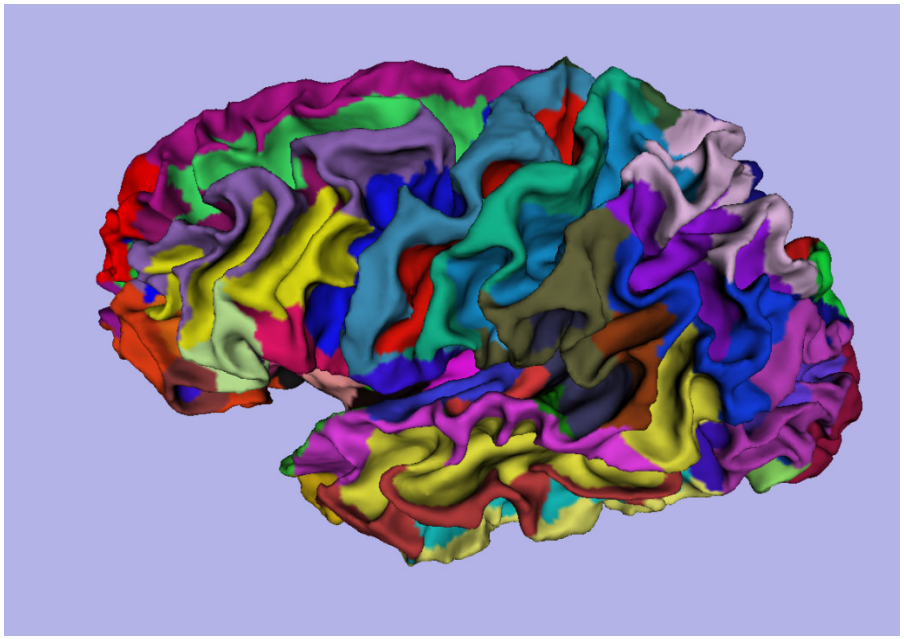

3D Visualization of FreeSurfer Data

Sonia Pujol, Ph.D.
Silas Mann, B.Sc.
Randy Gollub, MD., Ph.D.

Surgical Planning Laboratory
Athinoula A. Martinos Center
Harvard University

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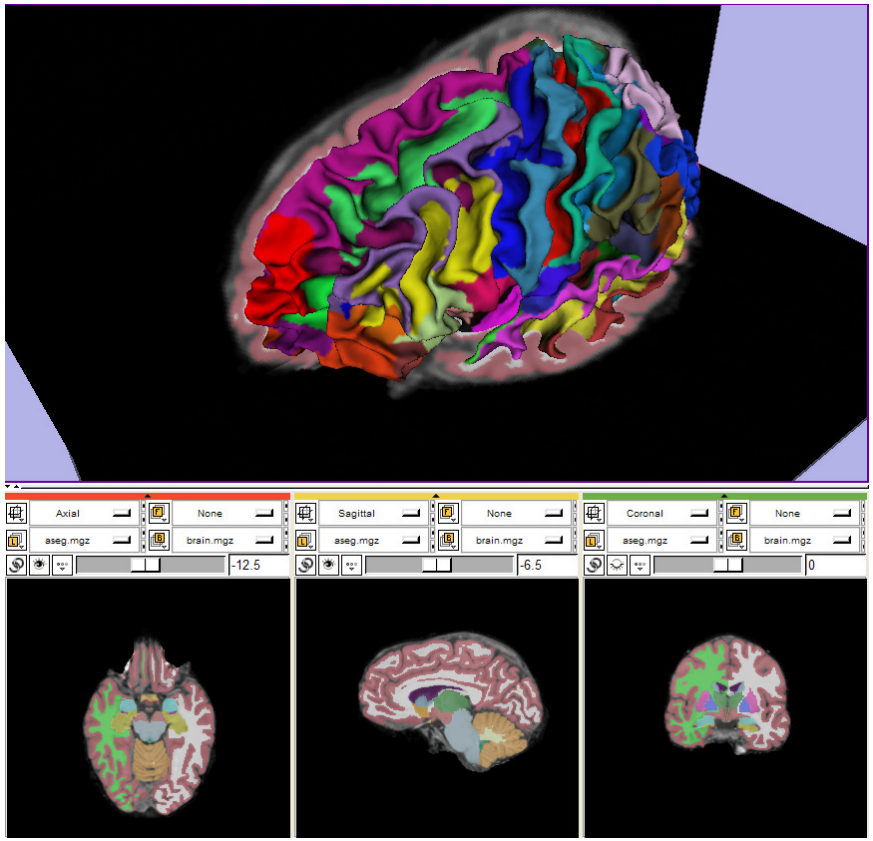
NIH P41RR013218

Morphometry Biomedical Informatics Research Network
NIH U24RRO21382

Surgical Planning Laboratory (BWH)
Thanks to Nicole Aucoin

Center for Functional Neuroimaging Technology
NIH P41RR14075

Learning Objective



Guide you step-by-step through the process of loading and viewing **FreeSurfer** segmentations, surface reconstructions, and parcellation results within **Slicer3.**

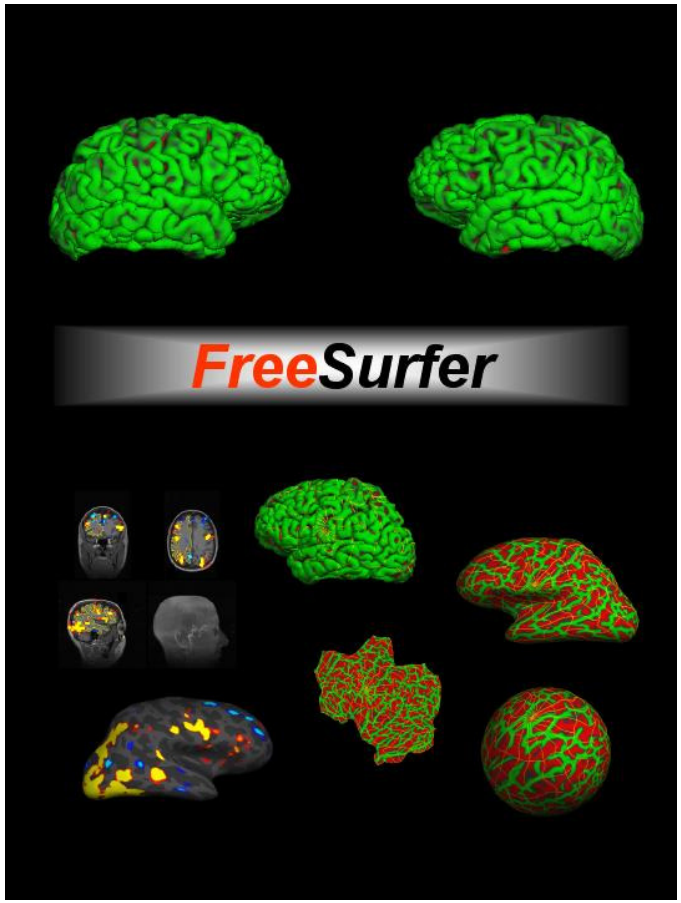
Prerequisites

This tutorial assumes that you have completed the course **Slicer3Visualization Tutorial.**

Tutorials for **Slicer3.4** are available on the Slicer101 page:

http://www.slicer.org/slicerWiki/index.php/Slicer3.4:Training#Software_tutorials

Prerequisites



This tutorial assumes a working knowledge of how to use **FreeSurfer** to generate segmentation and surface files.

Tutorials for **FreeSurfer** are available at the following location:

http://surfer.nmr.mgh.harvard.edu/fswiki/Tutorials/

Materials

- This tutorial requires the installation of the **Slicer3.4** software and the tutorial dataset.

- Download and install the Slicer3.4 software from the Slicer web site

http://www.slicer.org/pages/Special:SlicerDownloads

Disclaimer: *It is the responsibility of the user of Slicer to comply with both the terms of the license and with the applicable laws, regulations, and rules.*

Materials

This tutorial makes use of the same T1 weighted image dataset (bert) that is used for the FreeSurfer tutorial available at the following location:

http://surfer.nmr.mgh.harvard.edu/fswiki/FsTutorial

If you already have the FreeSurfer subject 'bert' on your computer, then just download the file 'slicerGenericScene.mrml'

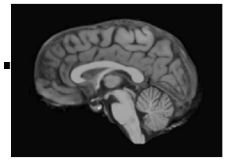
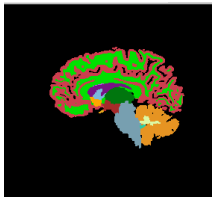
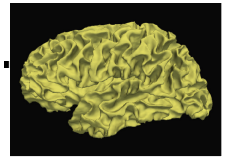
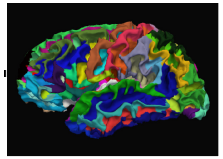
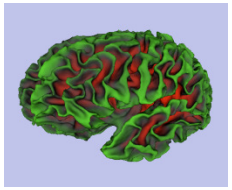
http://www.na-mic.org/Wiki/index.php/Image:SlicerGenericScene.mrml

If you don't have the FreeSurfer tutorial dataset known as 'bert' on your computer, then download the archive below:

http://www.na-mic.org/Wiki/index.php/Image:FreeSurferData.tar.gz

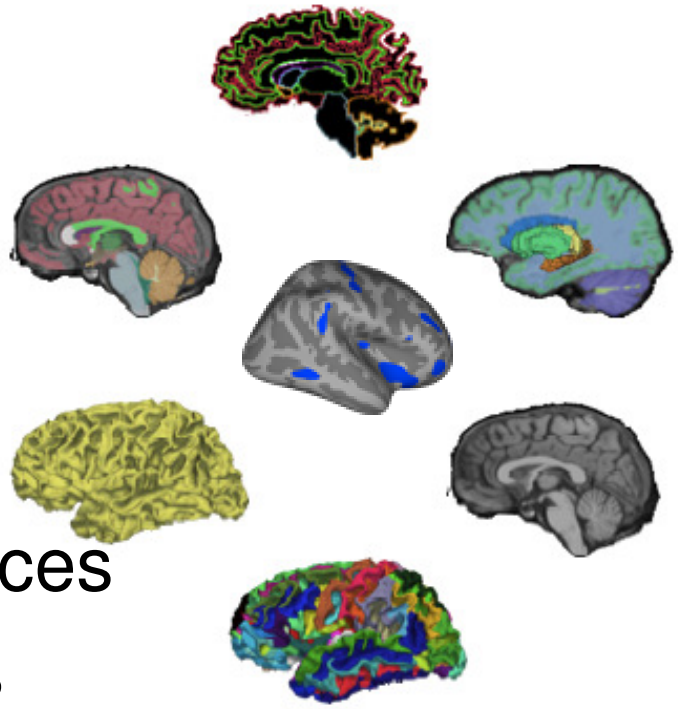
Overview

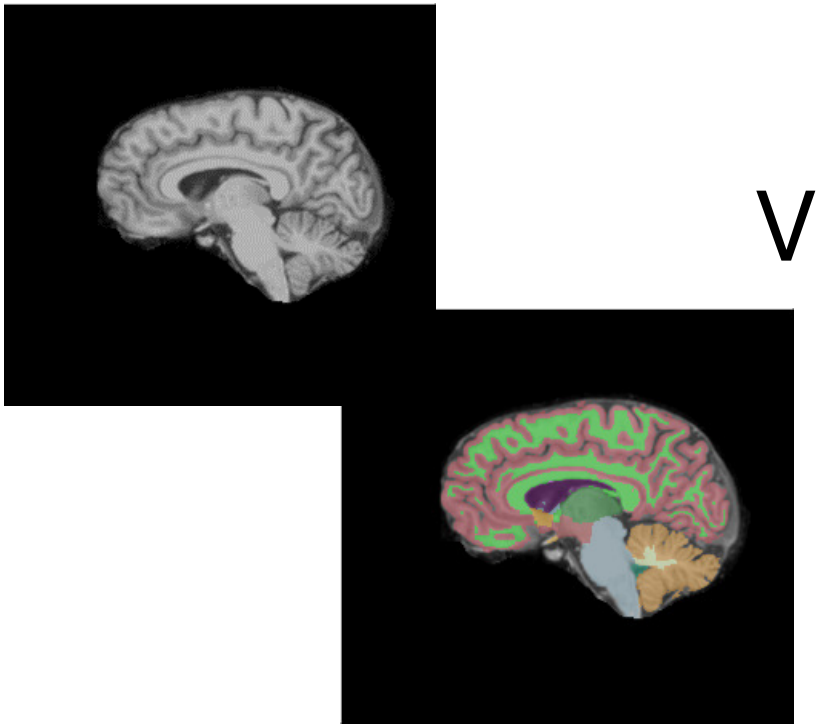
From **FreeSurfer**, **Slicer3** can load:

- Brain volumes . . . . . 
- ASEG volumes . . . . . 
- Surfaces . . . . . 
- Parcellation Maps . . . . . 
- All of the above, via a scene file. . . . . 

Overview

- Part 1: Loading and Visualizing FreeSurfer Volumes
- Part 2: Building 3D Models
- Part 3: Loading FreeSurfer Surfaces and Visualizing Parcellation Maps
- Part 4:Automatic Data Loading via a Generic Scene File

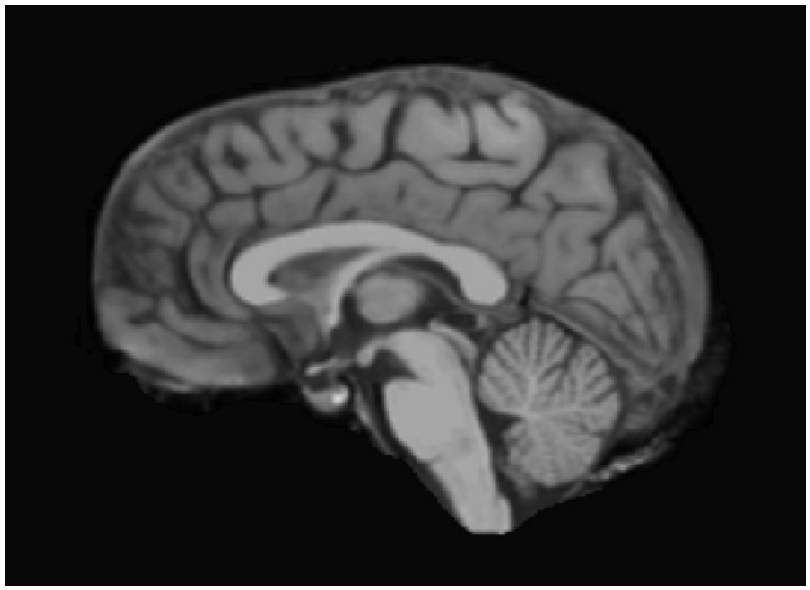




Part 1: Loading and Visualizing FreeSurfer Volumes

Loading a Brain File

FreeSurfer pipeline



Intensity corrected

T1 volume

↓

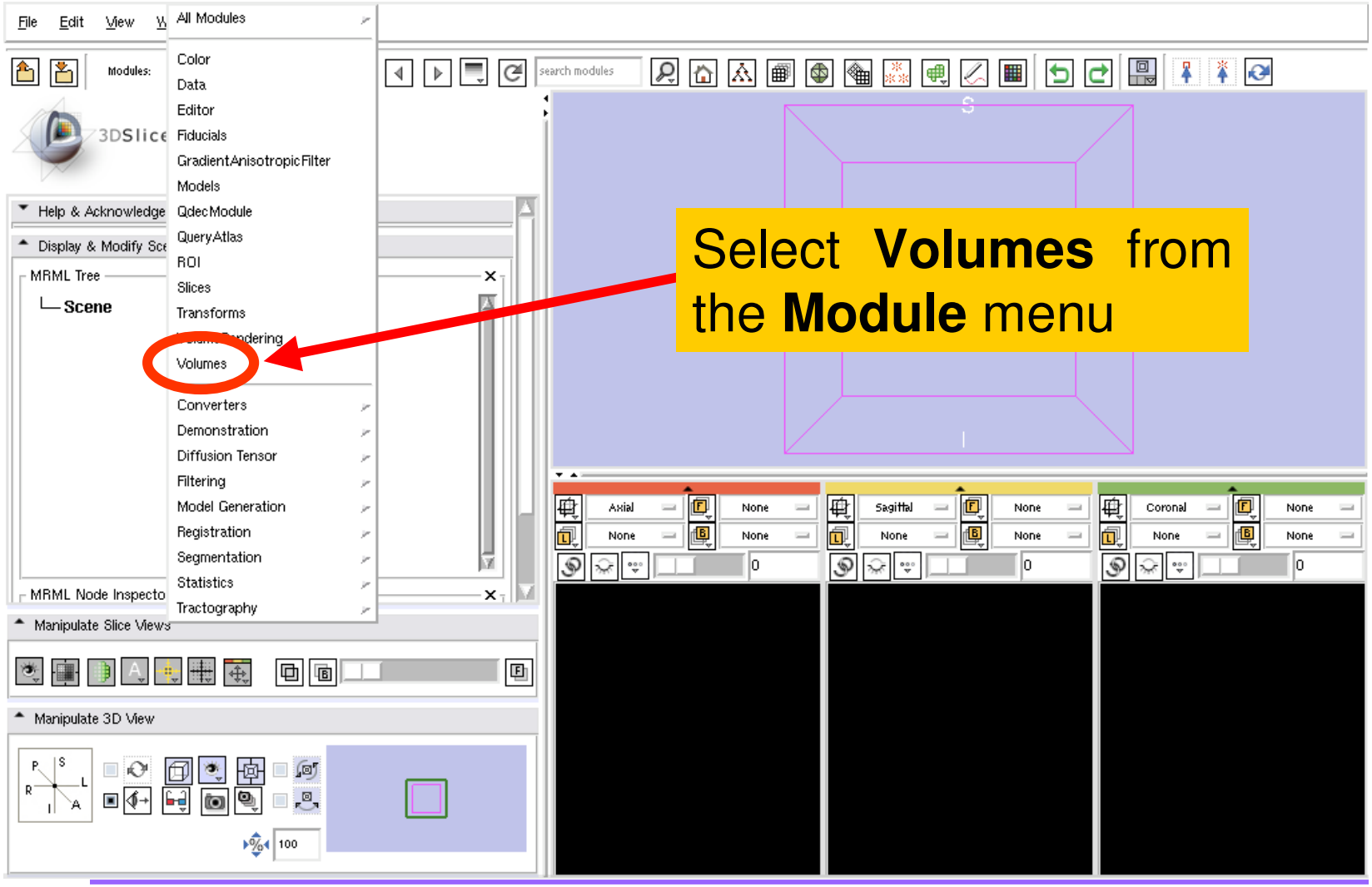
Skull Stripping and
Noise Filtering

Watershed Algorithm

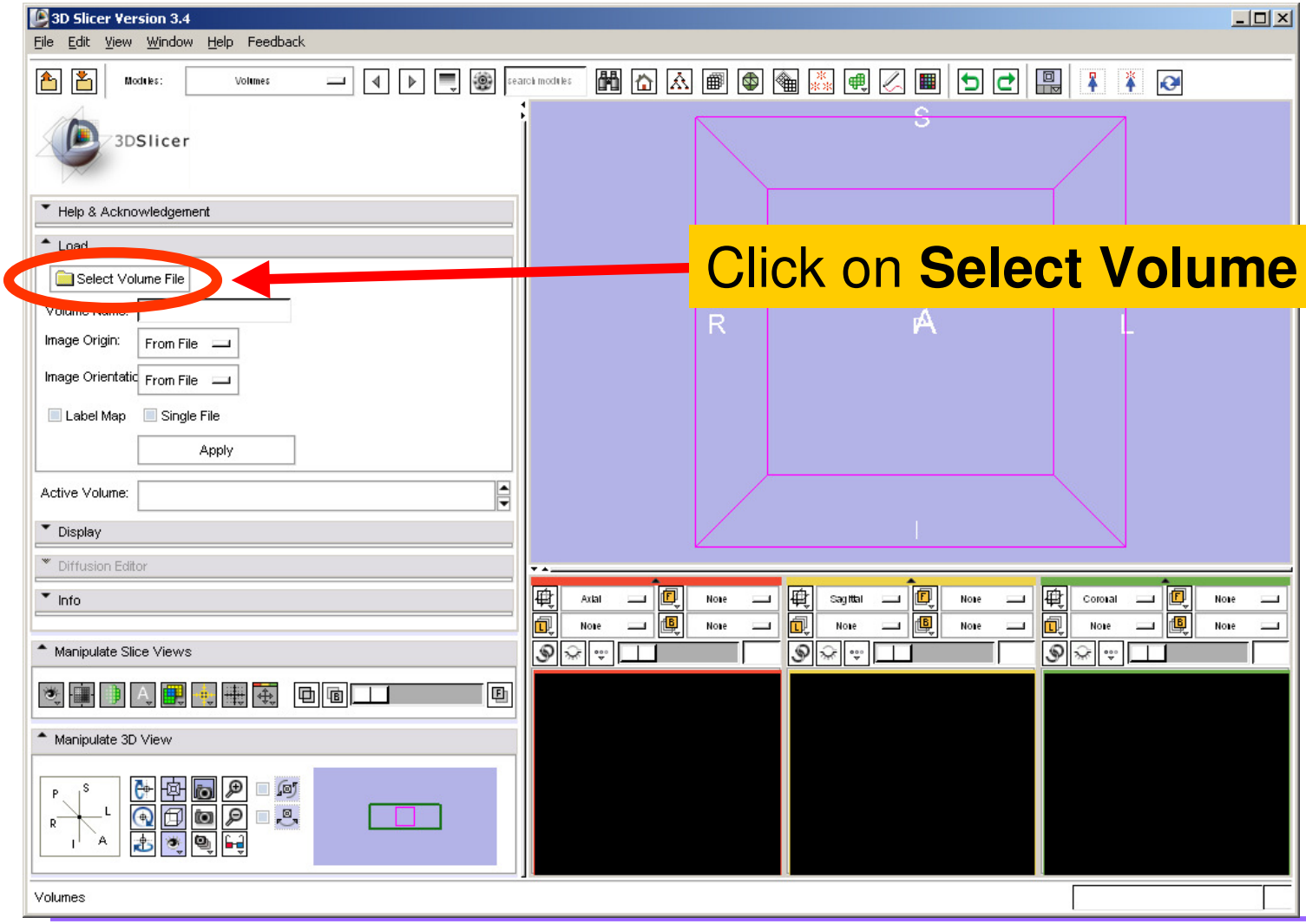
↓

brain.mgz

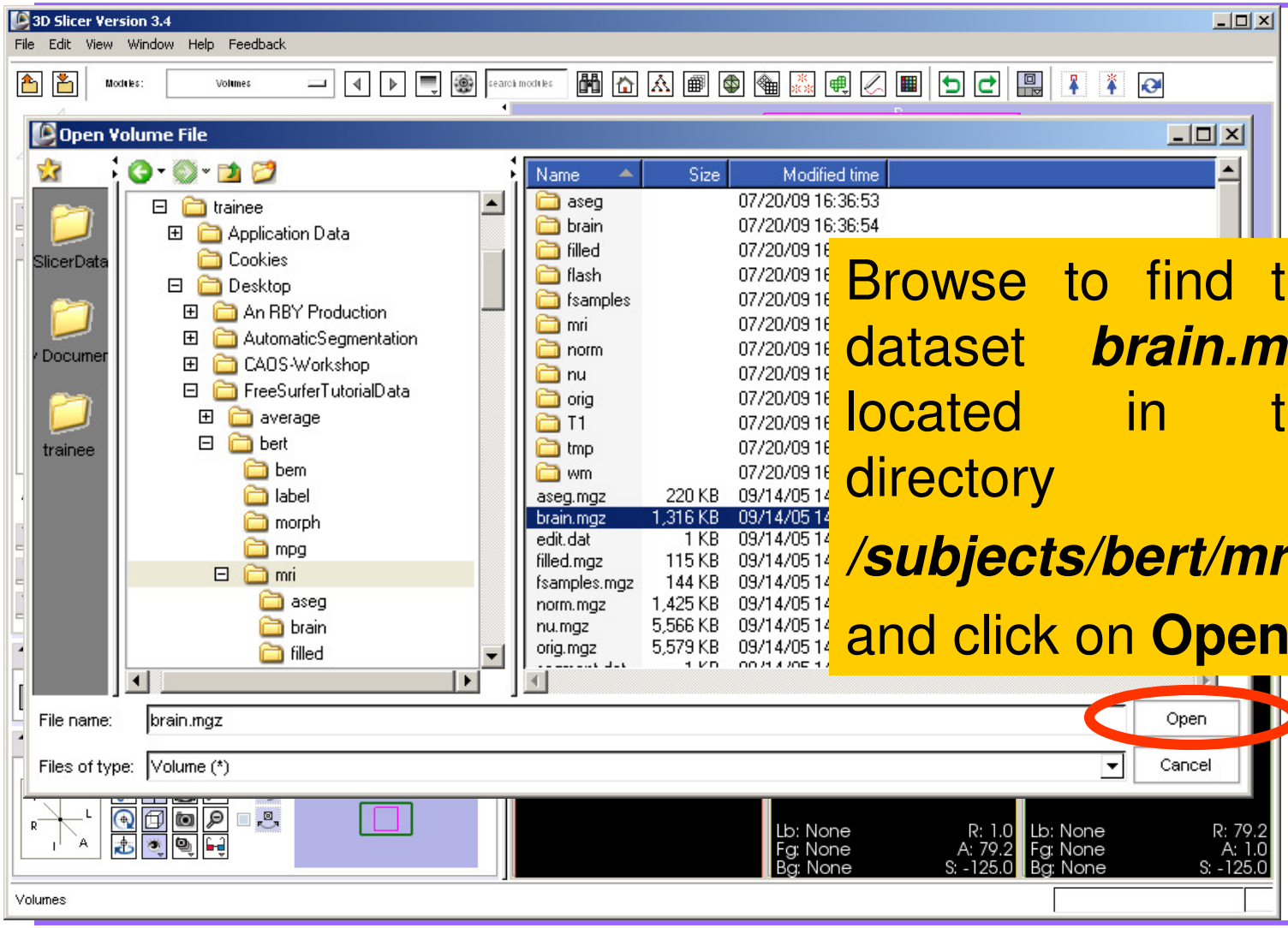
Loading a Brain File



Loading a Brain File

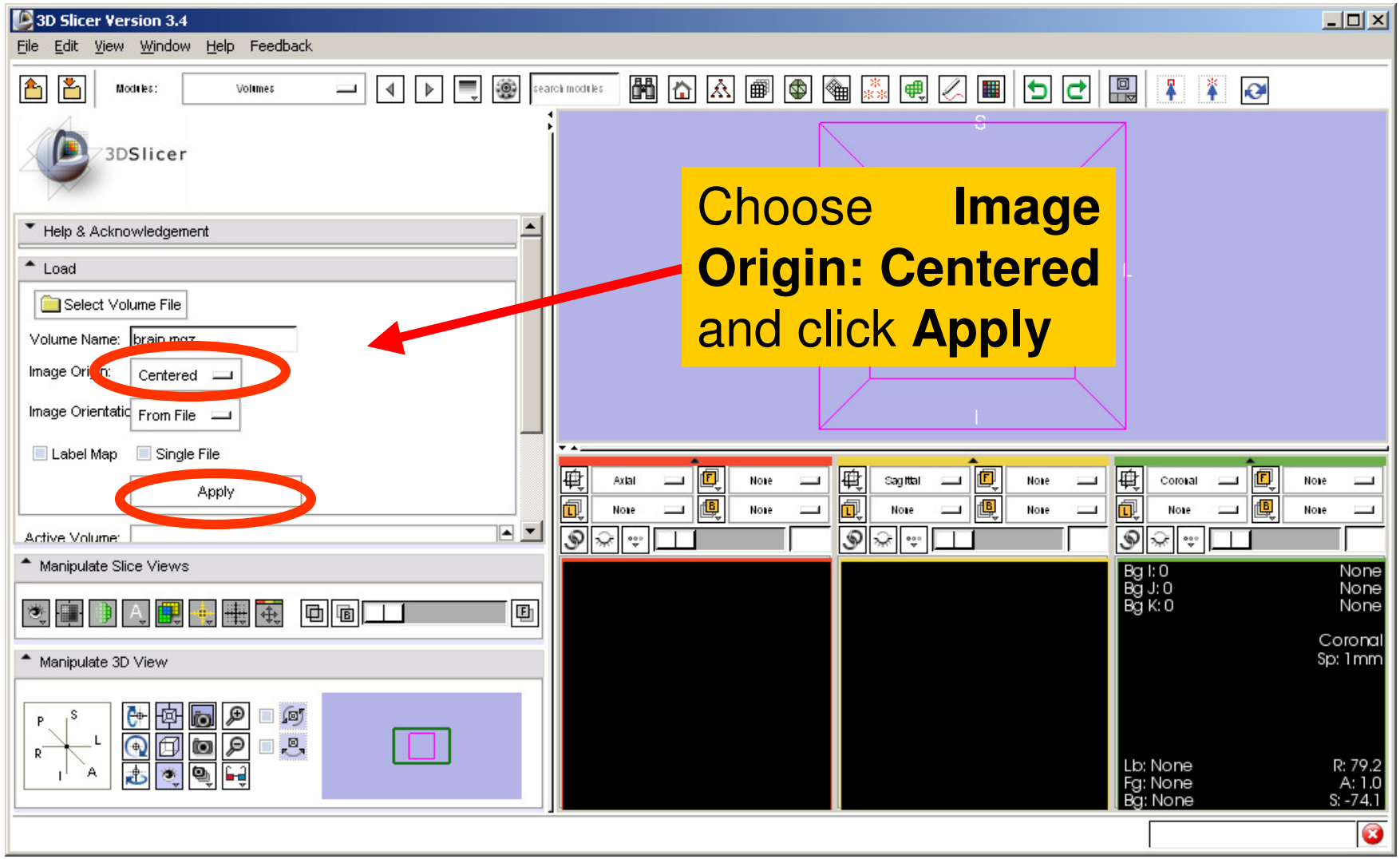


Loading a Brain File

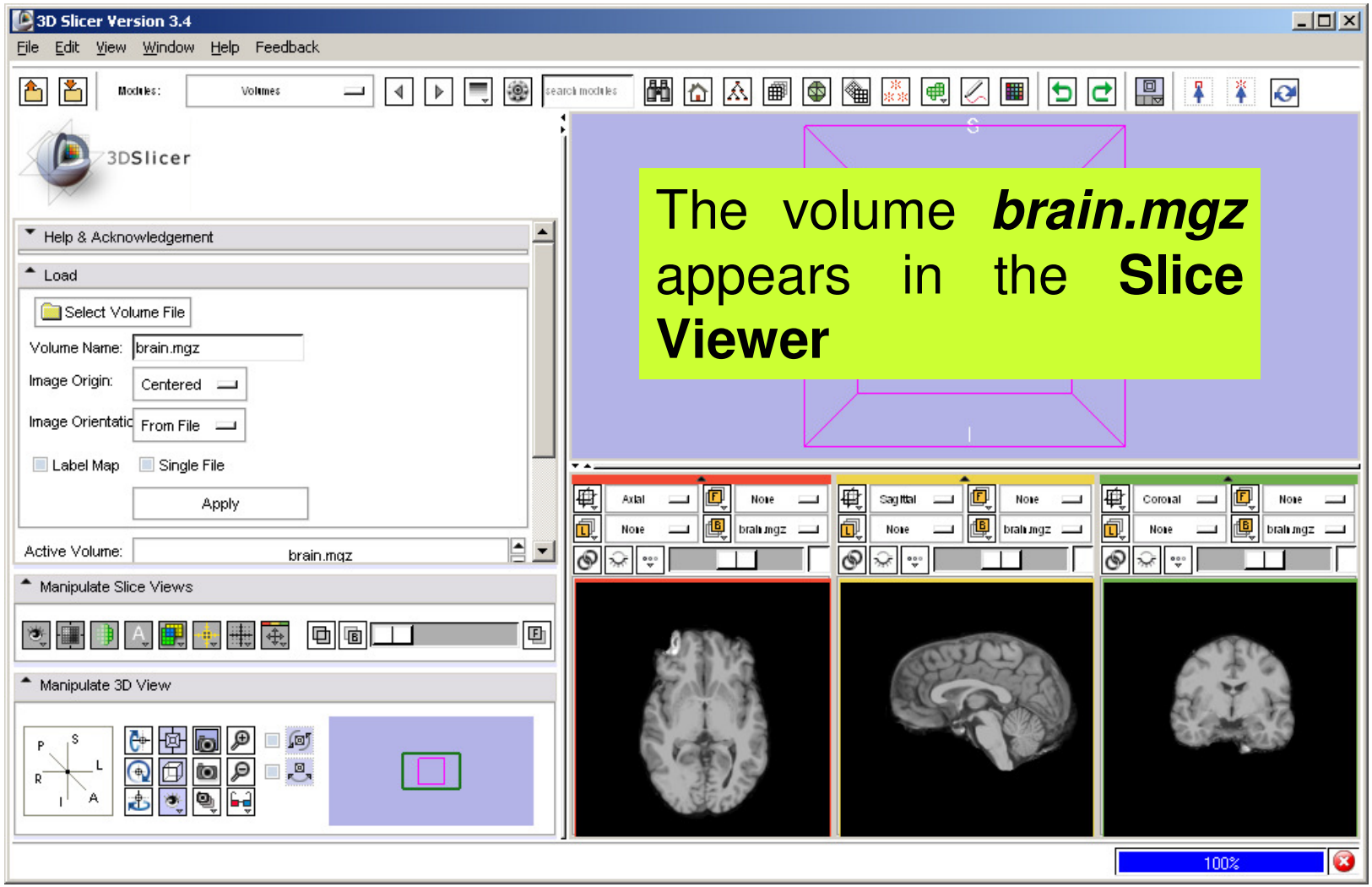


Browse to find the dataset ***brain.mgz*** located in the directory ***/subjects/bert/mri/*** and click on **Open**

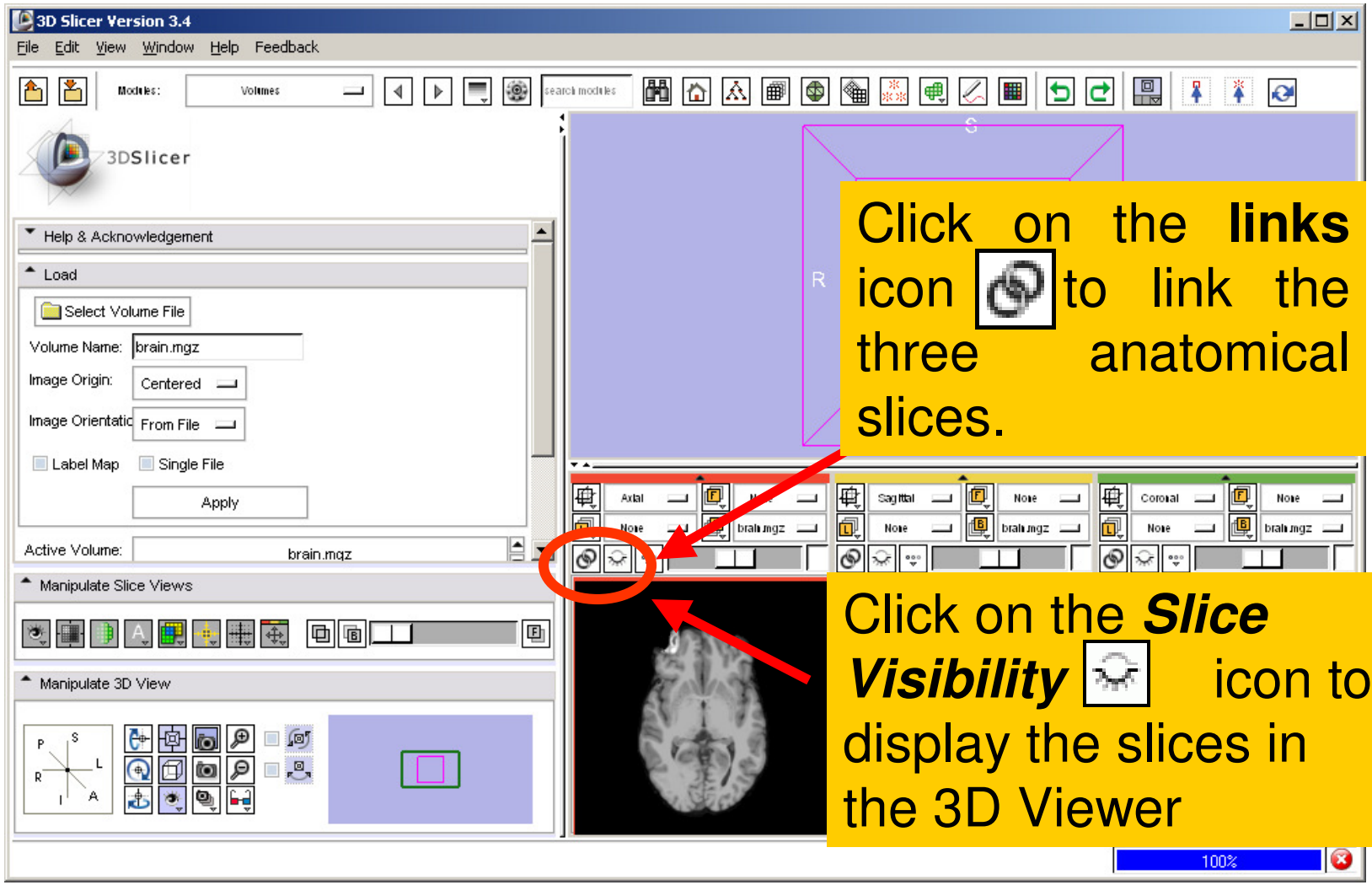
Loading a Brain File



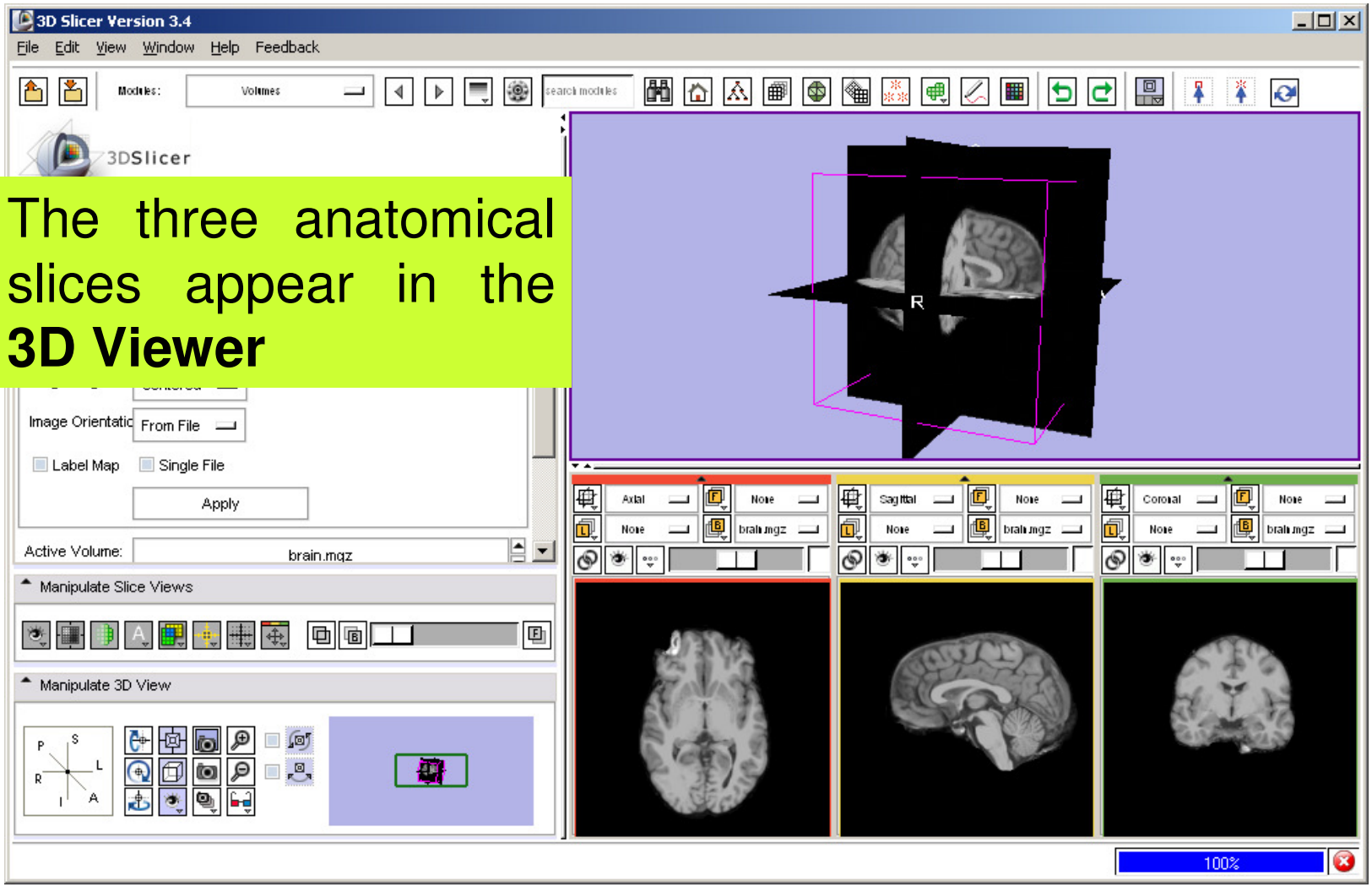
Loading a Brain File



Loading a Brain File

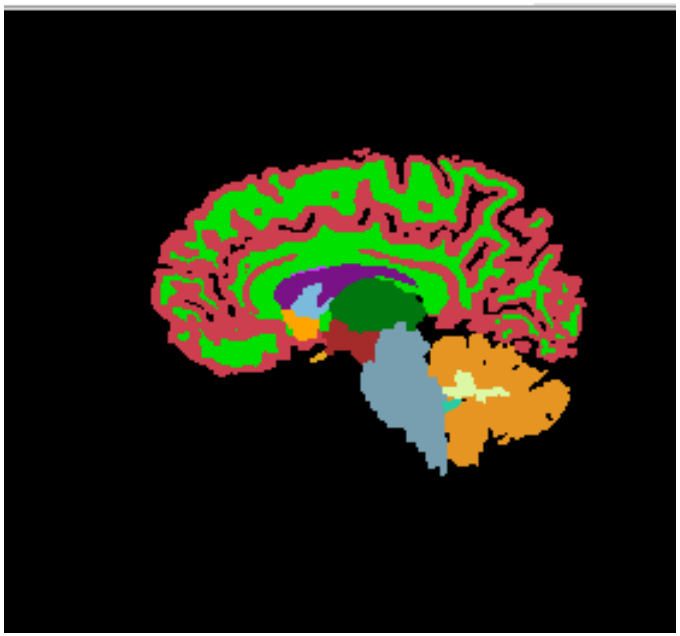


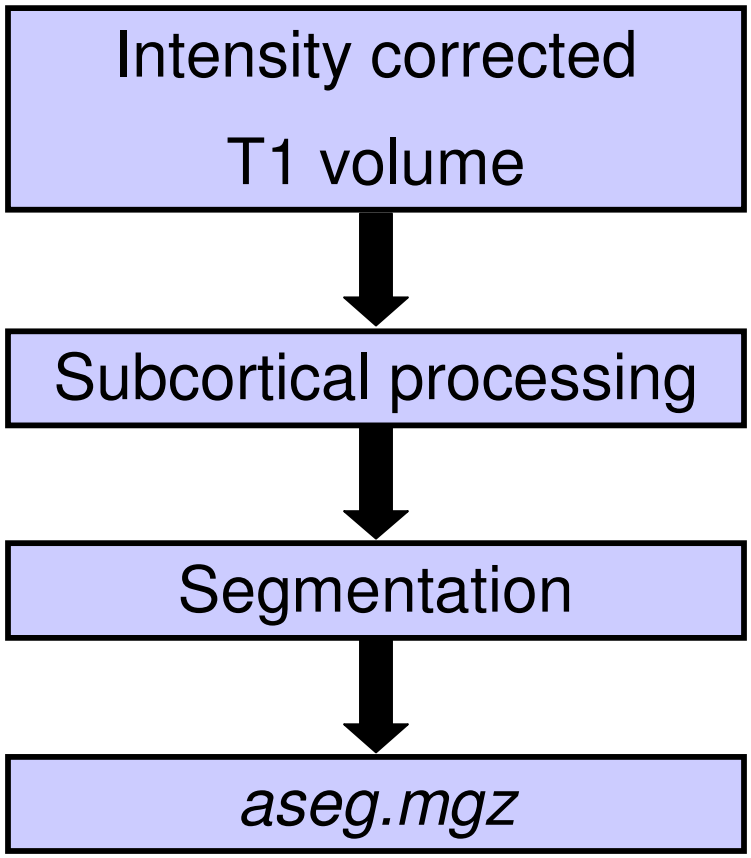
Loading a Brain File



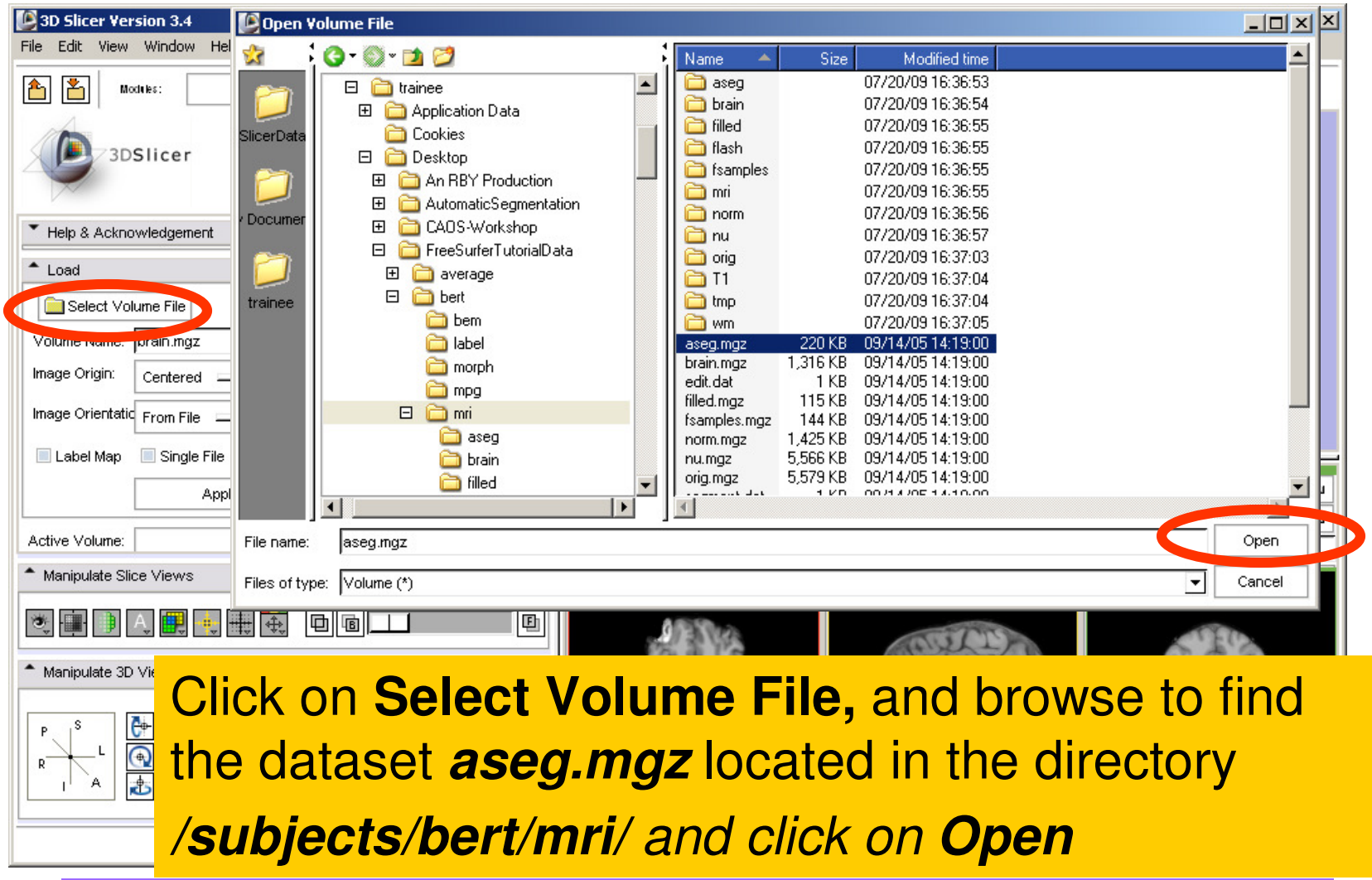
Loading an ASEG File

FreeSurfer pipeline



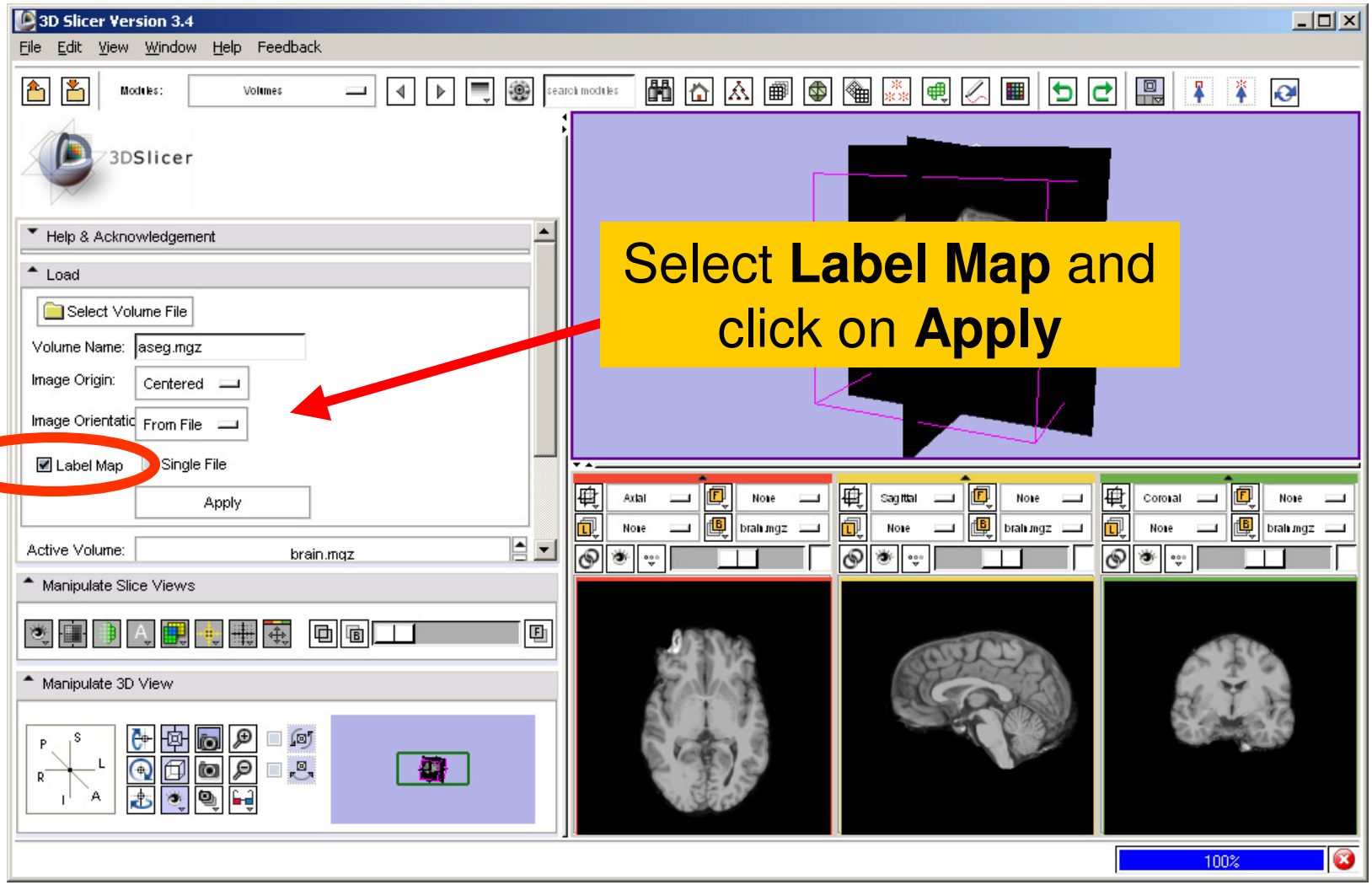


Loading an ASEG File

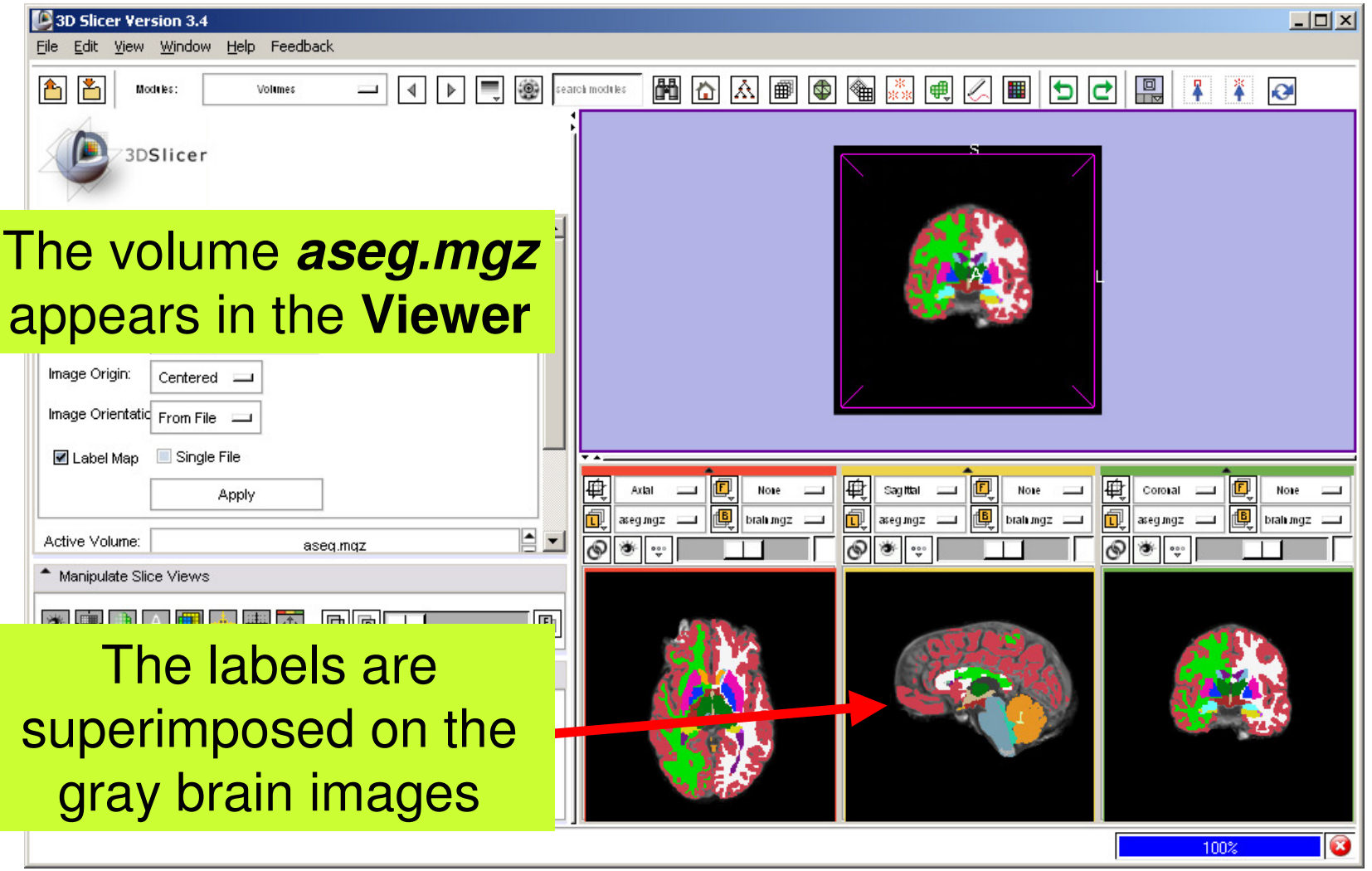


Click on **Select Volume File,** and browse to find the dataset ***aseg.mgz*** located in the directory ***/subjects/bert/mri/*** *and click on* ***Open***

Loading an ASEG File



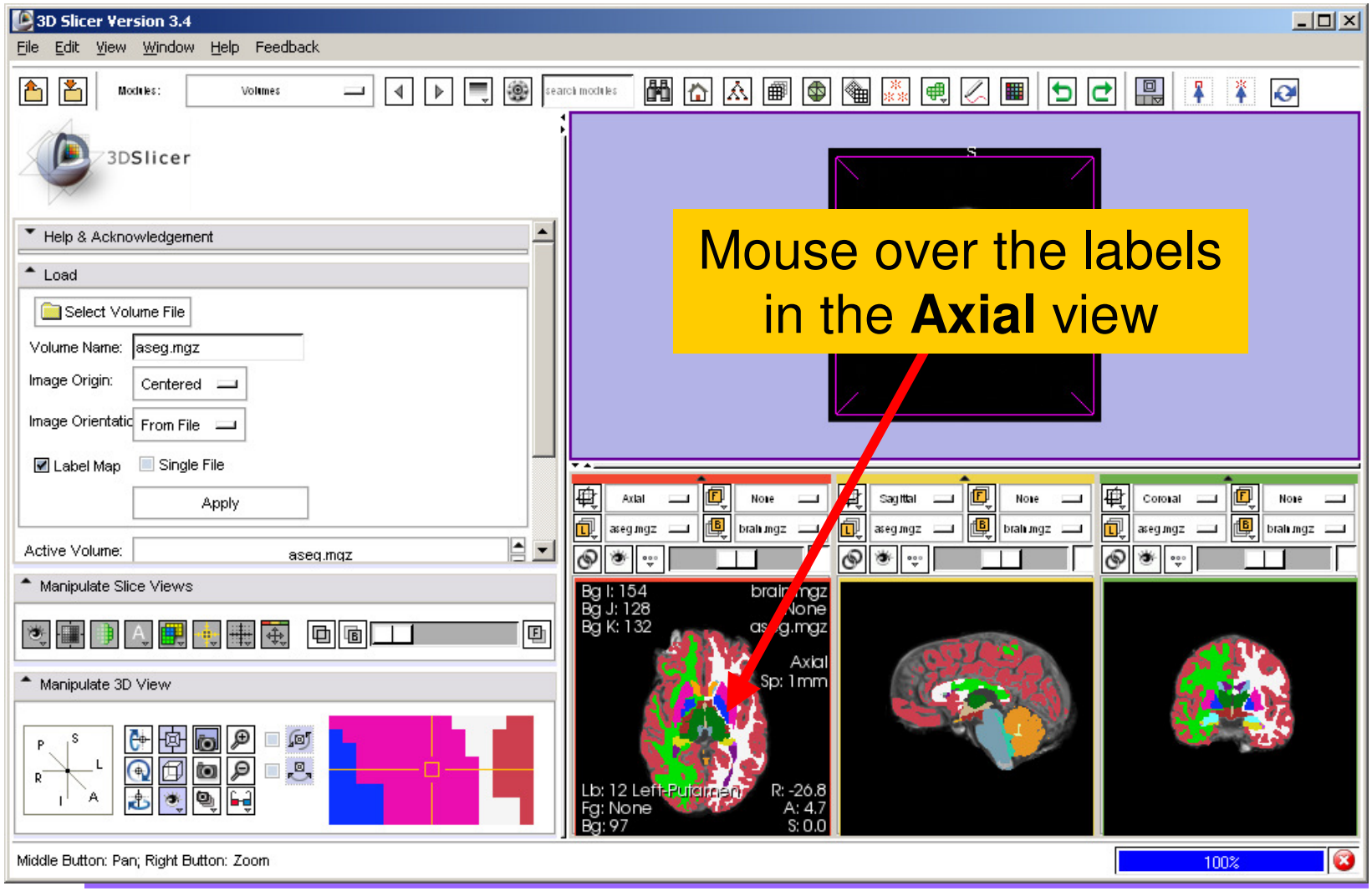
Loading an ASEG File



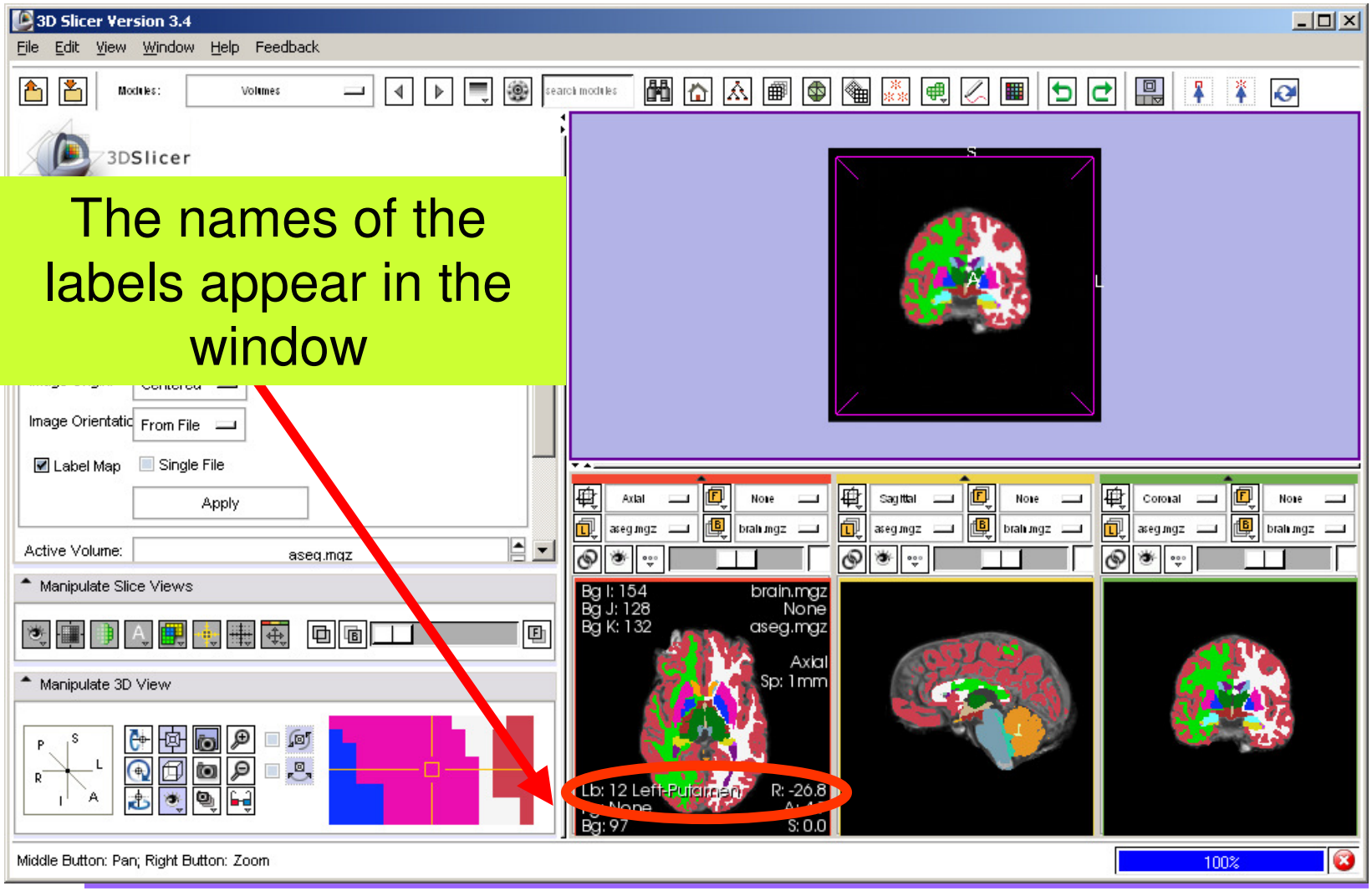
The volume ***aseg.mgz*** appears in the **Viewer**

The labels are superimposed on the gray brain images

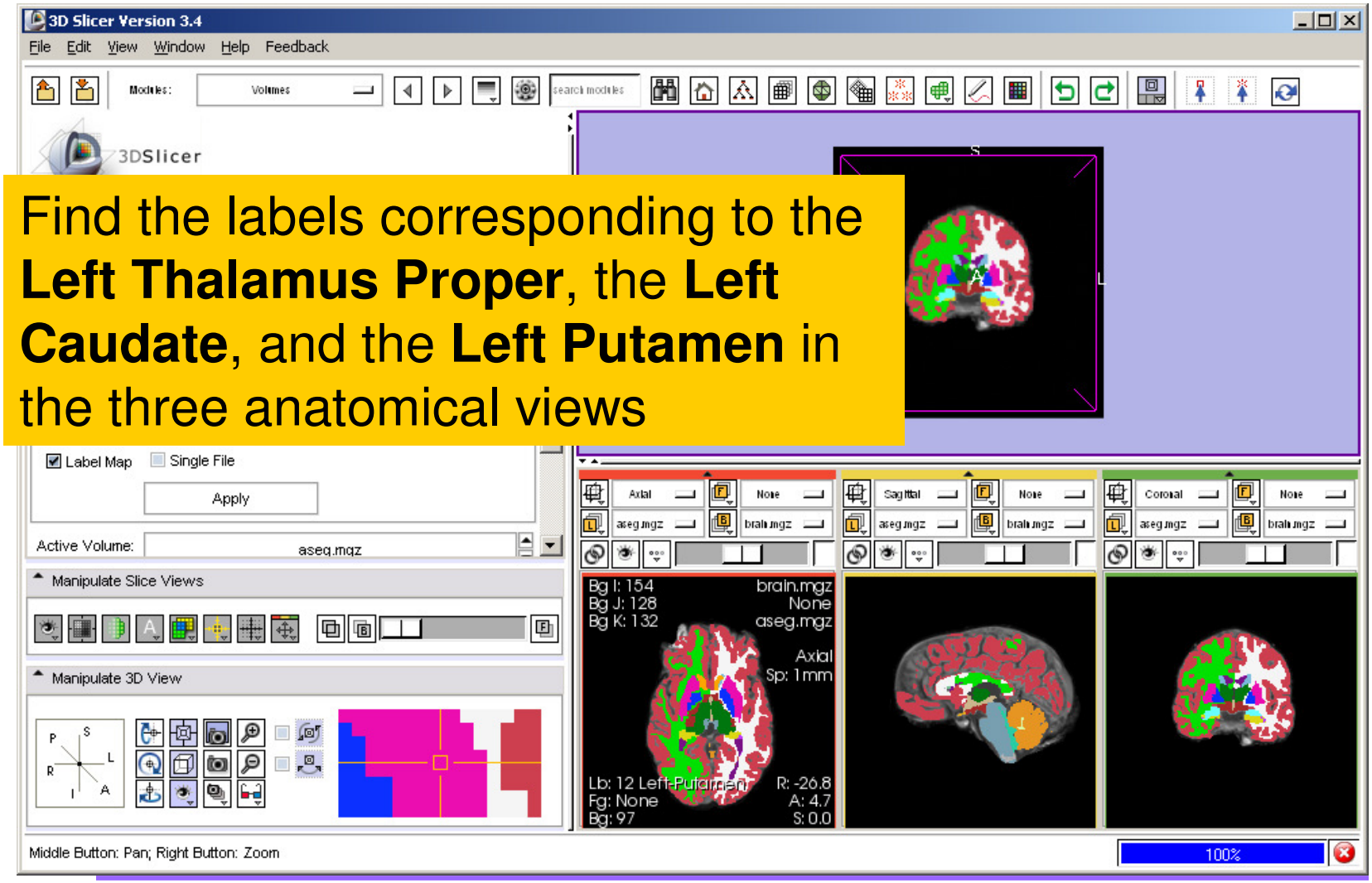
Overlay Brain & Segmentation



Overlay Brain & Segmentation

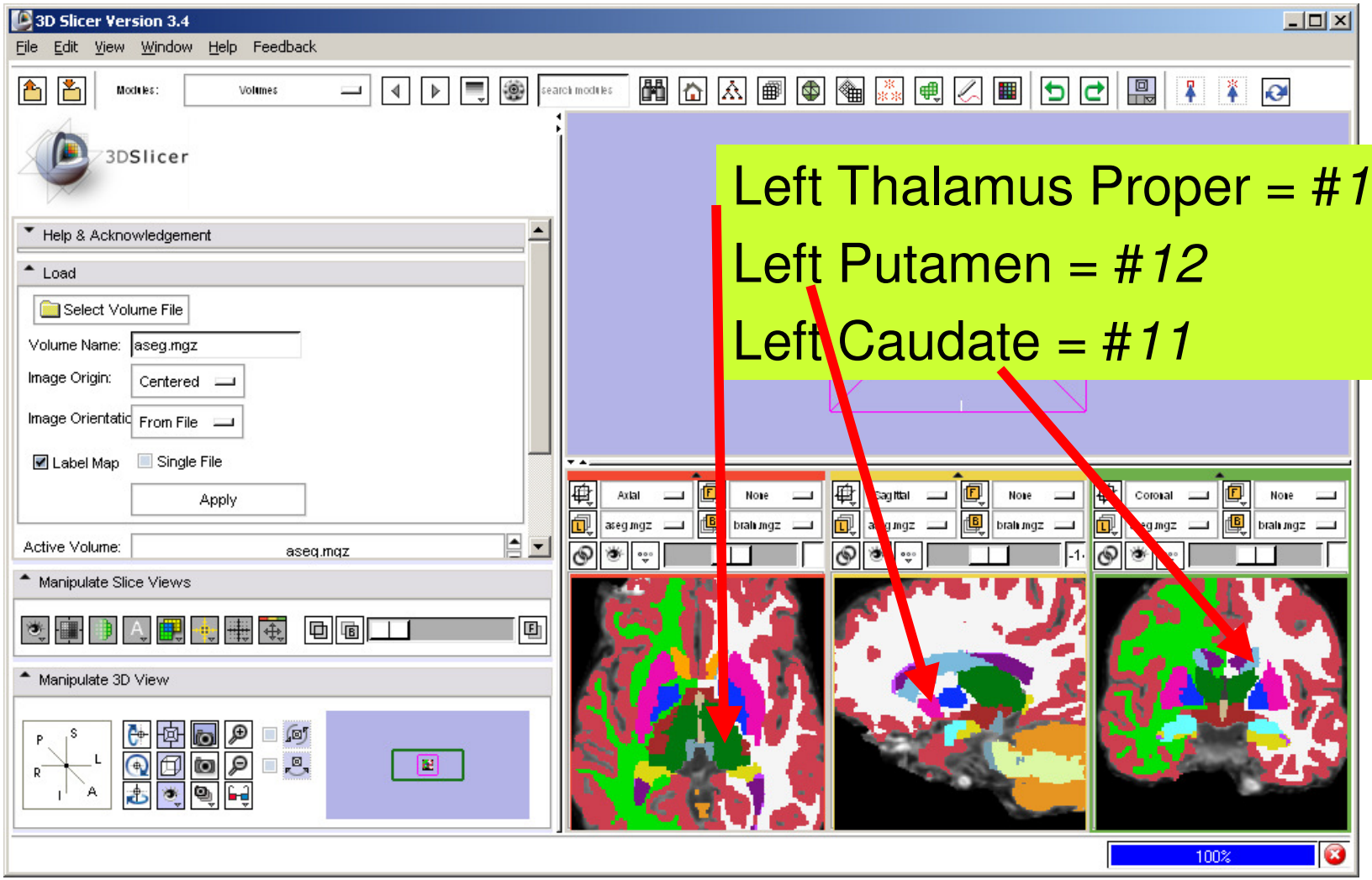


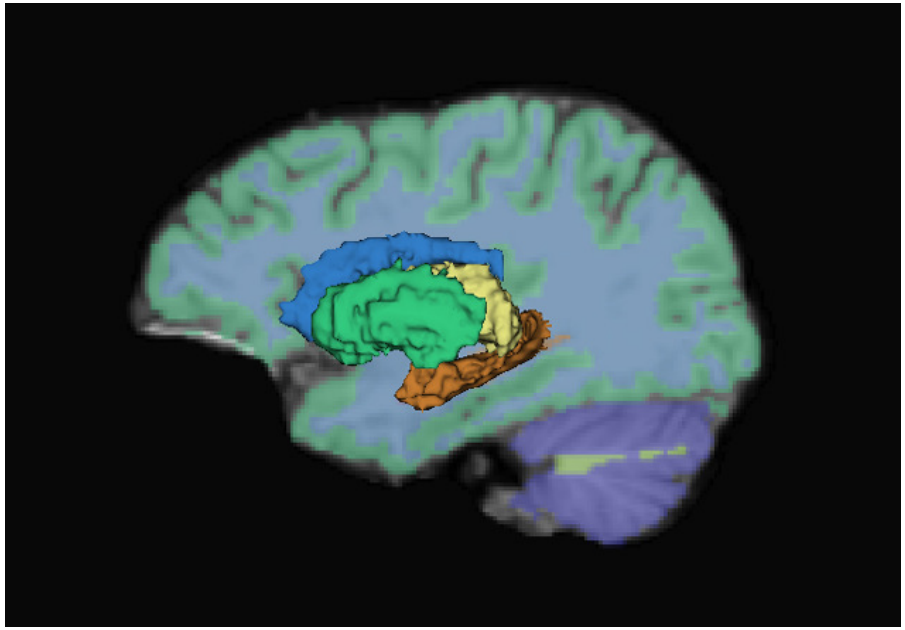
Overlay Brain & Segmentation



Find the labels corresponding to the **Left Thalamus Proper**, the **Left Caudate**, and the **Left Putamen** in the three anatomical views

Overlay Brain & Segmentation

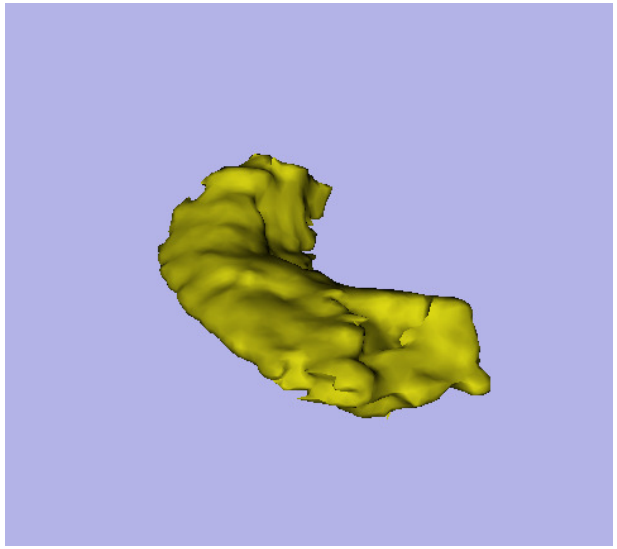




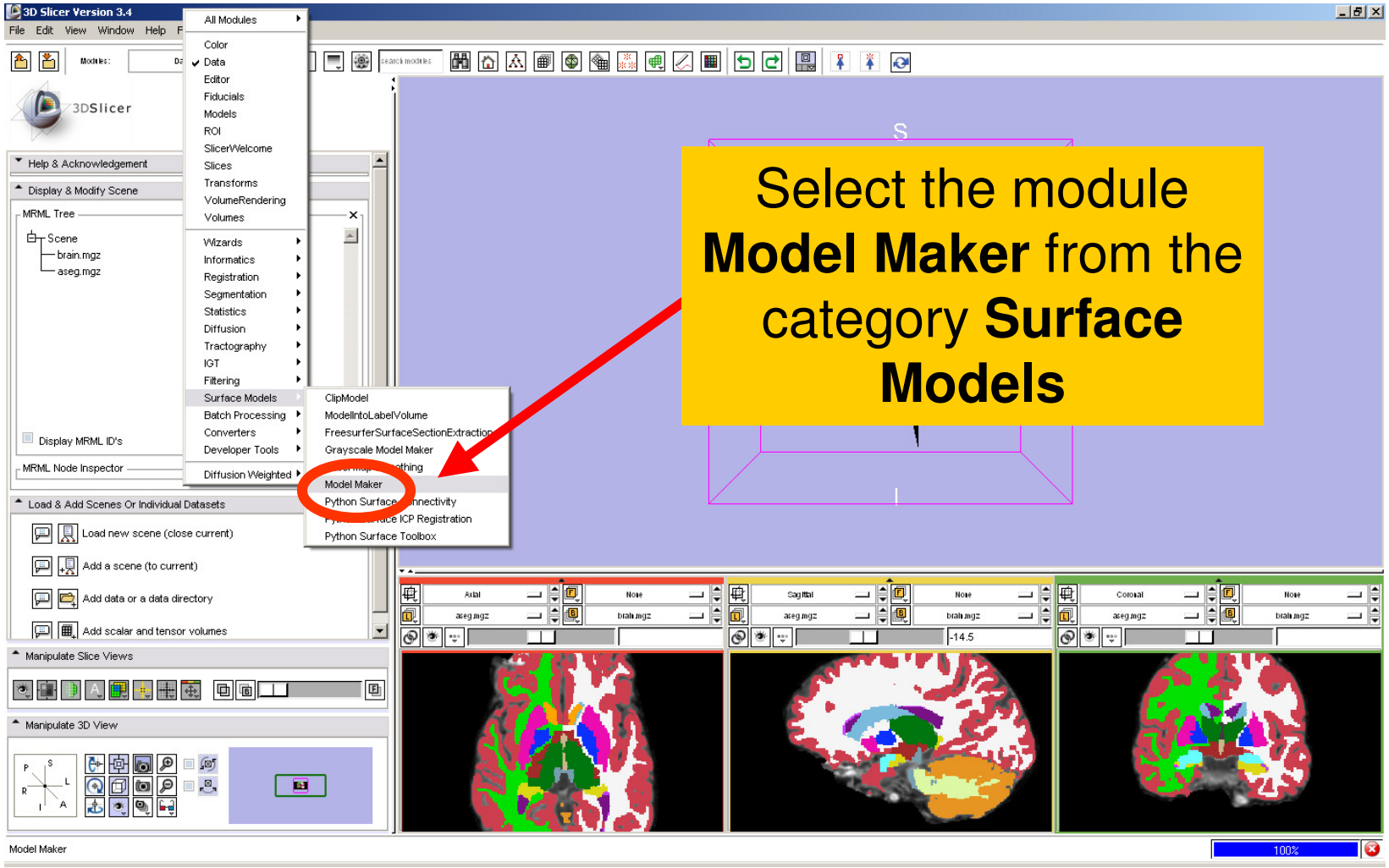
Part 2: Building 3D Models

Building 3D Models

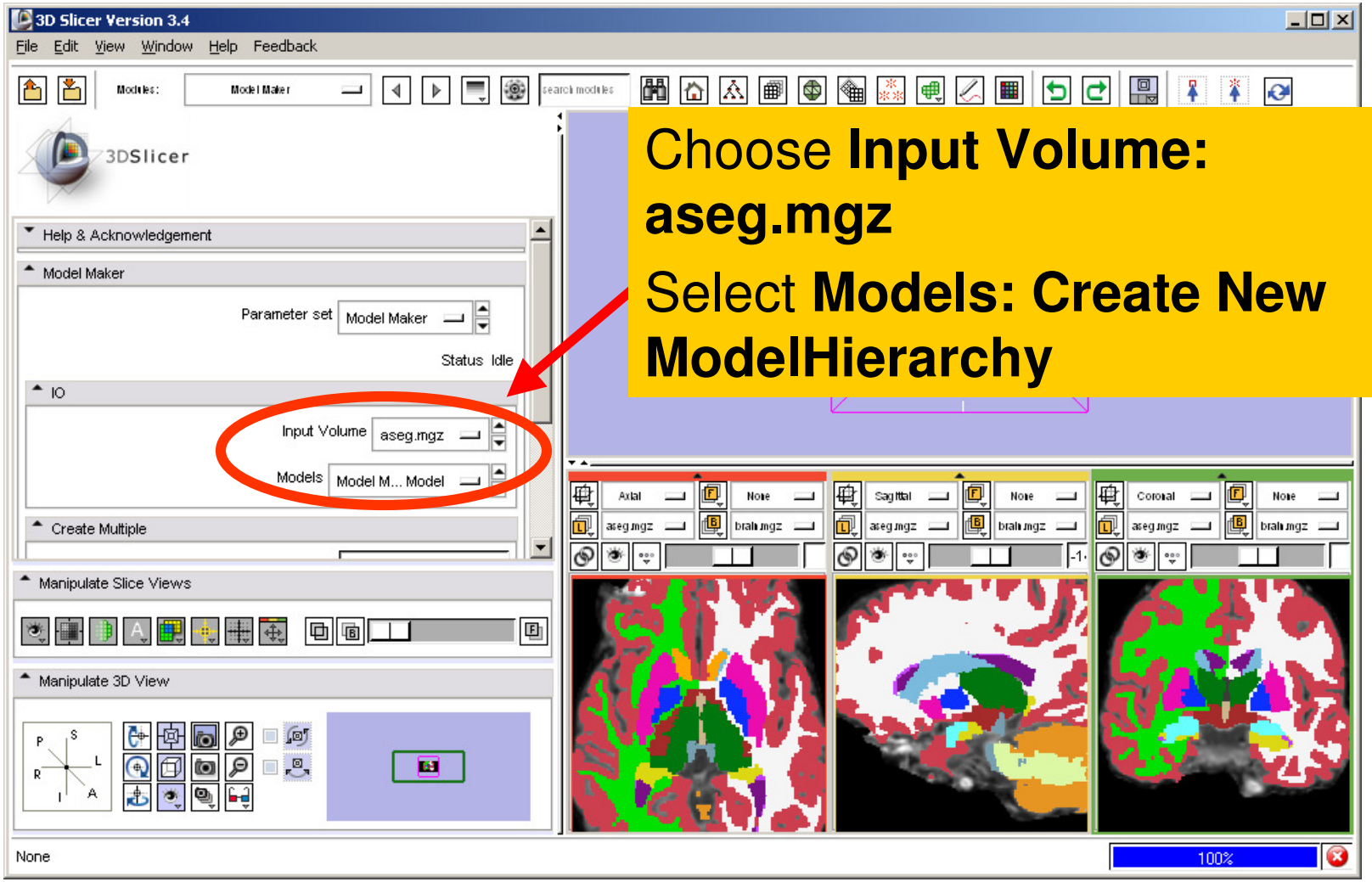
- Building a Single Model
- Building Multiple Models



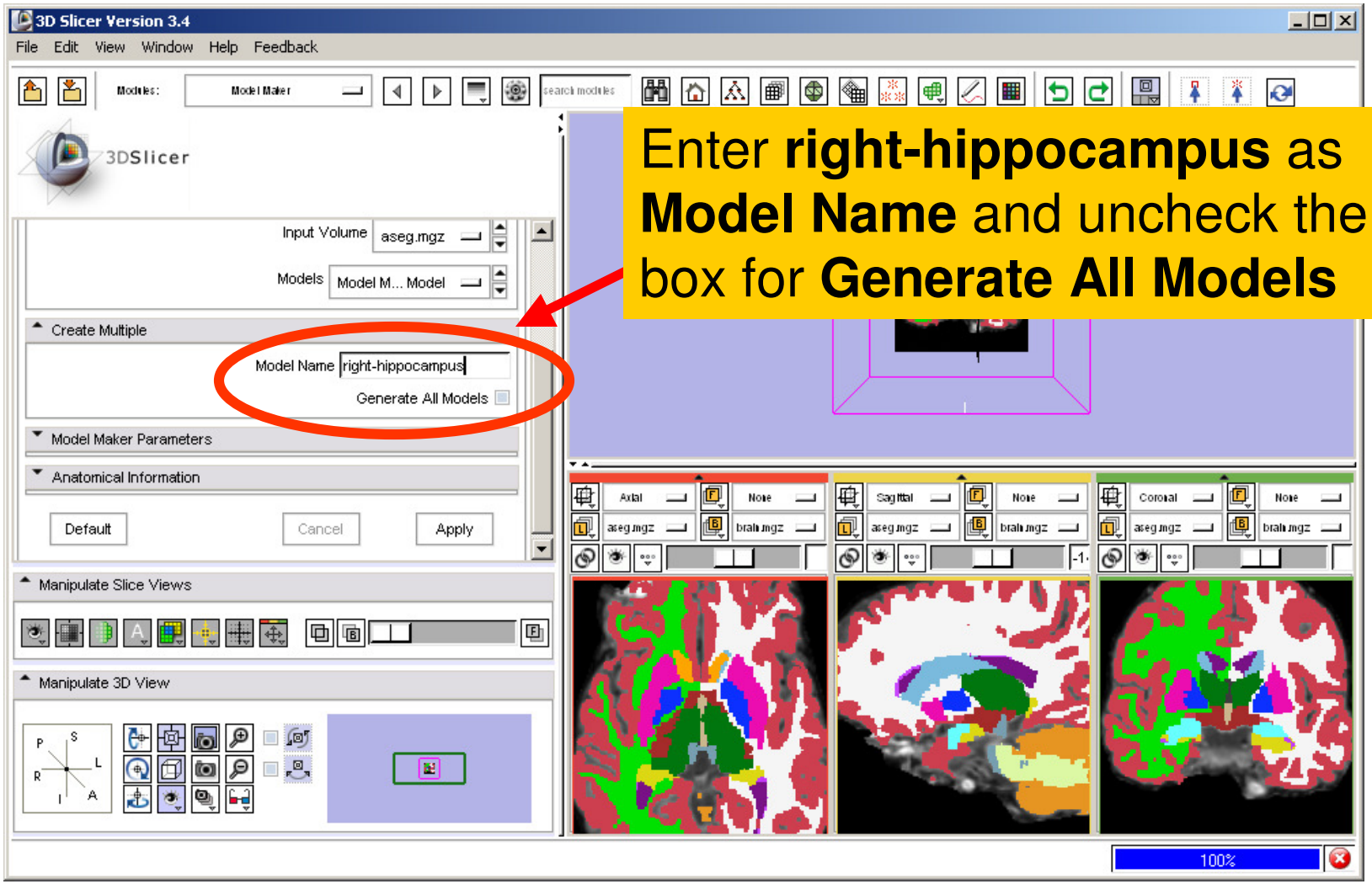
Building a Single Model



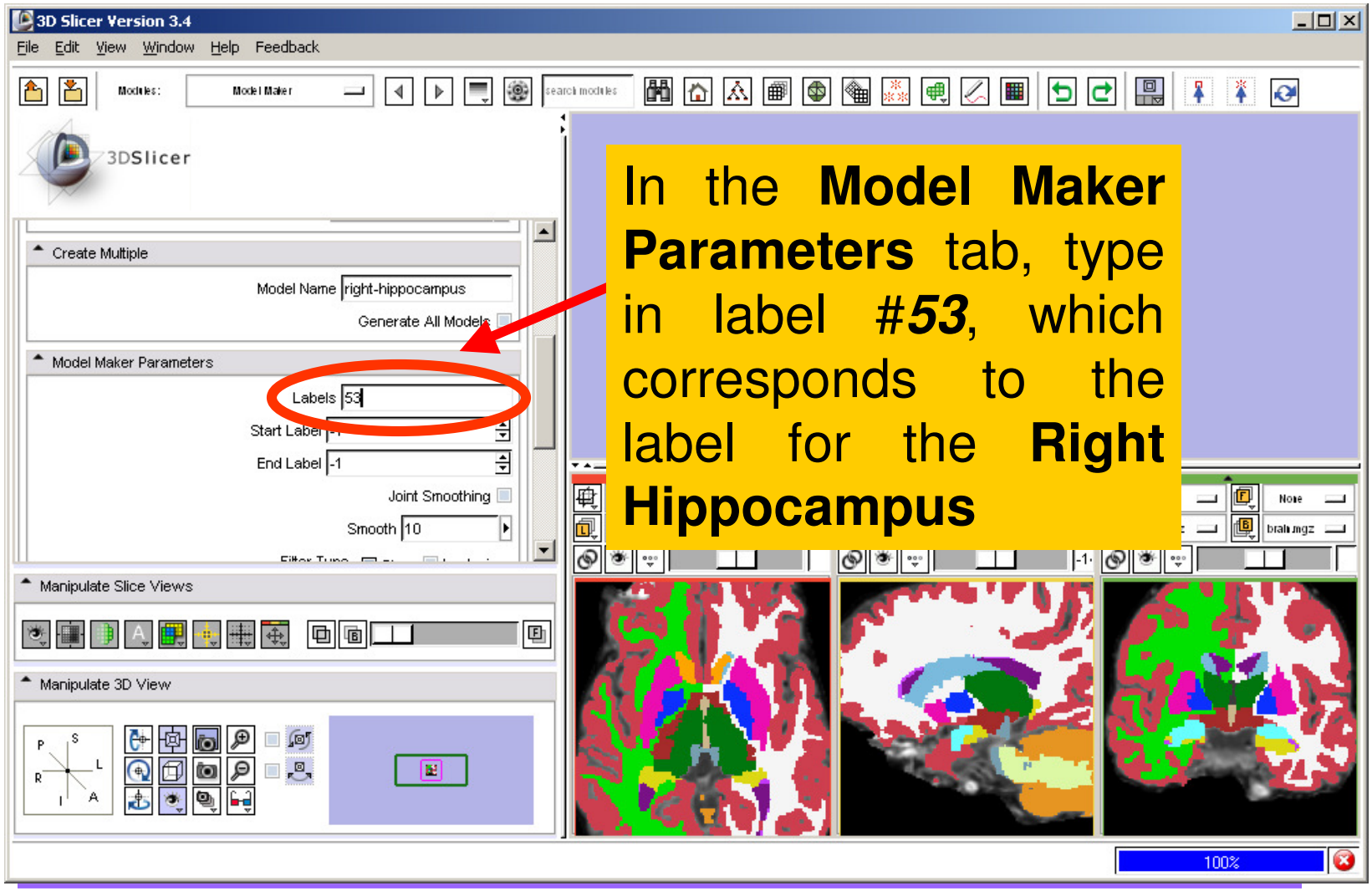
Building a Single Model



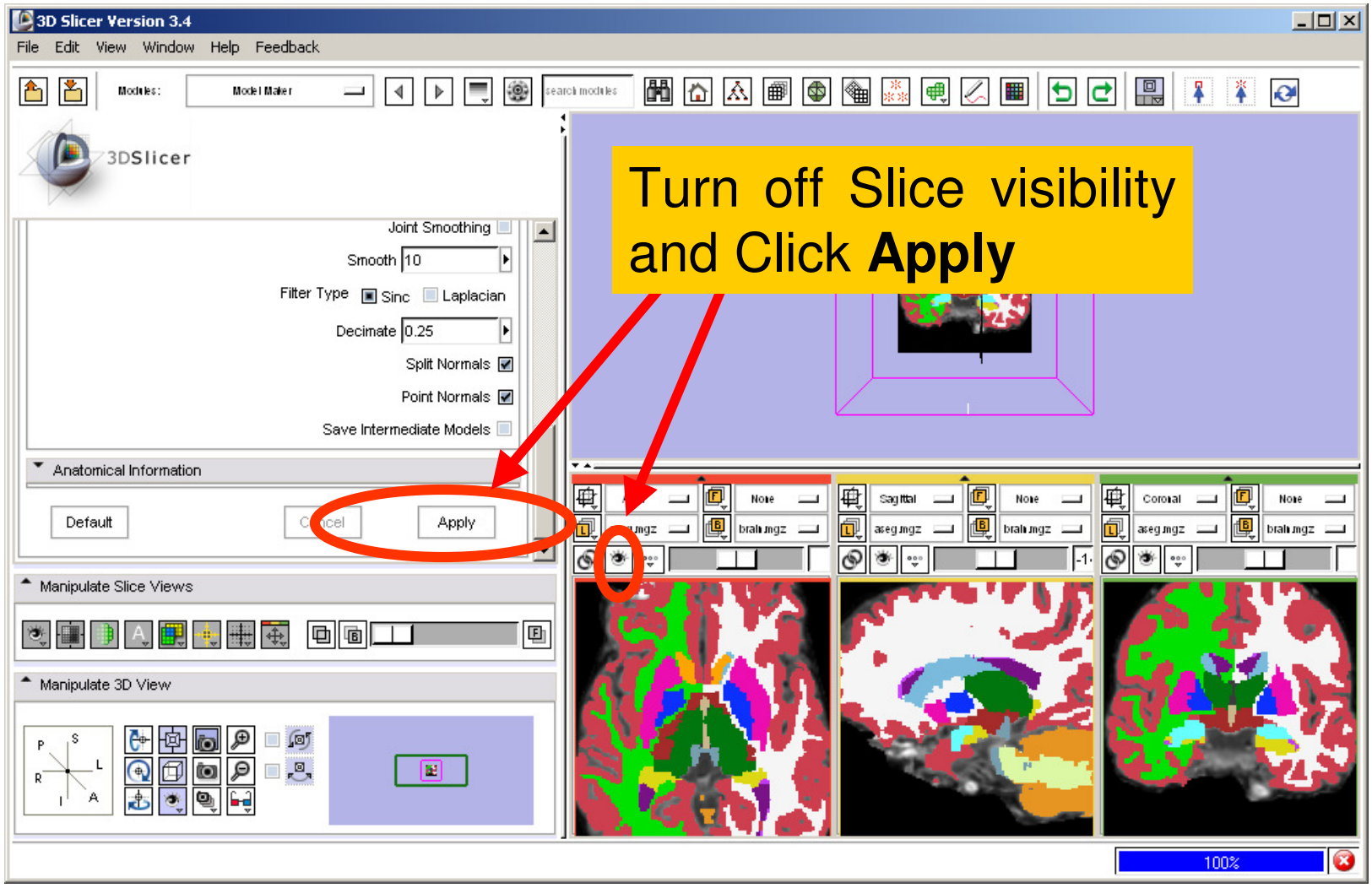
Building a Single Model



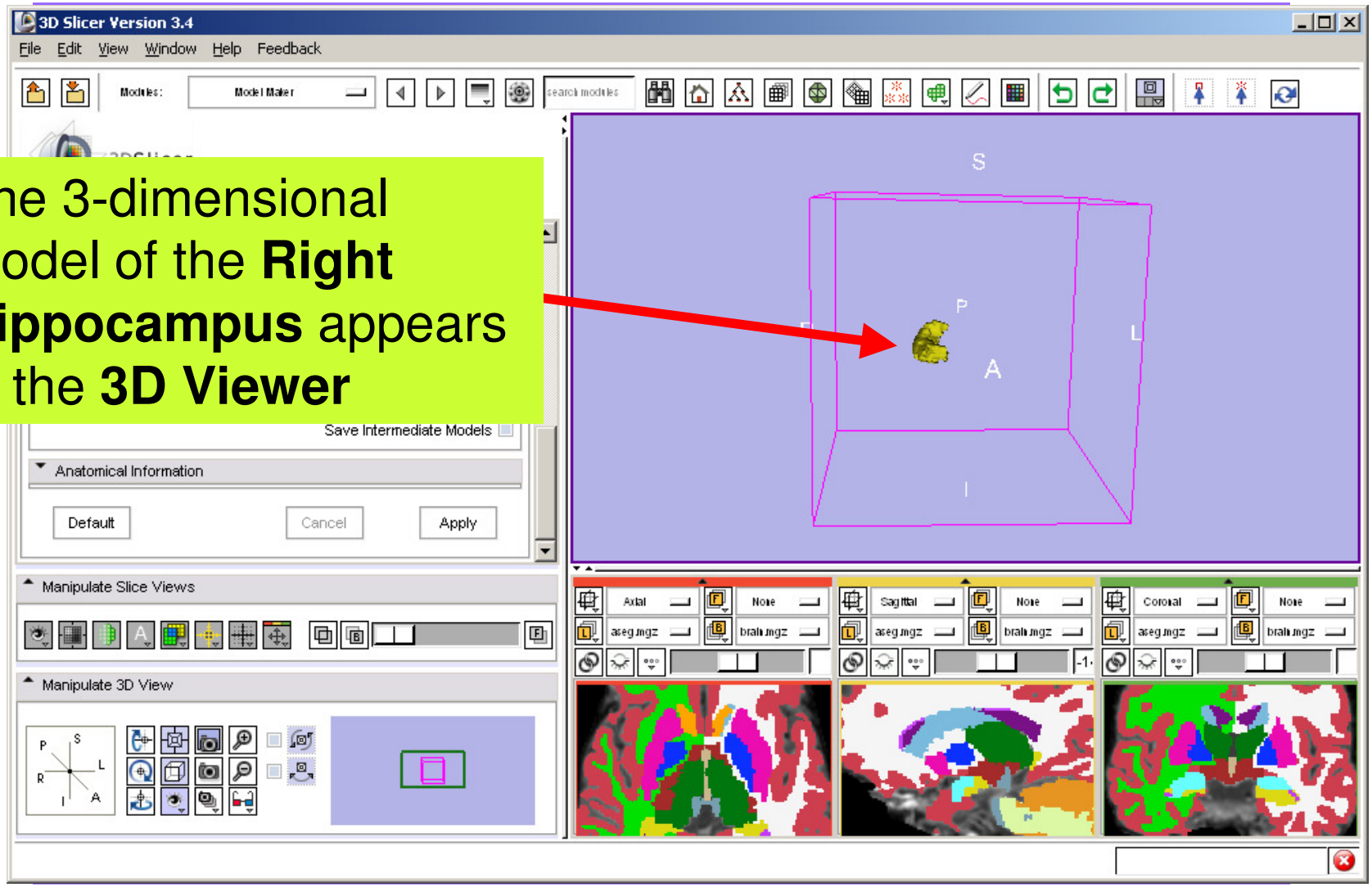
Building a Single Model



Building a Single Model



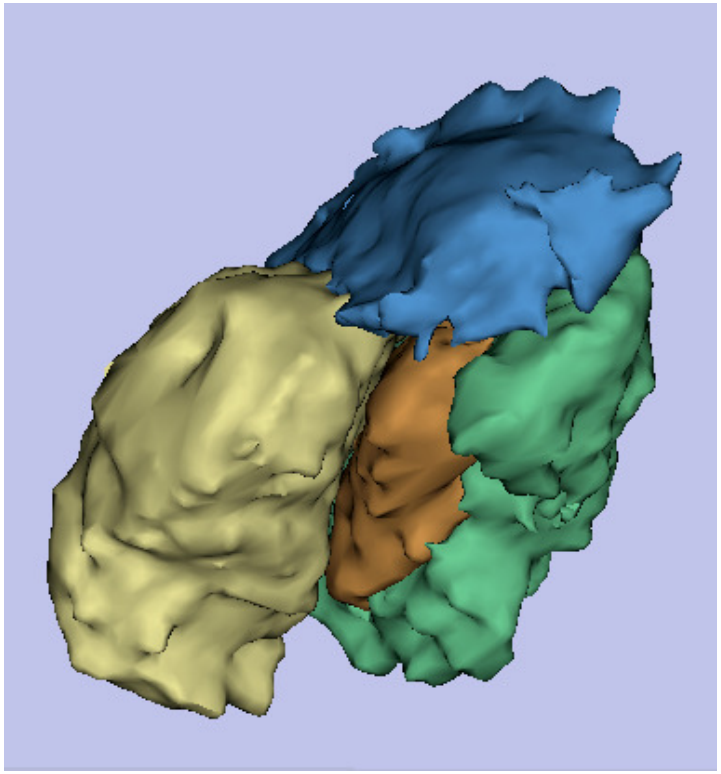
Building a Single Model



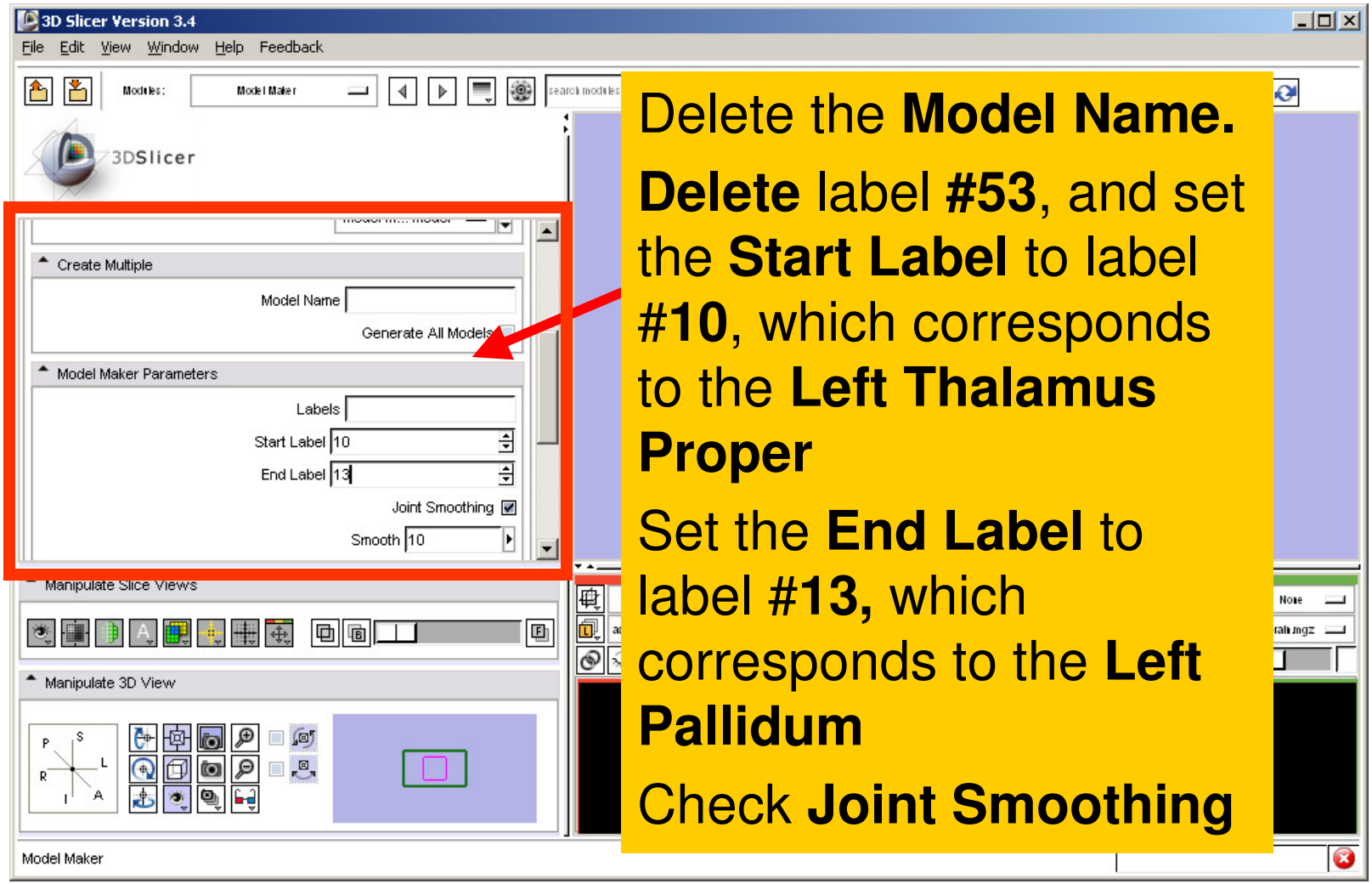
The 3-dimensional model of the **Right Hippocampus** appears in the **3D Viewer**

Building 3D Models

- Building a Single Model
- Building Multiple Models



Building Multiple Models



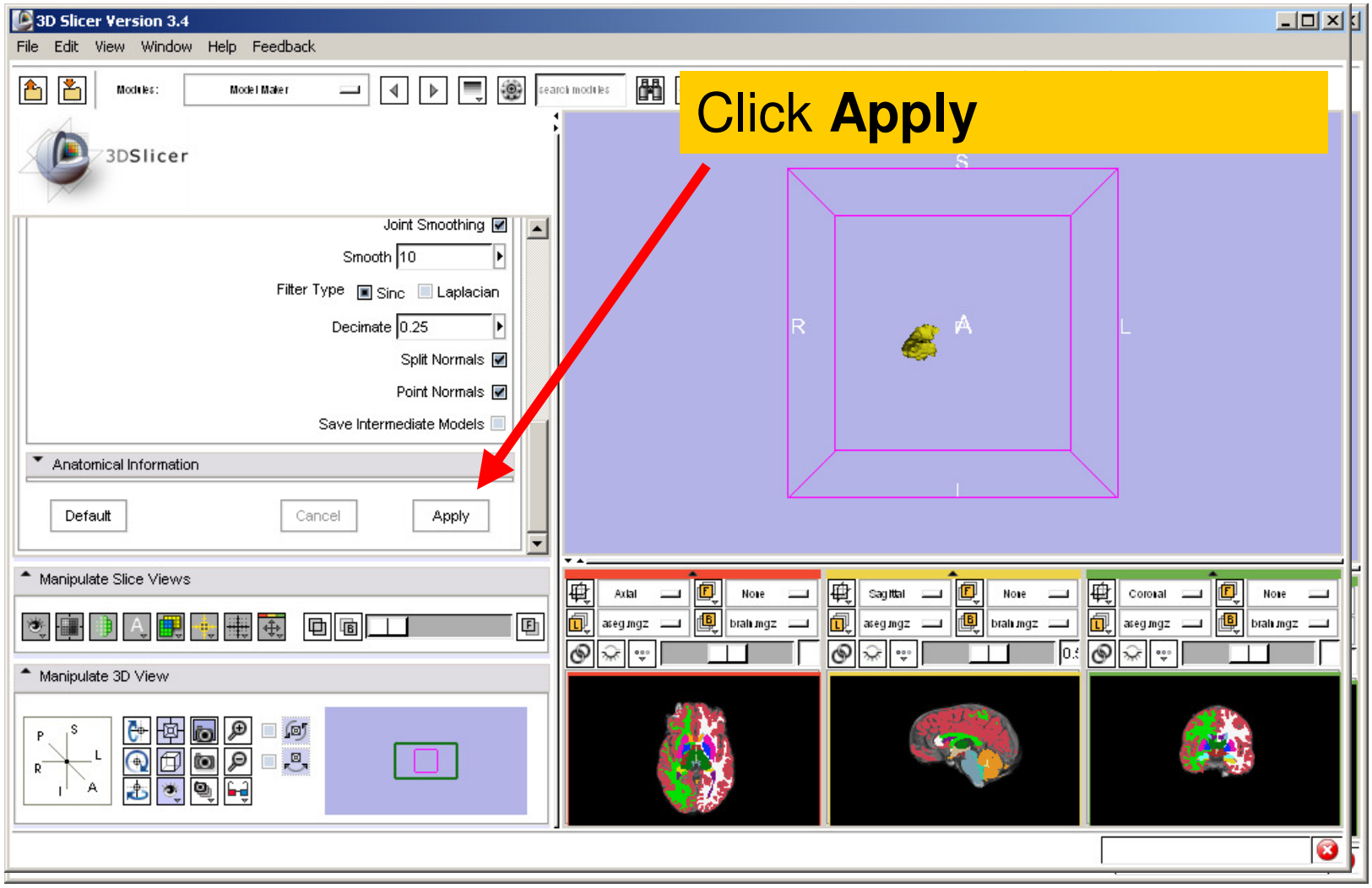
Delete the **Model Name.**

Delete label **#53**, and set the **Start Label** to label **#10**, which corresponds to the **Left Thalamus Proper**

Set the **End Label** to label **#13,** which corresponds to the **Left Pallidum**

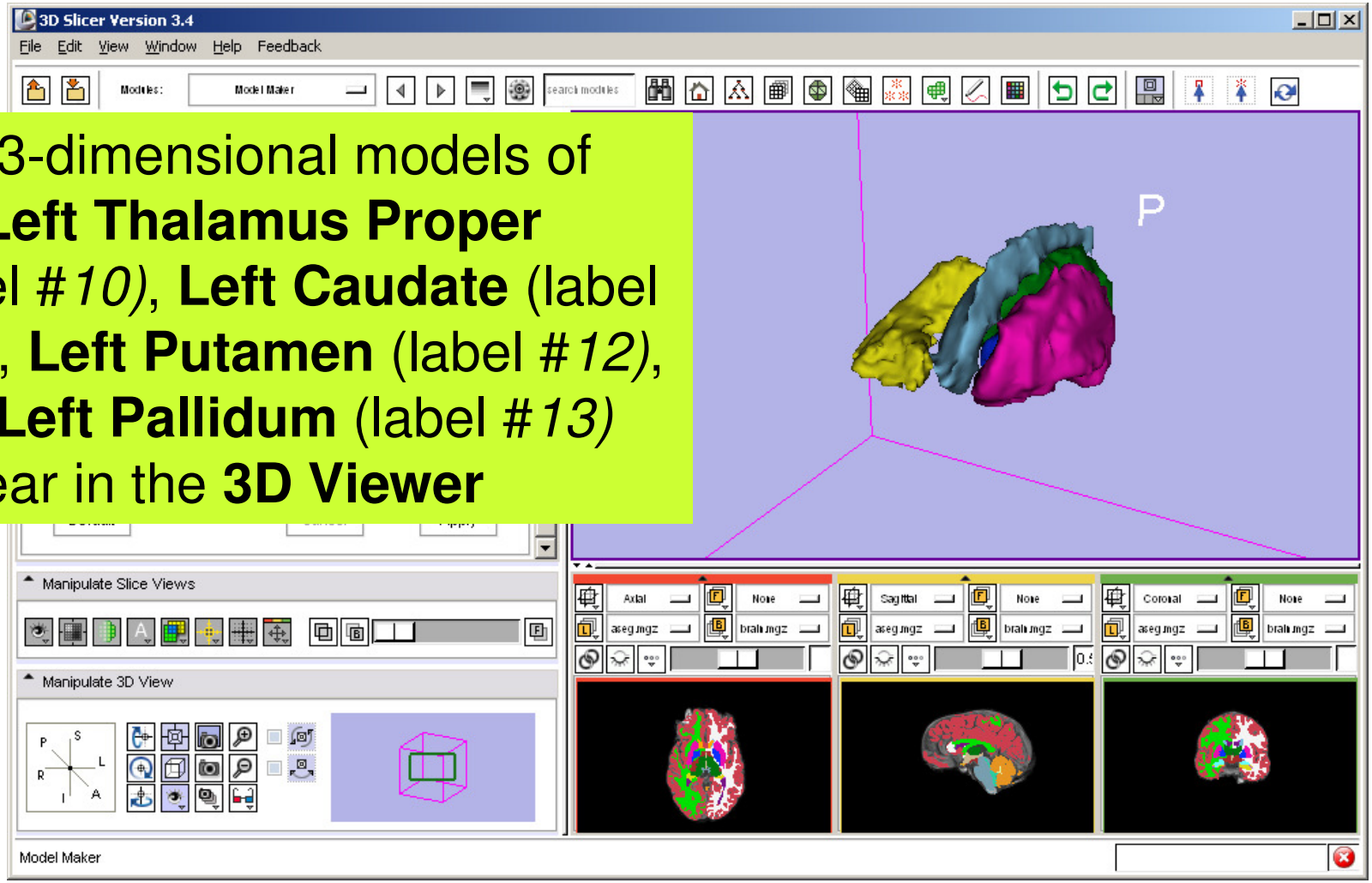
Check **Joint Smoothing**

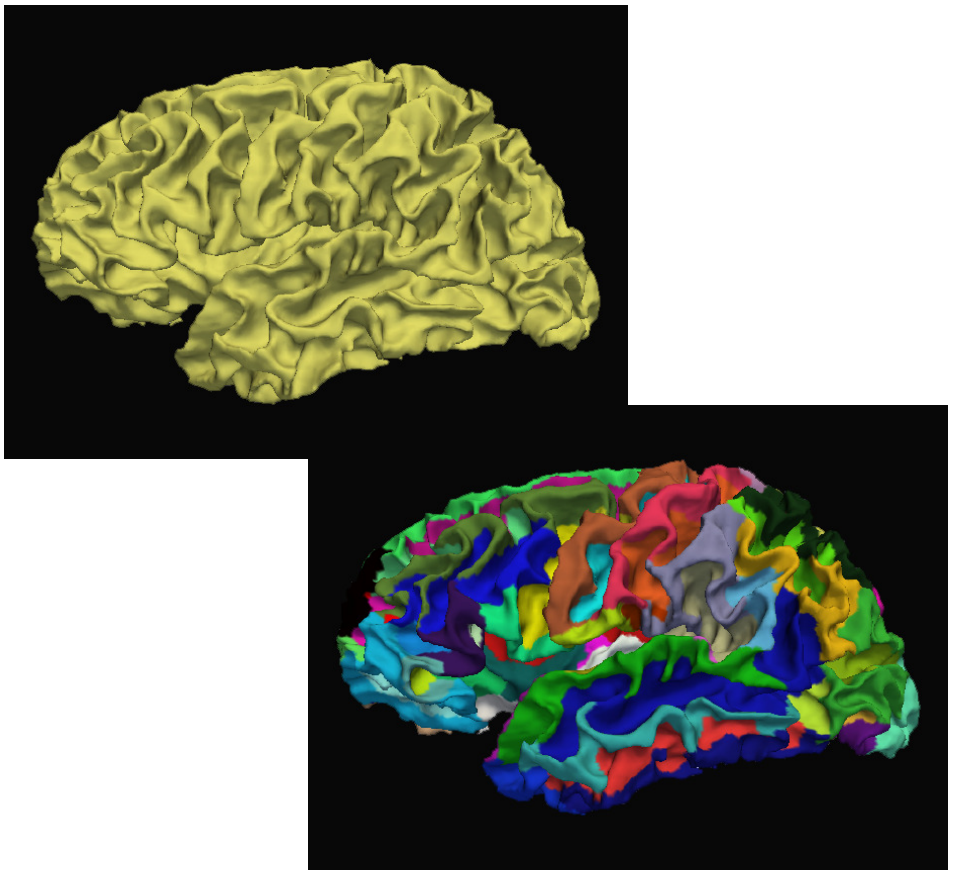
Building Multiple Models



Building Multiple Models

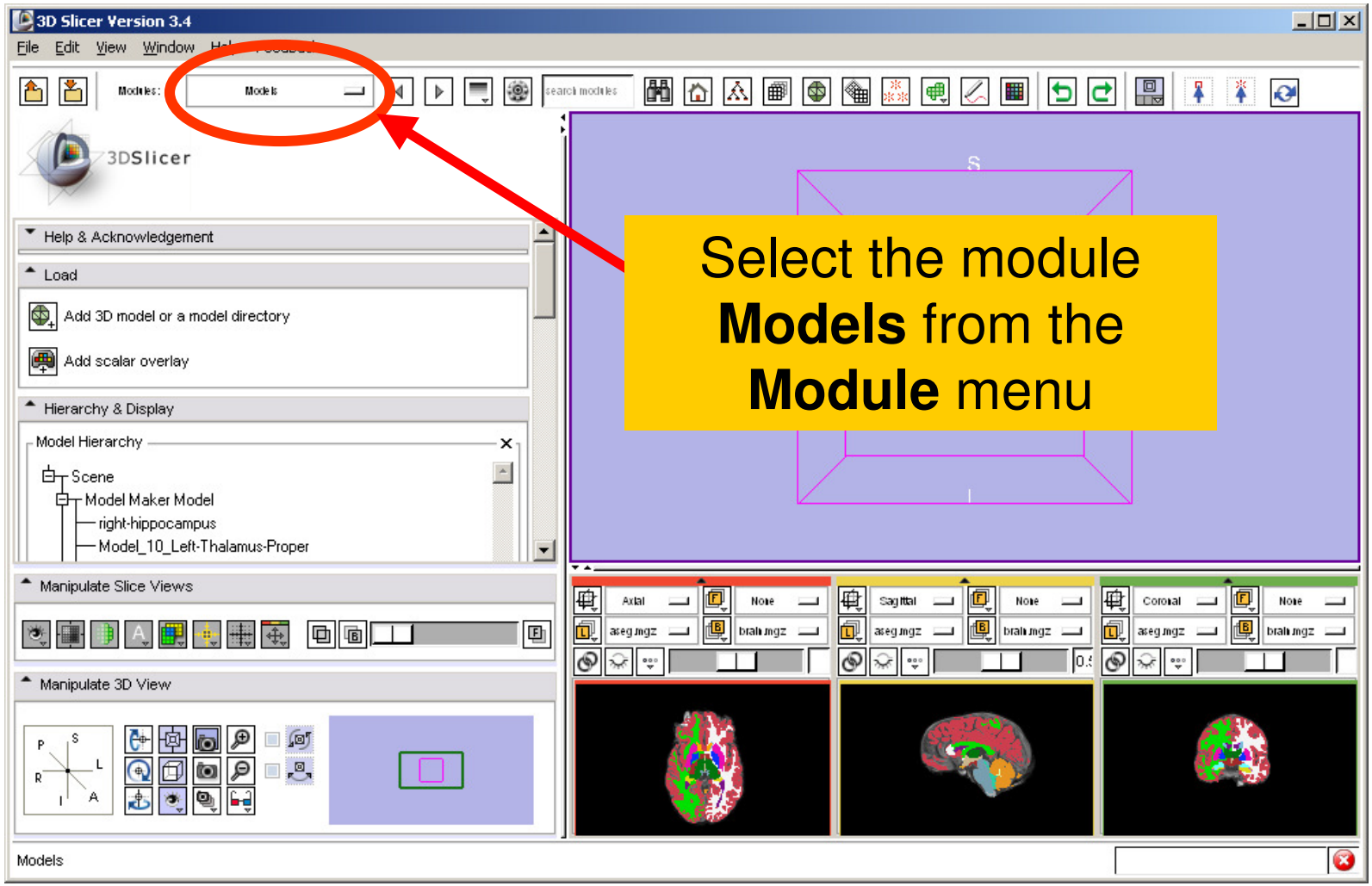
The 3-dimensional models of the **Left Thalamus Proper** (label *#10)*, **Left Caudate** (label *#11)*, **Left Putamen** (label *#12)*, and **Left Pallidum** (label *#13)* appear in the **3D Viewer**



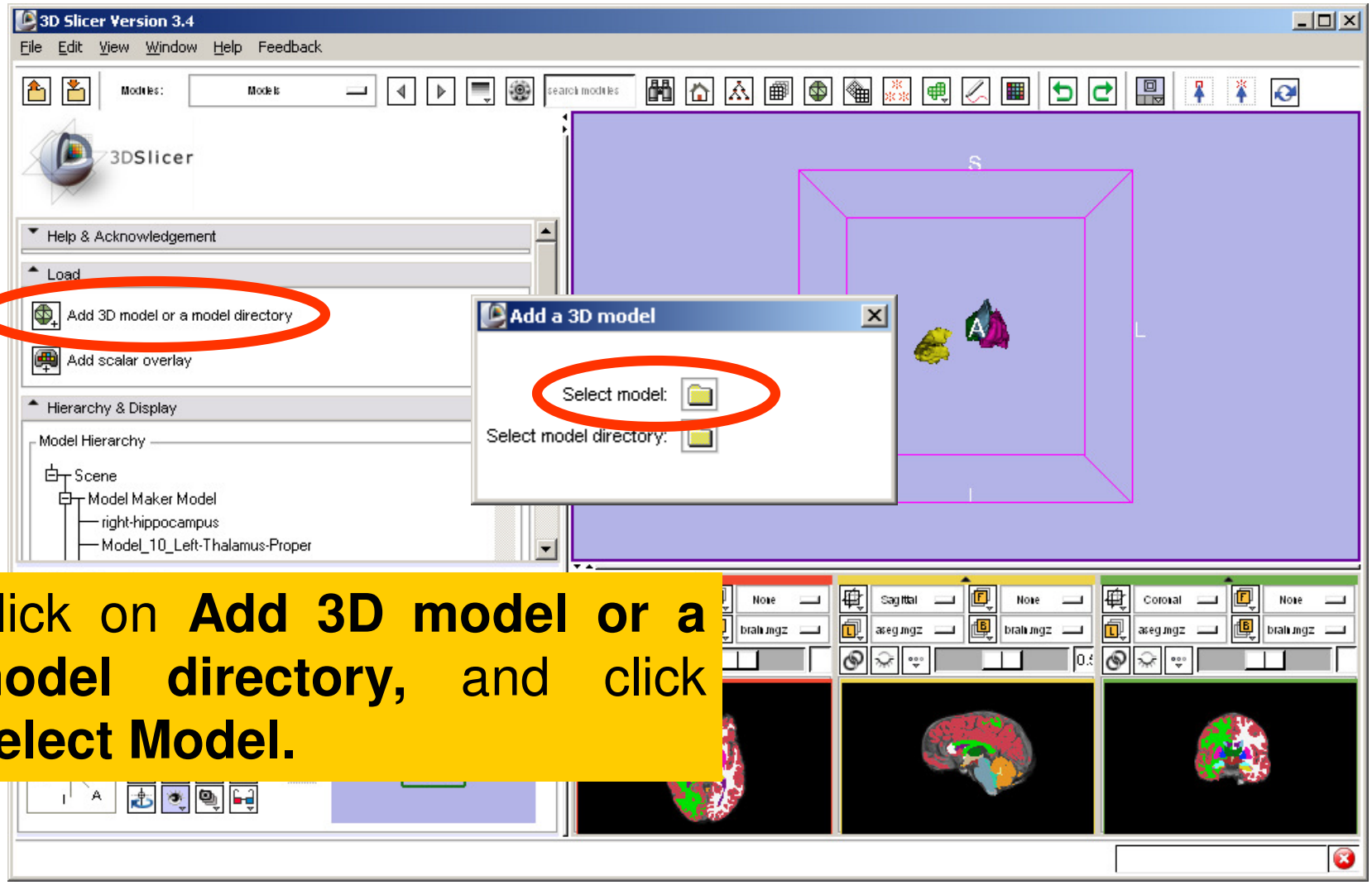


Part 3: Loading FreeSurfer Surfaces and Visualizing Parcellation Maps

Building Multiple Models

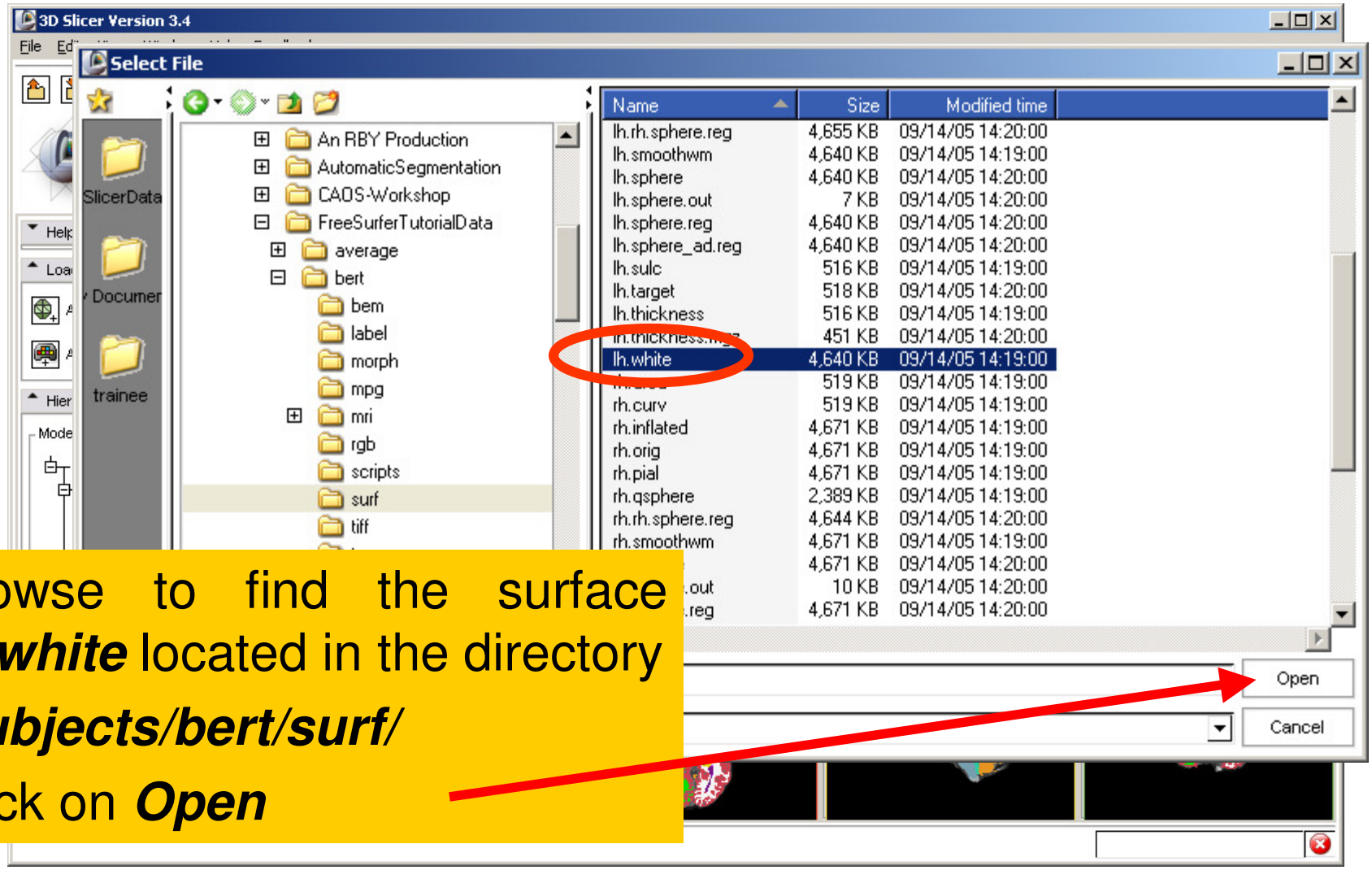


Loading Surfaces



Click on **Add 3D model or a model directory,** and click **Select Model.**

Loading Surfaces

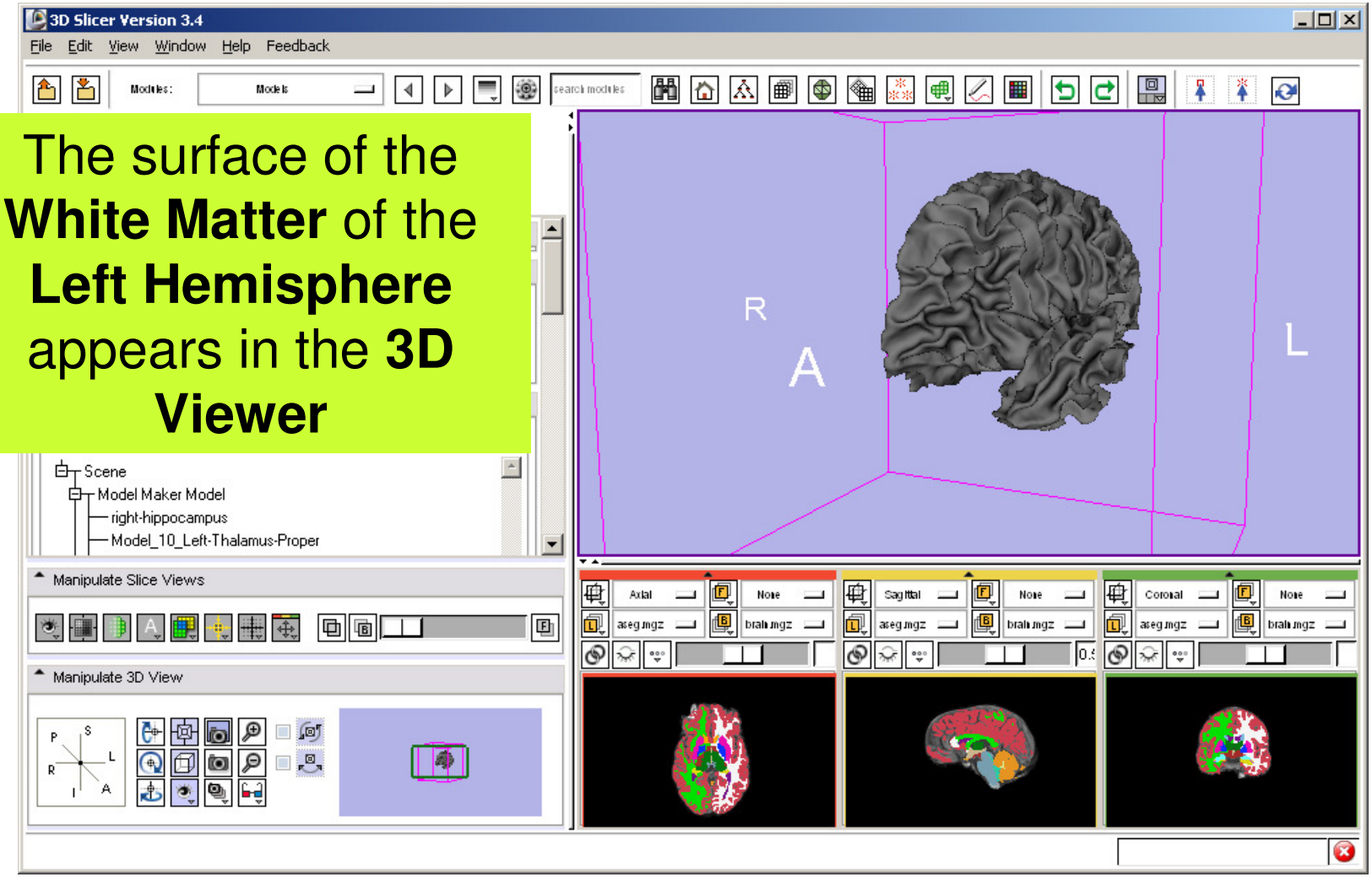


Browse to find the surface ***lh.white*** located in the directory ***/subjects/bert/surf/***

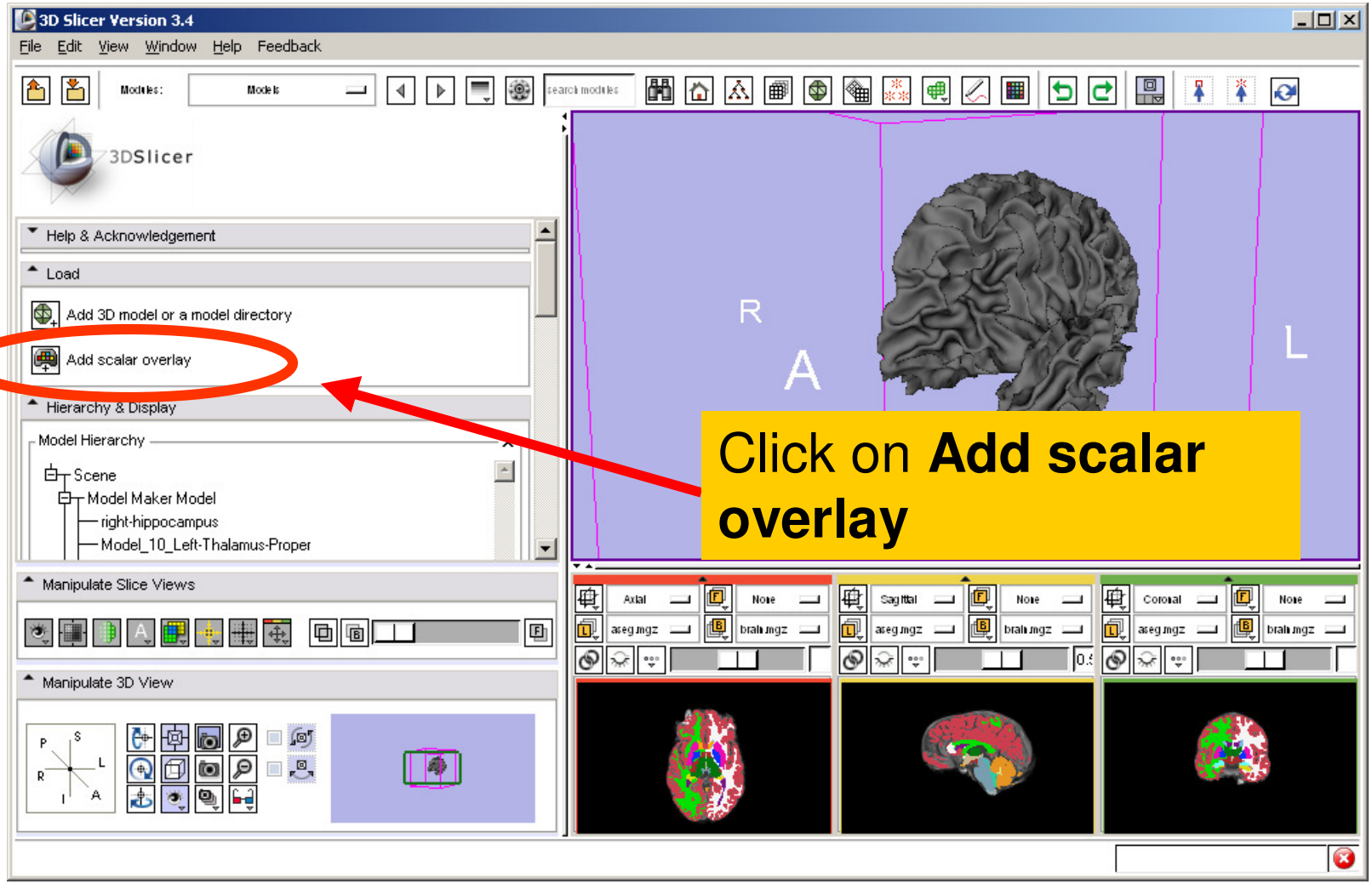
Click on ***Open***

Loading Surfaces

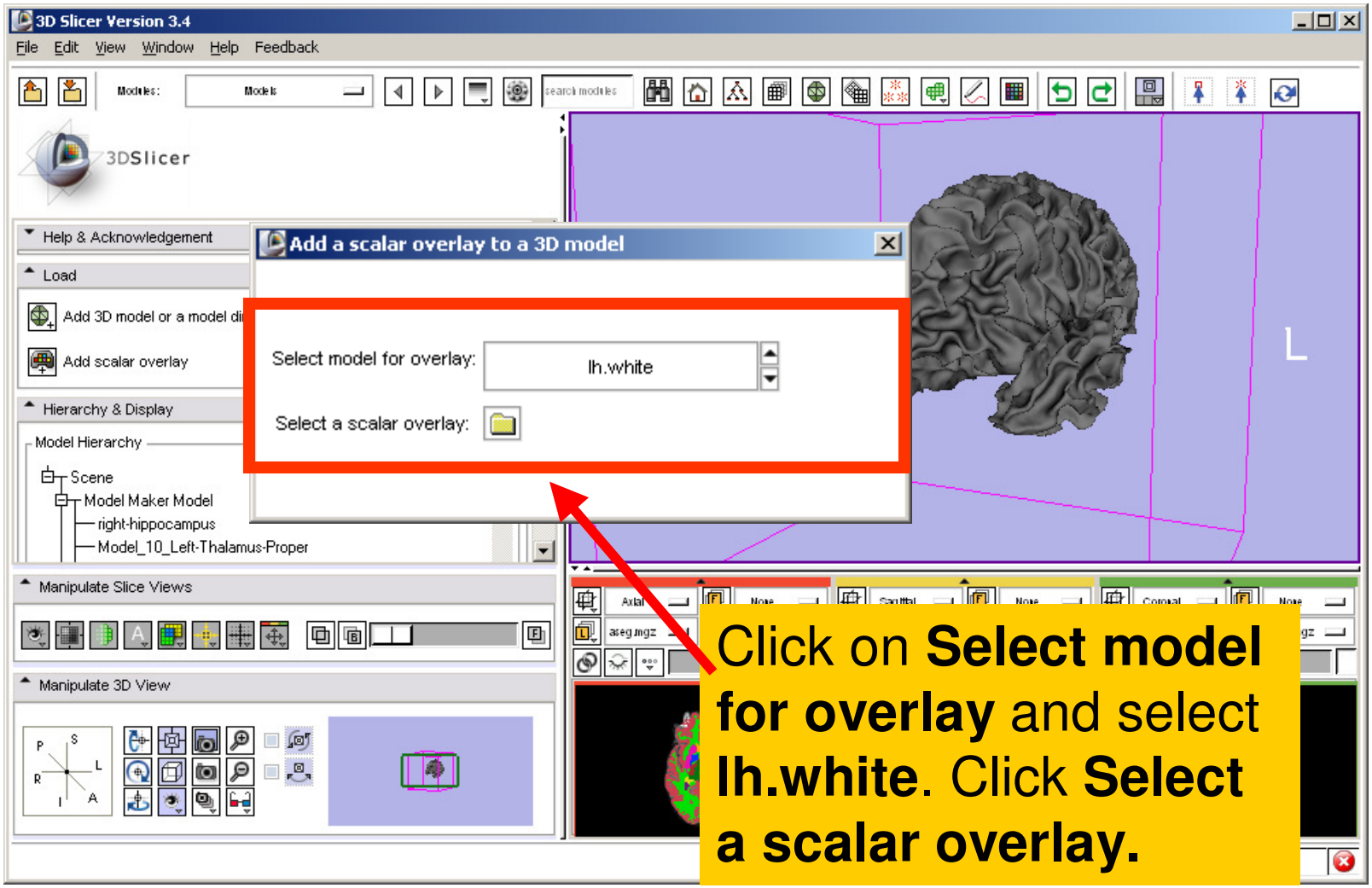
The surface of the **White Matter** of the **Left Hemisphere** appears in the **3D Viewer**



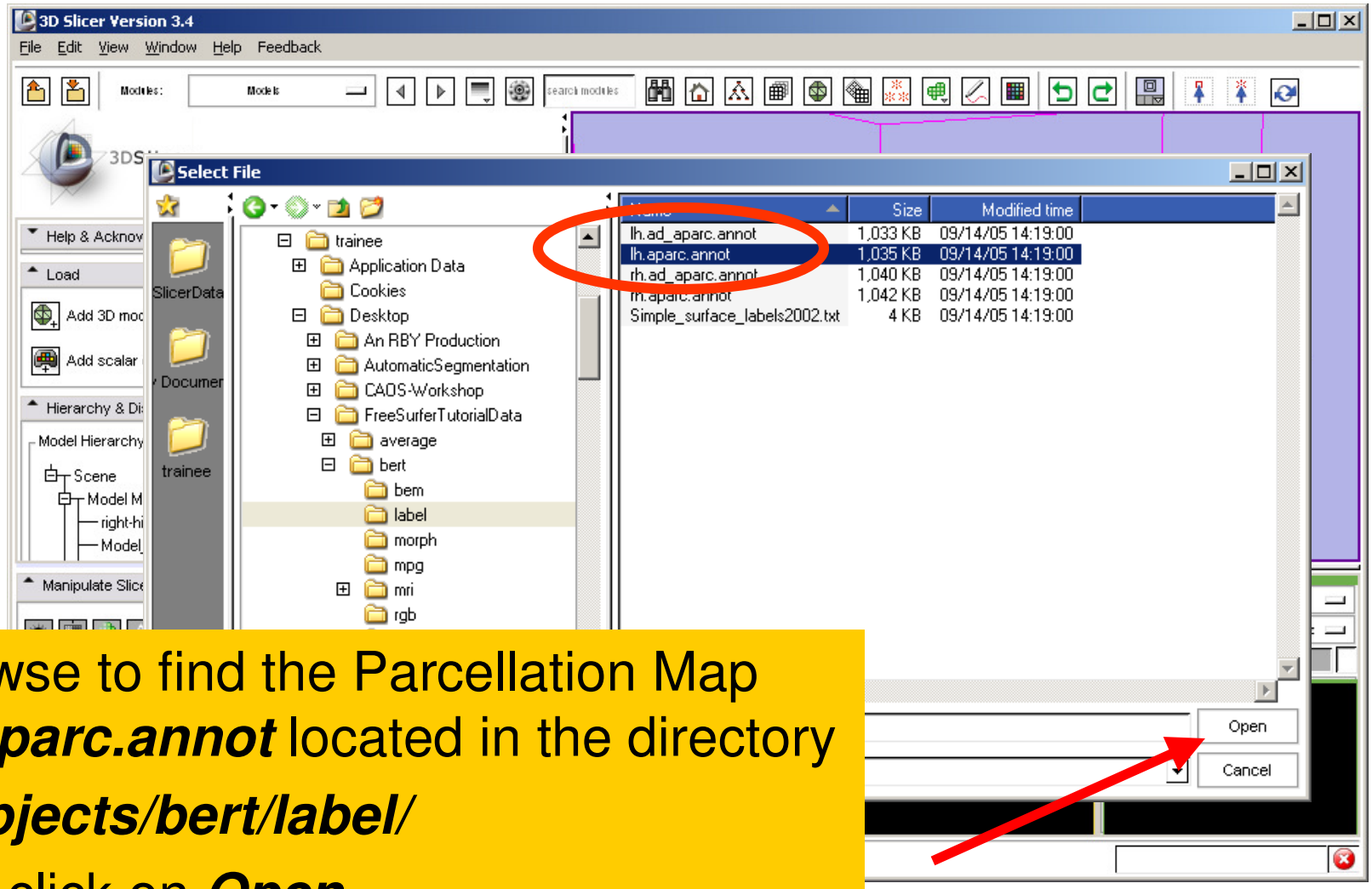
Visualizing Parcellation Maps



Visualizing Parcellation Maps



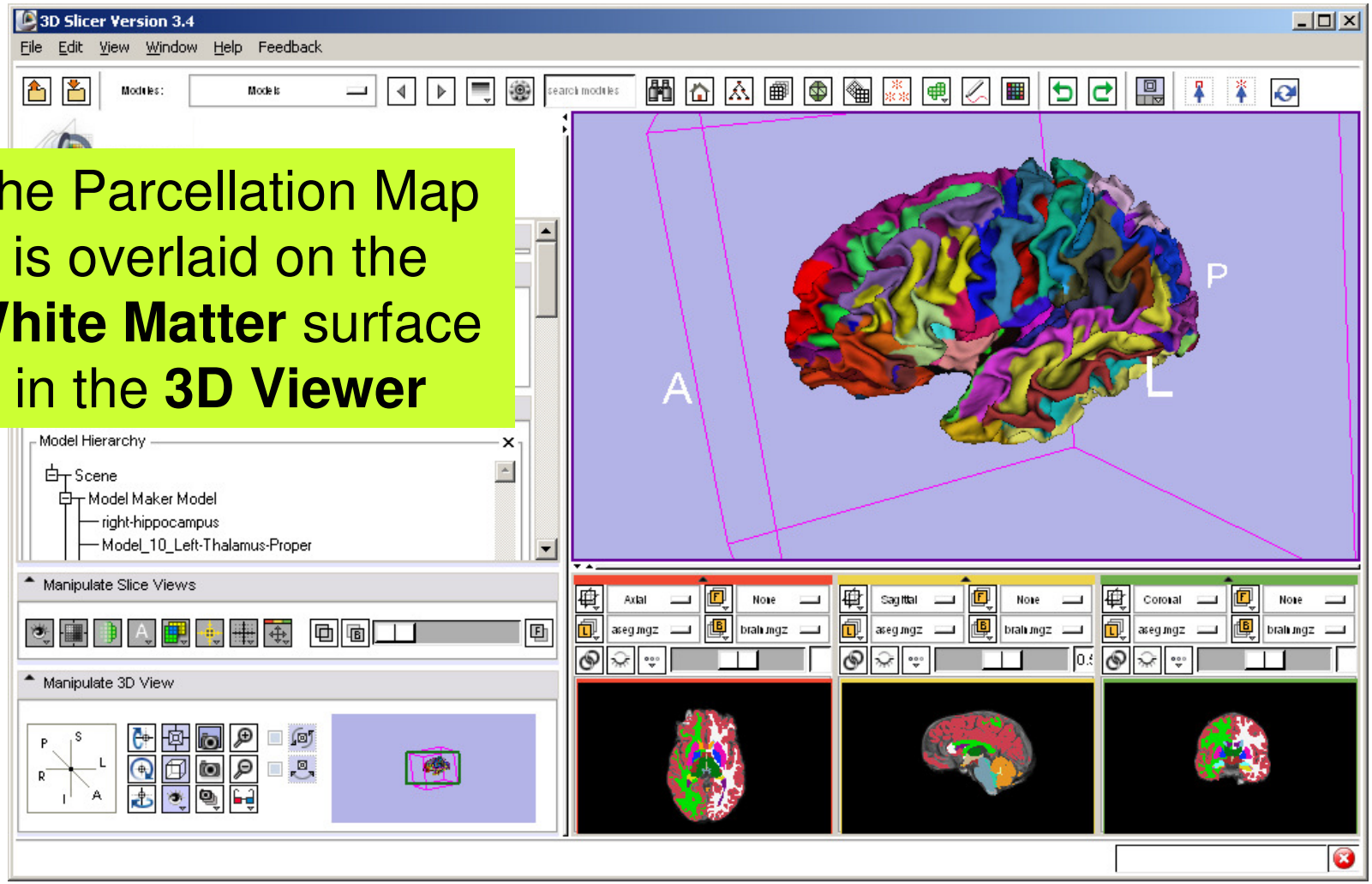
Visualizing Parcellation Maps

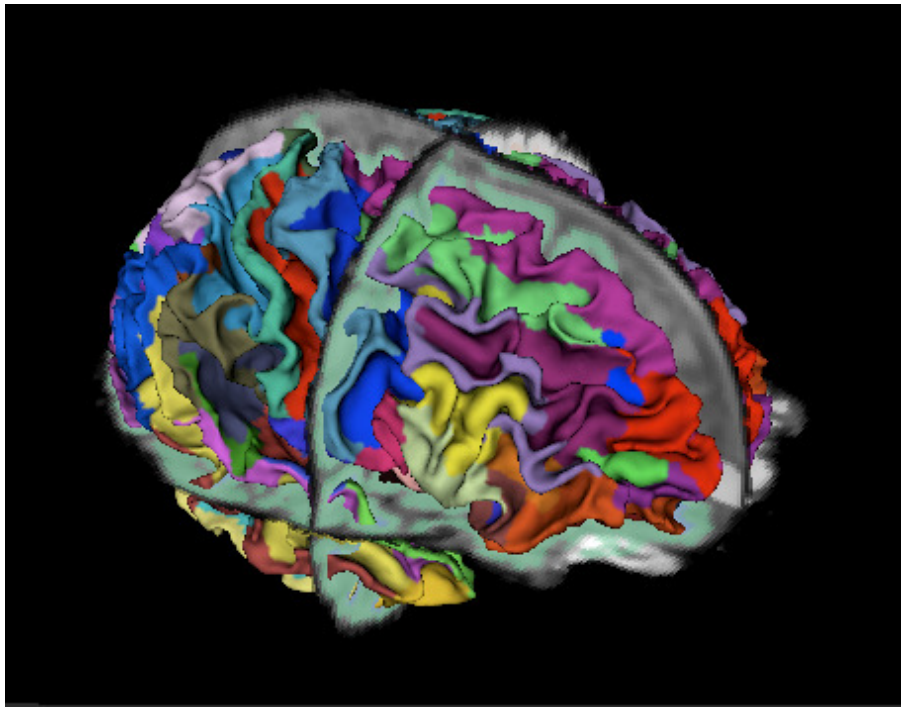


Browse to find the Parcellation Map ***lh.aparc.annot*** located in the directory ***/subjects/bert/label/*** and click on ***Open***

Visualizing Parcellation Maps

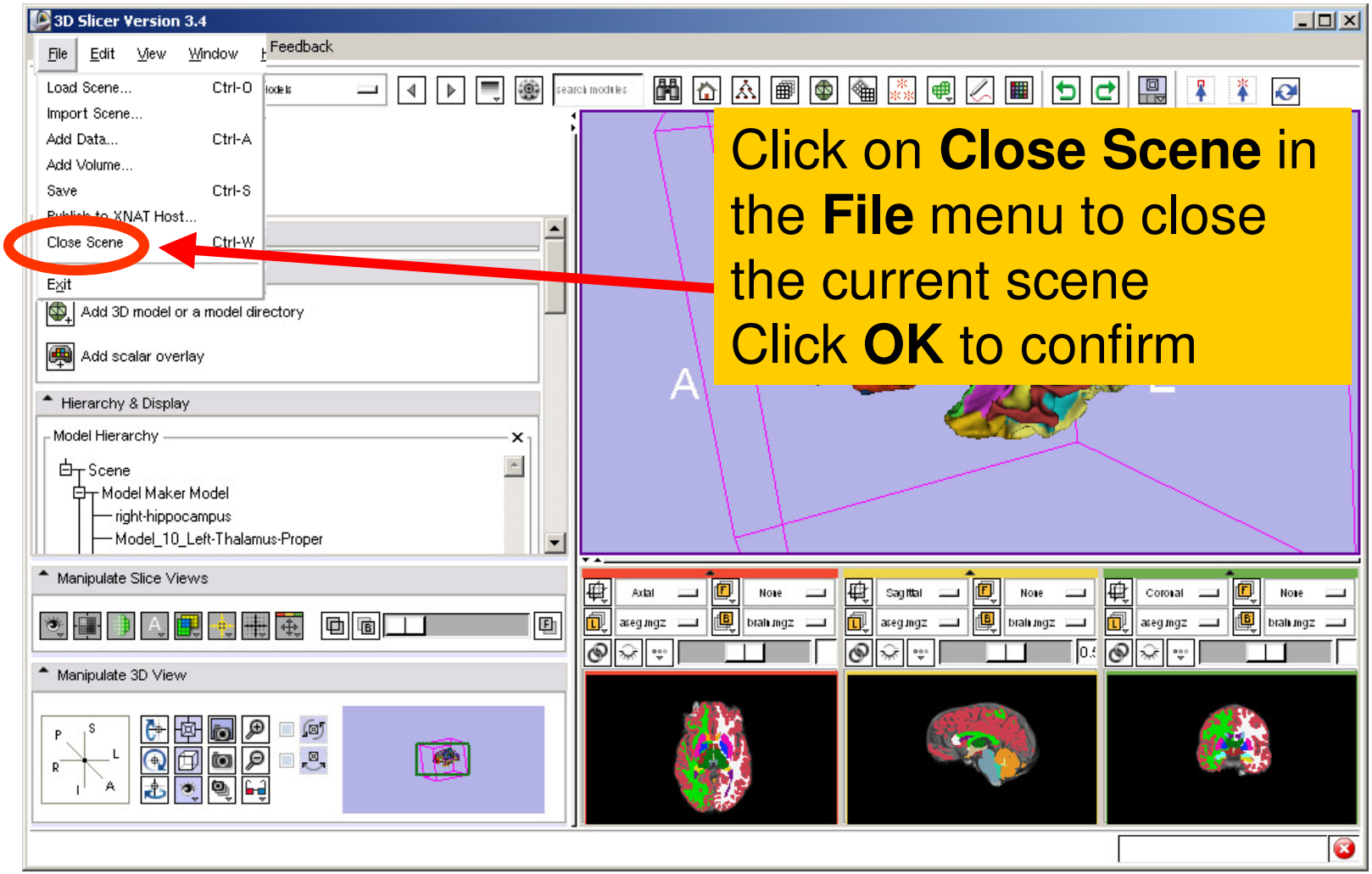
The Parcellation Map is overlaid on the **White Matter** surface in the **3D Viewer**





Part 4: Automatic Data Loading via a Generic Scene File

Loading a Generic Scene File



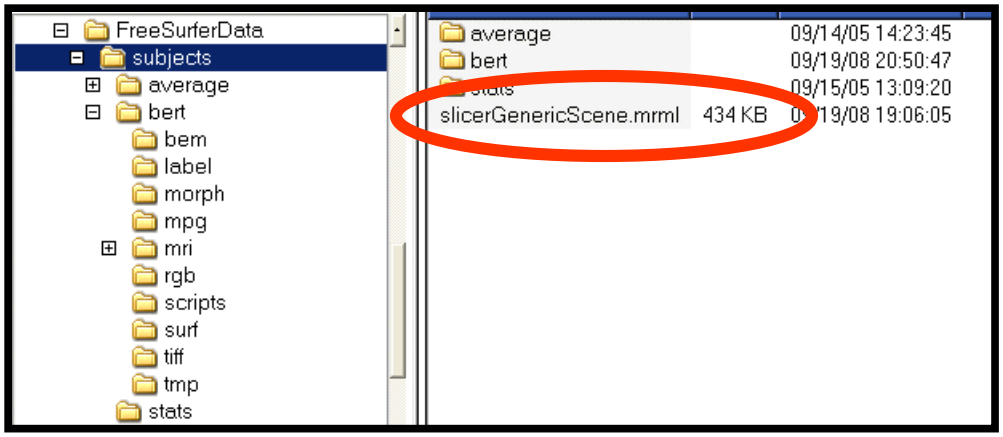
Loading a Generic Scene File

- The generic scene file works by looking in the subject directory created by **FreeSurfer,** and loading all available volumes and models based on known subdirectory names and filenames.

- The file slicerGenericScene.mrml will work properly if the subdirectory names and filenames have not been changed by the user.

Loading a Generic Scene File

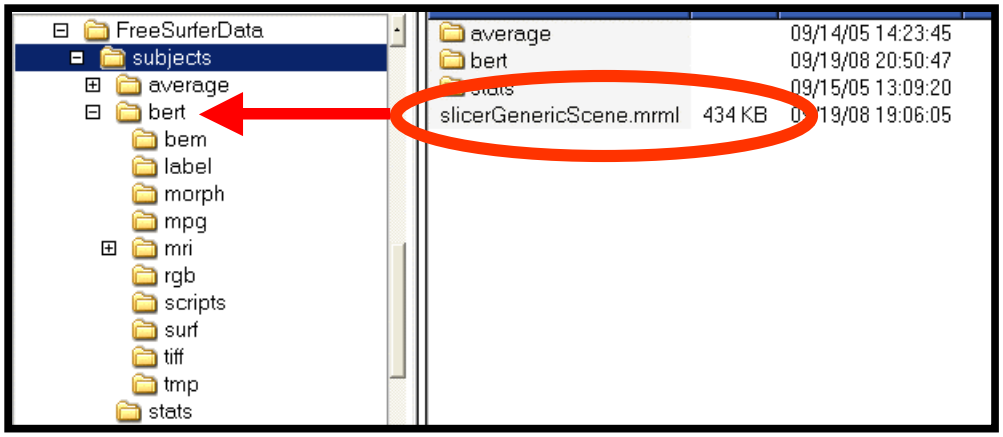
Copy the file **slicerGenericScene.mrml** into the directory /**subjects**/ of our tutorial dataset.



/subjects/

Loading a Generic Scene File

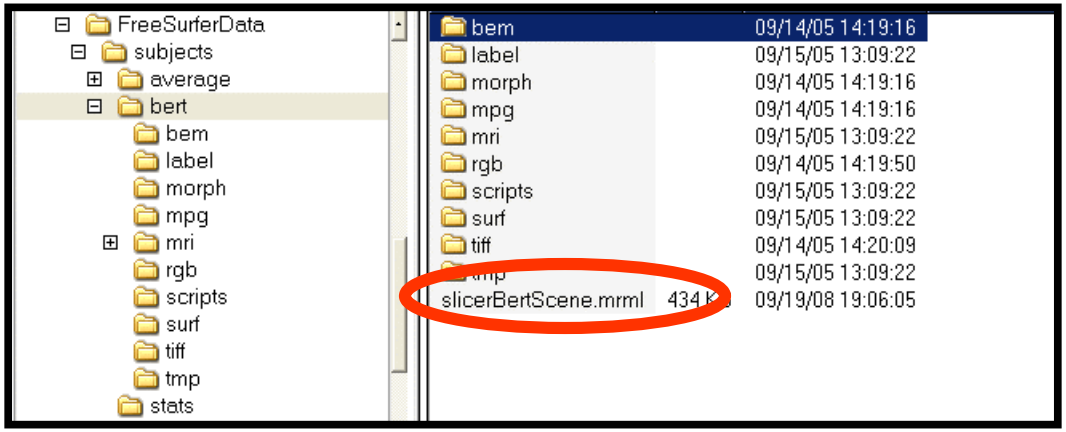
Copy the file **slicerGenericScene.mrml** located in the directory /**subjects**/, into the directory /**subjects/bert**/ of our sample subject.



/subjects/bert/

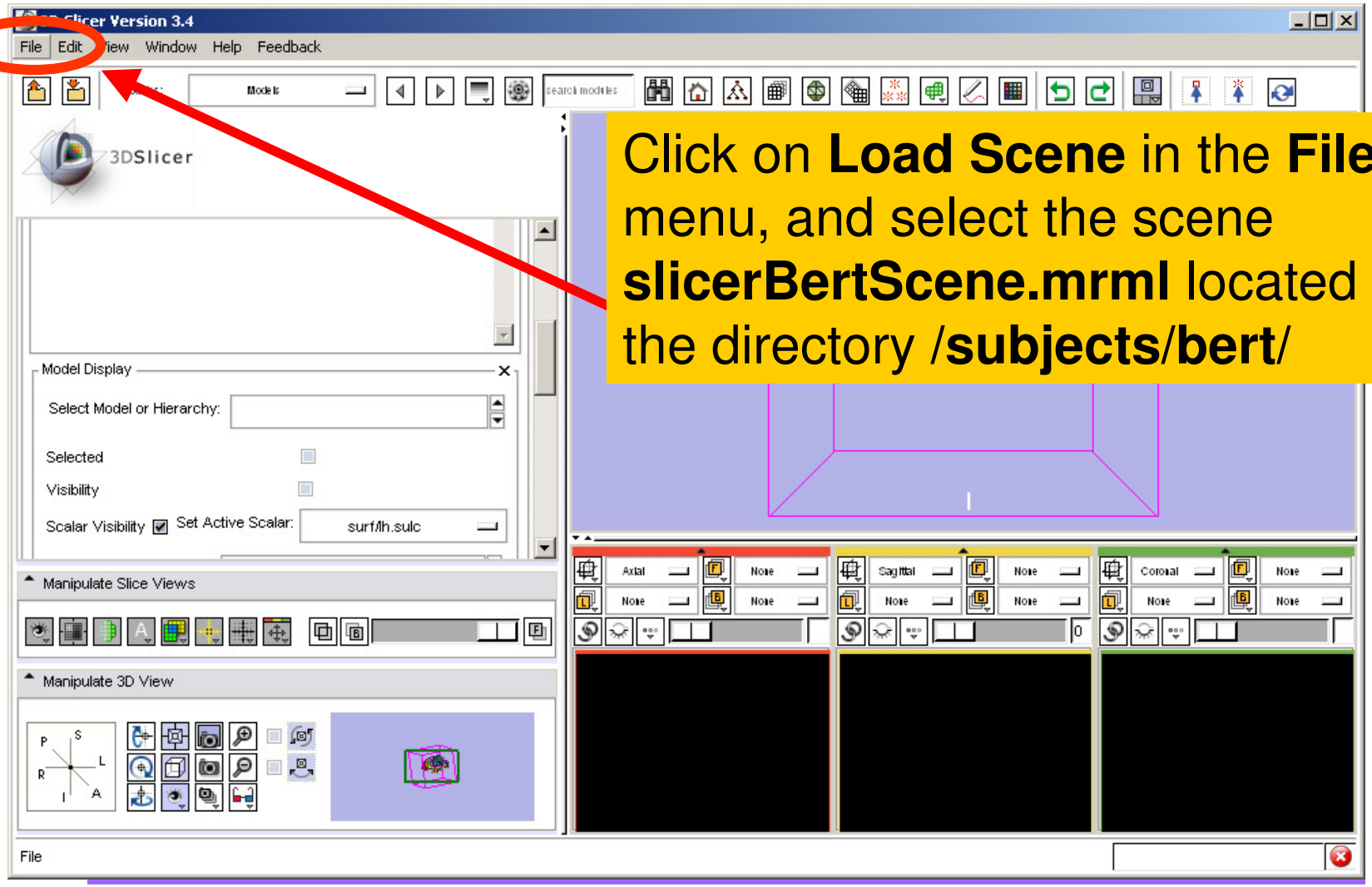
Loading a Generic Scene File

Rename the file **'slicerGenericScene.mrml'** located in the directory **/subjects/bert/ 'slicerBertScene.mrml'**



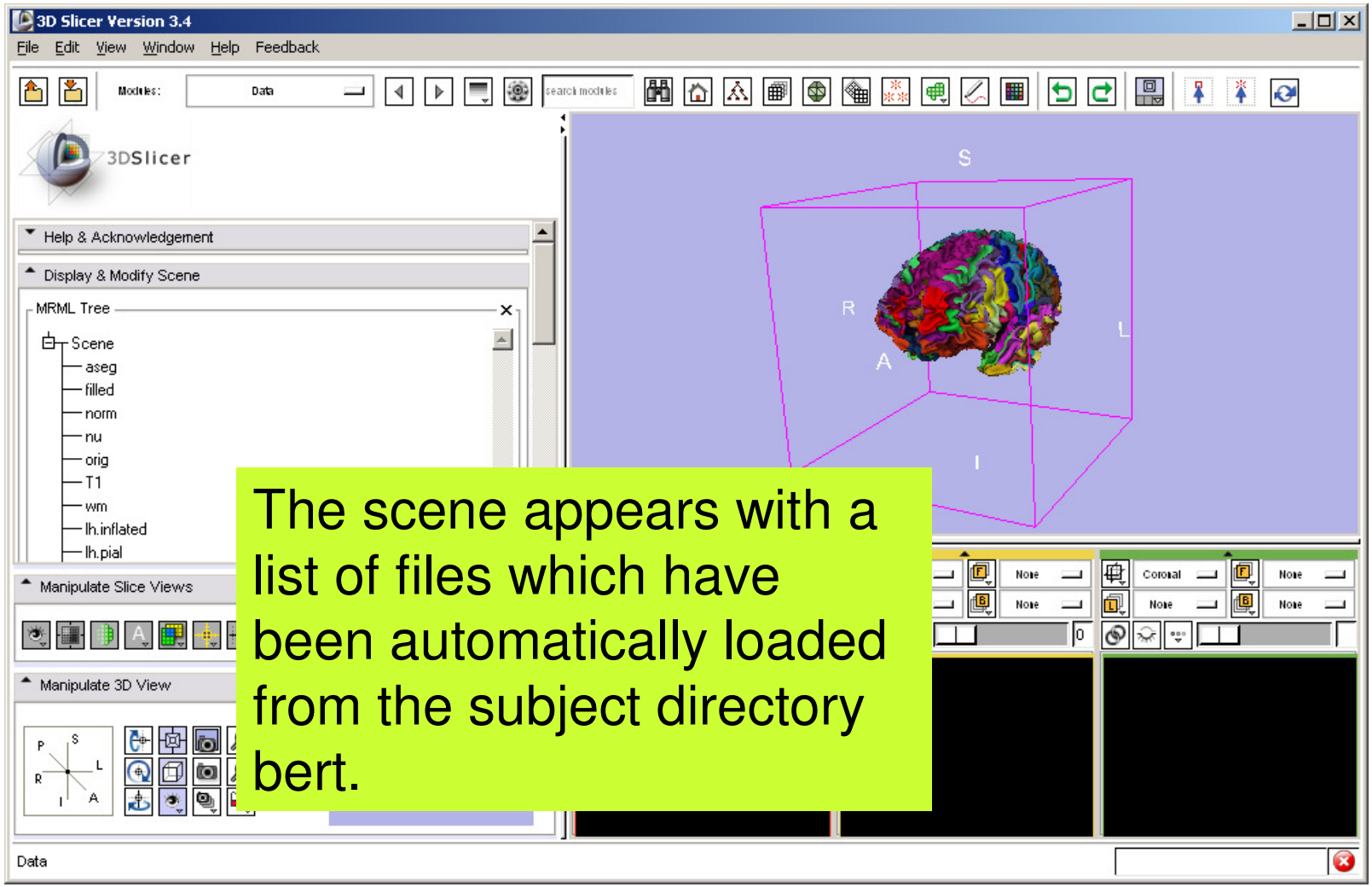
/subjects/bert/

Loading a Generic Scene File

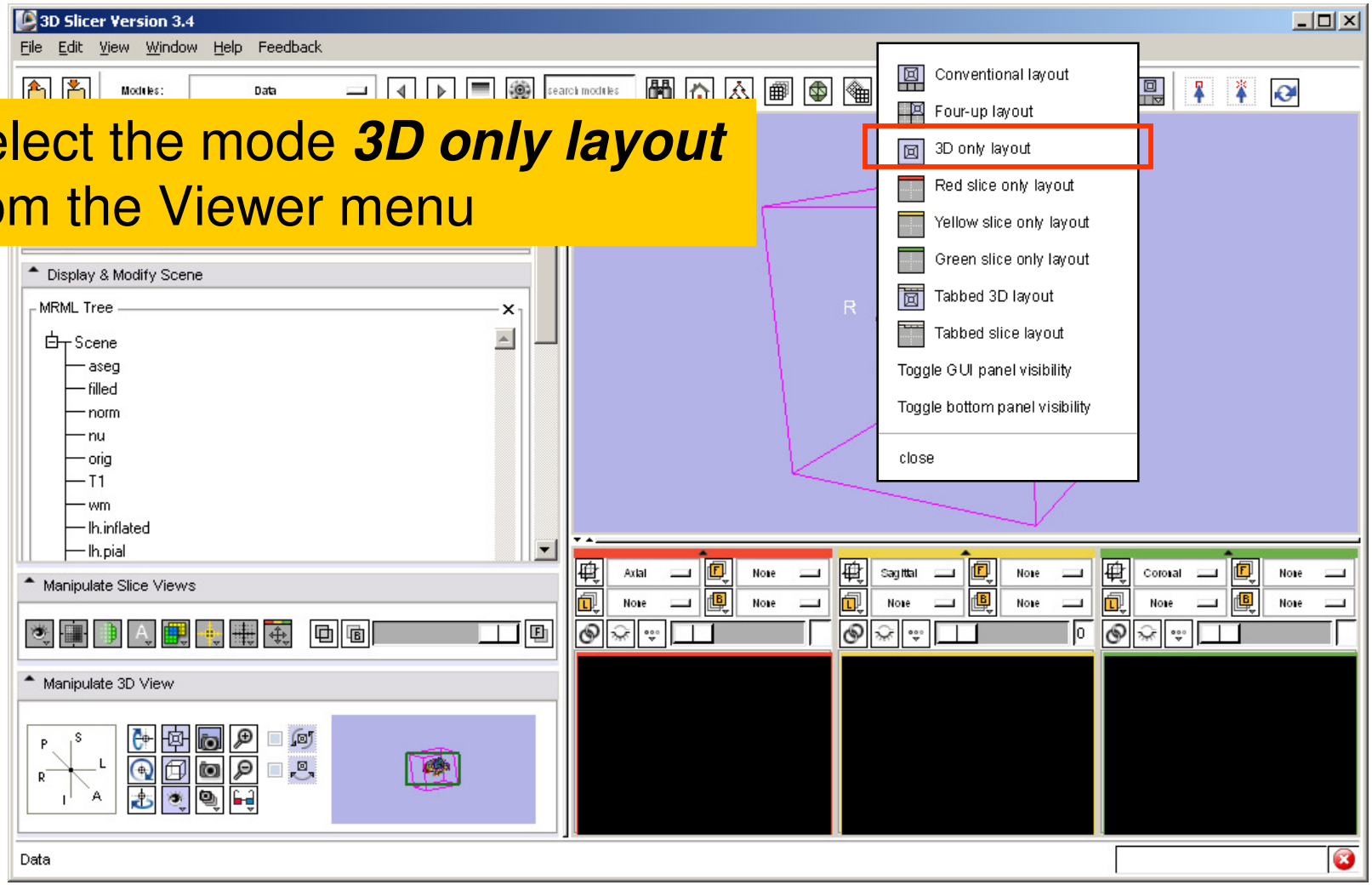


Click on **Load Scene** in the **File** menu, and select the scene **slicerBertScene.mrml** located in the directory /**subjects/bert/**

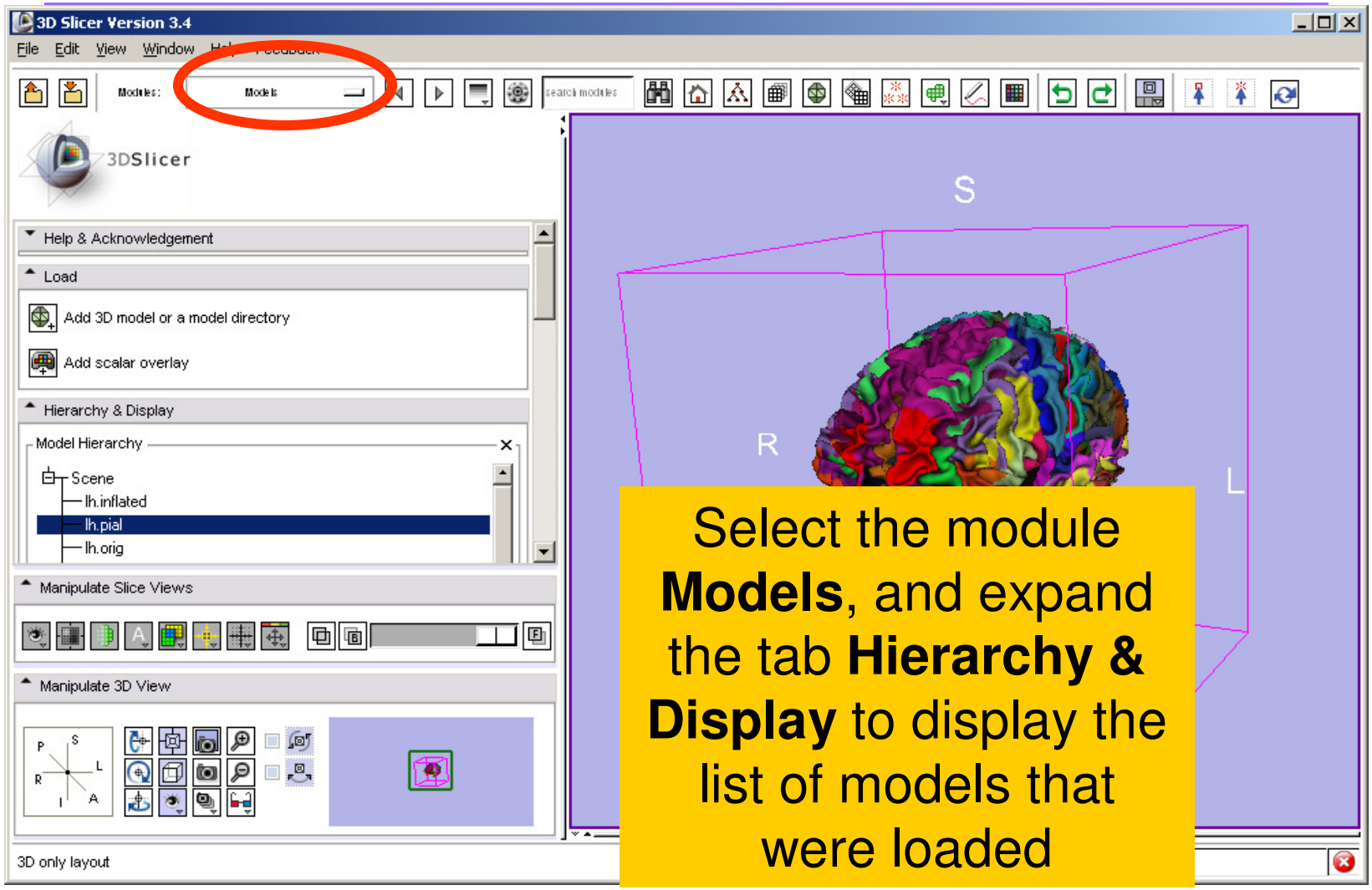
Loading a Generic Scene File



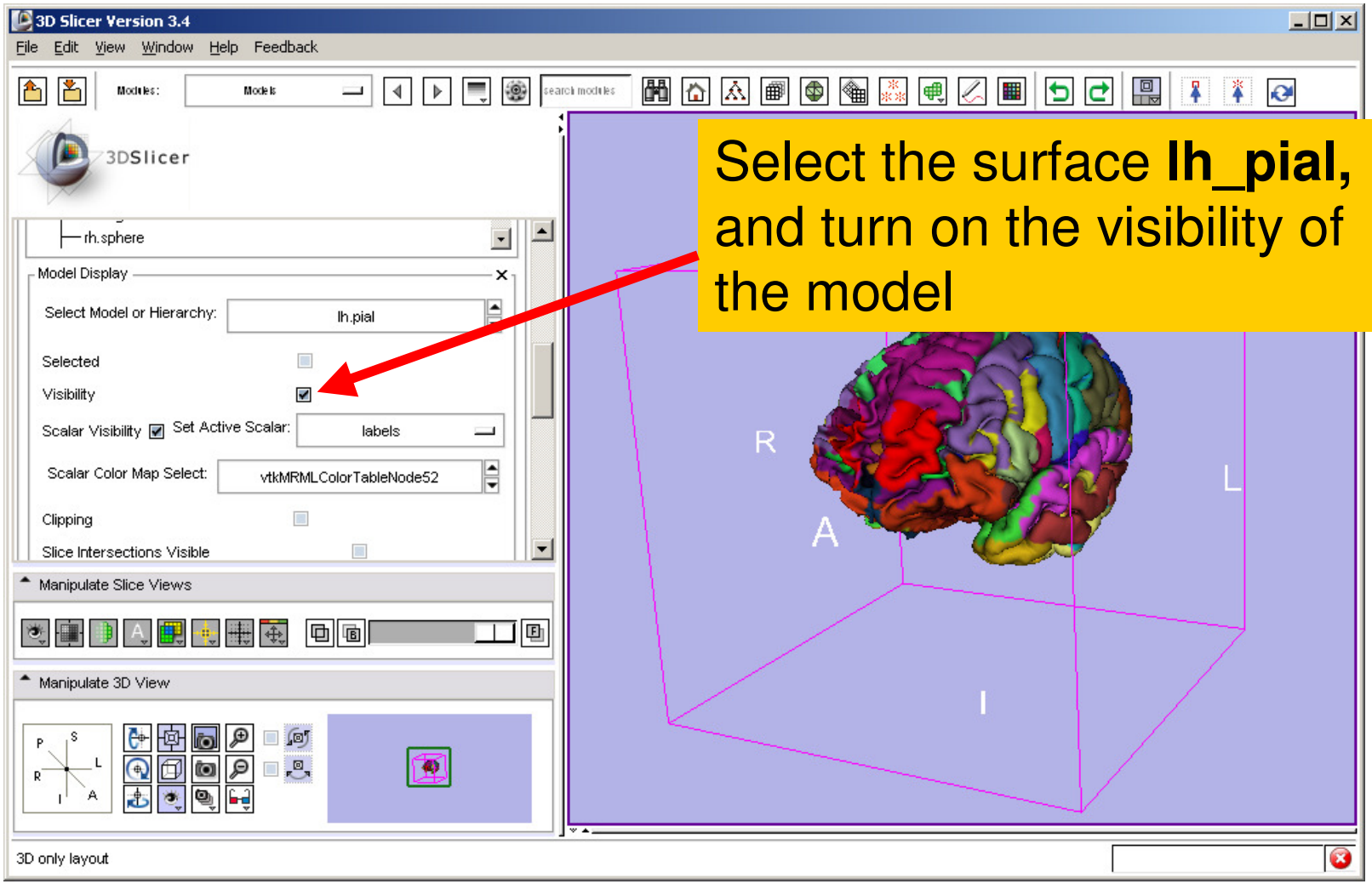
Loading a Generic Scene File



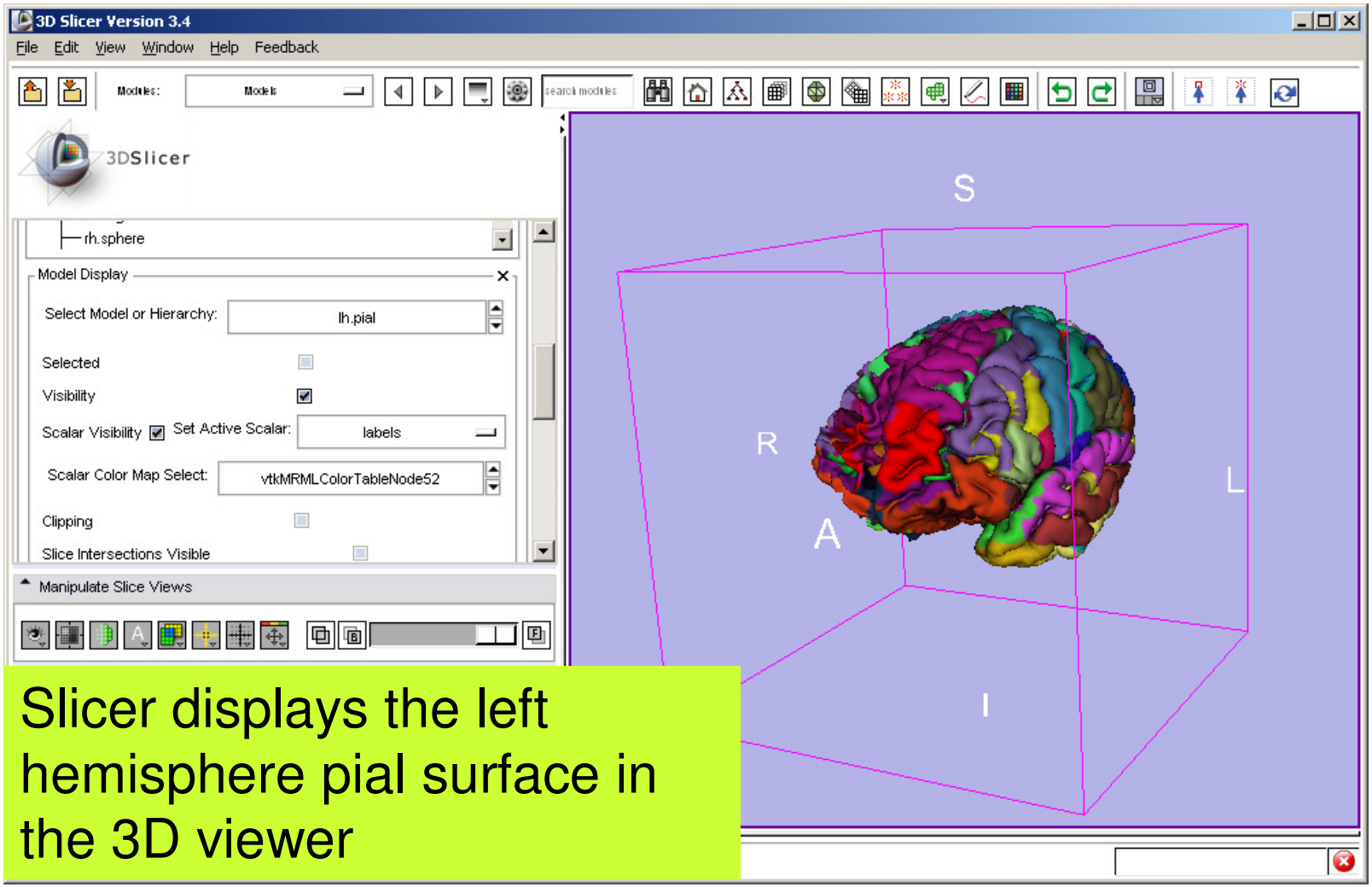
Loading a Generic Scene File



Loading a Generic Scene File

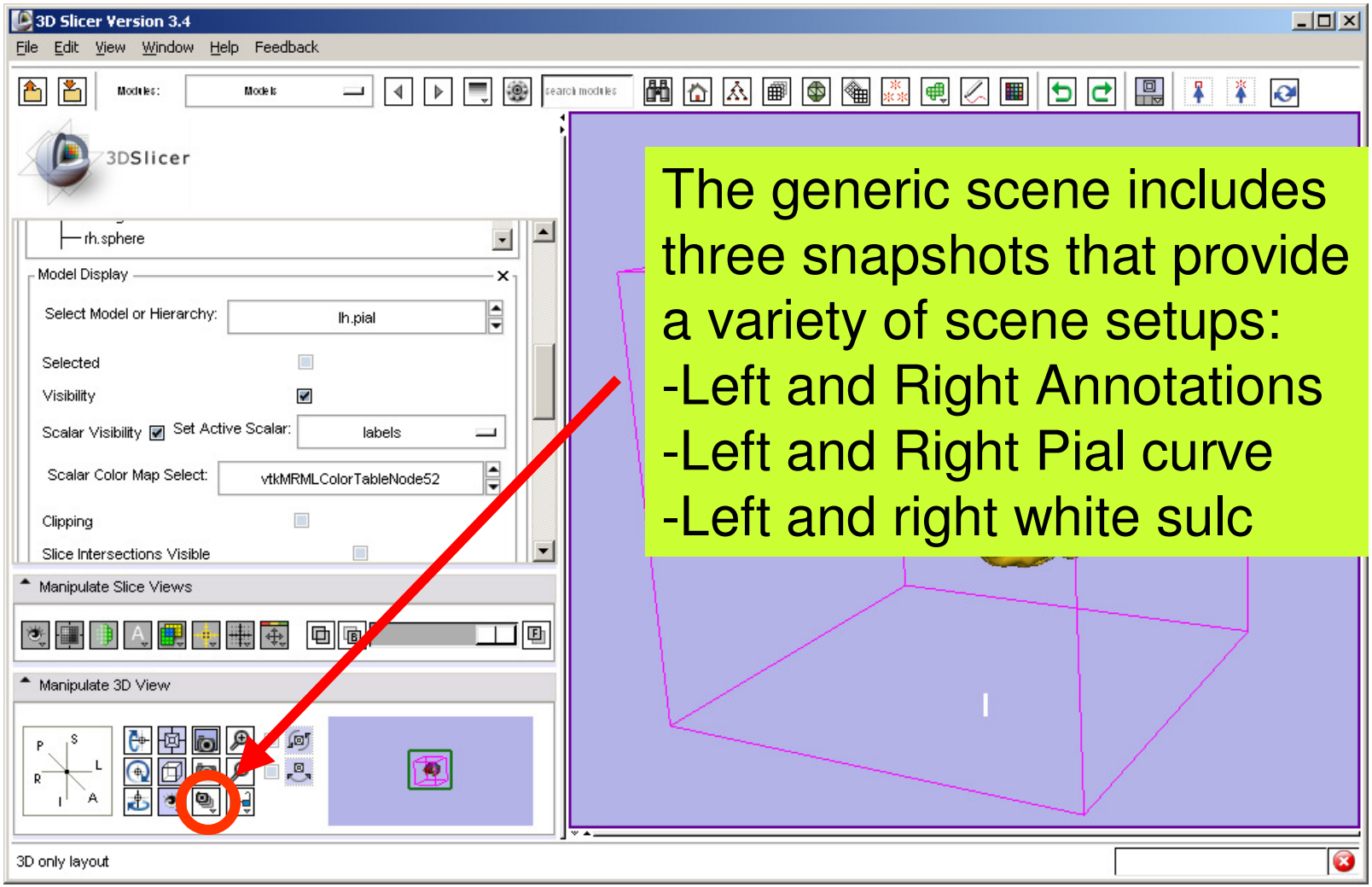


Loading a Generic Scene File



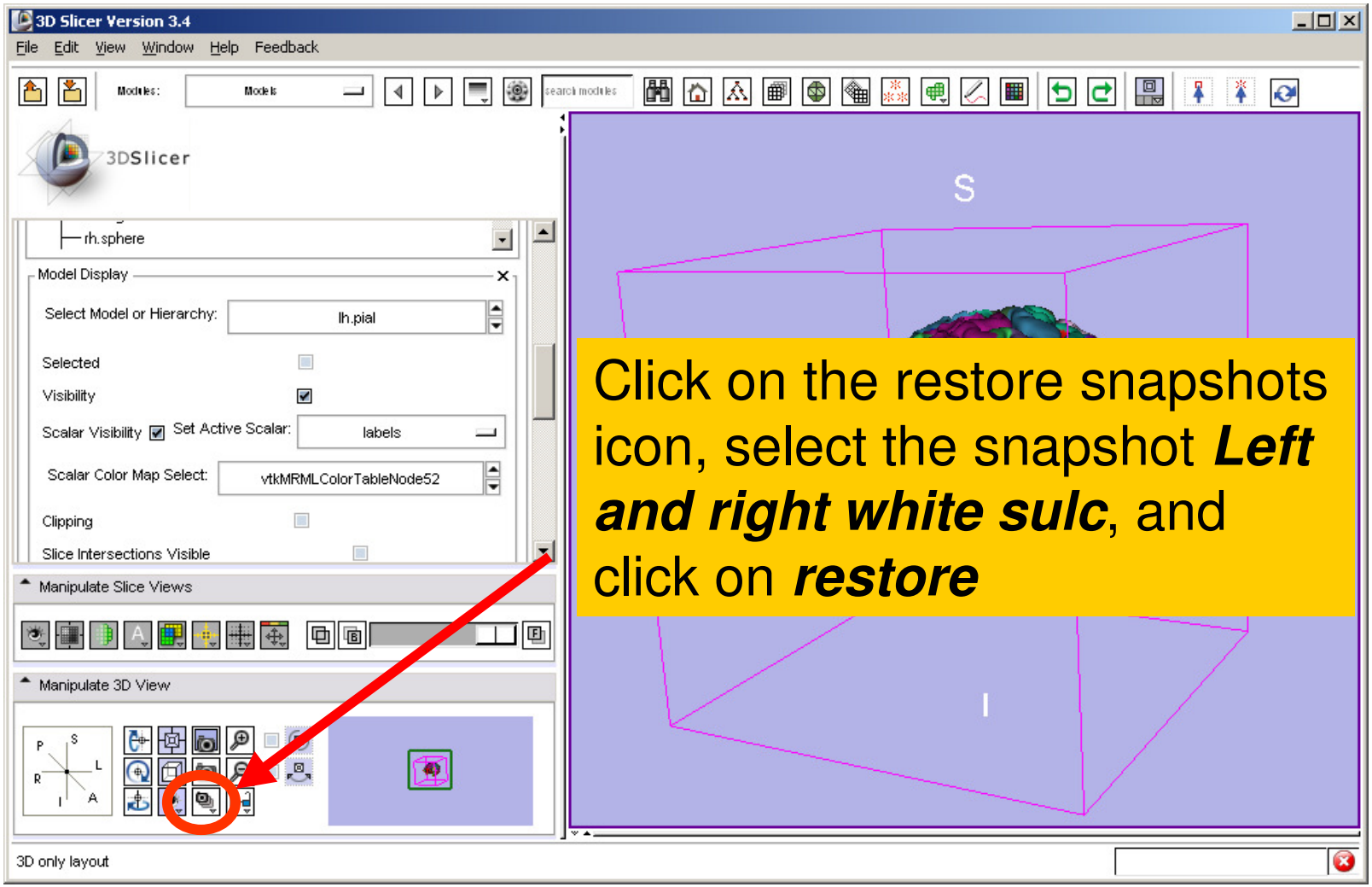
Slicer displays the left hemisphere pial surface in the 3D viewer

Loading a Generic Scene File



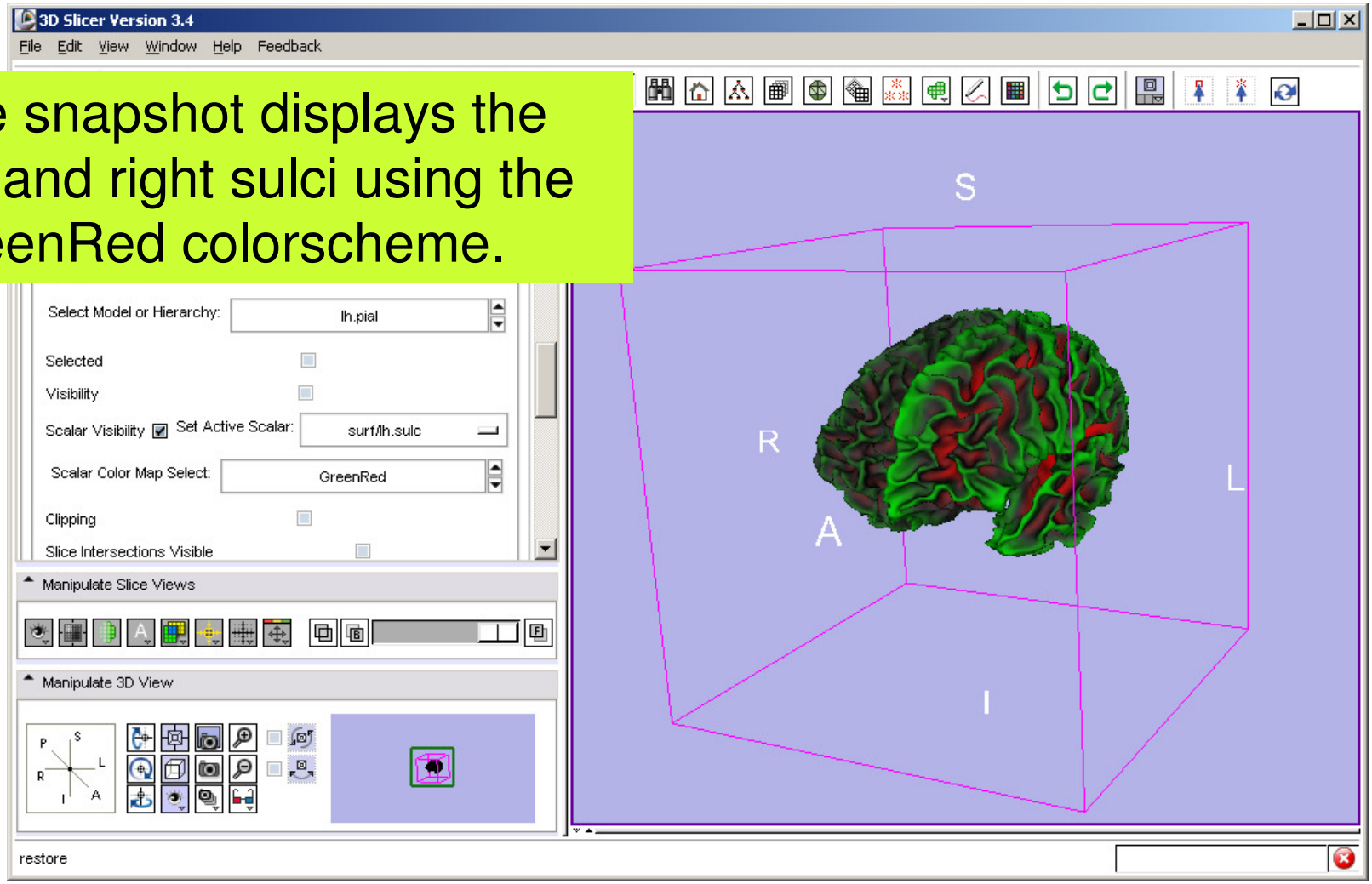
The generic scene includes three snapshots that provide a variety of scene setups:
-Left and Right Annotations
-Left and Right Pial curve
-Left and right white sulc

Loading a Generic Scene File



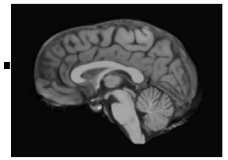
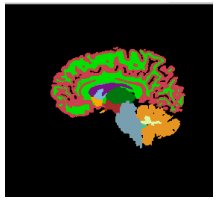
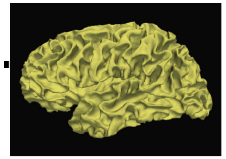
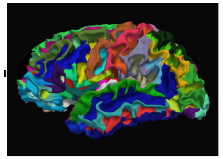
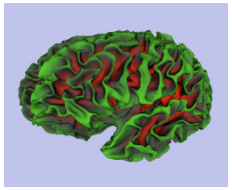
Loading a Generic Scene File

The snapshot displays the left and right sulci using the GreenRed colorscheme.



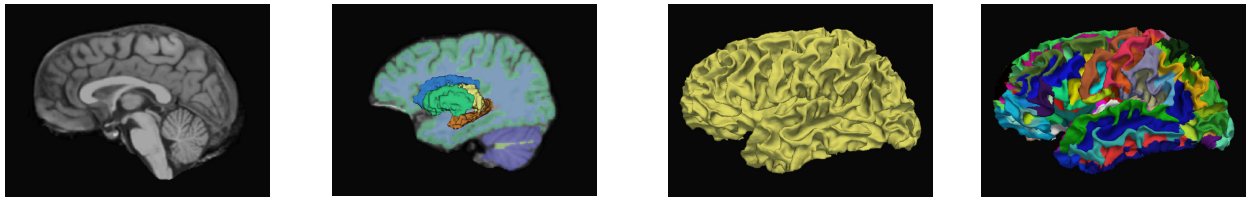
Summary

From **FreeSurfer**, **Slicer3** can load:

- Brain volumes . . . . . 
- ASEG volumes . . . . . 
- Surfaces . . . . . 
- Parcellation Maps . . . . . 
- All of the above, via a scene file. . . . . 

Conclusion

- 3D visualization of brain segmented surfaces and parcellation maps
- Intuitive graphical user interface to interact with FreeSurfer data
- Multi platforms open-source environment



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