

PMOD Software Release Notes

Version 4.1

PMOD is a software
FOR RESEARCH USE ONLY (RUO)
and must not be used for diagnosis or treatment of patients.

Maintenance Builds of Release 4.1

<p>Build 5 Sept 15, 2020</p>	<ul style="list-style-type: none"> » PXM/protocols: The saved mask file was not considered in the processing. » PXM: For some DICOM data with missing frame durations a wrong timing could result so that modeling failed. » PFUS: Configuration of the legacy PFUS was not possible if only the fusion tool was licensed. » PFUS: Calculation of the rotation matrix from affine an transformation was improved. » PNEURO: Manual adjustment of rigid matching resulted in a segmentation failure. » PVIEW: Image saving from sidebar used DICOM SOP from previous operation. » P3D: MIP configured as initial landing page caused an exception. » Import of information from database to image series: Only limited information was used. » DICOM: The Study Instance UID is kept for the generation of derived objects (Secondary Capture, processing results) as long as the patient-related information is not changed. » DICOM: Support for faulty NM data encoding each slice in a file. » DICOM: Fix to read certain legacy Paravision data. » DICOM: Special handling to read data from the Total Explorer (missing frame duration, wrong decay correction). » DICOM: Graceful handling of missing slices when loading data. » DICOM: Problems occurred if the folder containing DICOM data was itself named DICOMDIR. » DICOM: If only a sub-range of slices was loaded, the SUV information was missing. » Transaction server: Automatic generation of the port number improved.
<p>Build 4 June 4, 2020</p>	<ul style="list-style-type: none"> » PXM: Parametric mapping using non-DICOM images was affected by a timing problem (only models which support slice-wise timing). » PKIN: Enabling of the options in the lateral taskbar (e.g. randomized fitting, LLS initialization) had the side effect of changing the model in all regions to the model applied in the current region. » PNEURO/Batch: "Brain split" was not applied in batch processing when the dedicated checkbox was enabled. The "split brain" setting in the step-by-step Neuro interface overrode the batch setting. » PNEURO/Comparison to normal database: VOIs belonging to a database disappeared when loading NORMALIZED images twice in a row. » PNEURO: The normalized PET images saved from the lateral taskbar are now prefixed with NORMALIZED in the description. This allows skipping the normalization procedure in the comparison to a normal database. » PNEURO acceptance test was not working properly if not executed at program start.

	<ul style="list-style-type: none"> » VOI: Scaling is now supported also in the direction orthogonal to the contour definition plane. » VOI: Undo/redo functionality improved. » Image processing tools: When applied to multiple images in replace mode the first image was overwritten. » Image loading with operations: Now the operation can be defined individually for all selected series. Previously, the operation defined for the first series was applied to all selected series. » R console: Supports the latest R4.0 version on all operating systems. » Spaces were omitted in text output after recent Linux updates. The default Look & Feel was changed to "System" to avoid the problem. » Image algebra results in a long series description which is used as file name in certain formats. This created saving problems due to file names longer than supported by the operating system. » DICOM/Segment saving: Binary maps are now supported in addition to probability maps. » P3D: FreeSurfer surfaces can be directly loaded and displayed. » PGEM: Acceptance test improvements. » Update check and help access were changed to support the https protocol. » Client-side functionality added to connect to a cloud license server.
<p>Build 3 March 3, 2020</p>	<ul style="list-style-type: none"> » VOI iso-contouring: The selection "Inner Holes" Yes/No was not working properly. » VOI: Save of pixel dump failed for dynamic image data and if the VOI was defined on a single frame. » P3D: Fix for protocols including database VOIs. » P3D: Added loading and rendering of FreeSurfer surfaces. » PKIN: Naming of the menu entries for loading blood components improved when using the model filter. Subtle revision of behavior when switching model filter between transferring TACs and loading blood data. » PNEURO: The MR normalization templates for mouse and rat were not properly prepared. » PNEURO: The PET only workflow did not work, if Hammers 1mm was selected and FDG or AV45 controls etc. were used as templates. » PNEURO, PSEG: PVC calculations for images larger than 256x256x256 voxels failed. » PCARD: Improvements of the apex segmentation for PET MBF data by using irregular sampling. » PCARD for MR: Wall thickening calculation improved; volume units changed to [ml] for small animal data. » PGEM: Toolbar functionality extended by polymesh loading and STL saving. » PGEM: VOIs were not displayed after adding new elements to a model. » PGEM: Report of track statistics revised. » R: Automatic R package installation supported on Linux; conversion of VOI pixel dump into an image fixed; image saving supported from R console. » The configuration "Communication with www.pmod.com" was not serialized.

	<ul style="list-style-type: none"> » DICOM: When loading images saved from PMOD other than PET or Enhanced the shifting of frame times to zero resulted in wrong times. » DICOM: Improvements of the output SOP handling when saving multiple files at once. » MicroPET format: Improvements to load Digimouse images. » FreeSurfer format added for loading. The surface description is converted into a volumetric representation suitable for data processing.
<p>Build 2 Dec. 12, 2019</p>	<ul style="list-style-type: none"> » PNEURO: "Save all" didn't correctly handle the change of the output modality in subsequent calls. Protocol fix: The settings for VOI intersection with the tissue segments were not restored. » PSEG: Texture analysis enabled for all segmentations; texture results are cleared when closing the underlying data. » PKIN: Export to Olinda 2 cas files extended by female model. » VOI: Better handling of duplicate names when appending from a VOI file. » Big data (with $>2^{31}-1$ voxels per frame): Fixes of reduction procedure and of filters. » DICOM: Fixed problem with reading multi-frame images saved from PMOD as single slice MR; fixed issue with missing orientations in dynamic RECON TOMO NM objects. » Viewing tool: Cropping can be applied to more than one of the loaded images. » Batch processing: Reduction and reslicing loading operations didn't work properly; incompatibility with some 4.0 batch definitions including registration fixed. » Segmentation tool: Fix of 2D active model segmentation. » Fusion display: Triangulation in zoom mode fixed. » MR inhomogeneity tool: Method based on 6 probability maps added. » PGEM: Several issues fixed in the report; vessels in the heart model extended and improved; protocol execution fixed; spatial offset between streamlines and VOIs fixed.
<p>Build 1 Oct. 30, 2019</p>	<p>Initial upload of 4.1 version.</p>

Product Release 4.1

As with every PMOD release, functionality and stability have been improved in all modules. Major enhancements can be found in PXMOD, PFUS, PCARD and PSEG as detailed below.

<p>General</p>	<ul style="list-style-type: none"> ▶▶ Image reduction options for coping with large data sets: Slice selection in increments supported in loading operations dialog window; cropping and interpolation facility added on the View page of the viewing tool. Single slice cropping is now possible. ▶▶ Handling of variable slice times improved to handle different variants of storing the times in DICOM. ▶▶ New facility on the image information window for inspecting the slice locations. ▶▶ Python script added as example for using the External Script tool. ▶▶ Revision of the units list, grouping the more relevant ones at the top. ▶▶ R: Undo option for R-Console command editor added; conversion of aggregate structure into flat table, which can be easily exported; keyboard Ctrl+B executes the highlighted command block; 'Max lines in printout' configuration added. ▶▶ Copying of dates in the information dialog window: can now be restricted to empty elements only. ▶▶ Color tables: new list organization; defaults updated; perceptually uniform sequential color maps added. ▶▶ Segmentation tool: Histogram can be restricted to a VOI; information about segment number was always using the result from the first frame; ▶▶ ATL password hashing without external library. ▶▶ Configuration: Main configuration (species, oncology) are now on user level; box to enable update checking moved from toolbox to configuration; ▶▶ The 'Last used dialog size' now only relates to the application window. ▶▶ All images in the console buffer can be saved at once. ▶▶ Reorganization of the templates in the resources folder. ▶▶ Client for support emailing updated to javax.mail.jar 1.6.2. ▶▶ Scientific image capture: now uses display unit; numeric precision of color bar annotation configurable; serialized behavior. ▶▶ Image value inspector: now also active on MIP; value probe at cursor location in the image can be enabled from the context menu. ▶▶ Database: Whole database export/import removed; data export directory added to configurable paths.
<p>VOI</p>	<ul style="list-style-type: none"> ▶▶ Texture analysis now includes 64 indexes: 23 are based on the pixel histogram within a VOI, 25 based on the gray level co-occurrence matrix (GLCM) and 16 based on the gray level run length matrix (RLM). The calculations have been implemented and tested according to the report of the Image Biomarker Standardisation Initiative (IBSI Documentation). ▶▶ Performance improvements: atlas outlining; maximum diameter calculation (by factors); undo/redo; iso-contouring. ▶▶ Statistics: Multi-statistics result can be aggregated also if R is not configured. In fraction classification mode, the median statistics is now using the unchanged voxel values. ▶▶ Naming of VOIs using predefined lists directly by right-clicking.

	<ul style="list-style-type: none"> ▶▶ Possibility to reduce VOIs created on high-resolution images for use at lower resolution. ▶▶ Statistics viewer: Copy to Clipboard using system locale number format option added to improve compatibility with Excel number formats. ▶▶ Compatibility classification deprecated. ▶▶ Arithmetic operation in VOI with masking outside fixed.
<p>PXMOD</p>	<ul style="list-style-type: none"> ▶▶ Harmonization of the methods for determination of k_2' for reference tissue modes requiring fixed k_2': (1) Entered k_2' (2) k_2' fitted using target TAC (3) k_2' obtained as median value of k_2' map calculated by SRTM, with outlier removal. Available for Logan, SRTM2, MRTM2 and 6 BPnd Methods. ▶▶ Correct handling of variable times across slices in multiple blood-based models (Patlak, Logan, DV methods, 2-Compartment models, 3-Compartment sequential model, MLAIR, Spectral SAIF). ▶▶ Specification of the target tissue is now optional in the models, except when it is required to establish reasonable parameters for iterative fitting (2-Compartment models). ▶▶ The masking parameter now allows to specify a percentage of excluded pixels (least energy). ▶▶ Various user interface improvements: Graphical elements to clarify the meaning of different sections in the panels; adjustment of the preprocessing plots to layouts similar as in PKIN (e.g. unused samples set to grey); revision of the entries in the VOI list related to the blood data; TAC preparation step is skipped if no VOIs are outlined; model-switching retains more of the common configuration settings; better control of the panels which are shown in the different models; explanatory tooltips added for preprocessing options. ▶▶ Distinction between Load Protocol (data and model definition) and Load Settings (only model definitions) clarified. ▶▶ Watabe model: derived high- and low-flow curves are not shown any more. ▶▶ MBF parametric mapping for NH3 data: vRV fitting set to optional (reduces some noise); usage of data only up to 240sec for fitting. ▶▶ TKE (turbulent kinetic energy) model for 4D flow velocity image data.
<p>PCARD</p>	<ul style="list-style-type: none"> ▶▶ Perfusion model for dynamic 99m-Tc Tetrofosmin SPECT images added (Shrestha et al.) ▶▶ Presets added for the pig species and segmentation optimized. ▶▶ Heart model size specification: interactive adjustment improved; can be shifted away from the center; different specifications for rest and stress possible; moved from status line to the control area ▶▶ 3D rendering of the epi/endo meshes for gated images. Allows to generate movies of the beating heart optionally with slice images and surface texture. ▶▶ Segmentation: performance for high resolution data improved. ▶▶ Results are harmonized between the PET and the MR cardiac tools. ▶▶ The polar plots resulting from a transmural analysis integrate the epi- and endocardial results. ▶▶ Gated analysis: supported if contours are only defined at two timepoints (systole/diastole); volume curve added to results panel and to report (MR). ▶▶ 3D: Sampling point visualization improved; texture on LV mesh fixed;

	<ul style="list-style-type: none"> » Rest/stress perfusion polar plots can be scaled to a common maximum. » Deprecated: centerline segmentation deprecated; setting model size using markers.
PFUS	<ul style="list-style-type: none"> » User interface improvements: tooltips added; label revisions; status line info improved; option selection for workflow type instead of a series of buttons; » Workflow for hybrid data added which directly ends on the 'Comparison' page. » Hot spot alignment initialization: New dialog window to define a common location in the input and reference images. » MIP page: the color table thresholds of the MIP images can be defined in absolute values. » Comparison page: MIP can be enabled/disabled; various options to propagate the color tables among the displayed series. » Image operations on 'Image Algebra' do not switch back to the 'Reference' step. » Scientific output of fusion display uses interpolation defined in the main display. » Matching using only the information in a box improved. » Scatter plot: Now offers Bland-Altman plot, box plot and Passing Bablok regression analysis. » Fixed problem with 3D deformation field visualization when arrows were visible and color was changed to solid. » Deprecated: Triple fusion page.
PSEG	<ul style="list-style-type: none"> » Improvements of PERCIST Report page: Summary line of the listed lesions; comparison of the current analysis with a previous one listing new lesions, vanished lesions and the change of the various parameters for the persisting lesions. VOI pairing based on names and progression analysis is directly done after loading the comparison report. » Synchronization of texture analysis configuration across direct analysis and PERCIST analysis.
PNEURO	<ul style="list-style-type: none"> » T2 and PET anatomical reference added as fusion image on the VOIs page. » Filling of the atlas VOIs on X and Y planes improved (stable and faster). » Fixed problem of relative (SUVR) statistics when using protocol execution. » The generated VOIs are directly available on the parametric maps (VOI and Fusion tab). » White matter parcellation enabling box is now on the 'Brain Segments' page.
PKIN	<ul style="list-style-type: none"> » In batch mode it is now possible to first fit the blood function(s) to the blood data before the tissue model is fitted. » Support for Olinda 2: The residence times calculated for dosimetry data can be saved Olinda 2 case; a new name list containing the organ names used in Olinda 2 is available for proper VOI naming during the organ outlining.

<p>PGEM</p>	<ul style="list-style-type: none"> » Heart Model: added new VOI definitions for both frames for Left Atrium and the Pulmonary Veins. » Added support of Siemens 4D flow DICOM image data, with separate series for each velocity direction. » Behavior of 3D button dependent on the context. » User interface streamlined. » Facility to edit the timing of models.
<p>P3D</p>	<ul style="list-style-type: none"> » 3D: Improved speed of cutting multiple large surfaces. » Faster display of big scatter data.
<p>Data Formats</p>	<ul style="list-style-type: none"> » Images with kBq/ml units are converted to kBq/cc. » Special handling for faulty Philips Achivea DICOM anonymized by Synarc with wrong dimension pointers 00209165, 00209167 in the Dimension Index Sequence 00209222. » Saving images with short representation in memory as DICOM had no padding in the first volume. » Set PMOD as derived data producer in the enhanced DICOM objects.

Zürich, October 30, 2019

Maintenance Builds of Release 4.0

<p>Build 6 Oct. 23, 2019</p>	<ul style="list-style-type: none"> » CAUTION with PSEG/PERCIST report: TLG and SUV mean were not correct. Indication of the segmentation threshold in the report was incorrect. » PSEG: Texture analysis statistics can now be saved correctly. » PNEURO: Fixed save problem of a combined field transformation. Fixed segment alignment for already matched PET and MR using the 6 probability maps normalization for the segmentation. » VOI: Repeated outlining of atlas VOIs failed after the second time. » DICOM: Fixed issue related to DICOM saving of images without orientation information after mirroring. Improved loading of series consisting of multiple NM objects (Xeleris). Fixed timing issue when converting gated PET images as enhanced DICOM objects. » PCARD/Gated: Improved polar plot generation for septal basal area. » PKIN: Fixed problem with improper revision numbering when using Fit All. » Fixed problem with input format selection for batch anonymization. » Pipeline processing: All formats used the saving path configured for DICOM. » Saving during data splitting generates unique file names to avoid overwriting. » PVC VOI based plugin: Now accepts NaNs in the images; viewing tool could not be closed after VOI adjustments.
<p>Build 5 July 12, 2019</p>	<ul style="list-style-type: none"> » PXMOD: Fix of the Logan method. The provided target TAC had an influence on the selection of the time points included in the fit. No impact in case of target TAC with normal SNR. » PSEG: Button added to generate the reference sphere as alternative to using Ctrl+Shift+U. » PSEG: Report saving via transaction server had a problem. » VOI: Split of VOI into slice ROIs was added, and is also working for grouped VOIs. » VOI: NaN supported as background value in VOI masking. » VOI: Minor problem solved relating to Number of Pixels statistics for dynamic series. » Texture: Sub-millimeter GLCM distances are now supported. Run Length Matrices and the RLM based metrics are applicable to dynamic input data. » PVIEW: Region growing segmentation supports multiple seeds defined as markers. » PVIEW: New loading tool added for handling series with varying slice thickness. » PVIEW: Merge slices procedure improved to handle series with varying slice thickness. » PVIEW/Batch: Improved GUI for anonymization during pipe processing. Parameters of Reduction and Volume Reslicing tools during loading are serialized. » PCARD: Segmentation step triggered by auto-check works correctly now.

	<ul style="list-style-type: none"> » DICOM: Server support added for storing DICOM information objects not used in PMOD. » DICOM: Reading DICOM images improved to handle enhanced objects with incomplete information of dimension organization. » DICOM commitment: Configurable response delay implemented. » R console: Support added for R versions 3.5 and 3.6. » NifTI data: Support for meter and micrometer spatial dimension units. Issue with reading some compressed images fixed. » General: UI adaptations to make clear that PMOD is for research use only (RUO).
<p>Build 4 April 3, 2019</p>	<ul style="list-style-type: none"> » SUV information: Panel also available for SPECT, not only PET. » VOI: Calculation of fractal dimension fixed for specific situation (single slice VOI in coronal plane). » VOI: NaN supported as value for outside VOI masking (was replaced by 0 before). » PNEURO: Problem of merging PVC results fixed. » PNEURO: Merged VOI was previously not added to "Relative to" VOI list. » PSEG: Fix for PERCIST report. It failed in "Oncology" mode when contouring was performed on fixed threshold. » PKIN: All TACs display: Proper display of X axis and units for graphical models. » PKIN: Layout improvement reducing space of the control area. » PKIN Parameter Explorer: Only content visible in the table is copied to clipboard. » PKIN: Units of MLAIR regression coefficients corrected. » Fuse It: External tools are restricted to the page with image loading. » fMRI DICOM: Improved image sorting in the case of undetermined volume times. » PET DICOM: Fixed problem with frame reference time when converting Enhanced to regular PET objects. » DICOM: Fixed problem with dynamic high resolution images (over 2 gigabytes per volume, 16bit integer representation). » DICOM: Fix for reading images with unparsable/missing acquisition time. » DICOM: Improved support for storage commitment. » Database: Export/import of whole database is discontinued.
<p>Build 3 Feb. 25, 2019</p>	<ul style="list-style-type: none"> » ATL: Audit Log DB optimization for large databases. » PNEURO: VOI merge problem fixed. » PNEURO: Batch mode saving the results to the input data location uses the same image format as loading. » PKIN: Blood delay was not updated properly from the fitting history. » PXMOD: R1 threshold added to MRTM2 for masking low-perfusion voxels. » PSEG: Mask generation using Otsu method fixed. » Texture analysis: Verified according to Image Biomarker Standardisation Initiative. Only fix of run length matrix calculation required. (Reference: Zwanenburg A, Leger S, Vallières M, Lock S. Image biomarker standardisation initiative. arXiv preprint arXiv:1612.07003).

	<ul style="list-style-type: none"> » VOI: Volume statistics was not saved under certain condition (VolumeWithoutNaN deselected). » PCARD MR: Protocol extended; results saving improved; manual VOI definition fixed. » PSAMPLE: Support for the new twilite 3. » Database import of non-DICOM data: Name generation improved to avoid name duplication. » Database: Fixed problem of deleting images from DBs connected via transaction server. » DICOM: 12bit jpeg decoder added. » R Console: Communication problem with R 3.5.2 fixed. » Batch pipeline: Problem of selecting QC plug-in in the interface fixed. » Support for CT Liver segmentation via "CT VOI Generation" tool discontinued. » Atlas "Rhesus (RIKEN)" removed. "Rhesus Macaque (INIA19)" provides more details.
<p>Build 2 Dec. 21, 2018</p>	<p>» CAUTION: A vulnerability has been detected in the drivers of the WibuKey used for PMOD license protection. The provider has fixed the issue and the new drivers should be installed. So after downloading Build 2, please start the installer in the Pmod4.0/install/hksetup directory and install the new driver version 6.50. Alternatively, the WibuKey driver can directly be downloaded using the link https://www.wibu.com/support/user/downloads-user-software.html</p> <ul style="list-style-type: none"> » Linux systems: Default installation directory changed to user folder. This avoids permission problems in case the same person who installed PMOD is also its user. For a multi-user installation the /opt directory and a permission change with chmod is still recommended. » Config/USERS/MODULES: Showed Fuselt even when Fusion was not licensed. » VOI: Morphological operations improved (settings serialization, speed, interruption). » VOI: New "Accelerated" classification mode with substantial performance improvement for display and statistics. Recommended for all VOIs generated by automatic methods. » File loading path history: The loading and saving paths are not treated separately any more (for non DICOM images and non image components). » DB: Facility added to dump patient, acquisition and tracer application information of multiple studies from the database via the DB Export function. » DB: New filter (single vs. multiple file series) to distinguish ENHANCED PET from PET encoding. » INIA19 rhesus atlas: Brain only MR template added. » Pipe processing: Setting of "Replace Patient Information" is serialized. » PKIN: Behavior of saving fit results from parameter explorer changed. If "Use last region fits for table" is enabled in the configuration, the most recent model fit from the history is used. Otherwise, the current parameters are used, even if a fit was not successful. » PKIN: If target and reference region are the same, no fitting is performed.

	<ul style="list-style-type: none"> ▶▶ PXMOD: Better handling of batch failure. Subtle problem fixed with incorrectly setting the first parameter by a protocol or the default button. ▶▶ PNEURO: Sulci deformation option removed, but still working if enabled in old protocols. Default probability thresholds for masking with GM and CSF changed to 0.5 (previously 0.3). ▶▶ PCARD: Interpolation on/off 48 64 option added. Polar plots on the "Compare" page are also interpolated. %Max shown as overlay. Z-score values are shown in overlay. %lt/ut of the report images are based on the value range in the myocardial VOI. Comparative image report can be also printed from "Compare" page. "Baseline correction" switch available on dialog starting kinetic modeling. Configuration possibility for "Mixed"/"Compact" VOI layout. ▶▶ PSEG: Display unit selection supported by protocols. ▶▶ PGEM Heart model: Pulmonary veins added, aortic arch branches updated, left atrium improved. ▶▶ ATL: Configuration improved. Internal columns removed from the export of the audit log viewing dialog. Details which are too too long to fit into a DB record are now split into multiple records instead of truncation.
<p>Build 1 Oct. 28, 2018</p>	<p>Initial upload of 4.0 version.</p>

Product Release 4.0

In addition to the individual improvements detailed two major areas are further developed in the new version.

1. While highly flexible and with unique functionality, the VOI user interface had reached a overwhelming complexity. Therefore, in version 4.0, the interface has been reorganized in a new "Compact" layout. It covers less space and provides better functional grouping. As we are confident that it will make VOI analysis easier and more efficient, it is the new default layout. However, the previous layout is still available for users who prefer continuing their proven workflows.
2. The PSEG tool has been extended by a new workflow intended for users with a need to assess hot lesions in static PET images. It includes the PERCIST methodology for objectively outlining and documenting the uptake in oncologic whole-body scans, but offers additional features: The lesion outlining result can be combined with texture analysis, and can directly be converted into training data sets for machine learning.

General	<ul style="list-style-type: none"> » Global Oncology setting supports specification of default SUV variant. » SUV display units: Warning symbol next to colorbar if required information is not complete. » Fusion balance can be shifted by mouse wheel while holding down the "F" key. » Image information dialog window: Slice times and species editor added. » DICOM anonymization added to file format conversion. » Direct starting of DICOM loader after creation of DICOMDIR file supported. » Restart possible after global configuration change; starting possible at the end of installation wizard. » DB extended query revised: image filter added; only patients/series are listed which contain elements corresponding to the applied filter. » Rebinning of dynamic series. Down-sampling: The area under the curve in each pixel is maintained. Up-sampling: Uses spline interpolation between frame mid-times. » Time domain filter: Despiking with 9 samples median absolute deviation method (MAD9) added. » Partial Volume Correction external tool: GTM speed improvement by multithread calculation; PVC (Brain MR based) extended by white matter correction. » Pipeline: Improved names of aggregates generated pipeline lists; tool added to calculate similarity measures relative to a mask; Option to scan a directory tree to build the list of input files. » Active model segmentation: Extended by median filter size and myocardial width restriction; parameter optimization by specification of target mask. » Segmentation: restriction by template VOIs supported. » Incoming folder functionality can use script alternative to pipeline. » Noise addition external tool extended: Poisson and uniform distributions added; definition of noise amplitude; amplitude and stdv based on reference VOI; conditional based on pixel value (<, >, ==). » Texture analysis of dynamic data results in dynamic texture measures. » Scaling external tool: *IMG option added to scale pixelwise by an image. » Handling of NaN values in image interpolation improved.
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<p>VOI</p>	<ul style="list-style-type: none"> » New layout of the VOI user interface layout, called "Compact". » Statistics calculation: Results are displayed in display units (e.g. SUV); configuration list for defining the statistics of interest; time-consuming statistics moved from statistics menu to configuration list; indication of time-consuming elements in the list; default statistics menu entry; calculation speed improvements. » Iso-Contouring tool: Fundamentally revised; Average percentage threshold option added. » VOI naming using lists now also works on group level. A <number> at the end of the VOI name is used for generating label maps in PSEG. » New "Neutral" mode for selecting VOIs directly by clicking at them in the image or in the MIP. Single clicking into the VOIs list does not switch to contour definition plane, only double-clicking does. » <Ctrl+B> adds a prefix "{UNCLEAR}" to the name of the selected VOI. » "Peak" sphere volume can be defined for human, rat, mouse. » Speed improvement of VOI overlay display. » Properties dialog window reorganized; new property for locking contours. » Column in the VOI list indicating its role in tracking (seed etc) restricted to PGEM.
<p>PSEG</p>	<ul style="list-style-type: none"> » Completely new (PERCIST) workflow for static oncologic PET scans introduced, see documentation. » Texture analysis: measures based on run-length added.
<p>PNEURO</p>	<ul style="list-style-type: none"> » Rhesus macaque brain atlas added (INIA19, https://www.nitrc.org/projects/inia19/). » Handling of orientations (human/small animal) is based on selected atlas (manifest); error message in the case of species mismatch between subject and atlas. » Atlas viewer also shows the tissue probability maps. » Percent difference between partial-volume corrected and uncorrected result is saved with statistics.
<p>PKIN</p>	<ul style="list-style-type: none"> » Single pixel TACs from data inspector: coordinate added to name; dialog window not closed. » TAC from viewing tool: filter choice for target models extended. » Sigmoid-like parent fraction model added. » Residuals on Plasma panel were incorrect if plasma/whole-blood fraction was used. » Comments facility moved to a main interface tab. » Configuration in the model filter dialog window can be saved as a macro, which can be called in batch or from the taskbar. » Interruption possible for all types of multiple fittings, except for macros.
<p>PXMOD</p>	<ul style="list-style-type: none"> » Parametric mapping of energy loss from 4D Flow velocity field. » Improvements in models with multi-file selection for Interfile, Paravision and Varian formats.
<p>PCARD</p>	<ul style="list-style-type: none"> » Cardiac MR: Motion correction transformation saved in protocol; wall thickening calculation added; acceptance test fix.

	<ul style="list-style-type: none"> » Cardiac PET: use of "MBF" and "MFR" according to Consensus paper "Clinical Quantification of Myocardial Blood Flow Using PET". » Cardiac PET: LV object VOI for interactive definition of model size added. » Gated PET: Reversibility values fixed; wall thickening values added.
PFUS	<ul style="list-style-type: none"> » Automatic reslicing when switching using the VOI button instead of going through matching. » "Origin alignment" improved to include rotations for initial transformation of matched data with different orientations. » Cross-correlation quality measure of matching added. Has been used in literature to select the more adequate template (controls vs Alzheimer's). » Color table and species persistence improved.
PGEM	<ul style="list-style-type: none"> » 3D: In-scene colorbar with units; streamlines have arrows showing directions; possibility to add additional images when inspecting results; data profile from cutting with oblique plane. » 4D Flow: user interface revision; adjusted units for helicity and vorticity maps; recalculation without starting from data loading; multi-frame mask; pathlines as alternative to streamlines; NaN handling in streamline tracking; tracking defaults for aorta and brain vessels. » CFD: boundary condition setting improved; velocity boundary from 4D flow image data supported; serialization of case creation parameters.
R Statistics Console	<ul style="list-style-type: none"> » LASSO method implemented as discrimination alternative. » Cumulative sum curve added to histogram and density plot. » Function converting vectors and matrices into aggregates for using predefined scripts. » Rows and columns selection extended by select all. » Improved reporting of text and tables exceeding printout page size. » Script development: pm.copyColumns function added; multiple result sections supported, not only one at the end of script. » Predefined scripts support aggregates with time dimension.
Data Formats	<ul style="list-style-type: none"> » Database import: Improved filling of series description and patient id for non DICOM data. Better handling of formats using two files. » Database: Split series of a patient into new patients with one series each. » DICOM Server: Storage Commitment SOP added. » DICOM: Usage of PET units (activity concentration) when loading image data with multiple units. » DICOM: Dual gated data timing improved. » DICOM: Improvements in reading trigger times with Special Case: "Multivolume MR (sort by trigger times)". » Merging of GE DICOM data produced by dynamic whole body scanning: improved handling of decay correction. » Philips: PAR/REC format updated to handle modified column names (version 4.2). DICOM 4D Flow files can be loaded with Special Case: "Multiframe (Sort by slice position)". » Micropet: support for reconstruction method added.

Zürich, October 28, 2018

Maintenance Builds of Release 3.9

<p>Build 10 July 10, 2019</p>	<ul style="list-style-type: none"> » VOI: Sphericity statistics calculation problem fixed. » VOI: Statistics of the VOI group were not saved in file.
<p>Build 9 Dec. 21, 2018</p>	<p>» CAUTION: A vulnerability has been detected in the drivers of the WibuKey used for PMOD license protection. The provider has fixed the issue and the new drivers should be installed. So after downloading Build 9, please start the installer in the Pmod3.9/install/hksetup directory and install the new driver version 6.50. Alternatively, the WibuKey driver can directly be downloaded using the link https://www.wibu.com/support/user/downloads-user-software.html</p> <ul style="list-style-type: none"> » VOI: Massive speed improvement for the "Hottest Connected Voxels" VOI calculation. » Pipeline processing without user interface: fix for reading all command switches in script, particularly -lsn[...] for specifying the license server. » PCARD: Fixed problem of reading gated protocols saved in version 3.908.
<p>Build 8 Oct 11, 2018</p>	<ul style="list-style-type: none"> » VOI: polygon vertexes were shown as circles instead of the customary squares. » PCARD: Radial maximum sampling added a zero ring to the polar plot for certain settings of the crop box. » Database: Potential database creation problem on MacOS X Mojave fixed which related to missing control of locale information (language, regional settings).
<p>Build 7 Sept 18, 2018</p>	<ul style="list-style-type: none"> » PALZ CAVEAT: Since version 3.9 the PALZ results were different from previous versions. This is corrected, restoring the pre-3.9 behavior. <i>PALZ users are strongly advised to install Version 3.9 Build 7!</i> » Global "Oncology" flag: Impact including the statistics image overlay is restricted to PVIEW, PFUS, PSEG. » PNEURO: Fixed loading of gm/wm/csf map and normalization transformation in Brain Parcellation processing. » DICOMDIR creation: more graceful handling in case required elements are missing in the data. » SUV_{lbm}: BMI calculation according to Janmahasatian method fixed. » Overwriting of non-image files fixed (Linux system bug only). » Correction of bug when splitting of dynamic series to individual slices. » NaN values handling added for trilinear, cubic spline and sinc interpolation.
<p>Build 6 July 5, 2018</p>	<ul style="list-style-type: none"> » Anonymization when exporting data from a database improved: Complete removal of name etc from images and all components (statistics, VOIs, etc). Option to use synthetic name generated from the DB name by encryption algorithm. Option to indicate the name is already anonymized. » Privacy disclaimer added to start-up dialog (GDPR). » VOI: Statistics selection did not work properly. Statistics measures different from the selected ones could be saved.

	<ul style="list-style-type: none"> » VOI: Group surface area is also calculated for VOIs with fraction classification. » Dynamic VOI: Isocontouring % threshold is calculated individually for each frame. » Mouse (Ma-Benveniste-Mirrione) atlas: inferior colliculi corrected. the separation of the inferior colliculi into a left and a right part was faulty. » Merging of files: Decay correction corrected to properly handle multiframe DICOM data. » LMA GTM partial volume correction: Problem corrected which occurred for small % included pixels (PNEURO, PSEG for segmentations other than Organ separation). » PNEURO: When loading old protocols, the new option CSF masking is now enabled. Adjustable border for brain autocropping implemented for improving the reliability of MR/PET matching in batch runs. » PCARD: Sector overlays with values added to input data polar maps. Cosmetic change. Compare tab cosmetics related to polar maps. » PGEM: Save data profile for oblique cutting planes.
<p>Build 5 April 19, 2018</p>	<ul style="list-style-type: none"> » VOI statistics selection, new default: Only Averaged and SD are initially selected and the configuration dialog is displayed before first run. » VOI statistics of dynamic data: Bug fixed (introduced in Build 4). » Peak VOI for dynamic data: Peak calculation is now correctly done for each frame, and save/retrieve of dynamic peak VOIs was fixed. » Iso-contouring VOI for dynamic data: Restricting VOI was not handled correctly. » Fuselt: Protocol behavior fixed; correctly retrieves data and transformation. » PNEURO: Batch mode could be blocked by a dialog window appearing due to a mapping problem.
<p>Build 4 March 22, 2018</p>	<p>Main innovation: added features for assessing and documenting oncologic lesions. Please refer to the dedicated flyer in the News section on the PMOD website.</p> <ul style="list-style-type: none"> » Global oncology configuration establishes the following defaults: SUV display units, show MIP image in inverted gray, show patient name and ID, use terms "MTV" and "TLG" in statistics. » Hot-key (Ctrl+Q) driven placement of a peak VOI in lesion. » Hot-key (Ctrl+L) generation of an iso-contour VOI of lesion based on % SUVmax, %SUVpeak, or absolute SUV. » Hot-key based assessment of lesions relative to liver: (Ctrl+Shift+U) places 3cm sphere as reference, (Ctrl+U) performs iso-contouring at minimal level of tumor uptake and calculates SUVpeak. » Generation of an iso-contour VOI of lesion based on %SUVmax, % SUVpeak, or absolute SUV. » Configuration of the hot-key VOIs and the overlay statistics in a new panel of the data inspector. » Overlay of relevant VOI statistics (average, peak, max, MTV) in image. » Sorting of VOI list by descending SUVpeak, SUVmax, SUVmean, MTV, diameter. » Statistics units synchronized with display units (SUV type). » Lesion documentation via screen capture (Ctrl+E).

	<p>Other improvements and changes:</p> <ul style="list-style-type: none"> » Slowness on computer without internet connection due to update and documentation checking: improved, but it is recommended to install the documentation locally and switch off the update checking. » PNEURO: Saving both parametric maps and TACs in batch mode. » PXMOD: ssq map added to the SRTM2 model. » PKIN/Parametric mapping: Lack of synchronization between curve and parameter update fixed. » Texture analysis: NaN support, applicable for dynamic series. » PGEM: Export of OpenFOAM's volume mesh to Fluent format. » VOI statistics: Fixed problem in sphericity (was always zero). » Build installation: existing start scripts are not overwritten. » Database: Compatibility with current MySQL established. » R Statistics: Bland-Altman works with NaN. » File saving: Prevent file system write error for file names longer than 255 chars.
<p>Build 3 Jan. 15, 2018</p>	<ul style="list-style-type: none"> » Database of demo data extended by PCARDM and PGEM (CFD) examples. » PXMOD: Two models (Patlak, irreversible 2-compartment model with basis function fitting) added for the parametric mapping of dynamic FDG whole-body data. They account for the slice-wise timing definitions in the image header. » Slice-wise timing for TAC transfer to PKIN: average TAC uses timing of the slice in the VOI center; pixel-wise TAC uses timing of individual slice. » PKIN: Reference curve was not shown when reference region was the first in the list. » Amyloid Cortical Composite atlas added. It contains the definition of the most commonly used composite region for analyzing amyloid data, as well as several reference regions. » Mouse atlas renamed to "Mouse (Ma-Benveniste-Mirriore)" to credit the work of Ma and Benveniste who did the extensive atlas groundwork. » PFUS/PNEURO: Normalization templates derived from ADNI data (FDG, AV45 for AD and controls) added to the list of predefined templates. Brain masking for AV45 templates improved. » Pig Brain Atlas (CH. Malbert) labels fixed: Left/right corrections, Superior_cerebellar_peduncle moved to the non-lateralized Posterior_fossa. » PNEURO: User defined MNI atlases automatically offer the standard normalization templates if MNI is mentioned in the atlas manifest. » PNEURO: Option for enabling/disabling CSF masking and CSF threshold slider added. » PNEURO: Transformation results of a PET/MR workflow are cleared before PET-only protocol execution. » PNEURO: Anatomical reference control added to batch mode panel. » PNEURO/Compare to Norm: Variance pooling estimation corrected. Missing statistics VOIs fixed when repeating analysis with modified parameters. » VOI/RTSS: Fixed problem with conversion to RTSS when contours were defined in different plane orientations. Fixed issue with loading of RTSS

	<p>data. Fixed problem with wrong series instance UID in RTSS objects created by PMOD.</p> <ul style="list-style-type: none"> ▶▶ VOI: Problem of calculating fractal dimension for VOIs defined in X and Y directions fixed. ▶▶ VOI: Texture analysis can be started from Calculate Statistics menu of VOI Tool. ▶▶ PCARD: Segmentation parameters for mouse data has been adjusted (active models + valve plane fitting). ▶▶ PCARD: Manually edited VOIs are now saved correctly to protocols. Protocols for data with changed frame times are now retrieved correctly. ▶▶ PCARD: Specific protocol retrieval panels for cardiac MR applications. ▶▶ Pipeline processing: Can be started from command line script and run with or without user interface. Fixed problem with updating the QC tool state. ▶▶ Interpolation tool: Fixed reading of transformation when deformation field was previously loaded. Fixed saving of resliced image using deformation field transformation. ▶▶ PGEM: Improved conversion of CFD results to images for comparison with tomographic data. ▶▶ PGEM: Image data can be loaded while visualizing CFD results. ▶▶ R Console: Aggregate filtering in the presence of NA values fixed; scatter plot fixes. ▶▶ R Console: Linear Mixed Effect Models is now working with data containing NA values (which are excluded from the analysis). ▶▶ Network license: More detailed information in license server dialog. If all licenses are occupied there is an information that no license is available and connection can terminate other Pmod instance. ▶▶ Philips PAR/REC images: Now assumes milliseconds as trigger times units. Improved slice sorting and timing.
<p>Build 2 Nov. 9, 2017</p>	<ul style="list-style-type: none"> ▶▶ Dynamic Data with slice-dependent timing: Use of the VOI center location timing when transferring VOI TACs to PKIN. Automatic reformatting improved for handling of per-slice information. ▶▶ VOI: Configuration of the statistics measures of interest introduced for minimizing calculation time. ▶▶ VOI: Tumor volume segmentation method fixed and improved. Is now working for group of selected VOIs, and a VOI called "Bck" is automatically selected as background VOI. ▶▶ PXM/Resting state model: Fix to avoid masking of correlation matrix. ▶▶ PXM/VOIs tab: fraction mode is new default for interactively outlined VOIs. ▶▶ PCARDP/Gated: Segmentation method limited to EPI/ENDO Active Model. ▶▶ PCARDP/Perfusion: Problem in sector TAC calculation fixed. ▶▶ PCARDM: Segmentation parameters units unified to mm. ▶▶ PCARD protocols: VOI saving in protocols fixed. ▶▶ Texture analysis: Information in the tab titles improved. ▶▶ PGEM: DTI report problem fixed when patient information was missing. ▶▶ Fusion: Parameters of motion correction transformation can be presented as a graph.

Build 1 Oct. 30, 2017	Initial upload of 3.9 version.
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Product Release 3.9

New Features and Revisions

<p>General</p>	<ul style="list-style-type: none"> » Improved handling of the data path history when selecting from the file system rather than the database. » SUV dialog window and inspector revised. Support for SUV_{lbm} by Janmahastian method. Use of UCUM units (e.g. $g/ml\{SUV_{lbm}(Janma)\}$) when saving SUV images to enhanced DICOM objects, otherwise the DICOM SUV Type definition (0054,1006). » Texture analysis within VOIs. » Command line execution of pipeline definitions which include an input file list (e.g. <code>./java/jre/bin/java -Xmx1200M -jar pmod.jar PIPELINE[noGUI] pipe_definition_file.pipeProc</code>). » Pipeline processing: Restriction that a file can only appear once on the input list was removed. » DICOM server starting a pipeline processing with the received data: all non-image data are also saved. » External tool for calculation z-score values relative to the average and the standard deviation within a specified VOI (frame-wise operation for dynamic data). Useful for transforming the data as input to the supervised clustering method). » New option to keep triangulation at the same 3D coordinate when switching between images in a viewport. » Layout panel: "Go to coordinate origin" and "Go to x/y/z coordinate" buttons to support well-defined triangulation. » Extended list of isotopes and radiopharmaceuticals. » Proper units are set for images generated in situations beyond parametric mapping. » Skeletonization added to "Segmentation" external tool. » New automatic VOI generation approach resulting in the hottest connected voxels within a VOI. » External tool for calculation of texture features within VOIs.
<p>PNEURO</p>	<ul style="list-style-type: none"> » Template, Atlas and Parcellation resources converted to compressed images for saving space » White matter parcellation added, resulting in a white matter VOI for each atlas VOI. » Masking of grey matter regions by CSF improved for the maximum probability method. » Revision of the tree organization for better organizing the additional VOIs. » Batch mode improved in several ways: support for mapping added; option to create and save a quality control image showing the generated VOIs on top of the images; new interface item element for specifying the averaging range of dynamic series; saving of TACs, parametric maps, transformations and protocols. » Option to select the dynamic PET instead of the average PET after the VOIs have been outlined. » Support for user-defined atlases in parcellation improved. Supported also in batch mode.

	<ul style="list-style-type: none"> » Warning added when a loaded transformation doesn't match the space of input data.
<p>PKIN</p>	<ul style="list-style-type: none"> » Grid fitting: Start iterative fitting with initial parameter combinations which cover the whole physiologic parameter space. » Monte Carlo: Randomized fitting supported. » Monte Carlo: Noise can be added to tissue TAC instead of model curve. This allows studying situations where the model underlying the data differs from the fitted model. » Monte Carlo: The generated data and the fits can be added to the fitting history for inspection and export. » Monte Carlo: Noise generation using bootstrap method. » Parameter explorer: The listed results correspond either to the current model parameters, or to the latest successful fit. Previously non-fitted regions were omitted. » Fitting history included in parameter explorer to browse histories across regions more easily. » Parameter sensitivity to acquisition duration is now also supported for coupled fits. Creates history entries with the same revision number. » Number of fits required for convergence is also added to the fit details list. » Batch fitting with specified model configuration: Only the tissue model is replaced, the blood configuration now remains unchanged. » Fitting can be stopped after calling "Fit all". » Negative values allowed in blood data. » Blood curve resampling improved. Didn't work properly in all configurations. » "non-blood" model filter introduced which is default until blood data is loaded. » Averaging window introduced in "Plasma Ratio" model for use with bolus/infusion data, where the ratio equals Vt. » Standard error supported in the aggregation of kinetic modeling results. » Support for TACs with different timing across regions. This is particularly relevant for dynamic whole-body and dosimetry studies. » Dosimetry model: Output of cumulated activities for the IDAC2.1 dosimetry program (www.idac-dose.org). » Massive speed improvements for the transfer of pixel-wise TACs.
<p>PXMOD</p>	<ul style="list-style-type: none"> » Revised SRTM2 model, allowing to calculate k2' as the median for the SRTM results in a region and restricted to a physiological range. » Model for DWI MR images. Supports different calculations of the ADC maps including fit of mono exponential. » Model for PCASL MR images which are organized in two dynamic series (control, label), and a proton density image. Supports calculation of average perfusion. » Model for the seed-based correlation analysis of resting state fMRI data. A matrix showing the correlation between the signals of multiple VOIs is shown as image and can be explored with the data inspector probe. » Individual timing is supported for each pixel. This feature is particularly relevant for dynamic data acquired with continuous bed motion.

<p>PCARD</p>	<ul style="list-style-type: none"> » Gated PET: Improved volume and wall-thickening accuracy based on a new interpolated data set (called VOLUME). » Gated PET: More precise valve plane fitting. » Cardiac PET: Acceptance test revised. » Perfusion PET: Transmural gradient for flow areas calculated from the ratio of the endo and epi averages of the relevant segments. » Contours are smoothed. » Optional correction of myocardium TACs for activity remaining from previous scan. » Cardiac MR: Active model segmentation added; can be initialized by markers.
<p>PSEG</p>	<ul style="list-style-type: none"> » Clustering method when using external TACs replaced: the supervised clustering algorithm developed by Turkheimer et al. (2007) for PK11195 is now used instead of k-means. » Brain extraction added to the masking step.
<p>PFUS</p>	<ul style="list-style-type: none"> » Color table lt/ut propagation in absolute values supported.
<p>P3D</p>	<ul style="list-style-type: none"> » Functionality useful for vessel rendering and analysis: Skeletonization of a segment and creation of a vectorized path; creation of planes which can be moved along the path and always are orthogonal to; cutting of object by this plane. » Cutting of SR objects by use of a circle. » Texture display on oblique planes.
<p>PGEM</p>	<ul style="list-style-type: none"> » CFD: Integration with new CFD calculation engine OpenFoam 5.0. » CFD: Use of 4D-Flow derived flow boundary conditions. » CFD: Improvements in case creation GUI, case status detection, case downloading, log display and error detection. » CFD: Cutting interface shows loaded image data. » Added possibility of loading 4D flow data to a scene presenting CFD simulations results. » Added possibility of generating and using skeletons of geometric structures, and cutting those structures by planes perpendicular to the skeletons. » Loaded image data available on 3D page for all processing types. » Heart model updated. » Model with brain regions added.
<p>R Statistics Console</p>	<ul style="list-style-type: none"> » NaN are not removed when statistics are transferred to R Console. » Master table only includes mutual VOIs included in all aggregates » New function "pm.copyColumns()" for copying columns between aggregates. » GUI of Linear Models is not freezing any more during execution. » Improved NA handling when filtering variable is equal NA. » Version control introduced for required packages.

Data Formats	<ul style="list-style-type: none">▶▶ Handling of wrongly formatted injection date in some versions of Albira microPET files.▶▶ Matlab image loader extended to read 4D matrices as dynamic images.▶▶ Improved handling of reversed image indices in the PET DICOM object.▶▶ Fix for handling of DICOMDIR files with icon images.▶▶ Initial reading support for the evolving quantitative PET extension of the BIDS data standard (bids.neuroimaging.io), including encoding of ancillary information in the JSON format.
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Zürich, October 30, 2017

Maintenance Builds of Release 3.8

<p>Build 7 Oct. 2, 2017</p>	<ul style="list-style-type: none"> ▶▶ MacOSX: Improvements for popup panels which were sometimes hidden, depending on system configuration. ▶▶ PXMOD: Fixed problem with using the interactively defined VOI in later stage of the workflow. ▶▶ PBAS: Transfer of TACs to PKIN sets units to kBq/cc when "Global Scale factor to [kBq/cc]" is switched on. ▶▶ PFUS/General: Cubic spline interpolation optimized to avoid long waiting time for dynamic data. ▶▶ PCARD/Gated analysis of small animal data: Volume calculation fixed; segmentation improved; mass calculation fixed. ▶▶ PGEM: Fix related to 4D flow protocol execution; OpenFOAM version number included in acceptance test.
<p>Build 6 July 24, 2017</p>	<ul style="list-style-type: none"> ▶▶ PXMOD/DWI model: zero gradients are now accepted (as opposed to the DTI model). ▶▶ DICOM Server (when started from ToolBox): Pipeline applied to received images now saves also VOIs, statistics and captures. ▶▶ PNEURO: Saving template atlas from outlined VOIs preserves hierarchical structure. ▶▶ PNEURO: Hybrid, matched PET/MR data which was acquired in different orientations don't require the matching step any more. ▶▶ PCARD: MBF polar plots had wrong titles. ▶▶ DICOM: Adjustments to RTSS contour generation for improving MIM compatibility. ▶▶ DICOM: Improvements in reading dynamic MR series (GE private elements; velocity encoding parameter; ASL data sorting). ▶▶ Support for reading gzipped Nifti images. ▶▶ Merging of multiple static series into a single dynamic series: fixed time sorting. ▶▶ R Linear Models and Linear Discrimination: Bug fix related to the "relative to" option. ▶▶ R: Improvements in restricted master table creation including proper handling of the selected part. ▶▶ PGEM: Tracking improvements; CFD case creation streamlined; STL generation fixed. ▶▶ PGEM/4DFlow: Data management improved; protocol support for Philips data; fixes to report.
<p>Build 5 May 15, 2017</p>	<ul style="list-style-type: none"> ▶▶ PNEURO: Ability to save partial-volume corrected images during batch mode and from the "Save all" facility. ▶▶ PXMOD: Edited image acquisition times are now maintained. They were overwritten before because the images were loaded again before calculation. ▶▶ The window/level mode of changing the color table thresholds was improved. ▶▶ Problem fixed in top-hat edge-enhancement procedure. ▶▶ PGEM/4DFlow: Velocity formats with 3 files (e.g. Philips PAR/REC) are now supported by protocol.

<p>Build 4 March 6, 2017</p>	<ul style="list-style-type: none"> » VOI: Erasing was not working properly for VOIs created by "Outline Maps". » PNEURO Batch: Option to save TACs as processing output. » PNEURO Parametric Mapping: Mapping configuration saved in protocol; maps saved in batch mode; maps available in the "Save all" dialog window. » PKIN: Procedure for explicit input curve resampling revised. Instead of using the fraction data timing, the denser whole-blood timing is used. » PKIN: Randomized fitting adds more variation to parameters with very small values. » PCARD: For EPI/ENDO segmentation an approximation of the myocardial mass is included as a result in the MBF workflow. » Image saving: Problem fixed when saving PET images with inconsistent decay correction parameters (times, factors). This information will be omitted. » PGEM: Acceptance test fixed. » PGEM, 4D Flow: Fusion image added as input image on the 3D tab; report improved. » PGEM, DTI: Bug fixed in the report and content improved. » PGEM, CFD: Interface for cutting surface mesh debugged and new feature added (appending cuts). » PGEM: VOIs are verified before adding them to the model (pixel size, origins).
<p>Build 3 Jan. 4, 2017</p>	<ul style="list-style-type: none"> » PNEURO: Batch mode now supports saving a protocol of the processing, as well as saving the transformations. » PKIN: Metabolites data were not saved when a reference tissue model was selected. » PKIN: Inclusion of the standard error in the aggregation. Usable for statistics in the R console. » PKIN: When fitting the parameters of the tissue and the blood models together, the shape parameters of whole blood were not adjusted. » VOI: Converter into DICOM RTSTRUCT improved. » VOI: Plugin added for VOI masking in pipeline. » Manual matching of individual frames of dynamic data improved to retain original orientation. » Aggregation: Improved handling of non-standard units (unit names enclosed in square brackets). » Memory usage of the matrix reduction option during loading improved.
<p>Build 2 Nov. 16, 2016</p>	<ul style="list-style-type: none"> » PKIN: Revised options for saving from the fitting history and the parameter overview. » PCARD: Tracer retention analysis added (called HED in 3.7). Polar plots corrected and VOI selection adjusted for transmural analysis. Retrieval of gated protocols fixed. » PGEM: Fixed problem with handling of the VOI tracking properties in protocol retrieval. Name extension of VOI in 3D scene now corresponds to tracking function. Improvements in the 3D scene control and movie creation. » P3D: 3D protocols with multi planes scene improved. Fixed track coloring in velocity mode with frame selection.

	▶▶ Improved reading of velocity encoding (VENC) from DICOM and Philips PAR/REC.
Build 1 Oct. 27, 2016	Initial upload of 3.8 version.

Product Release 3.8

Considerable effort was spent to optimize PMOD for the ever increasing data sizes, and improvements and extensions were achieved in the various tools.
 New Features and Revisions

<p>General</p>	<ul style="list-style-type: none"> » Support for data sets with very high resolution. Previously there was a limit of about 2^{31} voxels per volume, which prevented the loading of some high-resolved CT series. » User interface scales better for ultra-high display resolution. Larger fonts and scale factor for icon size introduced in the Appearance configuration. » Multiple network licenses can be handled by a single server. » System for tracking the processing progress of a study in the Audit Trail license type. » Administration tool for starting, stopping and monitoring server processes. » Sound can be disabled. » Installers for R added to distribution (Windows, Mac only). » Curve export proposes curve name as file name default. » User-specific default database when using a tailored database set. » Pipeline: Button added to set all intermediate plugin to results save mode. » Segmentation tool extended by histogram display, minimal cluster size, morphological closing and maximal number of clusters. » The patient age is shown in the image info dialog if it is available in the data or can be calculated from the birth and scanning date.
<p>VOI</p>	<ul style="list-style-type: none"> » VOI atlas of the domestic pig brain added (Courtesy: C-H. Malbert). » VOI-based image cropping simplified. » Interpolation between ROIs defined by B-splines on distant slices. » Copy/paste of multiple selected contours. » Change of the plane orientation in which ROIs are defined. » Tool to reduce the density of polygon vertices. » Additional statistics values: NumberOfNaNs - the number of VOI voxels with NaN value; VolumeWithoutNaN - VOI volume minus the volume of NaN voxels. » Morphological VOI tool parameters serialized. » Support for VOI generation from segmentation results. » In pipeline, the VOI Statistics plugin uses all VOIs associated to the image series.
<p>PNEURO</p>	<ul style="list-style-type: none"> » Multi-channel segmentation using two MR images for improving segmentation. » User-defined atlases and the 6 probability maps segmentation can also be used for the parcellation method. » All 6 segments calculated by the 6 probability maps segmentation are now saved. » Muller-Gartner-type partial volume correction variants added, including the region-based voxelwise method (RBV; Thomas et al, EJNMMI 2010).

	<ul style="list-style-type: none"> » Further harmonization of the parcellation and the maximum probability approaches: Brain splitting which is relevant for the left/right separation of white matter and cerebellum can be inspected, recalculated and switched off if it causes problems; when protocols are loaded and use of the saved VOIs enabled, the segmentation step is skipped if the result space corresponds to the VOIs. » Parametric mapping configuration is also stored in the protocol. » Batch mode: Full access to the masking details; brain split control added; new organization of PVC controls; type of protocol indicated. » Improvements related to normal databases: Support for pixel-wise age regression, allowing for the prediction of the image pattern at a certain age; normalization presets for non-human data; reorientation to standard orientation supported.
<p>PKIN</p>	<ul style="list-style-type: none"> » Parametric mapping tool for the analysis of pixel-wise TACs: the TACs of VOI pixels can be transferred to PKIN, analyzed with any model, and parametric maps generated from the results which are in the space of the input image. This tool is suitable for studying tissue heterogeneity, for example in tumors. » Data editor which allows for easily editing loaded data and importing new data via the clipboard. In this way TACs may also be appended to an existing data set. » Visualization of multiple model curves at the same time for comparing the results of different models visually. » Spectral analysis with subtraction of a fixed blood contribution. » Implementation of the SAIF spectral analysis variant (Veronese et al, 2010) which is applicable for irreversible tracers. » Extension of the model with vascular compartment to allow for reversible binding, not just trapping. » Addition of a reference tissue model based on the partial saturation approach for estimation of B_{avail} and $appK_D$ using a single injection protocol with raclopride (Wimberley et al, 2014). » Curve multiplication with exponential. » Bolus/Infusion model returns the percentage of the syringe content to inject as the bolus. » Display of the reference TAC when using reference tissue models. » Facility to plot all regional residuals at once. » Save KM parameters: uses last fit result rather than currently displayed model configuration; standard error added. » Parameter export from fitting history: all fitting results with common revision.
<p>PCARD</p>	<ul style="list-style-type: none"> » Gated PET: Improved segmentation; wall thickening polar plot added. » A new method was introduced for analyzing the transmural perfusion gradient using parametric flow mapping and separation of endo- and epicardial muscle (Sciagrà et al, 2015). » Smoothing parameter added for the MBF parametric map calculation, which has an impact on the transmural analysis. » In Stress/Rest comparison difference and reversibility added. » Dynamic polar plots can be saved as a dynamic image series so that parametric mapping may be applied.

	<ul style="list-style-type: none"> » Several options can be reconfigured when loading protocols (sampling, MBF mapping, transmural analysis). » Masking as part of the cropping procedure was retired.
PXMOD	<ul style="list-style-type: none"> » Model for resting-state fMRI data analysis. It performs the required preprocessing steps like de-trending, filtering, slice timing correction, motion correction, and calculates the correlation coefficients. » k_2' map added to SRTM model. » Better masking support: K-means clustering in the 2-tissue compartment ridge regression model uses the mask; thresholding is not considered if an explicit mask is defined. » Implementation of the spectral analysis with iterative filter (SAIF) model which is applicable for irreversible tracers (Veronese et al, 2010). » Check added that the sizes of the image and the mask agree.
P3D	<ul style="list-style-type: none"> » Distance calculation between two markers. » Introduction of oblique planes which can cut 3D objects, optionally with restriction in a circle. Can be applied for multiple cuts. » Reading and visualization of OpenFOAM polyMesh data representing calculation results such as pressure or velocity on a 3D mesh. » Optional inclusion of wire frame for solid objects.
R Statistics Console	<ul style="list-style-type: none"> » Linear discriminant analysis (LDA) added. The functionality covers the determination of the discriminant coefficients from a training set, is validation using a validation set, and the application for classifying an individual case. » Linear Mixed Effects model number of covariates increased; » ANOVA analysis extended to 5 groups. » The scripts using a mastertable can generate relative statistics for the analysis, and save the potentially restricted working mastertable in the workspace. » Facility added to remove packages; recommended when installing a new R version. » Several plots were improved regarding output and serialization. » Variable edit supports outlier removal using <, >, =, Range from to, and Automatic Quartiles Detection (Boxplot) method. » Export of tables and simple R variables to csv format for import in Excel, SAS, SPSS. » Vector element names visible as column headers.
Data Formats	<ul style="list-style-type: none"> » TIFF: Extended to support save of multiframe files and monochrome images including support for ModelPixelScaleTag (hex 0x830E) to preserve pixel size. » Previous origin values were used when no origins were specified in the file: BrainVisa ROI, Minc, Analyze avw, Matlab matrixes, Interfile, Hidac PET, Varian, GE Advance, Anatomist, nifti (when qform and sform are not defined). Now the origin is set to zero. » Interfile: Unsigned short value representation added for saving.
PSAMPLE	<ul style="list-style-type: none"> » Branching ratio introduced for conversion of the radioactive counts to activity concentration.

	▶▶ Event buffer introduced for recording the times of external events in the PSAMPLE file.
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Zürich, October 27, 2016

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