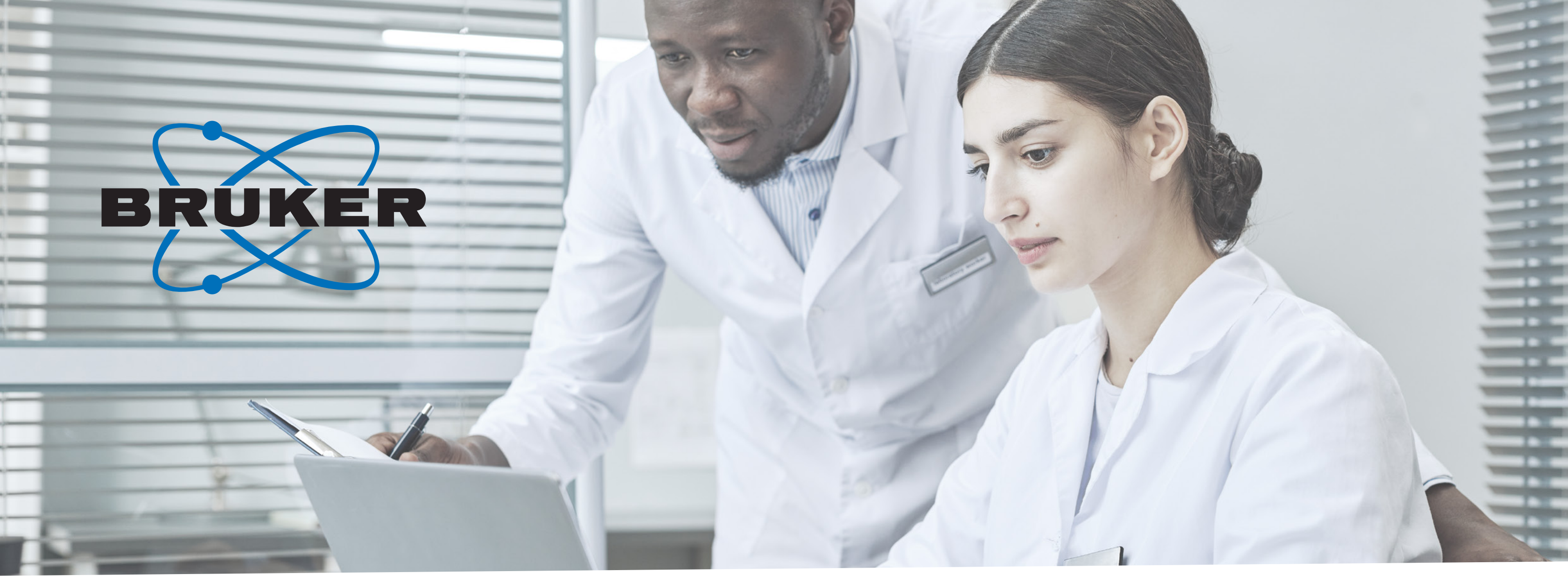

PCI SOFTWARE

ParaVision 360 V3.7

Smarter Imaging from Scan Planning to Analysis

Innovation with Integrity

The latest release of ParaVision 360, Version 3.7 brings enhancements across the imaging workflow from scan planning to analysis, accelerating acquisition, improving image fidelity, and streamlining analysis.

Accelerated Scanning with Automatic Orthogonal Reconstructions

Simplifying scanning, ParaVision 360 V3.7 introduces automatic orthogonal reconstructions of 3D datasets. Previously reliant on manual interaction, orthogonal views of 3D datasets can now be generated using an automated post-processing workflow.

To further support ease of use, this feature is pre-enabled in pre-optimized isotropic 3D protocols, delivering automatic i.e. axial, sagittal, and coronal reconstructions.

This new feature enables the introduction of fast scout protocols, specifically developed for efficient study planning. These rapid 3D acquisitions enable isotropic brain coverage in one minute, supporting accurate localization and planning of subsequent scans.

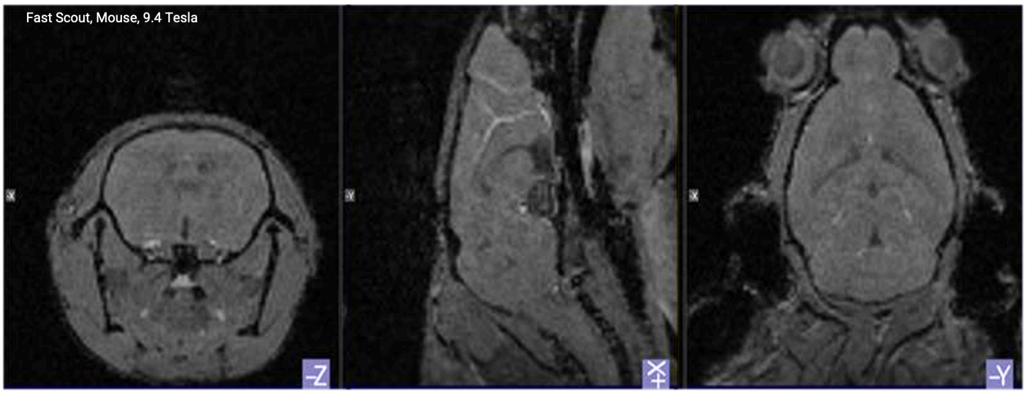

Figure 1 The Fast Scout isotropic resolution 3D scan for study planning provides automatic orthogonal reconstruction.

Enhancing EPI Fidelity with Field Map-Based B0 Distortion Correction

Echo Planar Imaging (EPI) remains the method of choice for advanced neuroimaging applications such as functional MRI (fMRI) and Diffusion Tensor Imaging (DTI), due to its ability to capture data with high temporal resolution. In particular, single-shot EPI is widely employed in fMRI to meet the demands of fast image acquisition. However, this speed comes at the cost of increased sensitivity to magnetic field inhomogeneities, often resulting in geometric distortions, especially in regions with strong susceptibility gradients.

While advanced shimming techniques and protocol optimizations can significantly reduce these artifacts, residual distortions often persist, compromising spatial accuracy and data interpretation. To address this, ParaVision 360 V3.7 introduces a robust field map-based correction algorithm. By leveraging spatially resolved field homogeneity data, this method enables precise post-processing correction of geometric distortions, thereby restoring anatomical fidelity and improving the overall quality and reliability of EPI-based datasets.

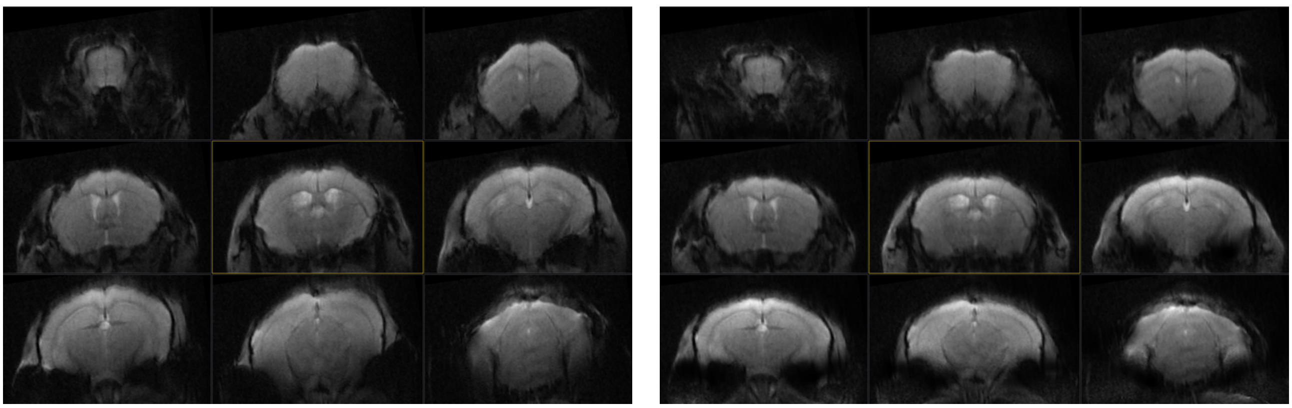

Figure 2 Single-shot EPI of in vivo mouse brain at 7 Tesla. Left: original; right: Field map-based corrected.

Smart Noise Reduction: Now Faster and in Series

Introduced in ParaVision, 360 V3.6, Smart Noise Reduction is based on a deep learning algorithm trained to distinguish noise from true anatomical and functional signals. Unlike traditional filters, which often blur fine details, this AI-based approach preserves structural integrity while effectively suppressing noise. The result is sharper, cleaner images that enhance visual interpretation and support more accurate quantitative analysis, especially in low signal-to-noise scenarios, such as with high-resolution or rapid imaging protocols.

With ParaVision 360 V3.7, Smart Noise Reduction is taken even further. In the latest version, reconstruction performance has been dramatically improved. Smart Noise Reduction in ParaVision 360 V3.7 now delivers results on average 7 to 10 times faster than before. This substantial acceleration shortens turnaround times, allowing users to move from acquisition to analysis more efficiently.

Reconstruction Time (Seconds)

Reconstruction	PV 360 V3.6	PV 360 V3.7
None	4	4
Smart Noise Reduction Strong, 70%	62	9
Smart Noise Reduction Strong, 100%	70	9
Smart Noise Reduction Large, 70%	96	10

Reconstruction Time (Seconds)

Reconstruction	PV 360 V3.6	PV 360 V3.7
None	3	3
Smart Noise Reduction Strong, 70%	50	7
Smart Noise Reduction Strong, 100%	55	7
Smart Noise Reduction Large, 70%	55	7

Table 1 Denoising reconstruction times in ParaVision 360 V3.6 vs V3.7. Top: sample mouse abdomen, FOV: (30 x 30) mm², Resolution: (100 x 100) µm². Slice Thickness: 1 mm; Bottom: sample mouse brain, FOV: (15 x15) mm², Resolution: (75 x 75) µm². Slice Thickness: 0.75 mm. Actual reconstruction times depend on data sizes and hardware.

Additionally, version 3.7 introduces automatic Image Series Denoising. Selection of this option as an automatic post-processing step enables denoising of entire image series, such as relaxation fits, perfusion time series, or cardiac cine sequences. This reduces manual processing and ensures consistent image quality across dynamic or multi-frame datasets.

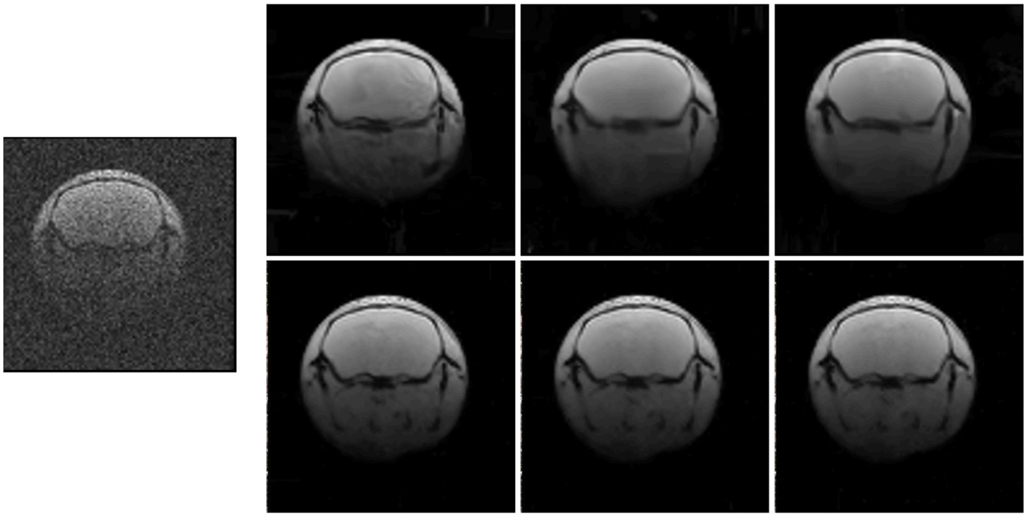

Figure 3 3 slice, 20 movie frame FLASH of ex vivo mouse brain at 9.4 Tesla. Far left: original data; top: individually denoised frames; bottom: denoising with Smart Image Series Denoising. Denoising with Smart Image Series Denoising provides clearer images with less variation across frames.

Using MRI to improve PET data

To enhance PET reconstructions, ParaVision 360 V3.7 introduces Bowsher Prior, a spatial regularization technique that leverages anatomical information from structural MRI images in the PET smoothing process. Under the assumption that tissues with similar structural characteristics (e.g., gray matter, white matter, or specific organ regions) often exhibit comparable metabolic or molecular activity, Bowsher Prior averages voxel intensities in the PET image by considering only those neighboring voxels that exhibit similar intensity values in the corresponding structural MRI. By restricting the averaging process to structurally similar voxels, Bowsher Prior preserves anatomical boundaries, reducing the risk of blurring across functionally distinct regions.

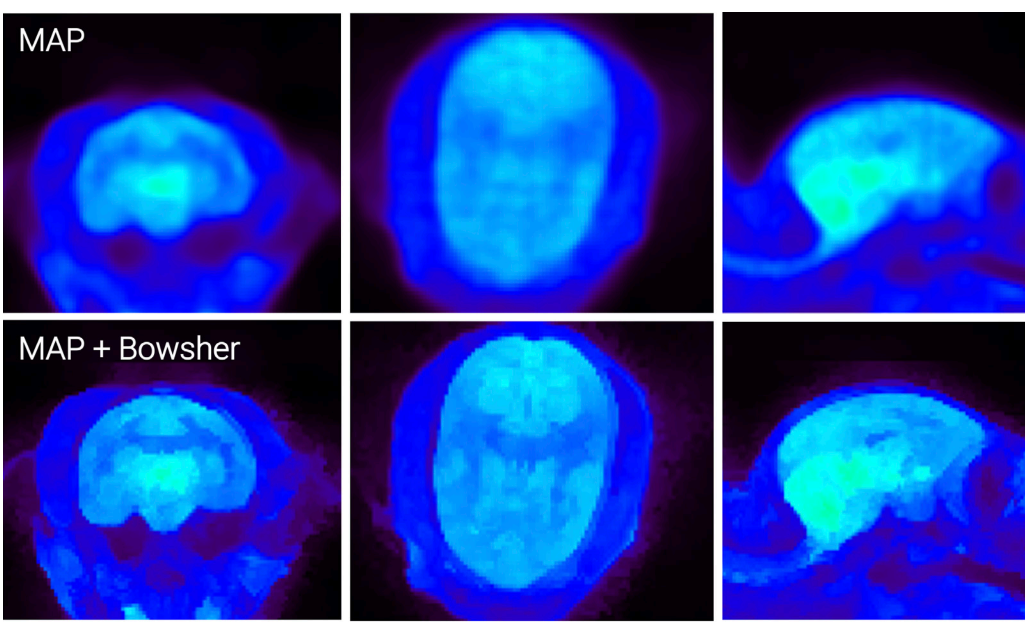

Figure 4 Marmoset brain imaging with PET FDG. Top: MAP reconstruction. Bottom: Bowsher Prior reconstruction, an advanced PET reconstruction algorithm that uses MRI prior knowledge averages on those voxels that have the closer values in the structural MR image. Courtesy: S. Valable and M. Naveau, Cyceron, Caen, France.

Enhanced Visualization with Cold Color Palette

With the release of ParaVision 360 version 3.7, Bruker has expanded its suite of color lookup tables to include the Cold color palette. This new palette maps low-intensity values to black, making it particularly effective for PET imaging without structural underlays. A further advantage is the harmonization between ParaVision and PMOD, a commonly used platform for quantitative PET analysis that also supports the Cold color palette. This alignment ensures a more consistent visual workflow across software platforms, enhancing interpretability and improving cross-software compatibility.

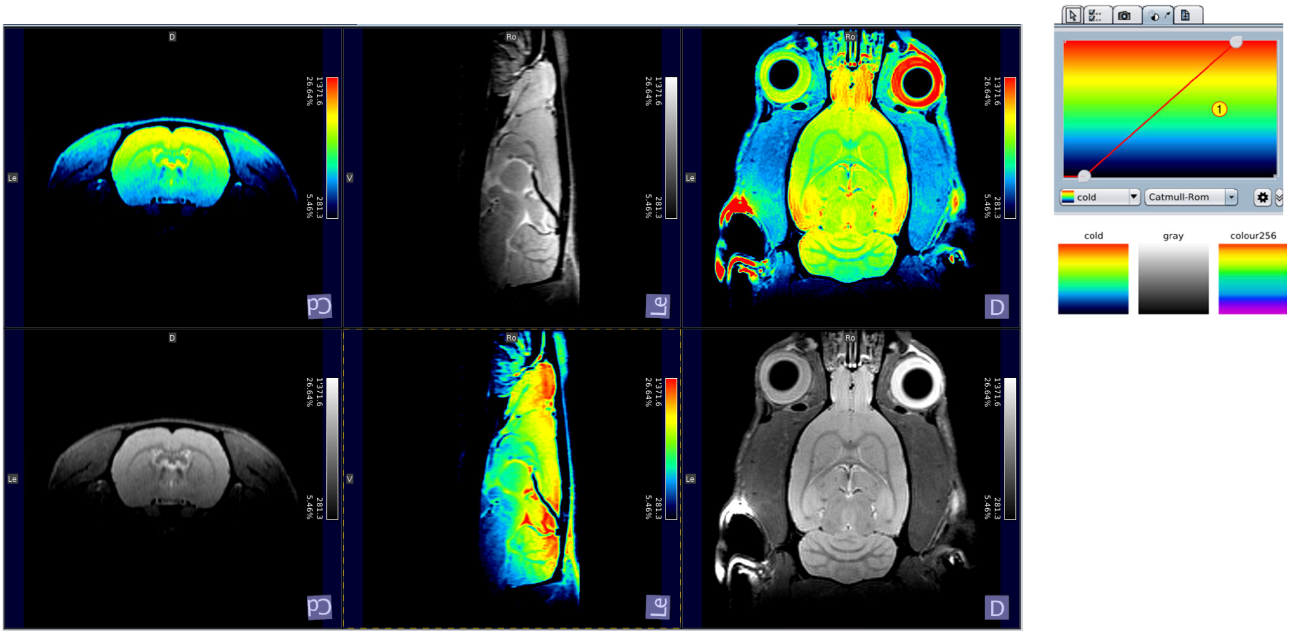

Figure 5 New cold color palette along with commonly used color palettes gray and color256 for comparison (right) as well as a RAREvfl rat in vivo dataset visualization using the cold color palette (left).

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All Bruker in vivo animal work was approved by the institutional animal care and use committee (IACUC) or local authorities and conducted under valid study permit.

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