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Educational Training Guide

NMI ParaVision 360 + pmod 4.5 Workflow Basics

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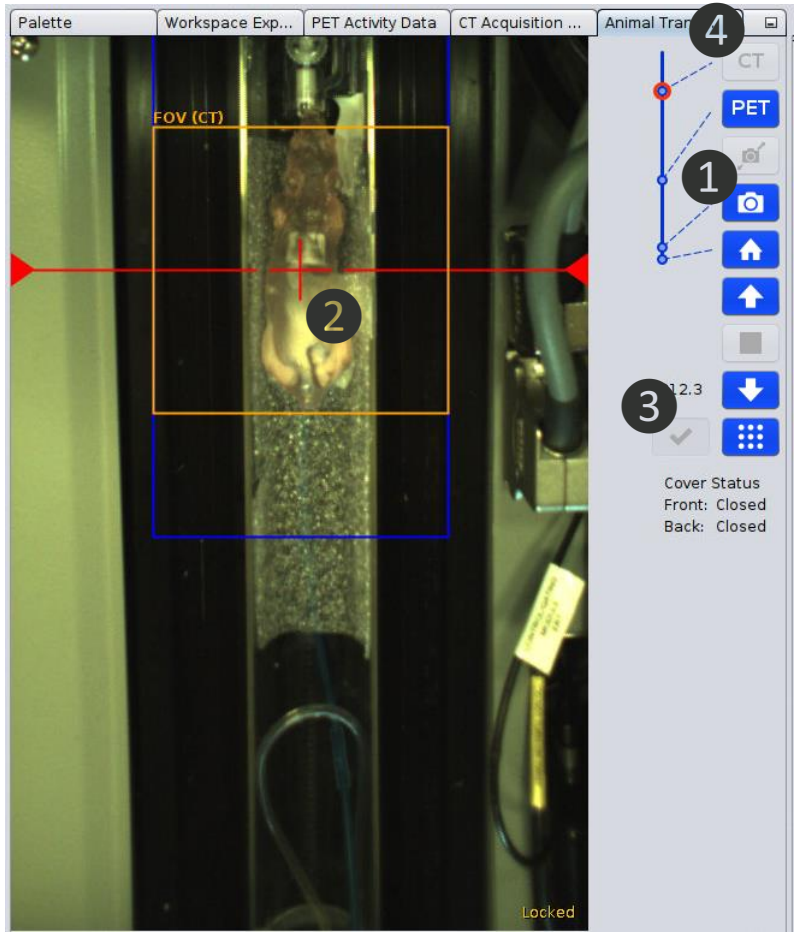
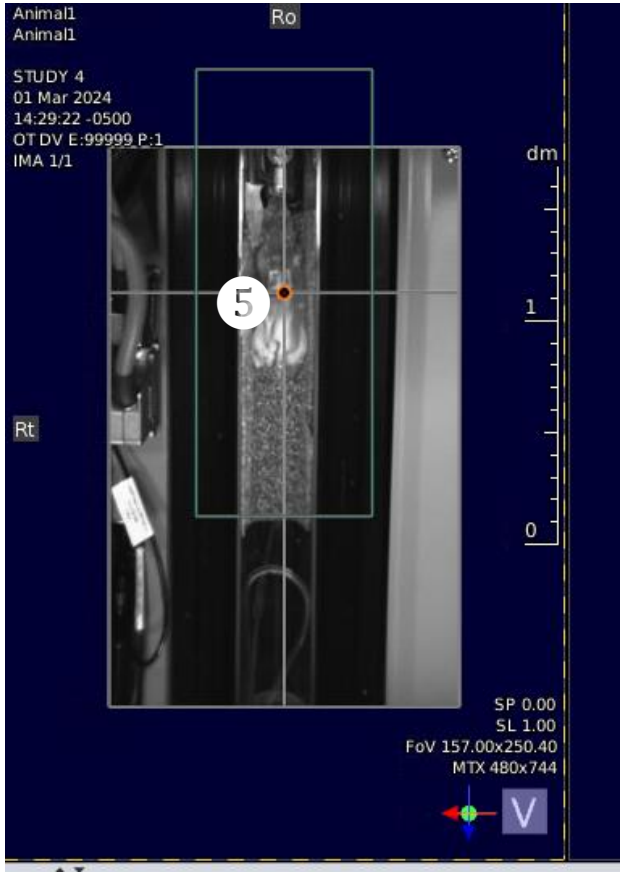
PET/CT & PET/MR: Animal Transport System Workflow

PET/MR & PET/CT
Animal Transport System (ATS)* Workflows





1. **Camera.** After placing the animal in the cradle set the ATS to camera.
2. **Position.** Move the crosshair to the center of your target object, noting the boundaries of the FOV(s) displayed.
3. **Set** the position for transport. **Tip: Set the position for each subject and study.**
4. **Select the Modality.** Select the modality button to drive the transport to PET, CT or MR.
5. **ATS Reference** box may be adjusted to move transport during study.

**For systems equipped with the ATS only.*

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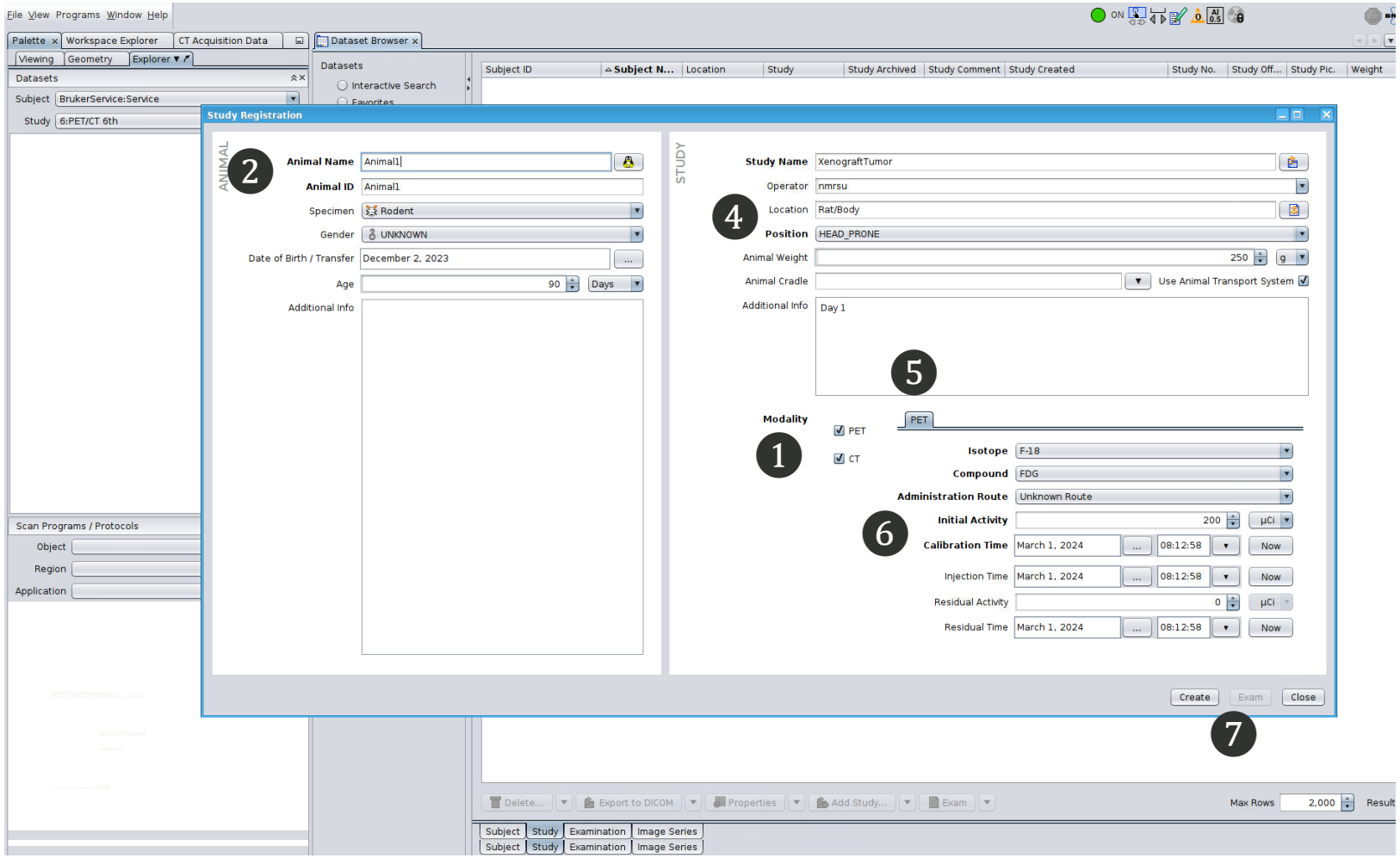
PET/CT & PET/MR: ParaVision 360 Study Workflows

PET/CT & PET/MR: ParaVision 360 Study Workflows
Key Menus

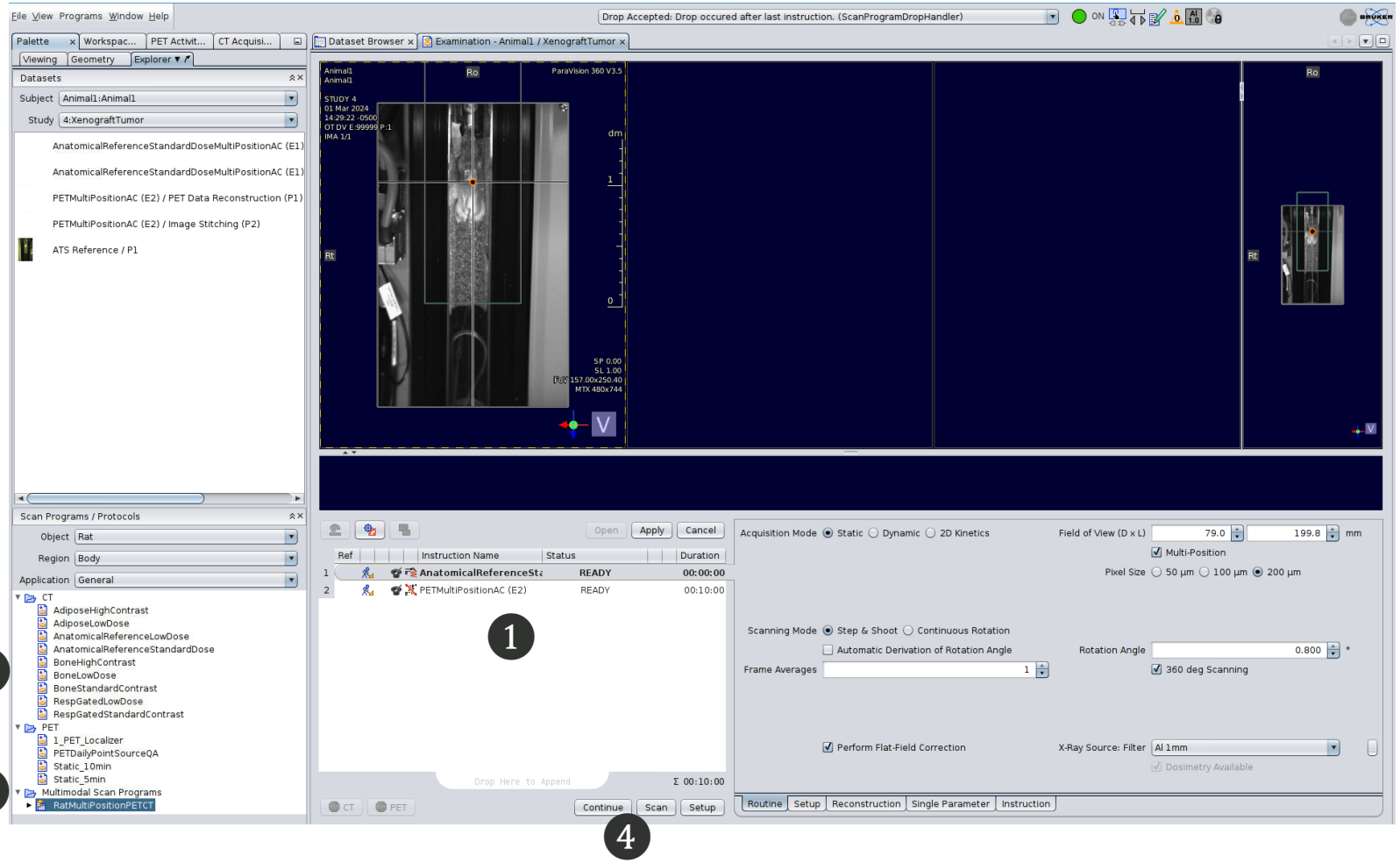
1. **Study Registration.** The process for entering study registration details (intended for a single animal at a single time point).
2. **Protocols & Multimodal Scan Programs.** Multimodal Scan Programs are predefined (or customized) PET + CT (or MR) scans programs with predefined scan protocol order, processing (stitching, attenuation correction, etc.).
3. **Palette.** Most centralized location for Scan Programs, Image Fusion, and Dataset Filtering. **Tip: Return to Palette for access to functions in central location.**
4. **Dataset Browser.** Location for accessing/searching data with search menus, DICOM export, and other study management tools.

PET/CT & PET/MR: ParaVision 360 Study Workflows
1. Study Registration



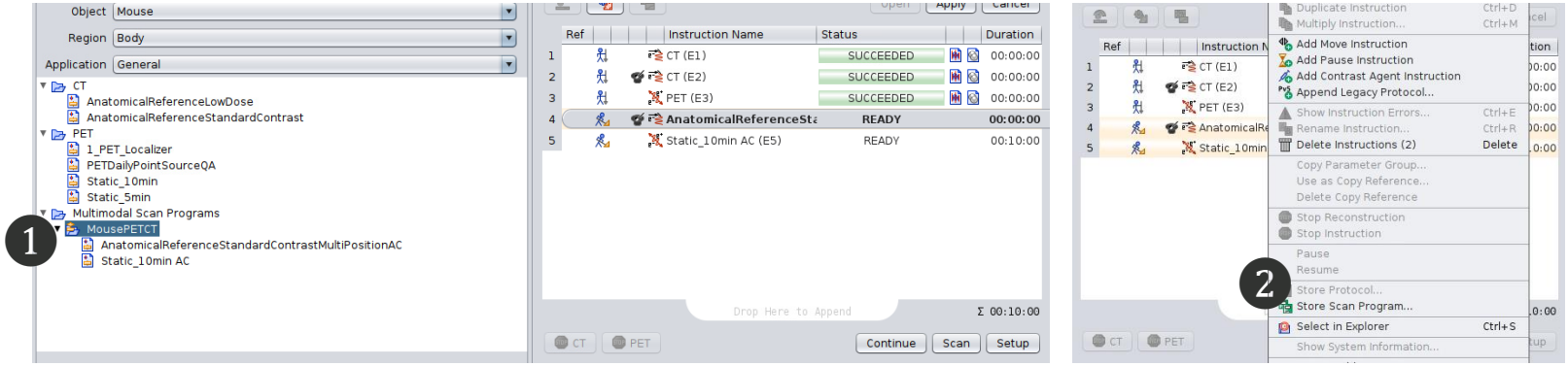
1. **Modality.** Check the PET and CT or MR modality boxes. **Tip: required to be set before setting other parameters.**
2. **Animal.** Enter the Animal Name & Animal ID.
3. **Study Name.** Enter a Study Name.
4. **Select the Location.** Select the Location defines the scan program and protocols for your acquisitions.
5. **Additional Info.** Enter additional information (e.g. study day in a series). **Tip: This variable is useful when sorting data in a PMOD.**
6. **Isotope/Compound/Activity.** Enter the activity and calibration time.
7. **Create, Exam.** Select Create and Exam to initiate a study.

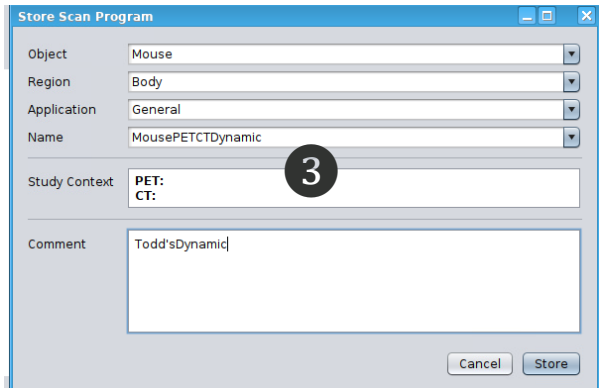
PET/CT & PET/MR: ParaVision 360 Study Workflows
2. Protocols & Multimodal Scan Programs

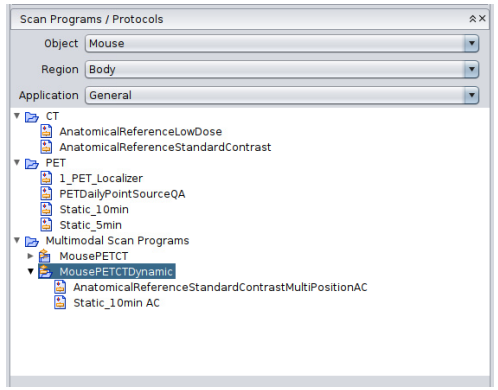


1. **Instruction Card.** Scan Programs & Protocols can be drag and dropped to the instruction queue for acquisitions.
2. **Multimodal Scan Programs** are found under Palette > Explorer. These are Interleafed PET & CT or MR scan protocols with pre-optimized with predefined AC processing.
3. **Protocols.** Individual PET, CT or MR scan protocols that can be added to the instructions. **Tip: Always perform the PET Daily QA workflow at the beginning of the day. Include the CT protocol that will be used to allow for CT warmup & flat-fielding.**
4. **Continue.** Select Continue to initiate scans.

PET/CT & PET/MR: ParaVision 360 Study Workflows
2. Custom Multimodal Scan Programs



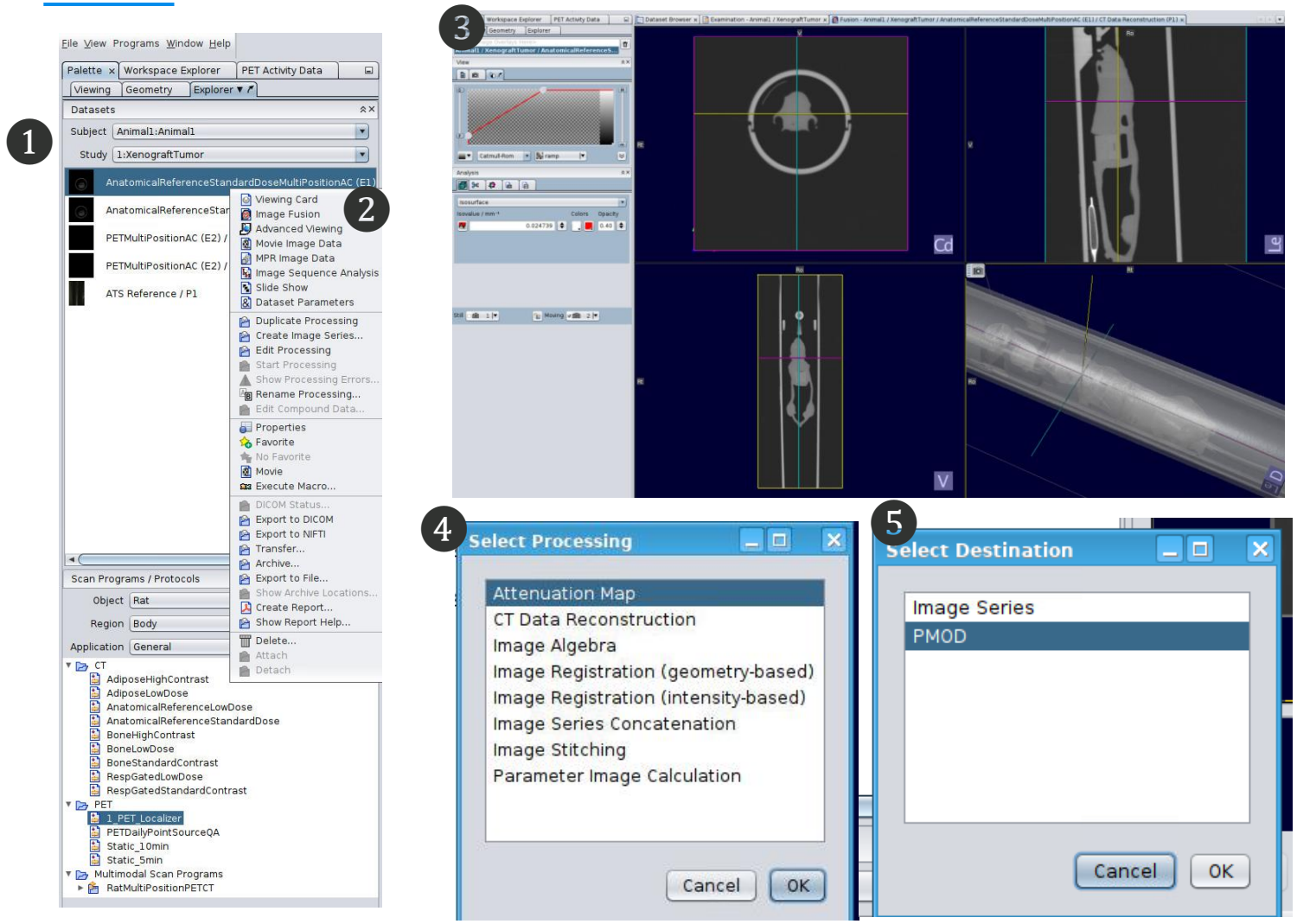




1. **Create a Custom Multimodal Scan Program.** Drag and existing multimodal scan program to the instruction card and modify the parameters as desired.
2. **Store Scan Program.** Highlight the modified multimodal scan program components and right click. select **Store Scan Program**.
3. **Store Scan Program Details.** Define the Object, Region, and Application in the menu. Enter a custom name. Add comments. Select Store. The custom multimodal scan program now appears in the protocol selection.

Caution! Please do not Overwrite Existing Scan Programs

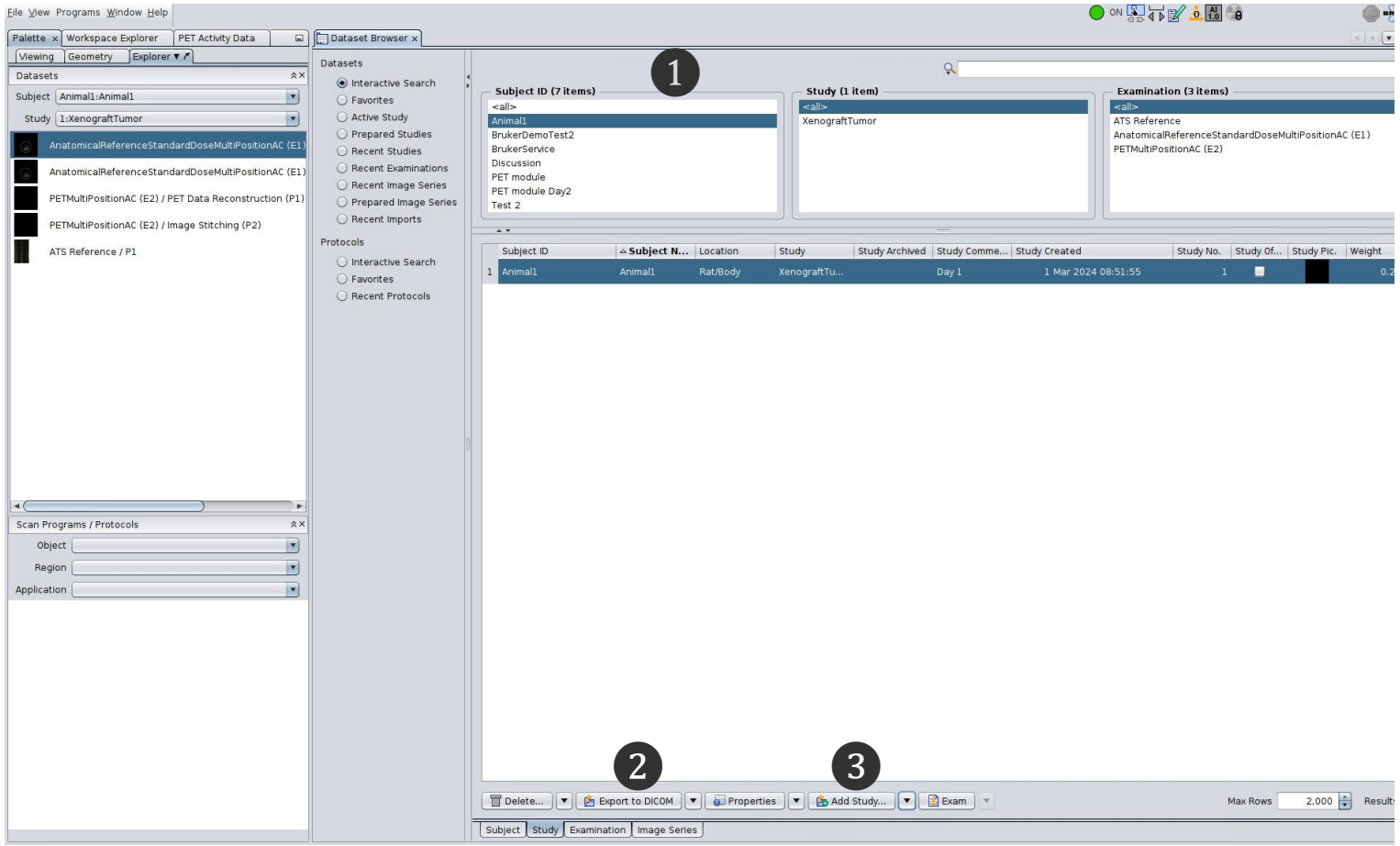
PET/CT & PET/MR: ParaVision 360 Study Workflows
3. Palette



1. **Datasets.** Datasets for the active study are found under Palette > Explorer. Thumbnails for images appear after reconstruction.

2. **Right Click** on image thumbnails for common processing tools such as: 3. **Image Fusion**, 4. **Create Image Series**, and 5. **Export to DICOM**.

PET/CT & PET/MR: ParaVision 360 Study Workflows
4. Database Browser



1. **Database Browser.** Use database browser to filter data by Subject and Study.

2. **Export to DICOM.** Select Export to DICOM or PMOD server.

3. Select **Add Study** to initiate to add a new study registration in preparation for your next study in a longitudinal time series. Modify the Study Name and Additional Info.

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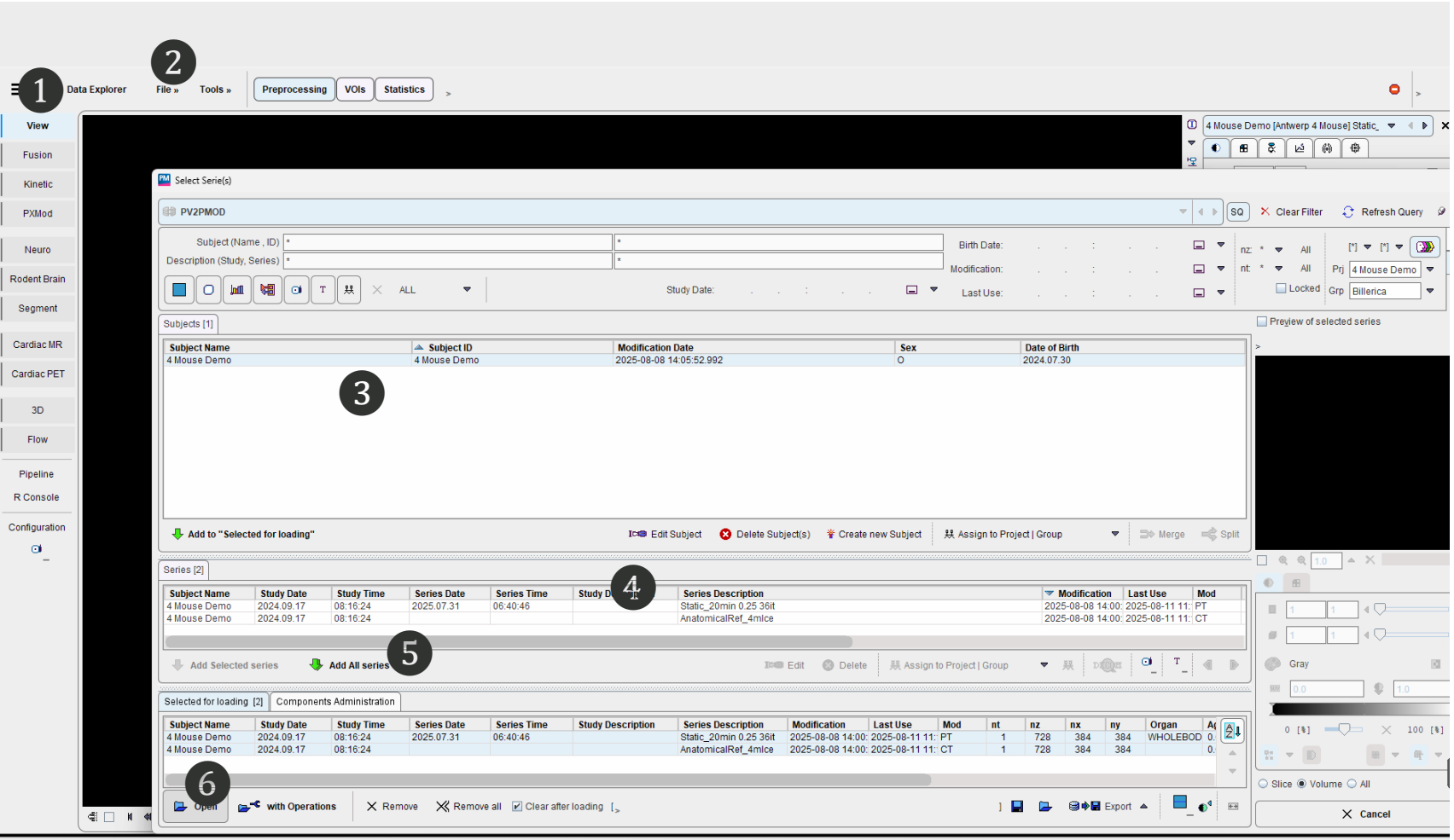
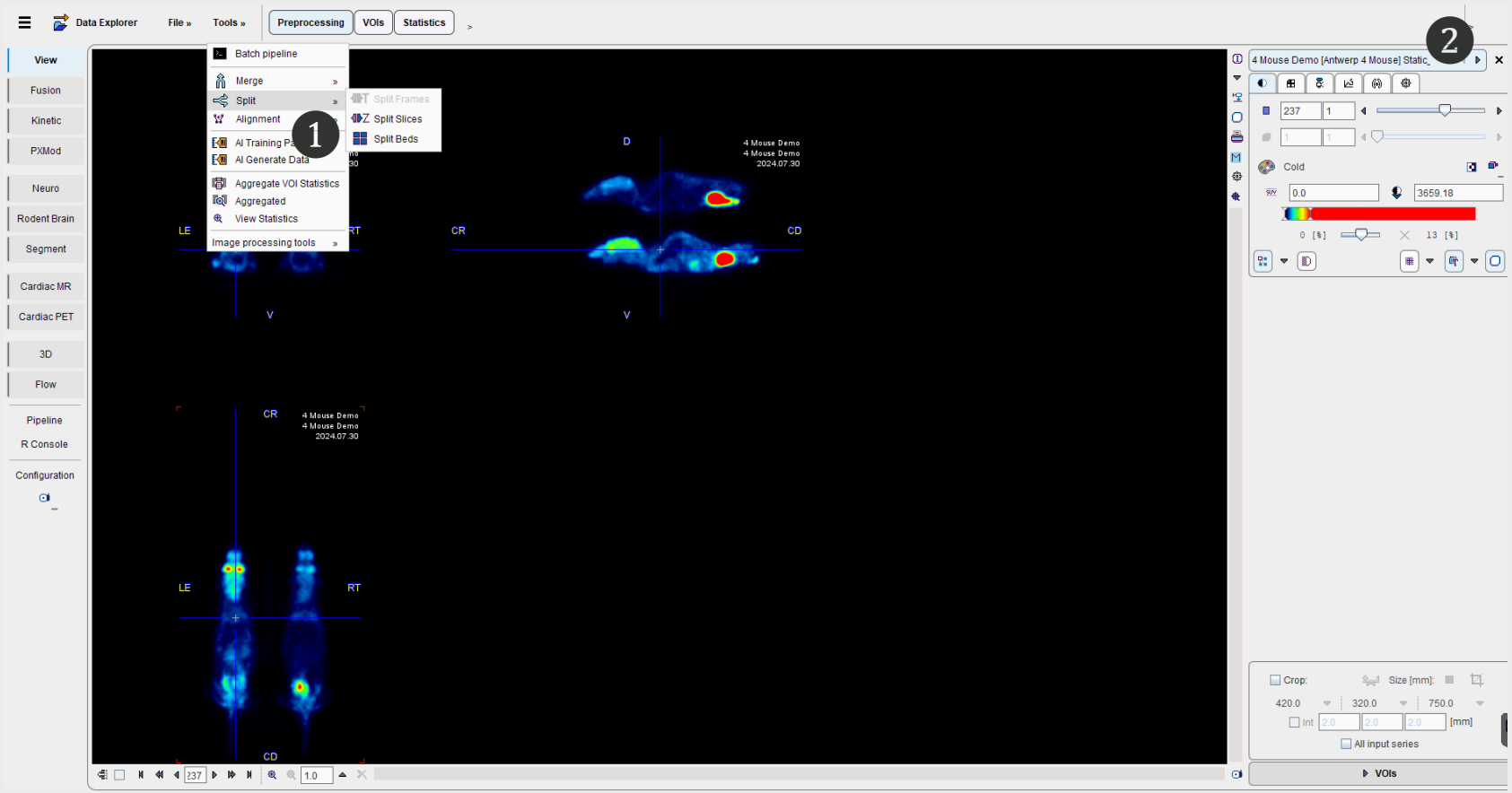
pmod v4.5 Multi Animal Image Cropping – Preprocessing in View (Skip this Step if Single Animal)

PET/MR & PET/CT: pmod Multi Animal Image Cropping – Preprocessing in View



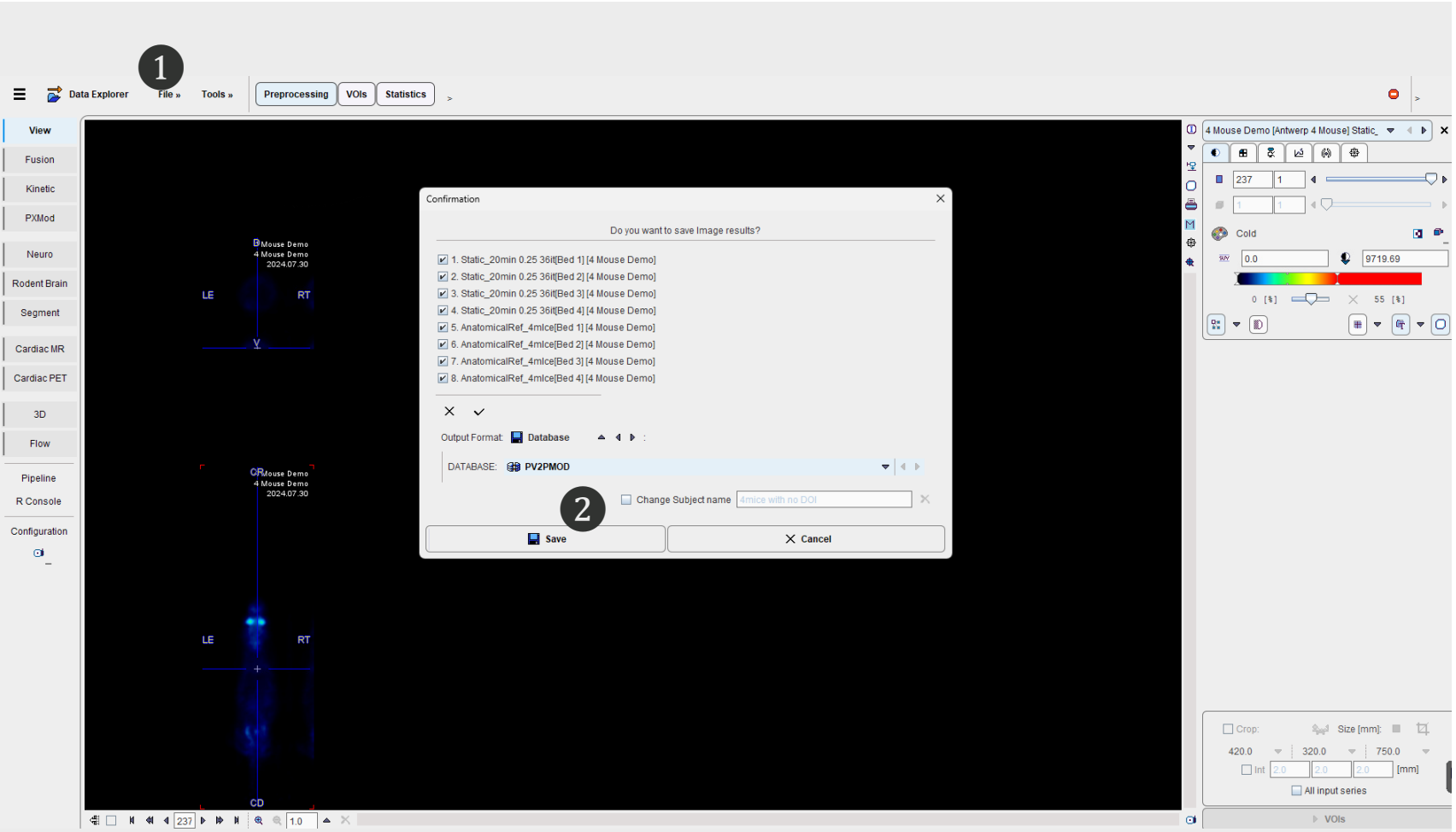
1. Open the **View** module.
2. From "File" menu, select option: Load image data > Database.
3. Select the **Subject Name** from the menu (in this example 4 Mouse Demo).
4. Highlight a PET and Anatomical images in the **Series tab.**
5. Select **Add Selected series**.
6. Select Open.

PET/MR & PET/CT: pmod Multi Animal Image Cropping – Preprocessing in View



1. Split Beds in the Select “Tools” menu. Select 4 beds or 3 beds from the pull down and select Yes. 4 (or 3) cropped images will be created.
2. Select the Anatomical Image and select Split Beds in the “Tools” menu again to split the anatomical images.

PET/MR & PET/CT: pmod Multi Animal Image Cropping – Preprocessing in View



1. Select Save All Data in the “File” menu.
2. Save the files to the Database. Continue with Fusion & Display.

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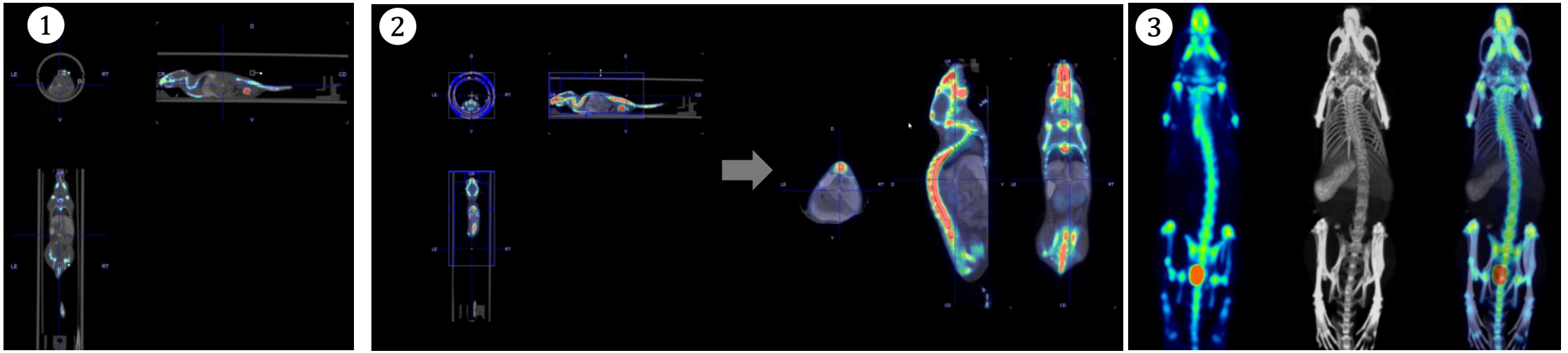
pmod v4.5 Multimodal Image Fusion & Display Workflows

PET/MR & PET/CT: pmod Multimodal Image Fusion & Display Workflow Basics

1. **Multimodal Image Fusion.** Workflow for fusion of PET data to CT or MR data.

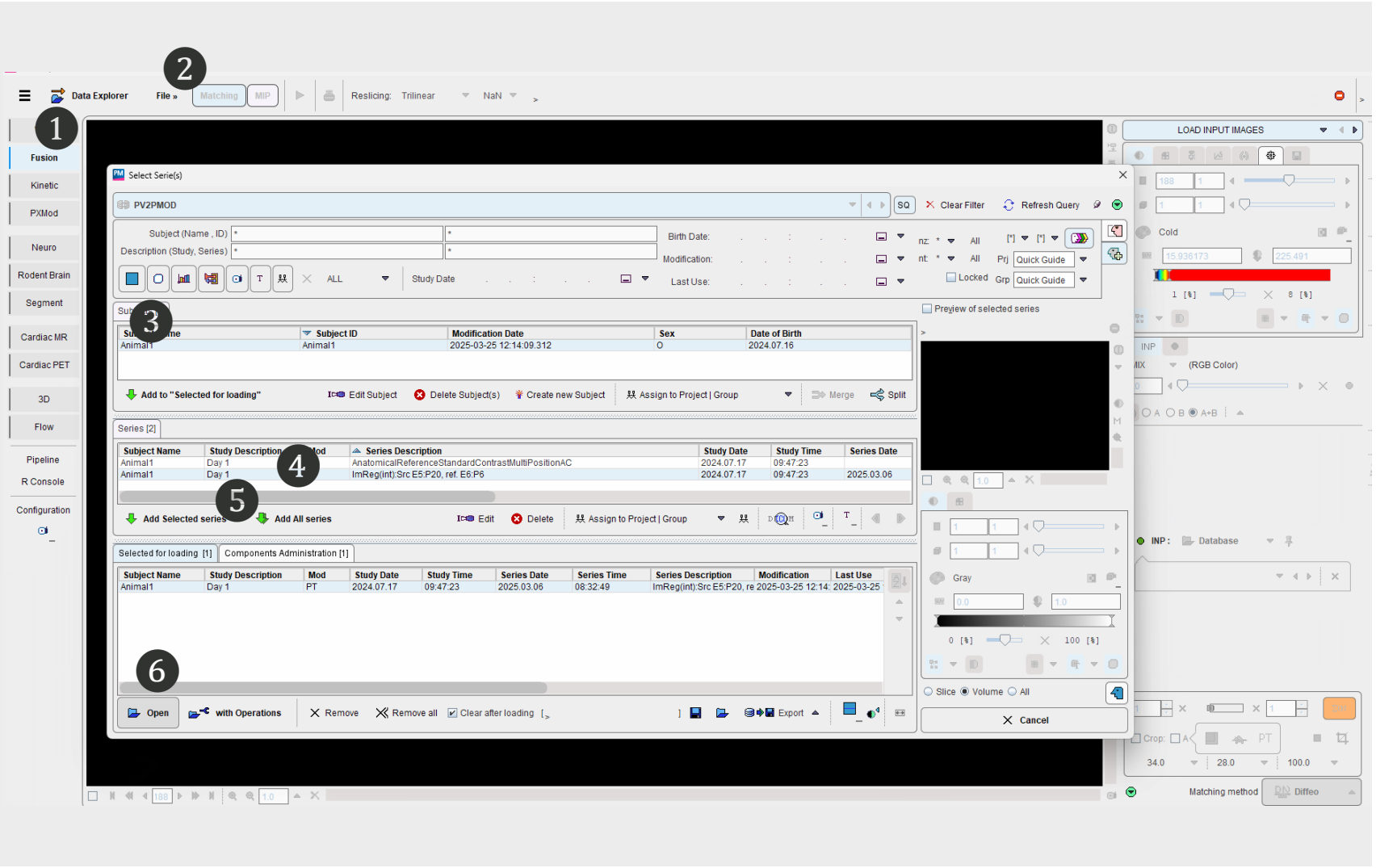
2. **Multimodal Image Masking/Cropping.** Process for subtraction of hardware components in CT image.

3. **Multimodal Image Display.** Workflow for Image Capture of Linear and/or MIP image display.



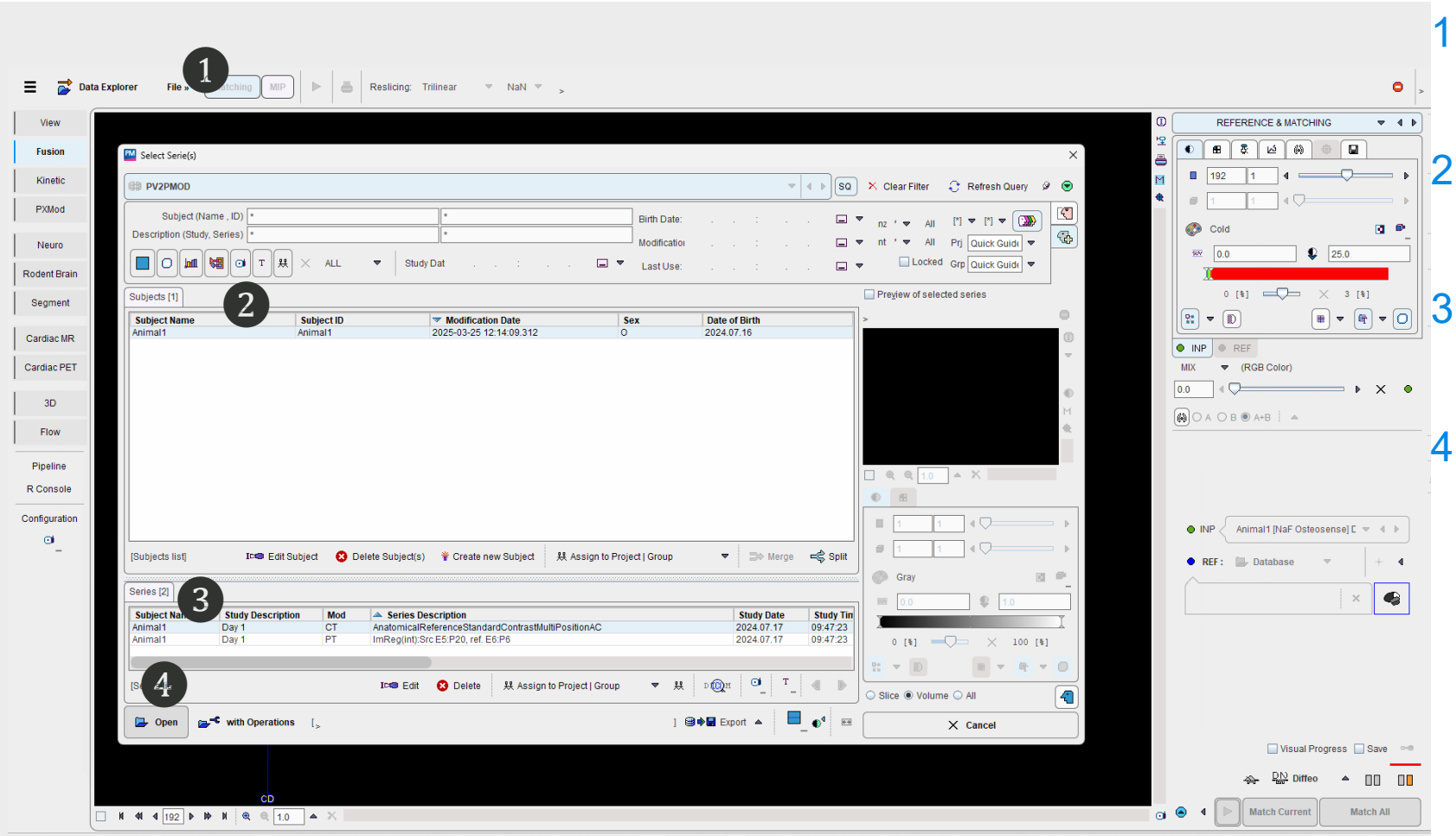
Tip: Begin by referencing the "PMOD File Management & Starting Reference For Bruker PET Data" to configure default application menus for simple workflows.

PET/MR & PET/CT: pmod Multimodal Image Fusion & Display
1. Multimodal Image Fusion



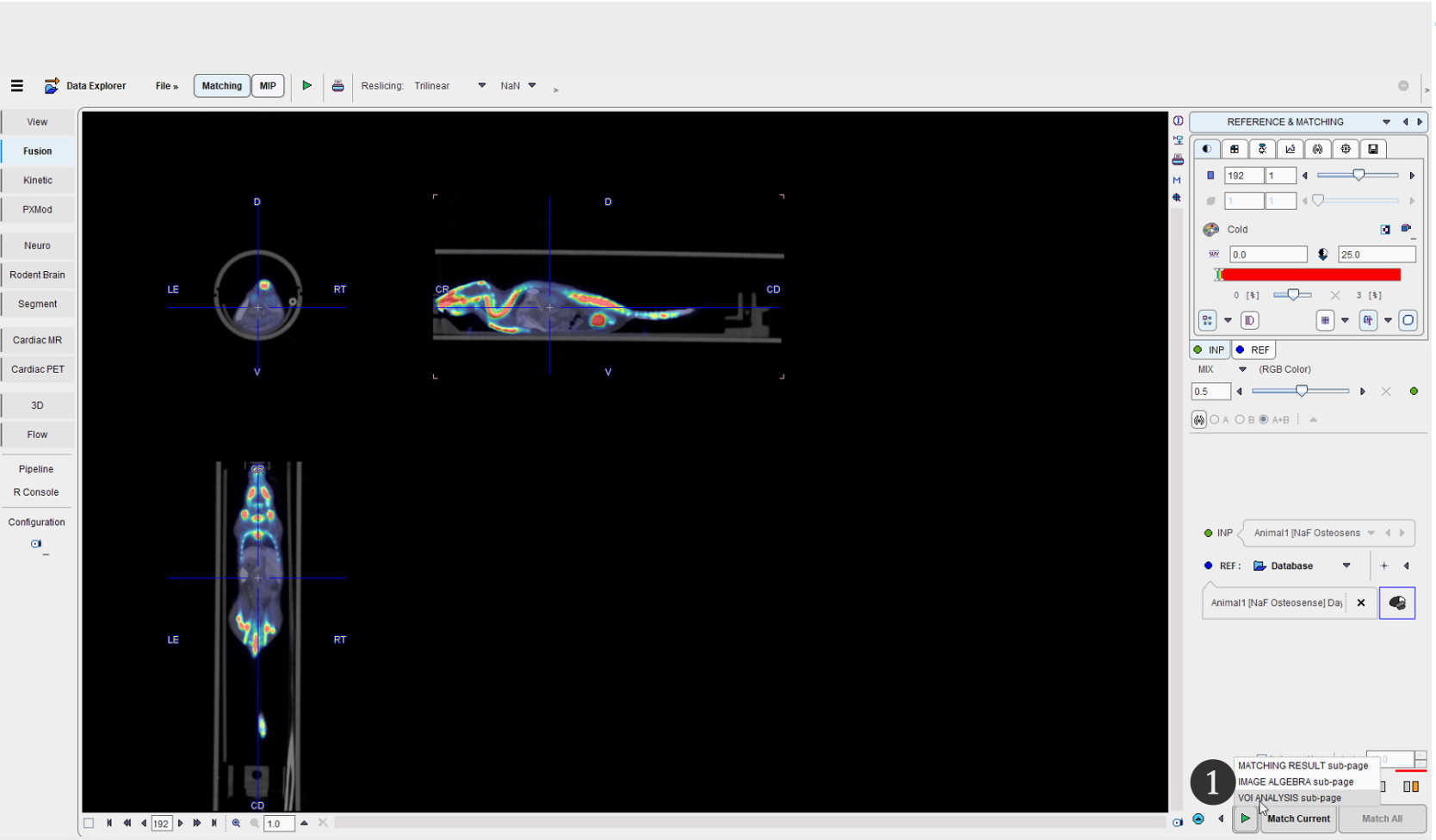
1. Open the **Fusion** module.
2. From "File" menu, select option: Load image data > Database
3. Select the **Subject Name** from the menu (in this Example Animal 1).
4. Highlight a PET image in the **Series tab.**
5. Select **Add Selected series**.
6. Select Open.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. Multimodal Image Fusion



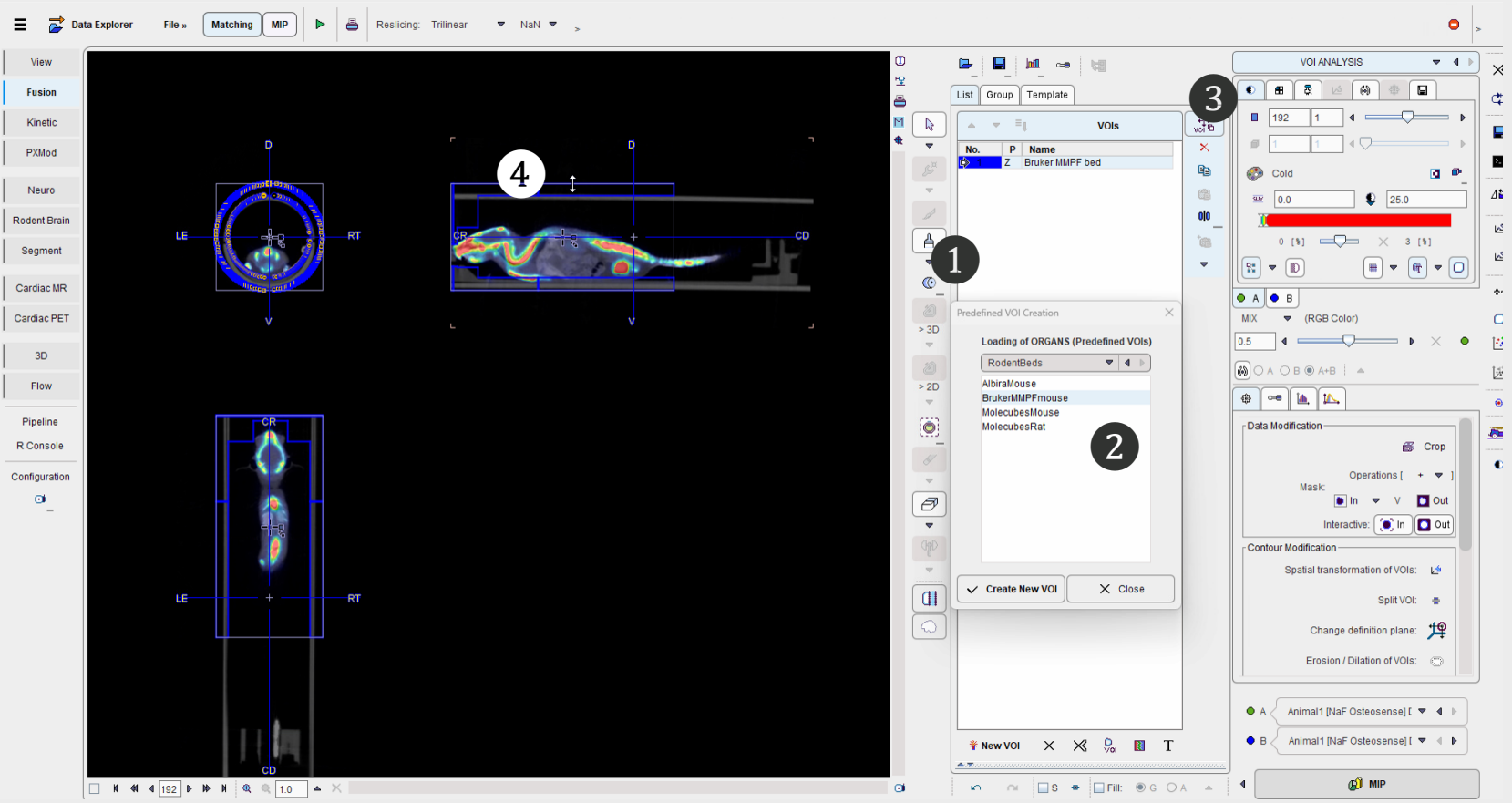
1. From "File" menu, select option: Load reference data > Database
2. Select the **Subject Name** from the menu (in this Example Animal 1).
3. Highlight the CT (or MR) image in the **Series tab.**
4. Select Open.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. Multimodal Image Masking



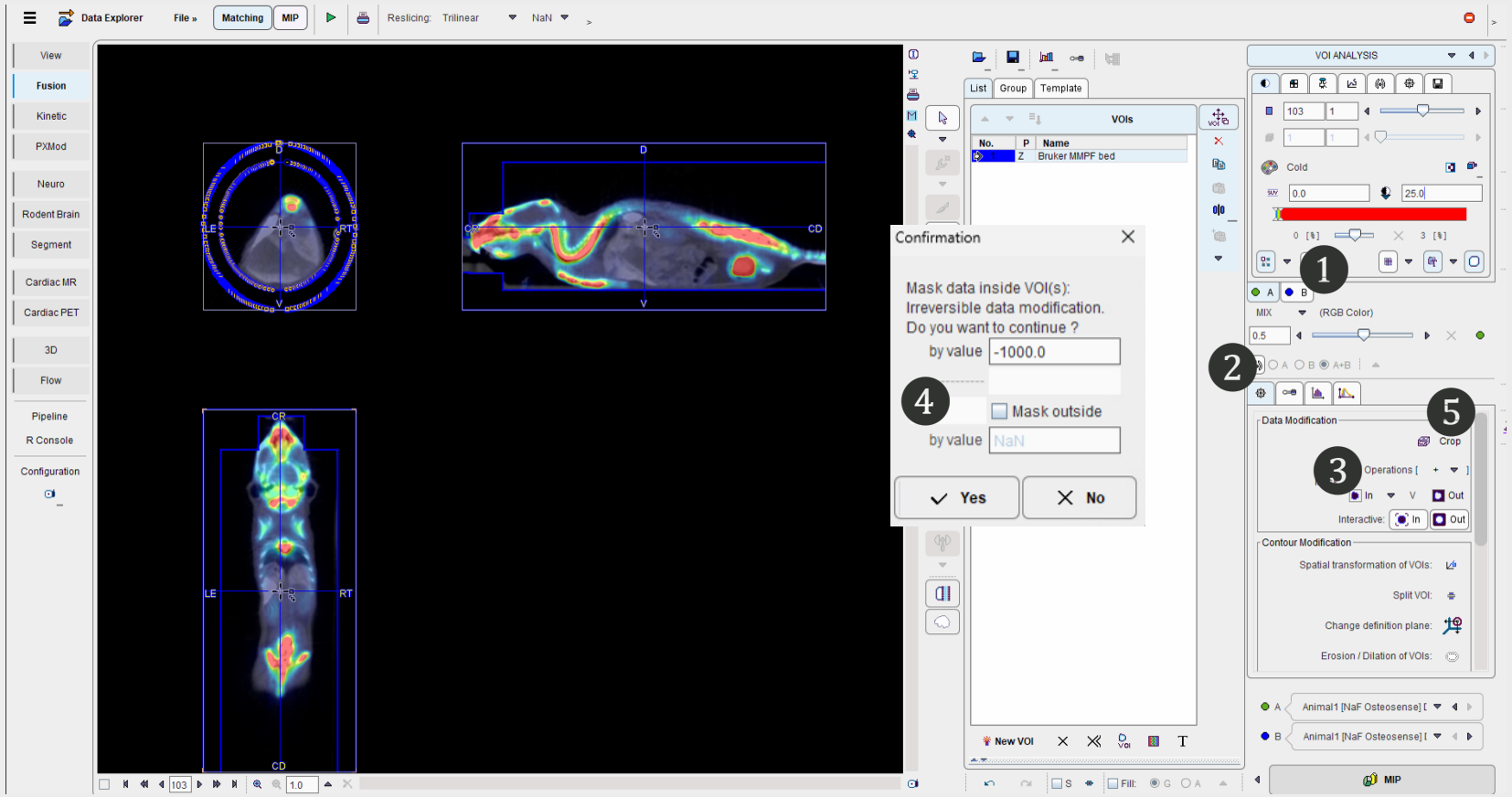
1. In workflow controls select **VOI ANALYSIS sub-page.**

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. Multimodal Image Masking



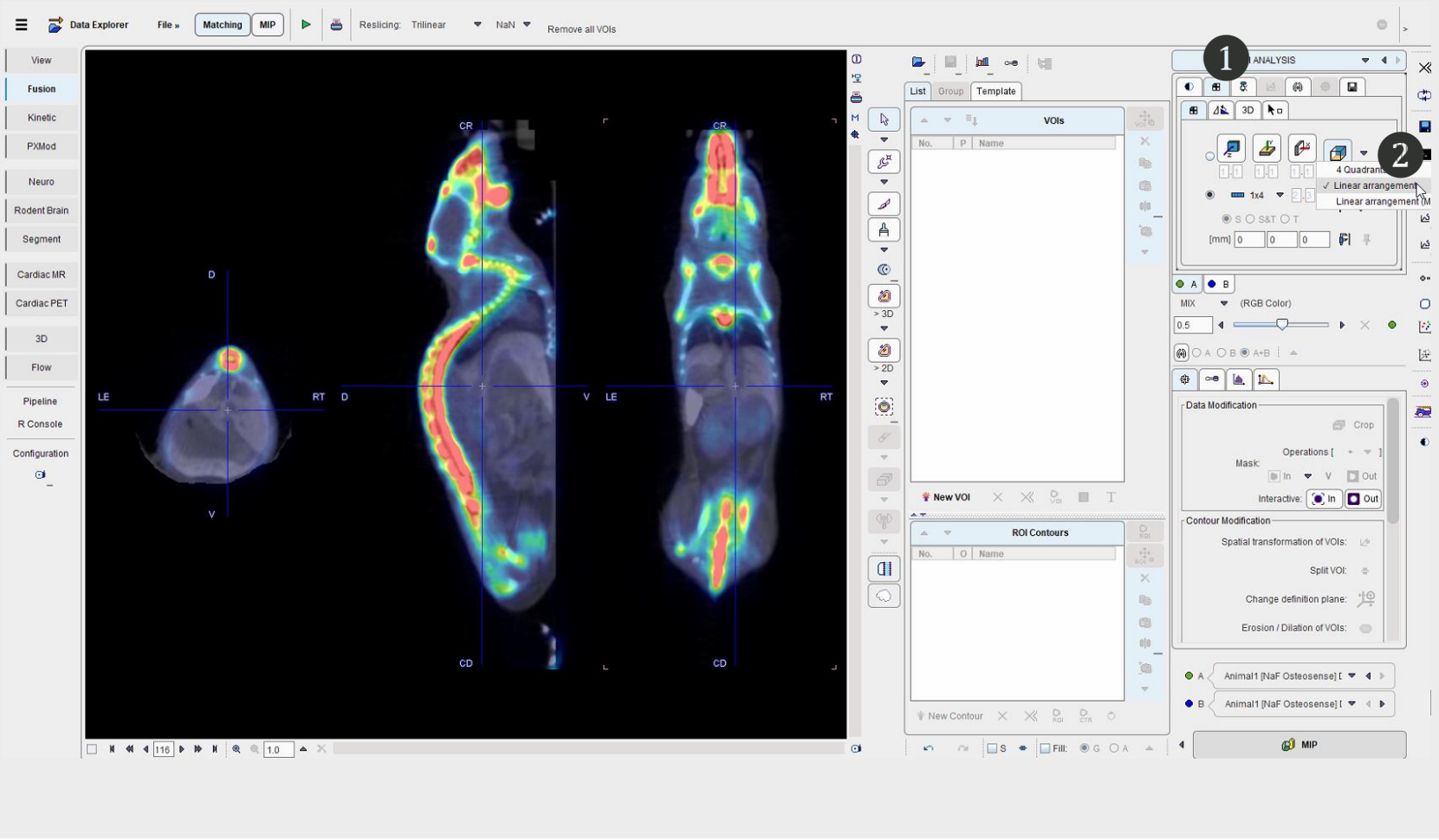
1. Place the orthogonal crosshairs in the image center. To create a VOI based on the Bruker MMPF cradle, first select **Create Regular VOI > Organs (Predefined VOI).**
2. Select **Rodent Beds > Bruker MMPF Mouse.**
3. Select the **Operation on Entire VOI** button.
4. Drag the VOI at the crosshair to align with the cradle.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. Multimodal Image Masking



1. Select **Tab B** to set the current active working image data to the CT (or 3D MR) data.
2. Select the **“Masking…”** tab.
3. Select the **“Mask voxels inside selected VOI(s)”** button.
4. For Hounsfield calibrated CT enter “-1000” in the dialogue, and select yes.
5. Finally select **Crop.** Then, change to **Tab A** and select **Crop**.

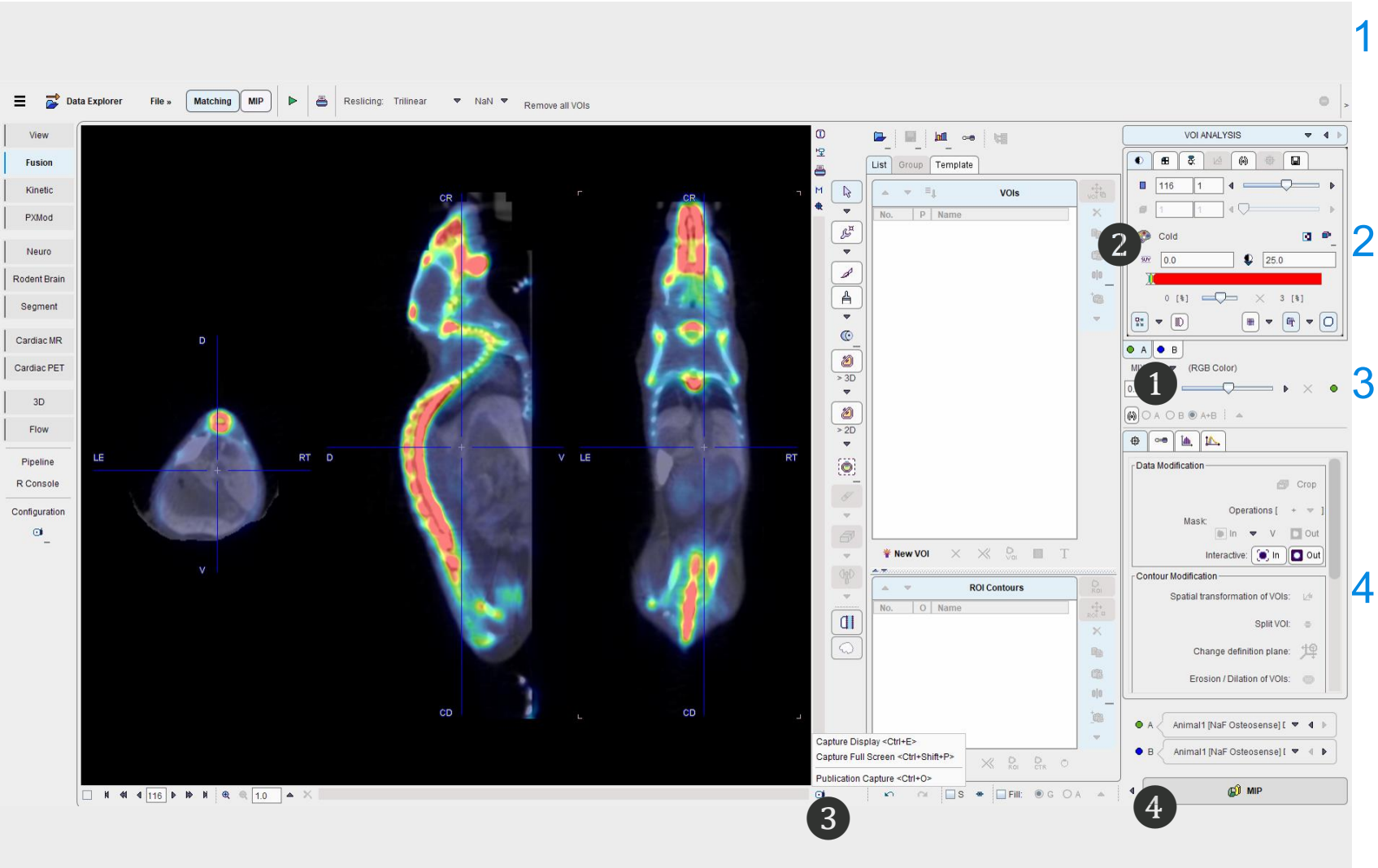
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
3. Multimodal Image Display



1. Select the **Image Display Layout** tab.

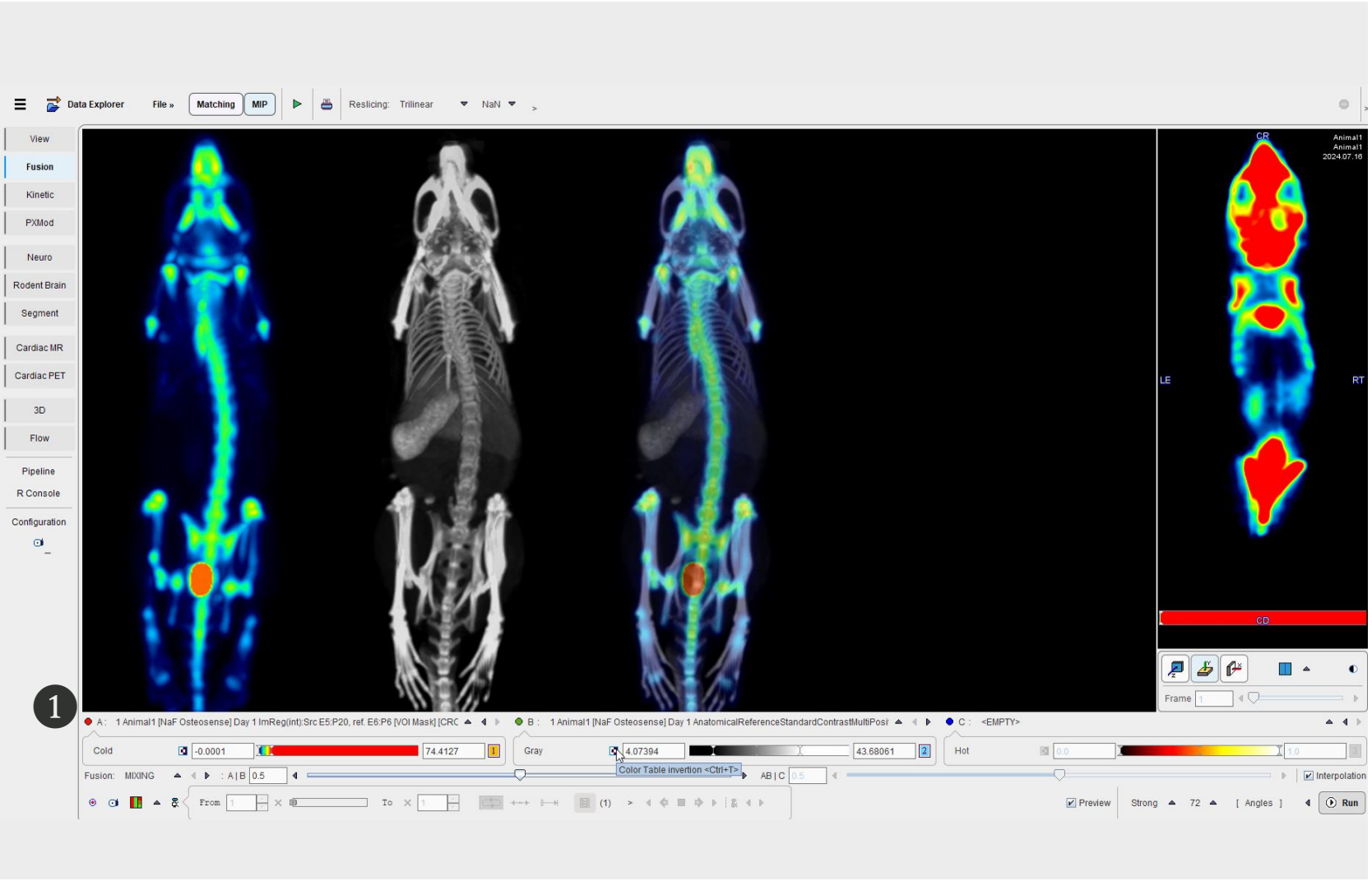
2. Select the **Linear arrangement** display selection, common for display in figures.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
3. Multimodal Image Display



1. Toggle between the A/B tabs to adjust contrast for the PET & CT (or 3D MR) images as desired.
2. Select the unit for display. This is often %ID/ml (**SUV**).
3. Select the **Capture Image Display** button, and select the Publication Capture button.
4. In workflow controls select **MIP.**

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
3. Multimodal Image Display



1. Set the first image to PET and second image to MR or CT using the pulldown menus A and B.

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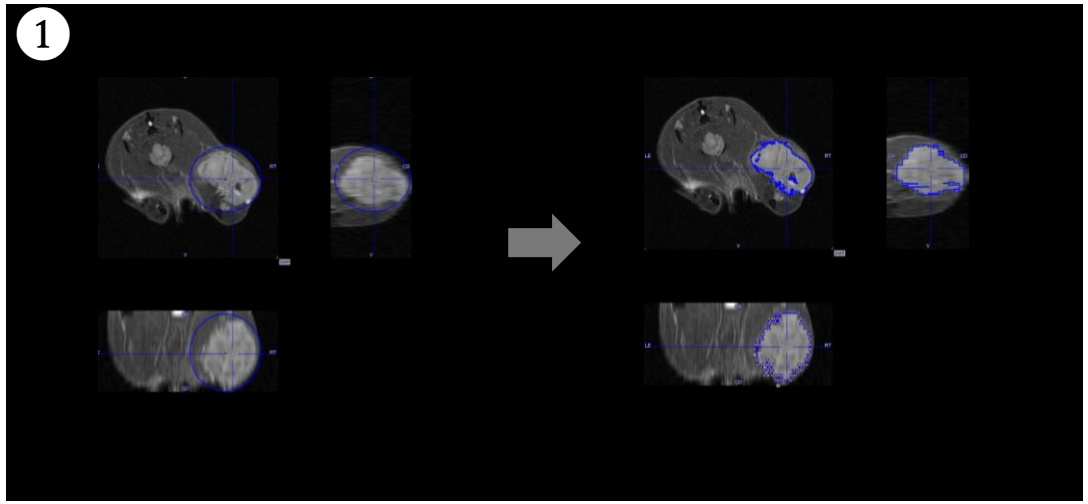
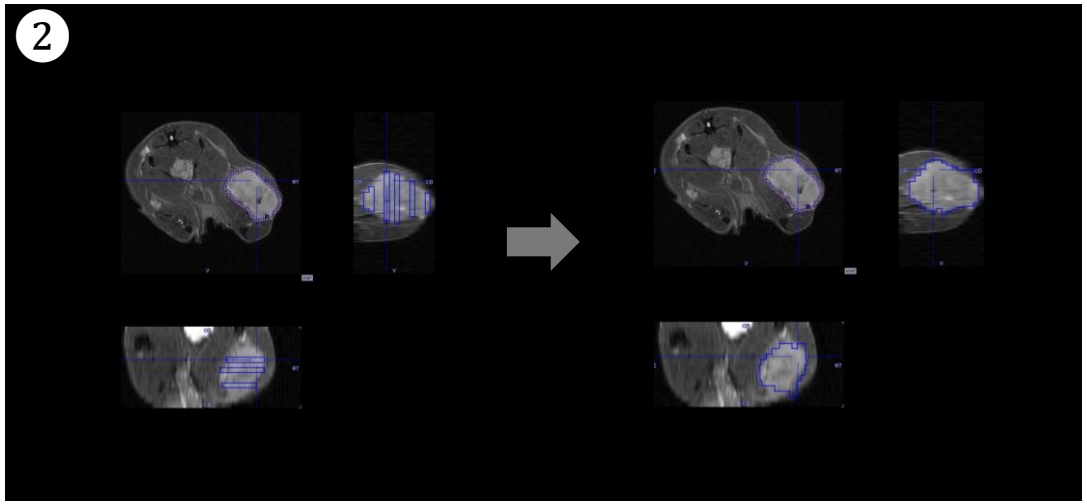
PET/MR & PET/CT Software Workflows: pmod 4.5 VOI Basic Workflows

PET/MR & PET/CT: pmod 4.5 VOIs Basics
VOIs by Iso-Contouring and Contour Interpretation

1. **VOIs** & Iso-Contouring by Region Growing

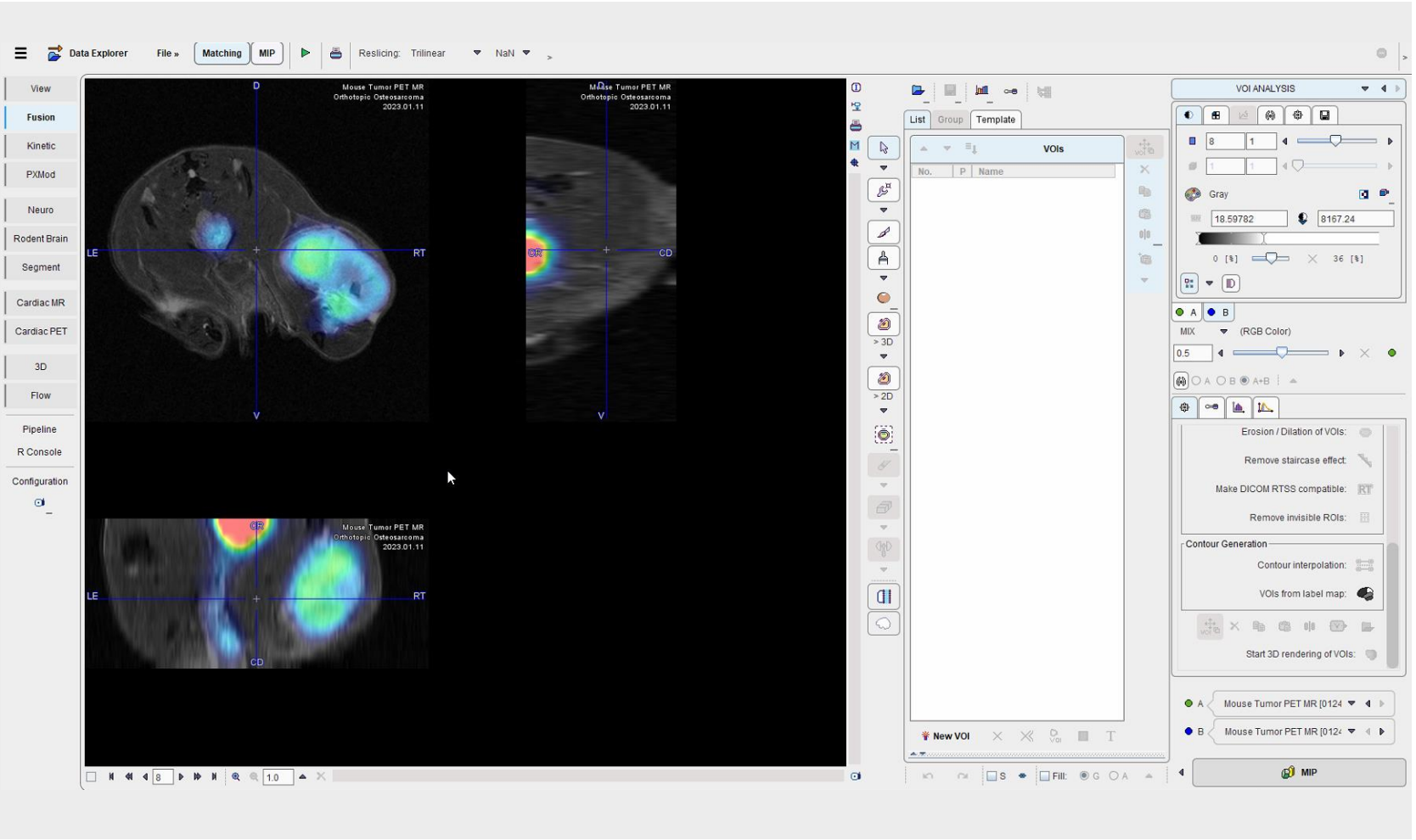
2. **VOIs** & Freehand with Contour Interpretation





Study data (courtesy Virginia Tech) was acquired in a BioSpec 9.4 MRI with a PET Insert Si103 and analyzed using PMOD v4.4

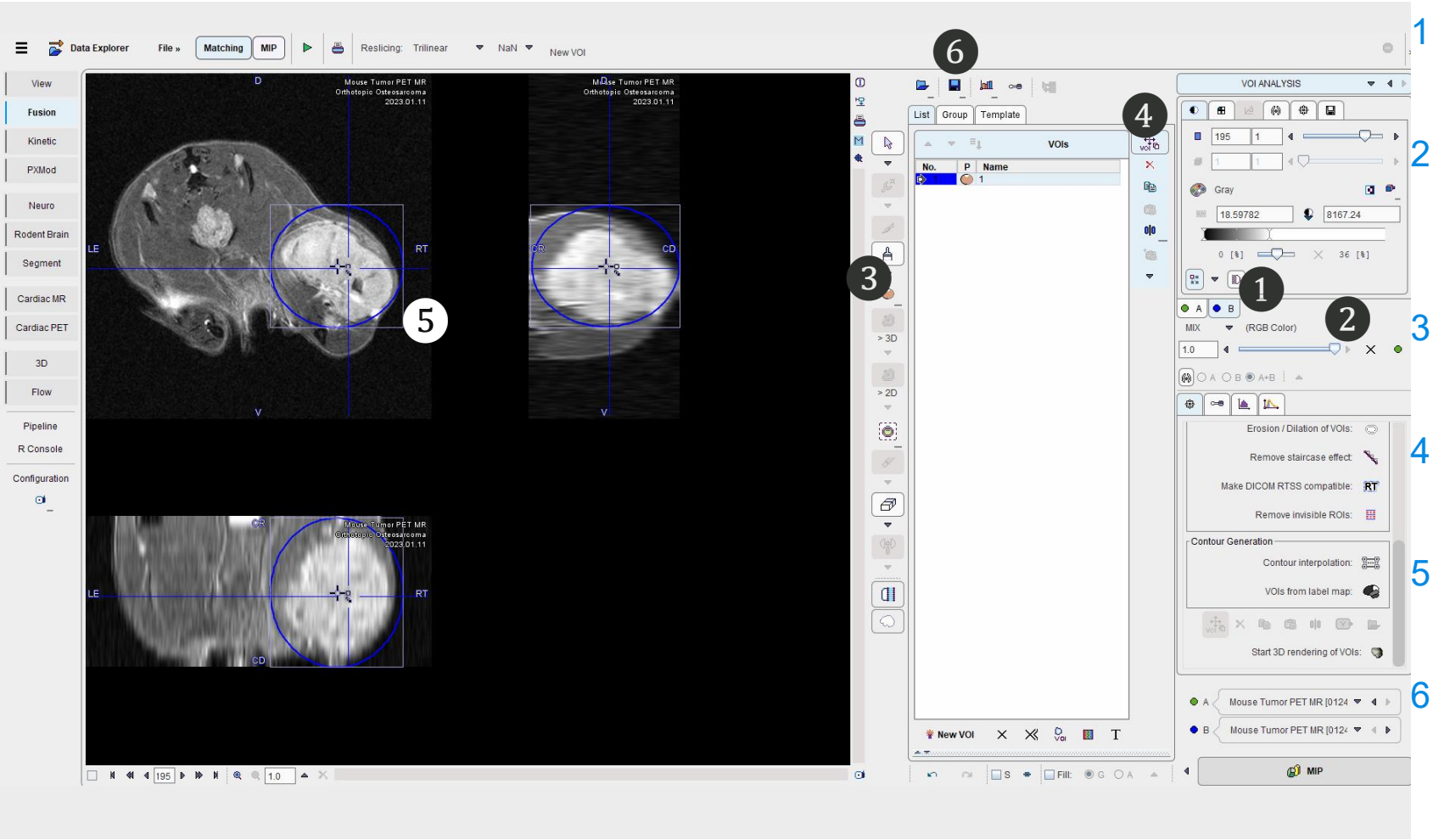
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
1. pmod PFUS VOIs & Iso-Contouring by Region Growing



1. Load multi-modal data and view at the VOI ANALYSIS sub-page menu.

Tip: The Iso-Contouring By Region Growing VOI method is suitable with targets with well defined anatomical or PET signal boundaries

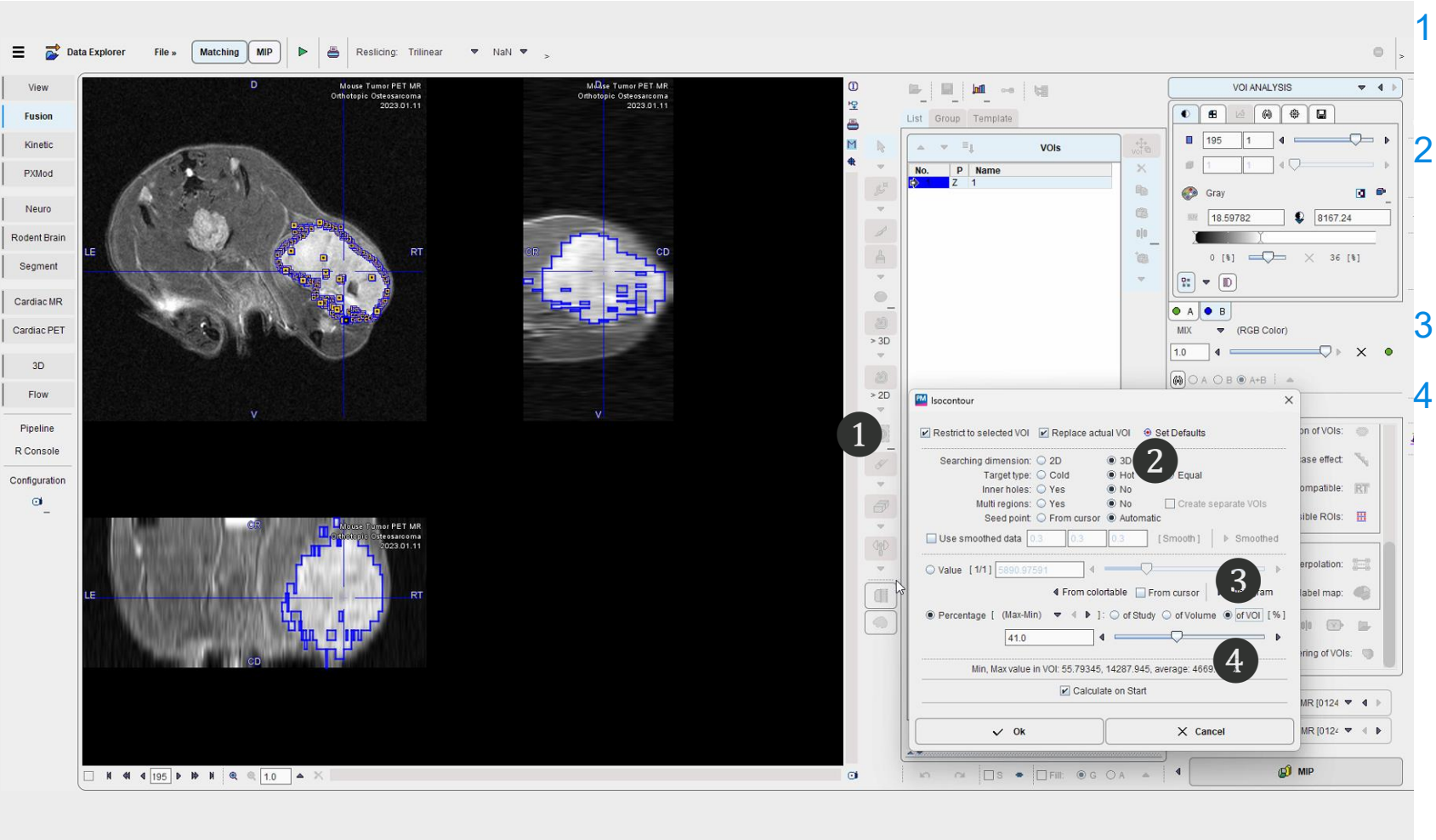
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
1. pmod PFUS VOIs & Iso-Contouring by Region Growing



1. Select **Tab B** to set the current active working image to the CT or MR reference.
2. Set the **Fusion Balance** slider all the way to the right, to visualize only Tab B (fusion slider value 1.0).
3. Select **Create regular VOI.** Select and choose SPHERE (analytic object).
4. Select the **Operation on Entire VOI button**.
5. Adjust the location and boundaries of the sphere to outside the tumor margins.
6. Select **Save VOI.** Tip: If additional studies will be analyzed, it may be useful to save the sphere VOI to the database for recall.

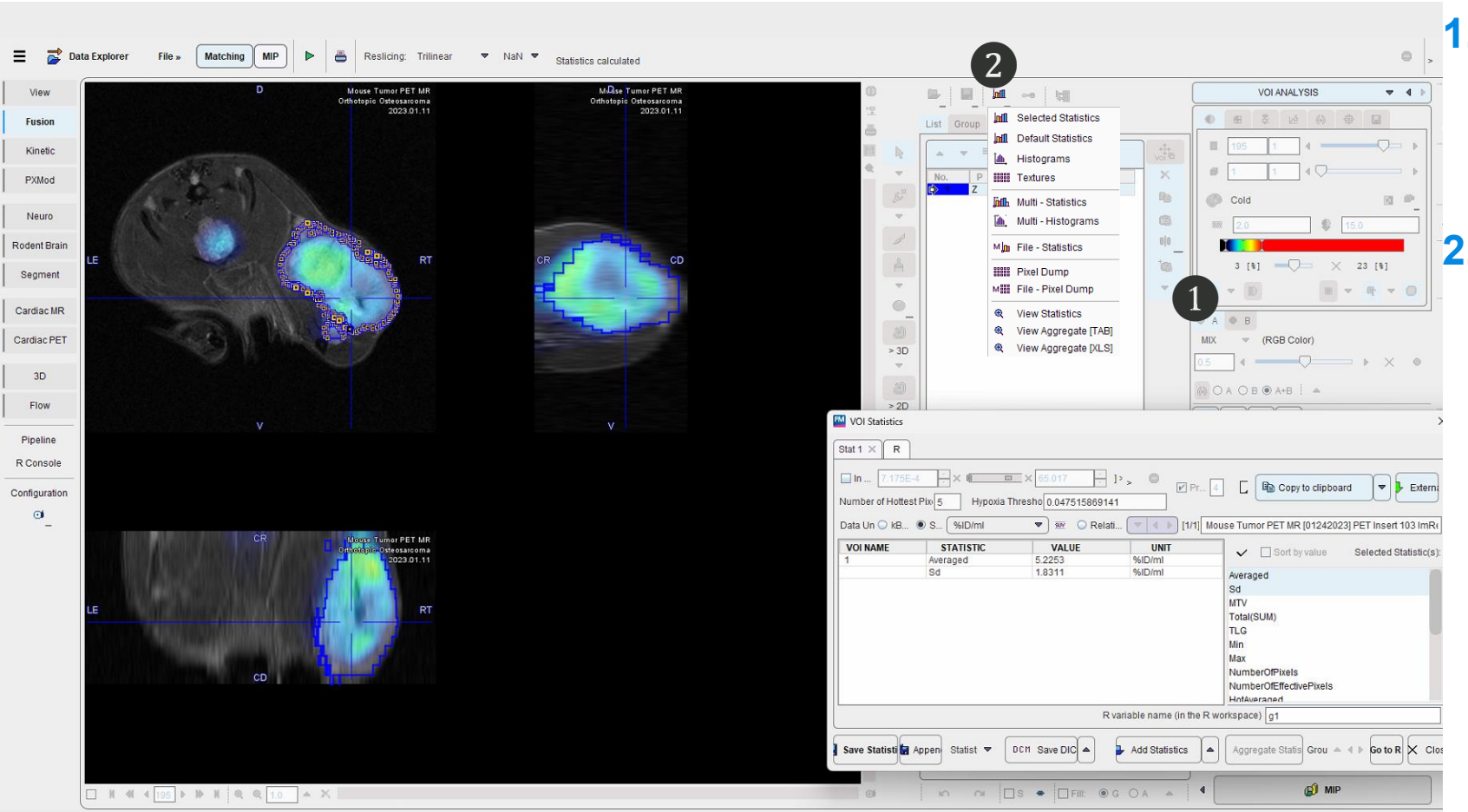
Tip: The Iso-Contouring By Region Growing VOI method is suitable with targets with well defined anatomical or PET signal boundaries

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
1. pmod PFUS VOIs & Iso-Contouring by Region Growing



1. Select button **Iso-contouring by Region Growing,** option **Isocontour.**
2. Check the **“**Hot” target type for e.g. PET signal, and “Cold” target type for negative contrast tissues (e.g. CT lung contrast).
3. Check the Percentage “**of VOI**” selection.
4. Set the thresholding boundaries value and select OK. Tip: Where Iso-contouring by Region Growing is applied directly to the PET image, users most often use a defined %ID/mL (e.g. 10%) value to threshold all data for consistency.

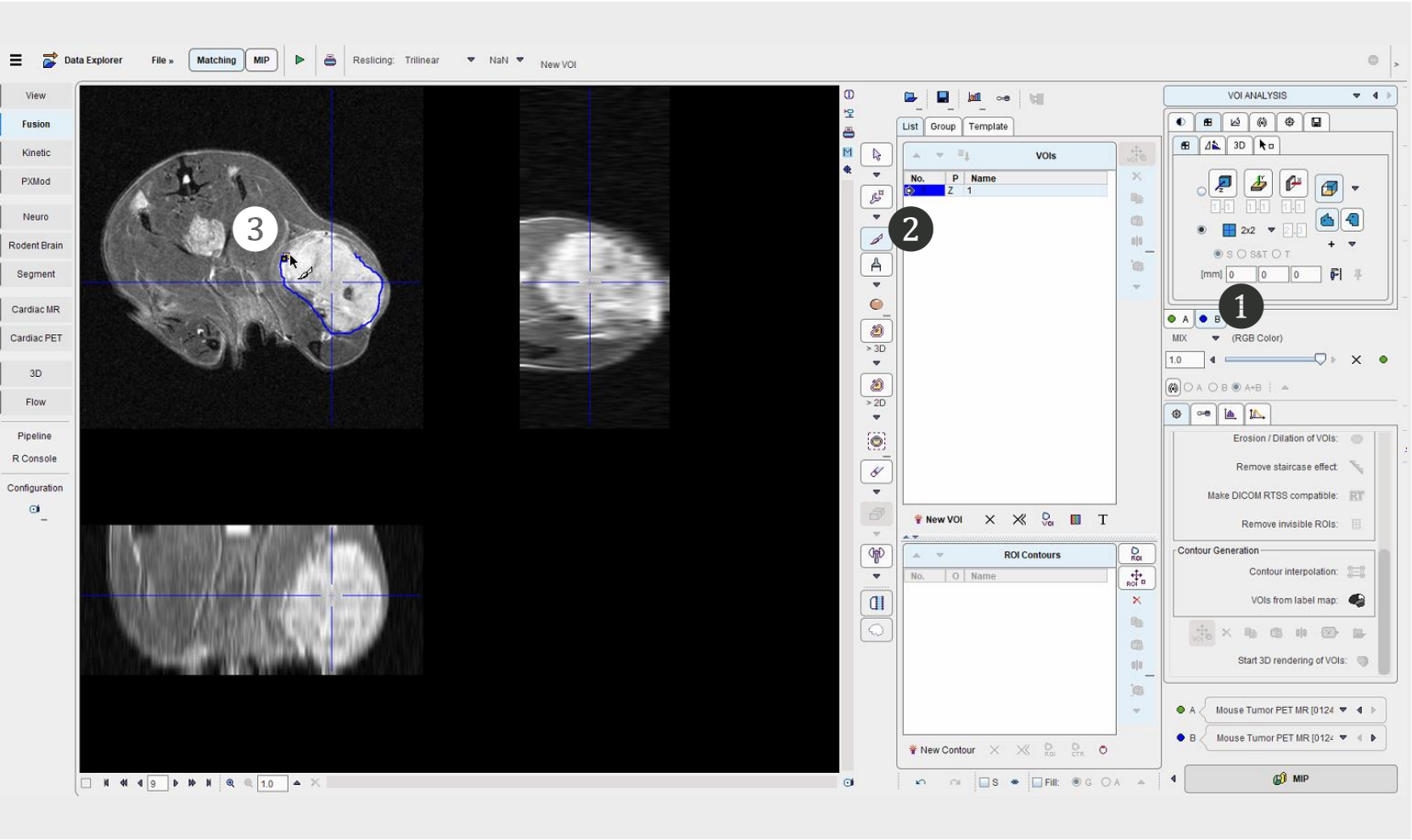
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
1. pmod PFUS VOIs & Iso-Contouring by Region Growing



1. **Tab A.** Select Tab A to set the active image to the PET input data.

2. **VOI Statistics.** Select the VOI Statistics button to view VOI statistic. Tip: Choose “Selected Statistics” or “Default Statistics” when prompted to view your predefined subset of statistics or an interactive menu of statistics respectively.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. pmod PFUS VOI & Freehand with Contour Interpretation

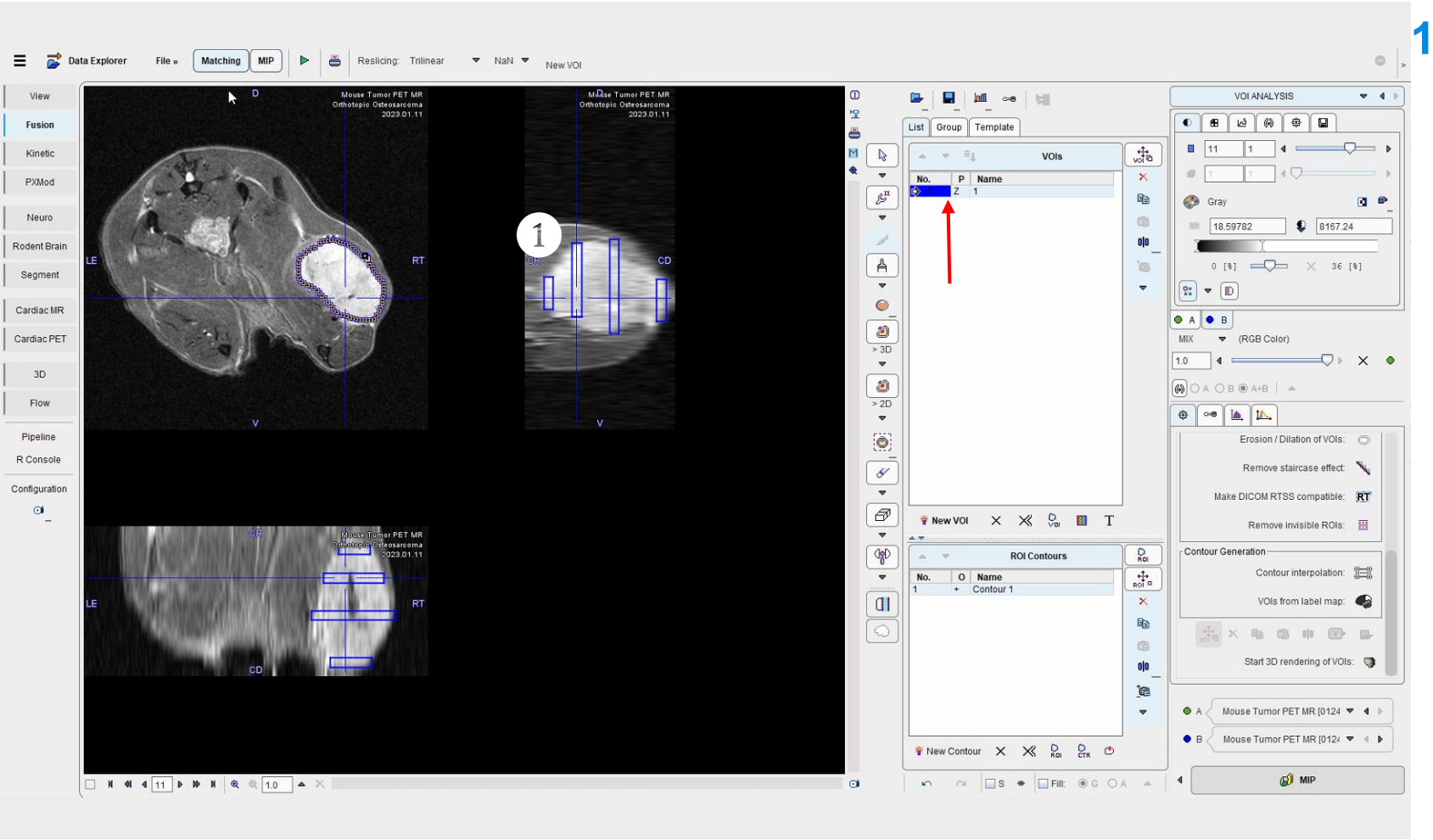


1. Select **Tab B** to set the active working image to CT or MR reference data.

2. Select the **Draw Polygon with Dense Vertices** button.

3. Tracer the ROI boundaries on a selected slice.

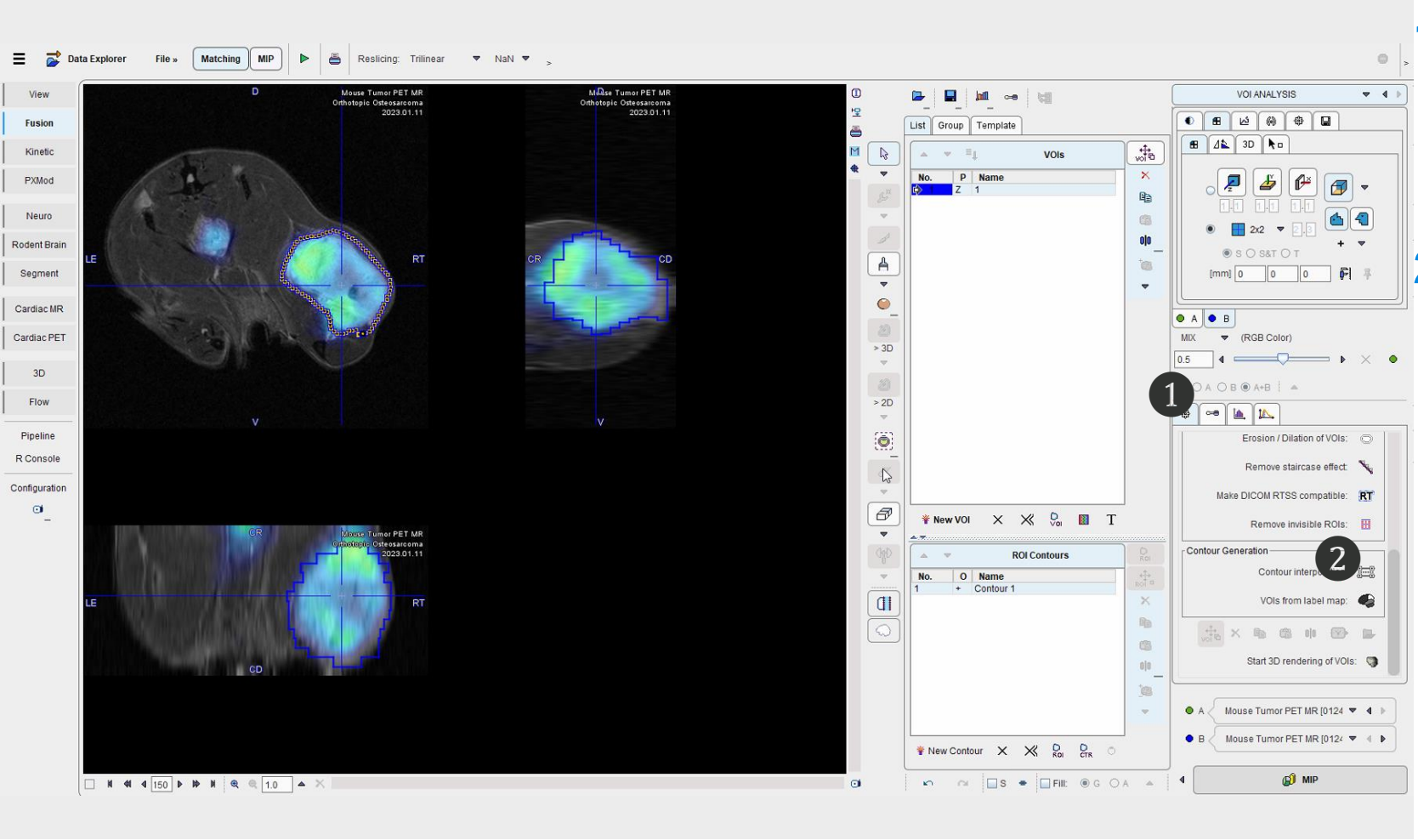
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. pmod PFUS VOI & Freehand with Contour Interpretation



1. **VOI.** Trace the ROI boundaries on additional non-contiguous slices. Slices must be draw in a single axis only (in this example: Z axis – indicated by red arrow).

Tip: The Freehand with Region Growing VOI method is useful for targets with faint boundaries.

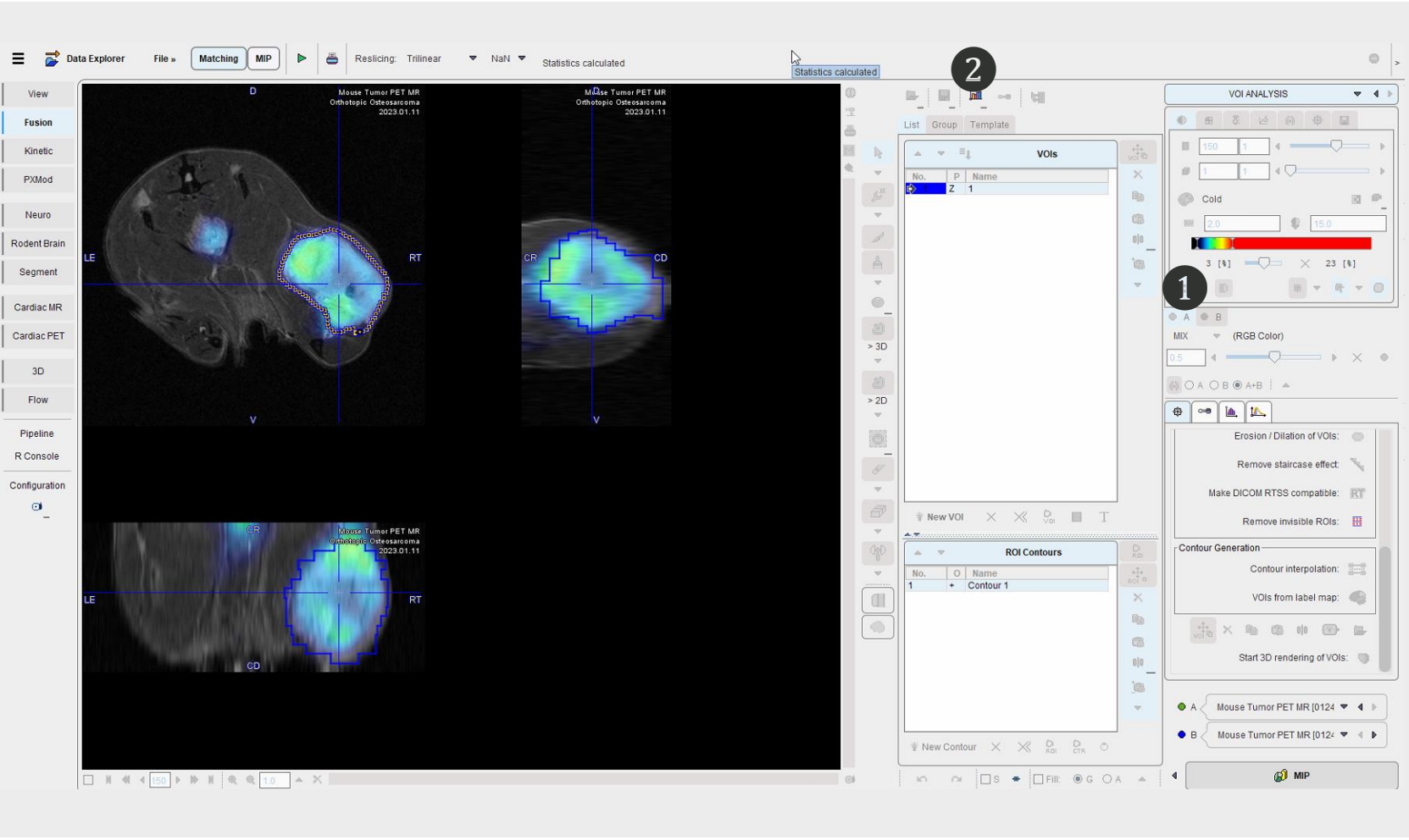
PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. pmod PFUS VOI & Freehand with Contour Interpretation



1. **Masking Tab.** Select the **“Masking…”** tab.

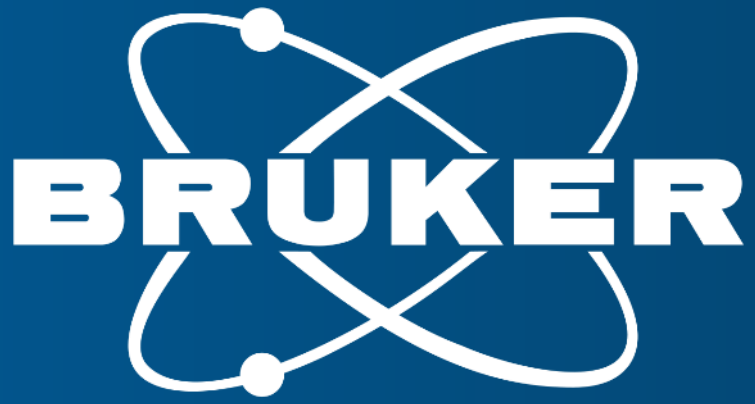
2. **Contour Interpolation.** Select the **Contour Interpolation** button to fill the non-contiguous spaces.

PET/MR & PET/CT: pmod Multimodal Imaging Fusion & Display
2. pmod PFUS VOI & Freehand with Contour Interpretation



1. **Tab A.** Select Tab A to set the active image to the PET input data.

2. **VOI Statistics.** Select the VOI Statistics button to view VOI statistic.



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