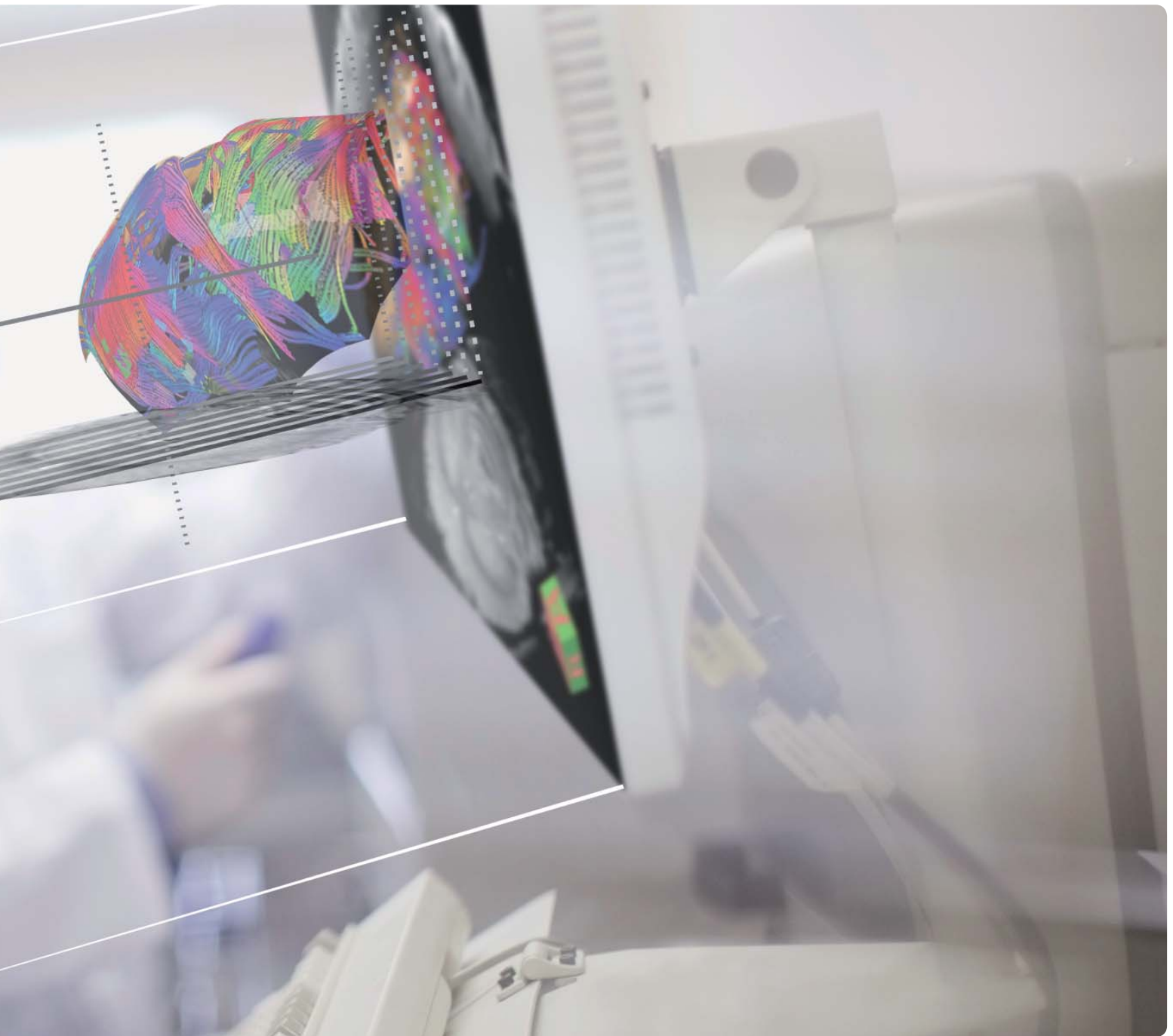
- **Site Planning - Customized Services:** For some instruments, this is the first step in ensuring optimum system performance. Bruker's technical departments can provide space-planning and site preparation services tailored to your individual needs.
- **Responsive Technical and Software Support:** Bruker's Service & Support hotlines are your first point of call. Support center engineers and scientists will quickly and efficiently gather key information, suggest relevant diagnostics and provide a swift solution.
- **Applications Support:** Our trusted experts continue to develop innovative *in vivo* imaging applications and solutions that meet a wide range of demanding needs in pre-clinical imaging, molecular medicine, biomedical and pharmaceutical research.
- **Education and Training:** Bruker offers a variety of advanced professional trainings, webinars, seminars and workshops. Our courses cover a wide range of applications and include hands-on lab sessions in our dedicated application support centers. To learn more about the training schedule and registration, please visit: [www.bruker.com/pci-training.html](http://www.bruker.com/pci-training.html)



## **Bruker – Continuous scientific innovation**

Bruker has been driven by the idea to always provide the best technological solution for each analytical task for more than 50 years now. Today, worldwide more than 6,500 employees are working on this permanent challenge at over 100 locations on all continents. Bruker systems cover a broad spectrum of applications in all fields of research

and development and are used in all industrial production processes for the purpose of ensuring quality and process reliability.



**A performance leader in preclinical imaging instrumentation**

Bruker offers advanced preclinical imaging solutions for a broad spectrum of application fields, such as cancer research, functional and anatomical neuroimaging, orthopedics, cardiac imaging, stroke models and many more. Our flexible instruments can be

combined for several different research programs – thus enabling higher versatility across all instrument platforms and significantly expanding research capabilities. Our range of techniques includes PET – Positron Emission Tomography, SPECT – Single Photon Emission Computed Tomography, microCT – Micro Computed Tomography, X-Ray, Fluore-

scence, Luminescence, Radioisotopic, MRI – Magnetic Resonance Imaging, MPI – Magnetic Particle Imaging.

## Enhancing research capabilities and accelerating time-to-market of drugs

- Knowledge and expertise of a global market leader in imaging technologies
- An unmatched portfolio of nine preclinical imaging modalities
- All modalities can be used singly or in combination with each other
- Advanced, proven imaging technologies from a single source
- Accelerated time-to-market of drugs and therapies
- A broad spectrum of industry, application and research tasks covered
- Service throughout the whole lifecycle of instruments and solutions
- Protection of investments in instruments and solutions
- A company managed by scientists, understanding the needs of scientists



imaging@bruker.com

For more information on preclinical applications,  
solutions and instruments please visit  
<http://www.bruker.com/preclinicalimaging>