NA-MIC
National Alliance for Medical Image Computing
http://www.na-mic.org

Subject Hierarchy

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NA-MIC Tutorial Contest: Winter 2016

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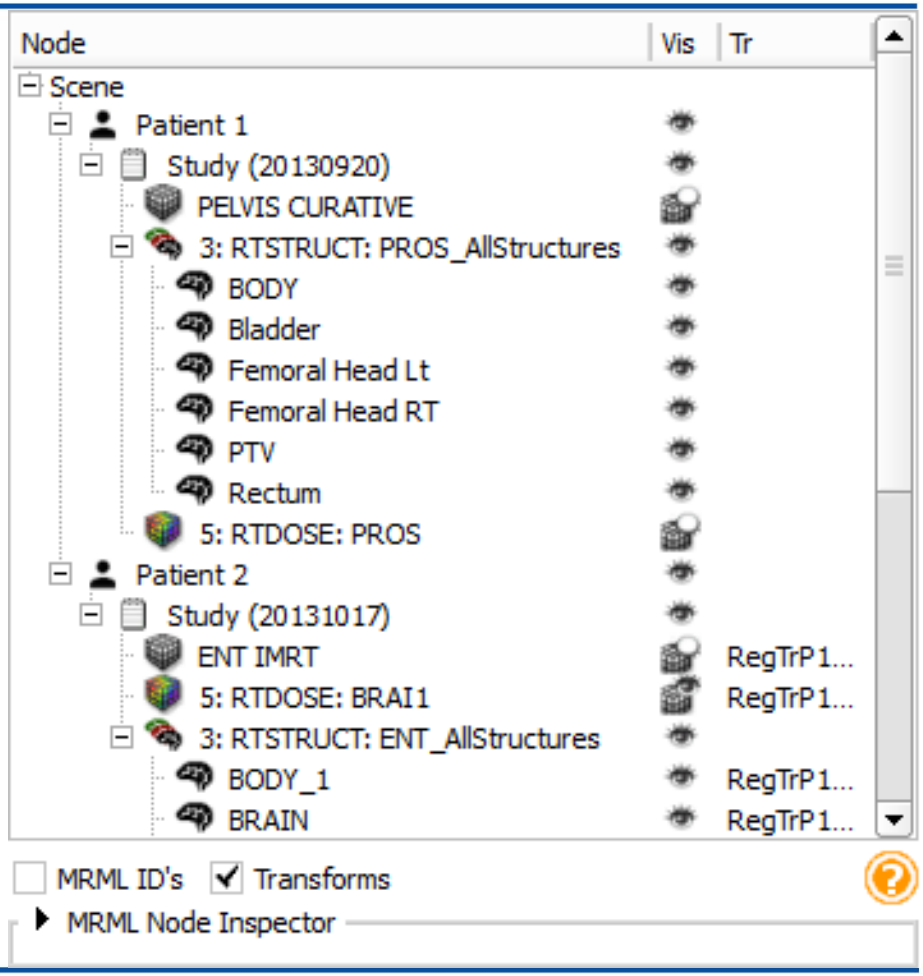
Learning Objective

This tutorial demonstrates the basic usage and potential of Slicer's data manager module Subject Hierarchy using a two-timepoint radiotherapy phantom dataset.



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Material

This tutorial requires the installation of the Slicer4.5 release and the tutorial dataset. They are available at the following locations:

Slicer download page:
http://www.slicer.org/pages/Downloads/

Tutorial dataset: IGRT Tutorial Dataset
http://slicer.kitware.com/midas3/download/item/205404/SlicerRT_WorldCongress_TutorialIGRT_Dataset.zip

Wiki page: http://wiki.slicer.org/slicerWiki/index.php/Documentation/Nightly/Modules/SubjectHierarchy

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Platforms

- Developed and maintained on Windows 64bit, Mac OSX, and Linux 64bit & 32bit

- Slicer requires
  - Minimum 2GB RAM
  - 64 bit strongly suggested

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Overview

1. Install SlicerRT extension
2. Import and load planning data
3. Explore loaded data in Subject hierarchy
4. Load second timepoint data
5. Add loaded data into new study
6. Register second timepoint to planning study with Subject hierarchy

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Part 1: Install SlicerRT extension

- Gives the ability to load radiation therapy data
- Allows demonstrating support of “exotic” data types in Subject hierarchy
- (Please ask the author about support of your data type if not yet available)

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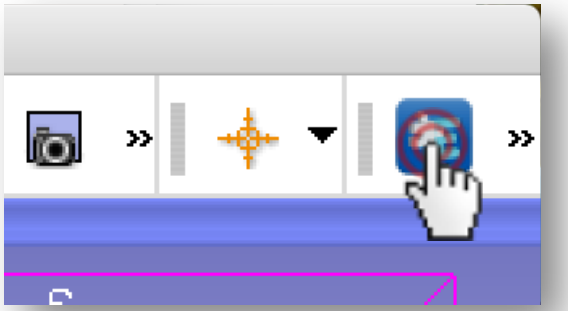
1/1: Install SlicerRT extension

- Open Extension Manager from the toolbar:



- Or from menu
  View / Extension Manager

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1/2: Install SlicerRT extension

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Part 2: Import and load planning data from DICOM

- Phantom dataset taken from a RANDO head&neck phantom
- Contoured for radiation therapy treatment
- Study contains a CT grayscale image and radiotherapy data: dose distribution, treatment beams, and plan information

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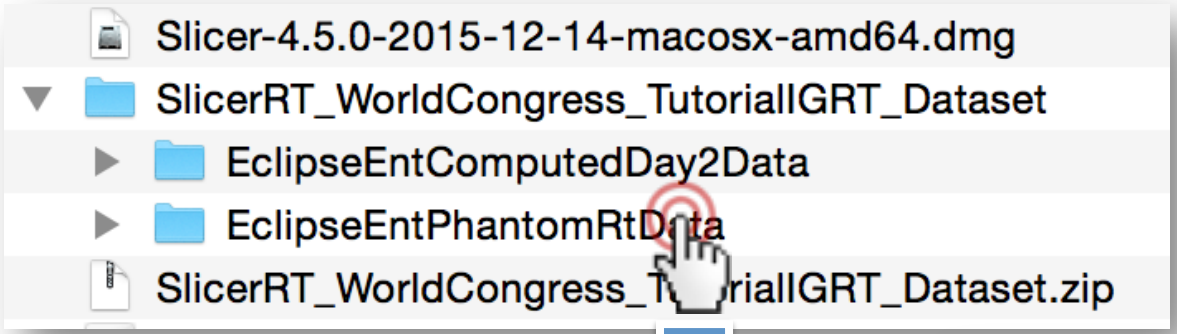
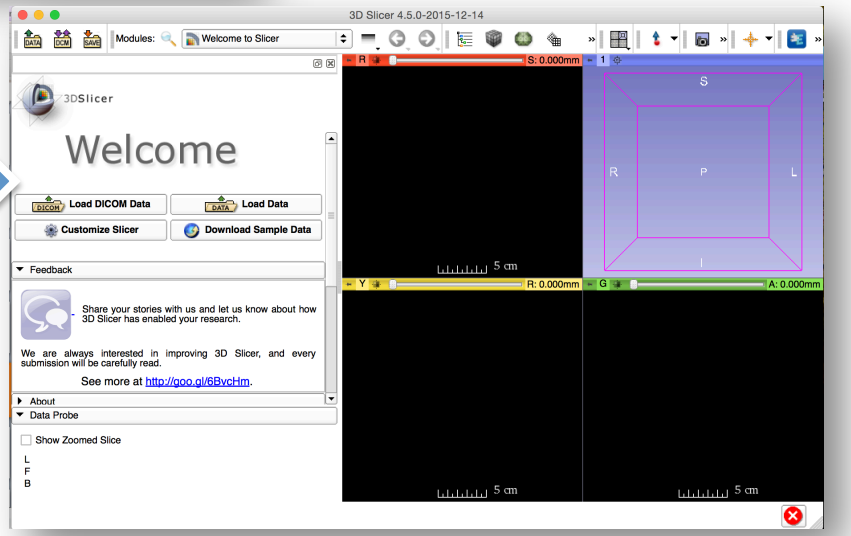
2/1: Import and load planning data from DICOM





Drag&drop ‘EclipseEntPhantomRtData’ onto the Slicer window

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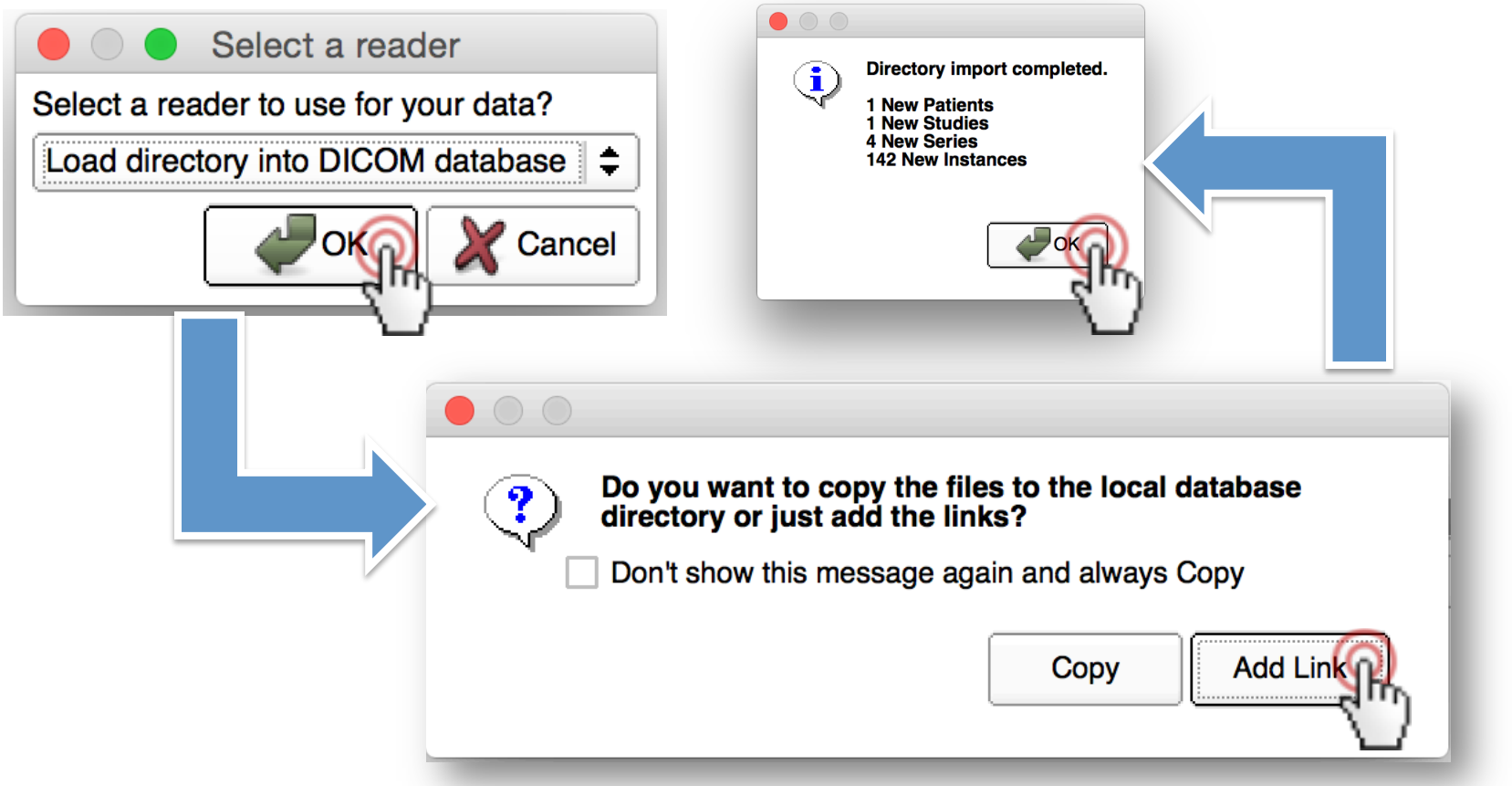
2/2: Import and load planning data from DICOM



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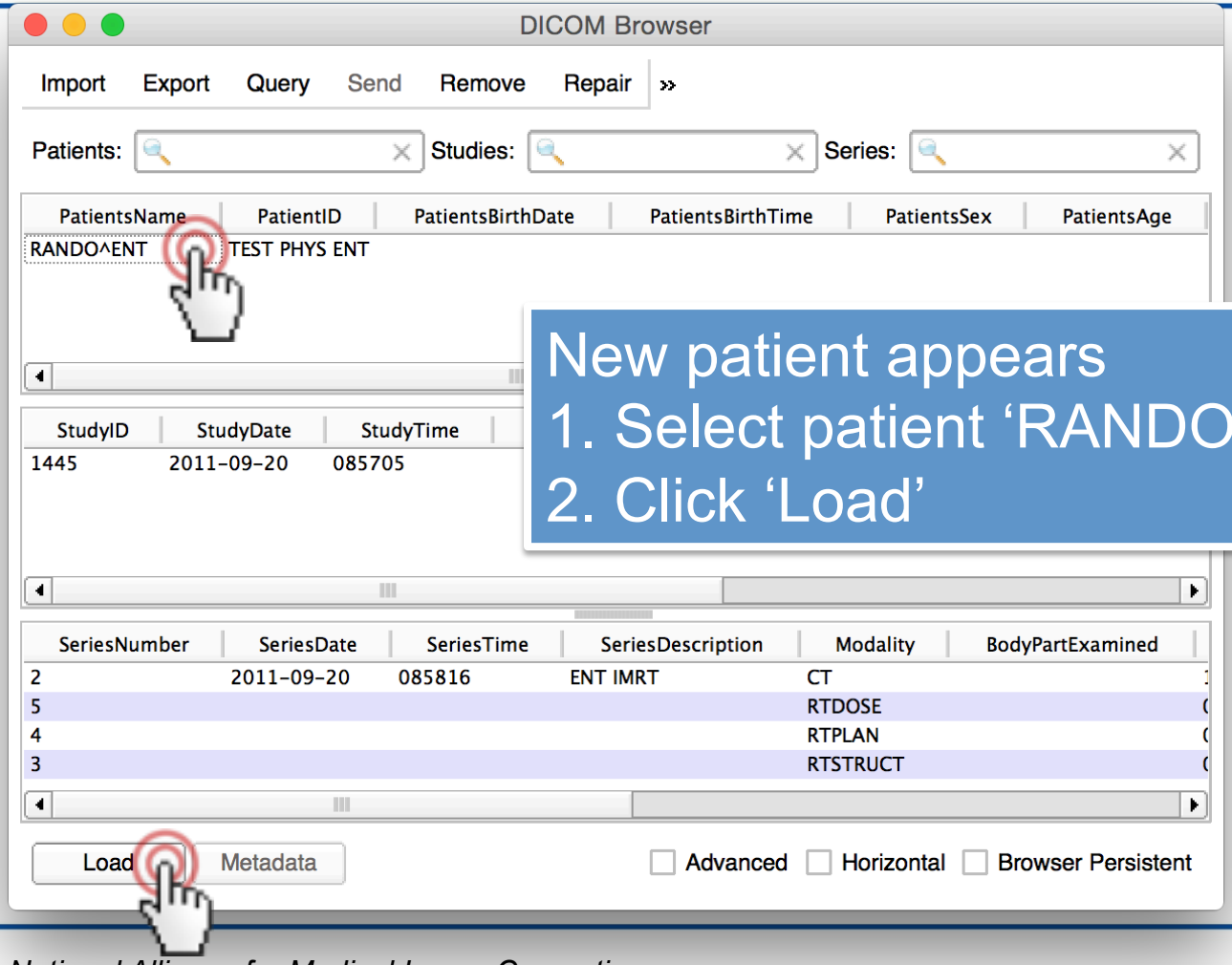
2/3: Import and load planning data from DICOM



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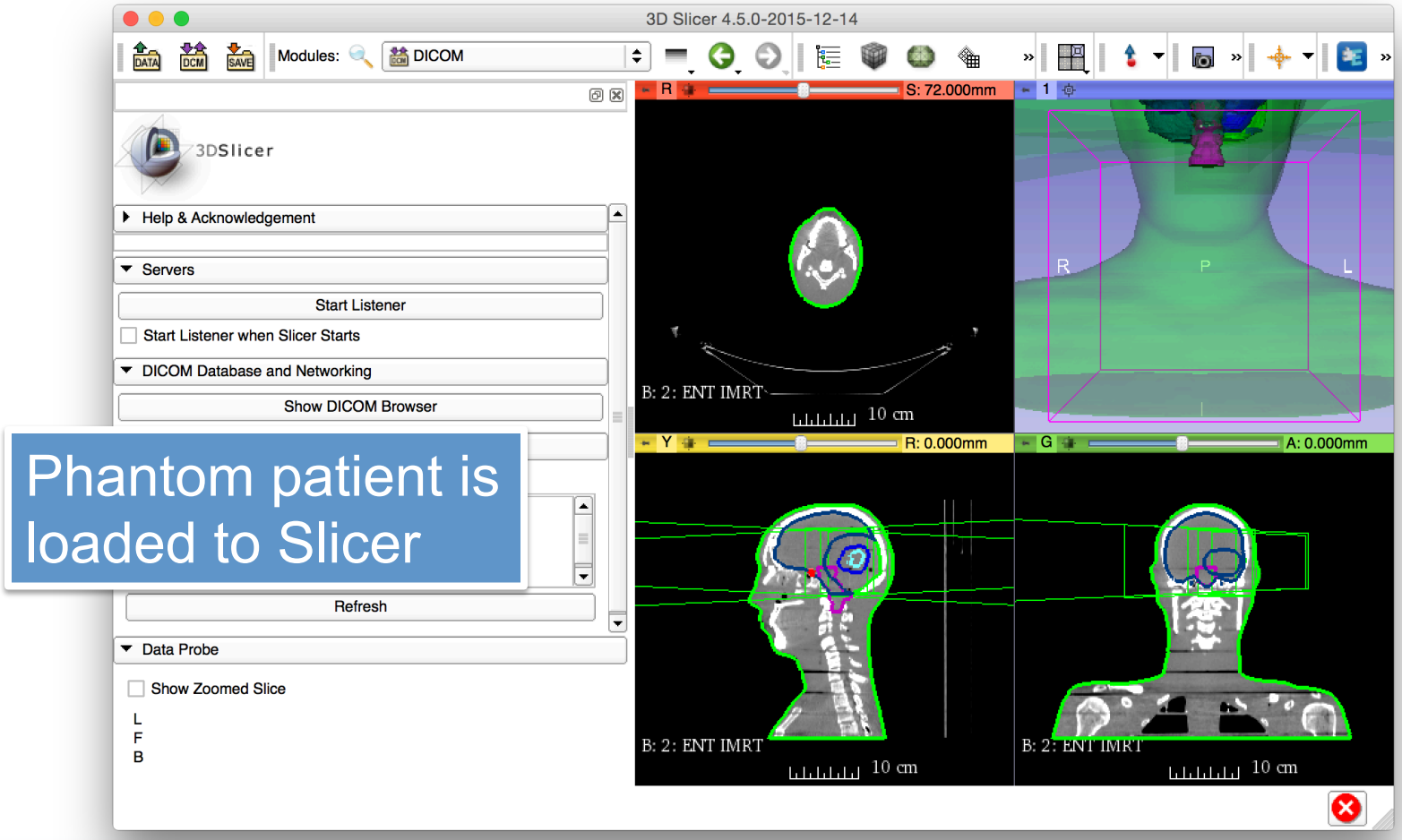
2/4: Import and load planning data from DICOM



Phantom patient is loaded to Slicer

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Part 3: Explore loaded data in Subject hierarchy

- Subject hierarchy automatically creates hierarchy for supported DICOM types
  - DICOM support can be added for any modality if not yet available

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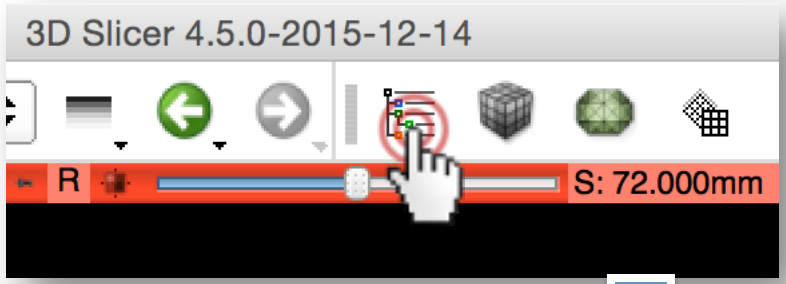
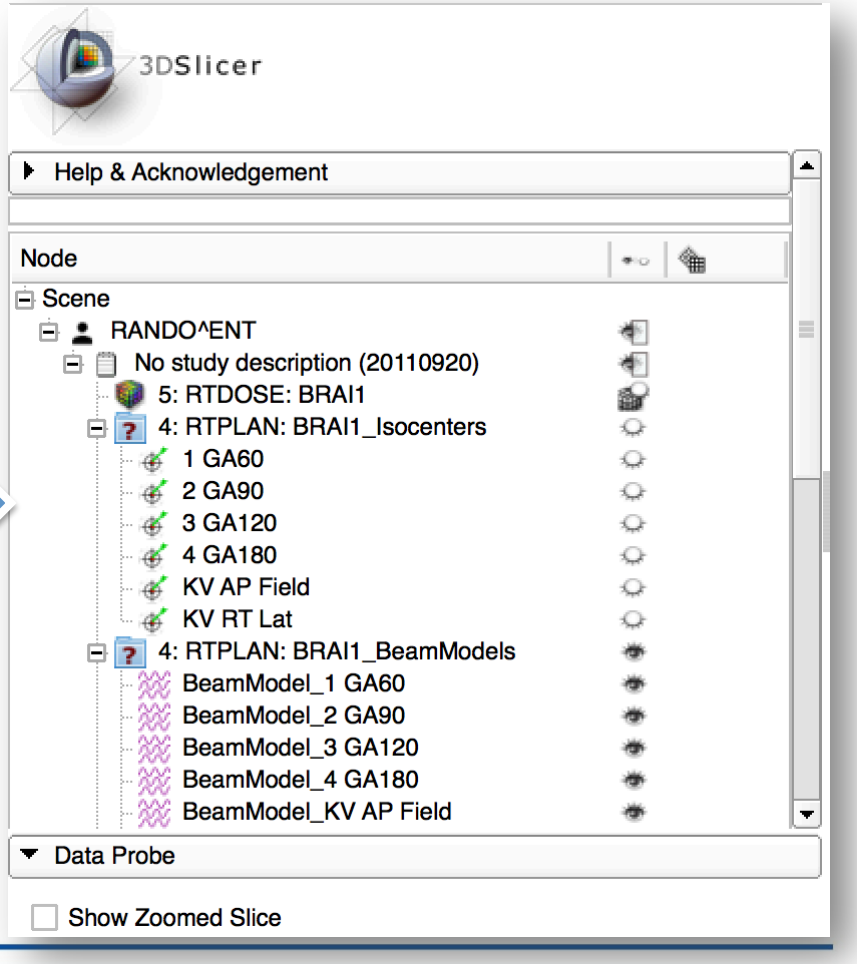
3/1: Explore loaded data in Subject hierarchy





Open Subject hierarchy module from the toolbar or from the module list
- Choose ‘Yes to All’

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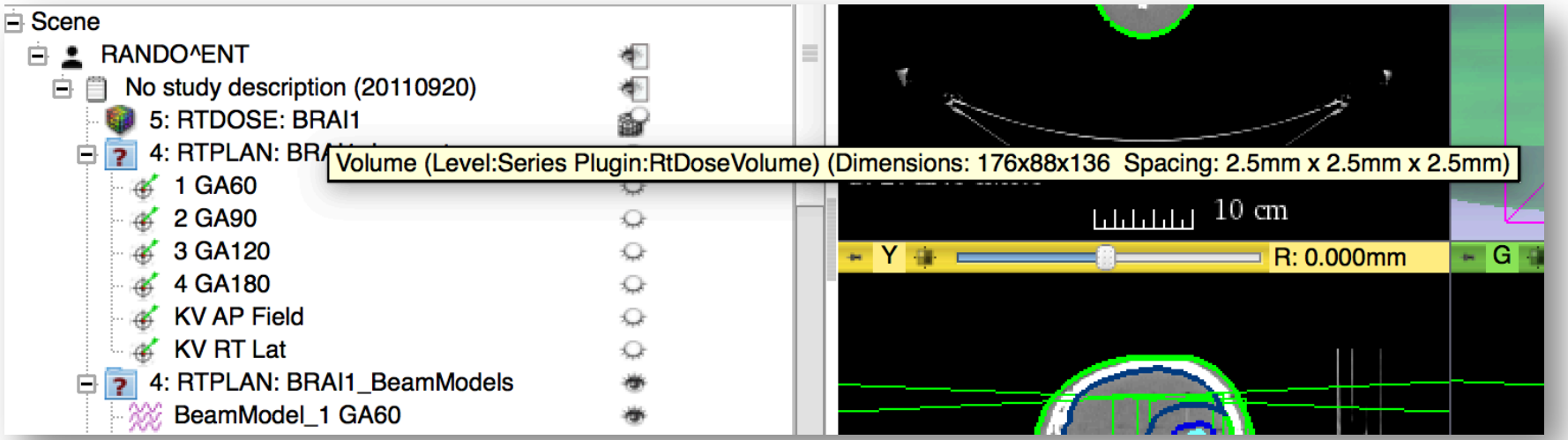
3/2: Explore loaded data in Subject hierarchy



Get more information about nodes by moving the mouse over the node in the tree

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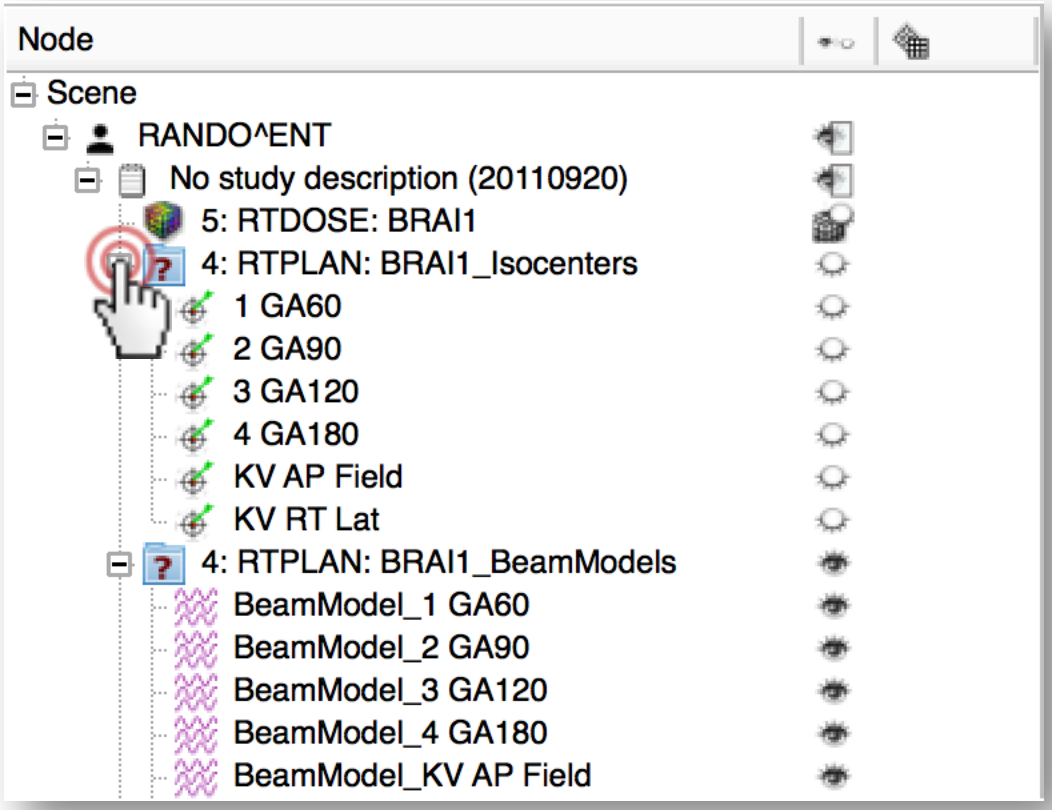
3/3: Explore loaded data in Subject hierarchy



Collapse branches by clicking the box next to the node's icon

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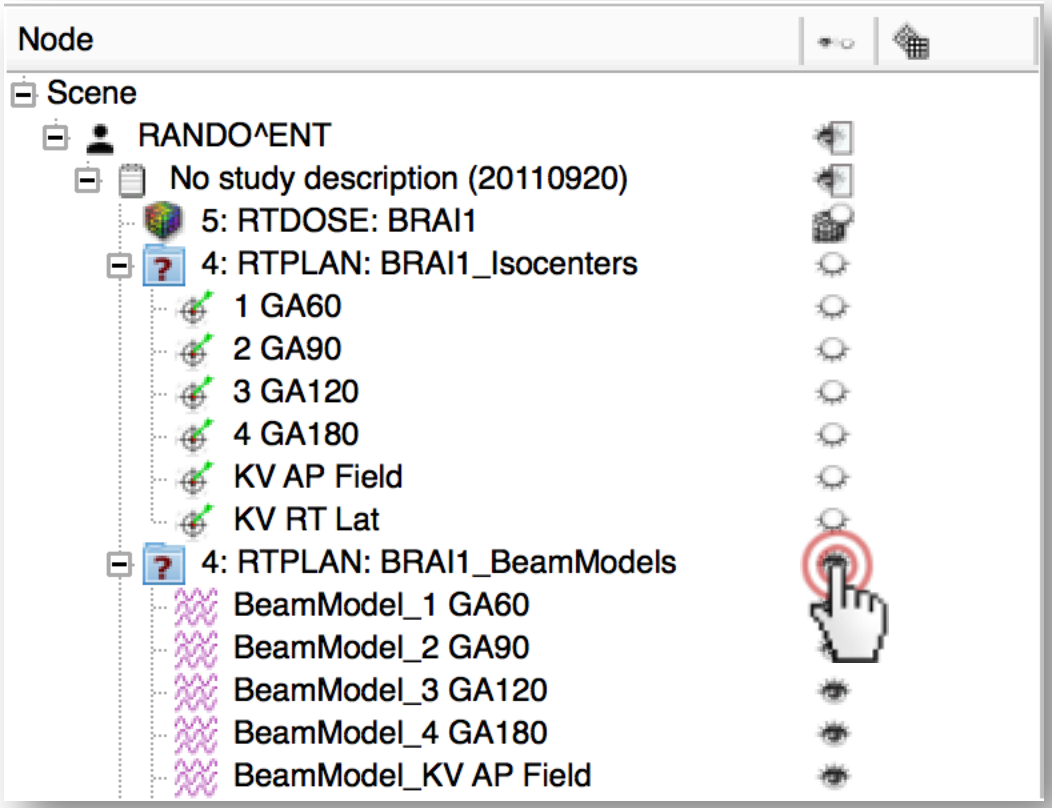
3/4: Explore loaded data in Subject hierarchy



Show/hide nodes or entire branches by clicking the eye icon in the node's row

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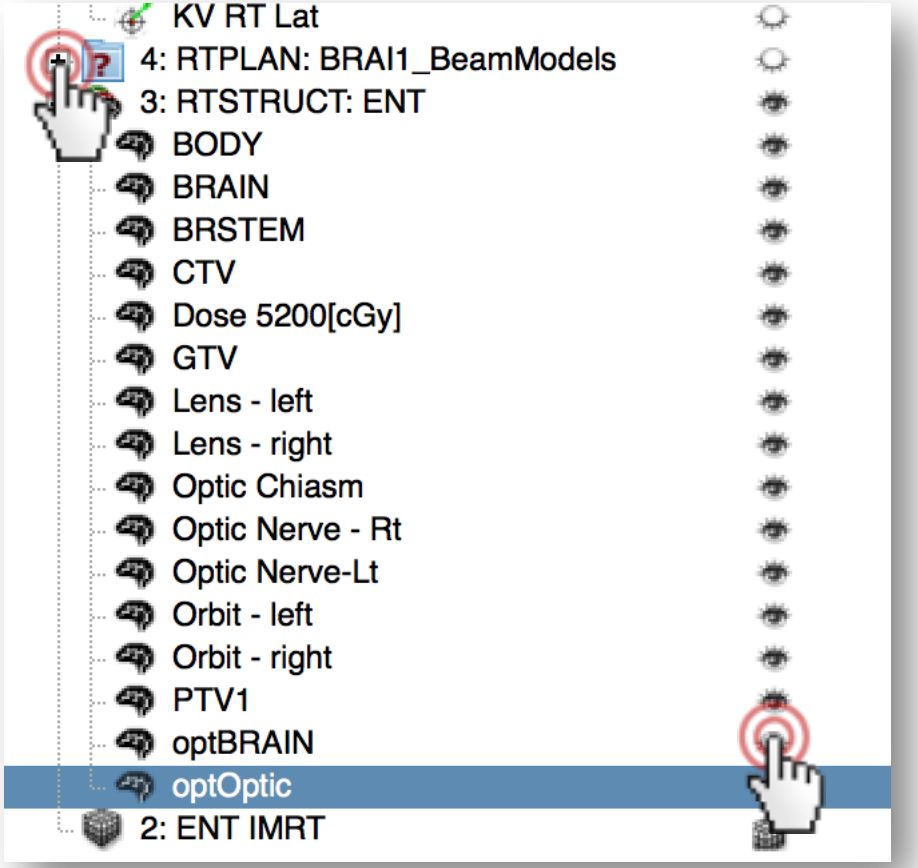
3/5: Explore loaded data in Subject hierarchy



1. Hide and collapse beam models to make the tree more compact
2. Hide structures ‘optBRAIN’ and ‘optOptic’ to see the inner organs in the head in the 3D view

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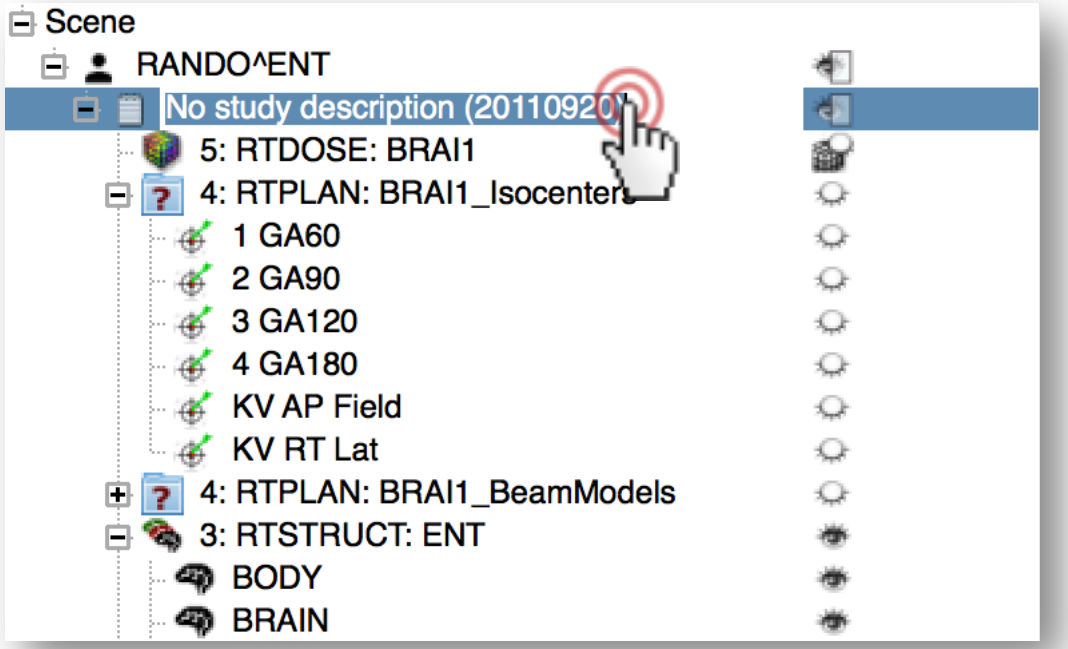
3/6: Explore loaded data in Subject hierarchy



1. Enter renaming mode for the study node by double clicking on its name 'No study description…'.
2. Rename it to 'Planning study'
3. Press Enter

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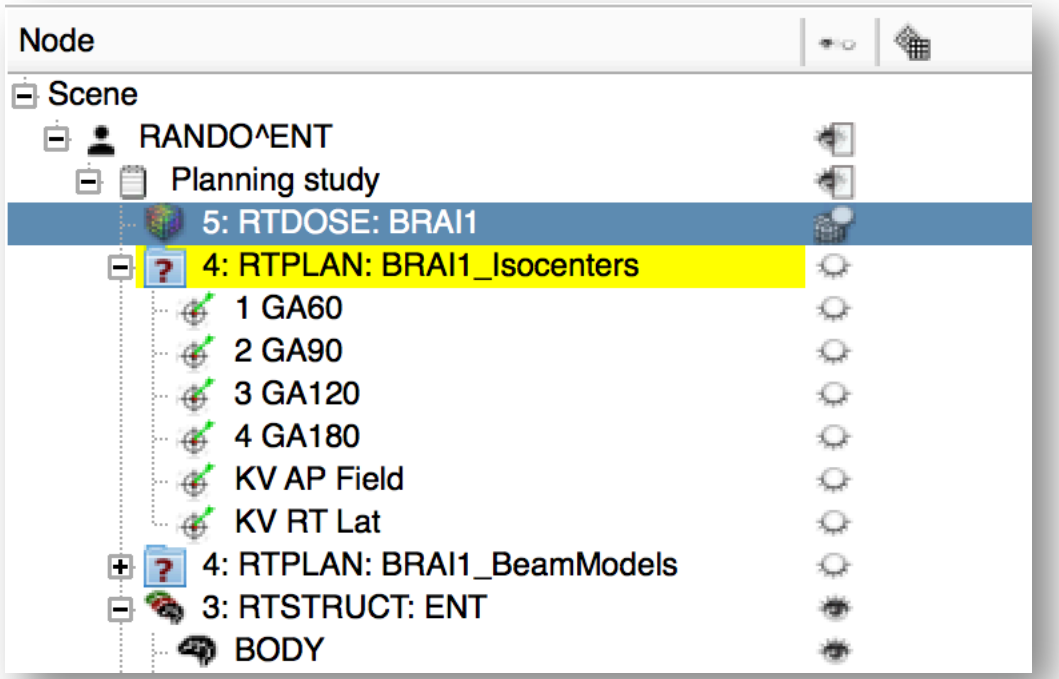
3/7: Explore loaded data in Subject hierarchy



Data objects referenced in DICOM by the selected node are highlighted in yellow

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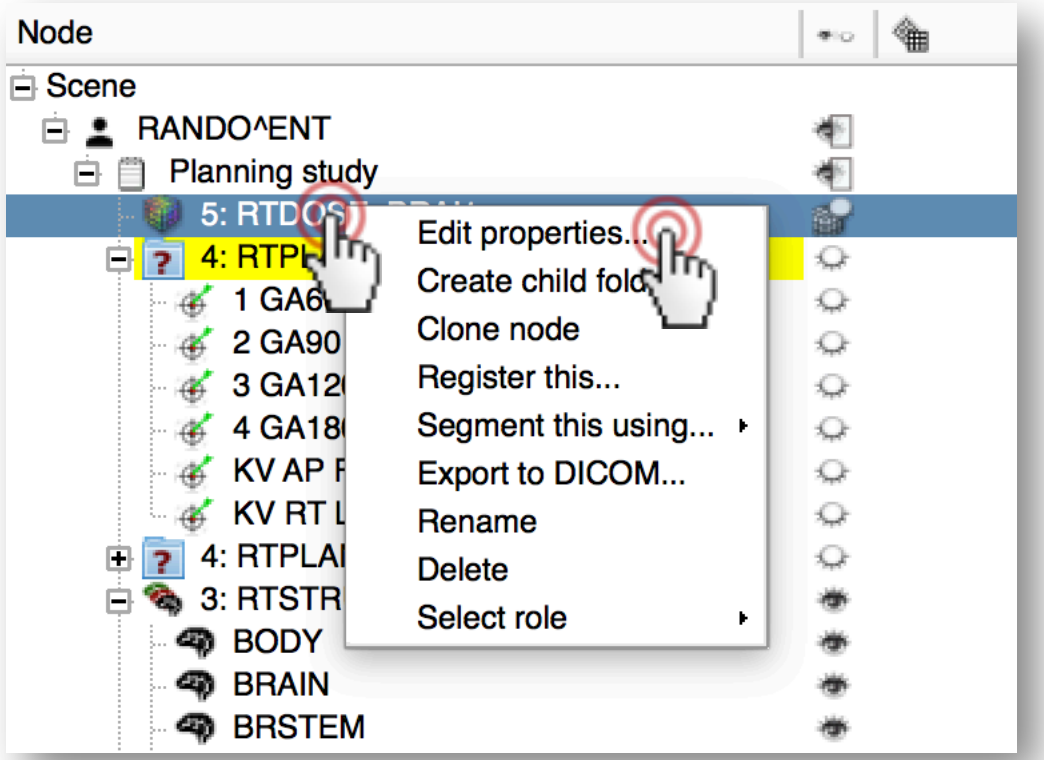
3/8: Explore loaded data in Subject hierarchy



1. Right-click on a node to access all actions associated to it.
2. Click 'Edit properties…' to switch to the module that handles the node

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Part 4: Load second timepoint data

- Simulated second timepoint for the same phantom dataset
  - Artificial deformation field applied on phantom CT and dose distribution
- Illustrates “day two” scenario of a hypothetical radiotherapy patient
- Stored in NRRD files

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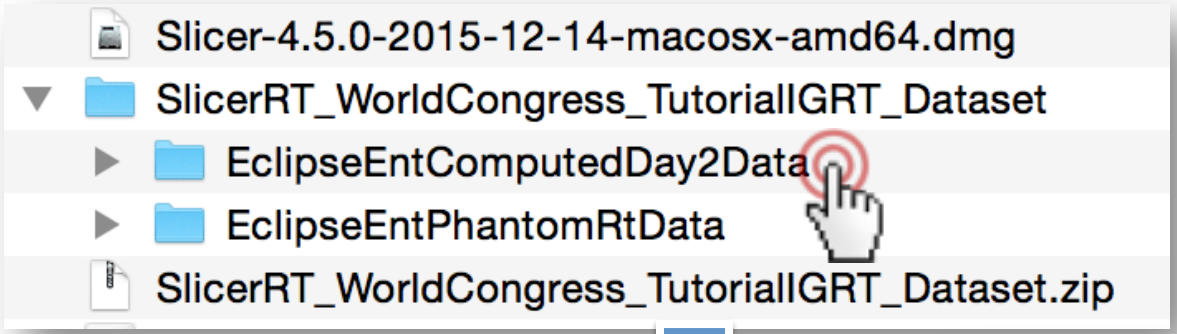
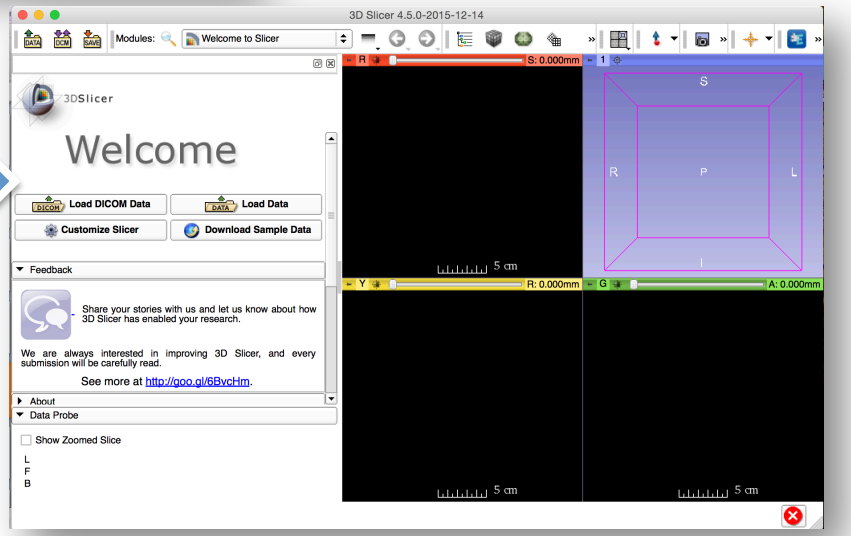
4/1: Load second timepoint data





Drag&drop ‘EclipseEntComputedDay2 Data’ onto the Slicer

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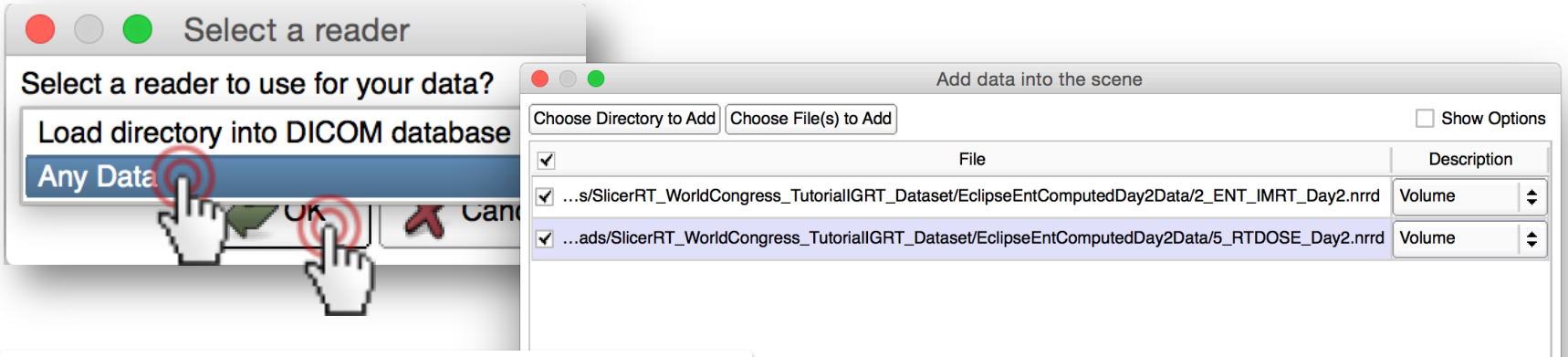
4/2: Load second timepoint data



1. Choose ‘Any Data’ in the pop-up dialog
2. Click OK. Add data window appears.
3. Click OK

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Part 5: Add day two data into new study

- Non-DICOM data such as NRRD are not automatically added to hierarchy
- Manual assignment of data into studies is possible
- (Solution is in place for automatic arrangement for data loaded from local directory structure – please consult module wiki page)

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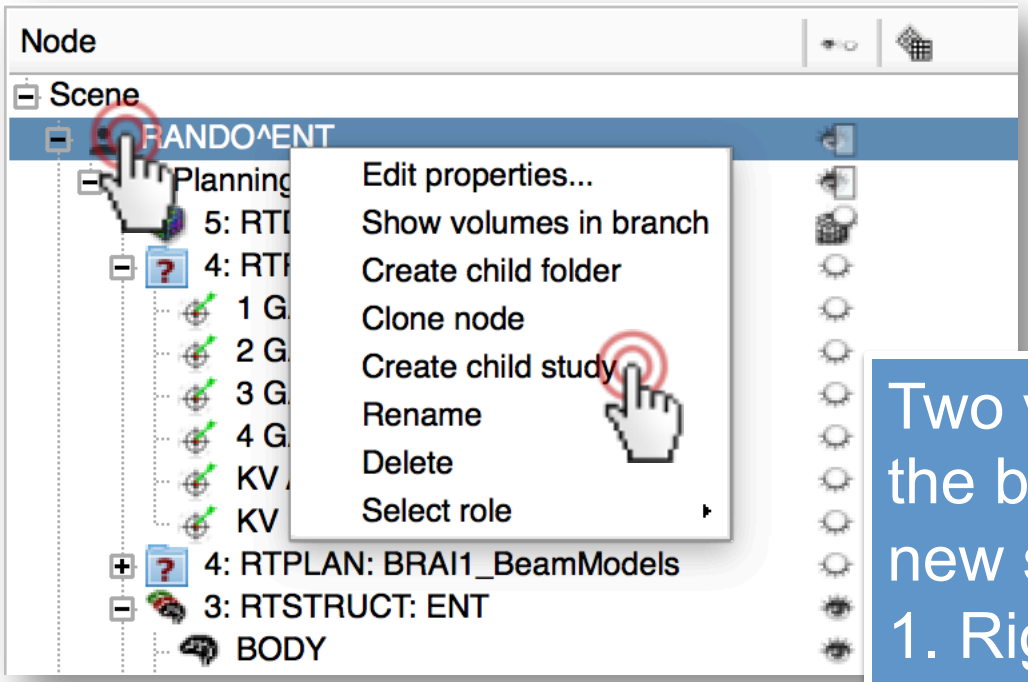
5/1: Add day two data into new study



Two volumes appeared on the bottom. Let's create a new study for them.

1. Right-click the patient
2. Select 'Create child study'

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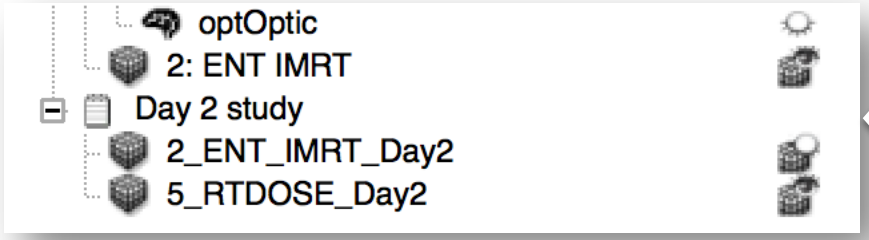
5/2: Add day two data into new study



1. Rename new study (appearing under the data in the planning study) to 'Day 2 study' after double-clicking its name
2. Select the two nodes by clicking the first one, then holding shift button and clicking the second one
3. Drag&drop the two selected nodes onto Day 2 study

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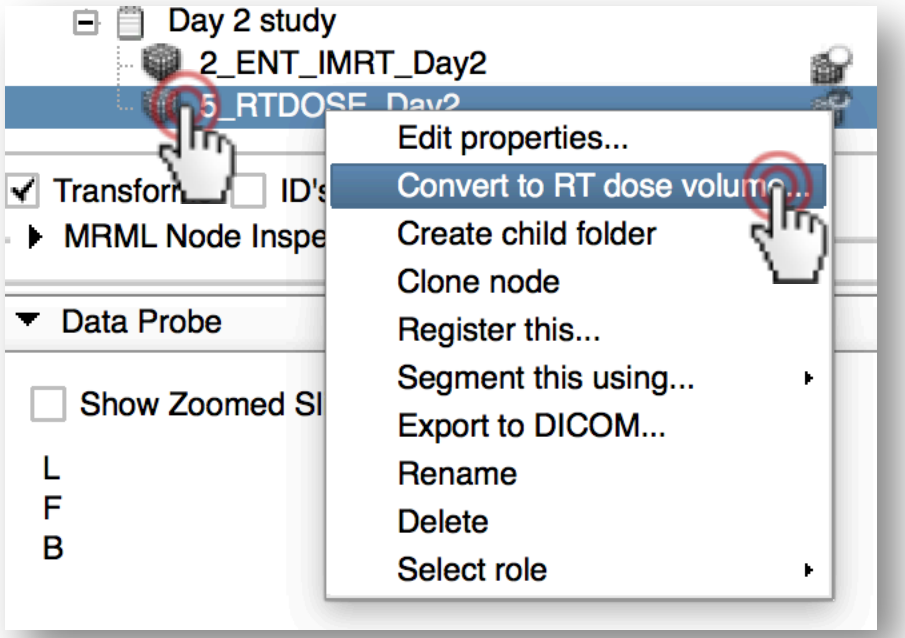
5/3: Add day two data into new study



Let's use a modality-specific action.

1. Right-click on the volume named '5_RTDOSE_Day2'
2. Choose 'Convert to RT dose volume…'
3. Click OK on both dialogs
4. Notice the icon change

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Part 6: Register day two study to planning study

- Allows accumulation of dose for both day's treatment sessions
- Demonstrates actions defined by Subject hierarchy plugins facilitating direct access of functions from the hierarchy
- (Please ask the author about potential new actions)

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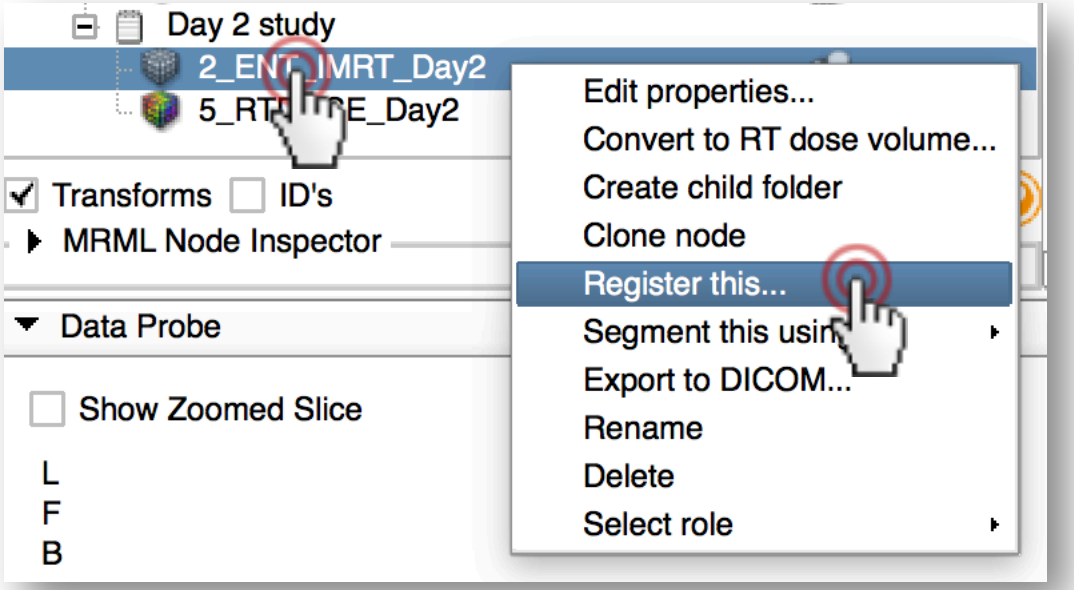
6/1: Register day two study to planning study



1. Right-click on '2_ENT_IMRT_Day2'
2. Select 'Register this…'

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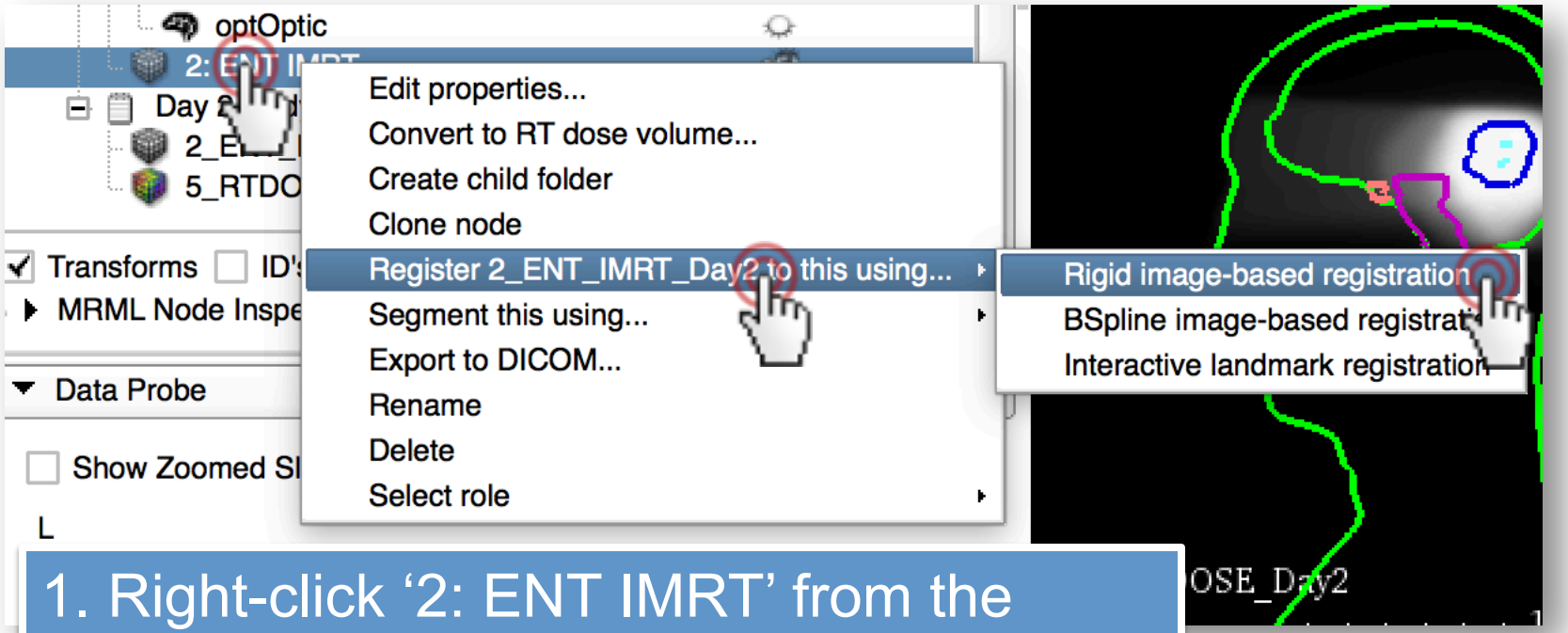
6/2: Register day two study to planning study



1. Right-click ‘2: ENT IMRT’ from the planning study
2. Go to ‘Register 2_ENT_…’
3. Select ‘Rigid image-based registration’

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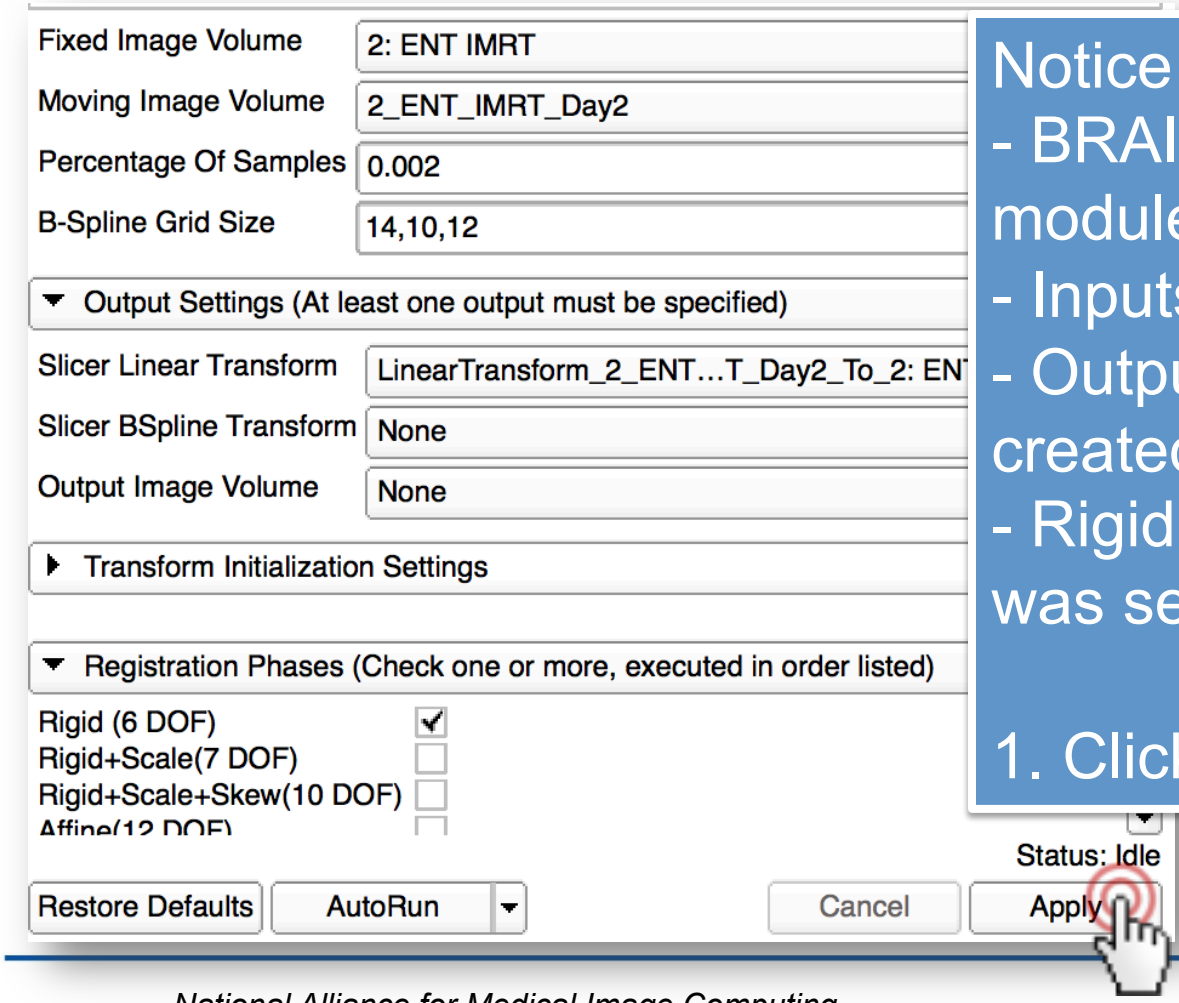
6/3: Register day two study to planning study



Notice that
- BRAINS registration module was selected
- Inputs were selected
- Output transform was created
- Rigid (6 DOF) phase was selected

1. Click Apply

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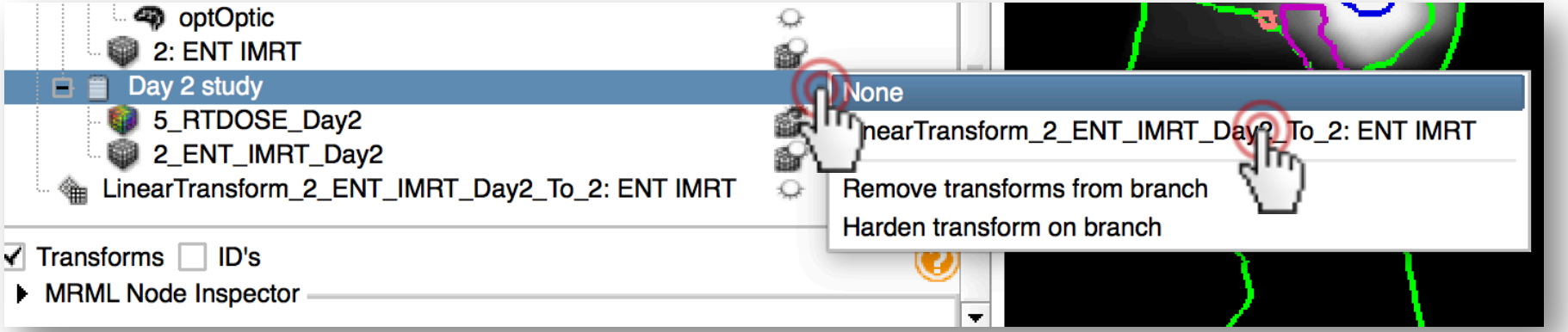
6/4: Register day two study to planning study



1. Once registration is done, switch back to Subject hierarchy
2. Notice that the transform was already applied to the CT volume
3. Double-click on the empty space in the rightmost transform column of Day 2 study
4. Open the selector by clicking ‘None’, and select the transform

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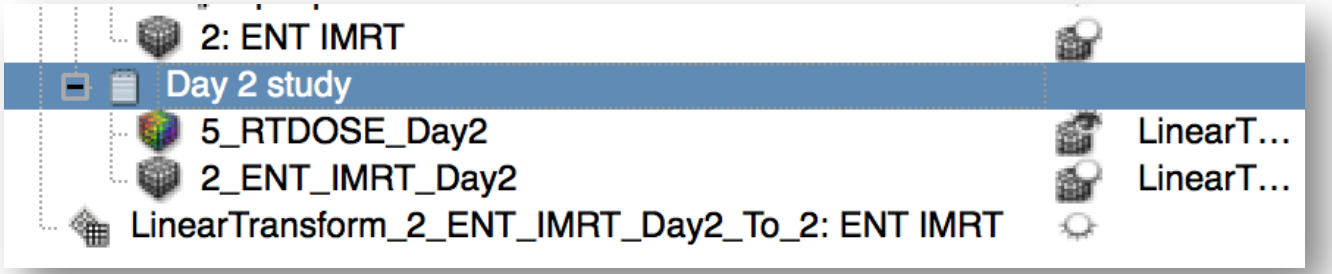
6/5: Register day two study to planning study



Notice that the transform was also set to the dose volume. Using the same action, any transform can be applied to whole branches.
This step allowed us to accumulate dose distributions for a patient delivered over two time points.

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Conclusion

Subject hierarchy is a central access point to review and organize data loaded into Slicer, while offering direct access to Slicer functions.

New data types and actions can be added to Subject hierarchy.

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Acknowledgments

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