

ParaVision[®] 360

- The Most Advanced Software for Preclinical Imaging Research

Bruker's Vision

Bruker's Preclinical Imaging team of creative scientists and engineers is dedicated to supporting the scientific community with innovative products and services, which leading researchers use in their daily advancement of disease cures for the benefit of mankind.

ParaVision has been an essential component of Bruker's preclinical imaging solutions from the very beginning.

ParaVision is the world's leading preclinical imaging software. Used in the most distinguished laboratories, it plays an integral role in the advancement of the cure of diseases, when ground breaking discoveries ranging from basic research to drug development are performed on Bruker instruments run with ParaVision.

Focusing on consistent quantification, ParaVision 360 makes scanning even more intuitive, while maintaining the full flexibility that Bruker users praise. The enlarged MRI sequence portfolio, which is exclusive to Bruker, and the powerful image data evaluation functions lead to maximum proficiency in scanning and analysis.

AVANCE NEO electronics, which are integral to ParaVision 360, make scanning faster and more precise. AVANCE NEO enables real-time decisions, makes dynamic shimming possible, and improves gradient performance.

ParaVision 360 enters the world of seamless multimodal imaging. Modern imaging laboratories hosting PET/MR instruments profit from the fully integrated common imaging platform spanning PET and MRI modalities. The simplicity and uniformity across the range of instrumentation allows operators to put their focus on their research.



● Consistent Quantification

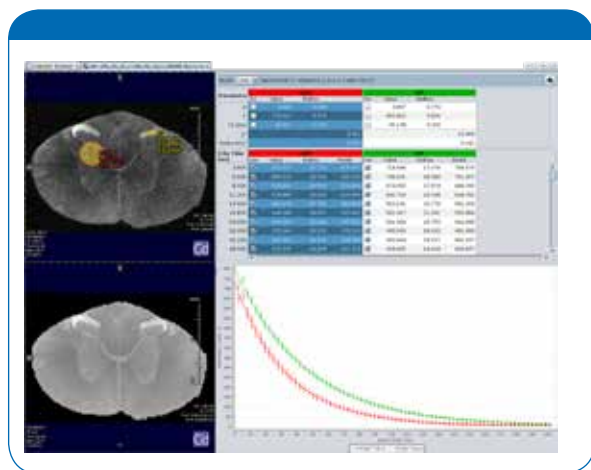
New introductions in ParaVision 360 make MR imaging more accurate, the data more consistent and better quantifiable, and the combination with PET even more precise.

Accurate and Sensitive Imaging

The introduction of AVANCE NEO electronics makes dynamic shimming possible, leading to even greater geometric fidelity in fast EPI imaging and improving metabolite quantification in multi-slice CSI.

Seamless Precision

The Animal Transport System (ATS), that can be controlled both from the touchscreen at the front of the instrument and from the console, provides the exact precision needed for combined PET and MR imaging and multistation acquisitions for largest Field of Views. Push-button automatic centering of slices to the isocenter of the magnet guarantees that MR images are always at the sweet-spot.



Interactive quantitative mapping

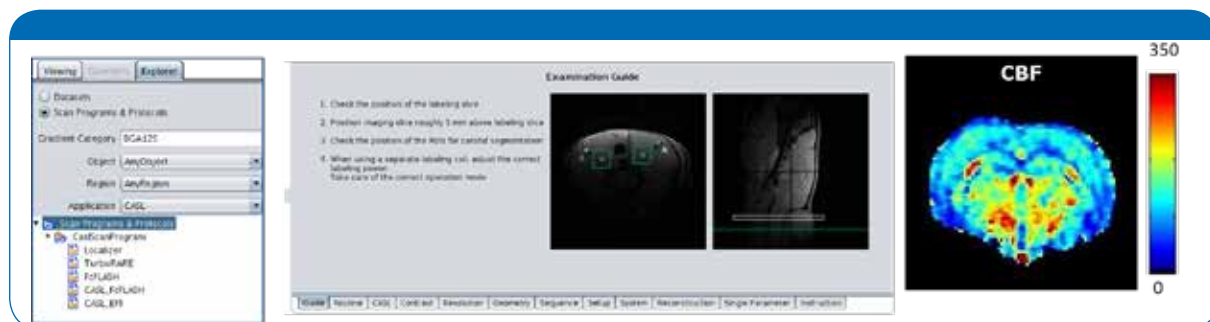
Quantifiable Data

Cardiac image quality is also better than ever before. Wireless IntraGate imaging is now coupled with radial UTE to allow 8-fold accelerated full heart cine coverage in IntraGateUTE. The minimized flow artifacts allow streamlined evaluation with automatic cardiac analysis software, and the image analysis tool allows to interactively map tissue properties.

Consistent Results

ParaVision users rely on the push-button pre-optimized protocols and scan programs, that come with the instrument. With CASL, Bruker debuts its first workflow package, containing a complete pre-prepared scan program, an examination guide, and an integrated reconstruction with automatic measurement of inversion efficiency and output of quantitative CBF maps. This full package makes the data operator independent and therefore increases the quality and reproducibility of longitudinal studies.

- Predefined protocols categorized via anatomy and application
- Scan program capability
- Report creation capability
- Dynamic shimming* for greatest image fidelity
- CASL workflow package for optimal scanning, reproducibility and consistency
- Full heart cine coverage with IntraGateUTE
- Animal Transport System control via touchscreen or from the console
- 1 μ s gradient timing for best EPI quality
- Interactive quantitative mapping



CASL workflow package with automatic CBF map output

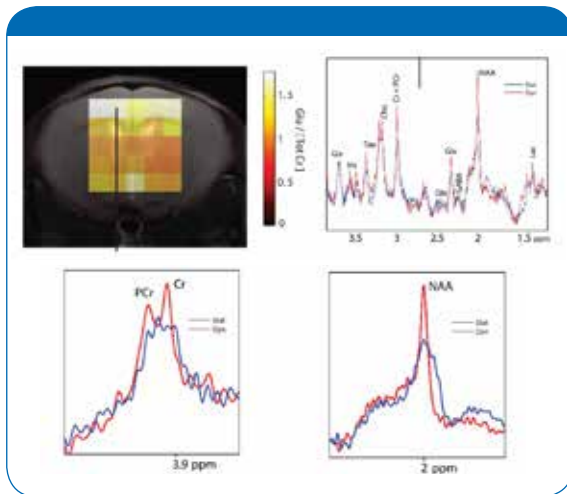
Courtesy: E. Barbier, L. Hirschler, J. Warnking, Grenoble Institute of Neuroscience, Grenoble, France

*Work in progress

● New Imaging Power

New Levels of Accuracy in Neuroscience

Once again setting the standard in preclinical imaging software, ParaVision 360 takes reproducibility to a whole new level with the introduction of the examination guide, which escorts the user throughout ASL measurements, ensuring optimal results, whether it be for investigating the extent of stroke damage and recovery or for following the progression of dementia. This consistency and reproducibility is of course only of use when the image fidelity is provided. The introduction of 1 μ s gradient timing provides greatest image exactitude for best EPI quality. Additionally, dynamic shimming provides for greatest image exactitude, improving mapping of structural and functional connectivity as well as leading to more accurate quantification in CSI.



Mouse multislice CSI with improved spectral separation and increased sensitivity due to dynamic shimming

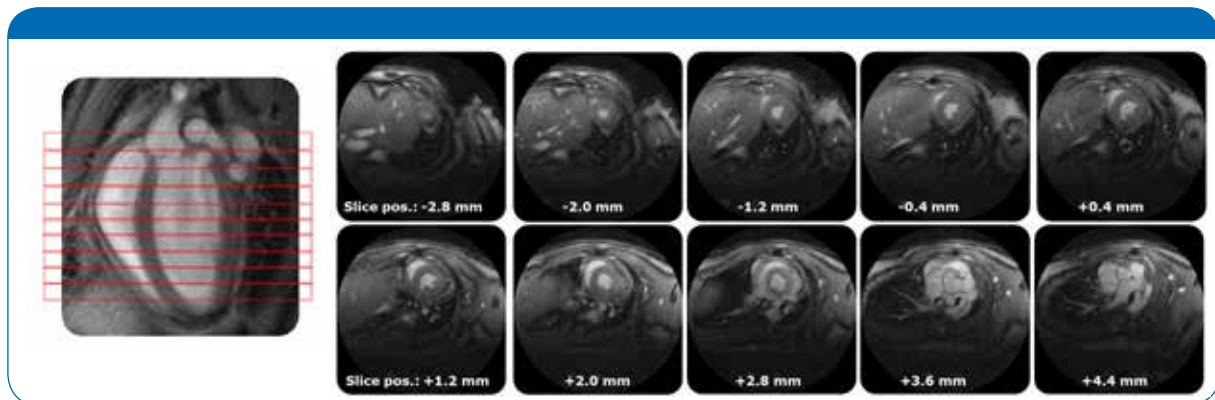
Courtesy: A. Seuwen, M. Rudin, ETH Zurich, Zurich, Switzerland

Precise Characterization of Cancer

Accurate image reproducibility is imperative for oncologists measuring tumor progression and treatment. Thanks to the highest sensitivity of ParaVision 360's integral AVANCE NEO electronics, even smallest metastases are visible in 3D volumes. Metastases can be seen all throughout the body using multistation acquisition with subsequent image stitching. Longitudinal tumor perfusion studies benefit greatly from the ASL examination guide, which assists throughout scanning and evaluation, ensuring consistency.

Wireless Cardiac Functional Assessment

A common characteristic of cardiac models is their instability. Speed of investigation is therefore crucial for animal welfare. Valuable setup time is saved by using IntraGate, since it does not require any electrodes. This unique method that records all heart frames without the need for triggering is complimented with UTE in IntraGateUTE leading to up to 8-fold acceleration compared to classical methods. The minimized flow artifacts facilitate streamlined evaluation with automatic cardiac analysis software.



IntraGateUTE enables full cardiac assessment with $(130 \times 130) \mu\text{m}^2$ in plane resolution and 14 cine frames per heart beat in less than 15 minutes

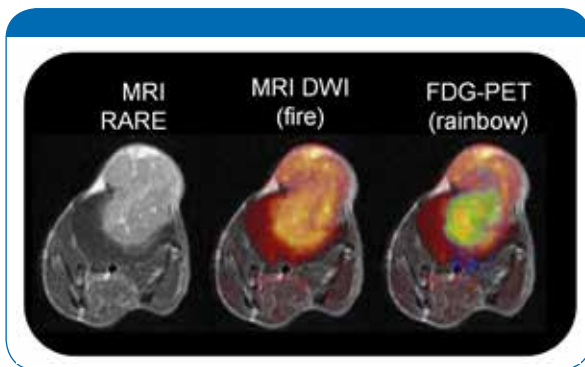
● Entering the World of Seamless Multimodal Imaging

Consistent Workflow for PET and MRI

Users of PET/MR instruments profit from a commonality between workflows, image processing and analysis, and data structure and management, all of which make operation faster and easier. Common terminology between the modalities and integrated single and multimodal workflows provide optimal clarity during scanning.

Efficient Animal Imaging

Animals are quickly positioned within the MRI and PET using the touchscreen of the Animal Transport System (ATS). Its accuracy guarantees perfect positioning correspondence between the two modalities and enables multistation acquisition for largest Field Of Views.



Mouse glioma study performed with simultaneous PET/MR at 7 Tesla.
Fusion of one overlay and two overlay datasets
Courtesy: U. Himmelreich, W. Gsell, C. Casteels, and C. Deroose,
Molecular Small Animal Imaging Center (MoSAIC), University Hospital

Automatic Attenuation Correction Maps

PET attenuation correction maps are automatically calculated taking the animal, the animal cradle, and the RF coil into account. Stitched datasets, obtained with multistation acquisition are used for animal attenuation.

Advanced PET Scanning

PET scanning is enhanced by such options as capture mode based on total time or total counts, definition of energy windows and limits, and animal cradle position shifting between frames. Additionally, dynamic reconstructions can be performed when the data is saved in List Mode format.

Seamless Analysis

Multimodal data is automatically coregistered and common image processing, viewing, and analysis tools, such as fusing, make evaluation straightforward and easy.

- Common terminology between instruments
- Common integrated multimodal workflows
- Common image processing, viewing, and analysis tools and functionalities
- Common dataset structure and management
- Automatic coregistration of multimodal data
- Automatic MR based PET attenuation correction
- Static and dynamic image acquisition
- Retrospective cardiac and respiratory gating and reconstruction
- Kinetic time course image reconstruction and segmentation
- PET random-, scatter-, and dead-time correction
- PET isotope decay correction



Isosurface reconstruction of Attenuation Correction Map

● At the Forefront of MRI

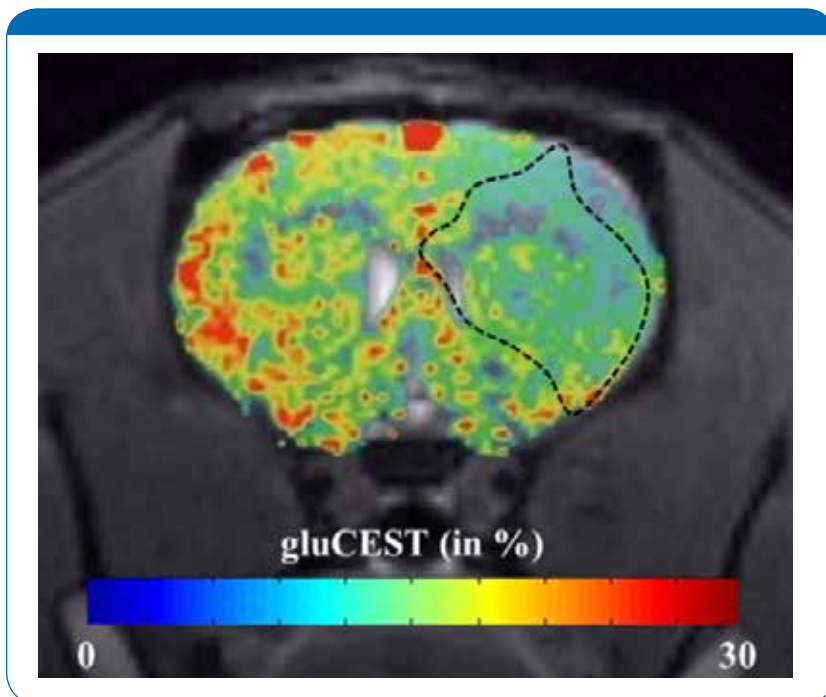
Greatest Accuracy

Image fidelity is greatly enhanced thanks to 3D dynamic shimming, improving fMRI activation location due to reduced geometric distortions of EPI images for overlays with morphology images as well as increasing sensitivity, spectral separation and sensitivity in multislice metabolite imaging.

Largest Method Portfolio

The already large MRI sequence portfolio, which is exclusive to Bruker, has been expanded even further. B1 can be mapped and shimmed based on the DREAM method and CBF can be quantitatively calculated from CASL based on EPI. The range and quality of tissue imaging is extended with the methods Double Echo Steady State (DESS), ideal for cartilage imaging and IntraGateUTE providing virtually flow- artifact-free full heart cine coverage. A dual echo-time option has been added to UTE3D, and a Saturation Transfer module including CEST and MTC options is available. A fat-water separation option is provided in RARE, enabling fat chemical shift corrected images.

- AVANCE NEO electronics for fastest timings
- Multi-station acquisition
- Image stitching for largest Field of Views
- Dynamic shimming* capability
- B1 optimization and mapping
- Saturation Transfer module with CEST and MTC
- Fat-water separation imaging
- Fat chemical shift corrected images
- IntraGateUTE for virtually flow-artifact free cardiac scanning
- Advanced reconstruction, viewing, and analysis functions
- Dual overlay, alpha blending, image clipping, cut volumes, image fusion
- On-the-fly image mapping
- Diffusion tensor evaluation
- Method development framework



Whole brain mapping of CEST metabolites: astrocyte reactivity region in rat at 11.7 T

Courtesy: J. Flament, CEA-MIRCEn, Fontenay-aux-Roses, France

*Data acquired with prototype implementation. Data evaluation requires further third party software.

Most Meaningful Results

In addition to new method introductions, ParaVision 360 paves the way in ease of operation use as well. The examination guide escorts the user throughout ASL measurements, ensuring results that are consistent and reproducible, increasing the quality of longitudinal studies.

Consistent Quantification

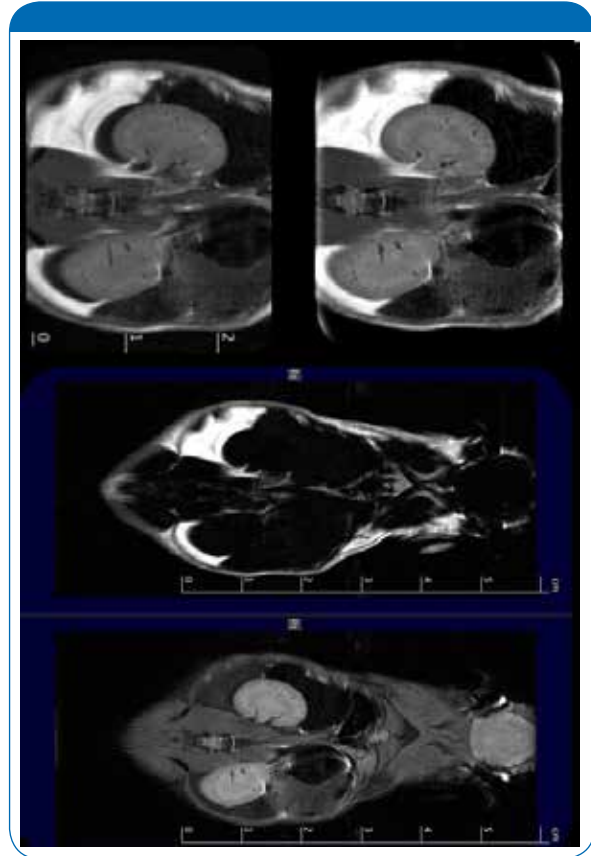
Analysis and quantification of data is a simple process when using the parameter map tool. Its interactive ROI navigation with immediate update leads to fastest generation of exportable parameter maps.

Powerful Data Analysis

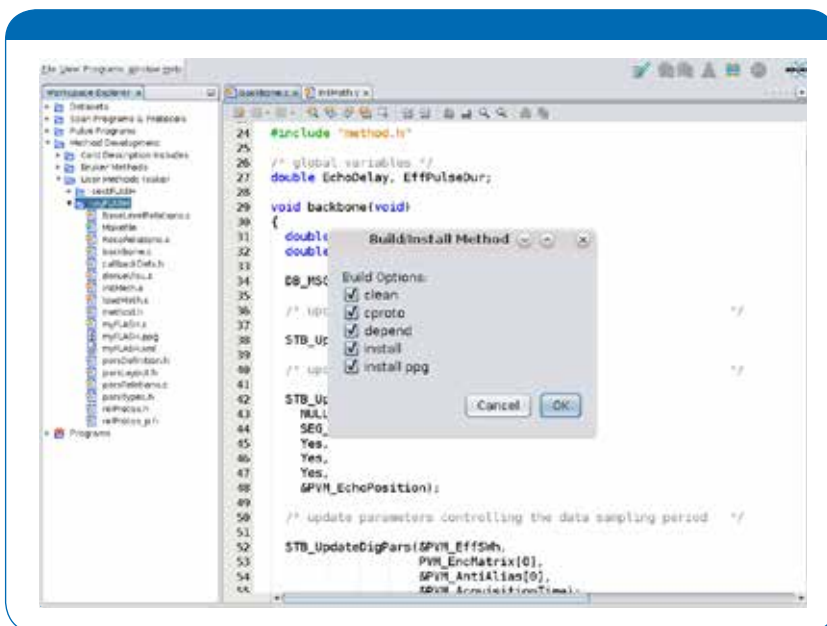
ParaVision 360 provides extensive reconstruction, viewing, and analysis functions, ranging from angles and annotation to surface rendering to underlay/overlay, to zooming/panning.

Full Flexibility

Additionally, an open method developing framework with open method source codes enables programming of novel methods and reconstruction options.



Fat-water imaging in mouse (middle and bottom) and fat chemical shift corrected image (top right) opposed to standard RARE (top left)



Method development framework

**Work in progress*

ParaVision 360

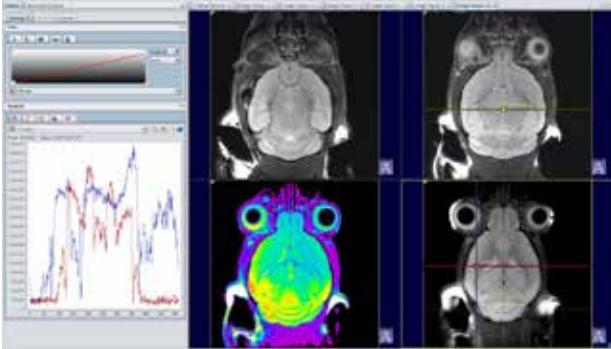
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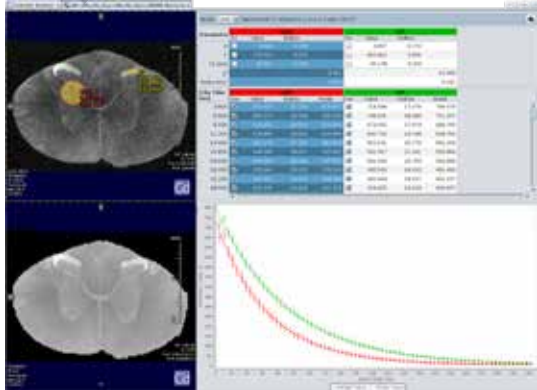
Image



View



Quantify



Record

