

SlicerIGT tutorial 2019

brain surgery navigation with live tractography

for 3D Slicer version 4.10

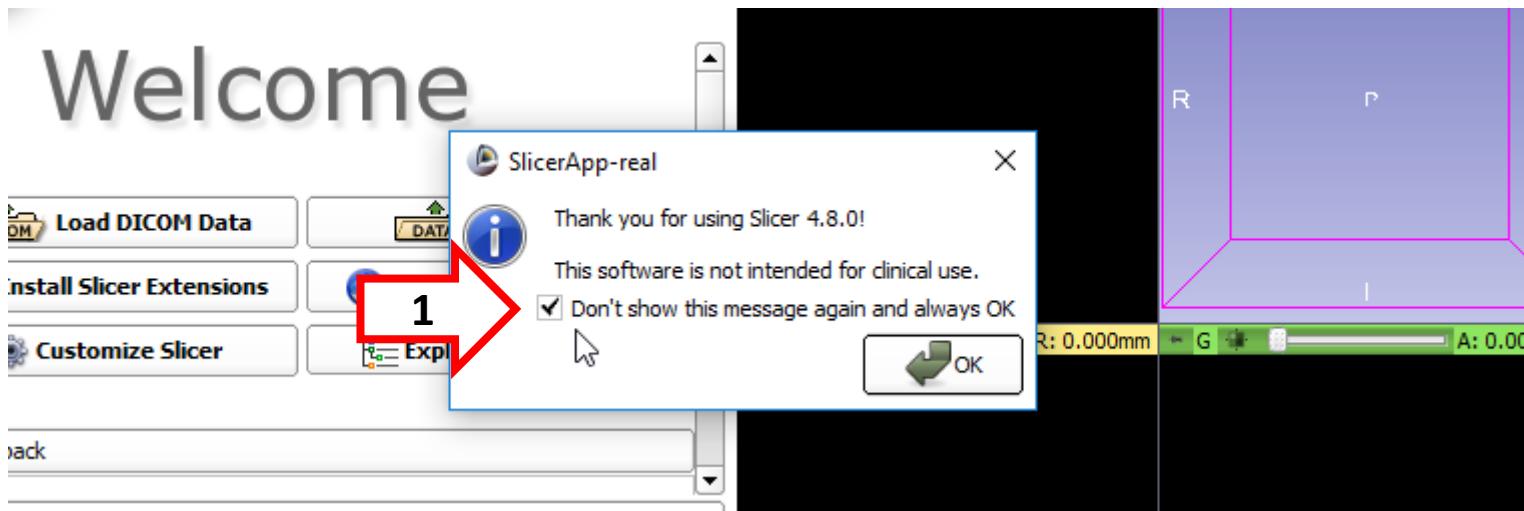
Prerequisites

This tutorial can be completed without any previous tutorials, but these tutorials are recommended

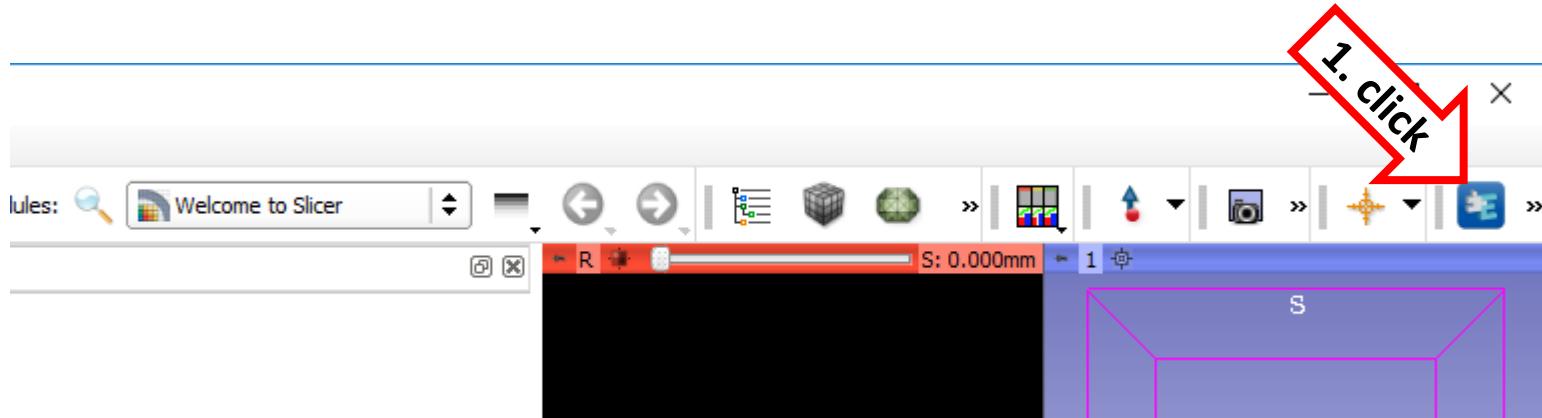
- Slicer4 Minute Tutorial from
<https://www.slicer.org/wiki/Documentation/4.8/Training>
- Diffusion Tensor Imaging tutorial from
https://www.slicer.org/wiki/Documentation/4.8/Training#Slicer4_Diffusion_Tensor_Imaging_Tutorial
- Previous SlicerIGT tutorials from
<http://www.slicerigt.org/wp/user-tutorial/>

Install Slicer

- Visit <http://download.slicer.org/>
- Download Slicer version 4.8 (blue buttons) for your operating system
- Run the downloaded installer
- Start up Slicer



Install Slicer extensions



**2. Find and install these extensions:
SlicerIGT, Sequences, SlicerDMRI**

The Slicer extension manager interface. It shows three available extensions:

- SlicerIGT**: Anatomical segmentation tool. Status: Available. Clicked by a red arrow labeled "3. click".
- Sequences**: Sequence analysis tool. Status: Available. Clicked by a red arrow labeled "4. click".
- SlicerDMRI**: Diffusion MRI analysis tool. Status: Available. Clicked by a red arrow labeled "5. click".

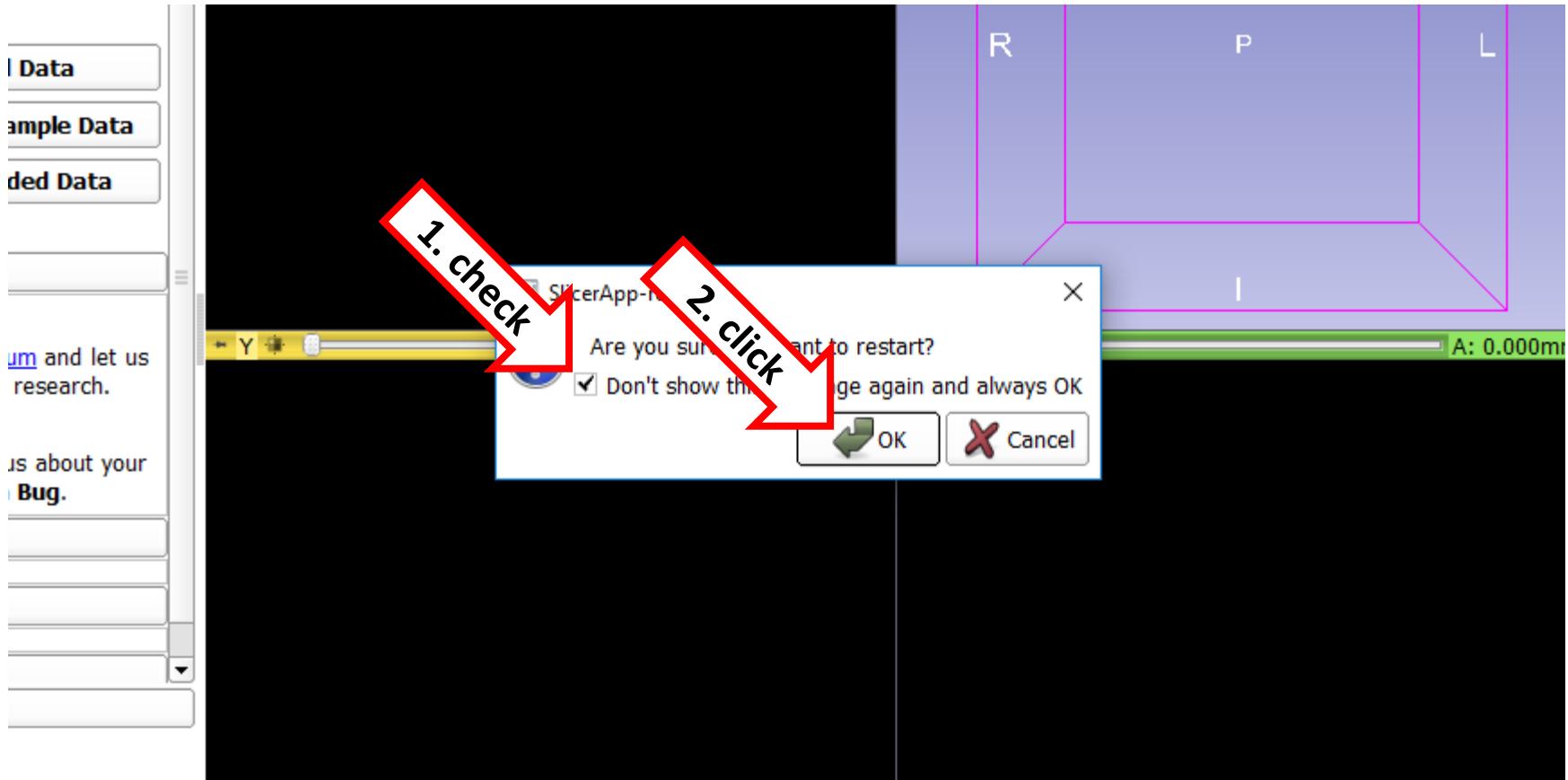
An "Install dependencies" dialog box from Kitware. It lists dependencies for SlicerDMRI:

- OMRI depends on the following extensions:
 - Tractography

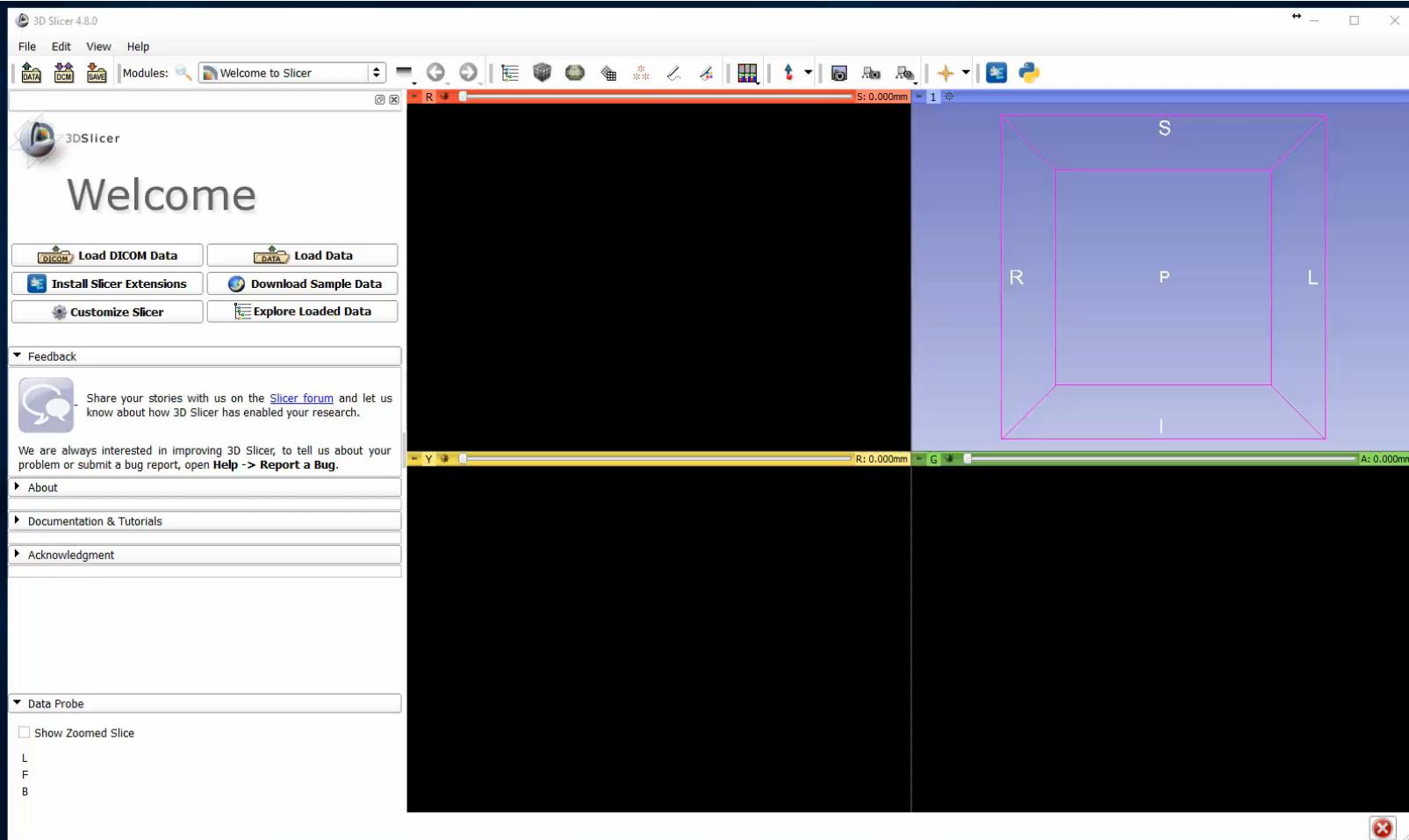
It asks: "Would you like to install them now?" with "Yes" and "No" buttons. A red arrow labeled "6. click" points to the "Yes" button.

The Slicer application window after the extensions have been installed. A red arrow labeled "7. click" points to the "Restart" button at the bottom left of the window.

Approve restart of Slicer (if asked)

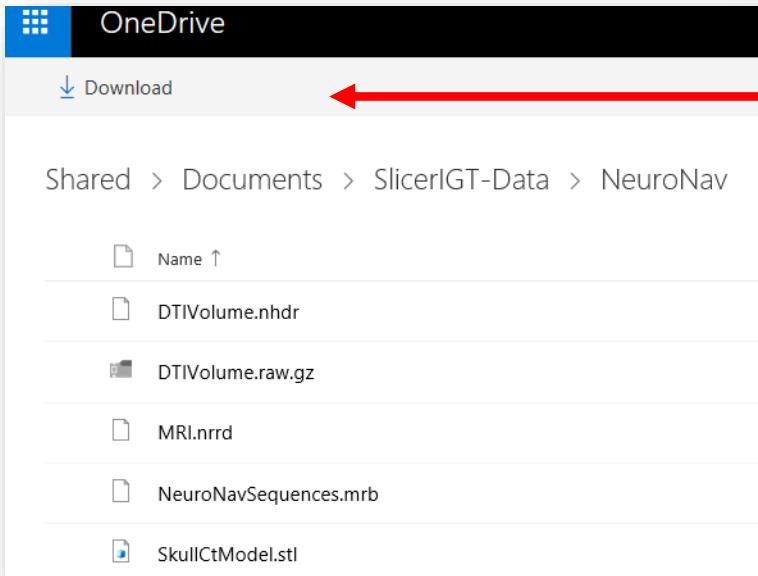


Verify extensions installed



Download tutorial data

- Visit the tutorial website:
<http://www.slicerigt.org/wp/user-tutorial/>
- Go to the SlicerIGT-Data folder
- Go to *NeuroNav* folder
- Download all files



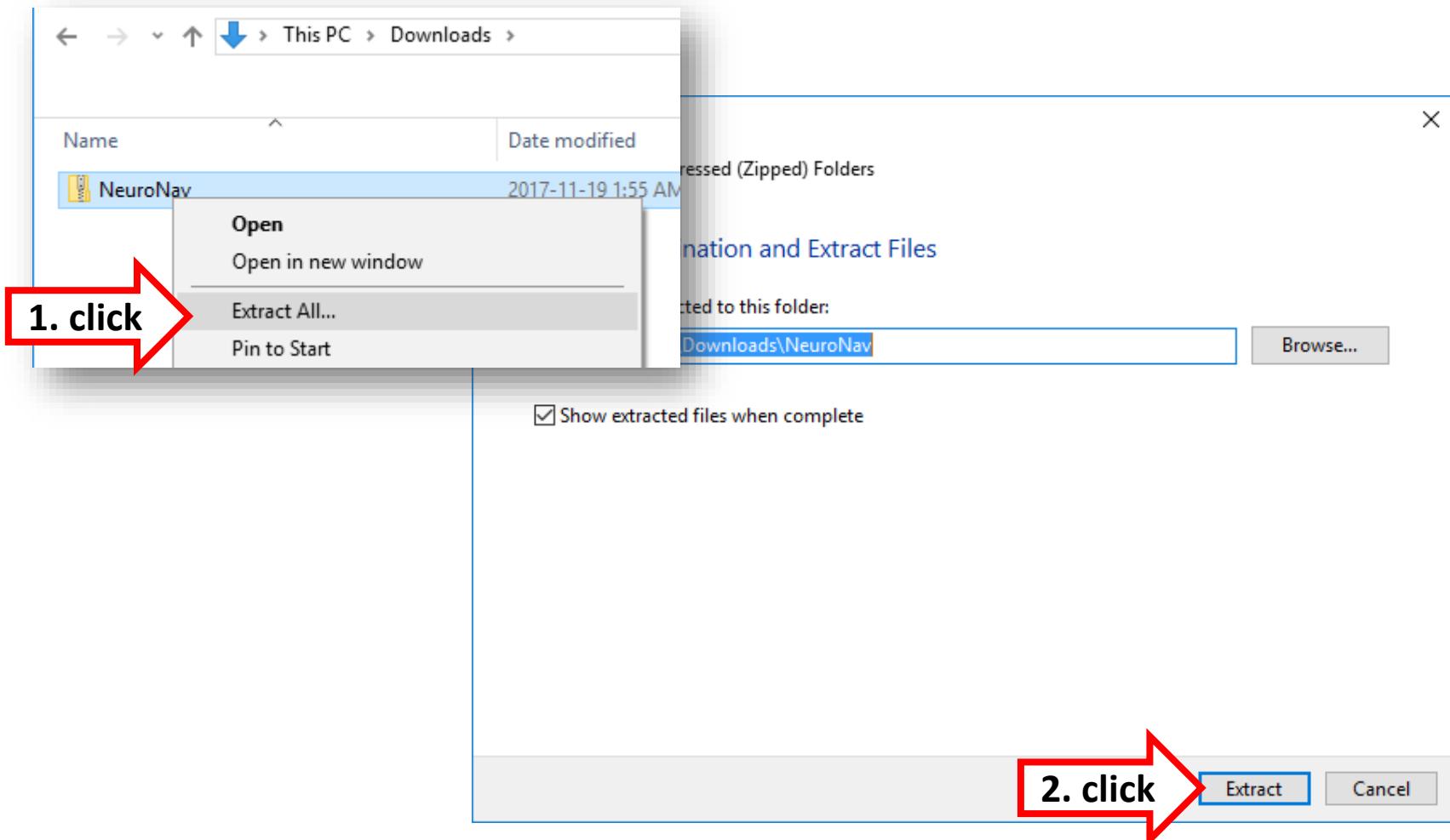
Sample data

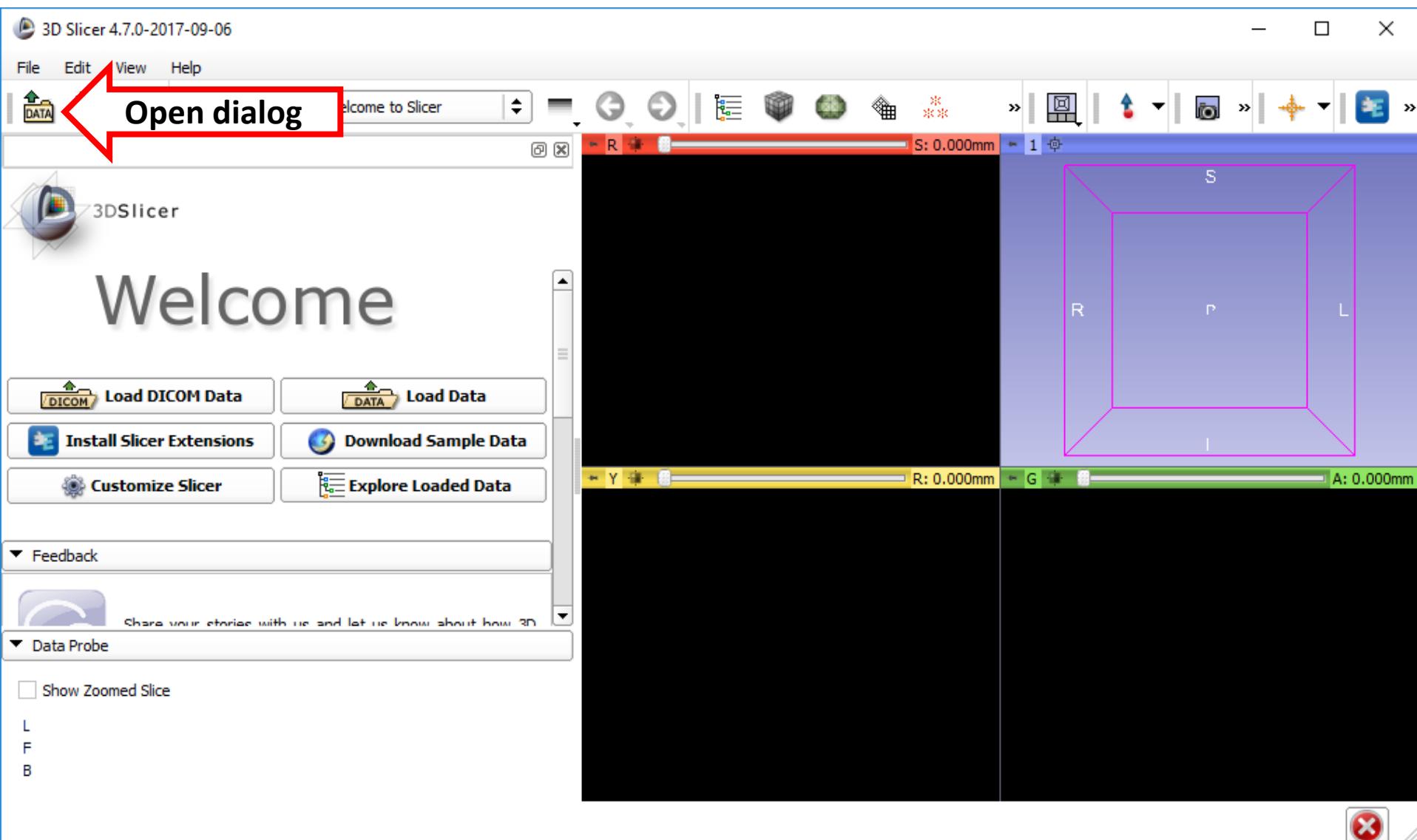
Most tutorials use input from the SlicerIGT-Data folder. Access the folder through >> [this link](#).

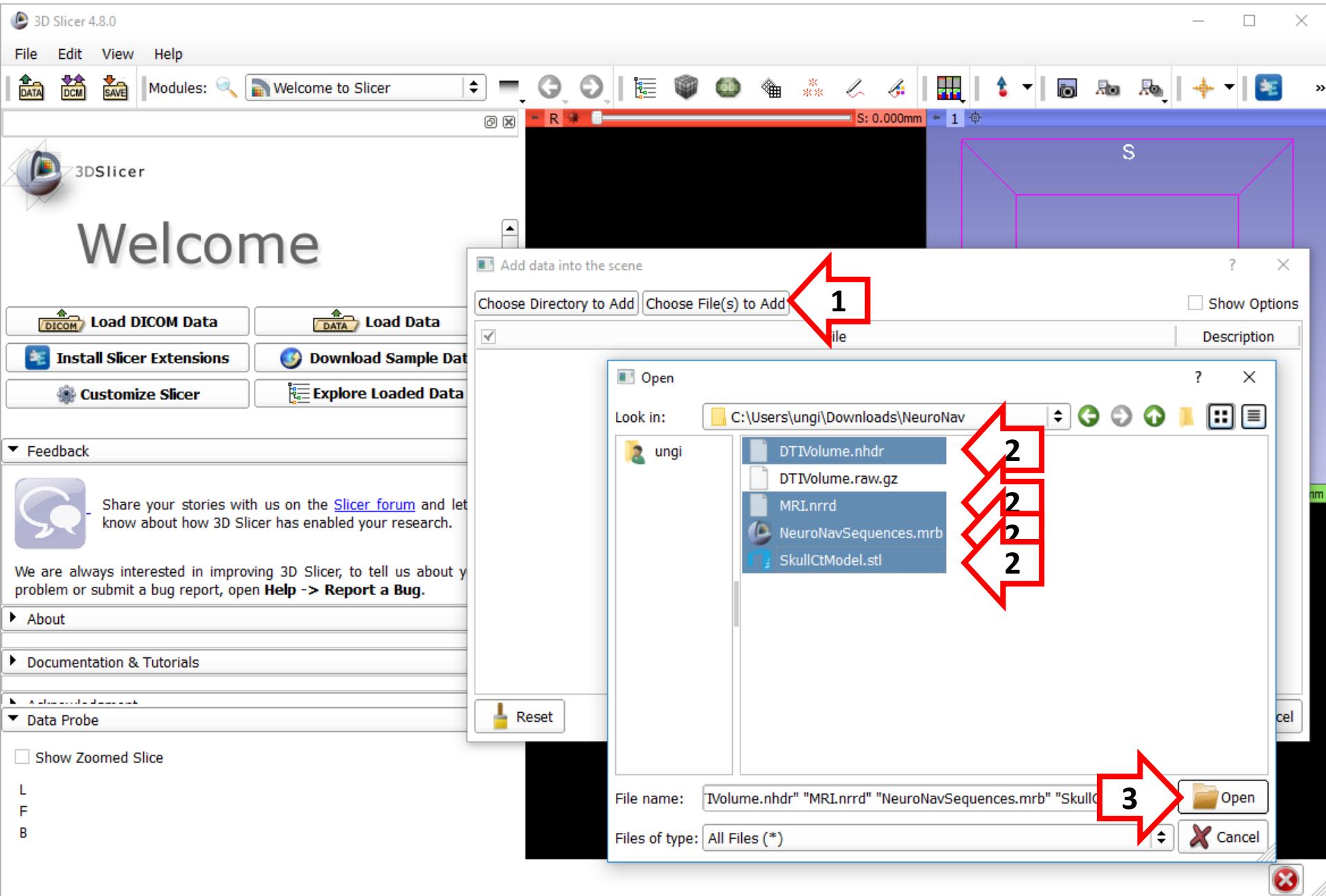
You can download the whole SlicerIGT-Data folder as a zip package by clicking on the Download link at the top left of the online data folder.

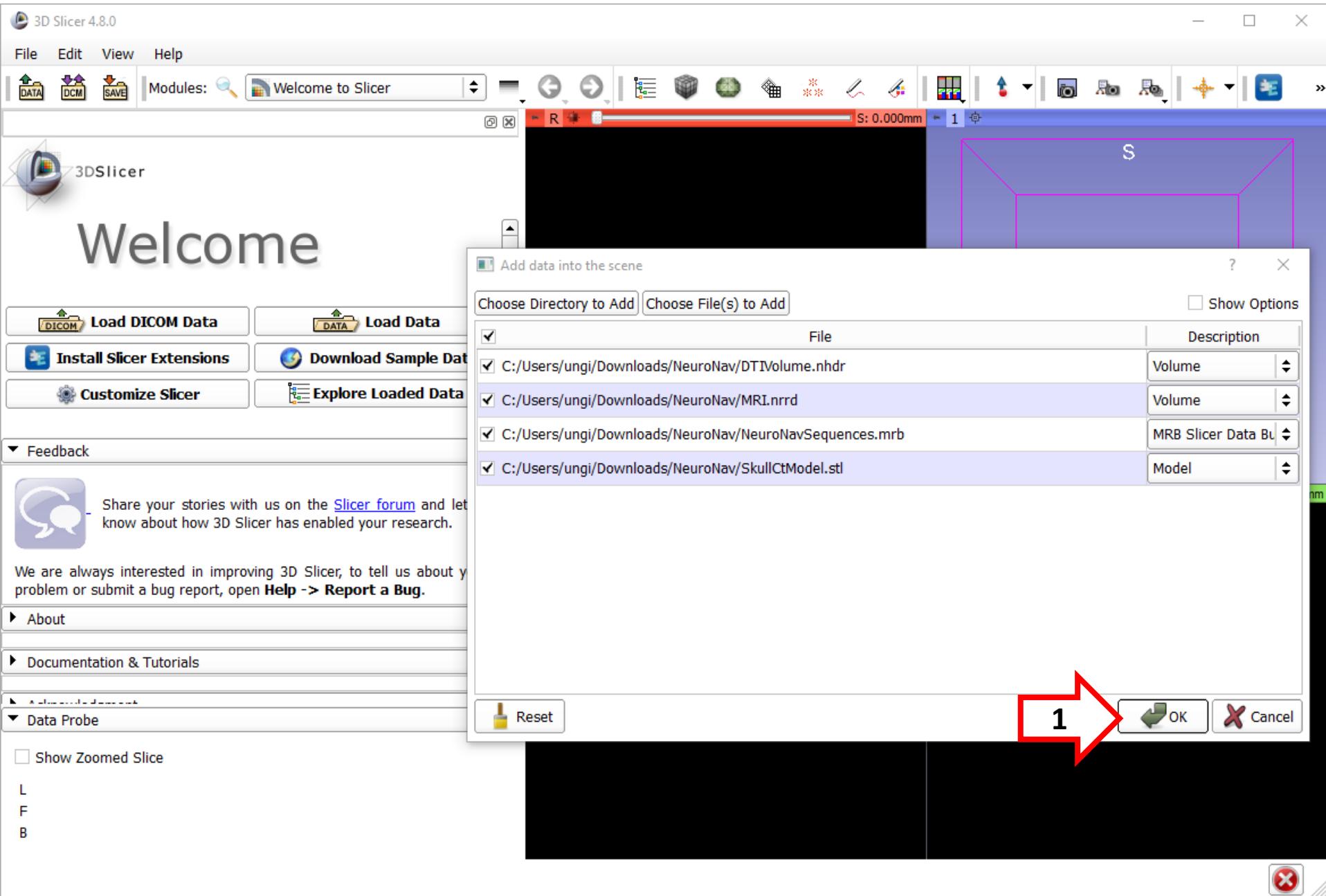
The *Download* button downloads a zip file that contains all files of the folder

Unzip tutorial data folder



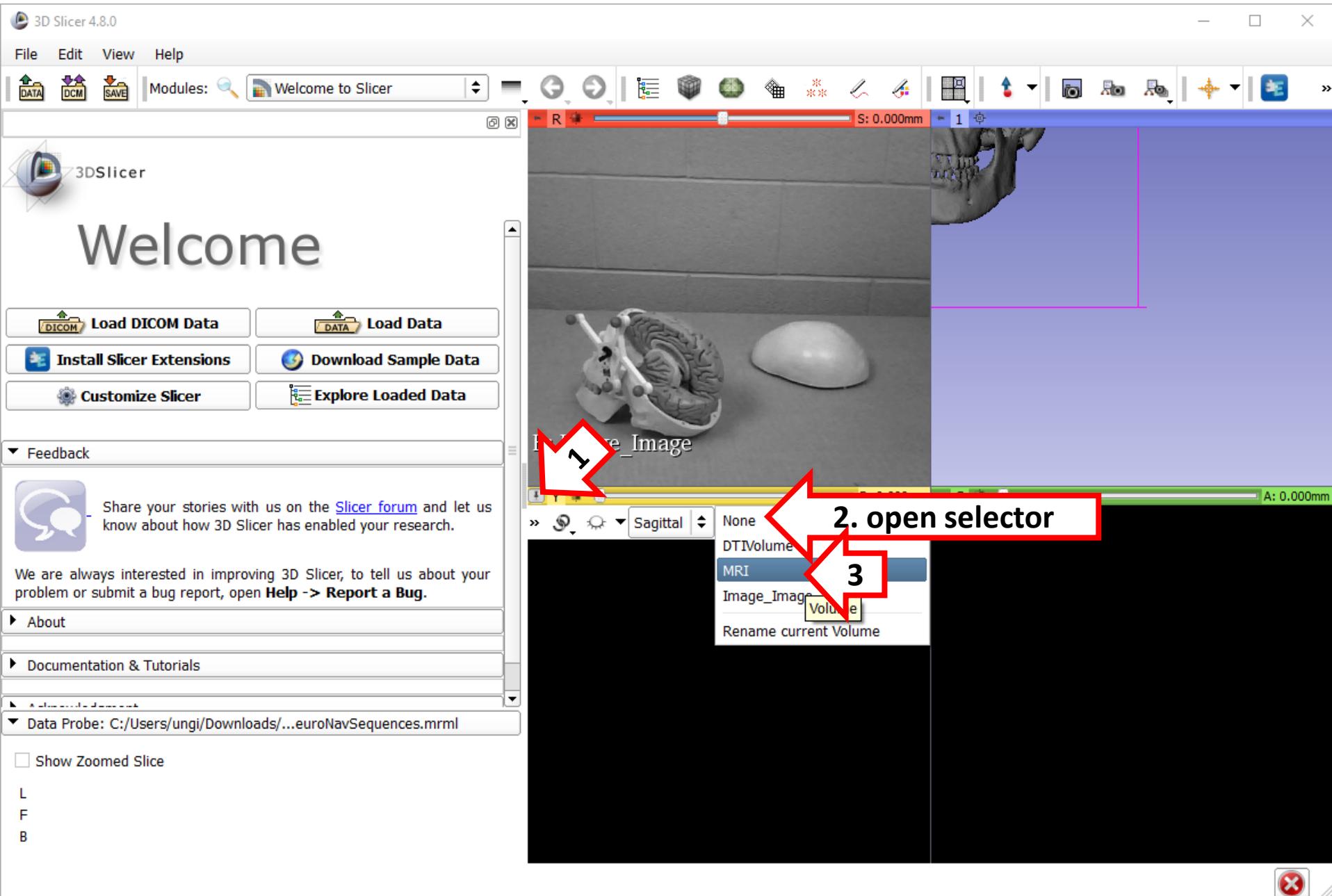


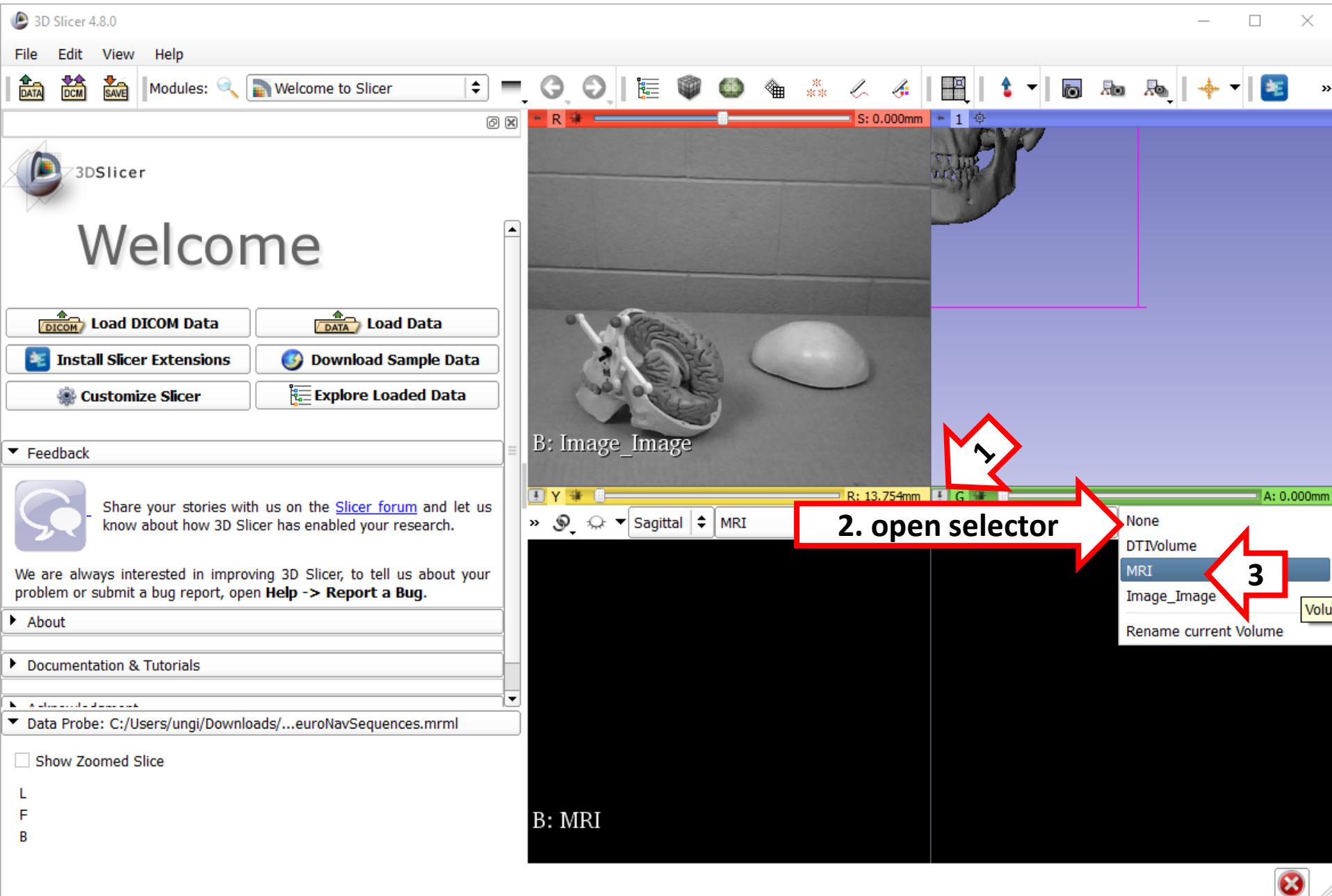


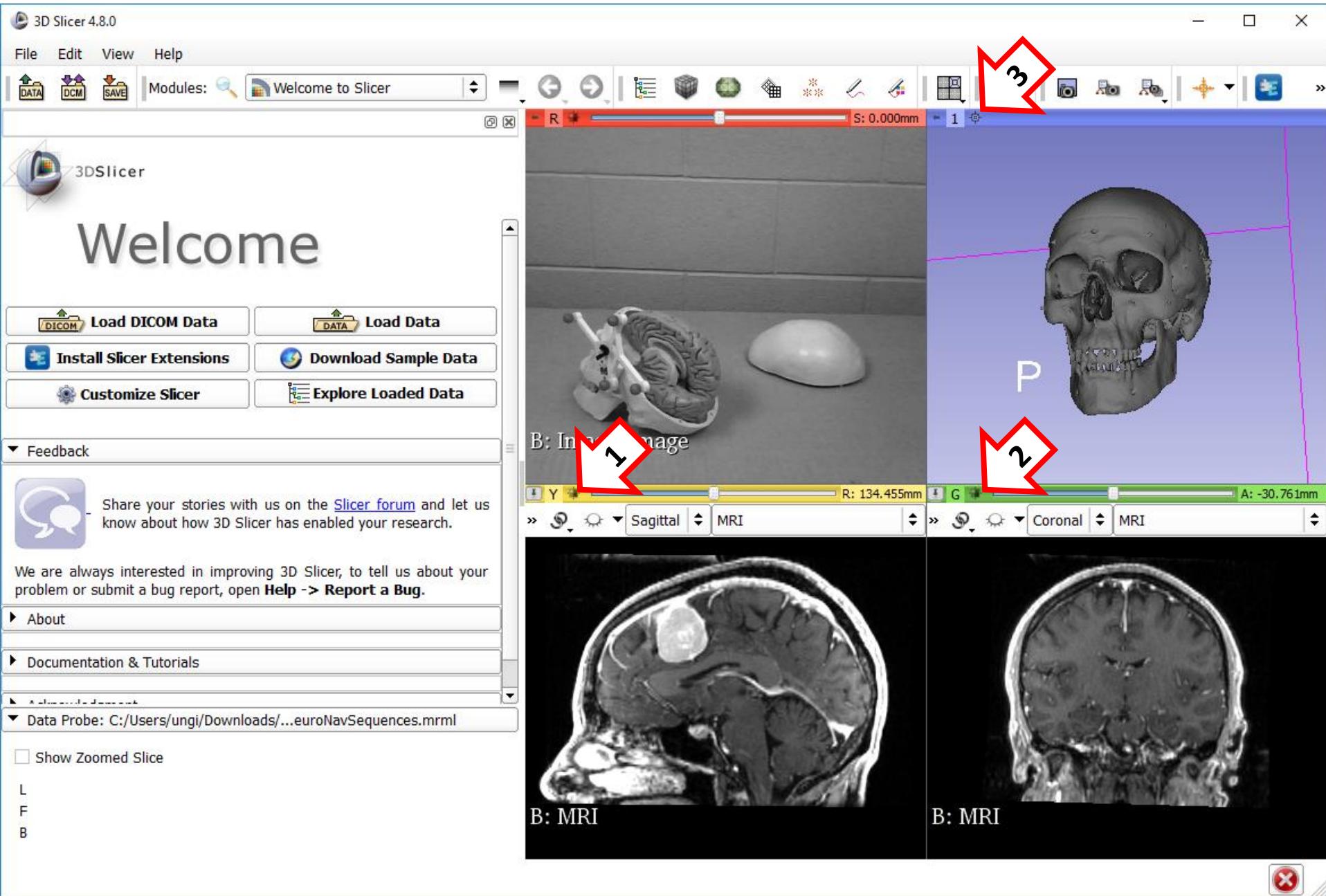


About the loaded data

- **SkullCtModel.stl**: Segmentation from CT scan of the plastic skull model
- **MRI.nrrd**: Magnetic resonance image of a person. (not the same one the plastic model was based on)
- **DTIVolume.nhdr**: Diffusion tensor image (from a third person)
- **NeuroNavSequences.mrb**: Time sequences for replaying tool motions
- All image volumes are already registered roughly (they more or less overlap, but they come from different patients, so the overlap is not perfect)

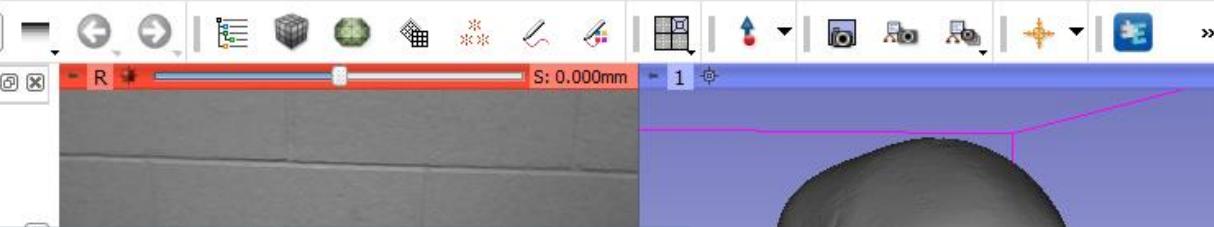








Modules: Welcome to Slicer



Welcome



Feedback



Share your stories with us on the [Slicer forum](#) and let us know about how 3D Slicer has enabled your research.

We are always interested in improving 3D Slicer, to tell us about your problem or submit a bug report, open **Help -> Report a Bug**.

About

Try 3D interactions

Mouse left button drag – rotations

Mouse wheel – zoom

Mouse middle button drag – panning

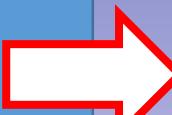
Mouse left button drag – intensity windowing

Try 3D interactions

Mouse left button drag – rotations

Mouse wheel – zoom

Mouse middle button drag – panning

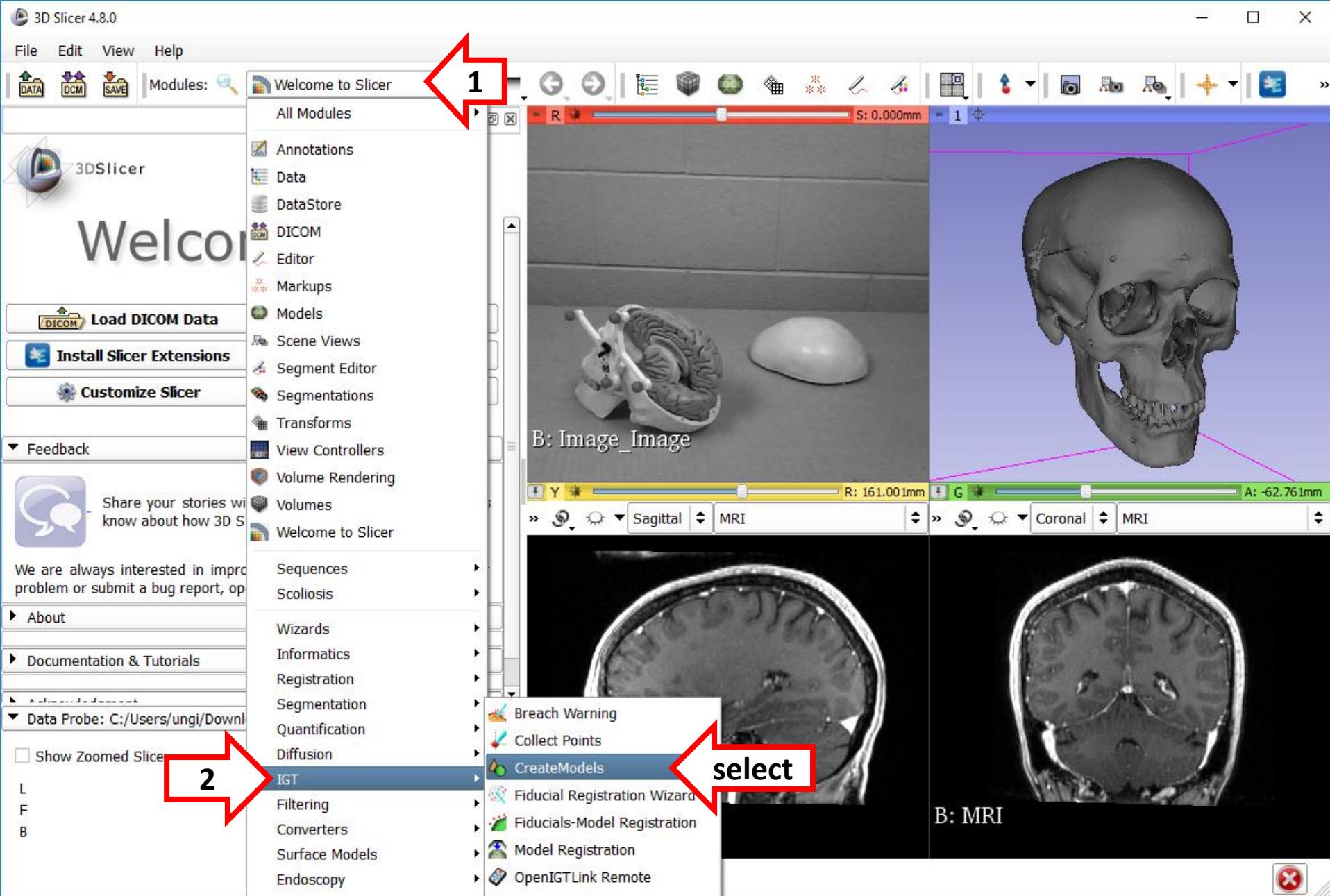


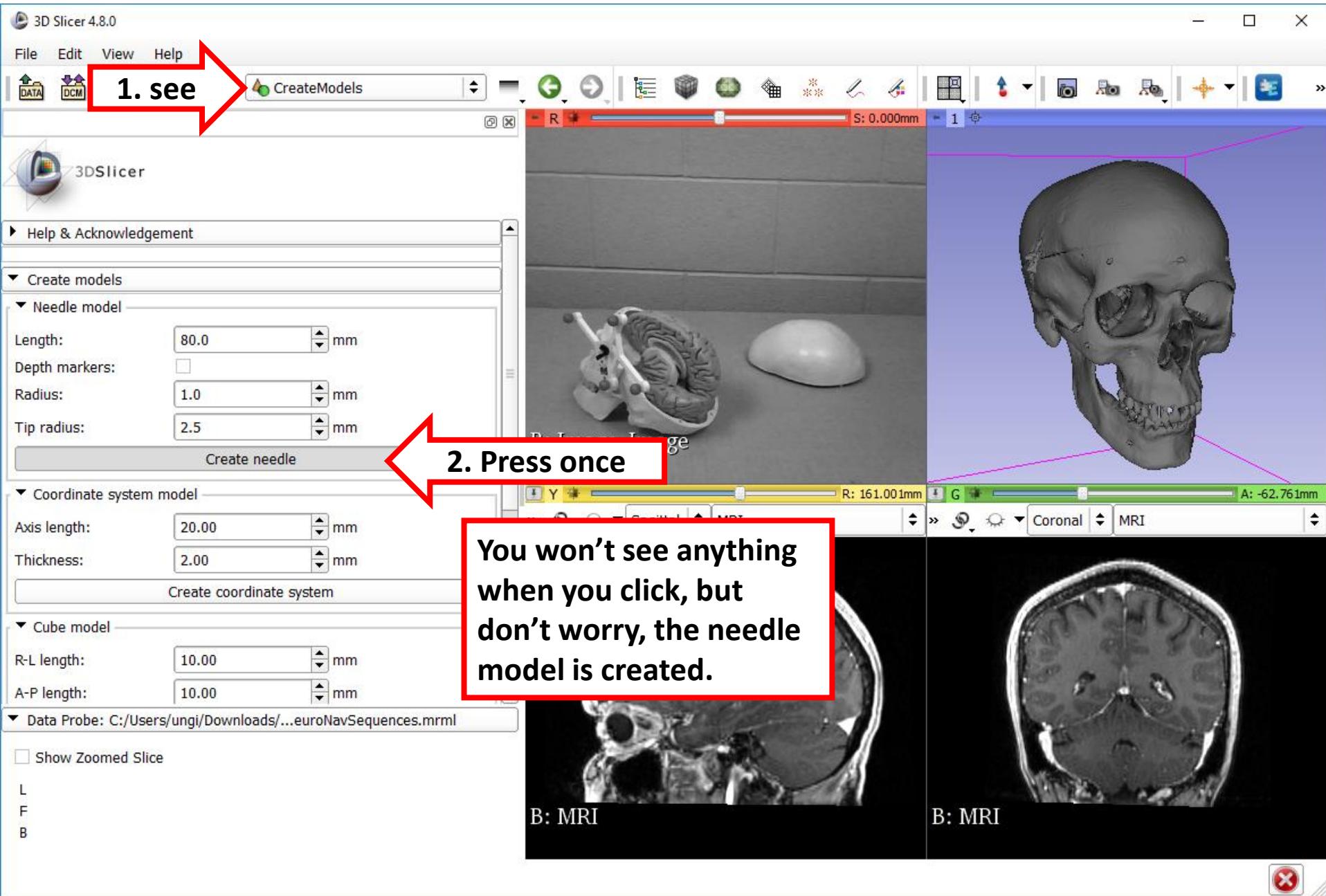
B: Image_Image

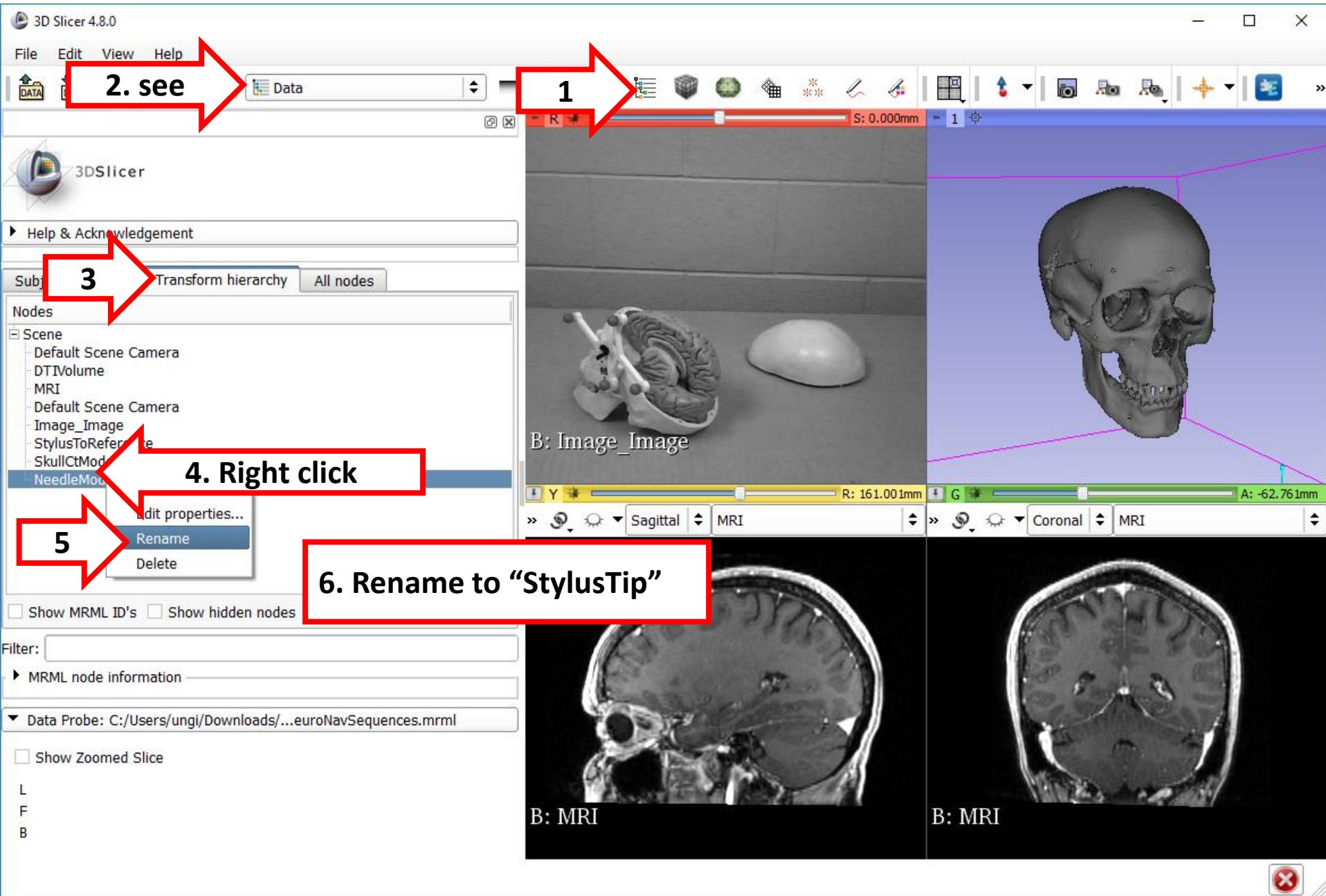


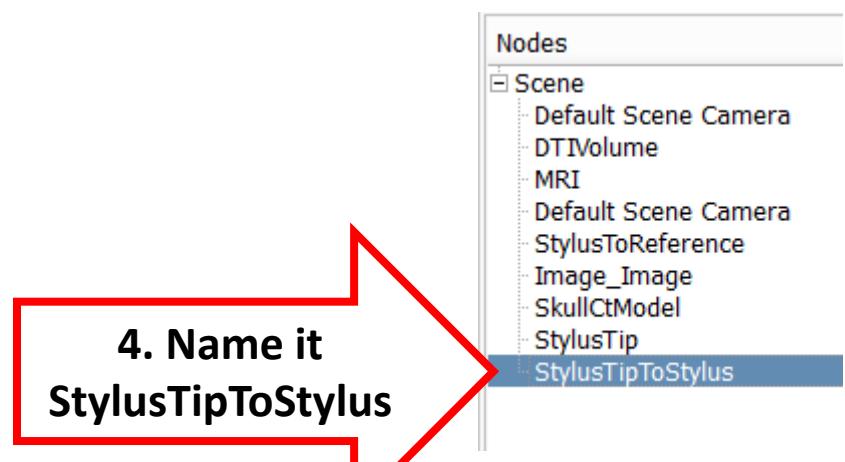
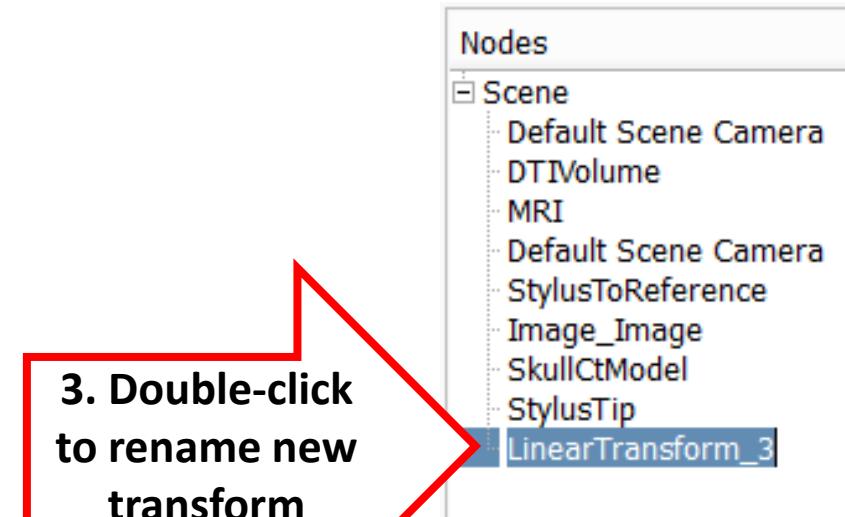
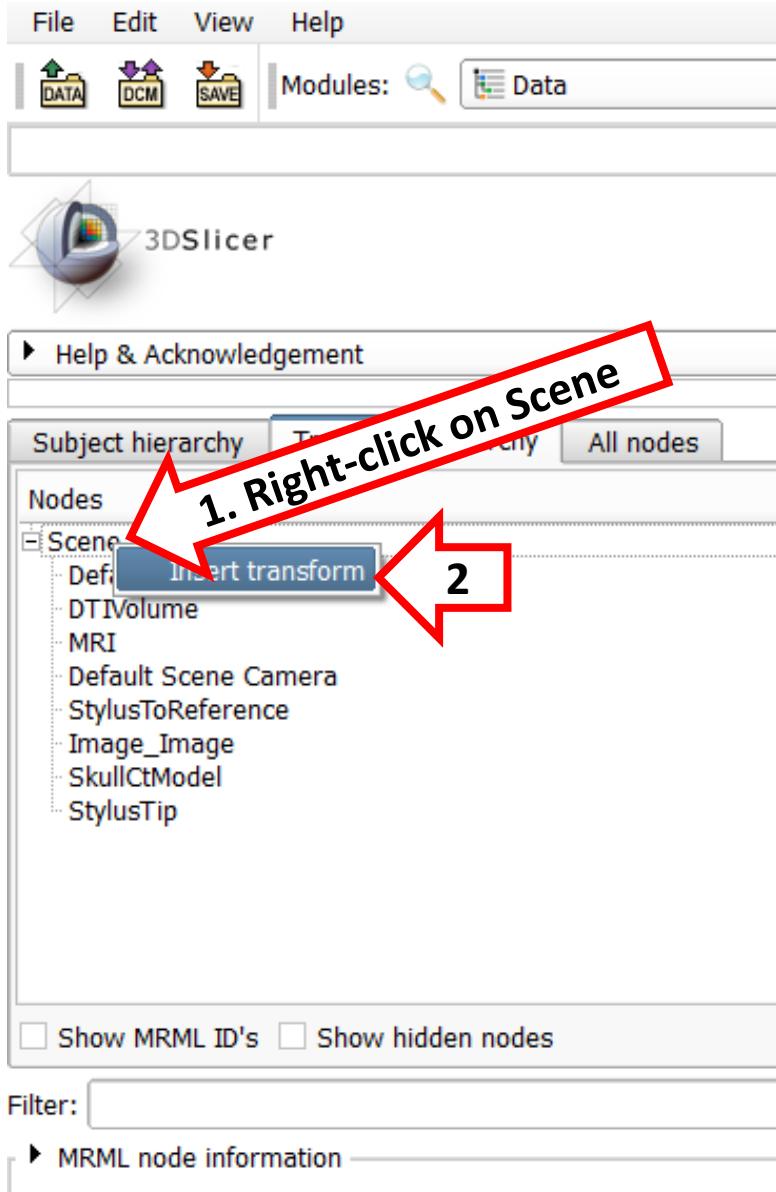
B: MRI

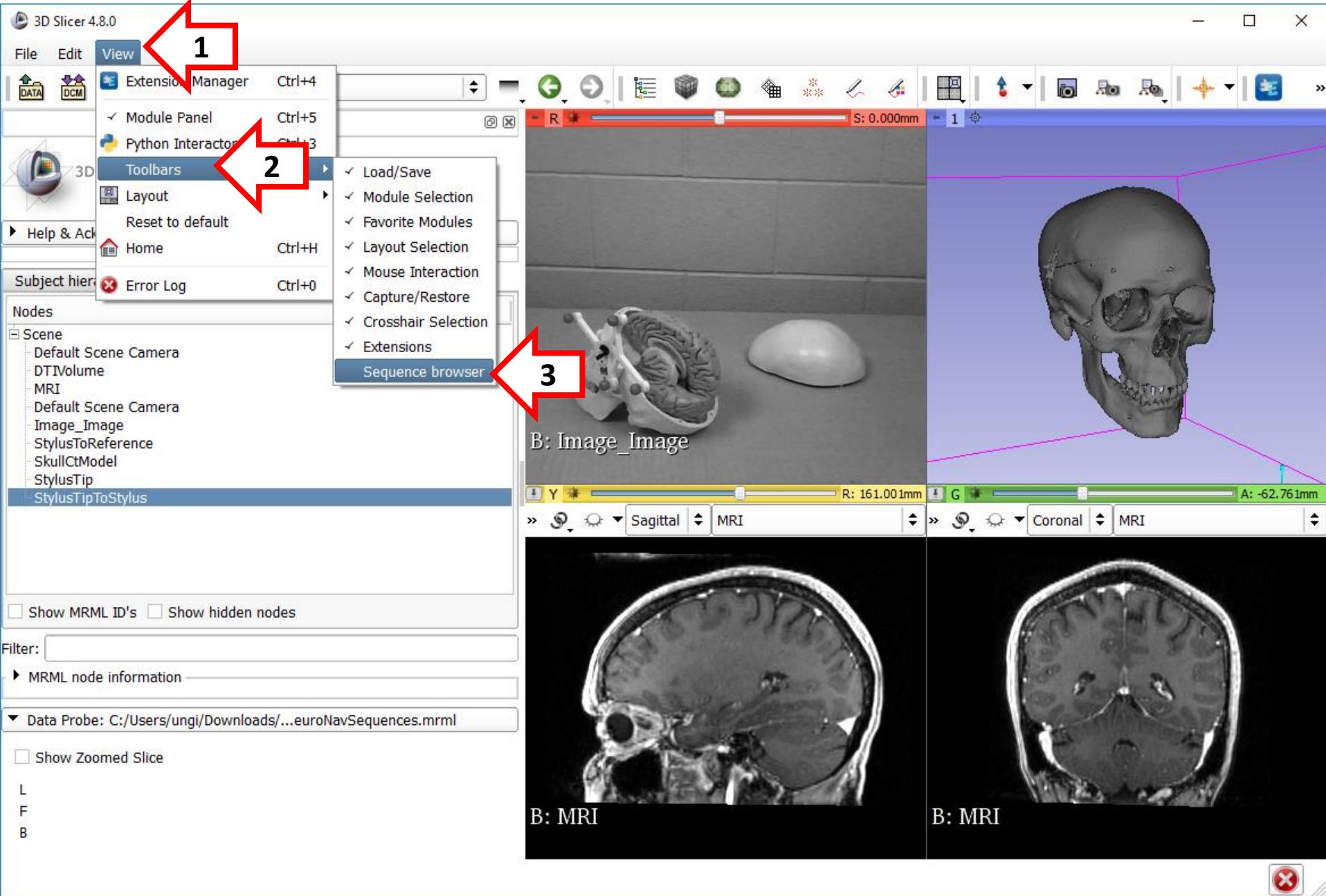












File Edit View Help



Select a SequenceBrowser



Help & A

Subject hi

Nodes

- Scene
 - Default Scene Camera
 - DTIVolume
 - MRI
 - Default Scene Camera
 - Image_Image
 - StylusToReference
 - SkullCtModel
 - StylusTip
 - StylusTipToStylus

 Show MRML ID's Show hidden nodes

Filter:

► MRML node information

▼ Data Probe: C:/Users/ungi/Downloads/...euroNavSequences.mrml

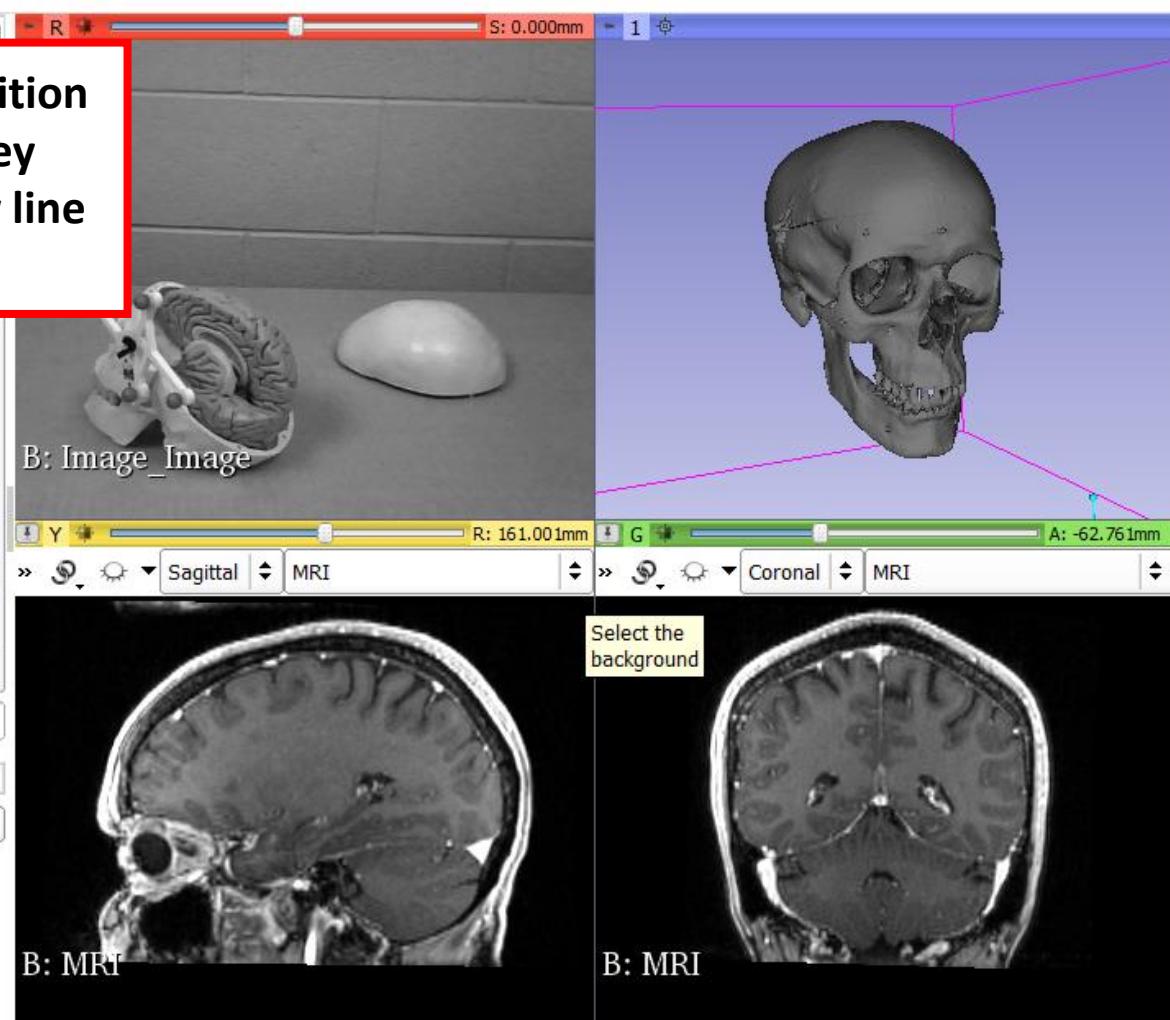
 Show Zoomed Slice

L

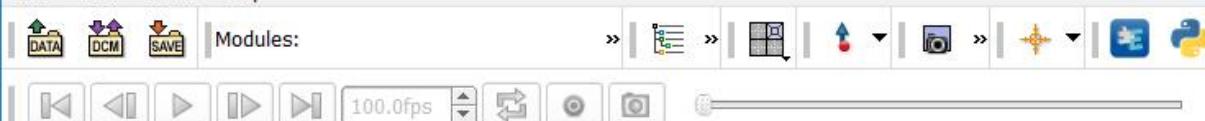
F

B

You can drag and drop the position of the toolbar grabbing this grey vertical bar. Putting it in a new line gives it more space.



File Edit View Help



Help & Acknowledgement

Subject hierarchy Transform hierarchy All nodes

Nodes

- Scene
 - Default Scene Camera
 - DTIVolume
 - MRI
 - Default Scene Camera
 - Image_Image
 - StylusToReference
 - SkullCtModel
 - StylusTip
 - StylusTipToStylus

 Show MRML ID's Show hidden nodes

Filter:

► MRML node information

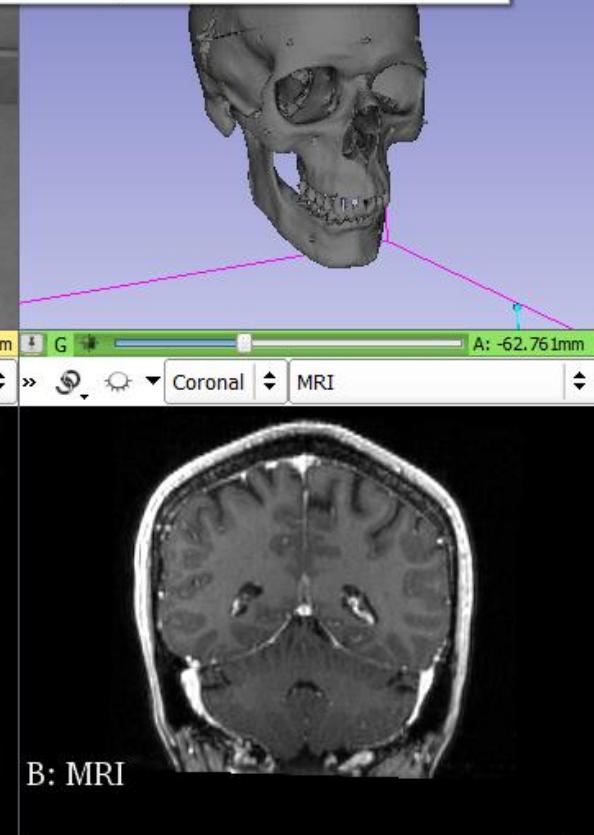
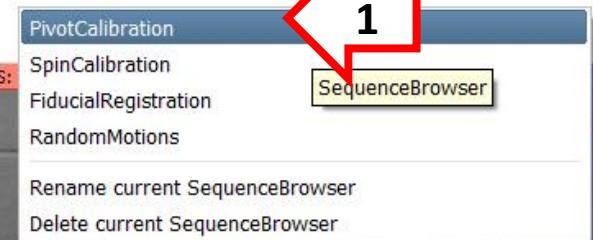
▼ Data Probe: C:/Users/ungi/Downloads/...euroNavSequences.mrml

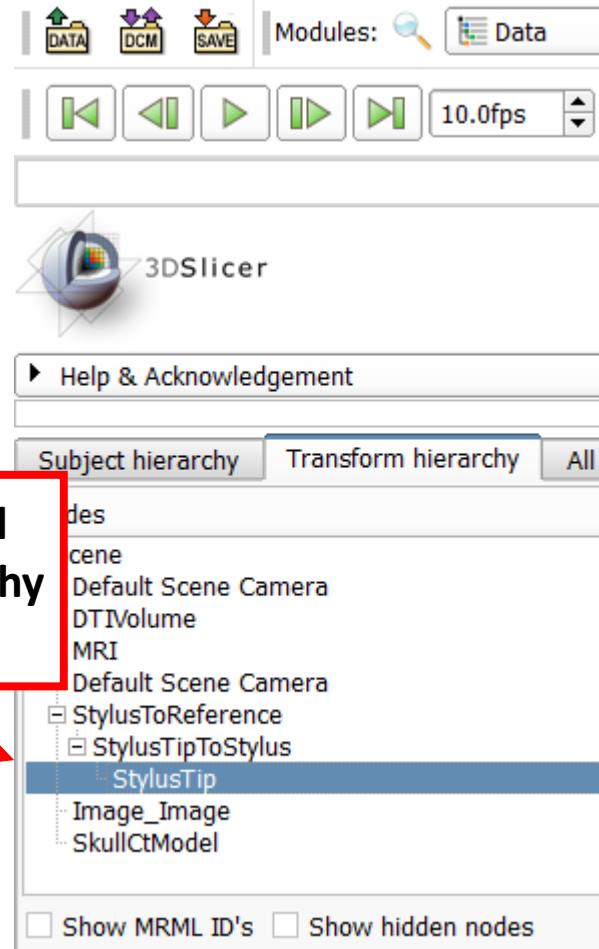
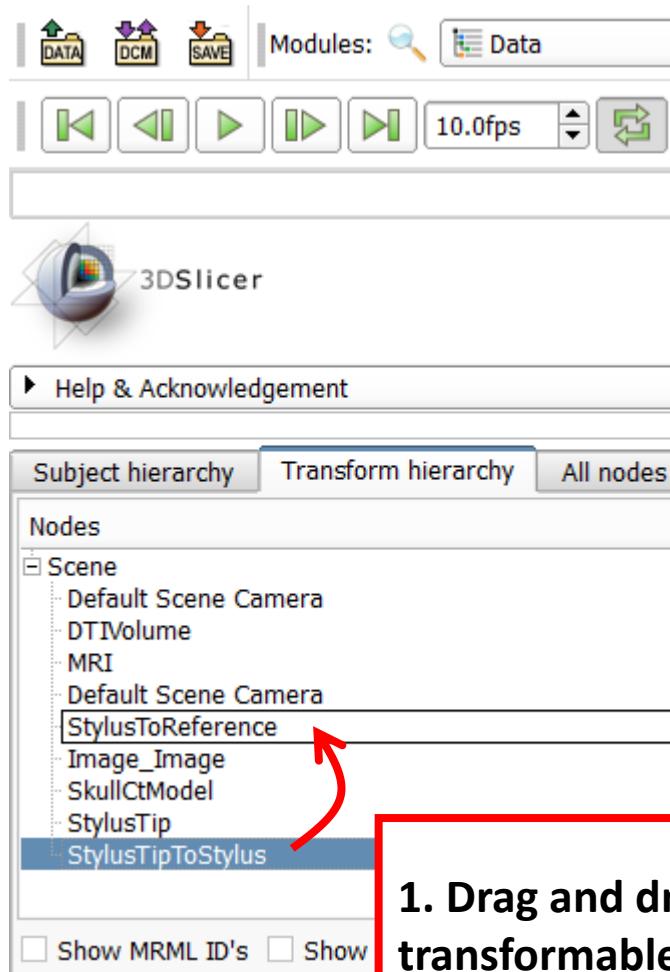
 Show Zoomed Slice

L

F

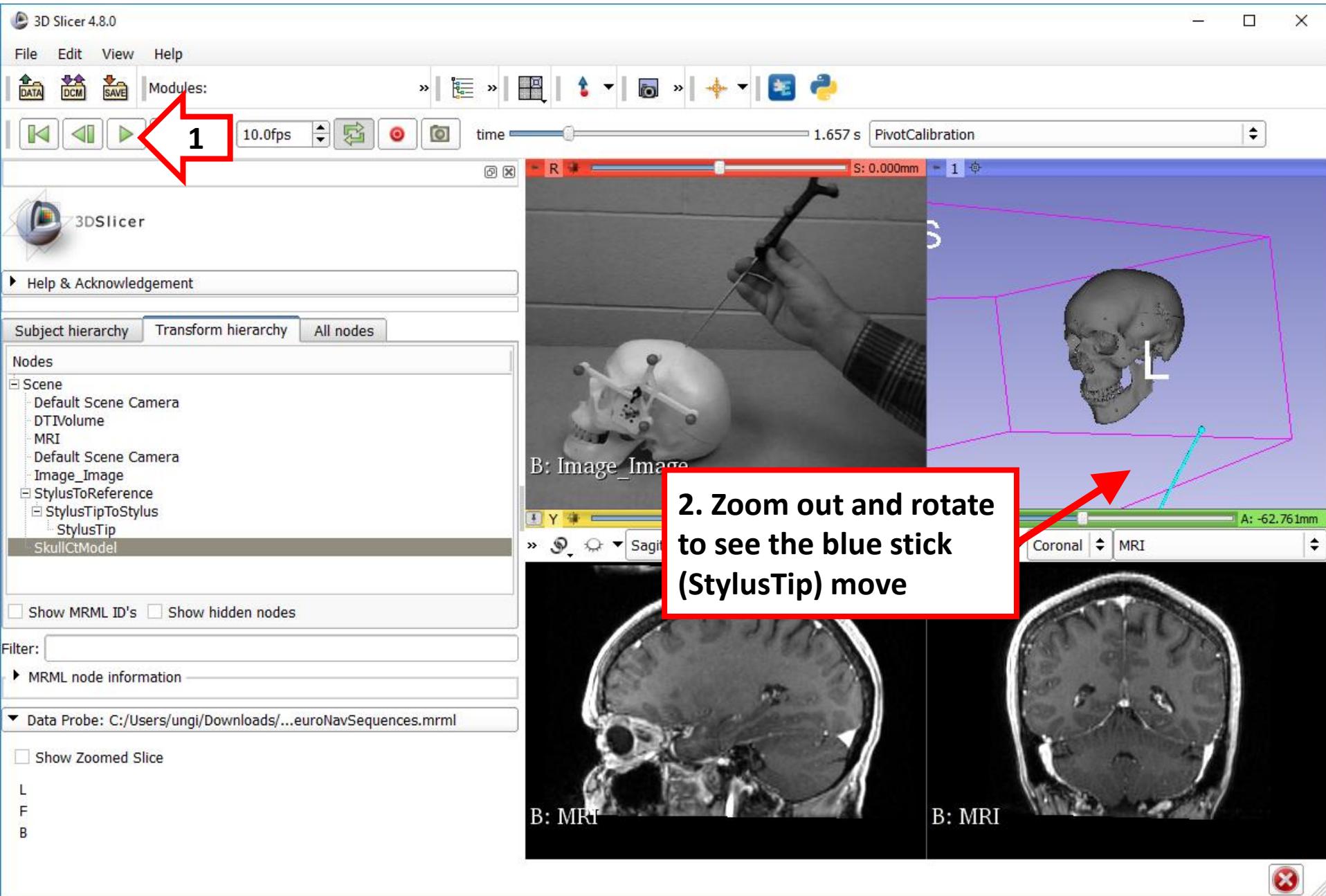
B





1. Drag and drop transformable nodes to create transform hierarchy

2. Drag and drop until the transform hierarchy looks like this



File Edit View Help



1

- Data
 - All Modules
 - Annotations
 - Data
 - DataStore
 - DICOM
 - Editor
 - Markups
 - Models
 - Scene Views
 - Segment Editor
 - Segmentations
 - Transforms
 - View Controllers
 - Volume Rendering
 - Volumes
 - Welcome to Slicer
- Sequences
- Scoliosis
- Wizards
- Informatics
- Registration
- Segmentation
- Quantification
- Diffusion
- IGT
- Filtering
- Converters
- Surface Models
- Endoscopy
- Utilities
- Developer Tools
- Legacy
- MultiVolume Support

2

- Breath Warning
- Collect Points
- CreateModels
- Fiducial Registration Wizard
- Fiducials-Model Registration
- Model Registration
- OpenIGTLINK Remote
- OpenIGTLINKIF
- PathExplorer
- Patient Browser
- Pivot Calibration
- Plus model catalog browser

3. select



Help & Acknowledgement

Subject hierarchy Transform hie

Nodes

- Scene
 - Default Scene Camera
 - DTIVolume
 - MRI
 - Default Scene Camera
 - Image_Image
- StylusToReference
 - StylusTipToStylus
 - StylusTip
- SkullCtModel

Show MRML ID's Show hidden

Filter:

MRML node information

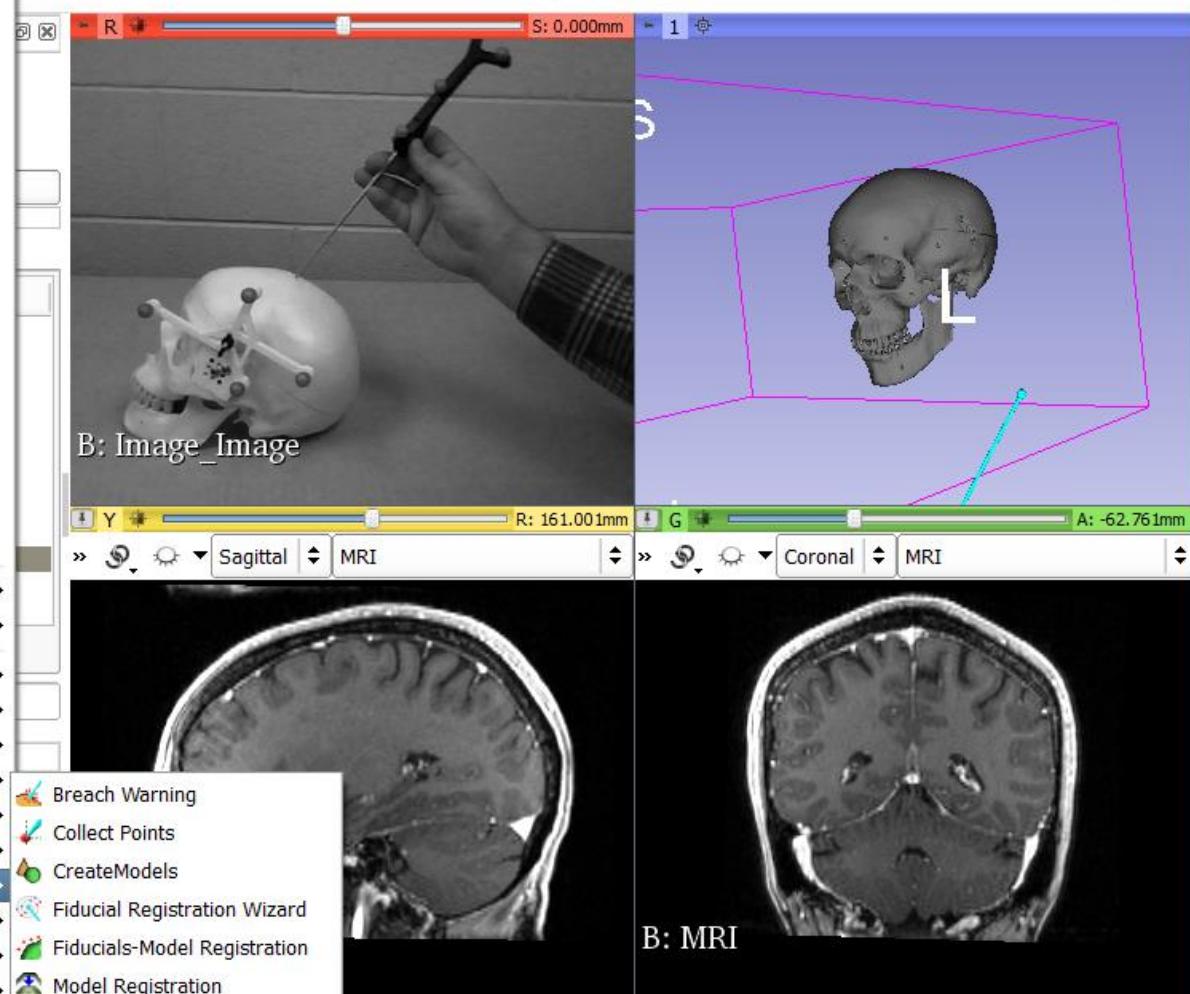
Data Probe: C:/Users/ungi/Downl

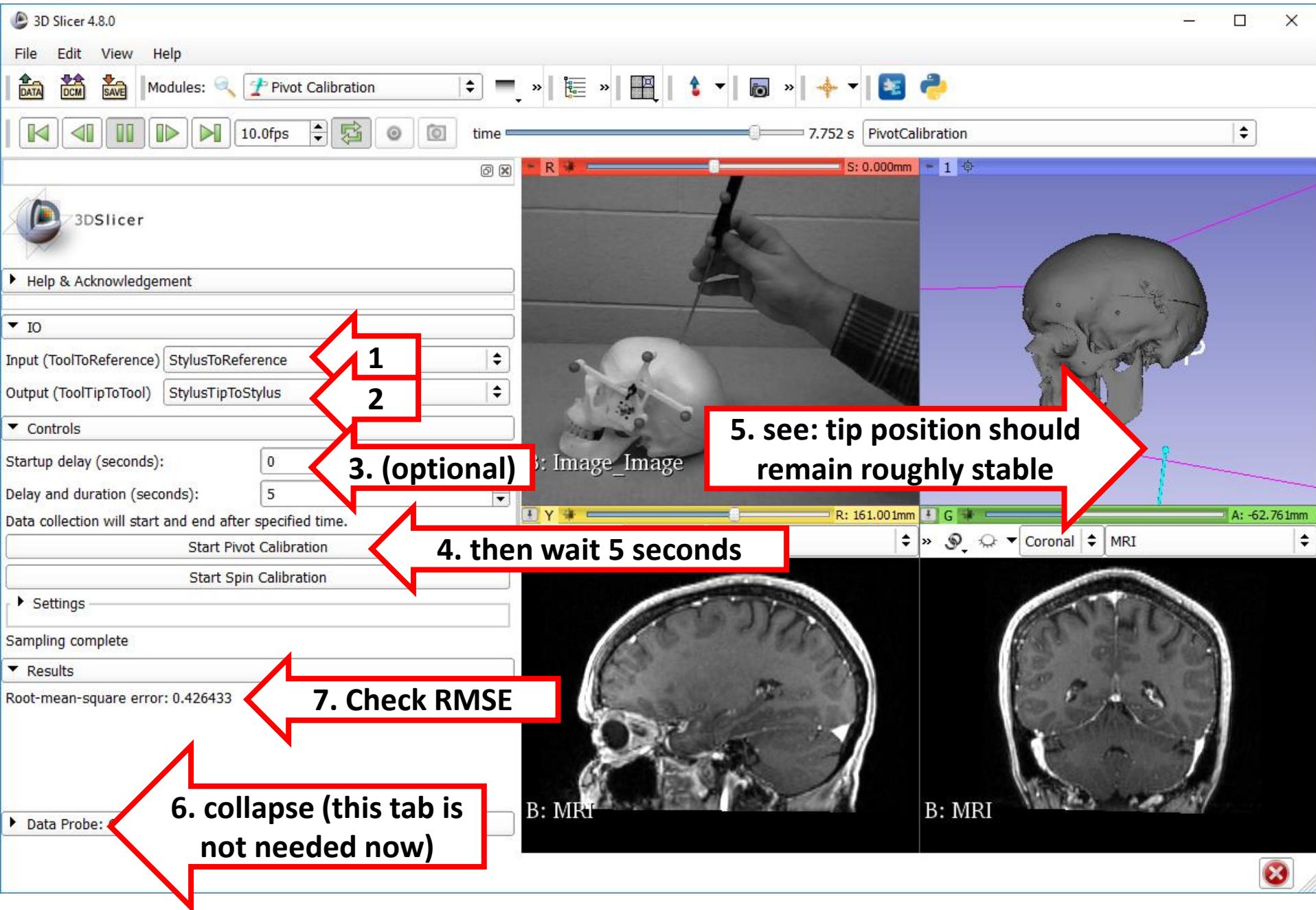
Show Zoomed SI

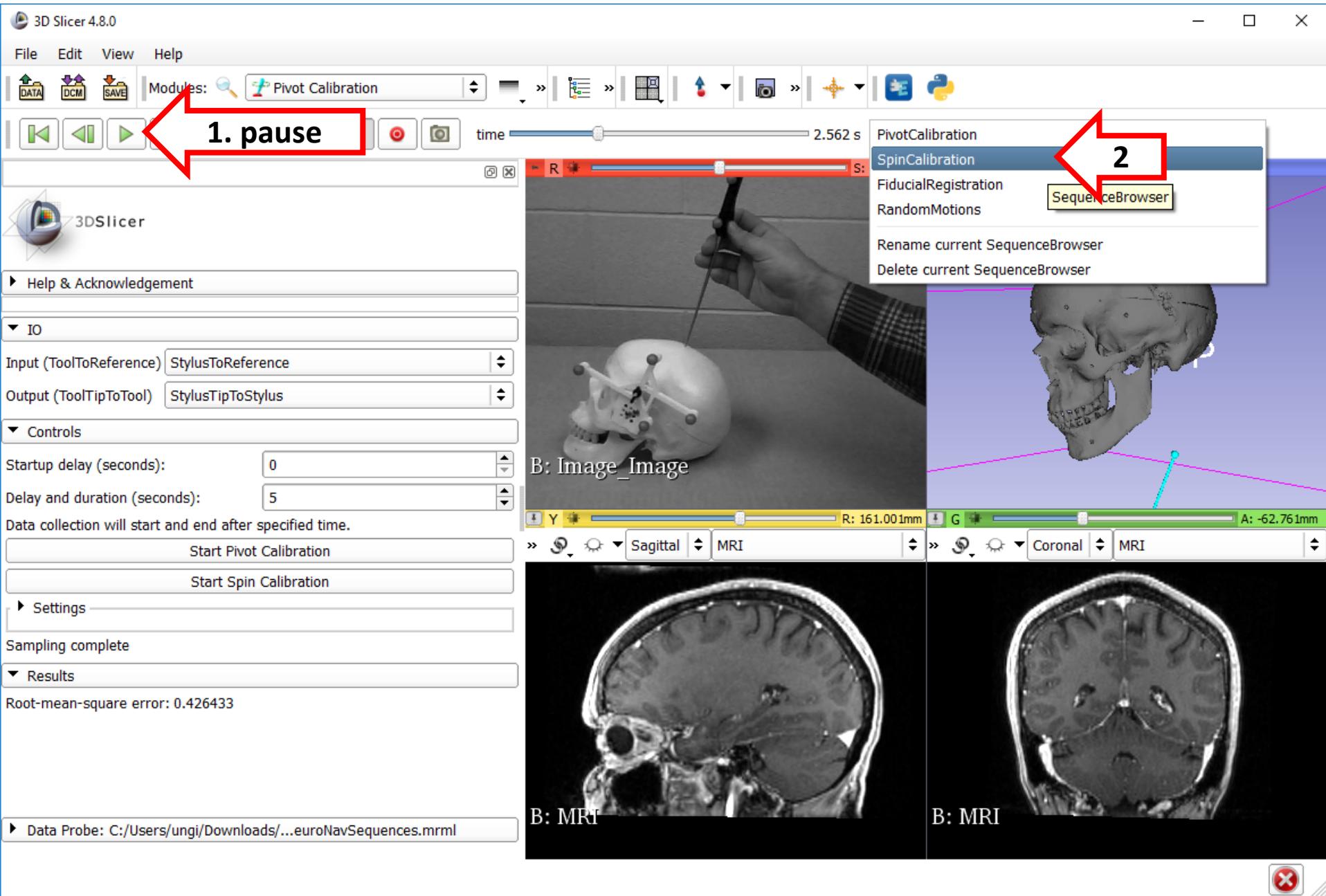
L

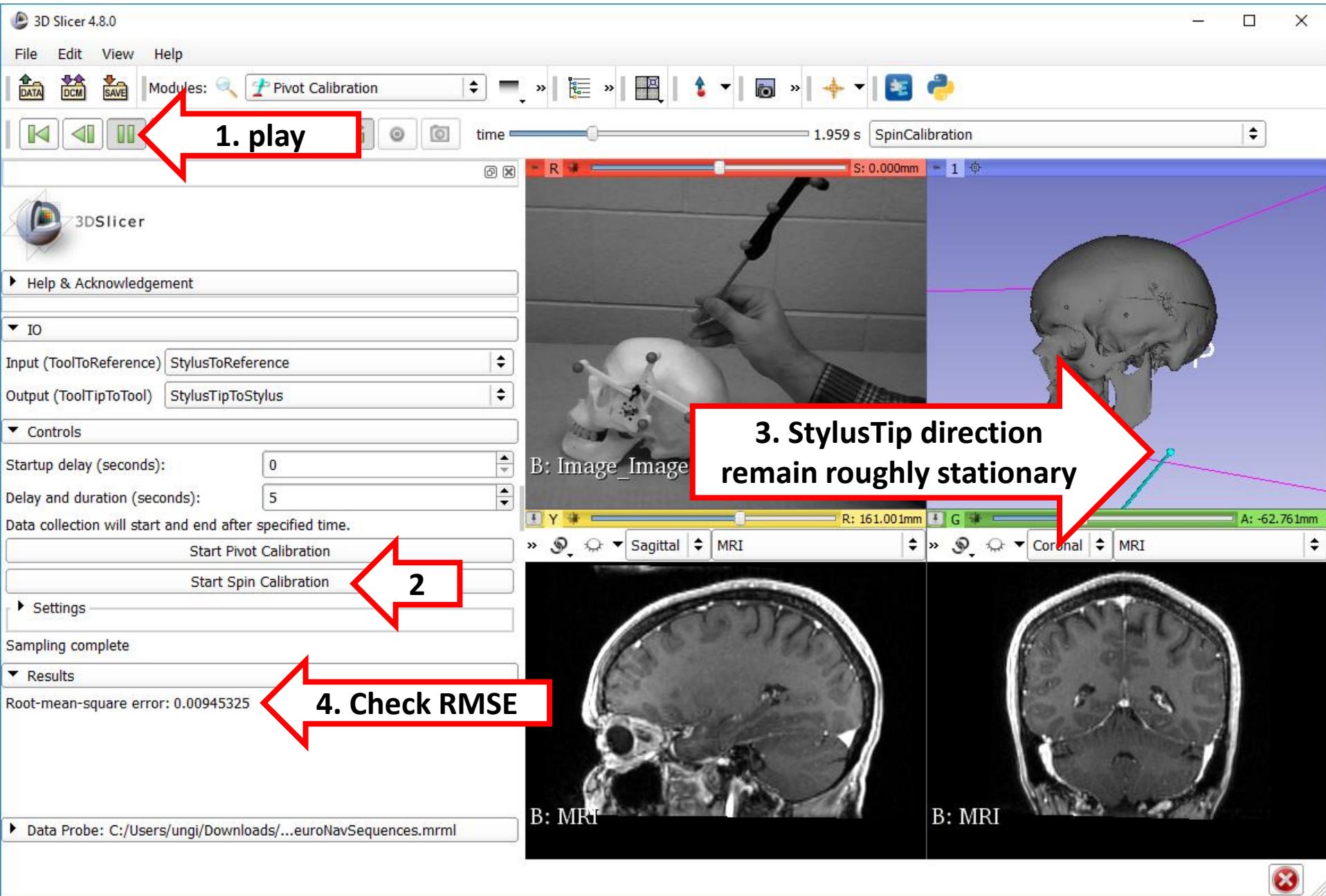
F

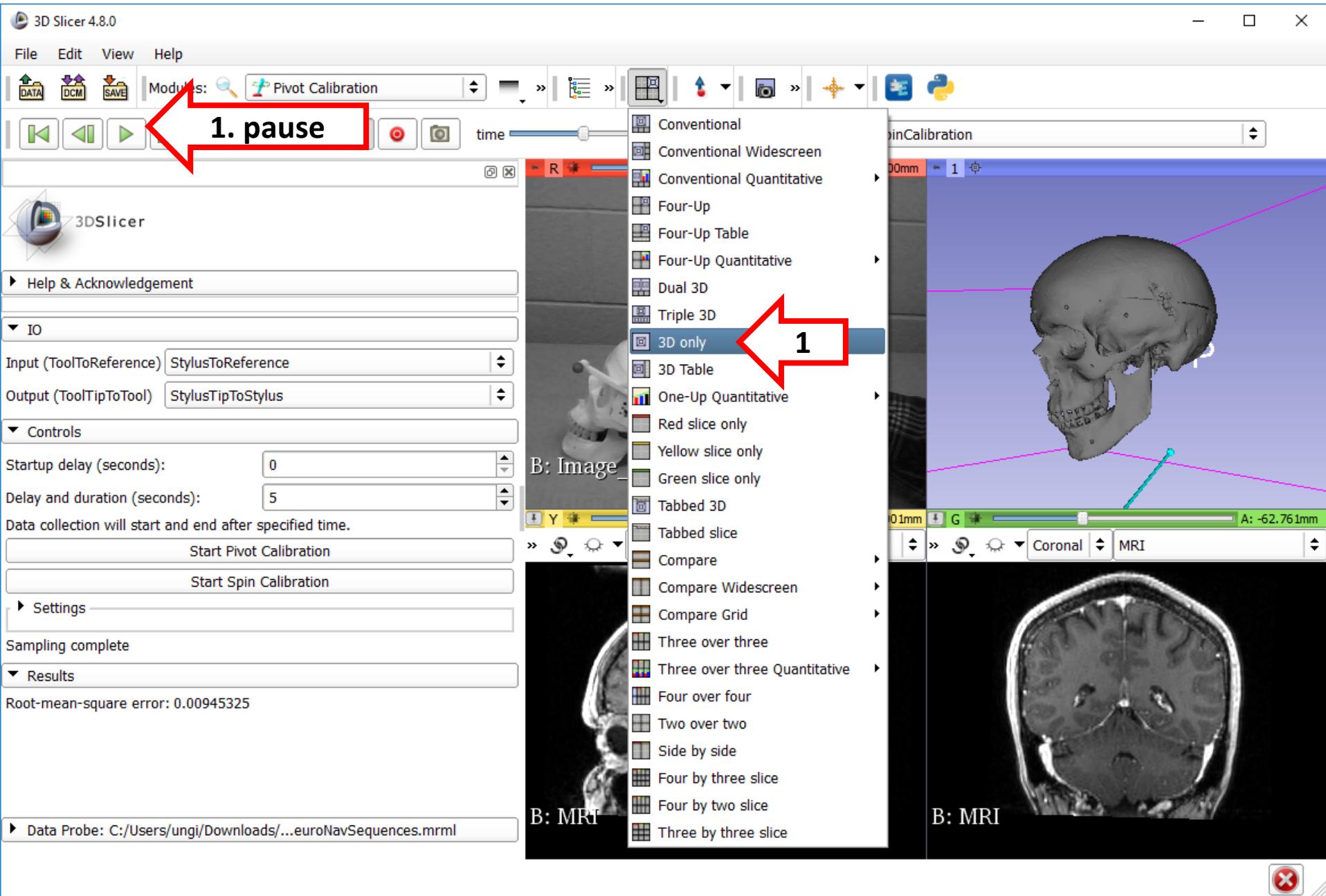
B

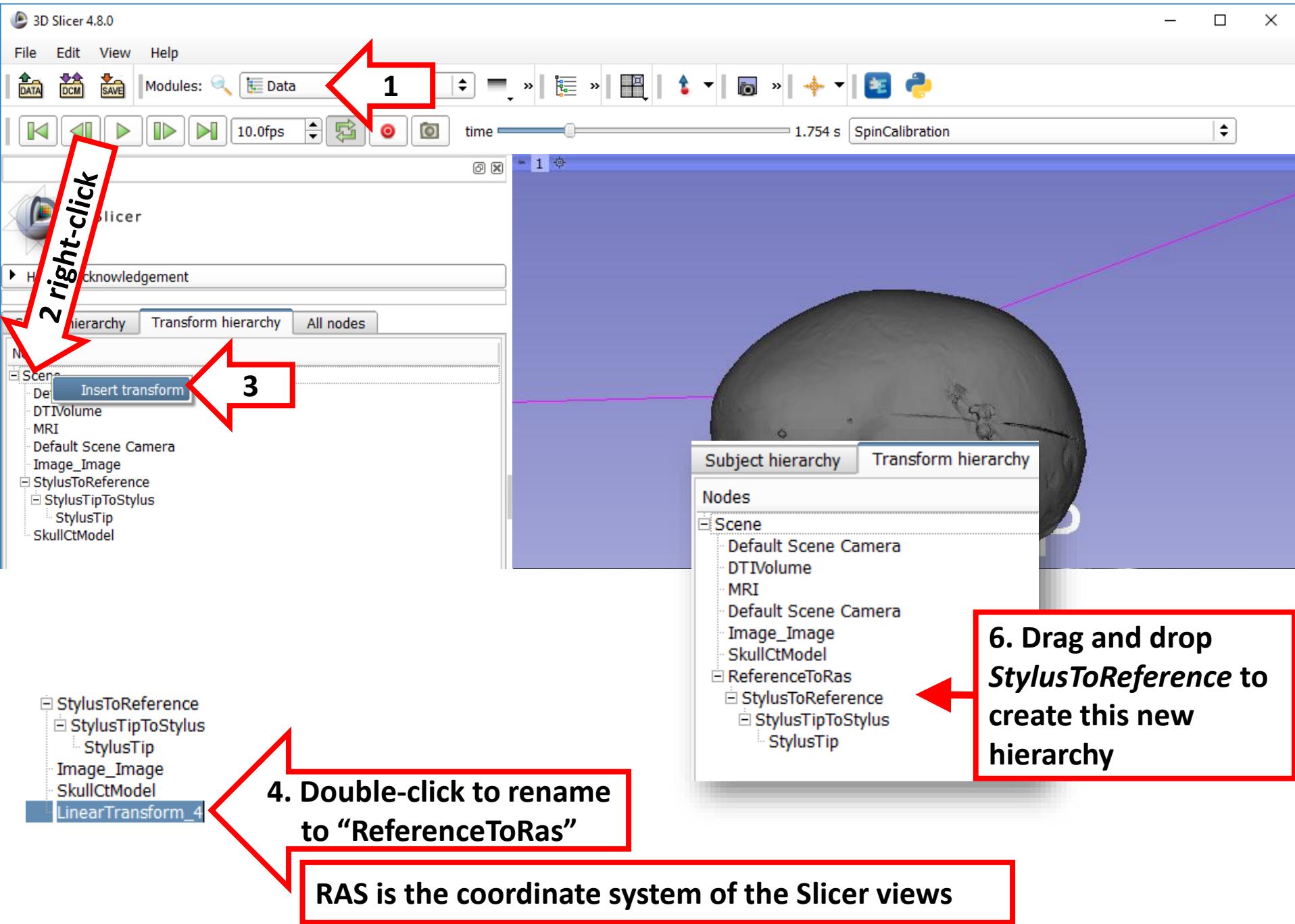


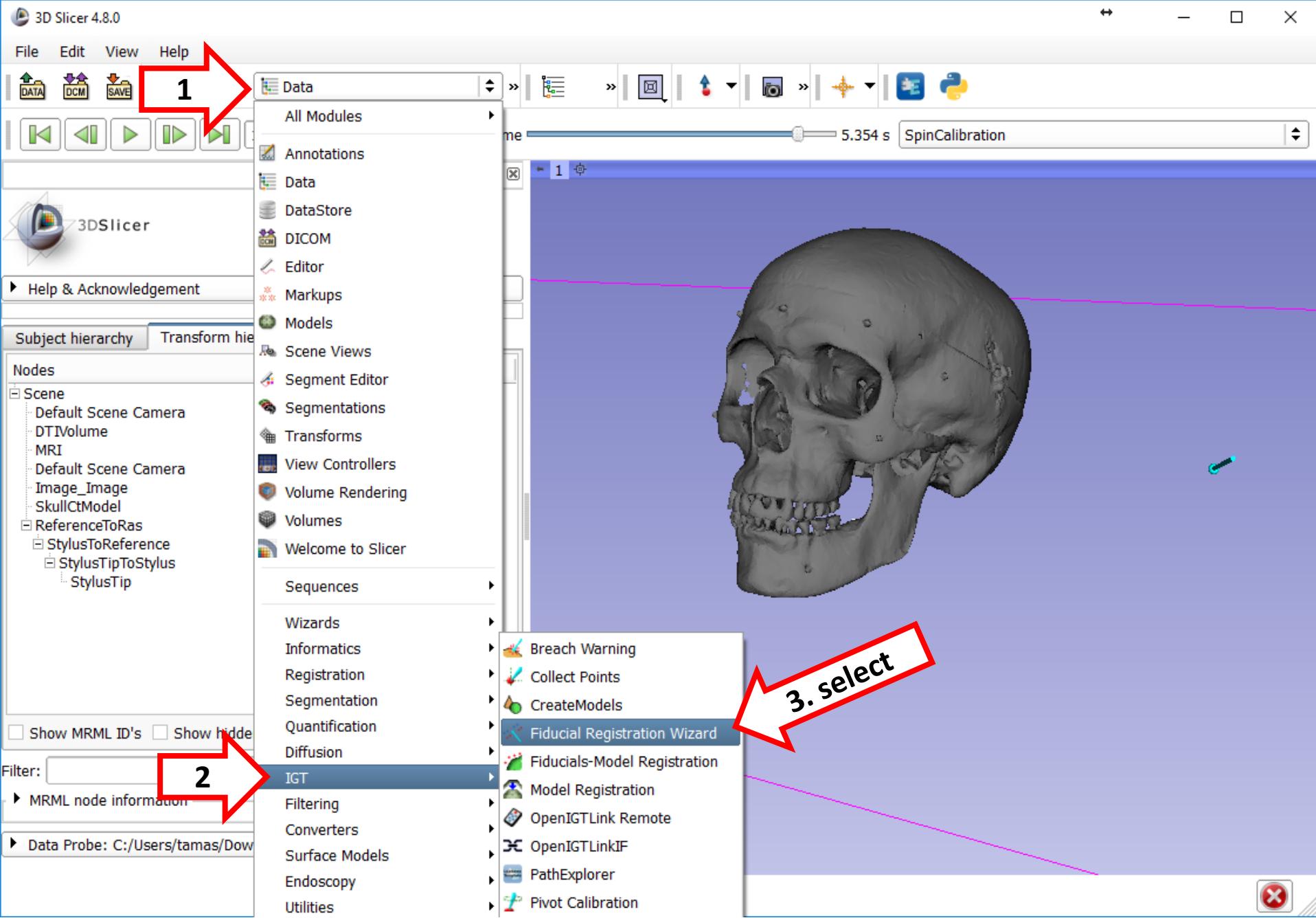












File Edit View Help

3DSlicer

▶ Help & Acknowledgement

▼ Display

FiducialRegistrationWizard

Point Matching Method:

Manual

From fiducials

None

1

Rename current Markup Fiducial

2

Create new MarkupsFiducial

Create new MarkupsFiducial as...

Delete current MarkupsFiducial

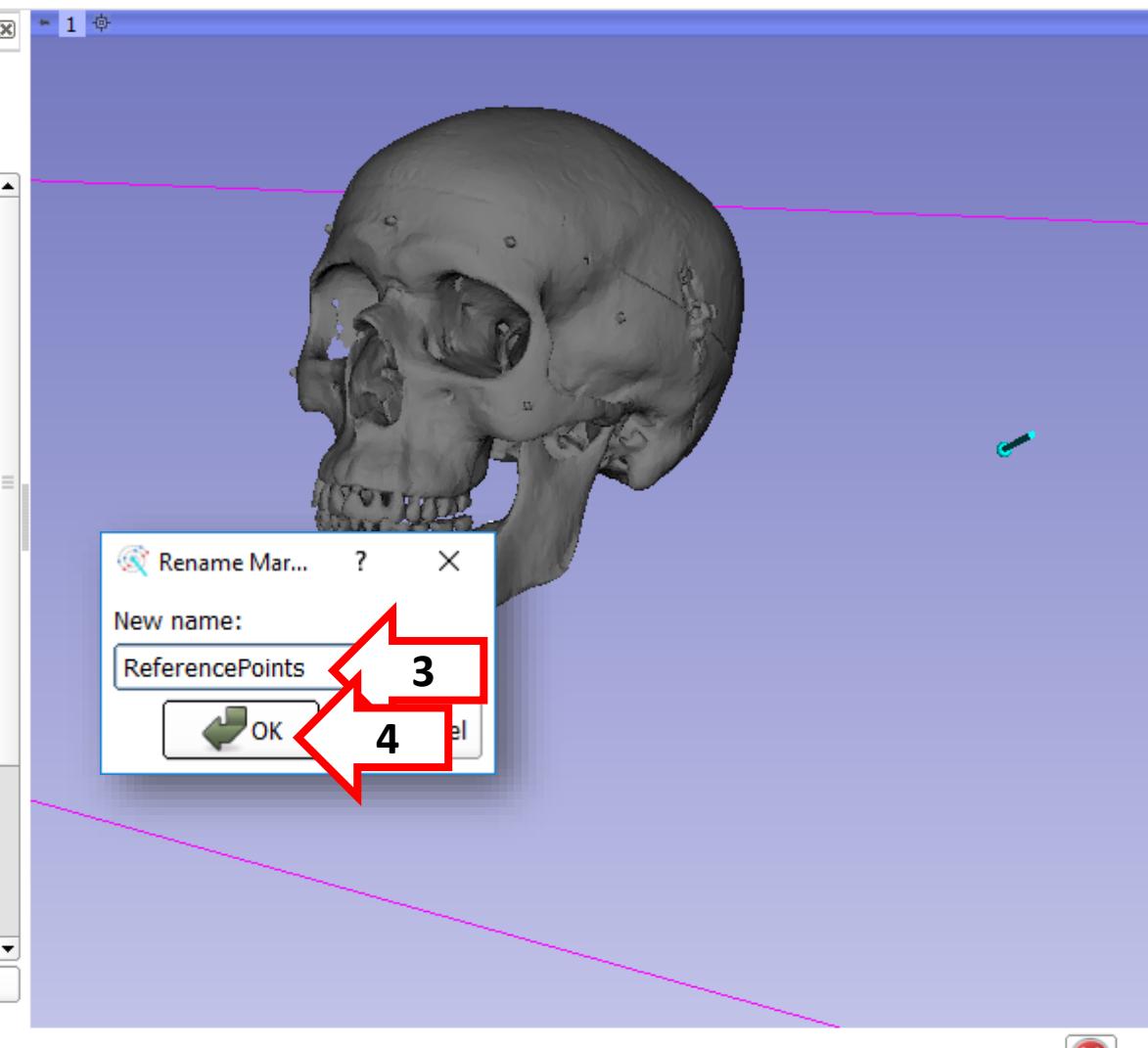
→ to fiducials

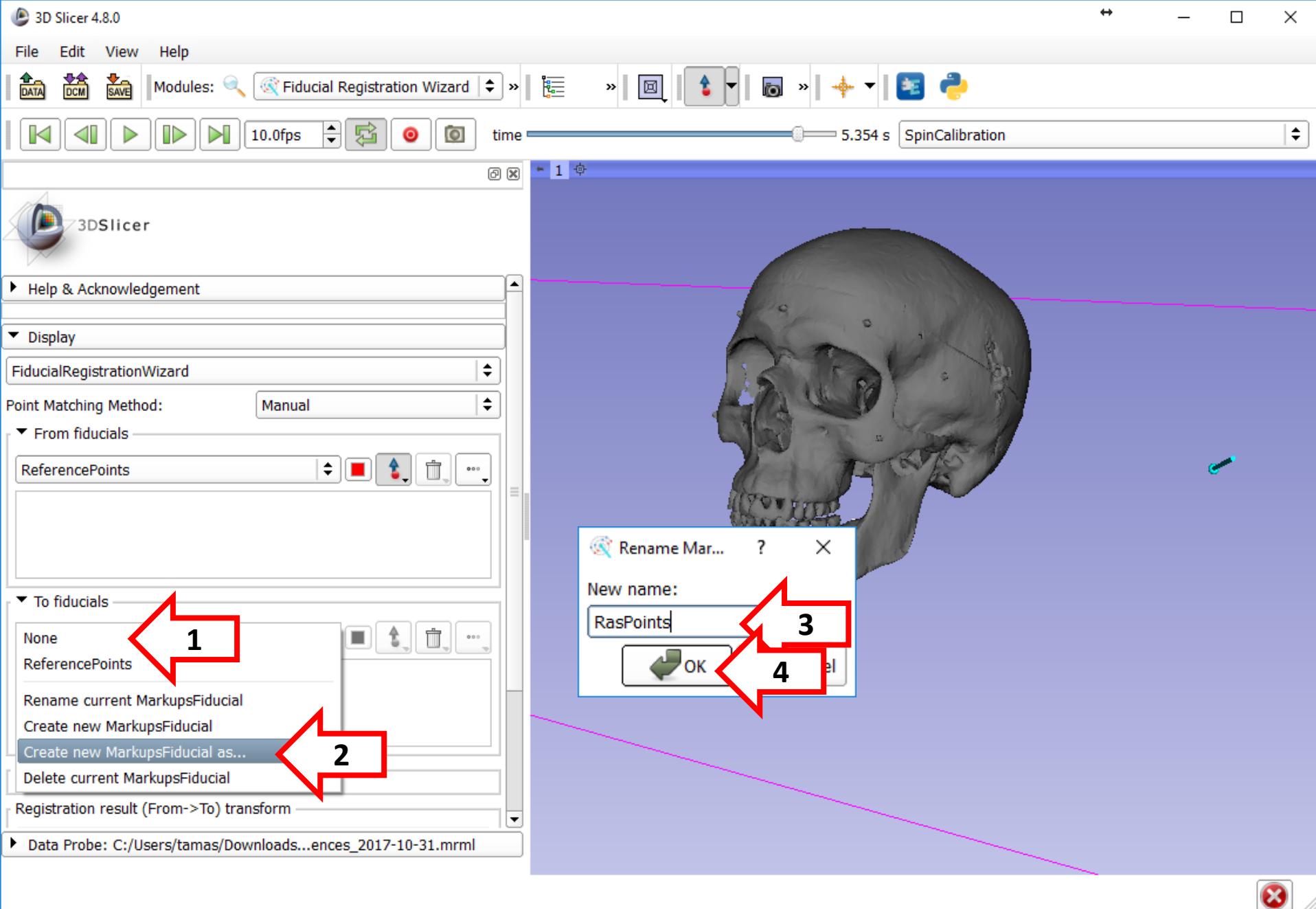
None

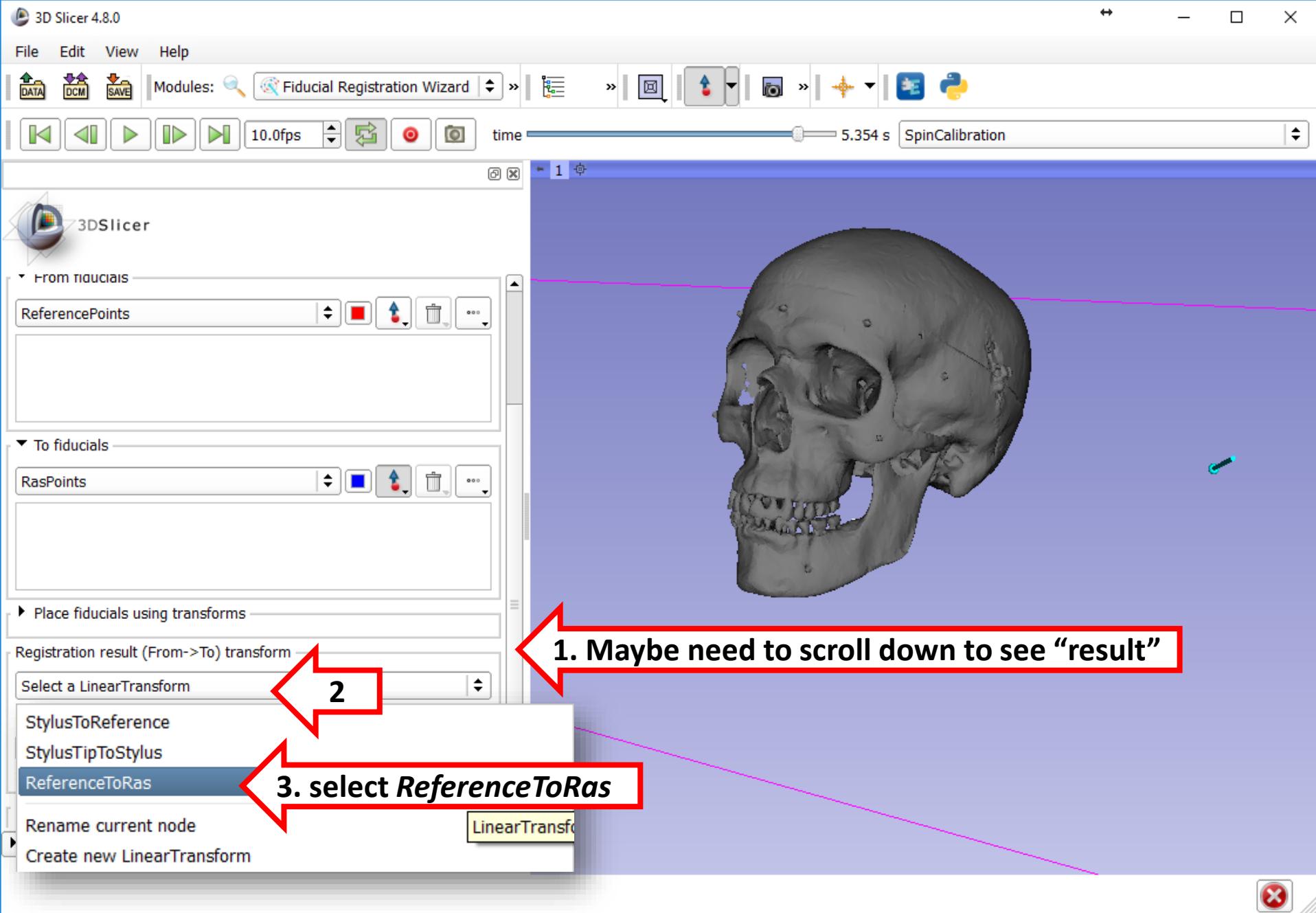
▶ Place fiducials using transforms

Registration result (From->To) transform

▶ Data Probe: C:/Users/tamas/Downloads...ences_2017-10-31.mrml







File Edit View Help



Make sure this button is
unchecked when
interacting with 3D viewer!

1



5.354 s SpinCalibration

3DSlicer

From fiducials

ReferencePoints

To fiducials

RasPoints

Place fiducials using transforms

Registration result (From->To) transform

ReferenceToRas

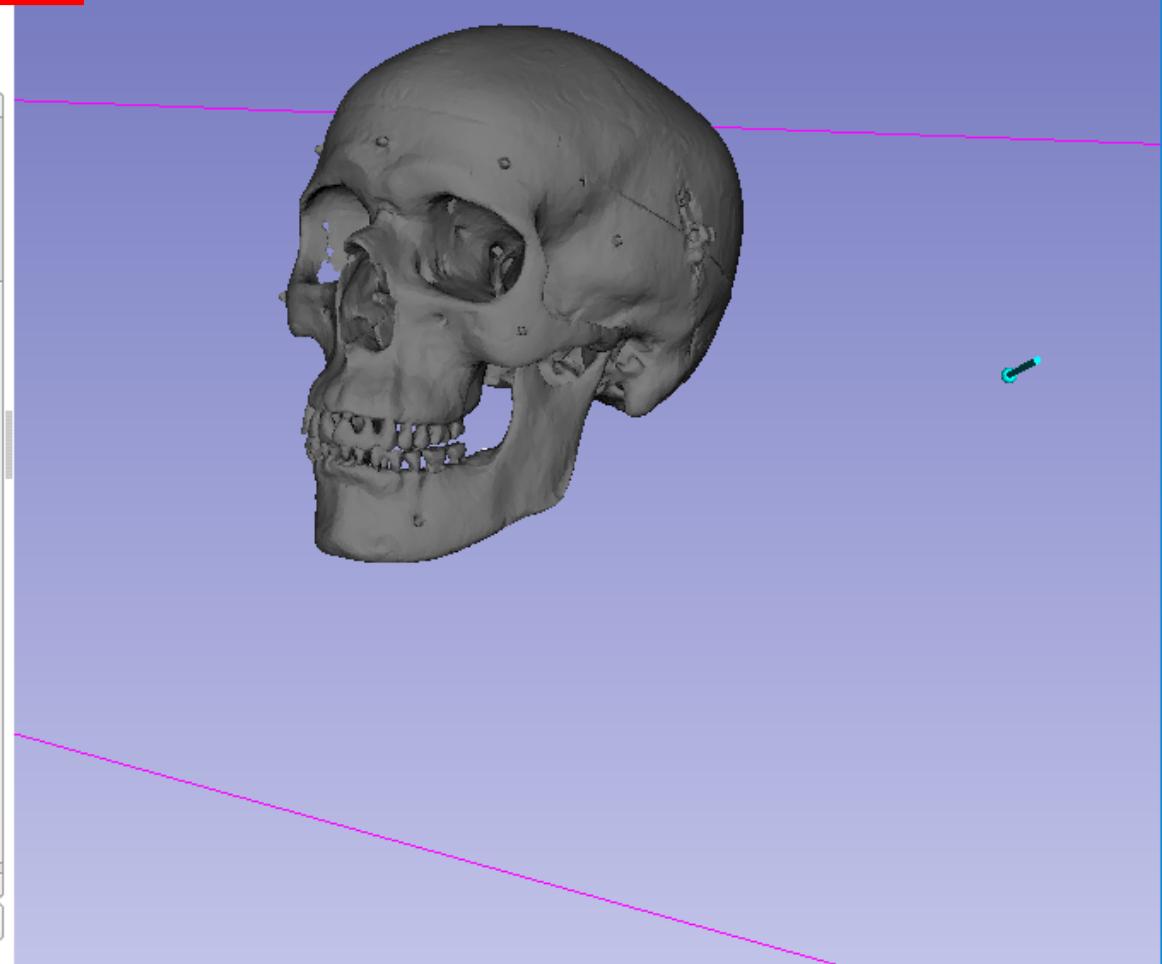
Result transform type: Rigid Similarity Warping

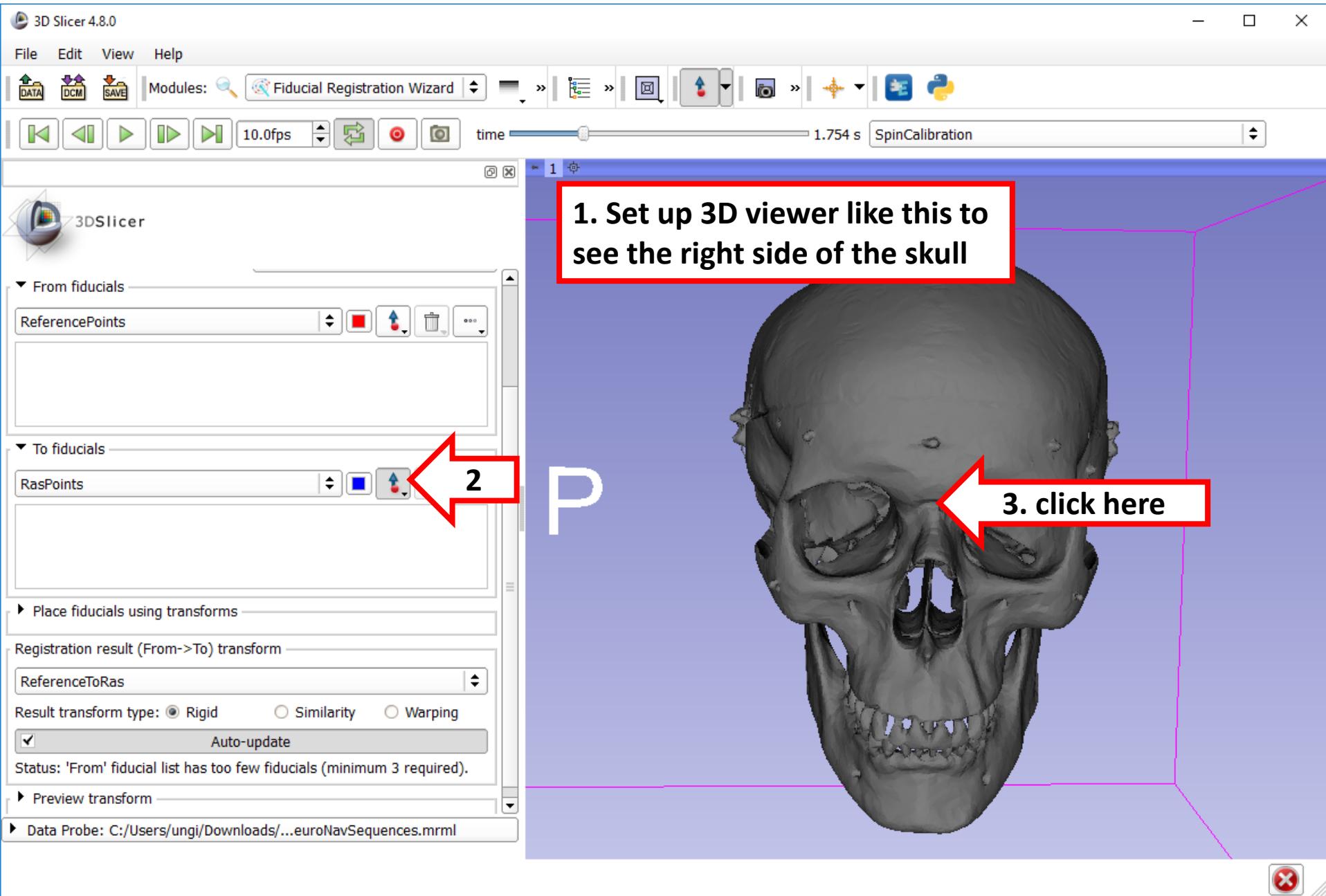
Auto-update

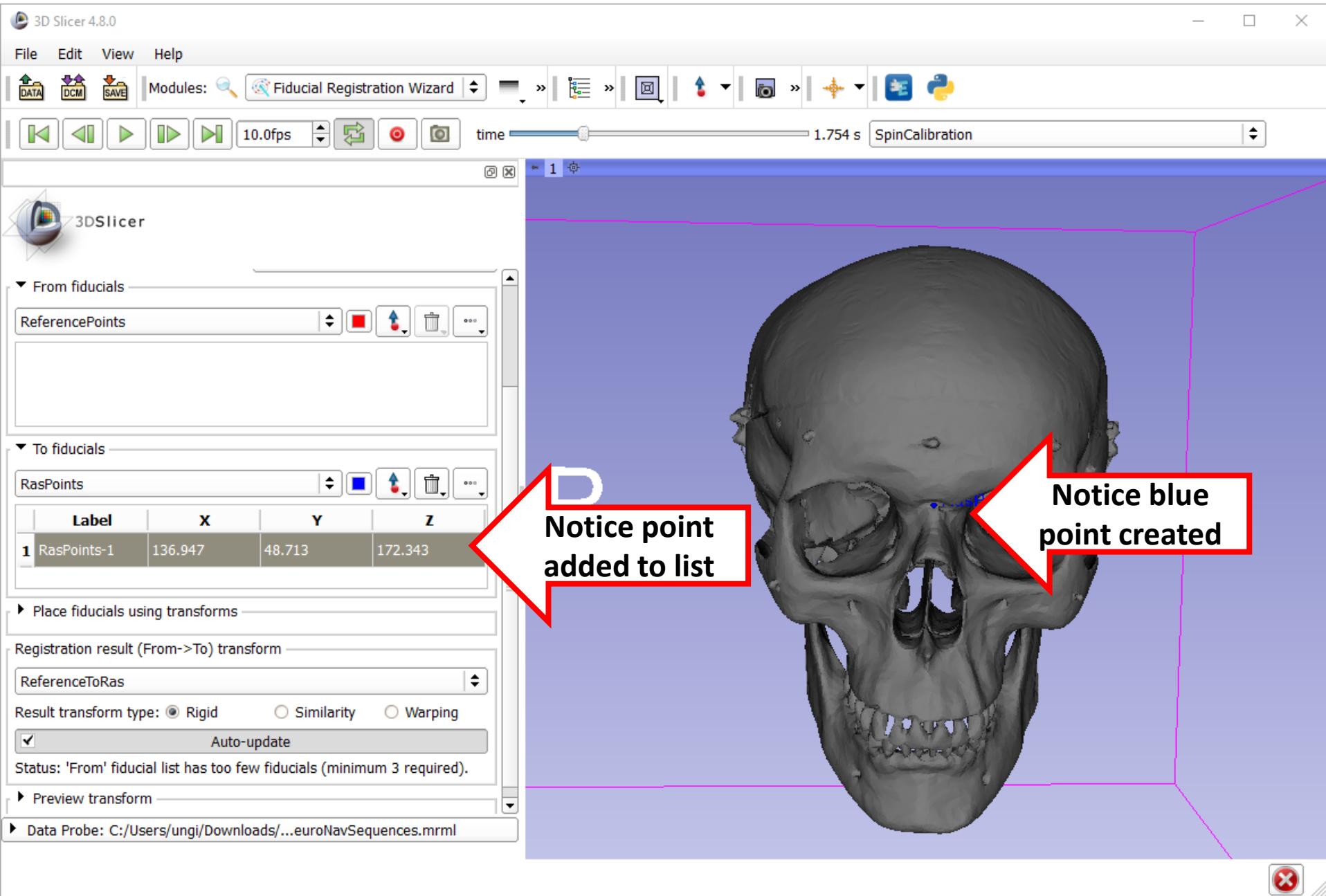
Status: 'From' fiducial list has too few fiducials (minimum 3 required).

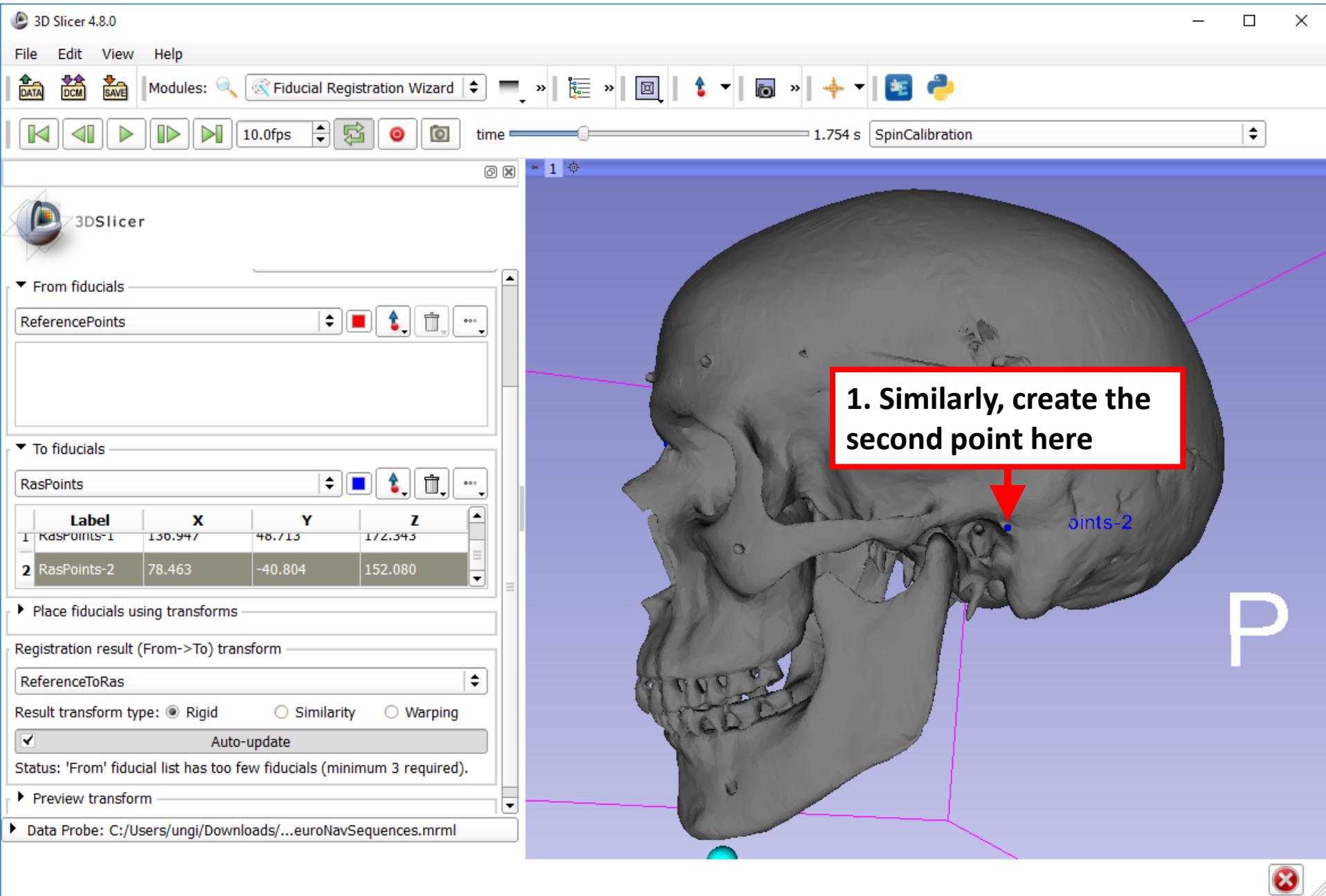
Preview transform

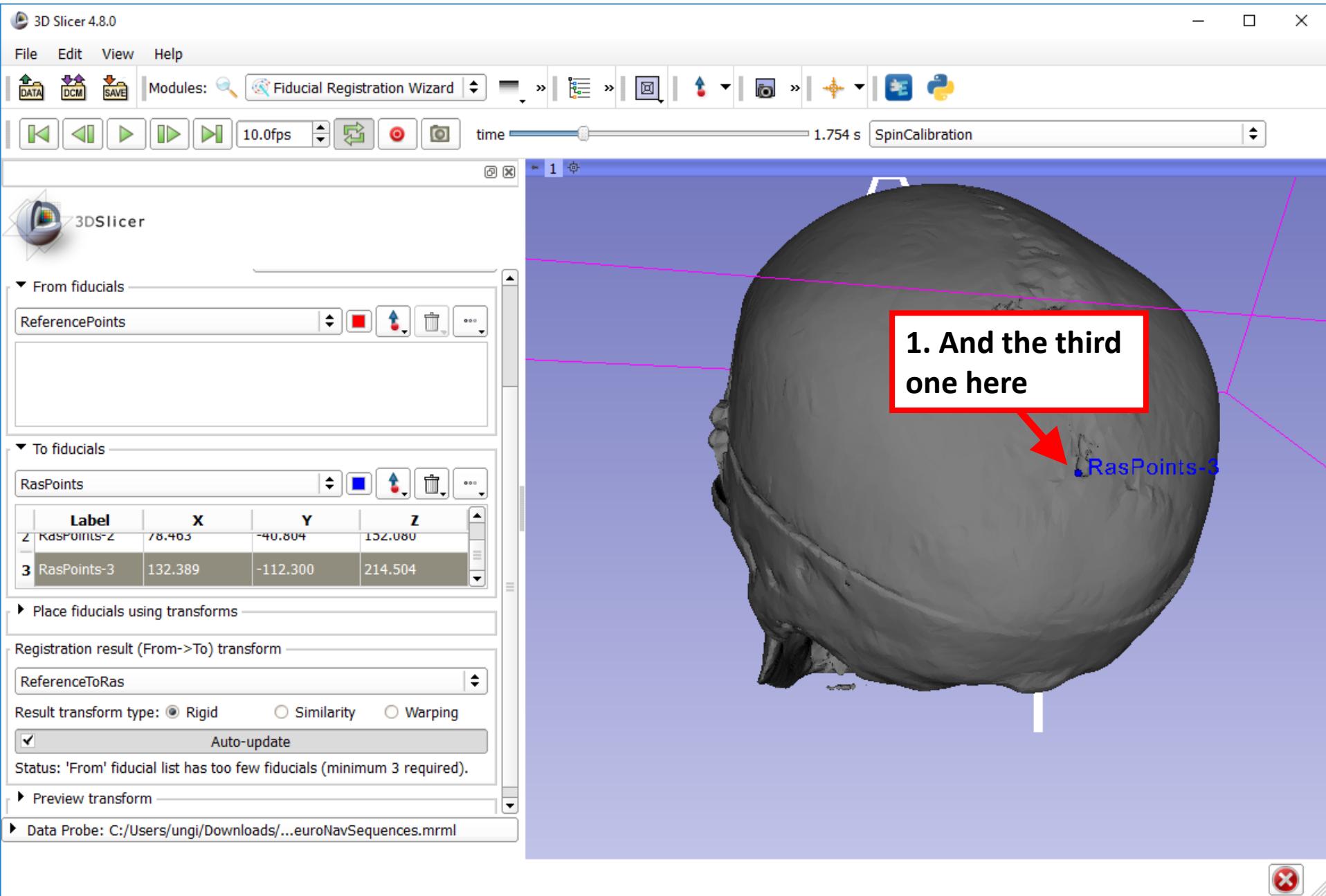
Data Probe: C:/Users/tamas/Downloads...ences_2017-10-31.mrml

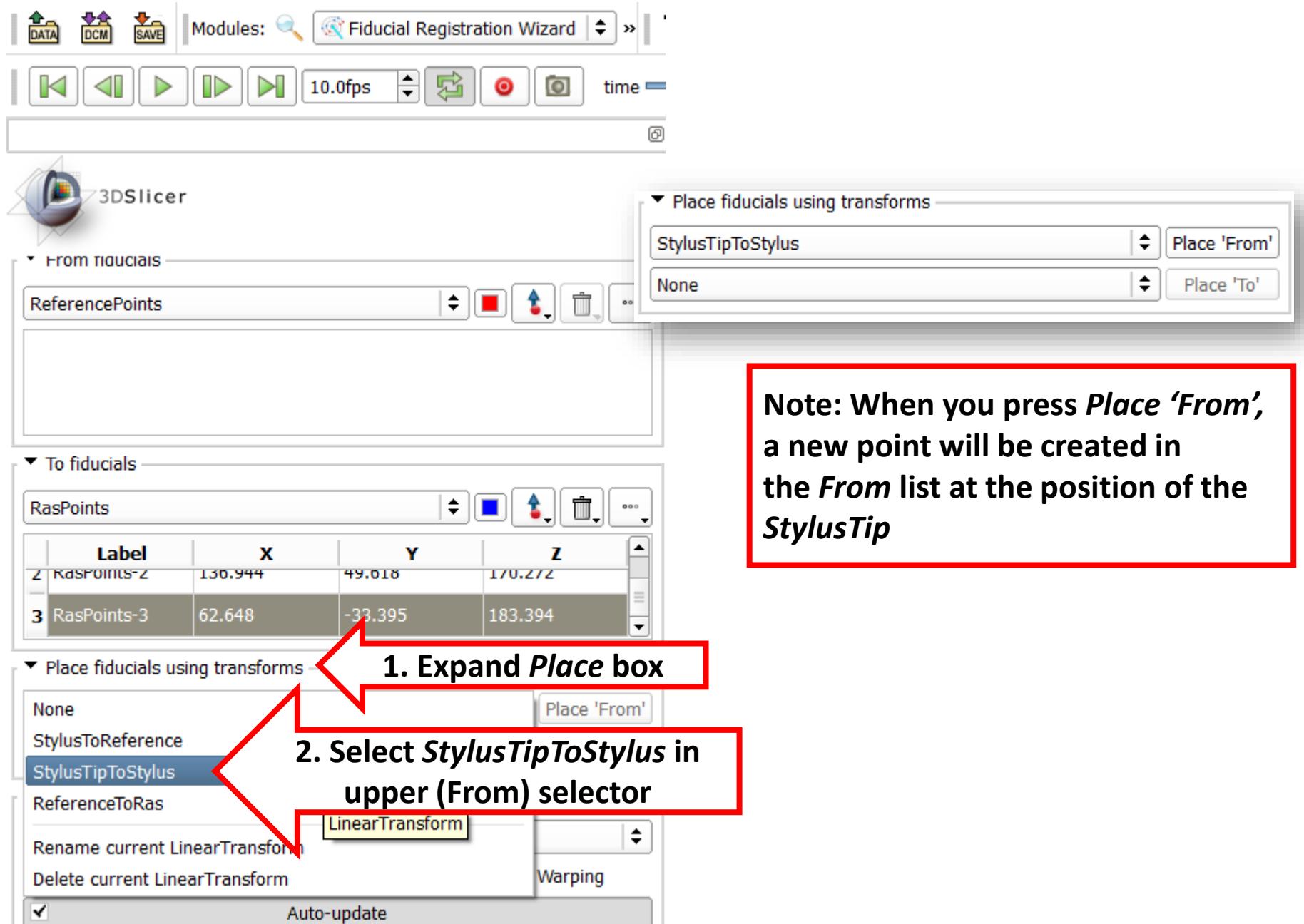












File Edit View Help

Modules: 🔎 Fiducial Registration Wizard

DATA DCM SAVE 10.0fps

time 1.754 s



From fiducials

ReferencePoints

1

SequenceBrowser

1

PivotCalibration

SpinCalibration

FiducialRegistration

RandomMotions

Rename current SequenceBrowser

Delete current SequenceBrowser

To fiducials

RasPoints

Label	X	Y	Z
2 RasPoints-Z	78.403	-40.804	152.080
3 RasPoints-3	132.389	-112.300	214.504

Place fiducials using transforms

StylusTipToStylus

Place 'From'

None

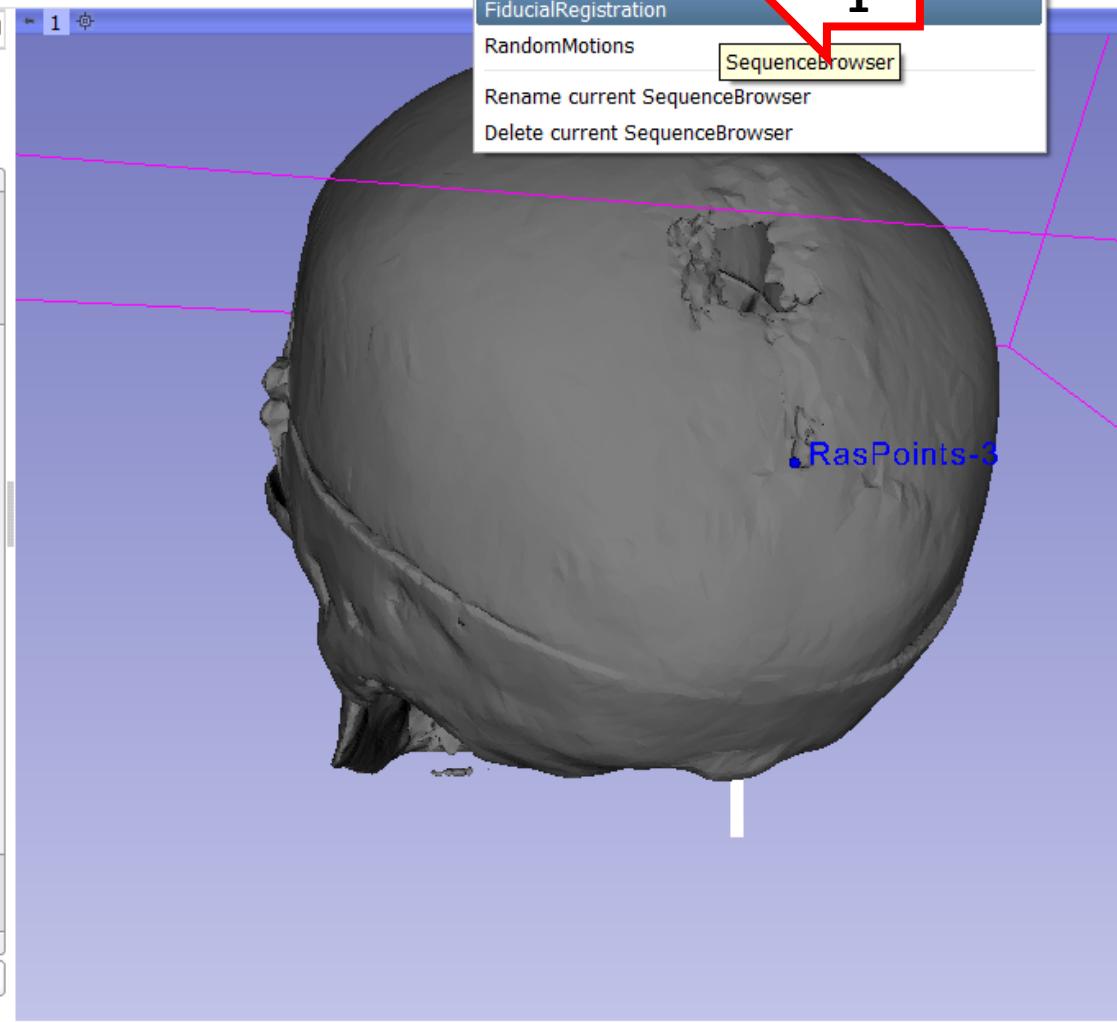
Place 'To'

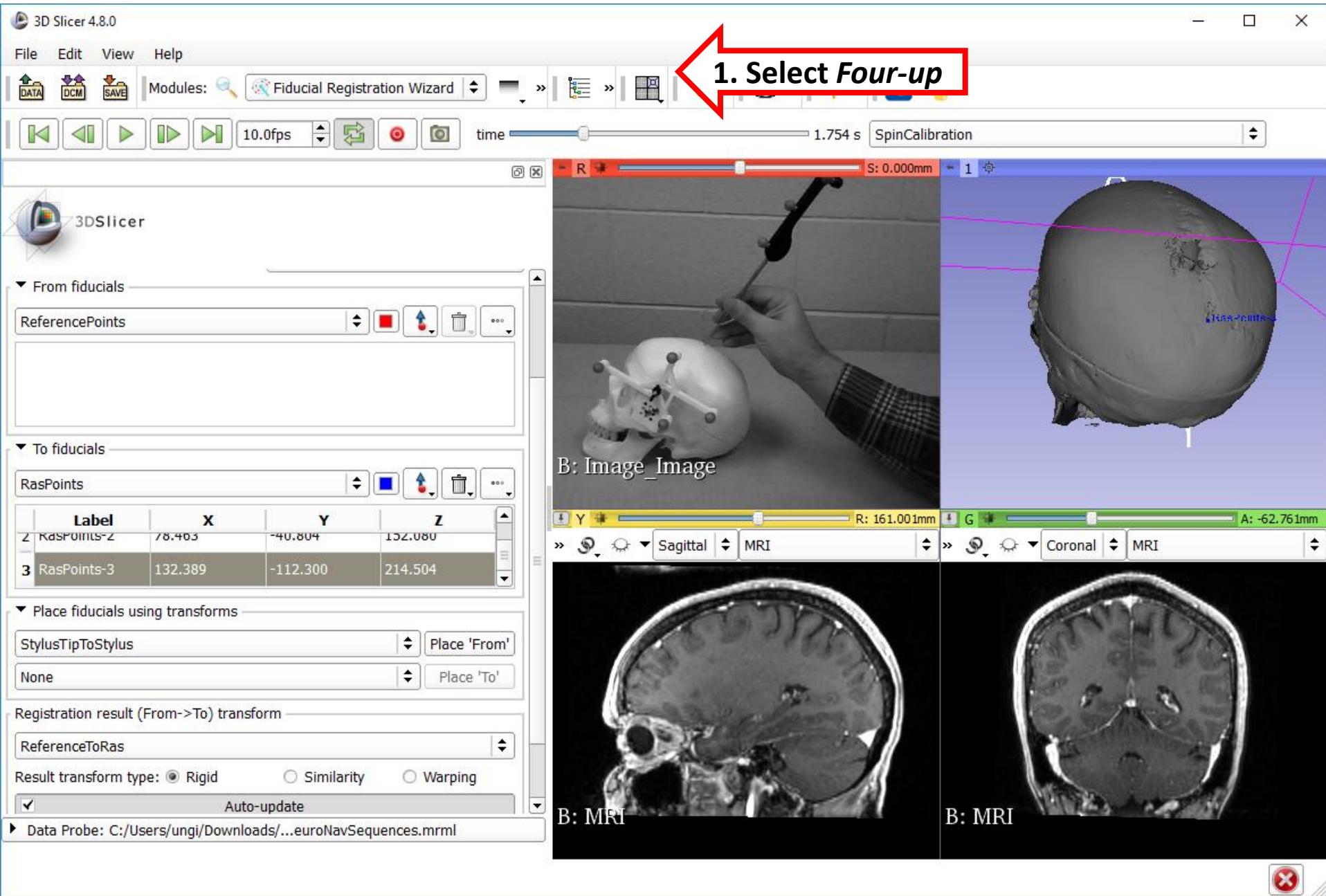
Registration result (From->To) transform

ReferenceToRas

Result transform type: Rigid Similarity Warping Auto-update

Data Probe: C:/Users/ungi/Downloads/...euroNavSequences.mrml





File Edit View Help



Modules: Fiducial Registration Wizard



10.0fps



time



1

Scroll time to the point where the stylus on the video points to the first registration point

From fiducials

ReferencePoints

Label	X	Y	Z
1 ReferencePoint...	540	-540	70.916

3. see

To fiducials

RasPoints

Label	X	Y	Z
2 RasPoints-Z	78.403	-40.804	152.080
3 RasPoints-3	132.389	-112.300	214.504

Place fiducials using transforms

StylusTipToStylus

Place 'From'

None

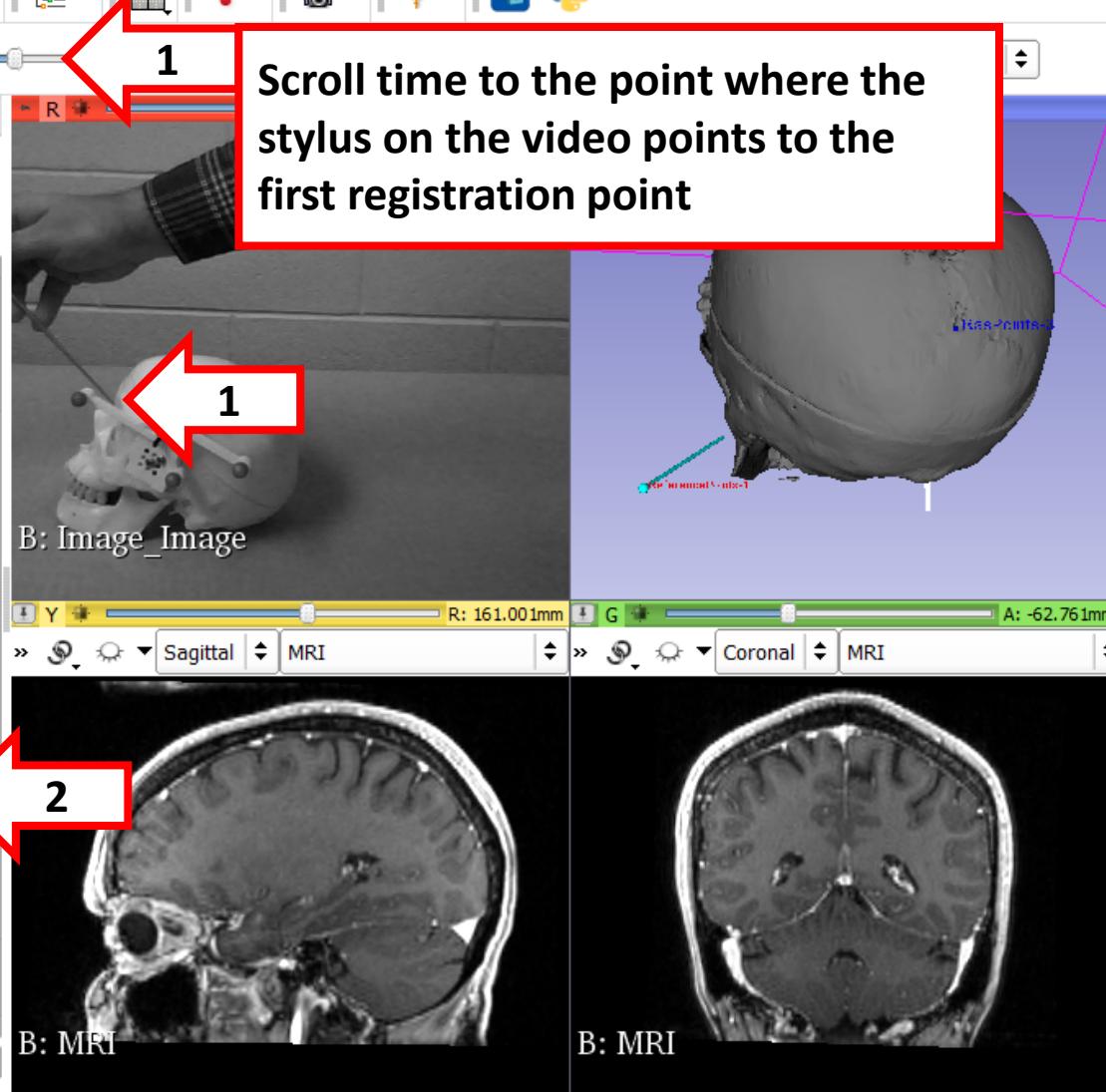
Place 'To'

Registration result (From->To) transform

ReferenceToRas

Result transform type: Rigid Similarity Warping Auto-update

Data Probe: C:/Users/ungi/Downloads/...euroNavSequences.mrml



File Edit View Help



From fiducials

ReferencePoints		...	
Label	X	Y	Z
1 ReferencePoint...	-56.710	-0.540	70.910
2 ReferencePoint...	-84.1	36.496	

3. see

To fiducials

RasPoints		...	
Label	X	Y	Z
2 RasPoints-Z	78.403	-40.804	152.080
3 RasPoints-3	132.389	-112.300	214.504

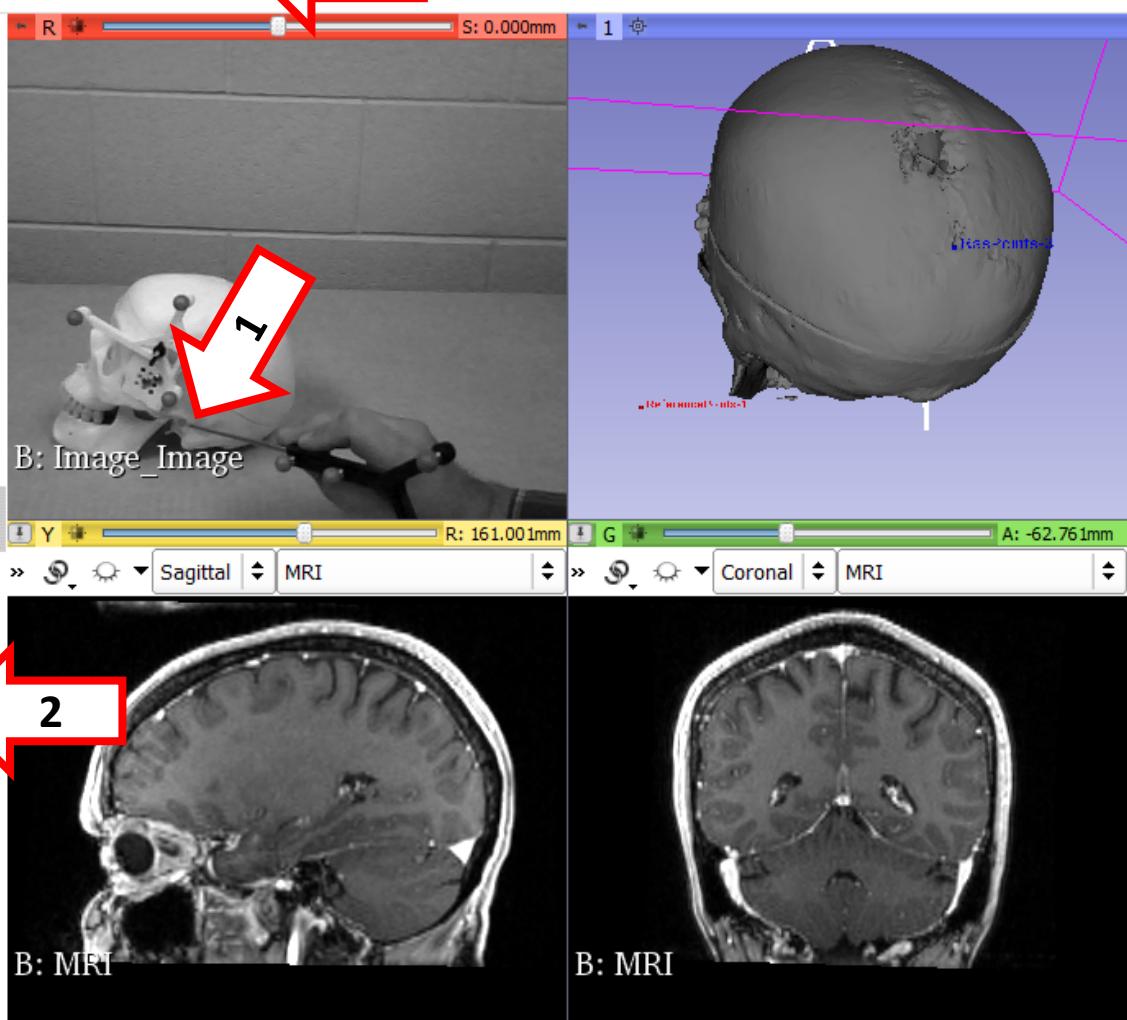
Place fiducials using transforms

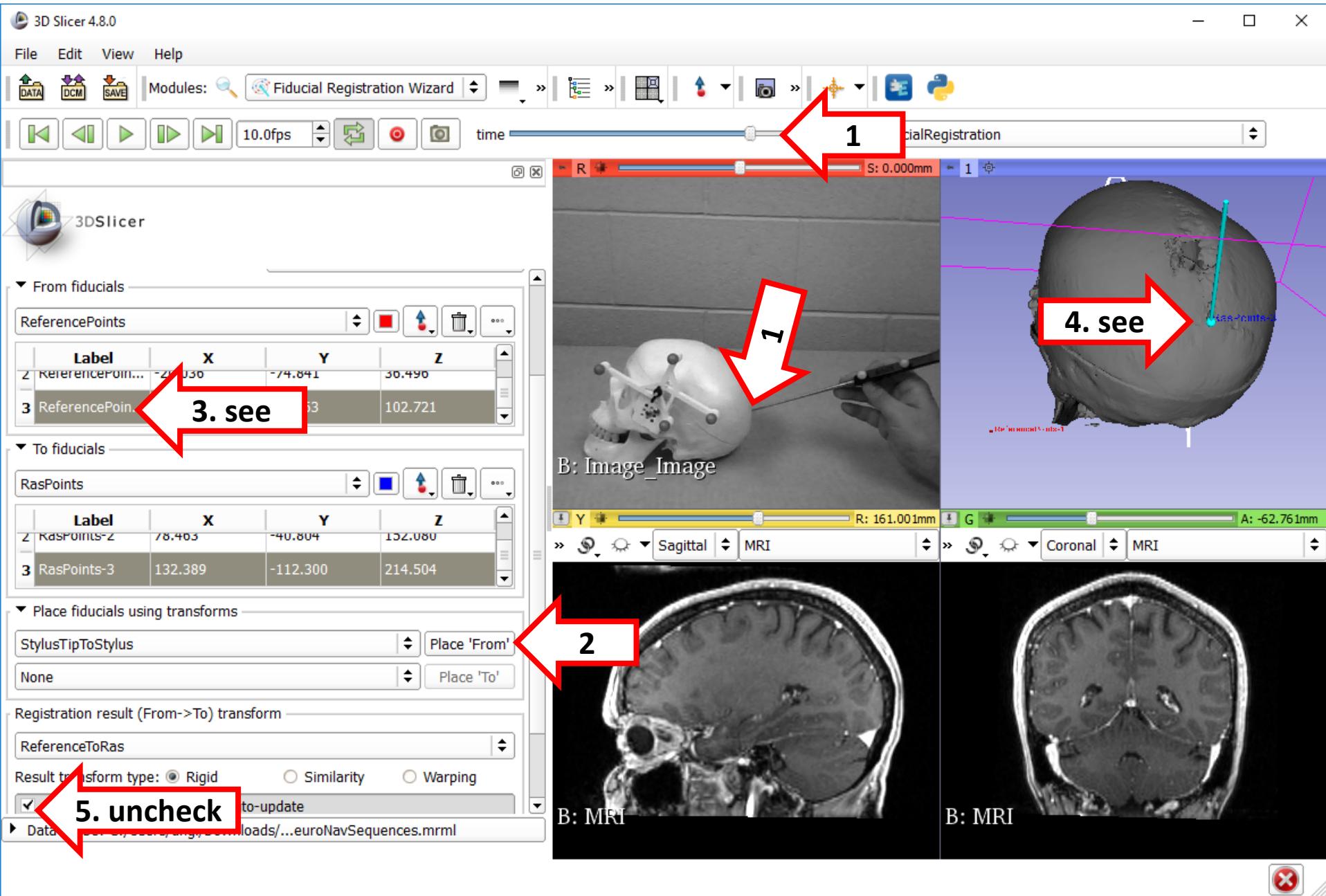
StylusTipToStylus None

Registration result (From->To) transform

ReferenceToRas Rigid Similarity Warping Auto-update

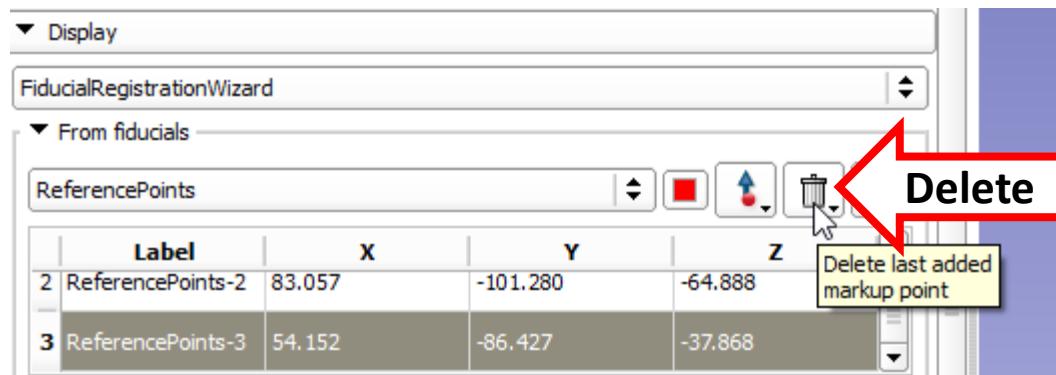
Data Probe: C:/Users/ungi/Downloads/...euroNavSequences.mrml



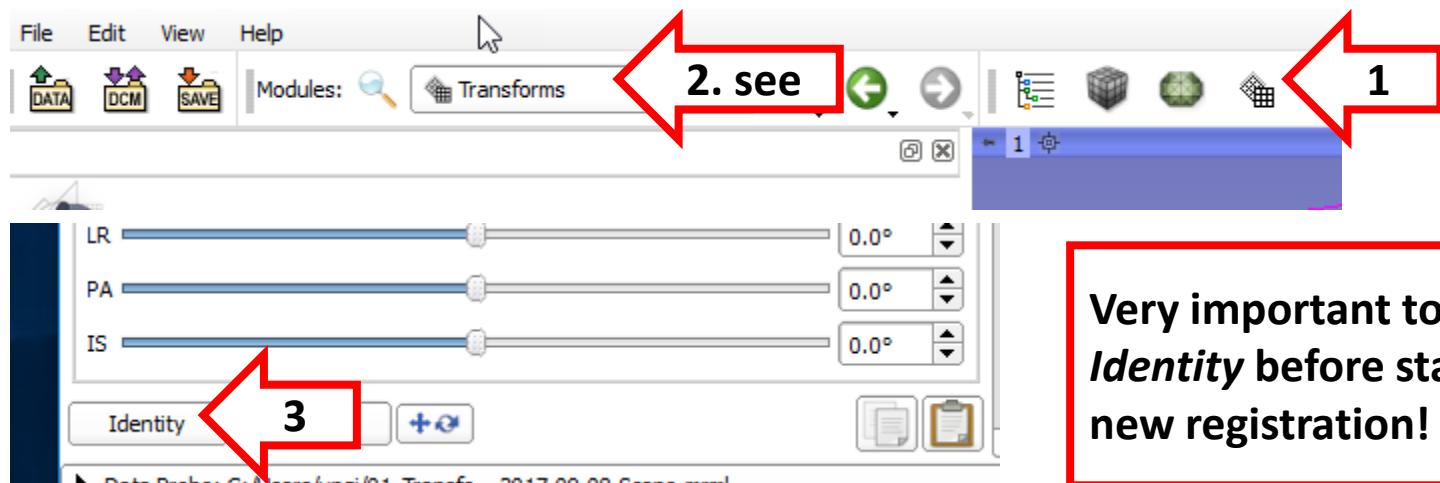


Troubleshooting

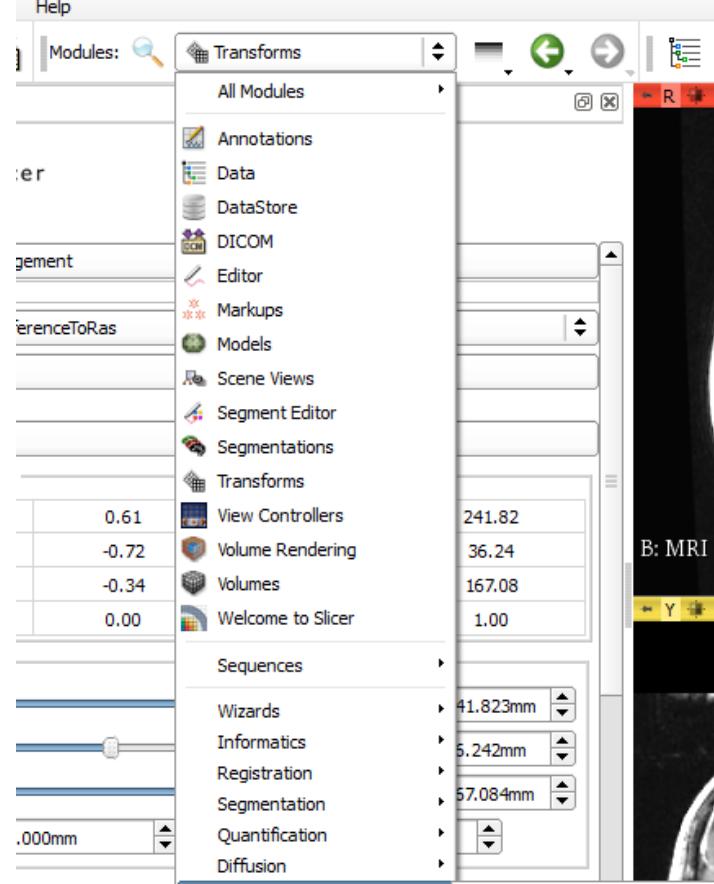
How to redo one point (before registration completed)



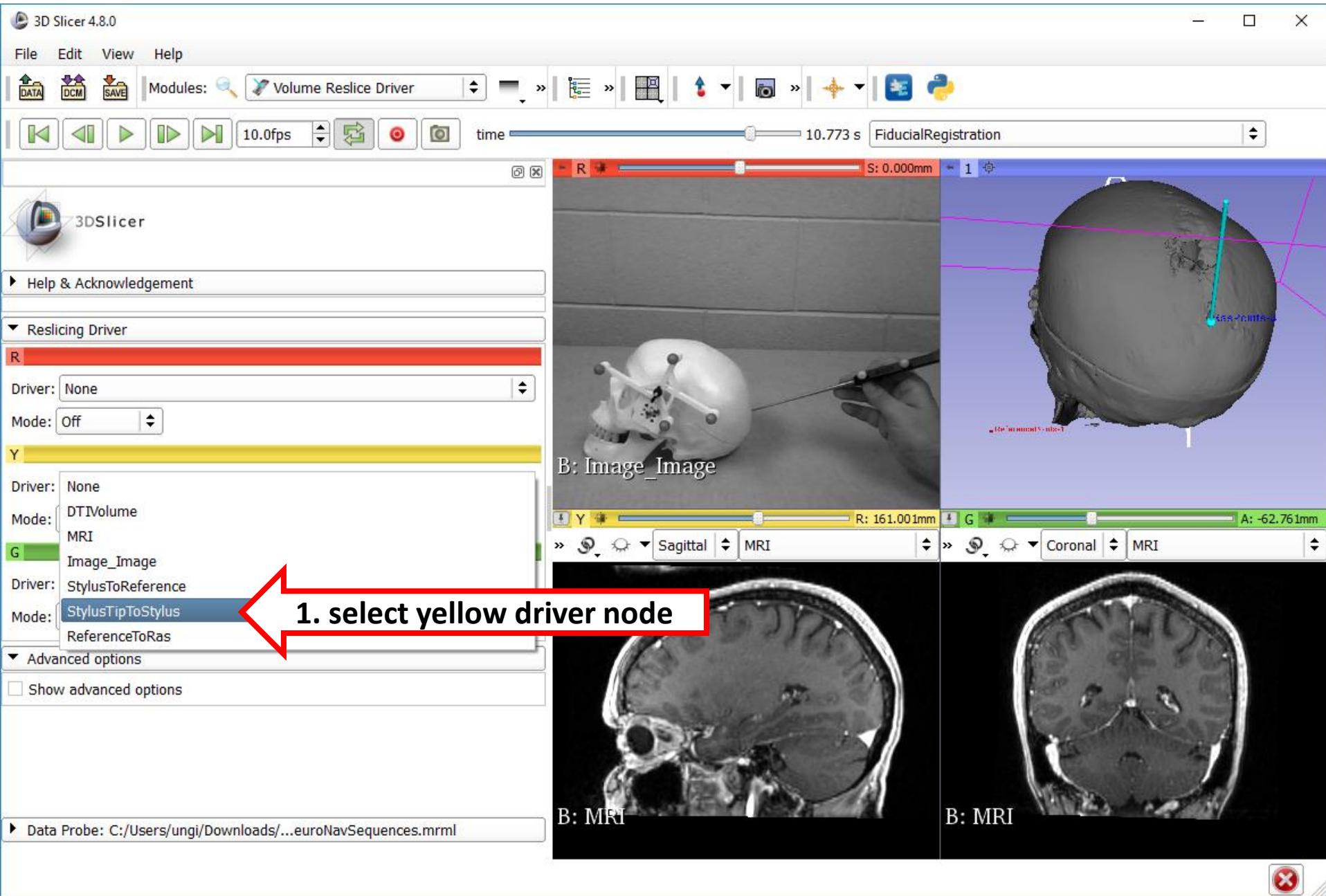
How to reset registration (after a completed registration)

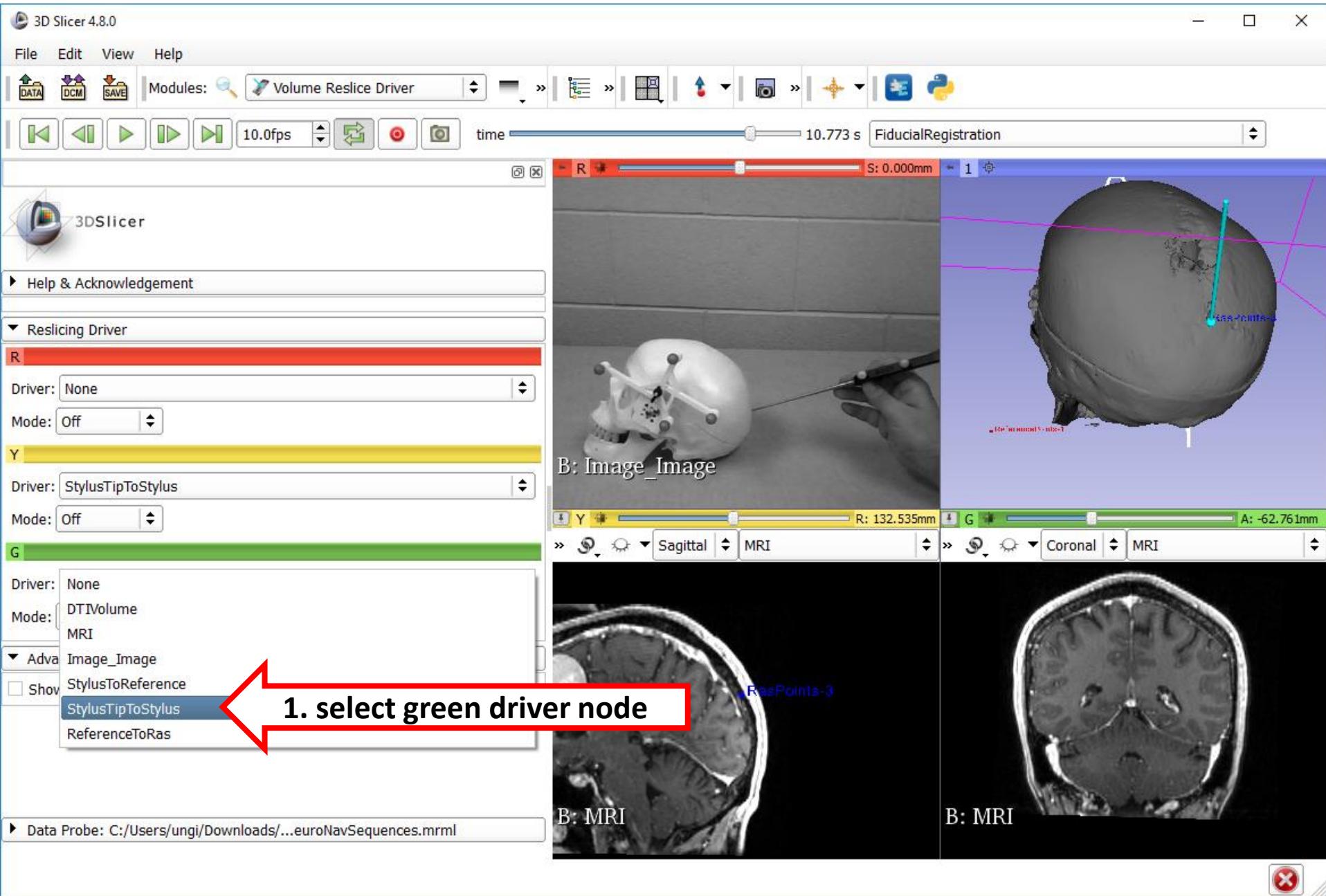


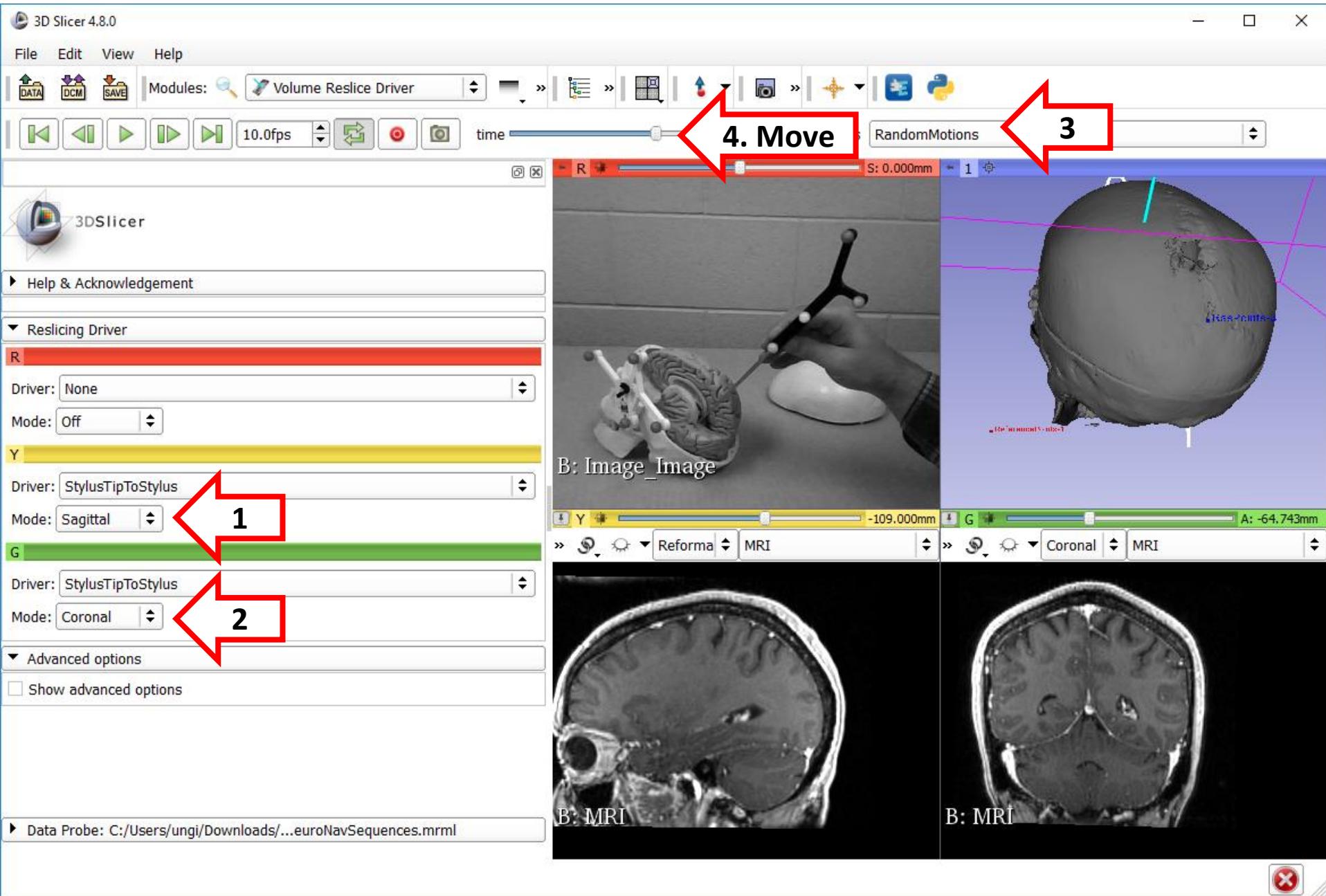
Very important to reset to *Identity* before starting a new registration!

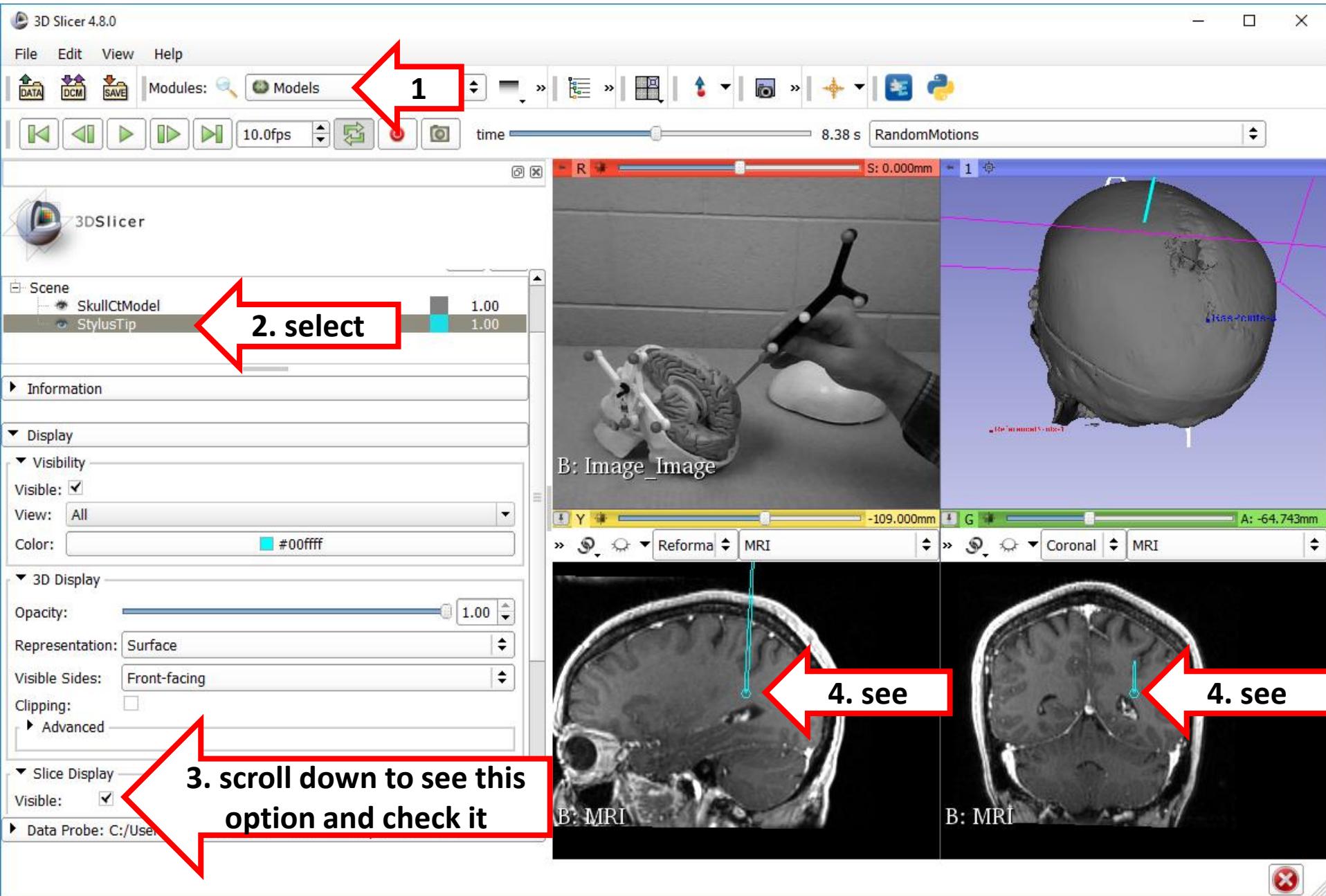


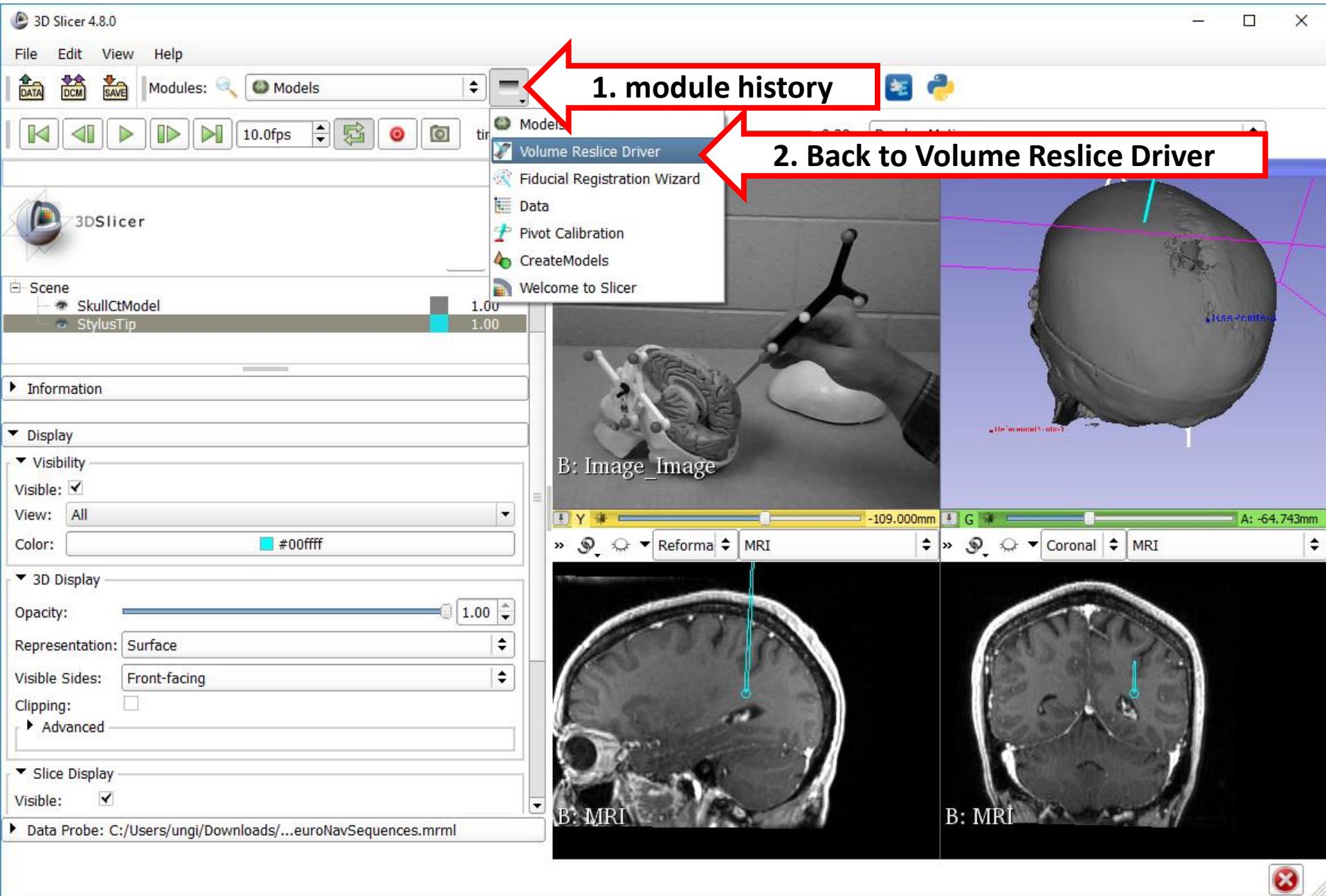
2. Volume Reslice Driver

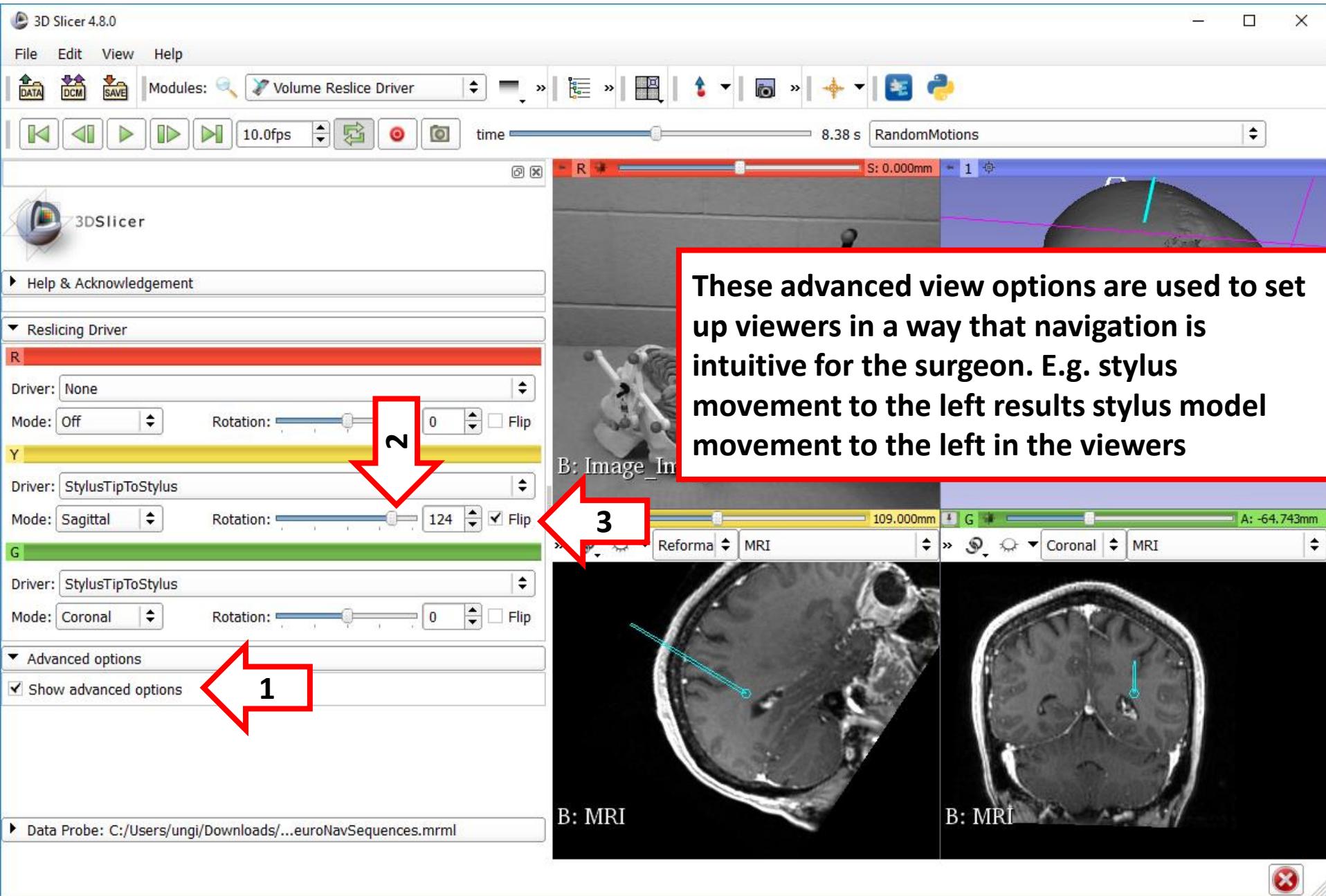














Modules:

1



10.0fps



time

8.38 s

RandomMotions



Help & Acknowledgement

ReferencePoints

RasPoints

Scale Rename current MarkupsFiducial

2

 Create new MarkupsFiducial Create new MarkupsFiducial as... Delete current MarkupsFiducial

New markups with current display properties

 Transformed Hide RAS

	<input type="checkbox"/>		Name	Description	R	A	S
1	<input checked="" type="checkbox"/>		RasPoi...		136.947	48.713	172.34
2	<input checked="" type="checkbox"/>		RasPoi...		78.463	-40.804	152.08
3	<input checked="" type="checkbox"/>		RasPoi...		132.389	-112.300	214.50

