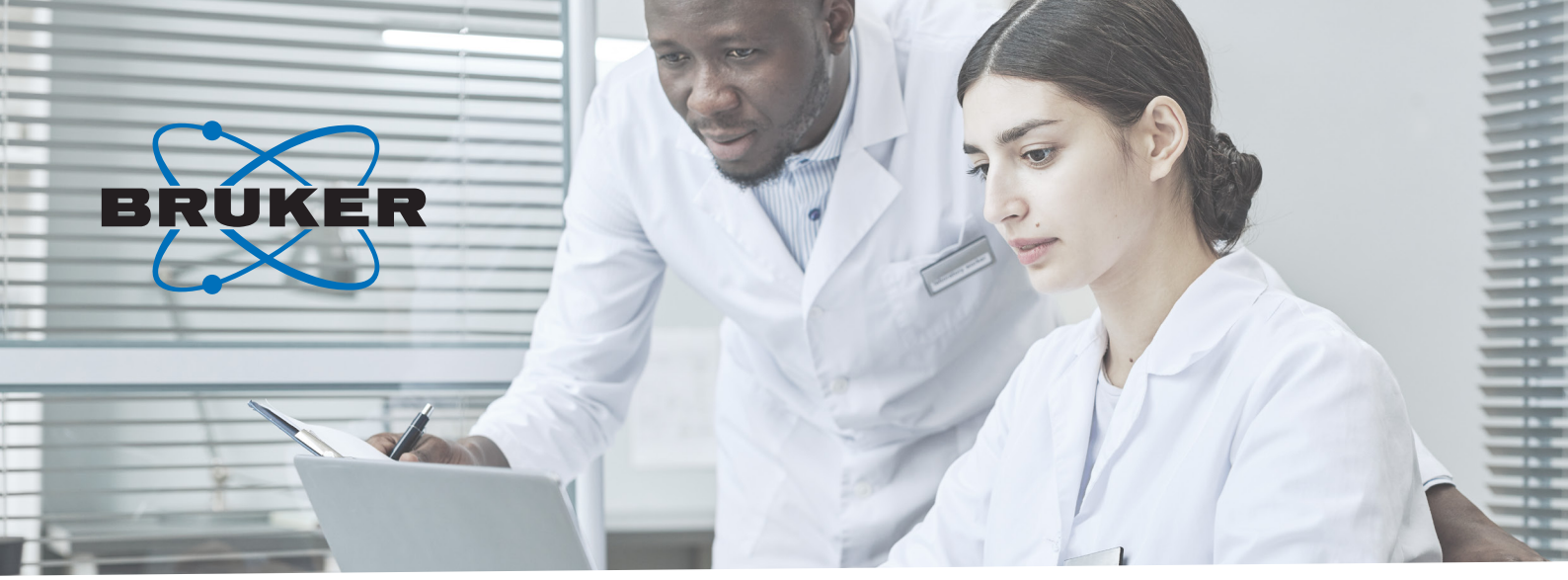

PCI SOFTWARE

ParaVision 360 V3.6

Speed with Security

Innovation with Integrity

ParaVision 360 is the most advanced preclinical imaging software. Version 3.6 enables fast scanning, while maintaining user security of result accuracy. In addition to extending the extensive method range, Version 3.6 introduces AI denoising, enabling faster scanning or enhancement of image quality, as well as more accurate analyses.

AI Denoising

ParaVision 360 V3.6 introduces a novel algorithm for AI-based MRI image denoising. Trained without any generative approach, the networks remove noise within the complex dataset, maintaining recorded signal.

The user has full control over this feature, as the denoising can simply be activated as an additional reconstruction step, leaving the original reconstruction untouched. Denoising strengths between 0% and 100% can be set and multiple post-processings with different denoising levels can be created if desired.

In addition to denoising static image data, the algorithm can also be employed for dynamic data such as those of heart cines.

The integration of AI-driven denoising into ParaVision allows researchers to further enhance image quality of high-resolution, high SNR scans or also to increase the throughput with shorter scan times, accepting more noise in original data which can be effectively removed by the network.

Beyond accelerating workflows or improving data quality, the AI denoising can be used for more precise quantification. Fits become more accurate with smaller standard deviation when data is denoised before fitting.

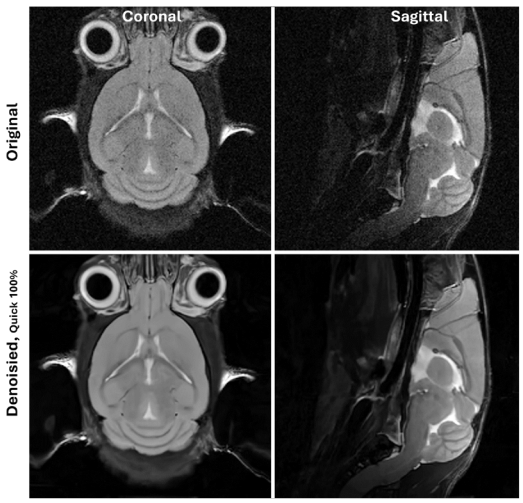

Figure 2: Mouse brain images acquired at 3 Tesla. TA per original: 3 minutes 48 s. Corresponding denoised data shows a clear SNR improvment.

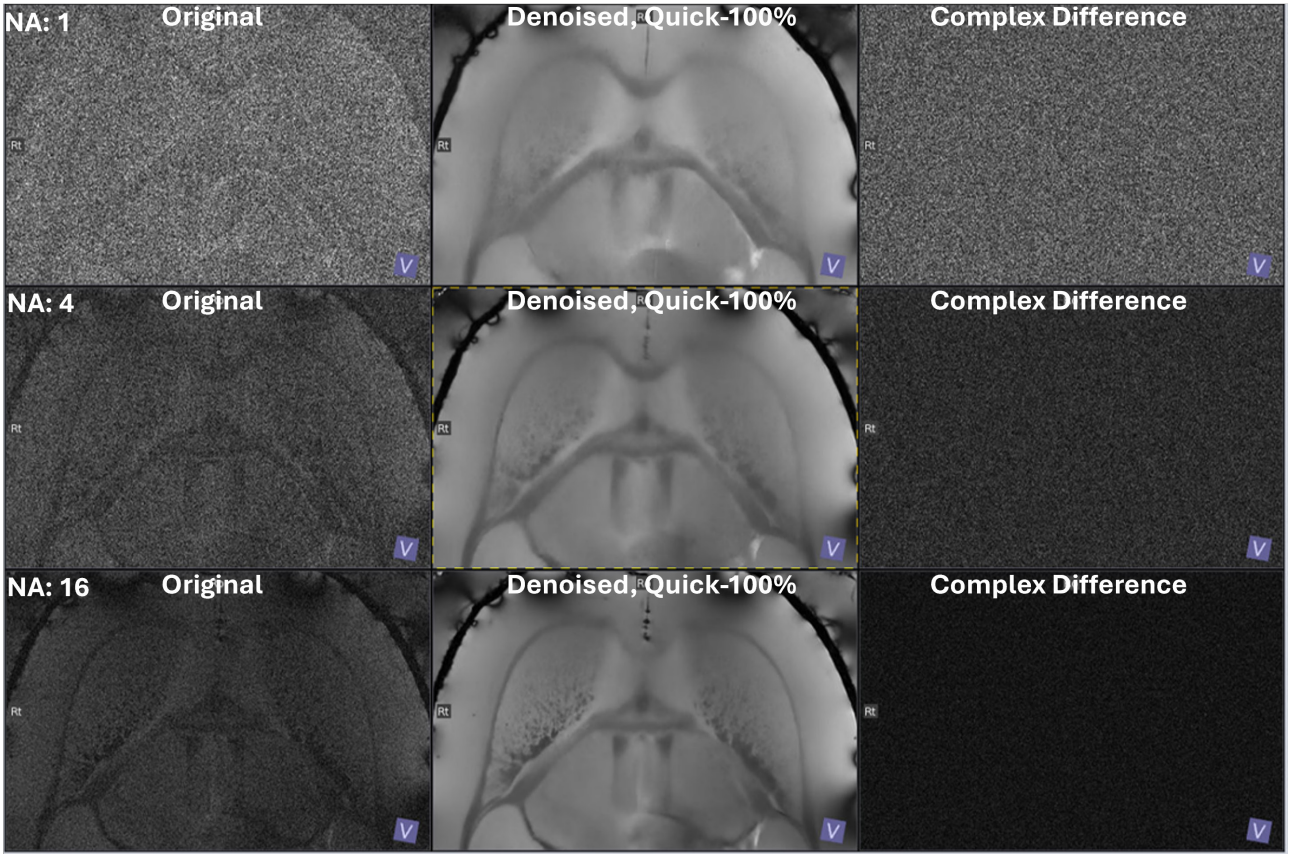

Figure 3: Examples of 3 datasets acquired at 18 Tesla with an MRI-CryoProbe on an ex-vivo mouse brain sample. The left column shows the 3 original TrueFISP (25x25x25) μm^3 resolved datasets acquired with 1, 4, and 16 averages, all other imaging parameters were maintained. In the middle column the denoised datasets are displayed. While it is clear that the most details are visible in the 16 averaged original, all datasets are notably denoised, demonstrating that even fast minimally averaged scans can become useful. In the right column the complex differences of the images in columns 1 and 2 are presented showing the noise contribution which was removed from the original images.

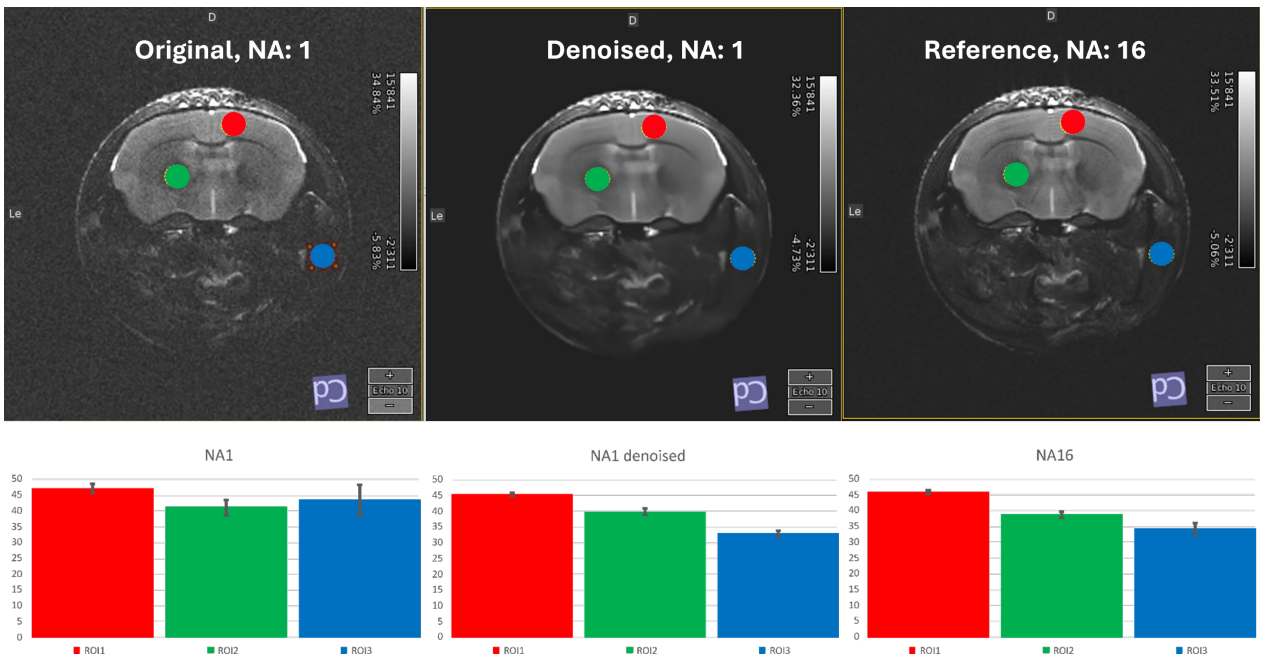

Figure 4: T2 values of 3 ROIs in ex-vivo mouse brain acquired at 9.4 Tesla. The T2 values of the denoised single averaged dataset are much closer to that of the 6 averaged dataset than that are of the non-denoised data. Furthermore, the error of the fits decreased after denoising.

Cardiac T_1 mapping

Preclinical cardiac T_1 mapping is challenging due to fast heartbeats and the need for double gating on respiration and the heart-beat to ensure high image quality. To address this issue, ParaVision 360 V3.6 introduces a Look-Locker-based segmented FLASH based T_1 mapping sequence enabling cardiac T_1 mapping. A segmented method, it allows for short measurement times by acquiring multiple k-space lines per heart cycle. Furthermore, the inversion pulse and the data acquisition are independently triggered to ensure best results.

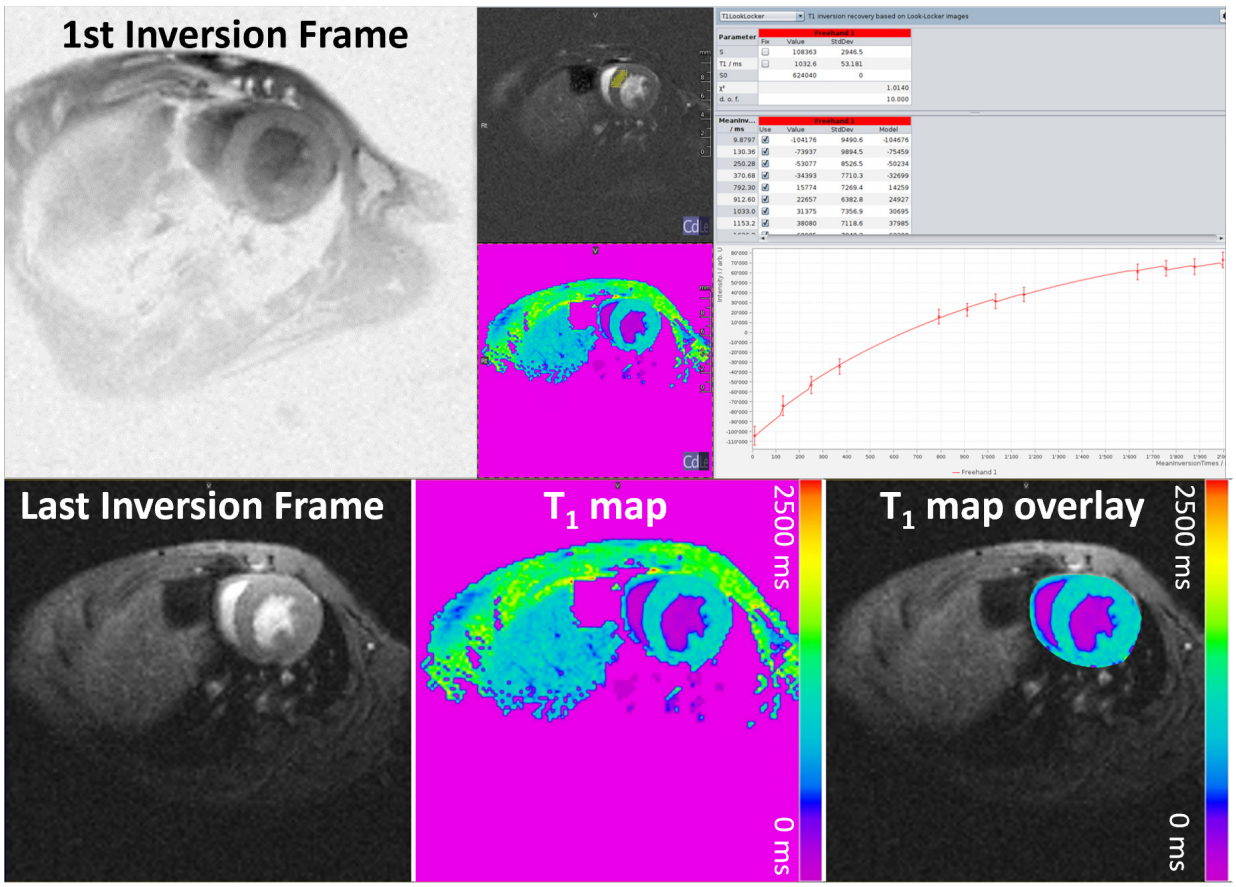

Figure 5: Cardiac T1 mapping example. A slice-selective Look-Locker based Inversion-recovery segmented FLASH measurement was performed on a mouse at 7 Tesla. Top row: on the left the first inversion frame is shown and on the right the inversion fit curve of the ROI in the mouse myocardium. In the bottom row the last inversion frame, the T1 map, and the overlay of the two are shown.

Dose Calibration Reference Point

As radionuclide image decay correction plays an important role in quantitative PET, ParaVision 360 performs an image decay correction on reconstruction. Starting in ParaVision 360 version 3.6, the default image decay correction is set to the scan start time. This provides an activity value representative of tracer activity at the scan start time. Furthermore, when using the scan start time selection, the details entered during the study registration for dose-calibration do not affect the image reconstruction, leading to higher accuracy. Users, however, can freely choose whether to activate this feature or to set the decay correction reference point to scan start or to dose-calibration as needed.

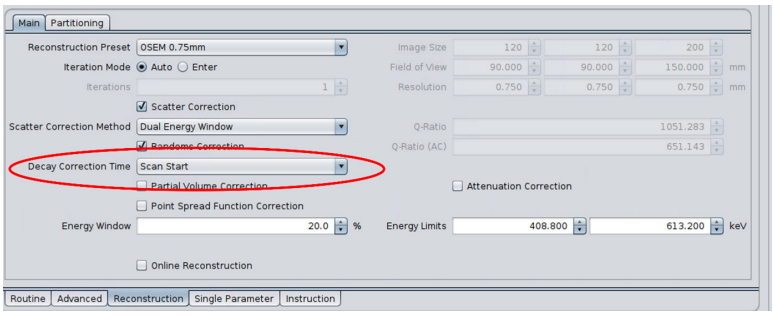

Figure 6: Reconstruction tab in ParaVision 360 V3.6 highlighting the Decay Correction Time point selection.

Protocols and Scan Programs

MRI

Originally introduced in ParaVision 360 version 3.3, the RAREvfl method enables fast, isotropic 3D T2 weighted imaging and was further improved in the latest versions. With ParaVision 360 version 3.5, 3D, pre-validated application protocols for RAREvfl isotropic imaging at 3 and 7 Tesla were introduced for the mouse and rat head. Additional 7 Tesla protocols as well as rat brain 3D T2 weighted protocols at 9.4 Tesla have now been introduced in ParaVision 360 V3.6. These protocols allow straightforward and fast morphological, isotropic 3D acquisitions.

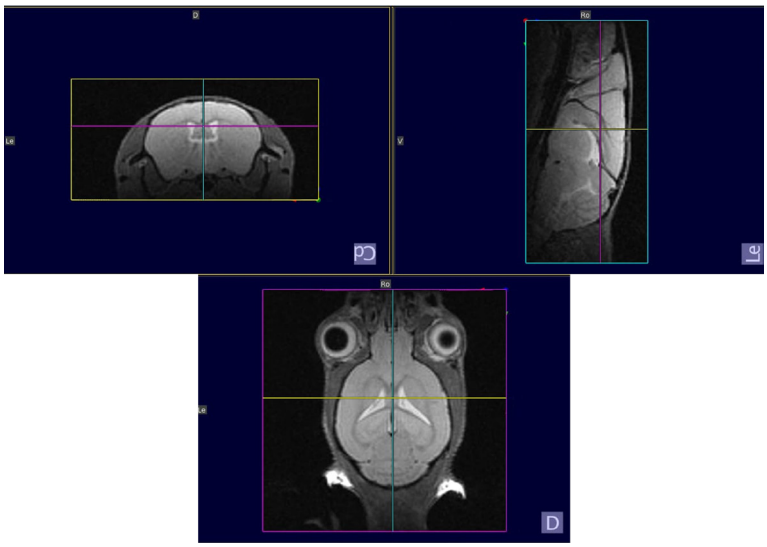

Figure 7: 3 orthogonal directions of an isotopically resolved 3D T2 weighted dataset from the mouse brain using the protocol for the BGA 20 gradient system at 7 Tesla.

NMI

Starting in ParaVision 360 version 3.6, PET/CT protocol and scan program logic is revised for improved workflow. Mouse and rat scan programs and protocol categories include region and application selection nomenclature consistent with intuitive logic inherent for the PET/CT study.

Newly introduced mouse protocol and multimodal scan program selections are shown in Figure 8. For rats similar protocols and scan programs were introduced.

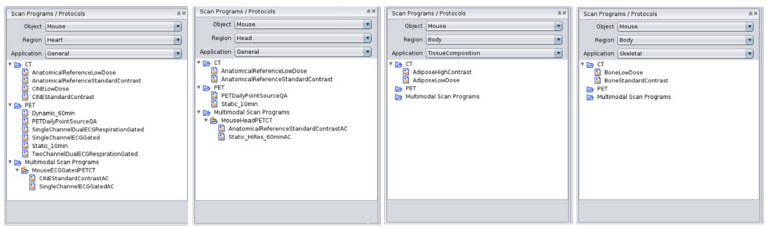

Figure 8: Examples of mouse protocol and multimodal scan program selections. For the mouse, the body location contains general, lung specific, and multi-mouse specific multimodal scan programs. Multimodal scan programs can also be found in the general heart location as well as in the general head location. The body locations also contain scan protocols for CT Tissue Composition and Skeletal.

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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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