Leonardo da Vinci (1452-1519), Virgin and Child
Alte Pinakothek, München

Data Loading & and Visualization

Sonia Pujol, Ph.D.

Surgical Planning Laboratory
Harvard Medical School

Slicer3

- An end-user application for image analysis
- An open-source environment for software development
- A software platform that is both easy to use for clinical researchers and easy to extend for programmers

Slicer3

Slicer3 is a multi-platform software that is developed and maintained on:

- Windows XP
- Linux x86_64
- Linux x86_32
- Mac OSX – Darwin x86-Intel
- Mac OSX – Darwin Power PC

Download Slicer 3.6

- Download and install the Slicer3.6 software from the Slicer web site

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

Disclaimer

It is the responsibility of the user of 3DSlicer to comply with both the terms of the license and with the applicable laws, regulations and rules.

Download Slicer3.6

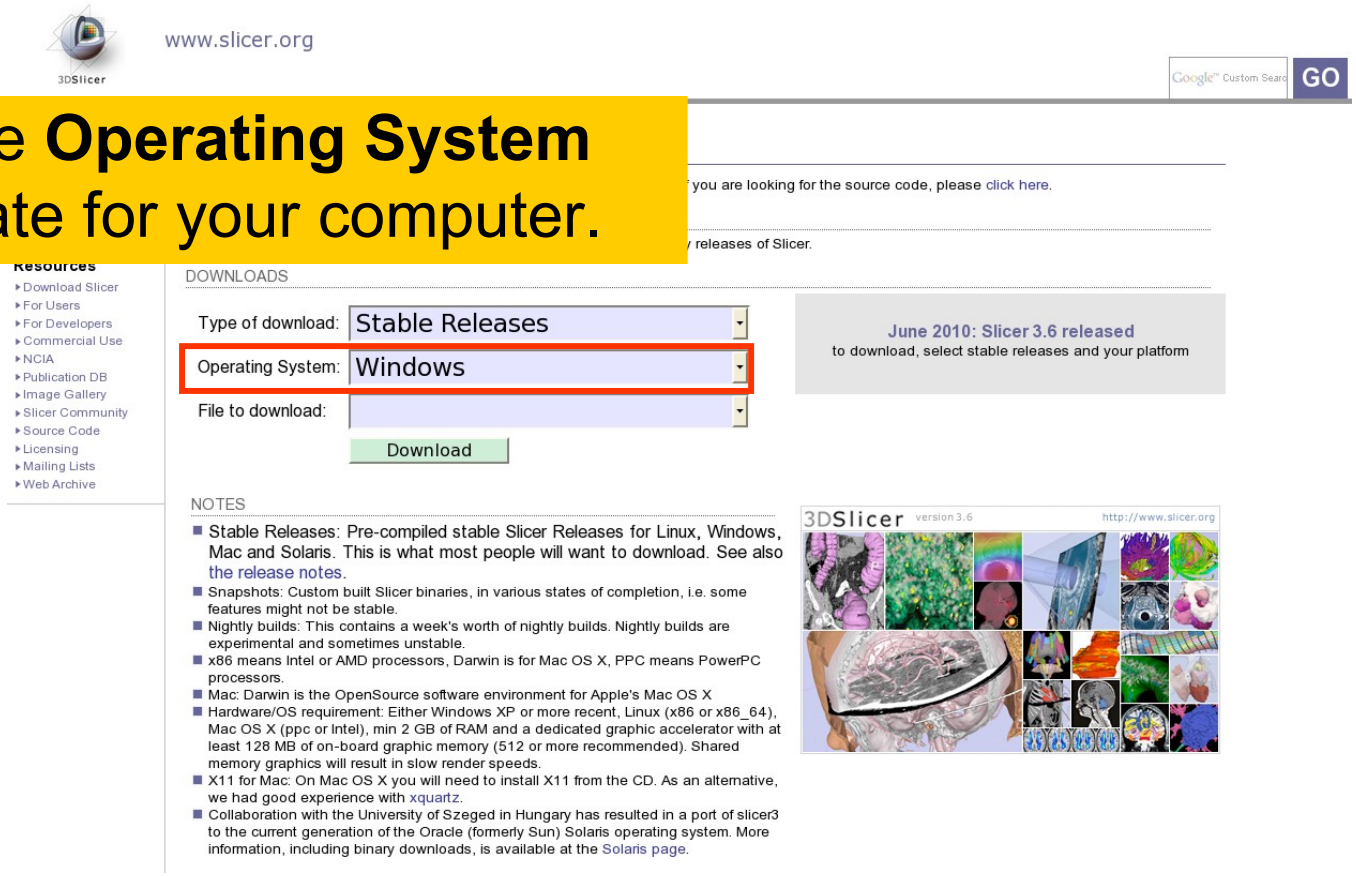
Slicer3 is under active development by the medical research community.
Frequent releases incorporating cutting-edge medical image analysis capabilities. This tutorial uses the current stable Slicer3.6 release version.

Download Slicer3.6

Select the **Type of download** **Stable Releases**.

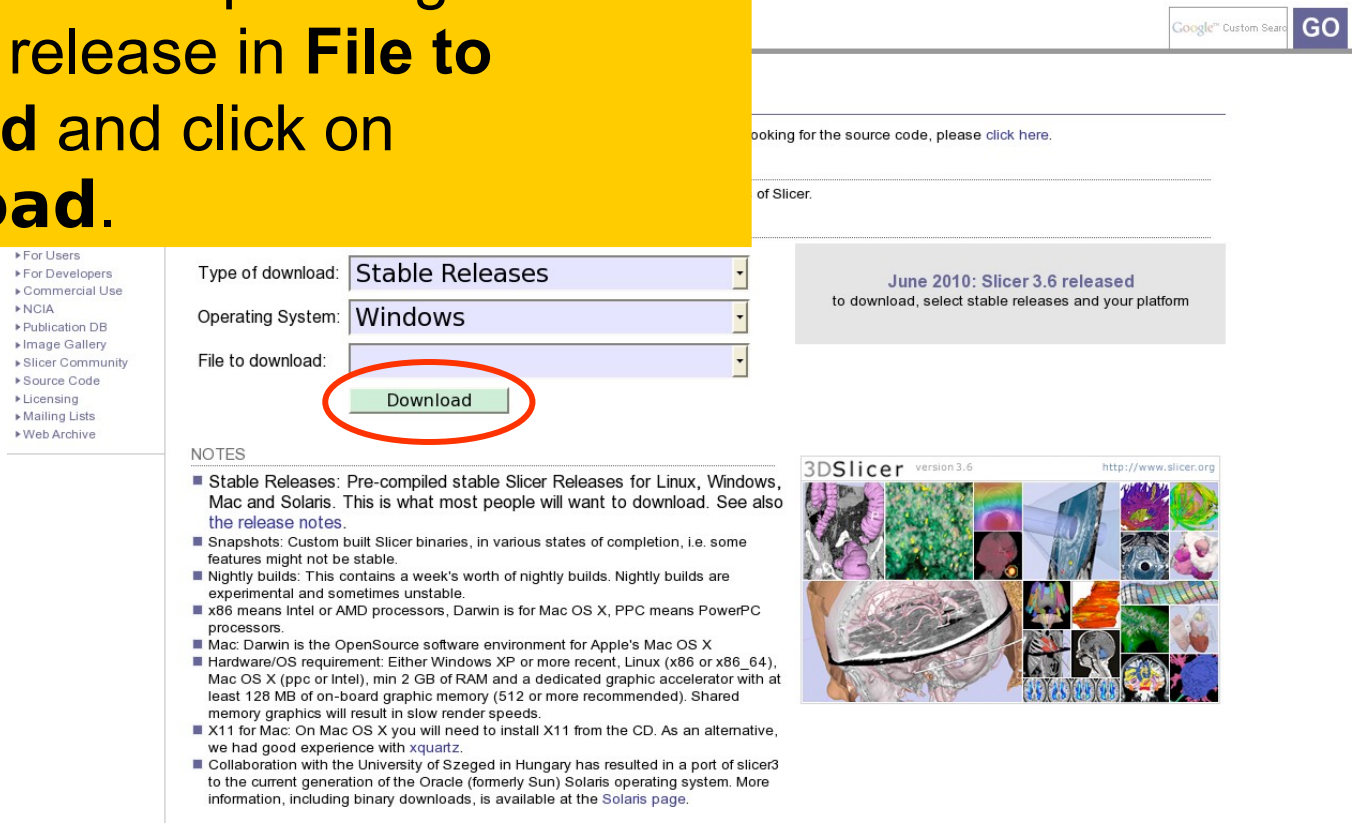
Download Slicer3.6

Select the **Operating System** appropriate for your computer.



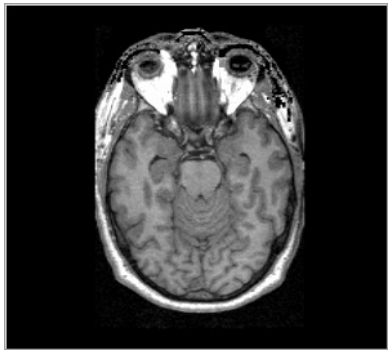
Download Slicer3.6

Select the corresponding latest Slicer3.6 release in **File to download** and click on **Download**.

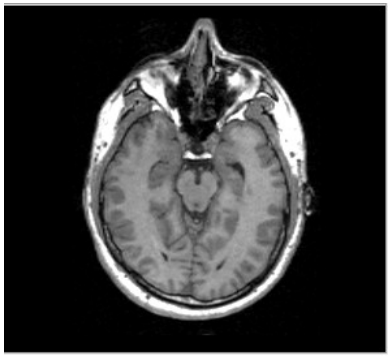


Download the training dataset

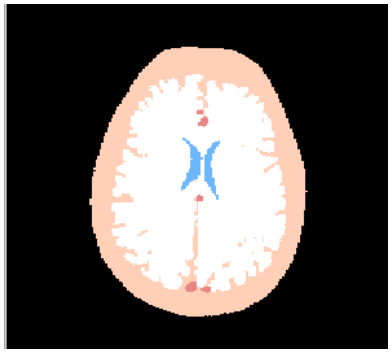
- This course is built upon three datasets of a single healthy subject brain:



MR DICOM
GRASS



MR Nrrd
SPGR

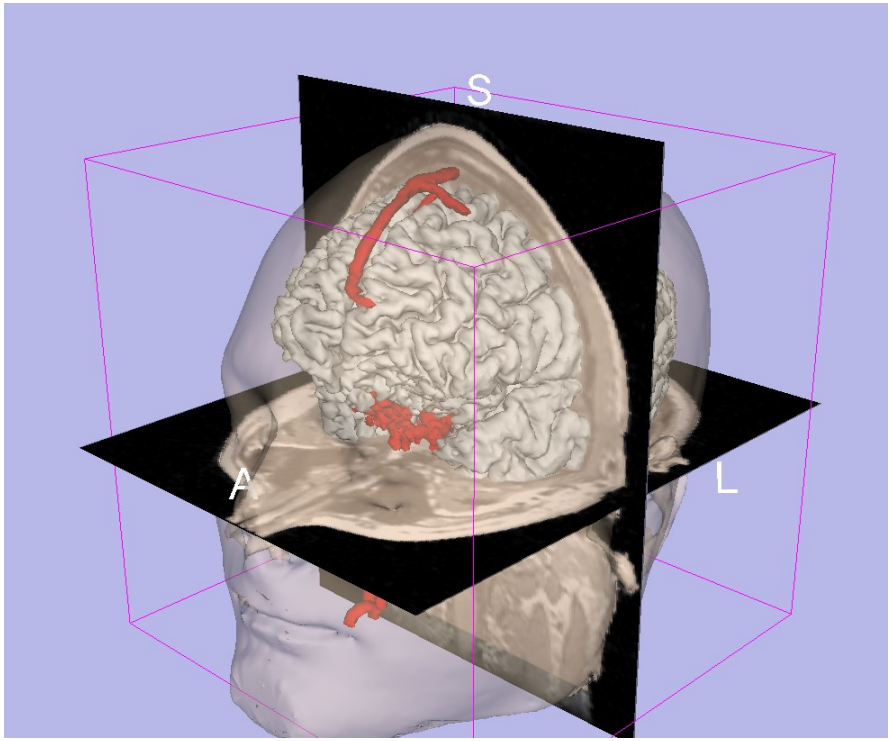


Pre-computed
Label Map

- Download and unzip the training dataset
  Slicer3VisualizationDataset.zip
  http://www.slicer.org/slicerWiki/index.php/Slicer 3.6:Training

Learning objective

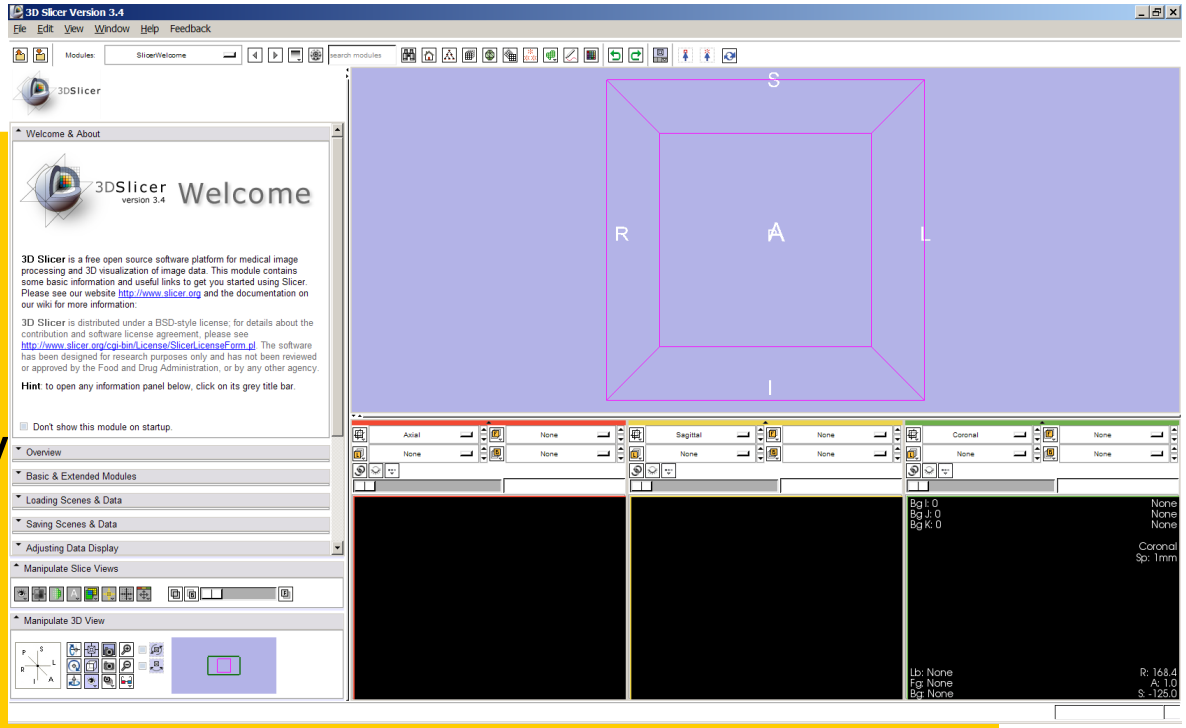
Following this tutorial, you'll be able to load and visualize volumes within Slicer3, and to interact in 3D with structural images and models.



Start Slicer3

Linux/Mac users

Launch the Slicer3 executable located in the Slicer3.6 directory

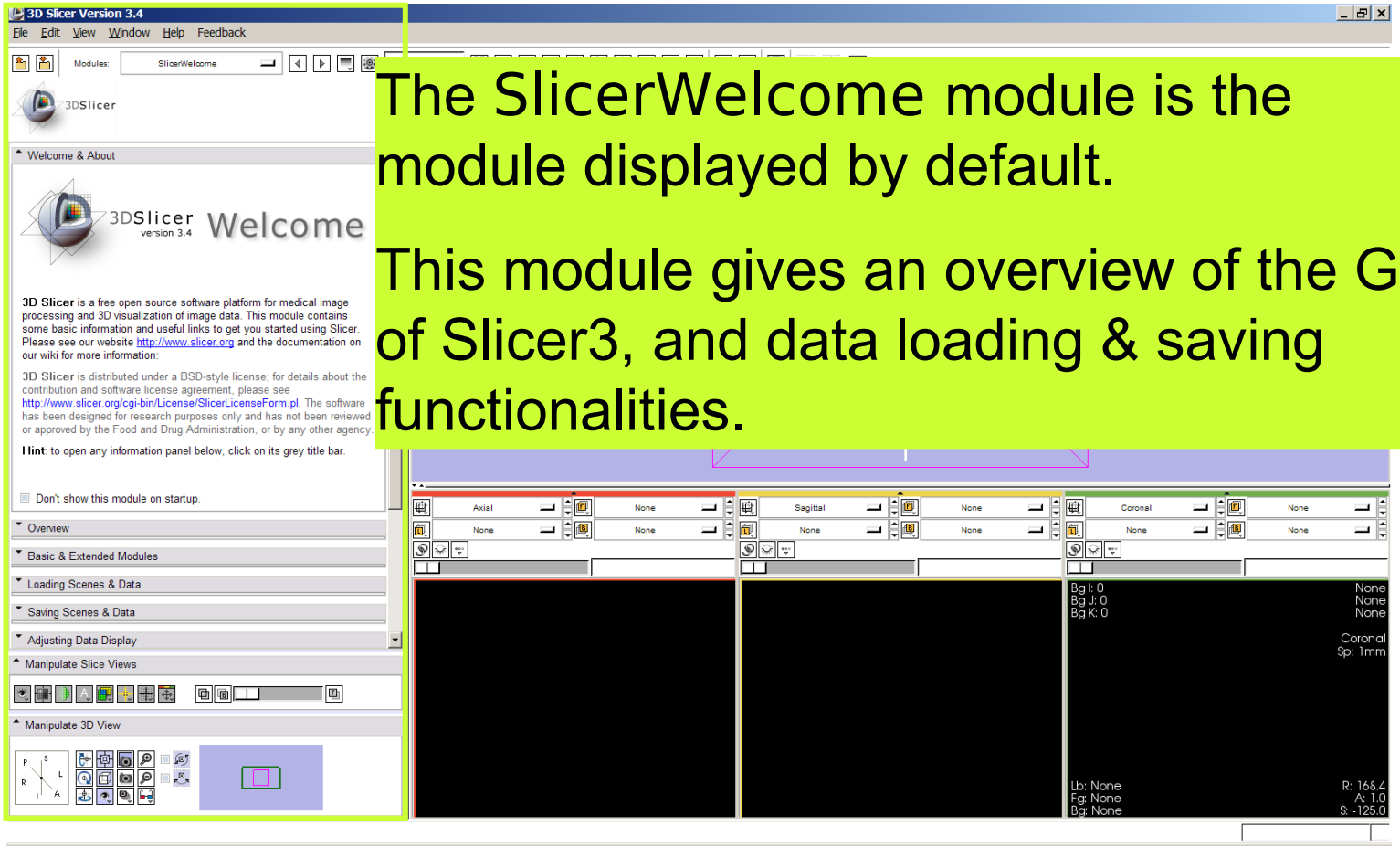


Windows users

Select

Start → All Programs→ Slicer3-3.6-2010-08-05→Slicer3

Slicer Welcome



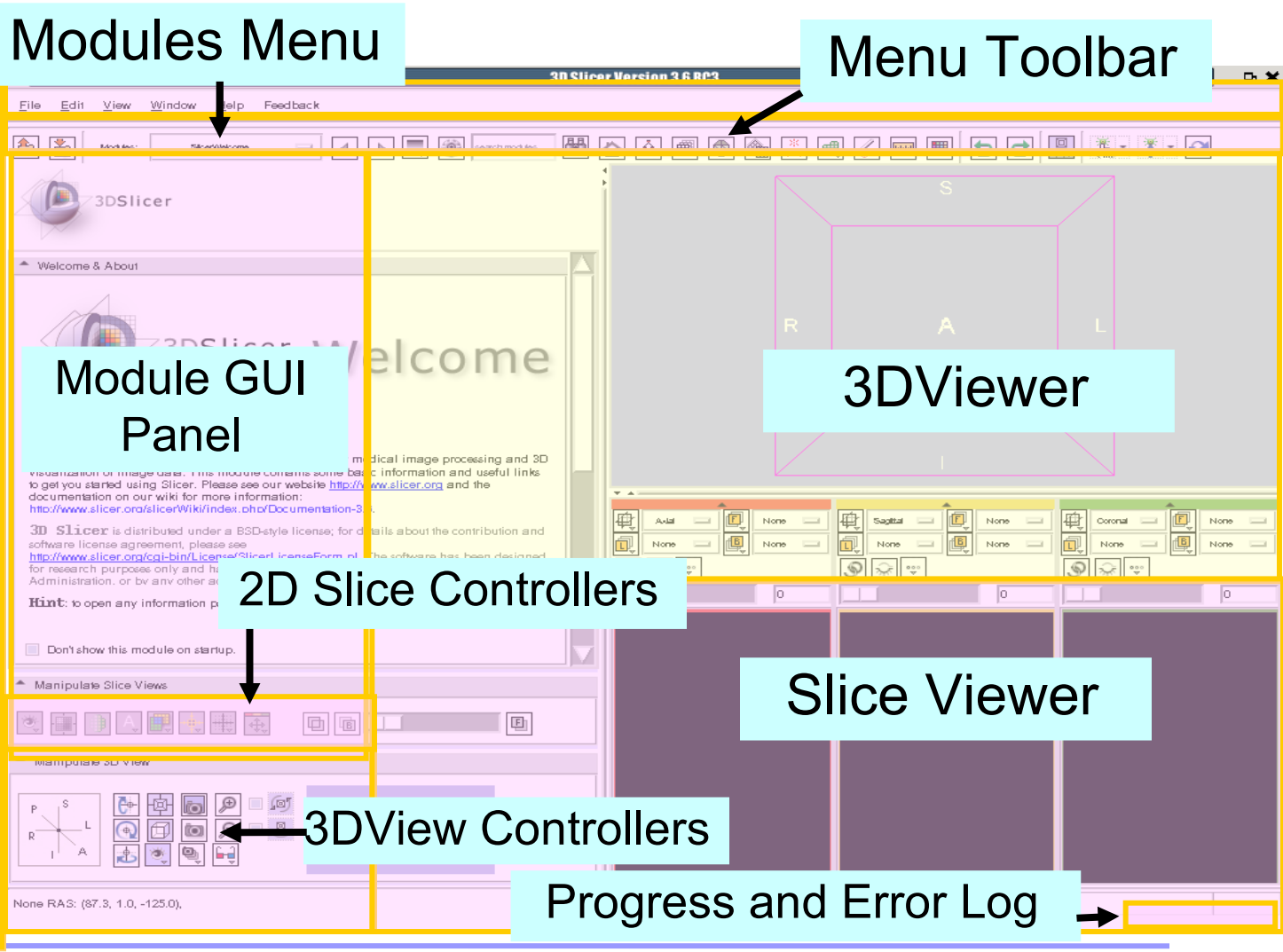
The SlicerWelcome module is the module displayed by default.

This module gives an overview of the GUI of Slicer3, and data loading & saving functionalities.

Slicer3 GUI

The Graphical User Interface (GUI) of Slicer3.6 integrates 8 main components:

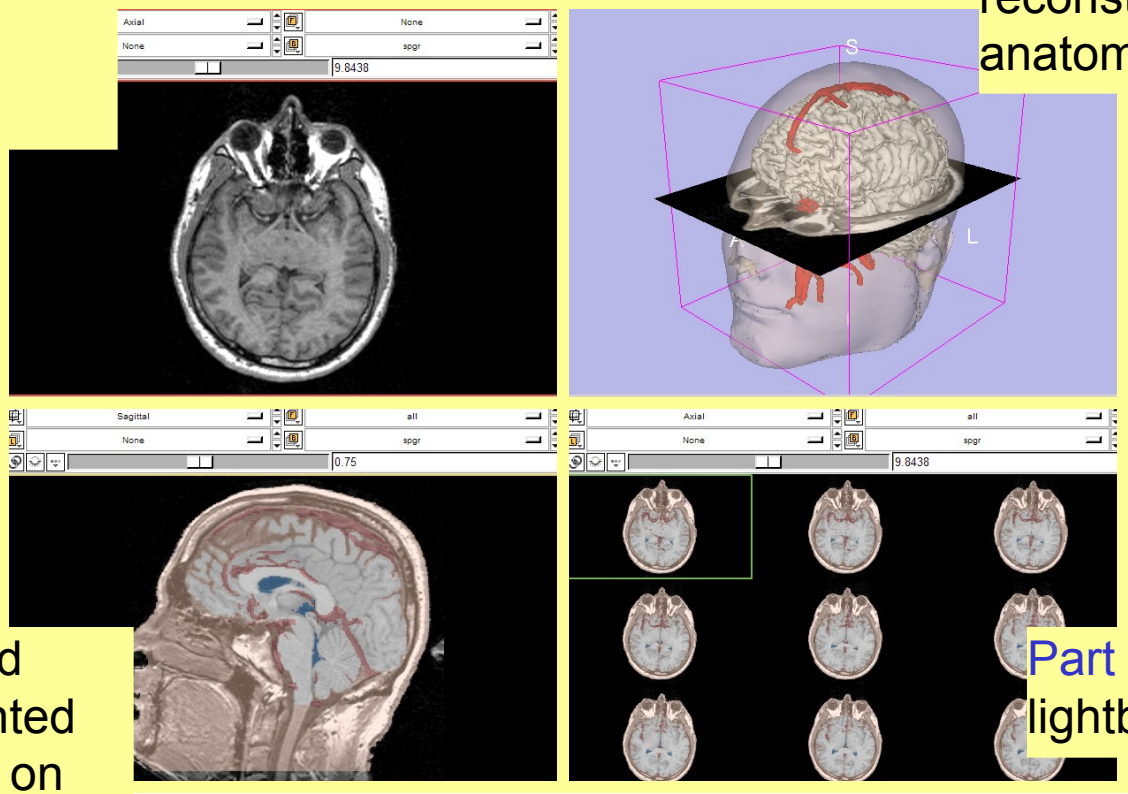
- the File Menu
- the Menu Toolbar
- the Module GUI Panel
- the 3D Viewer
- the Slice Viewer
- the Slice Controller
- the 3D View Controller



Overview

Part 1. Loading and visualizing multiple volumes simultaneously

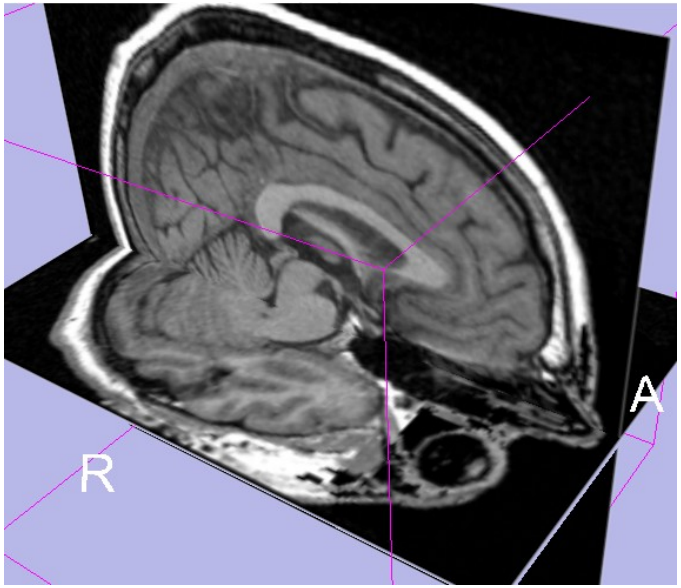
Part 3. Visualizing 3D reconstructions of anatomical surfaces



Part 2. Loading and visualizing segmented structures overlaid on grayscale images

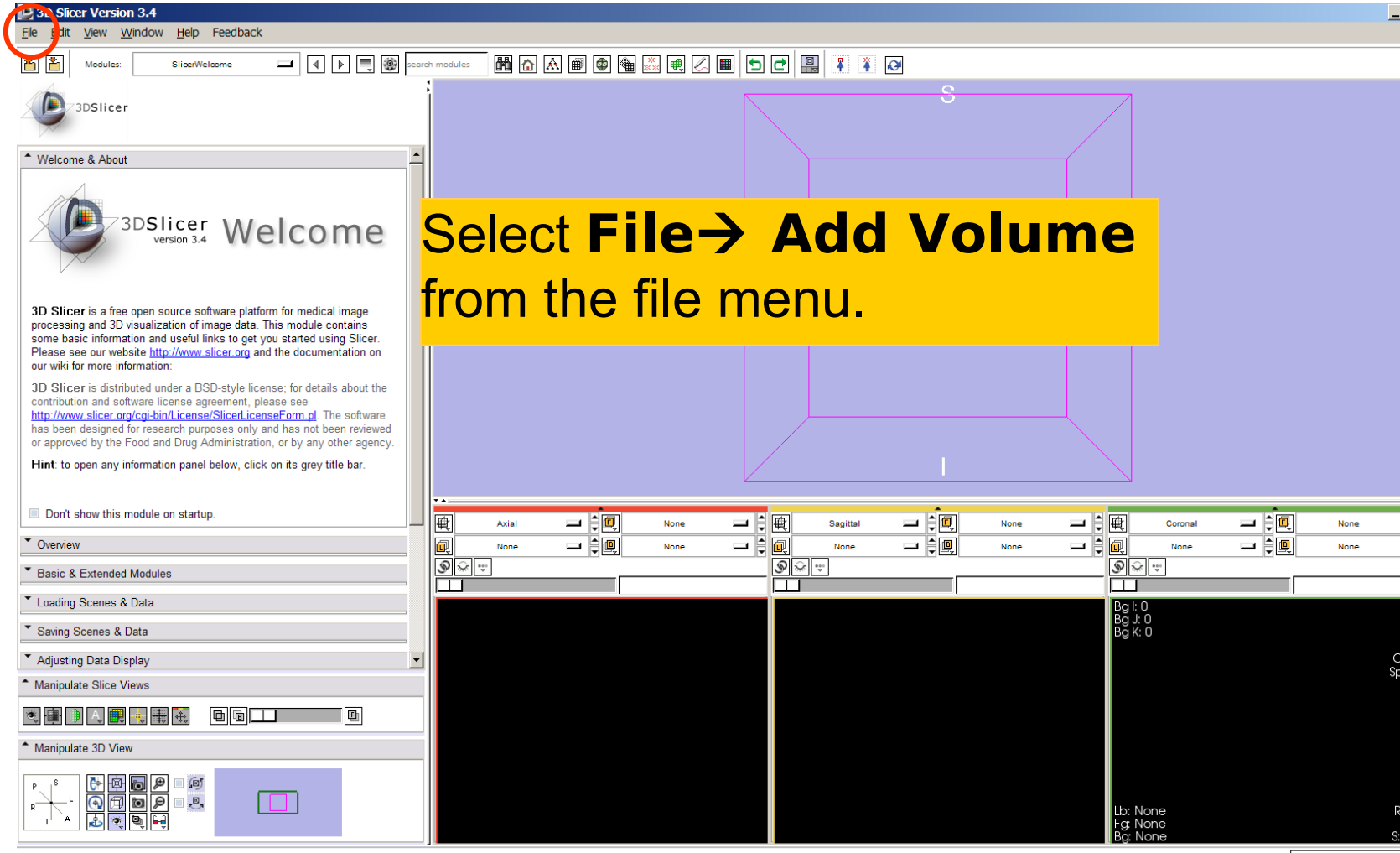
Part 4. The lightbox viewer

Part 5. Saving data



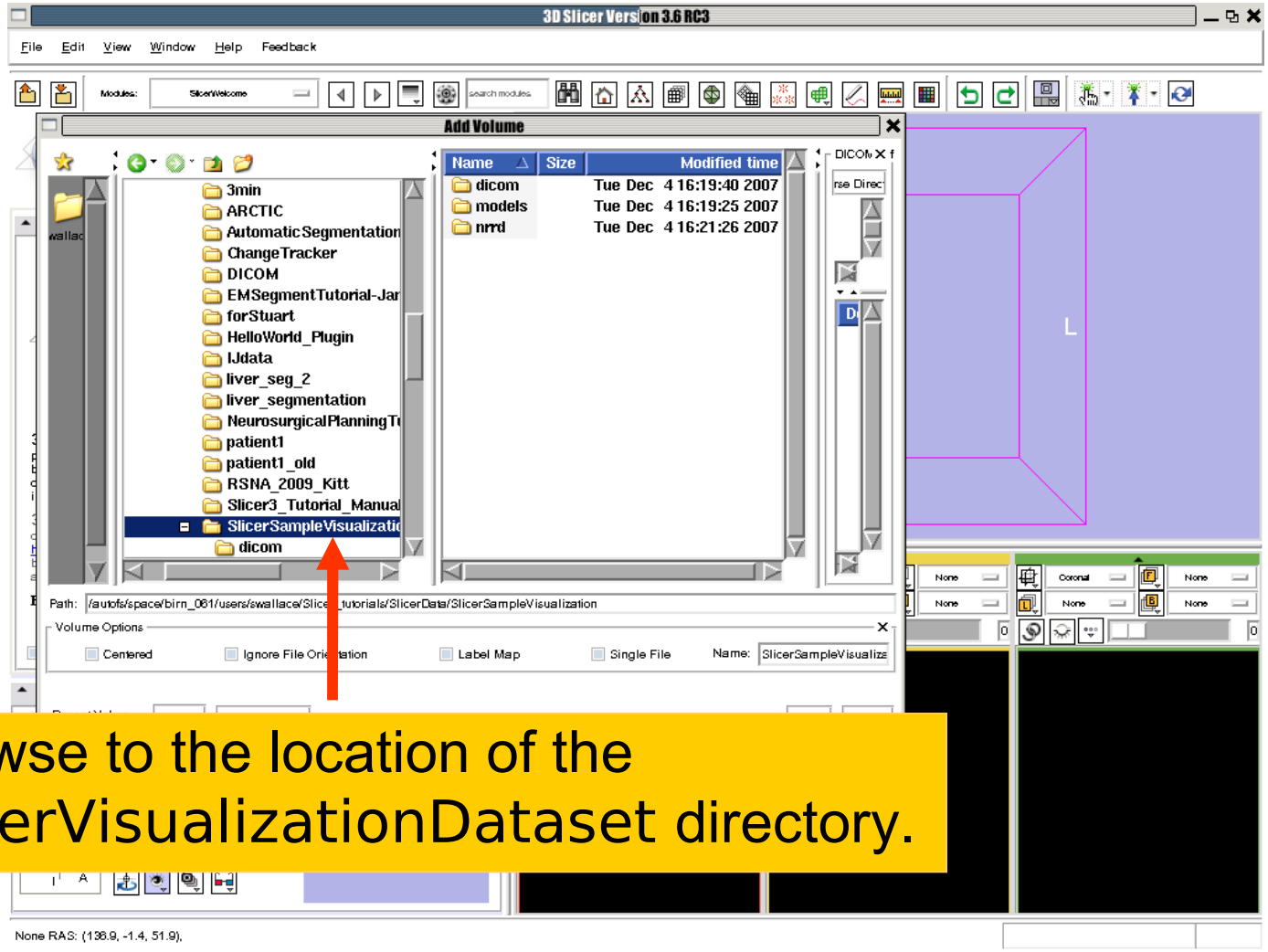
Part 1: Loading and visualizing multiple volumes simultaneously

Loading Volumes



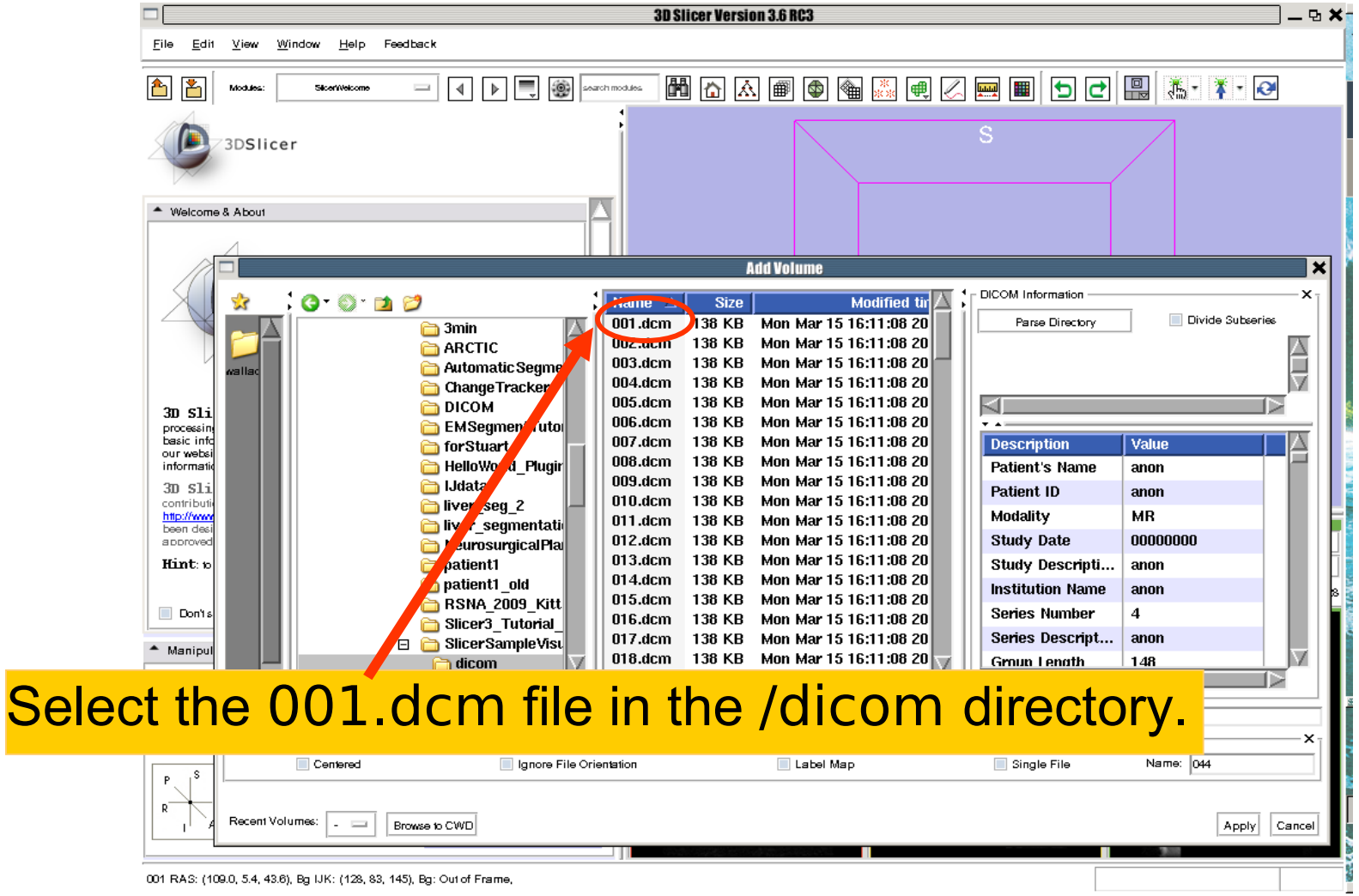
Select **File→ Add Volume** from the file menu.

Loading Volumes



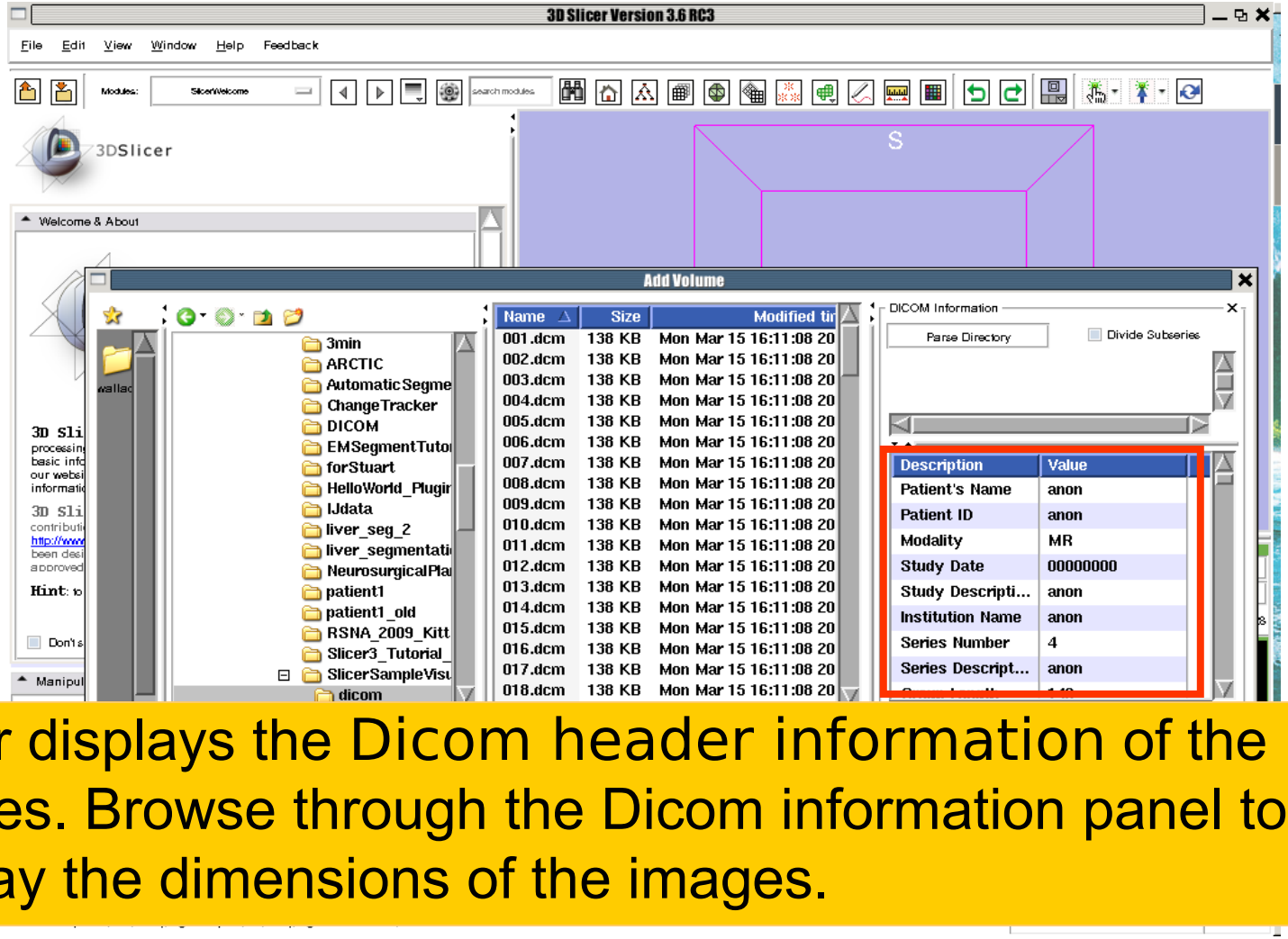
Browse to the location of the SlicerVisualizationDataset directory.

Loading Volumes



Select the 001.dcm file in the /dicom directory.

Loading Volumes



Slicer displays the Dicom header information of the images. Browse through the Dicom information panel to display the dimensions of the images.

Loading Volumes

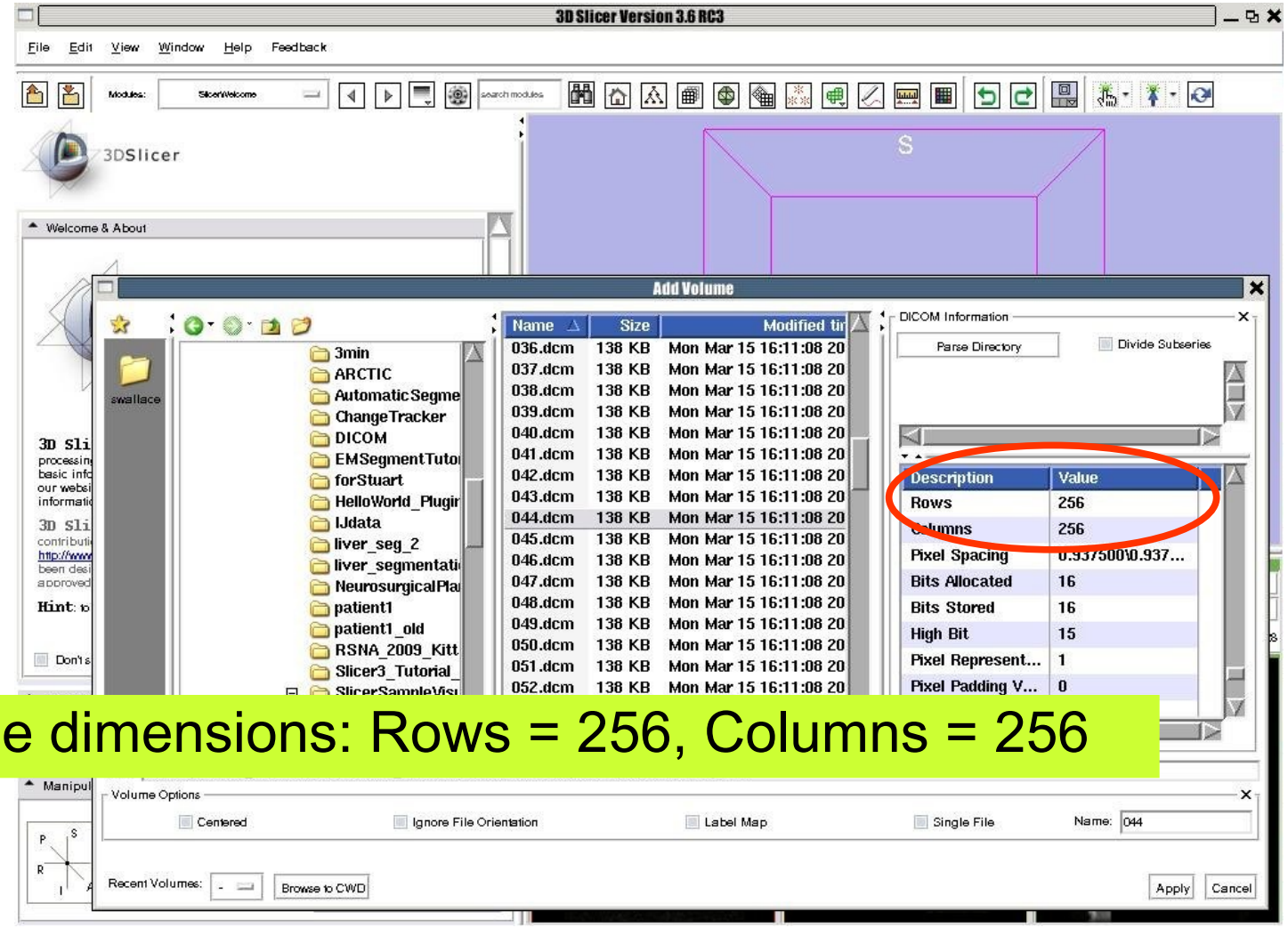
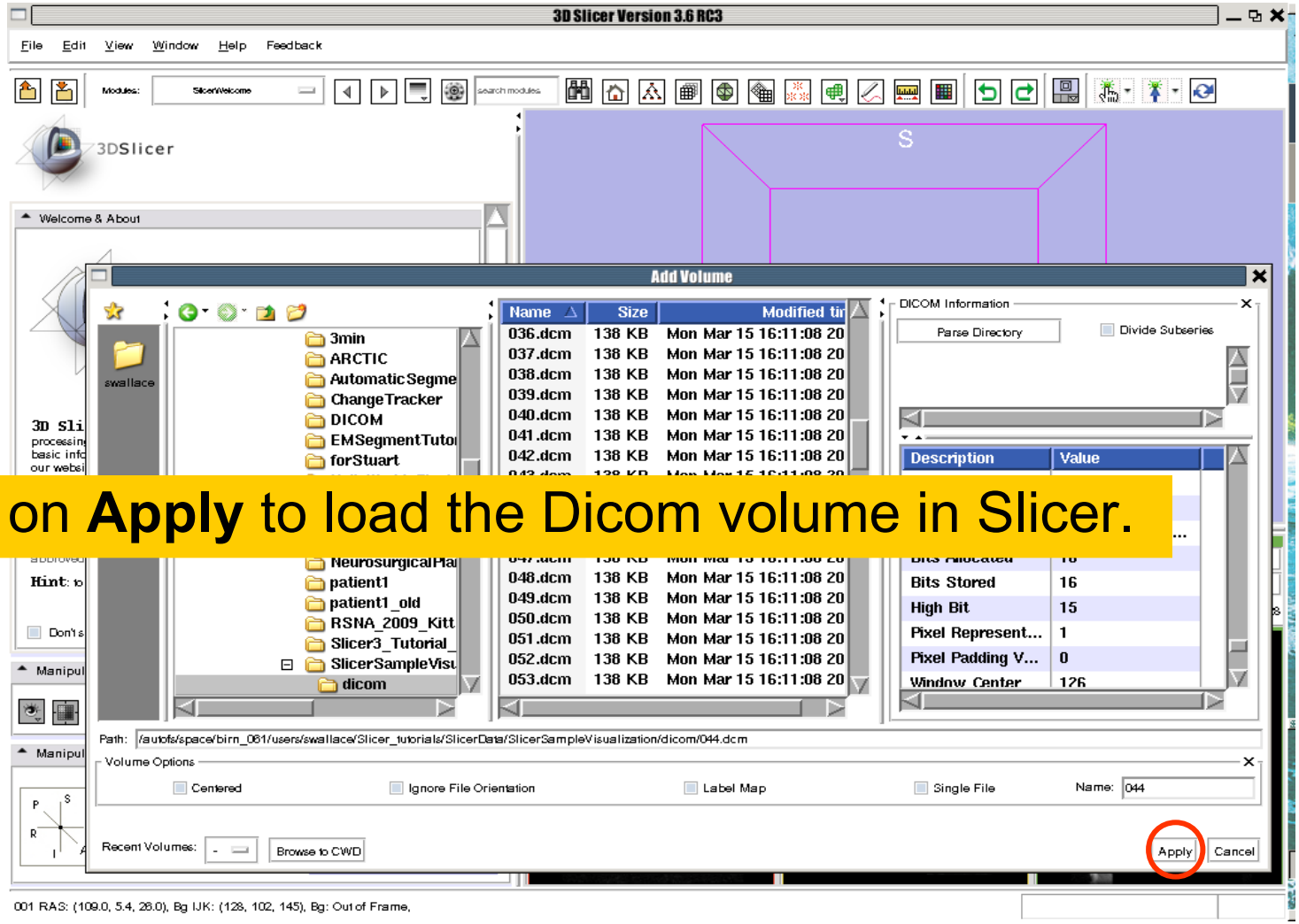


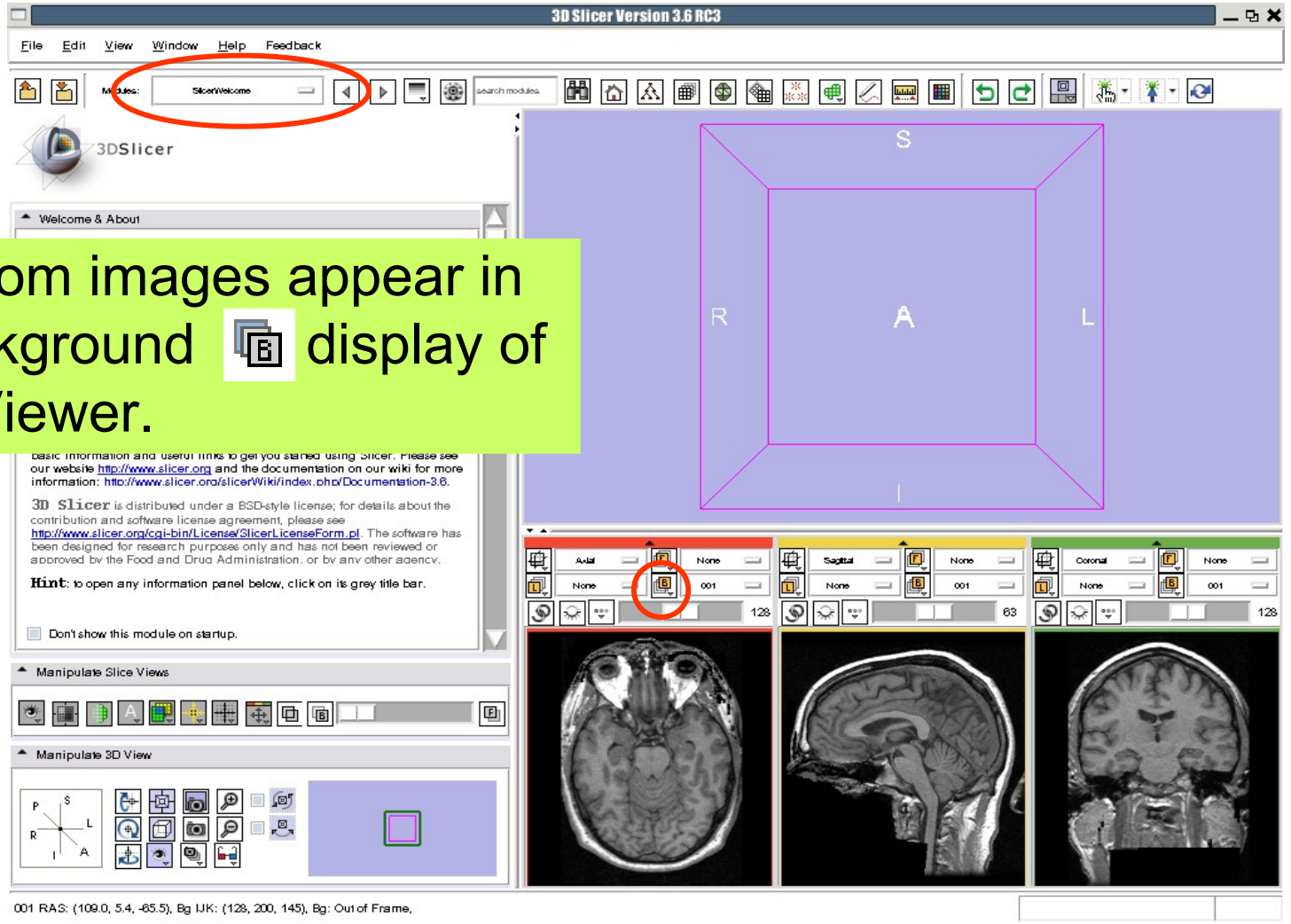
Image dimensions: Rows = 256, Columns = 256

Loading Volumes



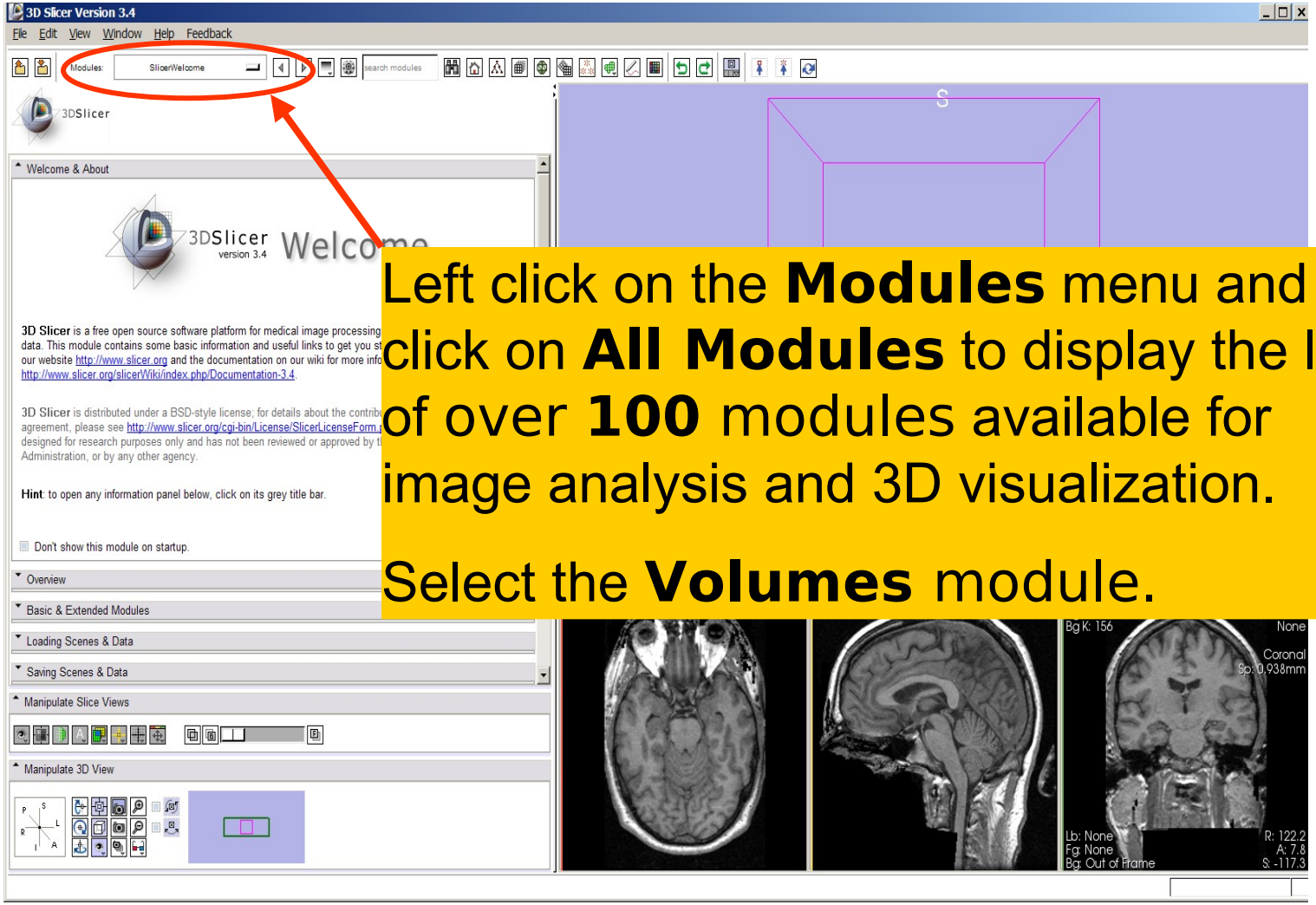
Click on **Apply** to load the Dicom volume in Slicer.

Loading Volumes



The Dicom images appear in the Background display of the 2DViewer.

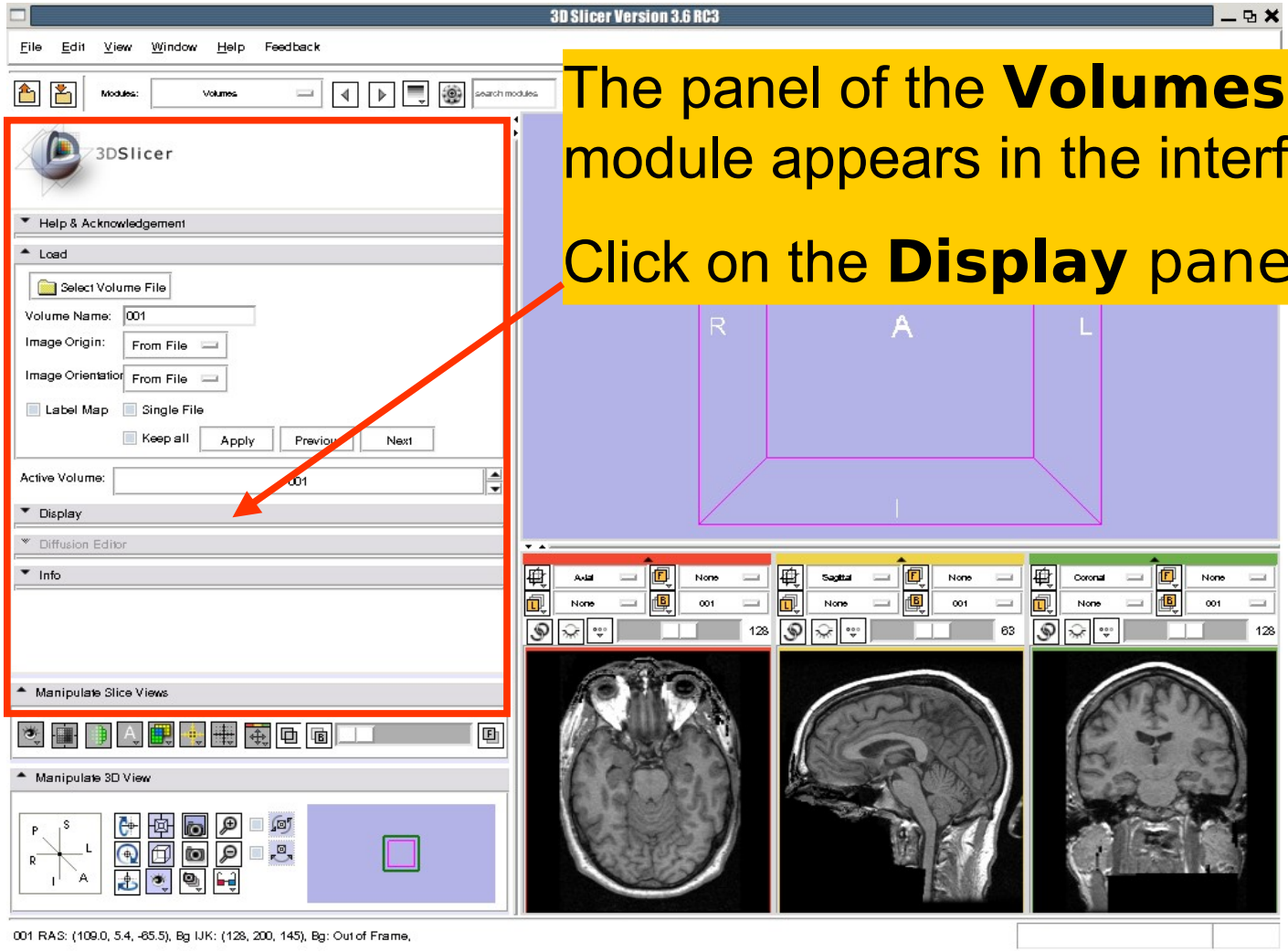
Loading Volumes



Left click on the **Modules** menu and click on **All Modules** to display the list of over **100** modules available for image analysis and 3D visualization.

Select the **Volumes** module.

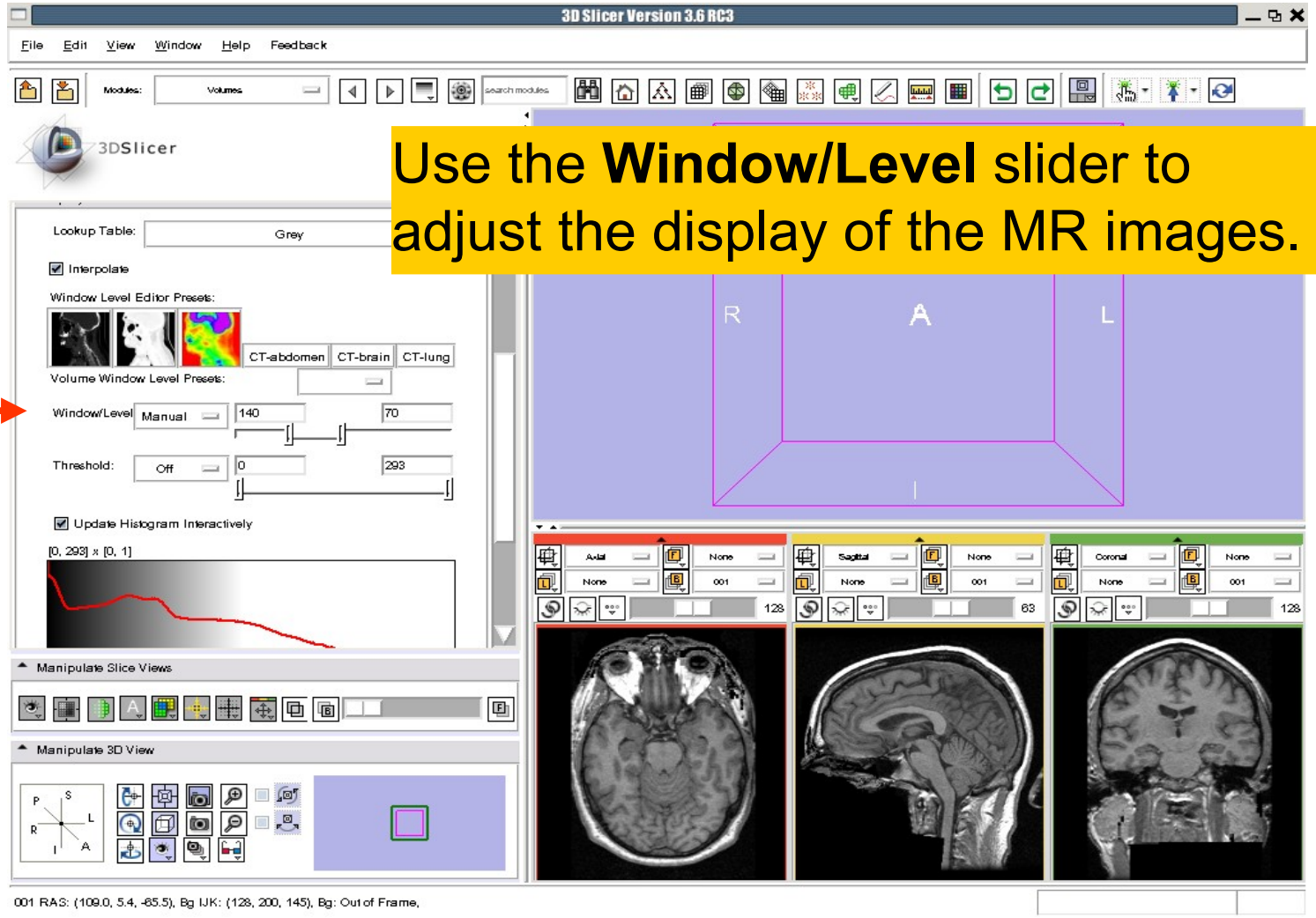
Loading Volumes



The panel of the **Volumes** module appears in the interface.

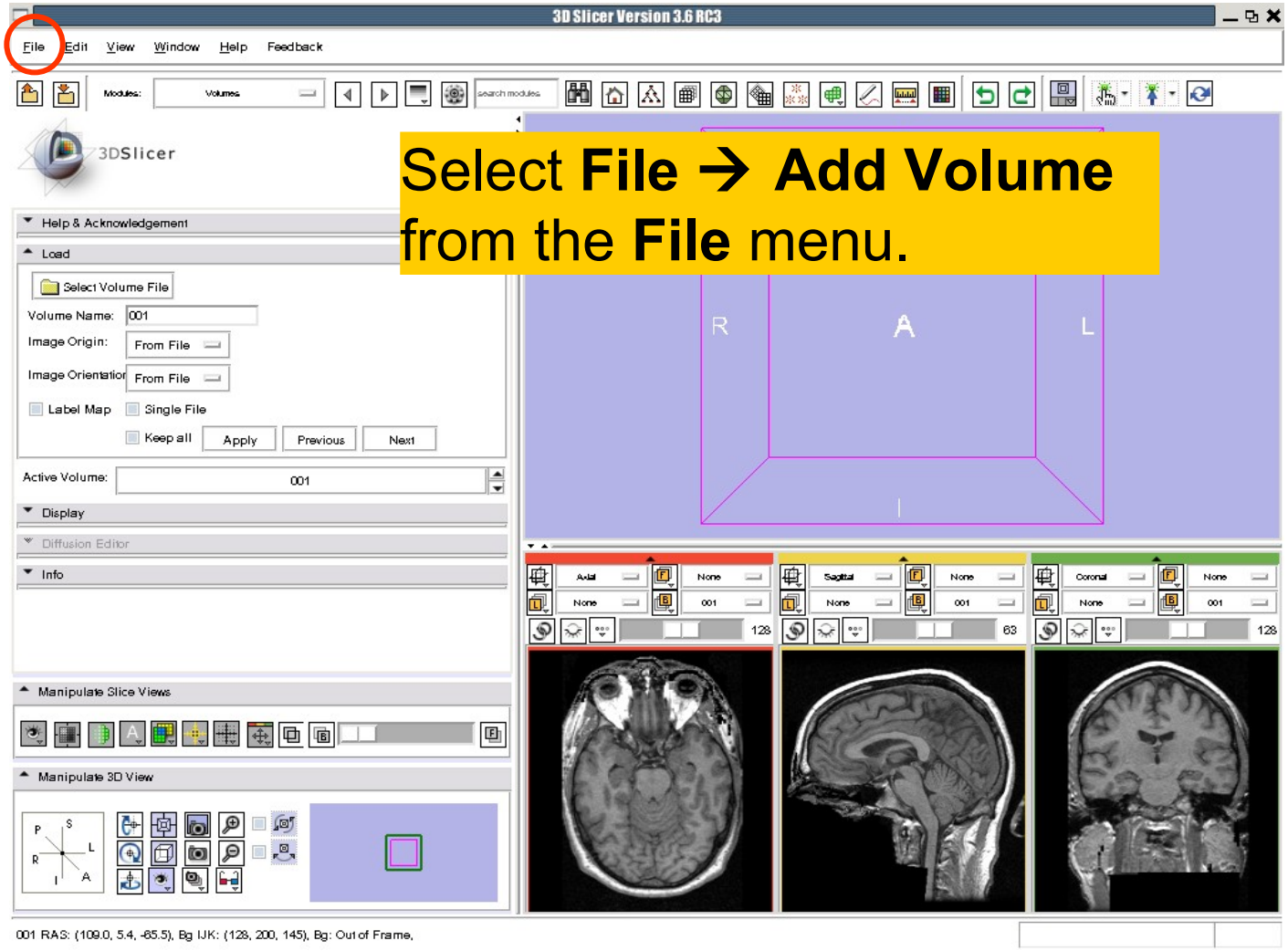
Click on the **Display** panel.

Loading Volumes



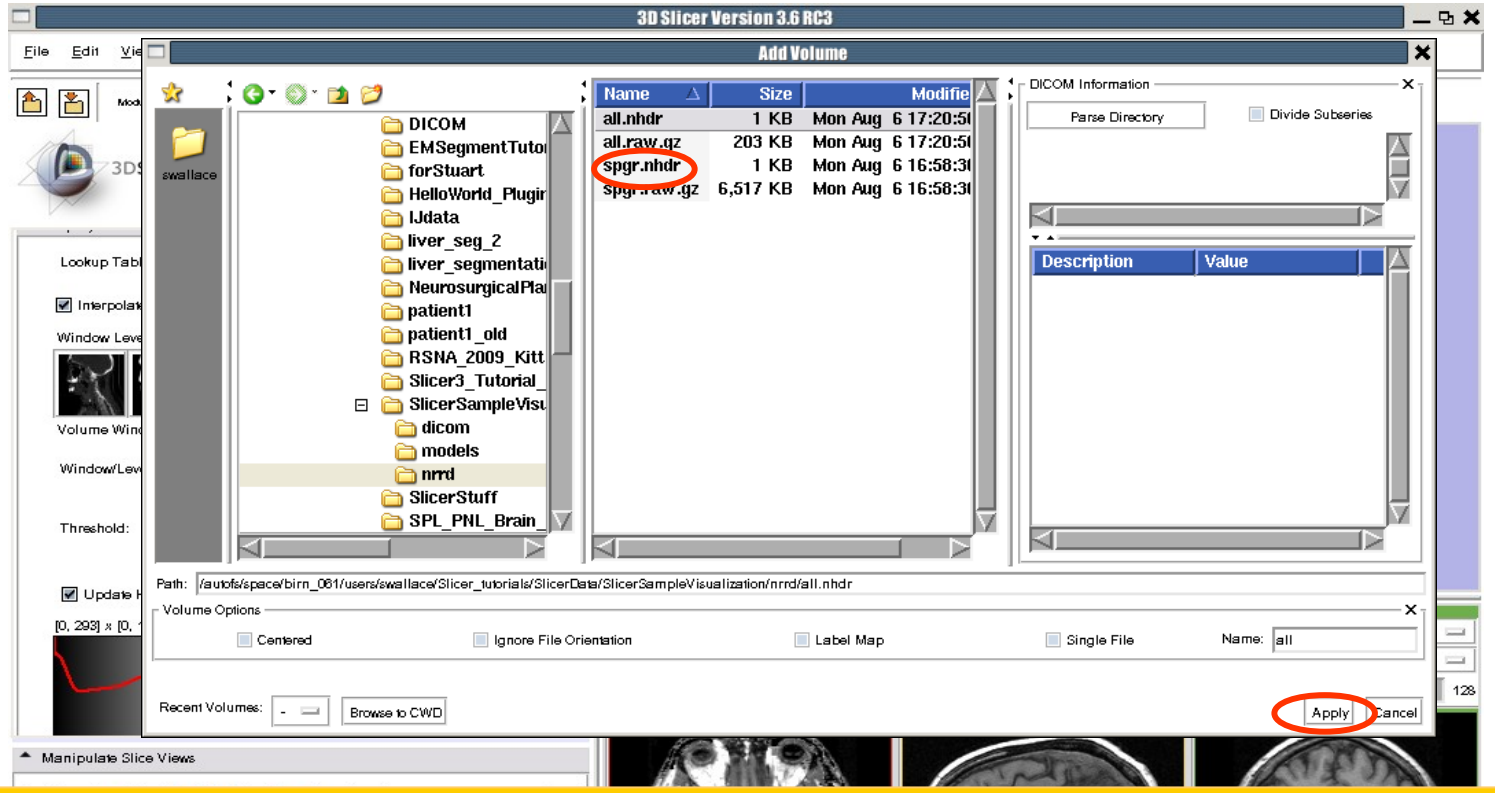
Use the **Window/Level** slider to adjust the display of the MR images.

Loading Volumes



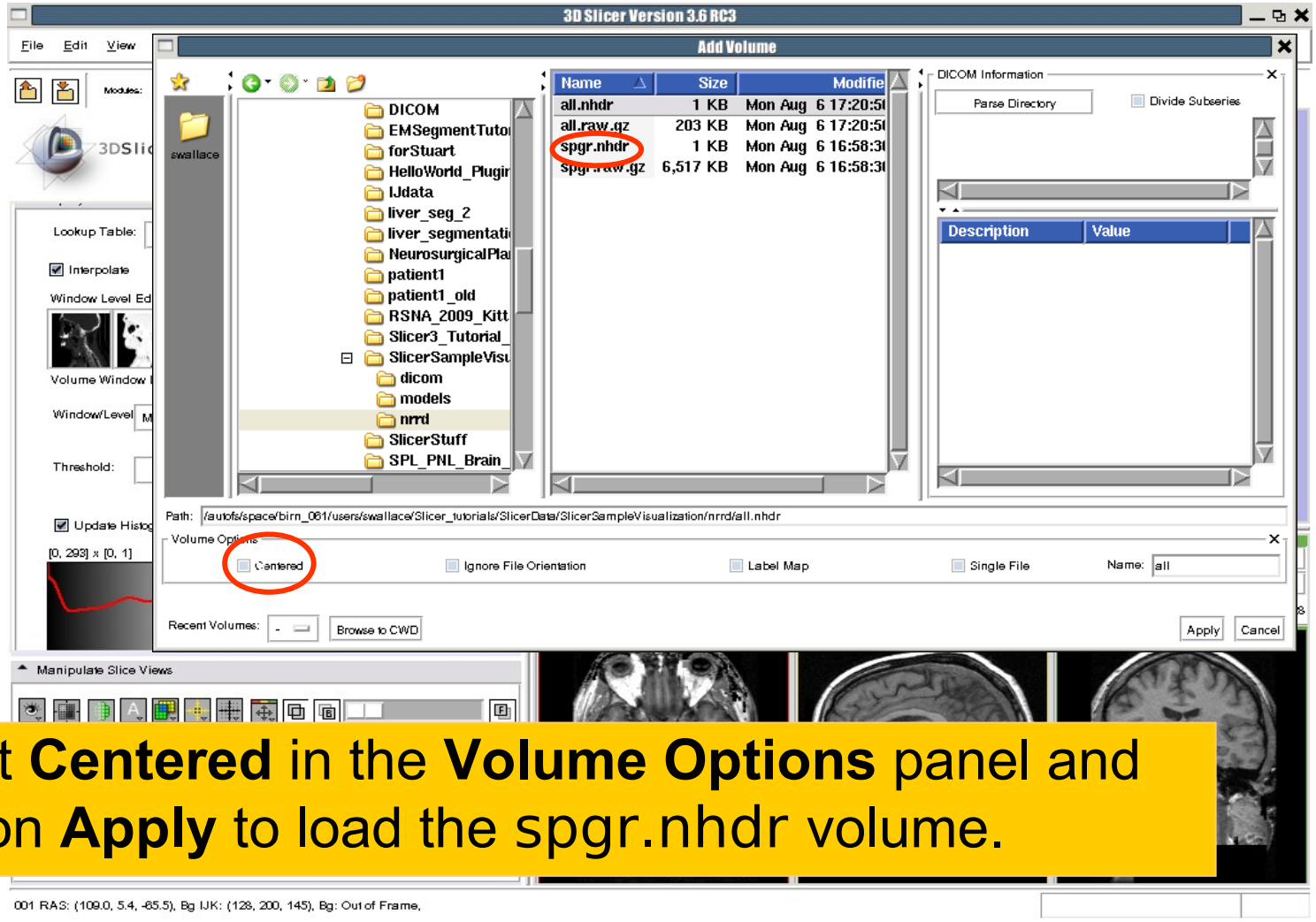
Select **File → Add Volume** from the **File** menu.

Loading Volumes



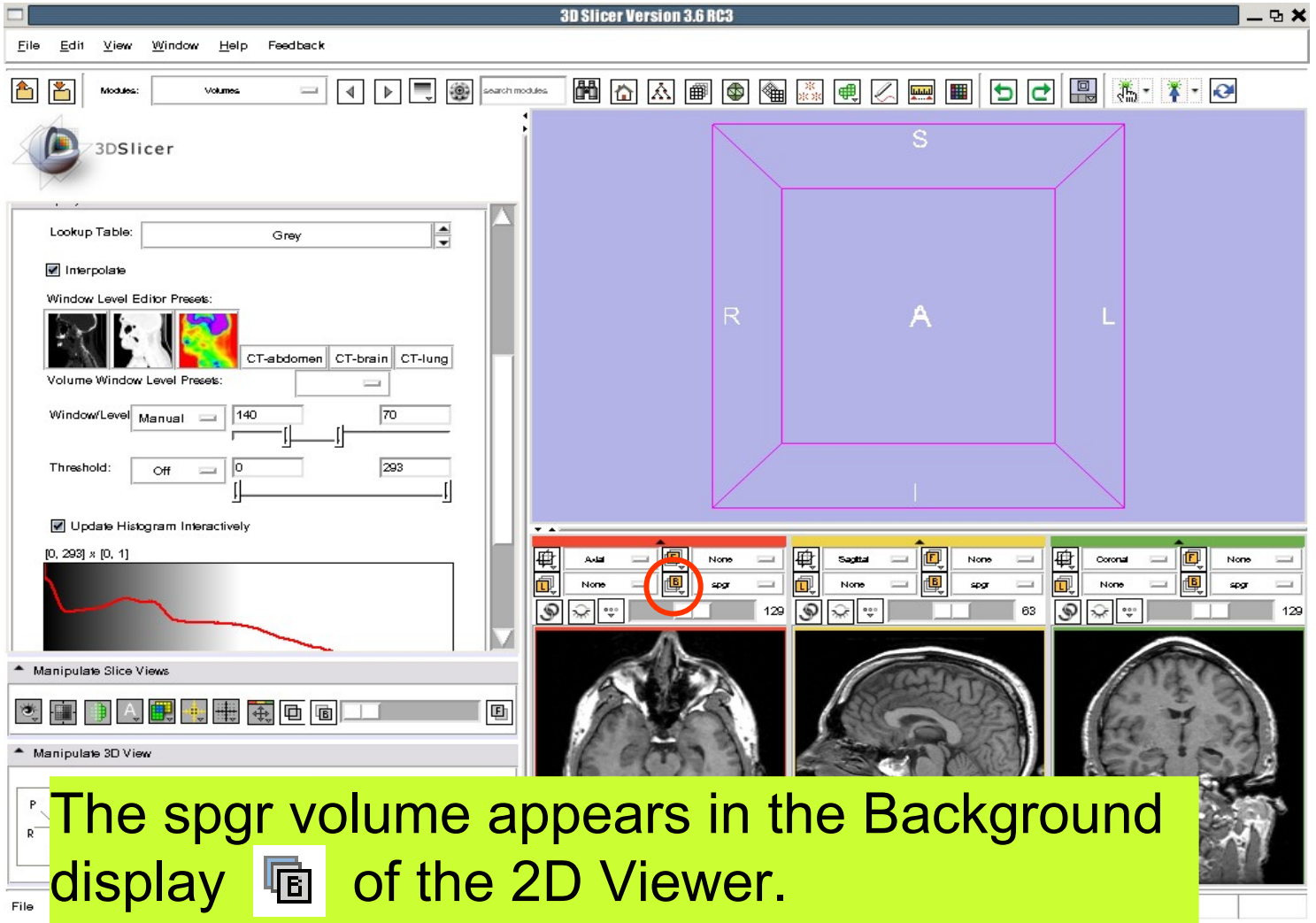
Browse to find the header file of the spgr volume (spgr.nhdr) located in the SlicerSampleVisualization/nrrd directory and click on **Apply**.

Loading Volumes



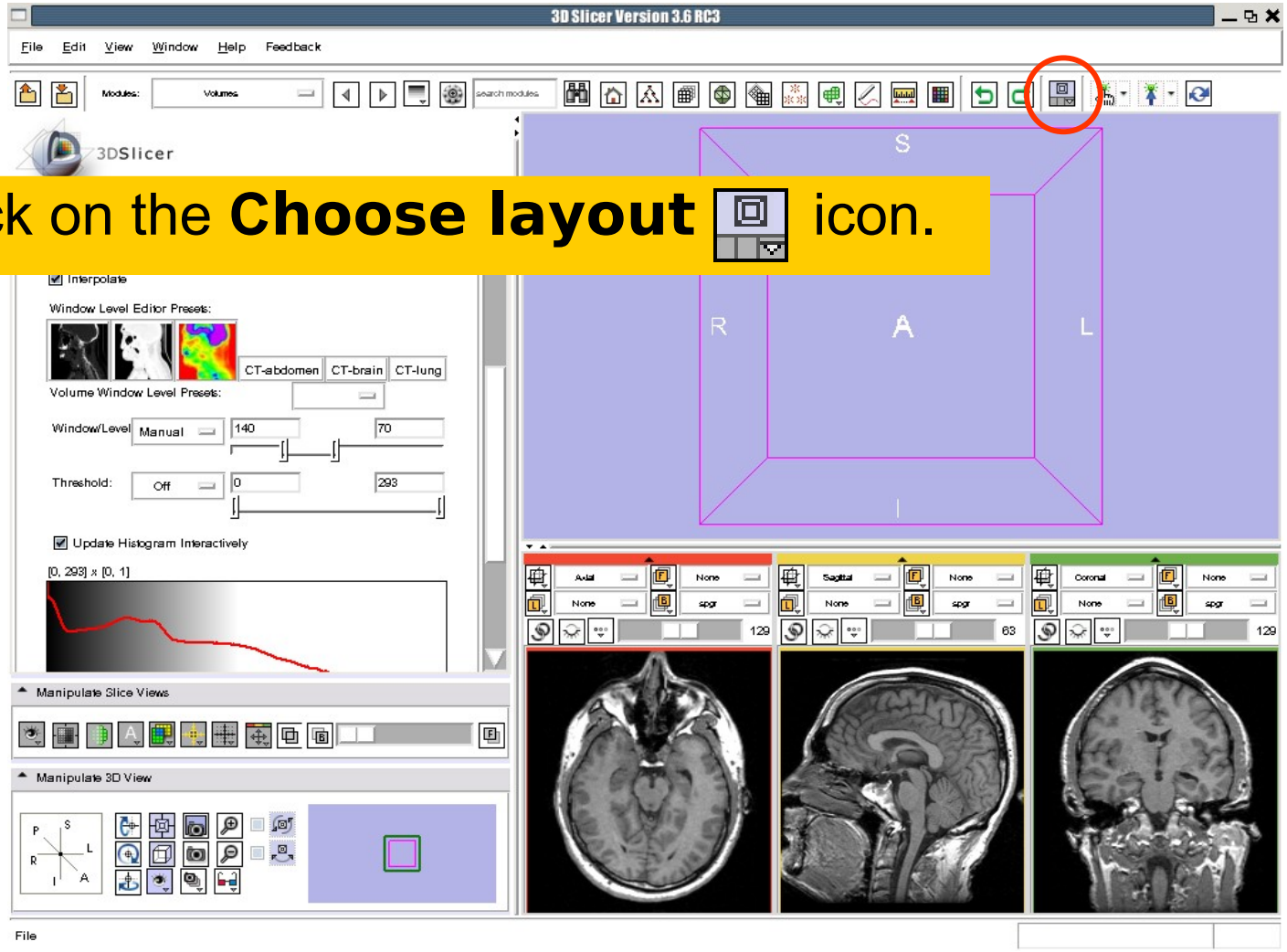
Select **Centered** in the **Volume Options** panel and click on **Apply** to load the spgr.nhdr volume.

Loading Volumes

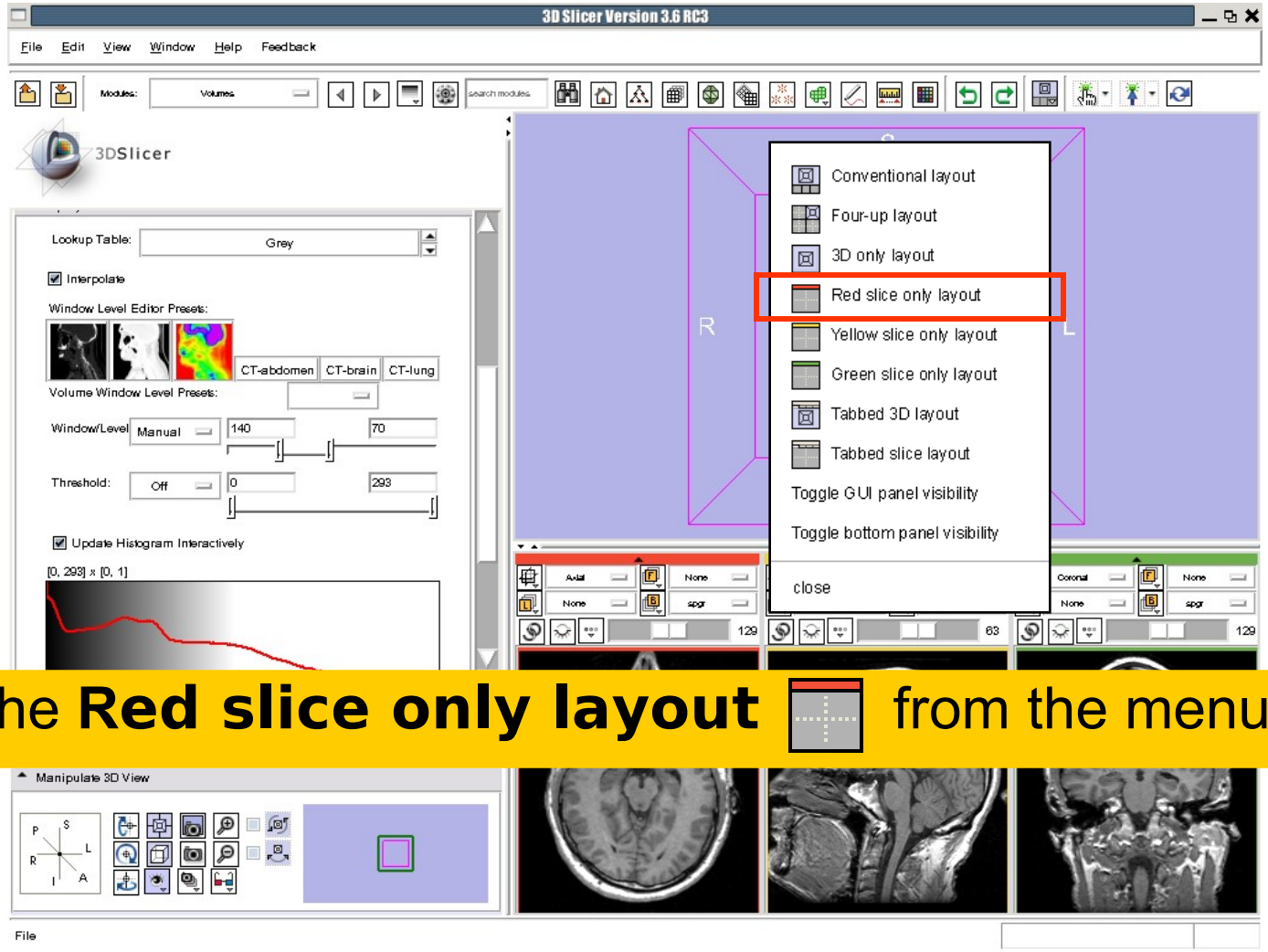


The spgr volume appears in the Background display of the 2D Viewer.

Exploring the data



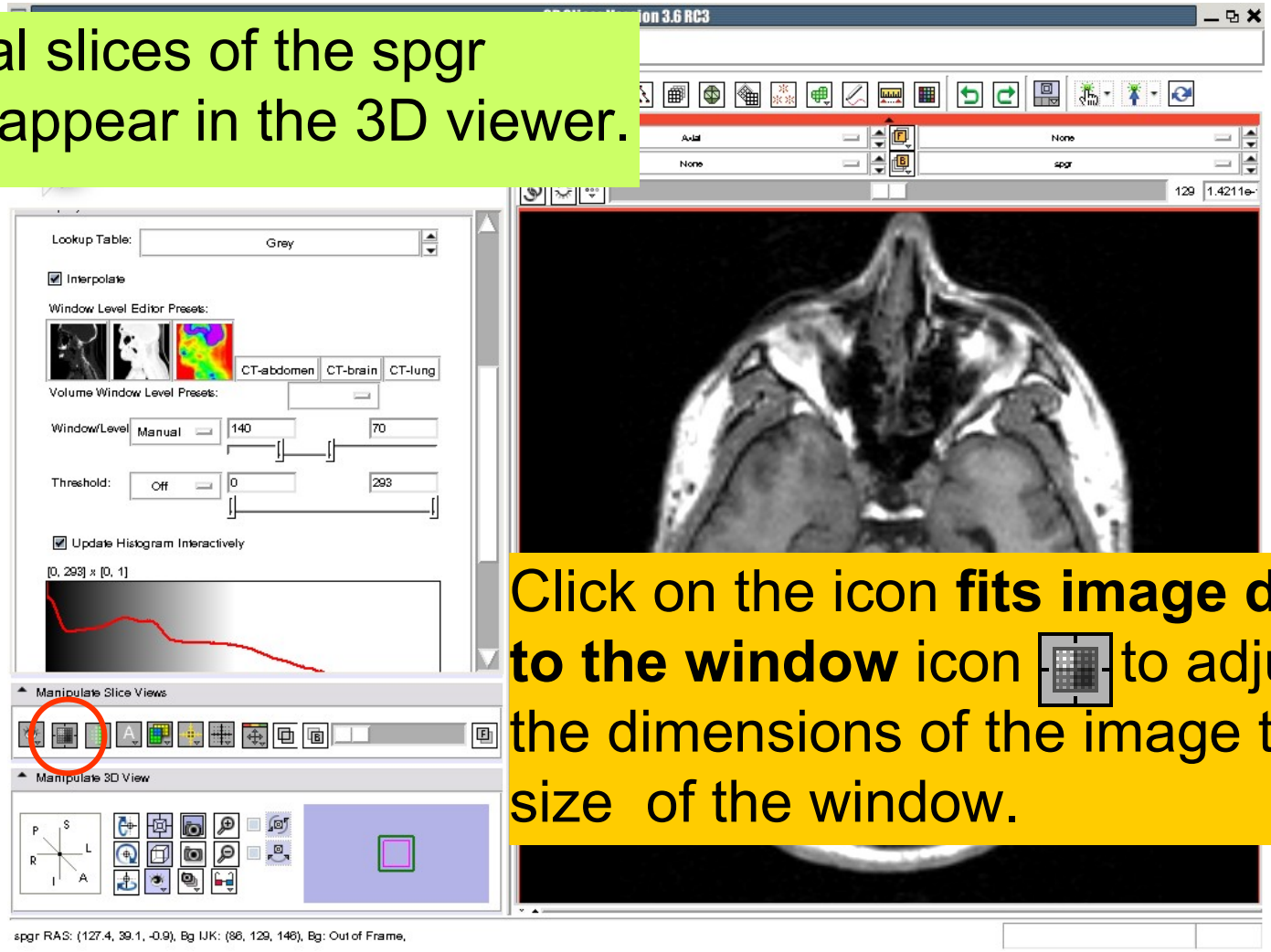
Exploring the data



Select the **Red slice only layout** from the menu.

Exploring the data

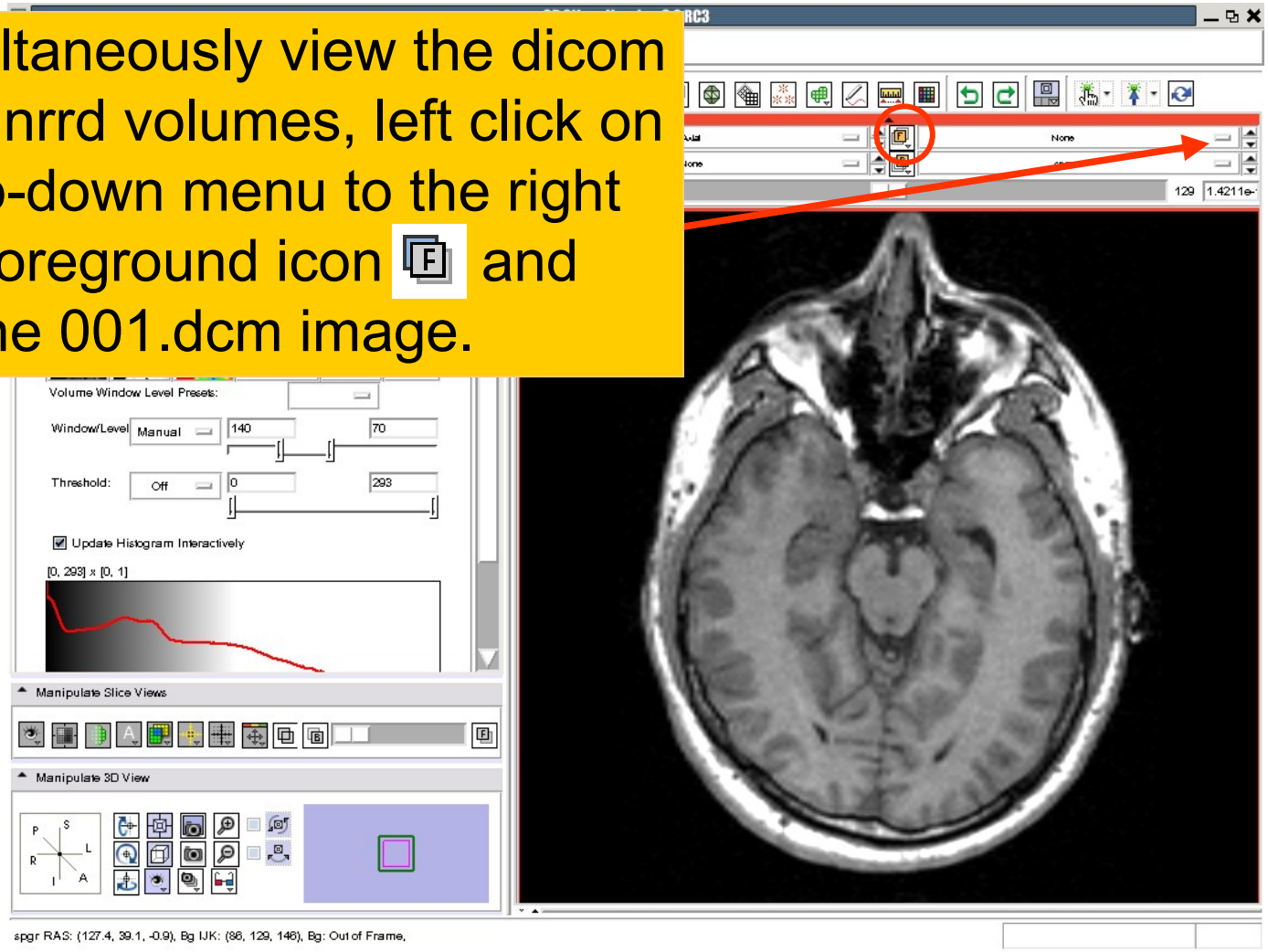
The axial slices of the spgr volume appear in the 3D viewer.



Click on the icon **fits image data to the window** icon to adjust the dimensions of the image to the size of the window.

Exploring the data

To simultaneously view the dicom and the nrrd volumes, left click on the drop-down menu to the right of the Foreground icon and select the 001.dcm image.

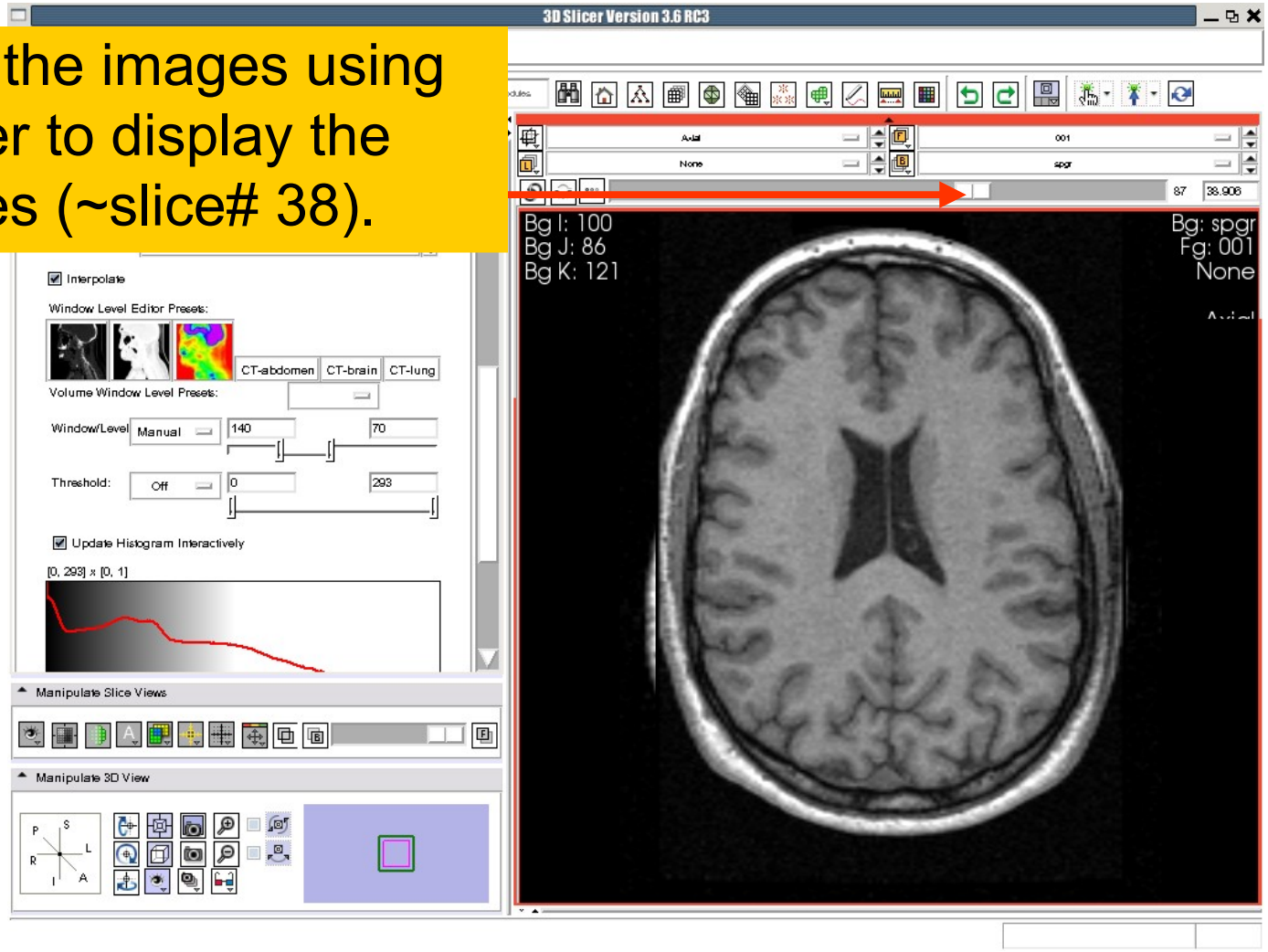


Exploring the data

Click on the Background  or on the Foreground  icon to display the spgr or the DICOM volumes in the Viewer.

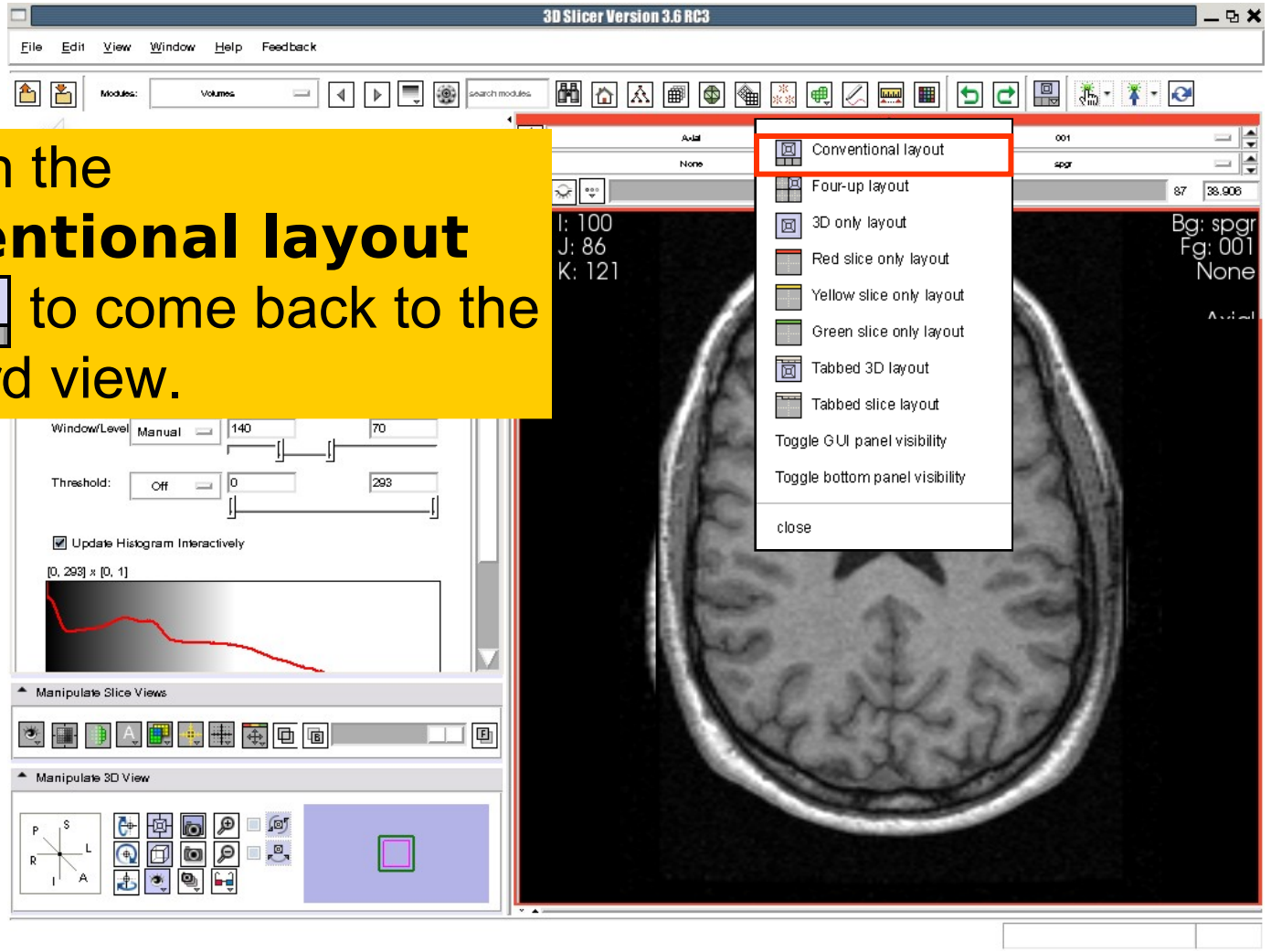
Exploring the data

Browse the images using the slider to display the ventricles (~slice# 38).



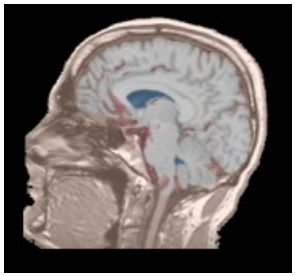
Exploring the data

Click on the **Conventional layout** icon  to come back to the standard view.



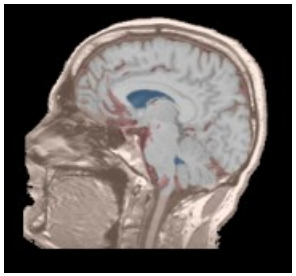
Loading Volumes

Click on the **fits image data to the window**  icon to adjust the dimensions of the image to the size of the window.



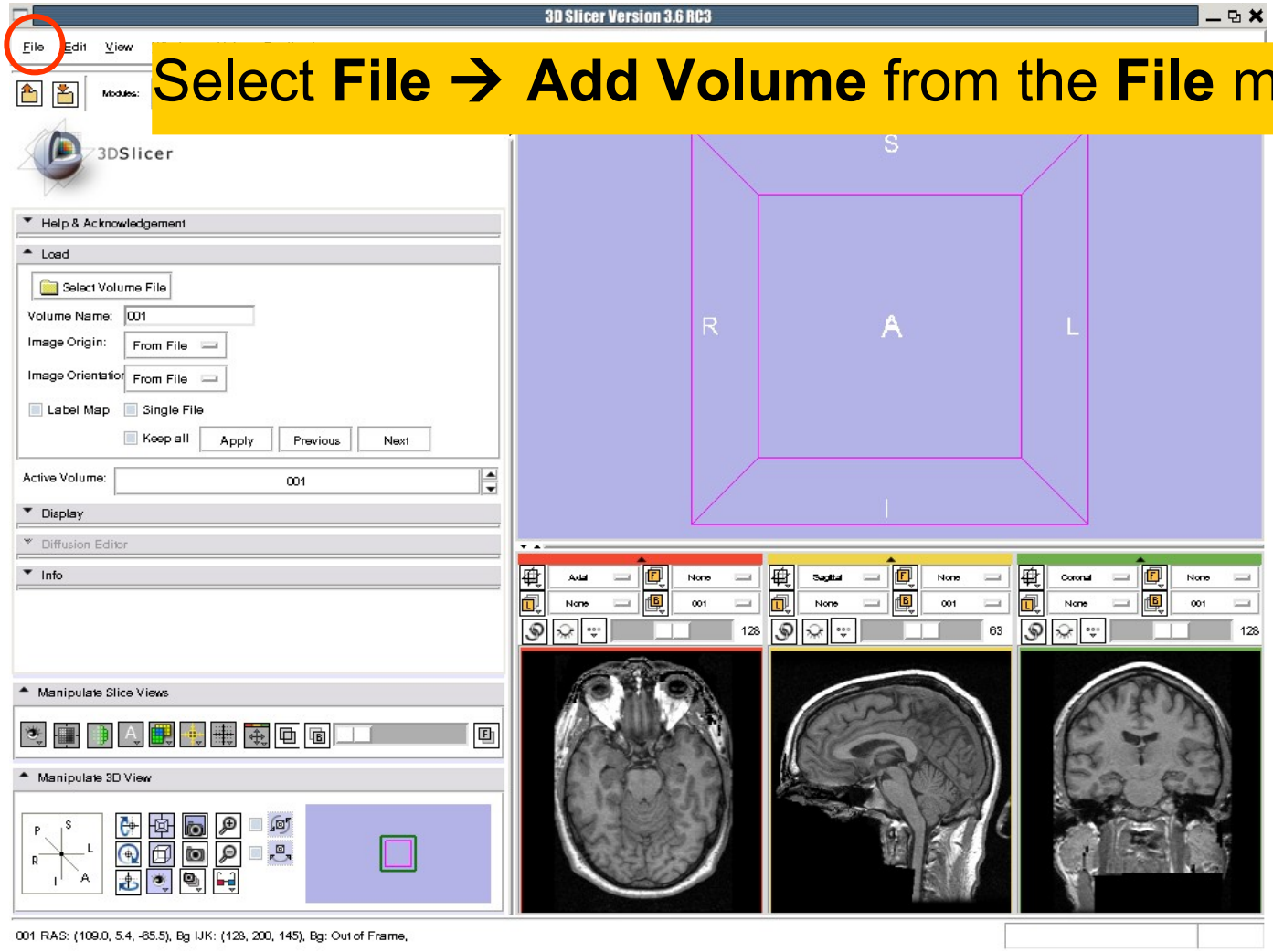
Part 2: Loading and visualizing segmented structures overlaid on grayscale images

Label map



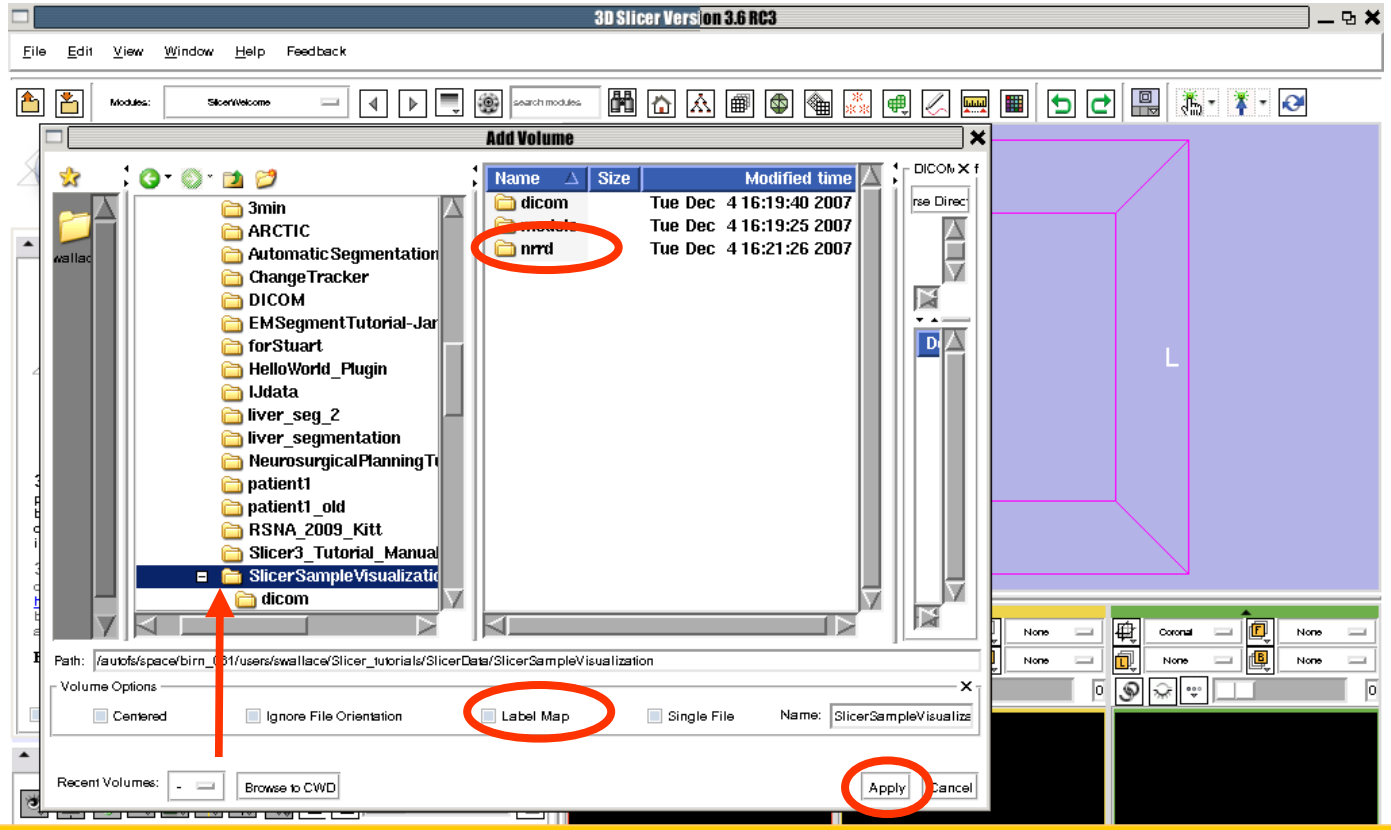
- Image segmentation is the extraction of structural information of particular interest from surrounding image.
- Each pixel is assigned a specific label value which corresponds to the anatomical structure that it belongs to.
- The three-dimensional result of the segmentation is a binary array called label map.

Loading a label map



Select **File → Add Volume** from the **File** menu

Loading a label map



Browse to find the header file (all.nhdr) of the label map dataset located in the SlicerSampleVisualization/nrrd directory set **Volume options** to **Label Map** and click on **Apply.**

Visualizing a label map

Slicer displays the **all.nhdr** label map in the Label layer 

Click on the **Links** icon. 

Visualizing Multiple Volumes

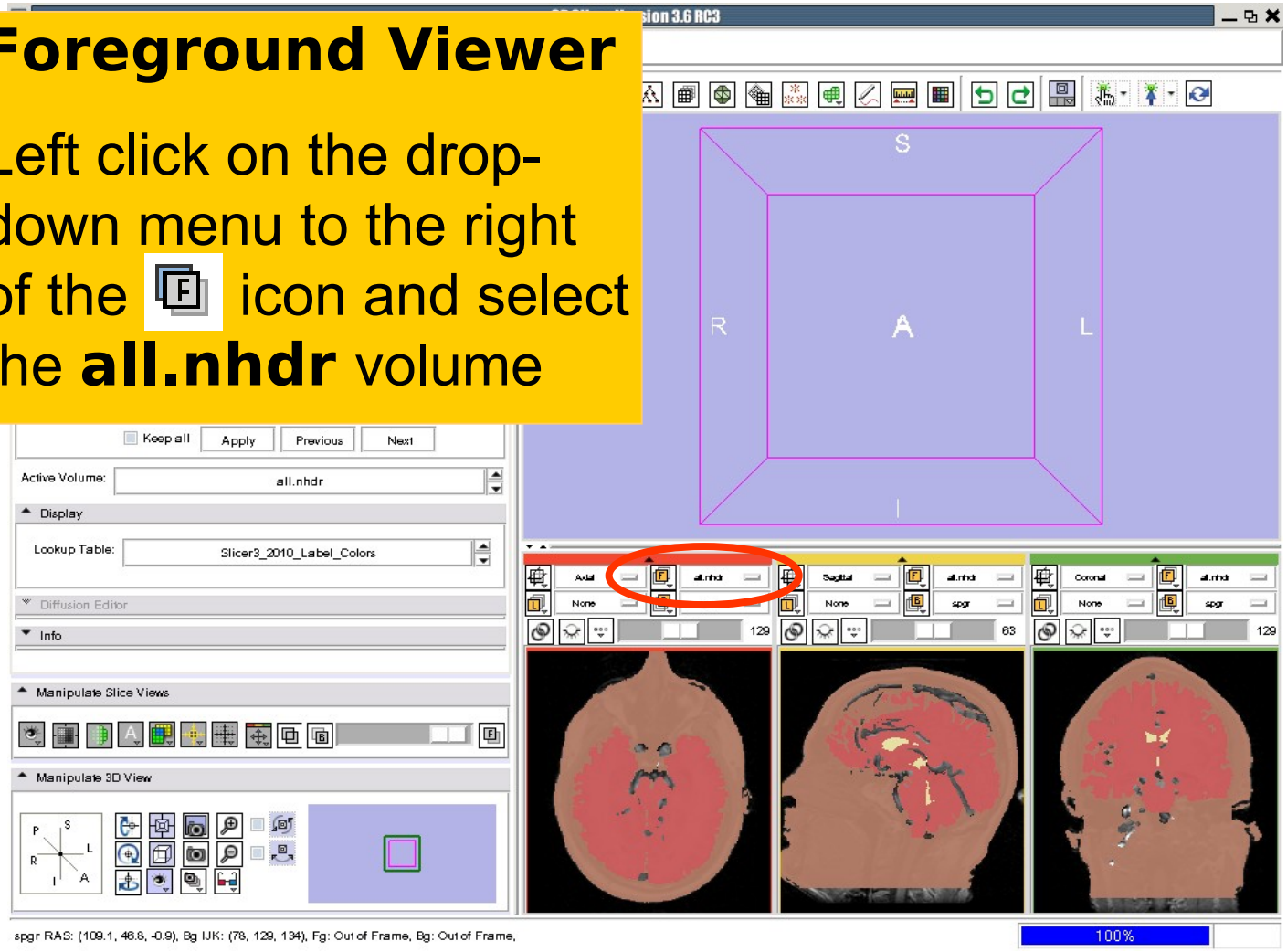
Label Viewer

Left click the drop-down menu to the right of the  icon and select **None**

Visualizing Multiple Volumes

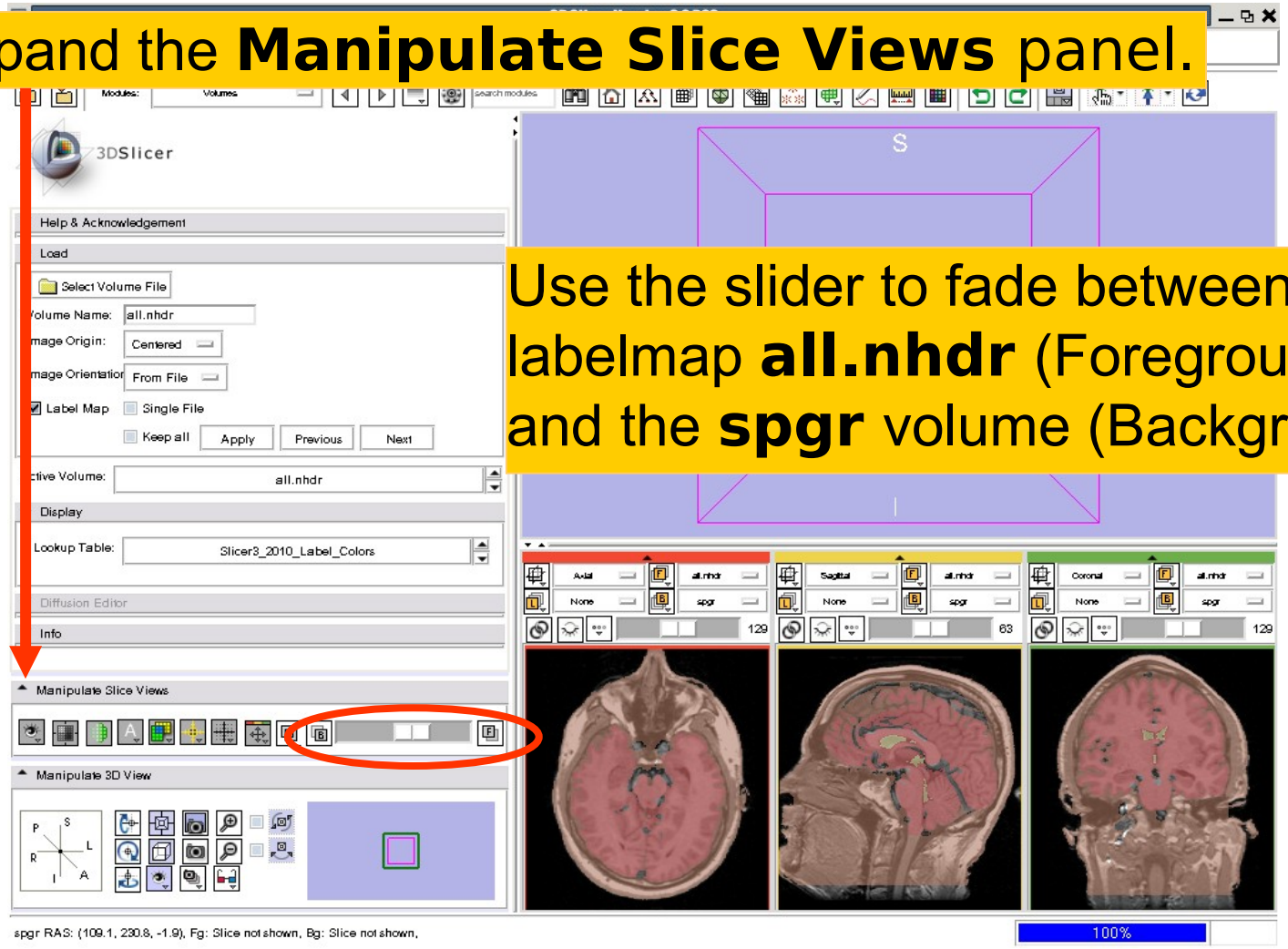
Foreground Viewer

Left click on the drop-down menu to the right of the F icon and select the **all.nhdr** volume



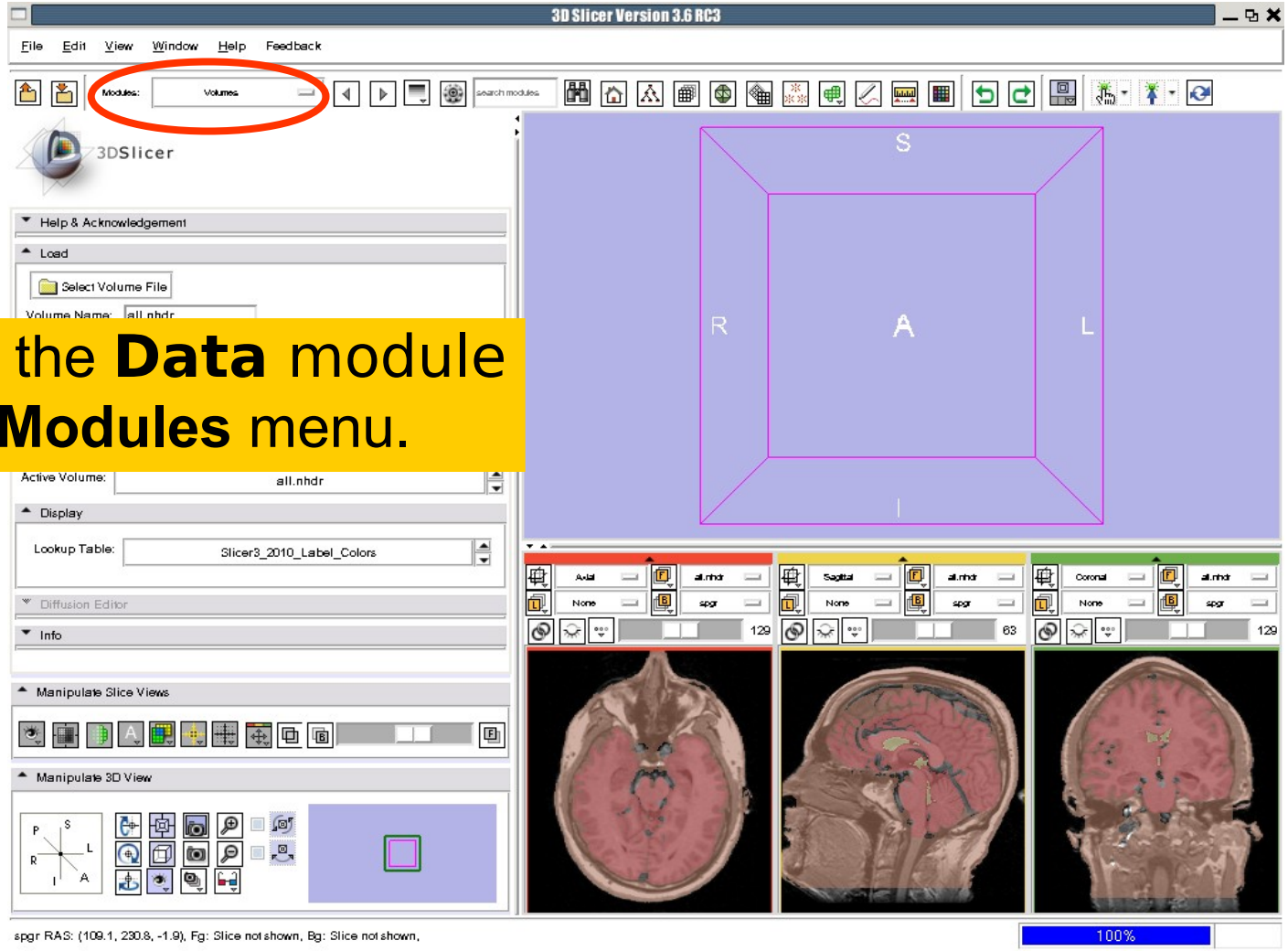
Visualizing Multiple Volumes

Expand the **Manipulate Slice Views** panel.



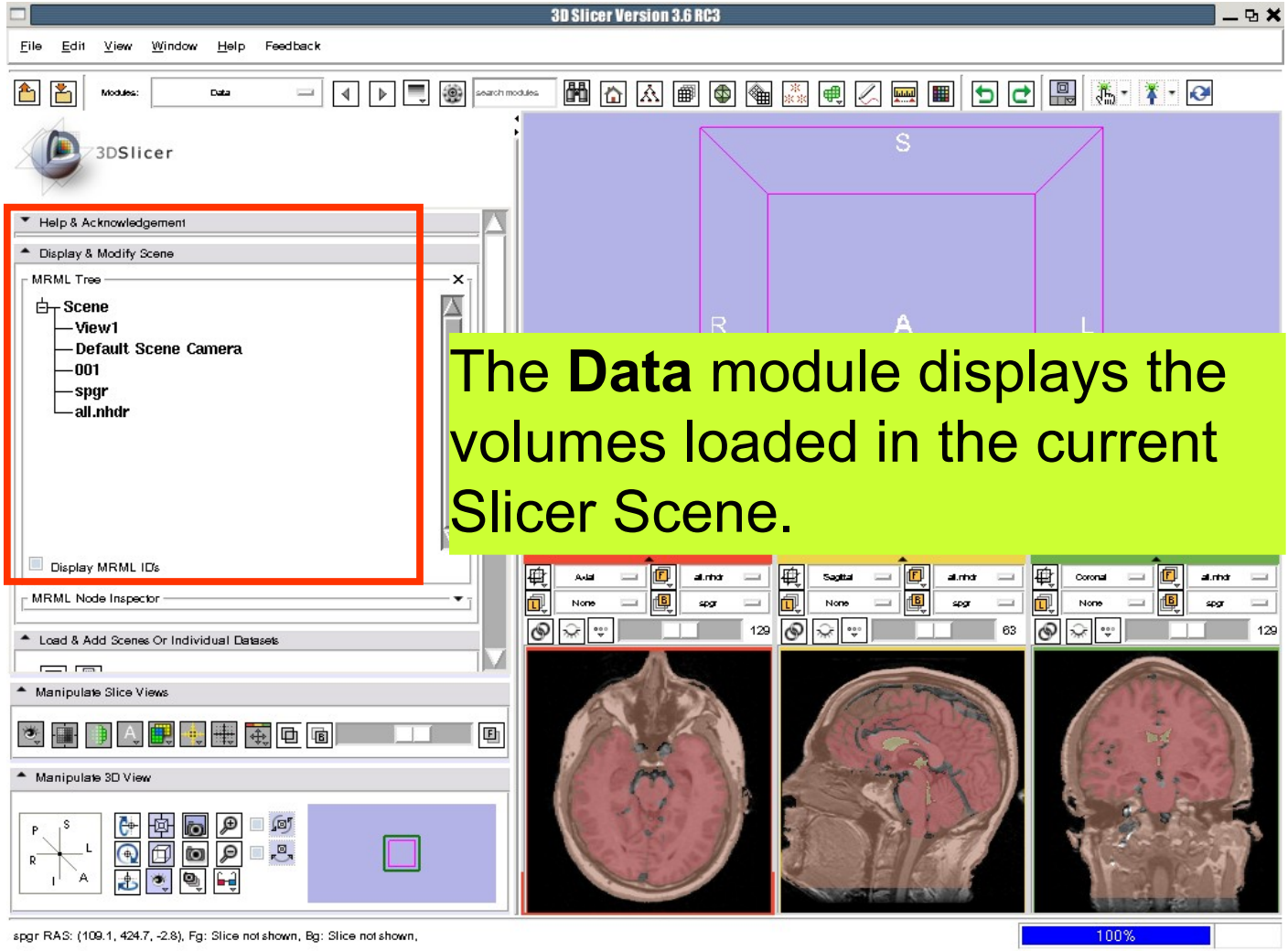
Use the slider to fade between the labelmap **all.nhdr** (Foreground) and the **spgr** volume (Background).

3D Visualization



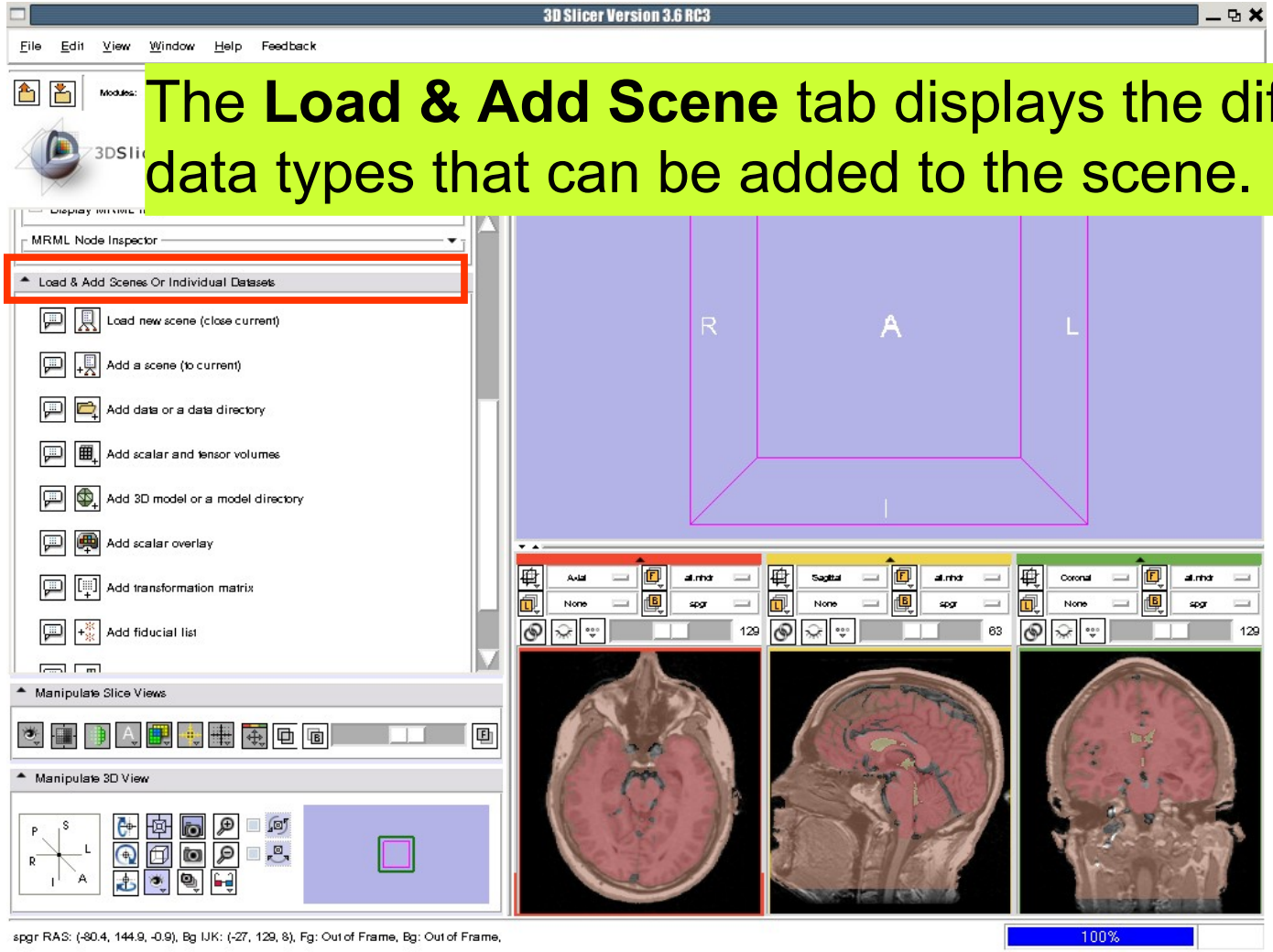
Select the **Data** module in the **Modules** menu.

3D Visualization



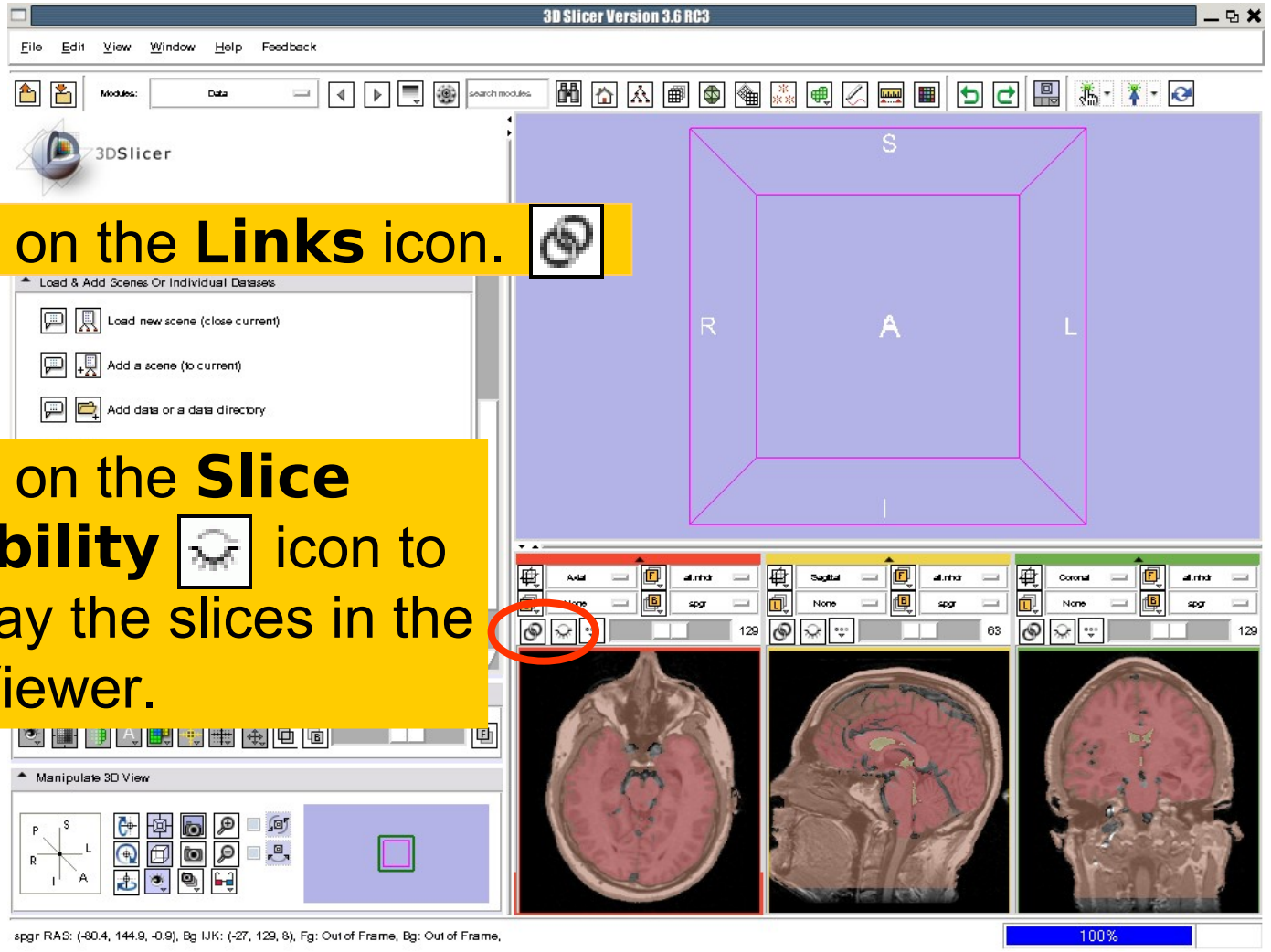
The **Data** module displays the volumes loaded in the current Slicer Scene.

3D Visualization



The **Load & Add Scene** tab displays the different data types that can be added to the scene.

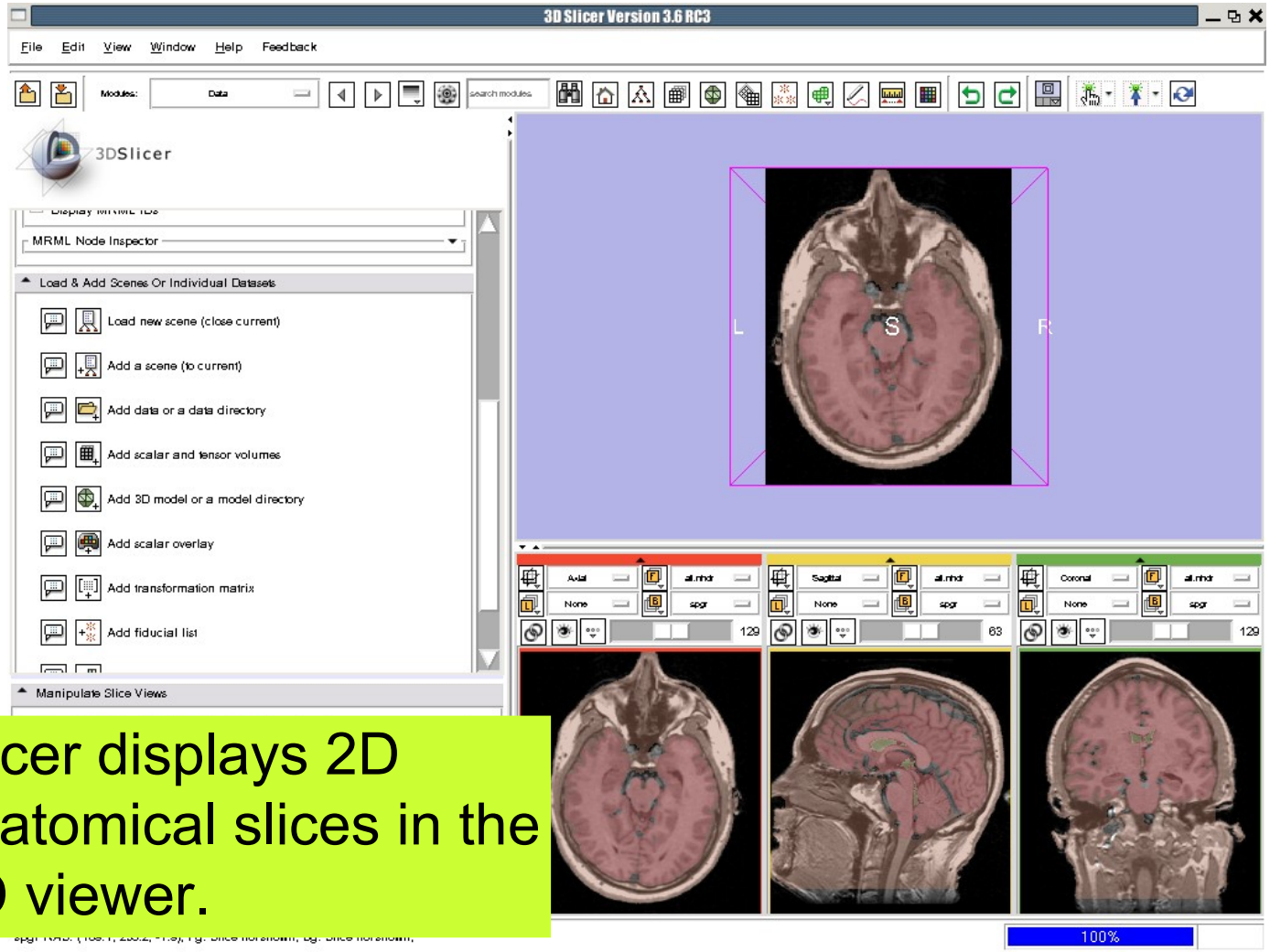
3D Visualization



Click on the **Links** icon.

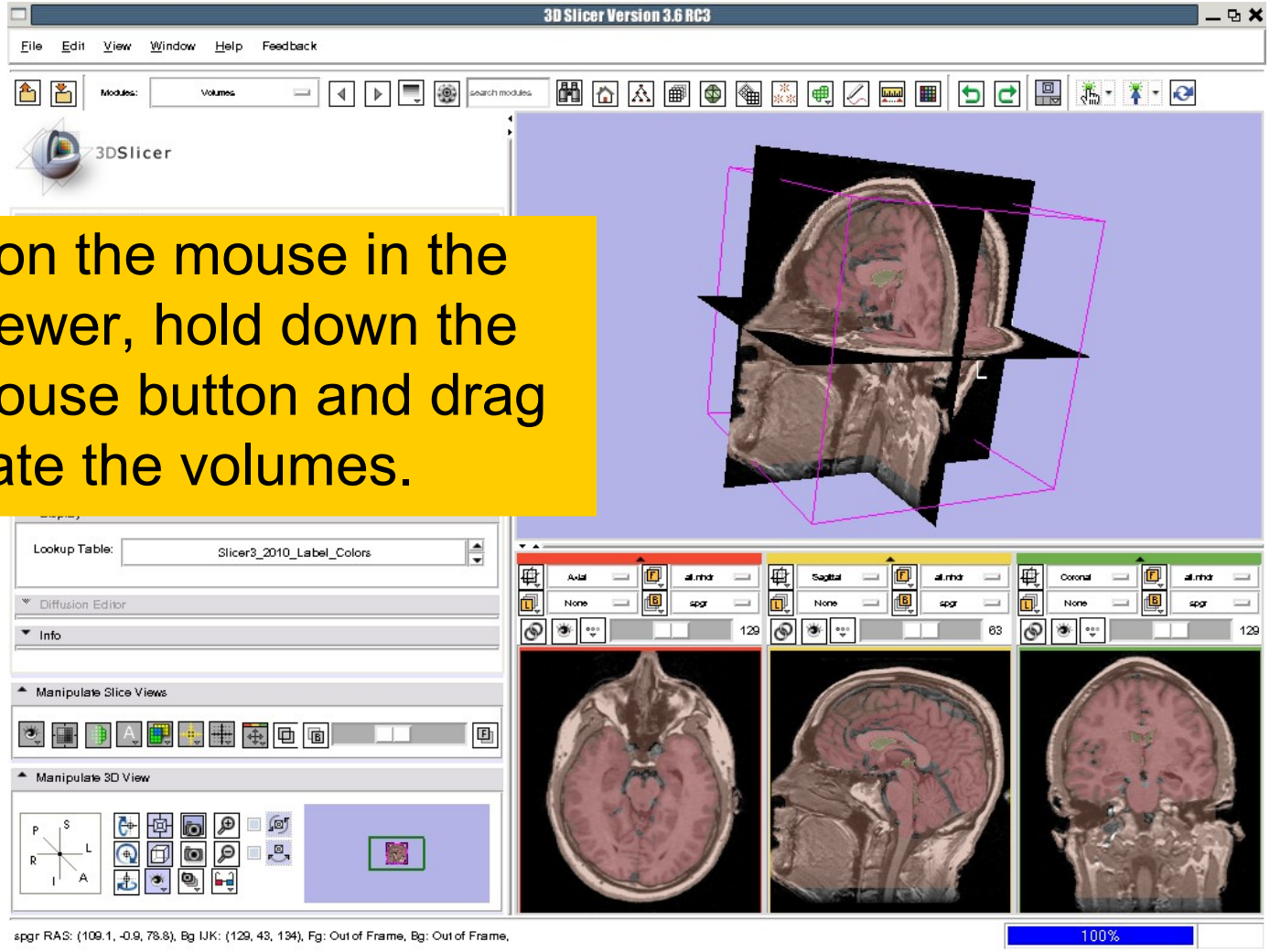
Click on the **Slice Visibility** icon to display the slices in the 3D Viewer.

3D Visualization

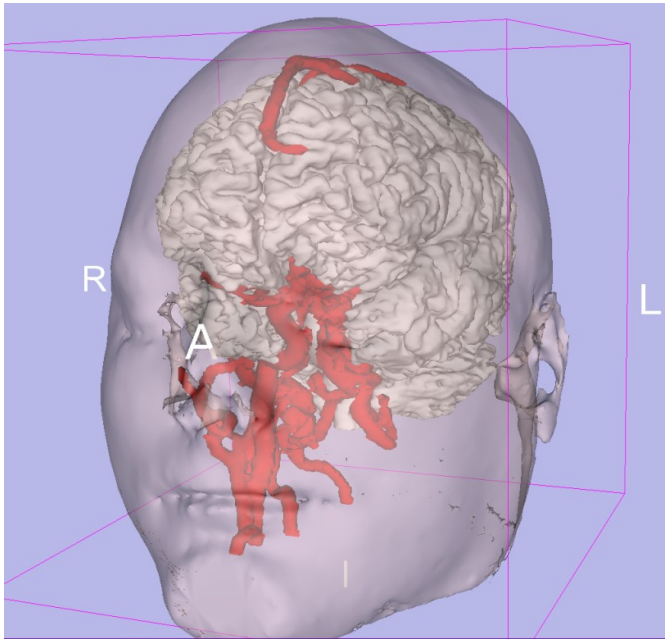


Slicer displays 2D anatomical slices in the 3D viewer.

3D Visualization

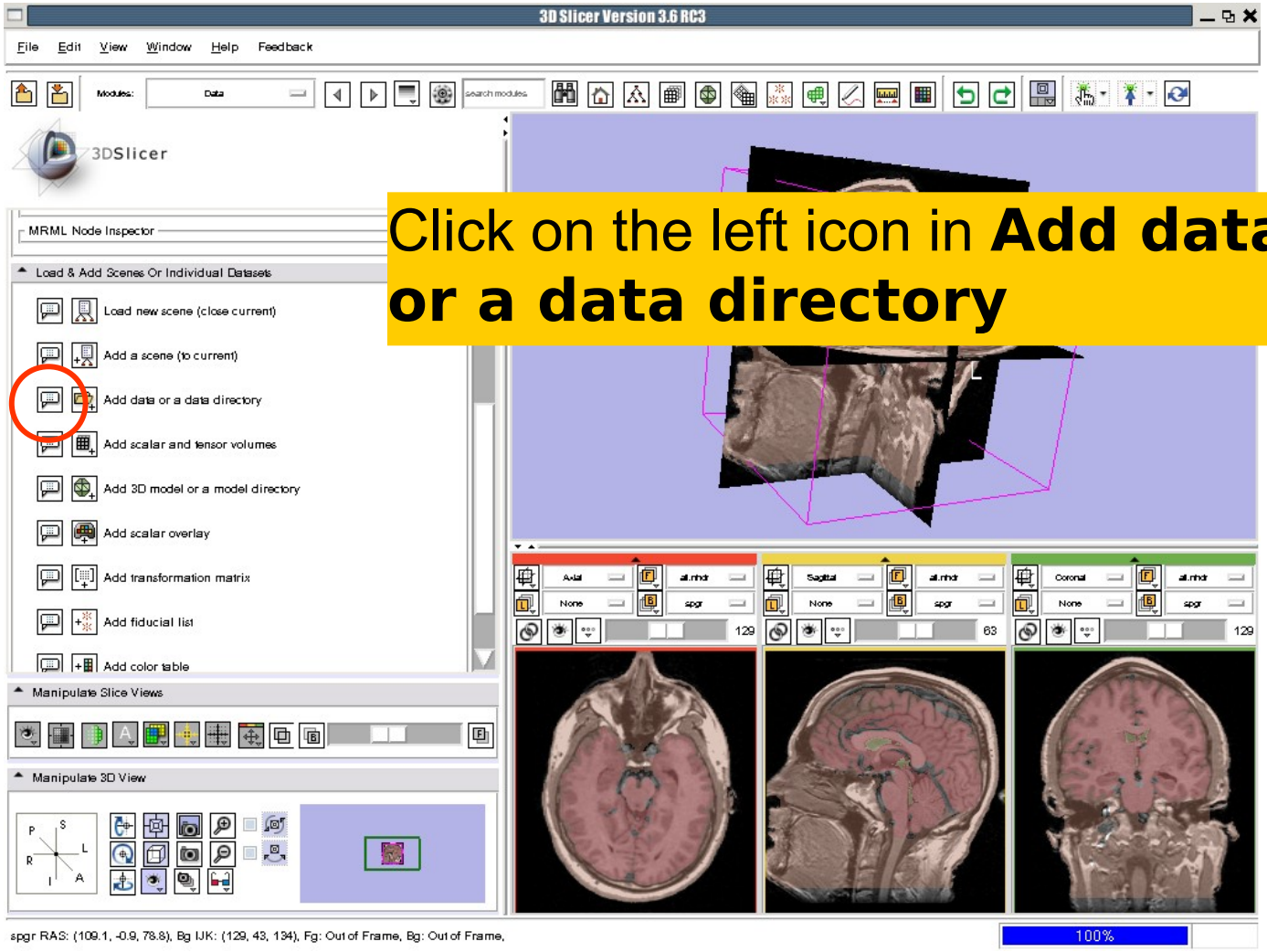


Position the mouse in the 3D Viewer, hold down the left mouse button and drag to rotate the volumes.

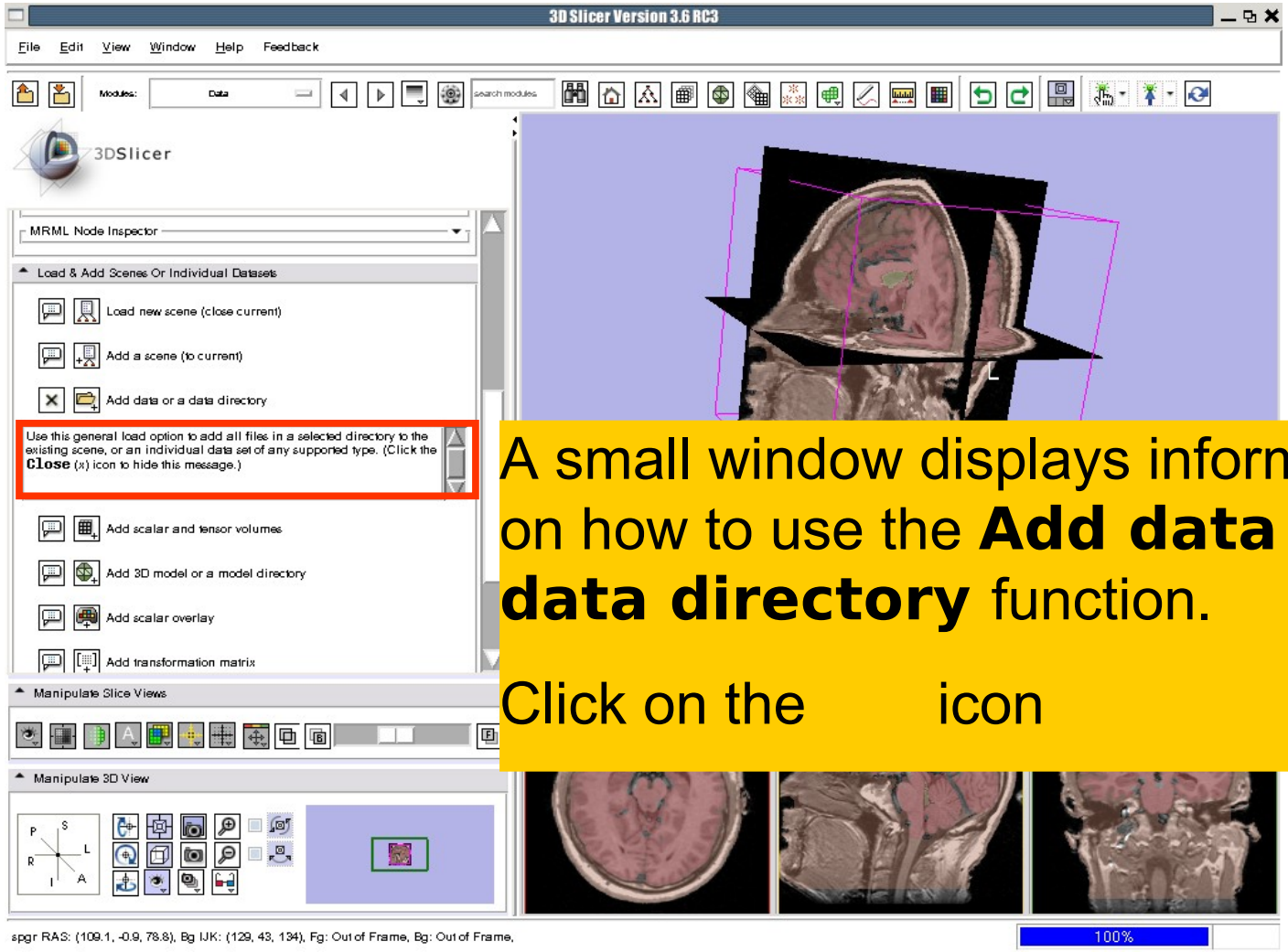


Part 3: Loading and visualizing 3D models of the anatomy

3D Visualization



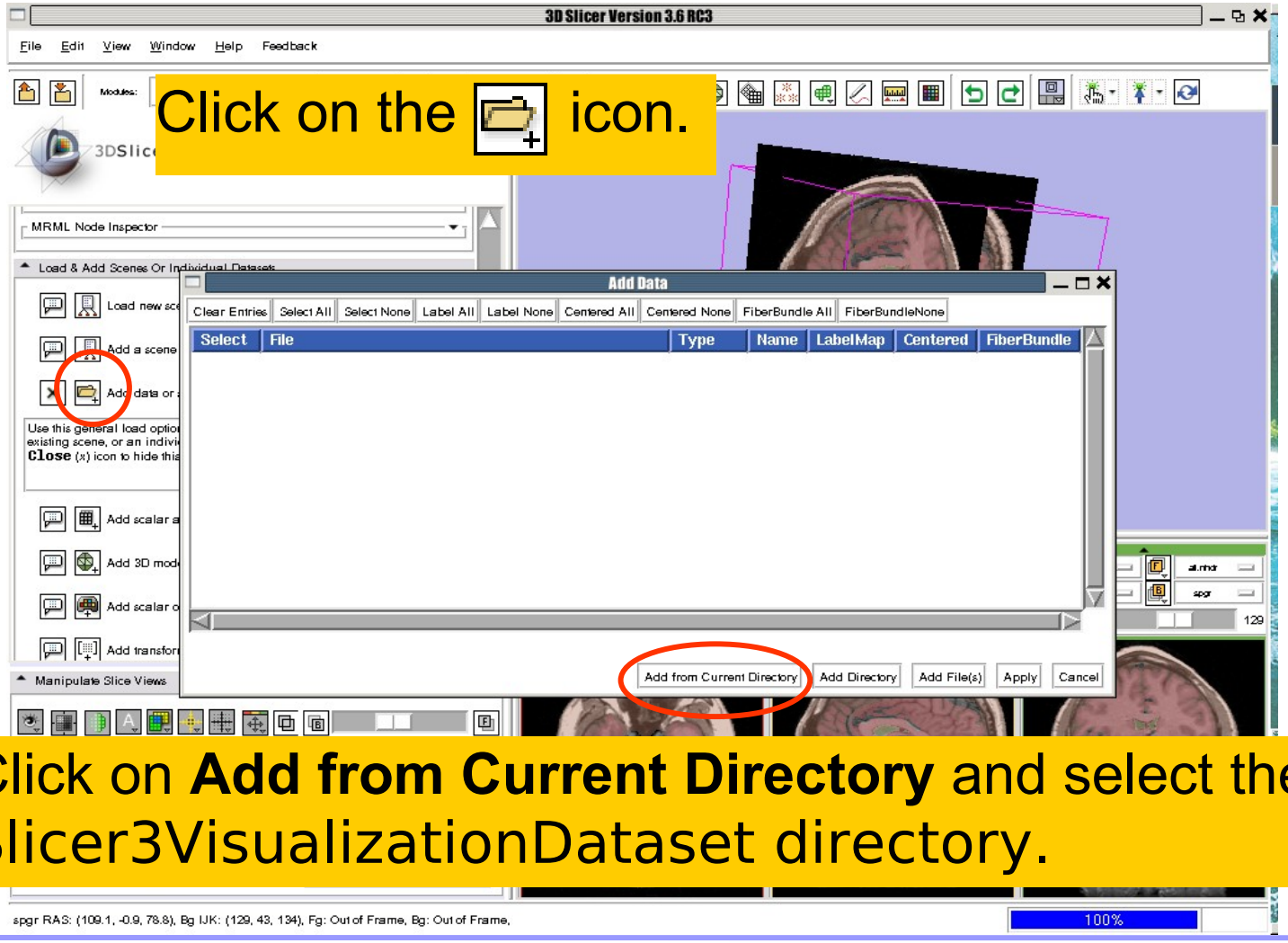
3D Visualization



A small window displays information on how to use the **Add data or data directory** function.

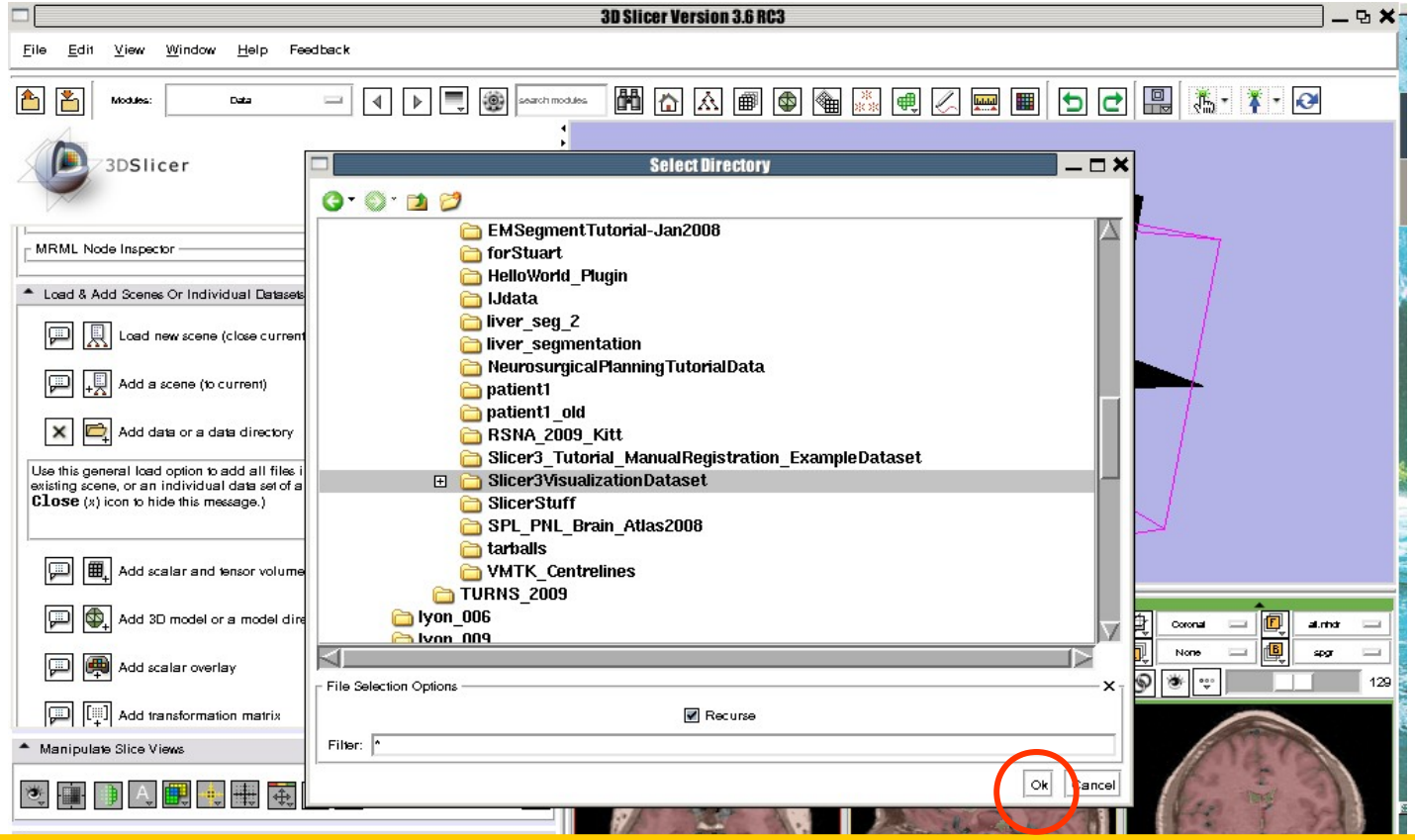
Click on the icon

3D Visualization



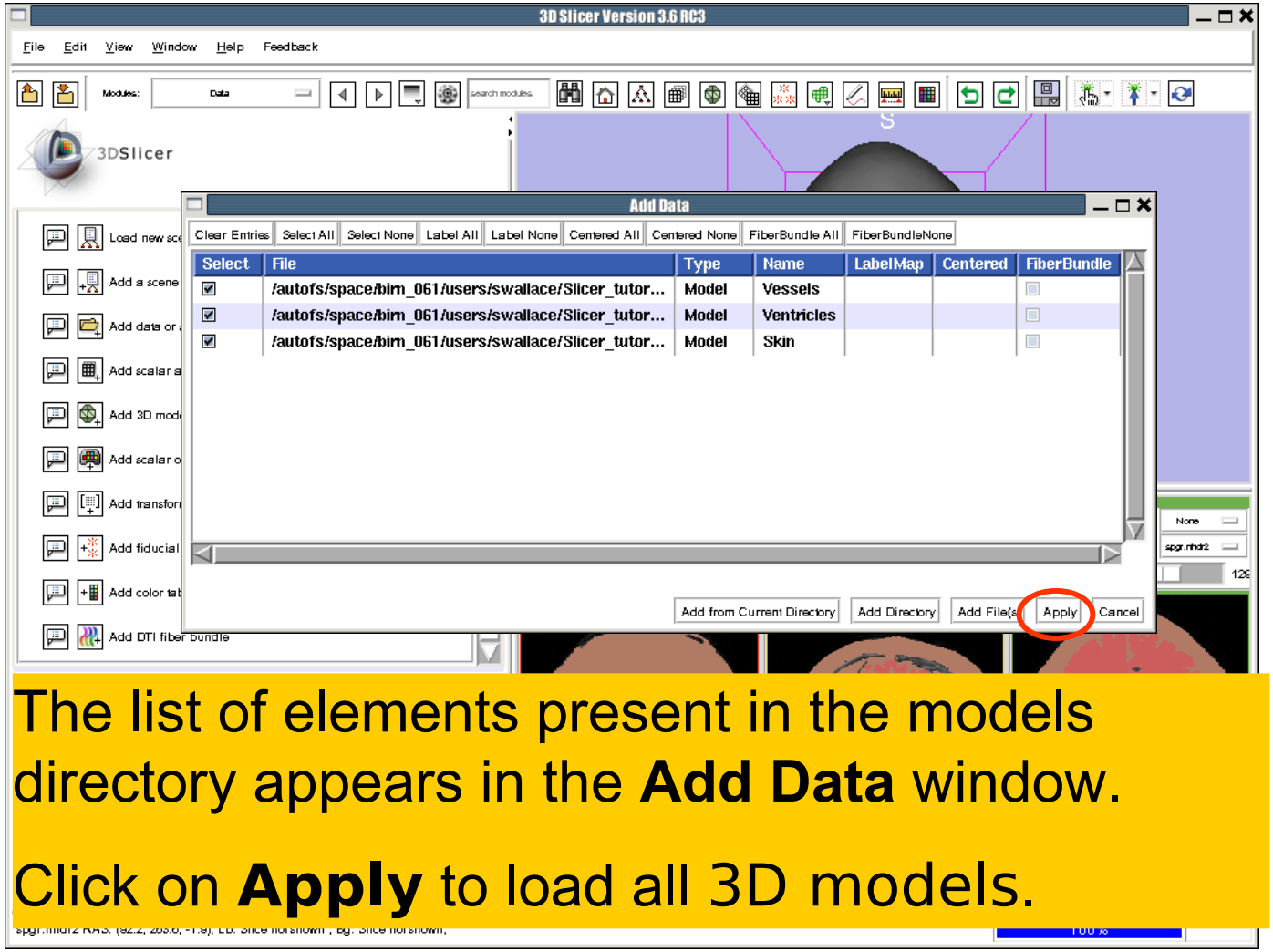
Click on **Add from Current Directory** and select the Slicer3VisualizationDataset directory.

Loading 3D models



Select the Slicer3VisualizationDataset/models directory and click on **OK**

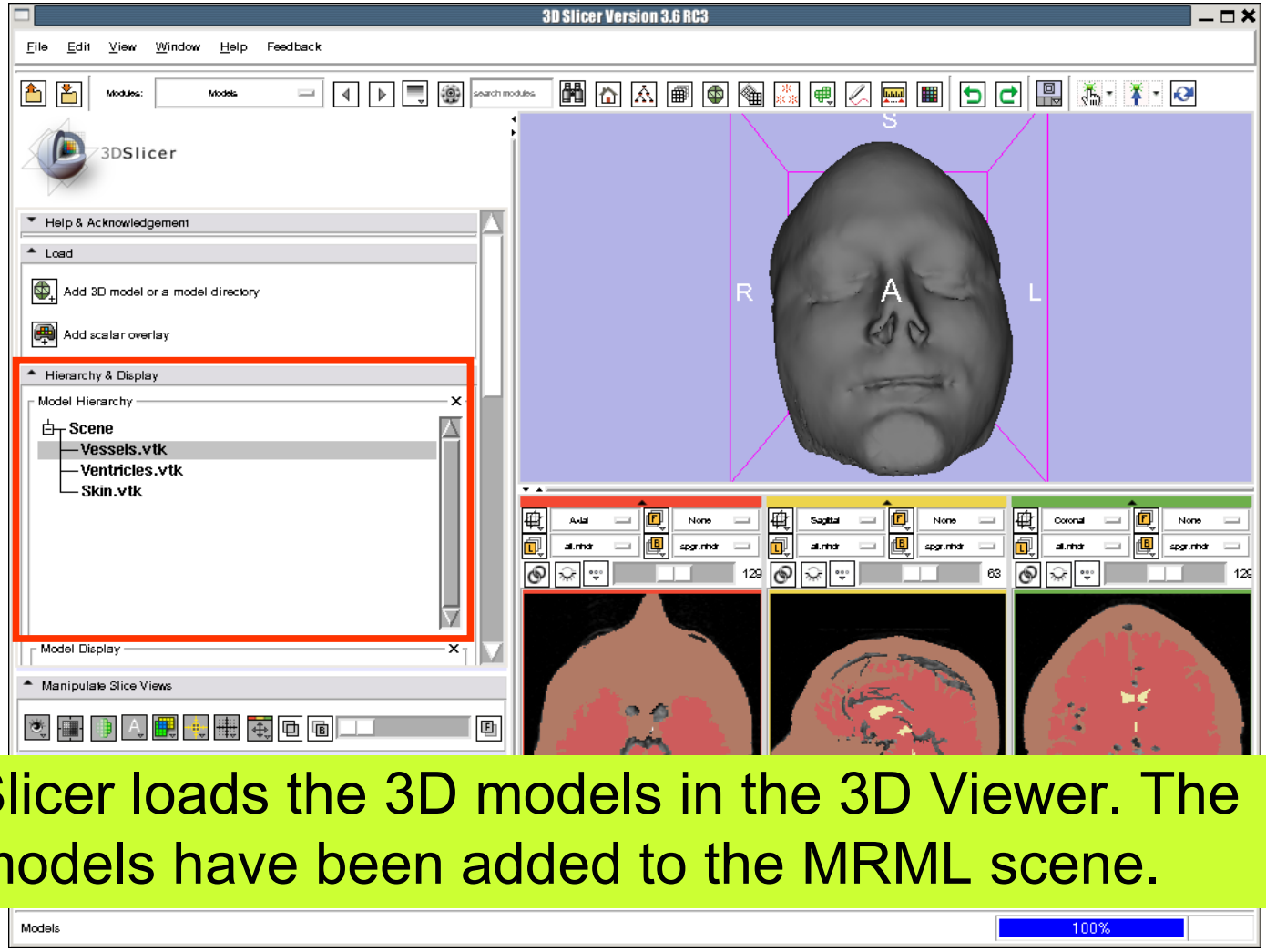
Loading 3D models



The list of elements present in the models directory appears in the **Add Data** window.

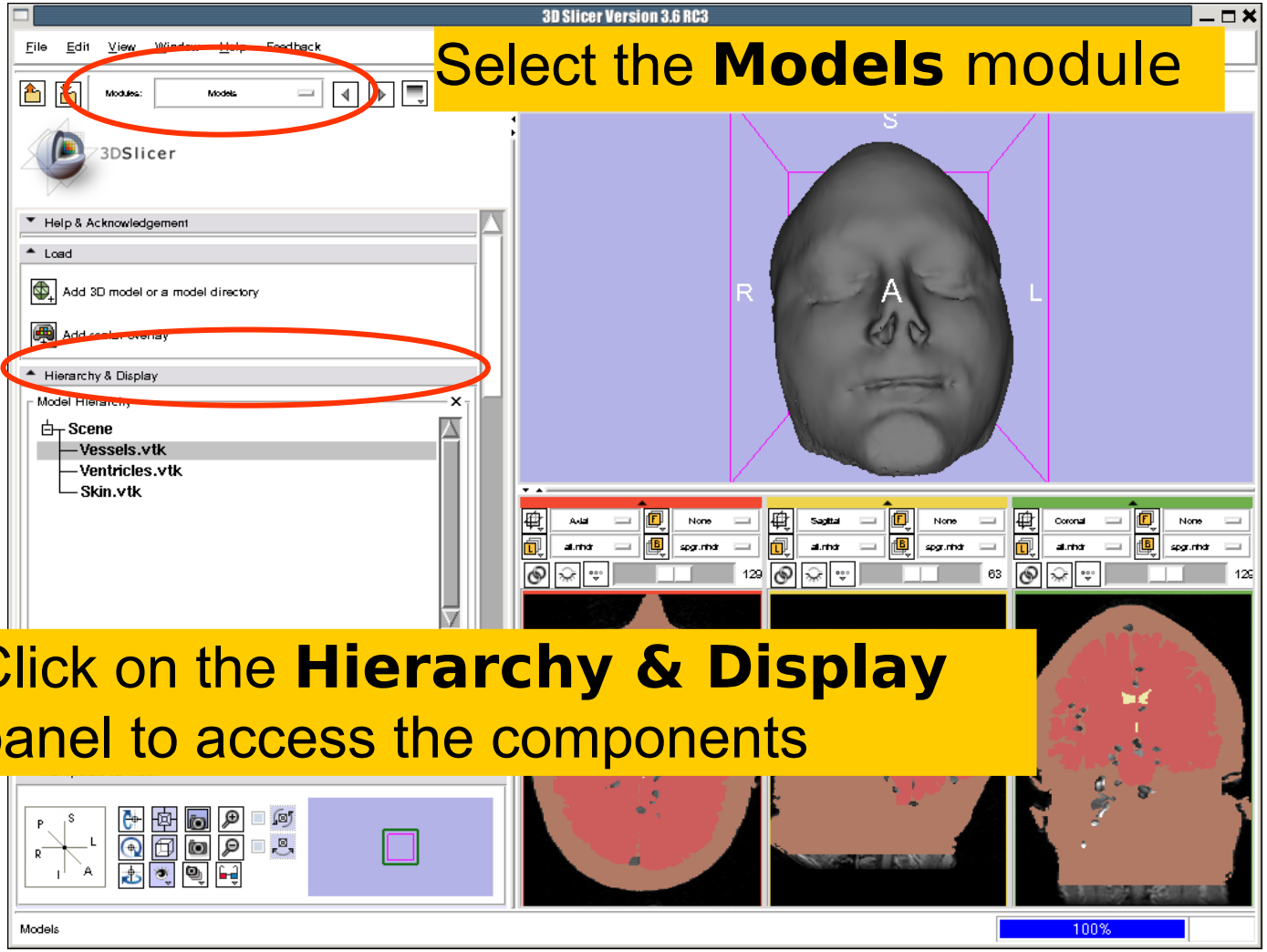
Click on **Apply** to load all 3D models.

Loading 3D models



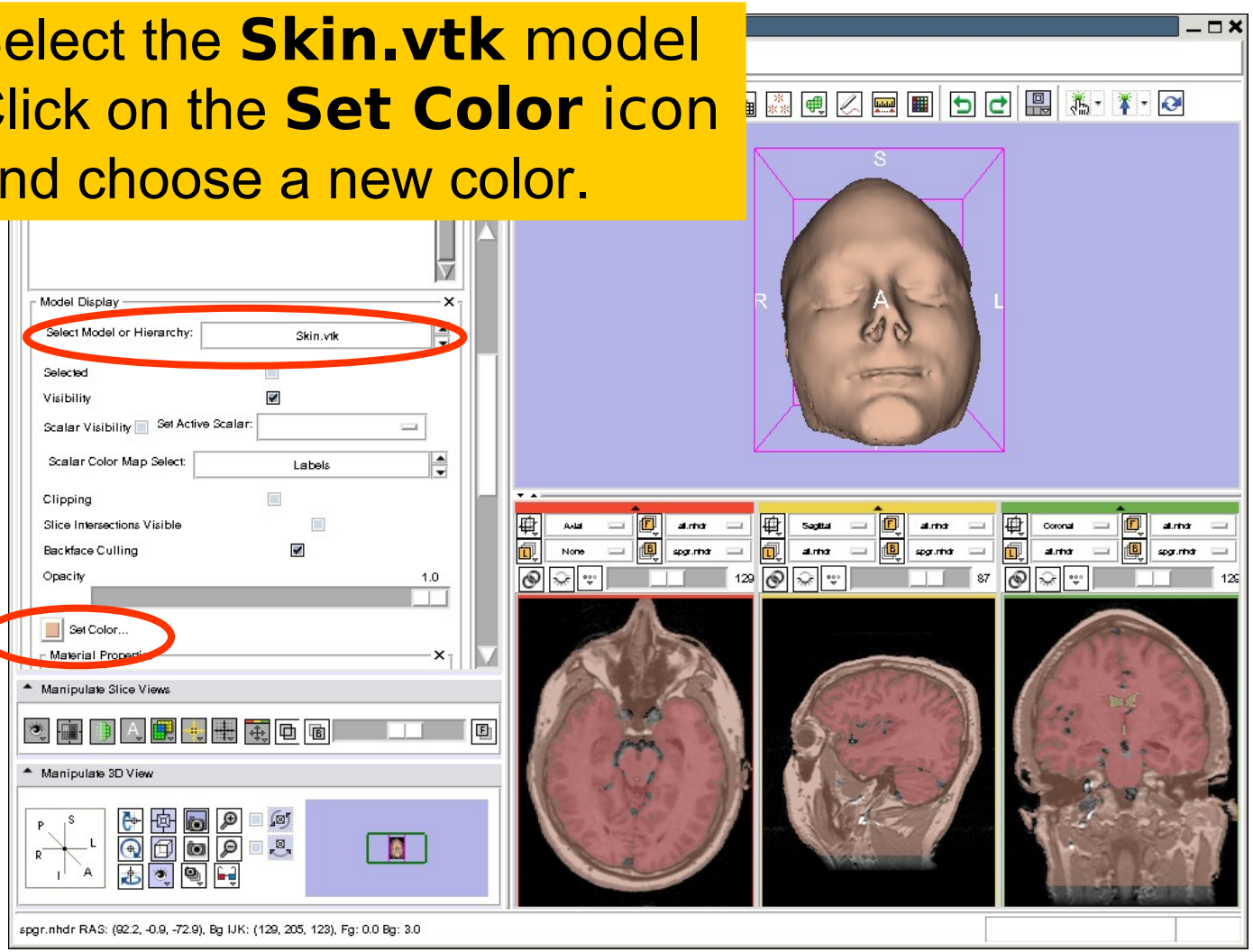
Slicer loads the 3D models in the 3D Viewer. The models have been added to the MRML scene.

Loading 3D models



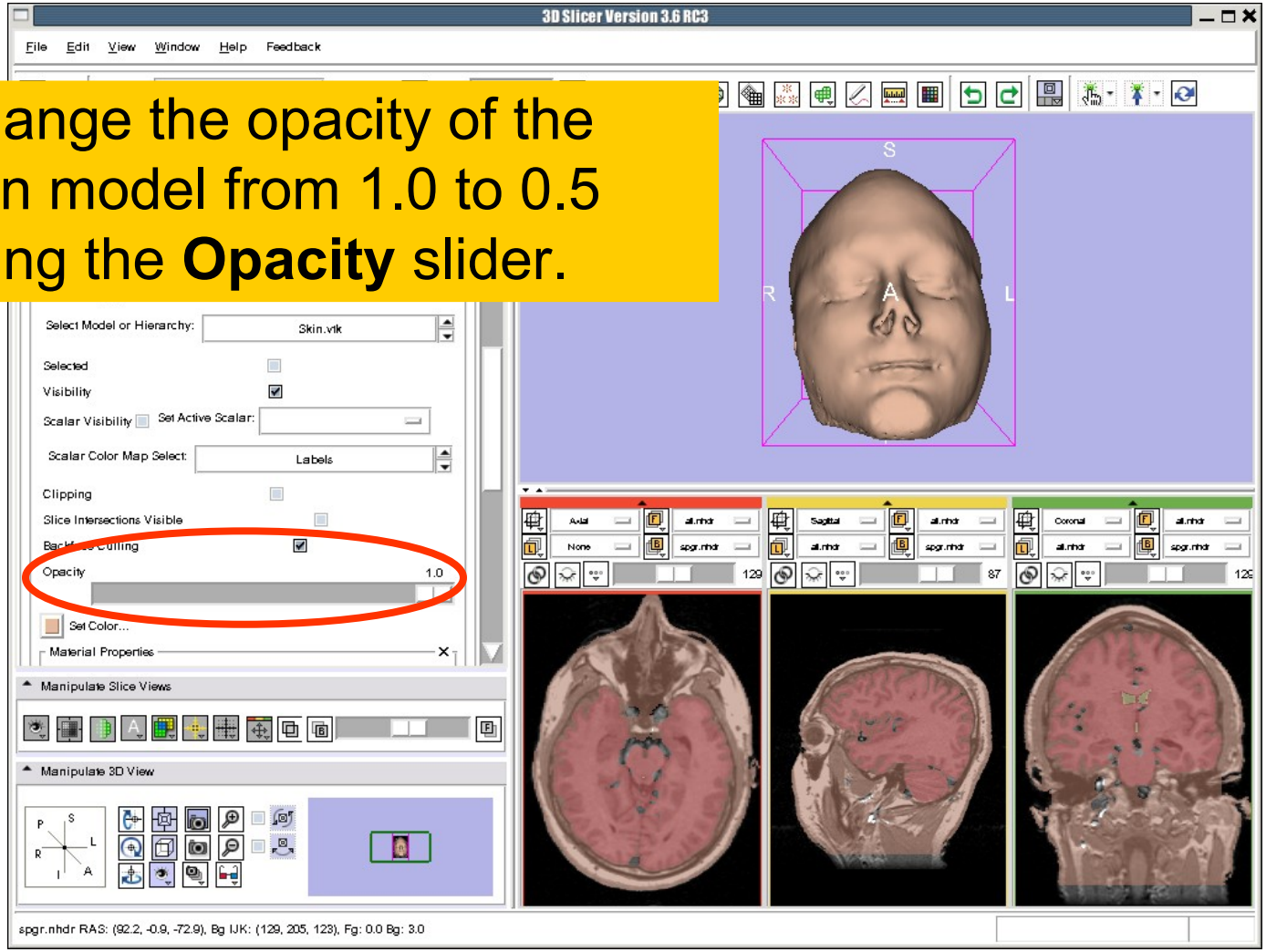
Visualizing a 3D model

Select the **Skin.vtk** model
Click on the **Set Color** icon
and choose a new color.



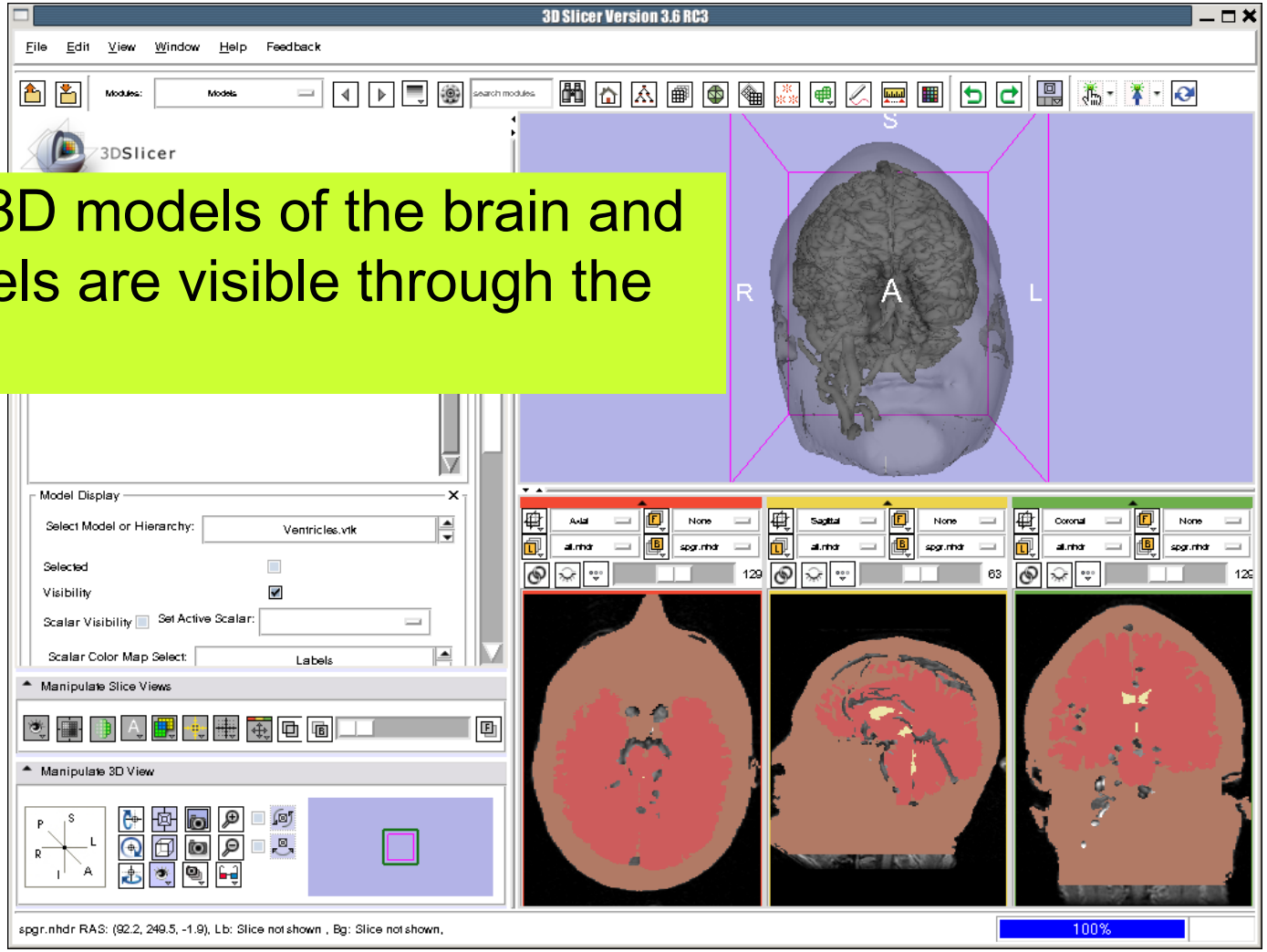
Visualizing a 3D model

Change the opacity of the skin model from 1.0 to 0.5 using the **Opacity** slider.

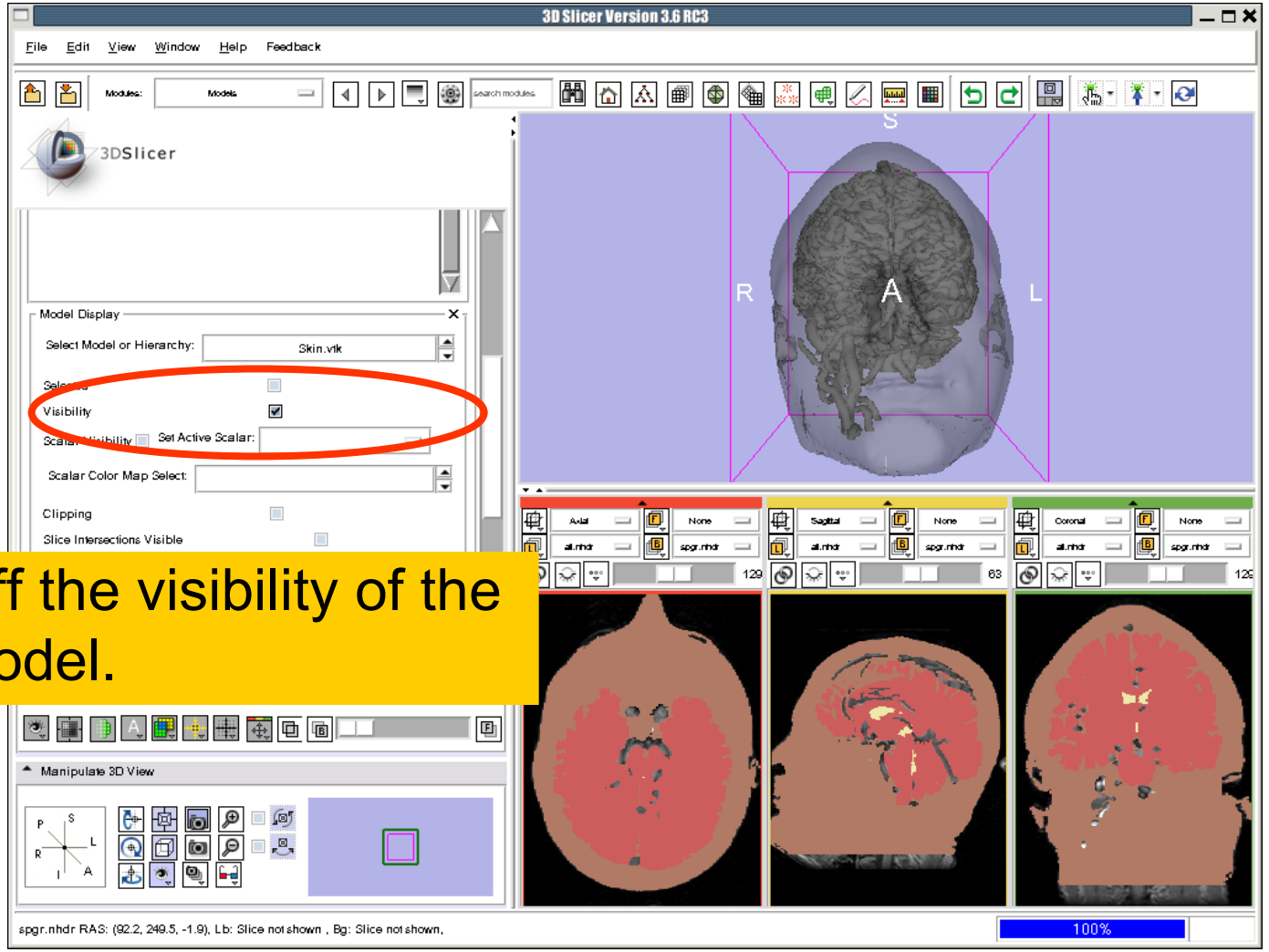


Visualizing a 3D model

The 3D models of the brain and vessels are visible through the skin.

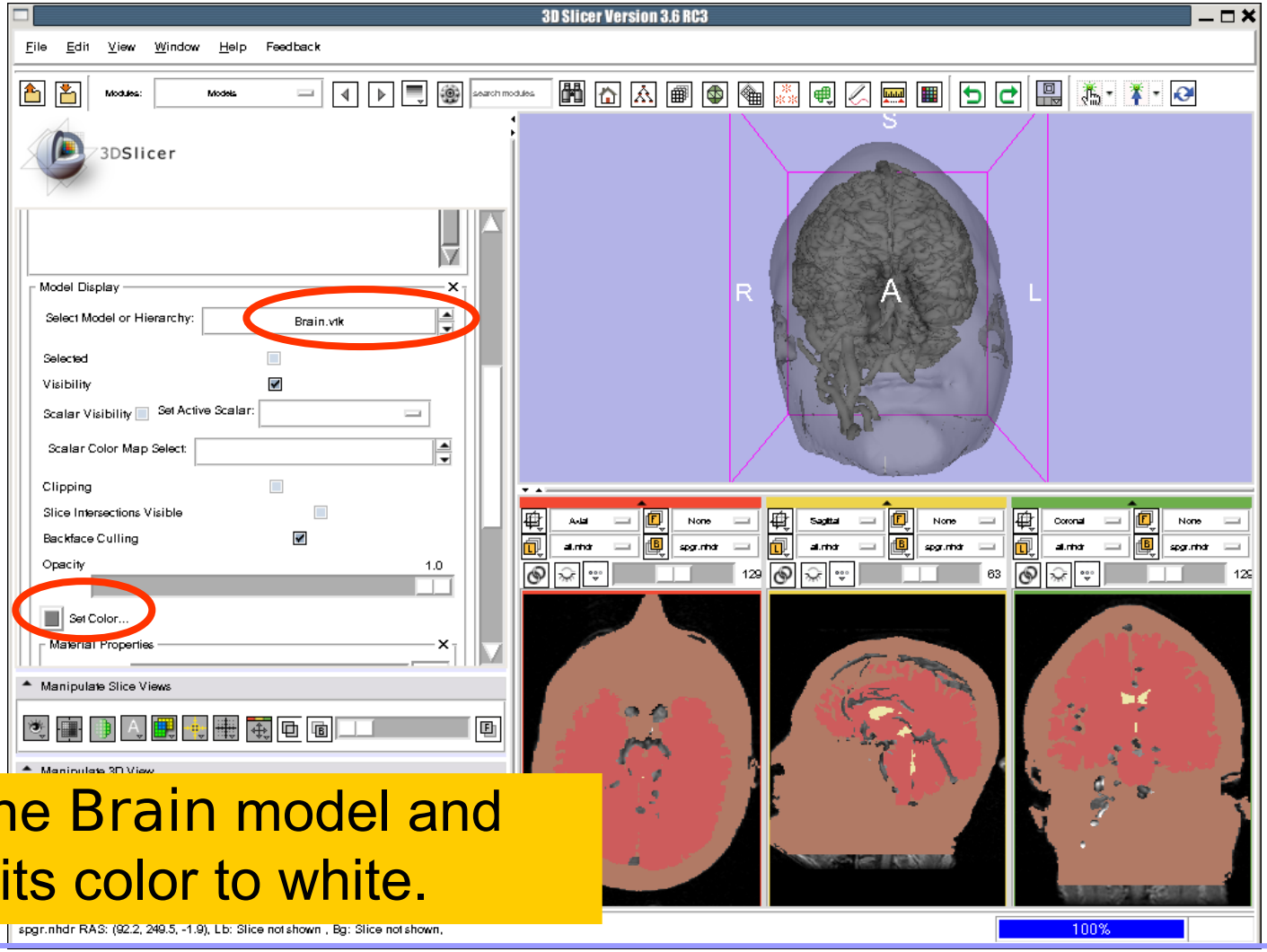


Visualizing a 3D model



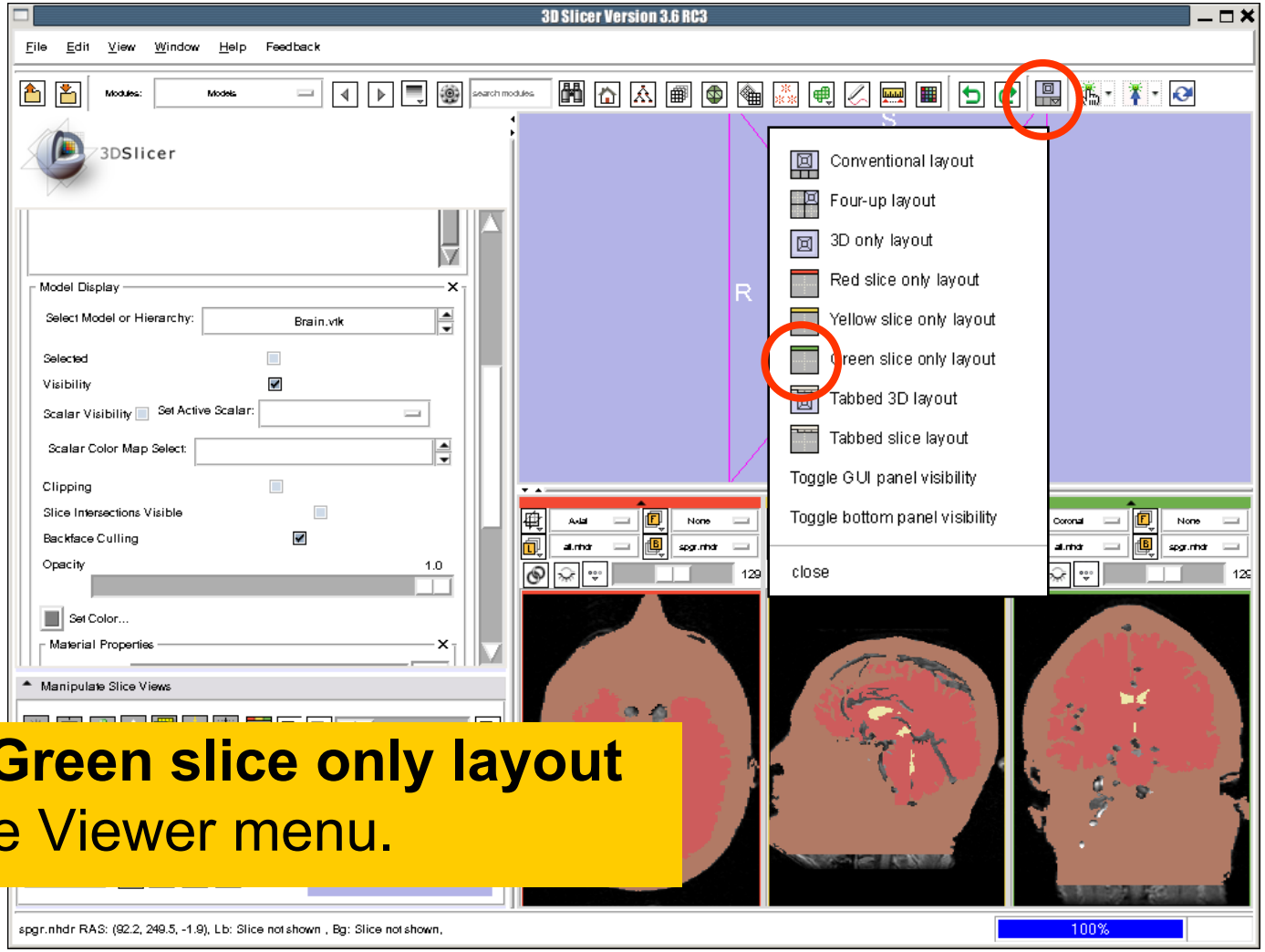
Turn off the visibility of the skin model.

Visualizing a 3D model



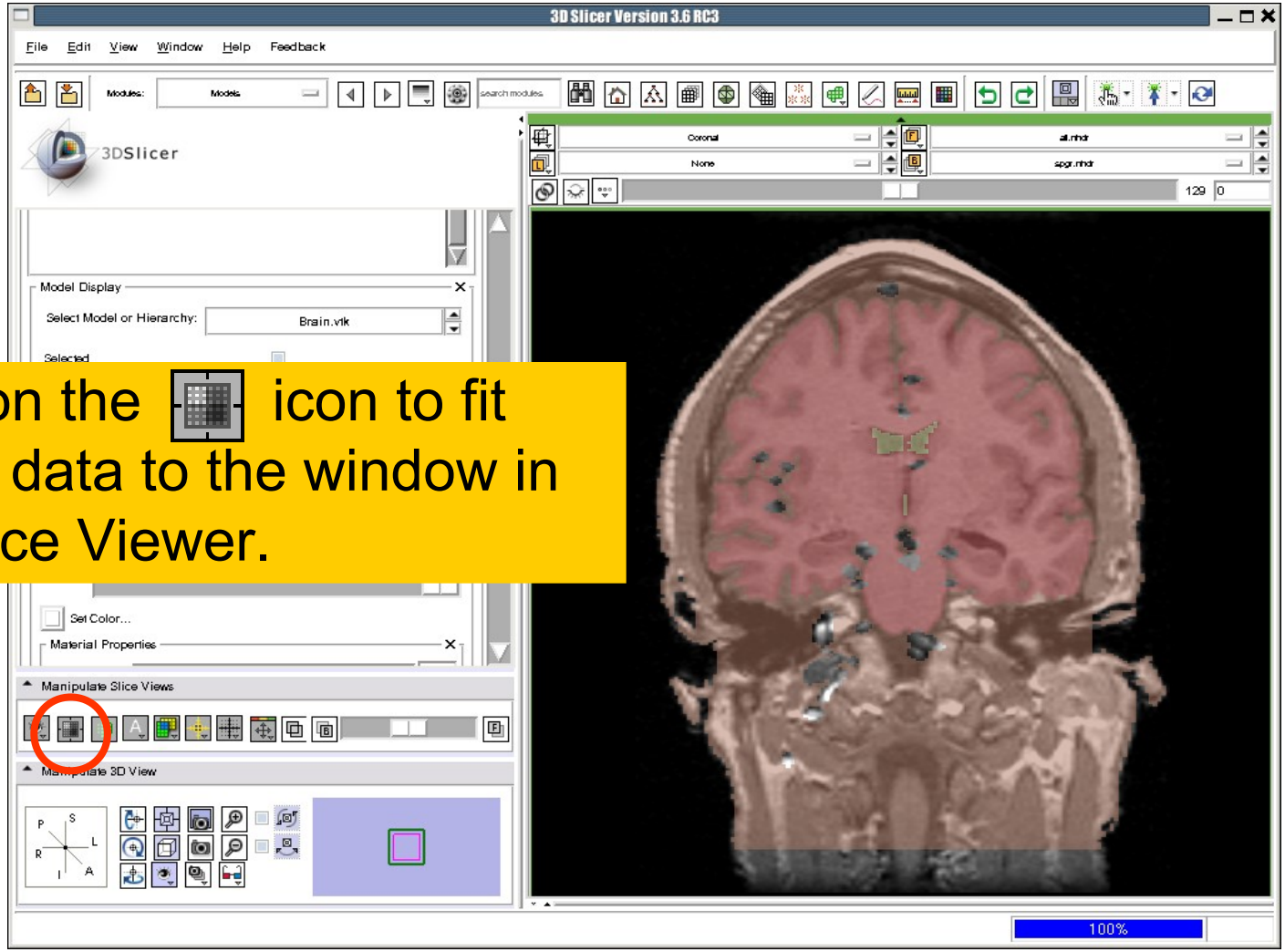
Select the Brain model and change its color to white.

Visualizing a 3D model



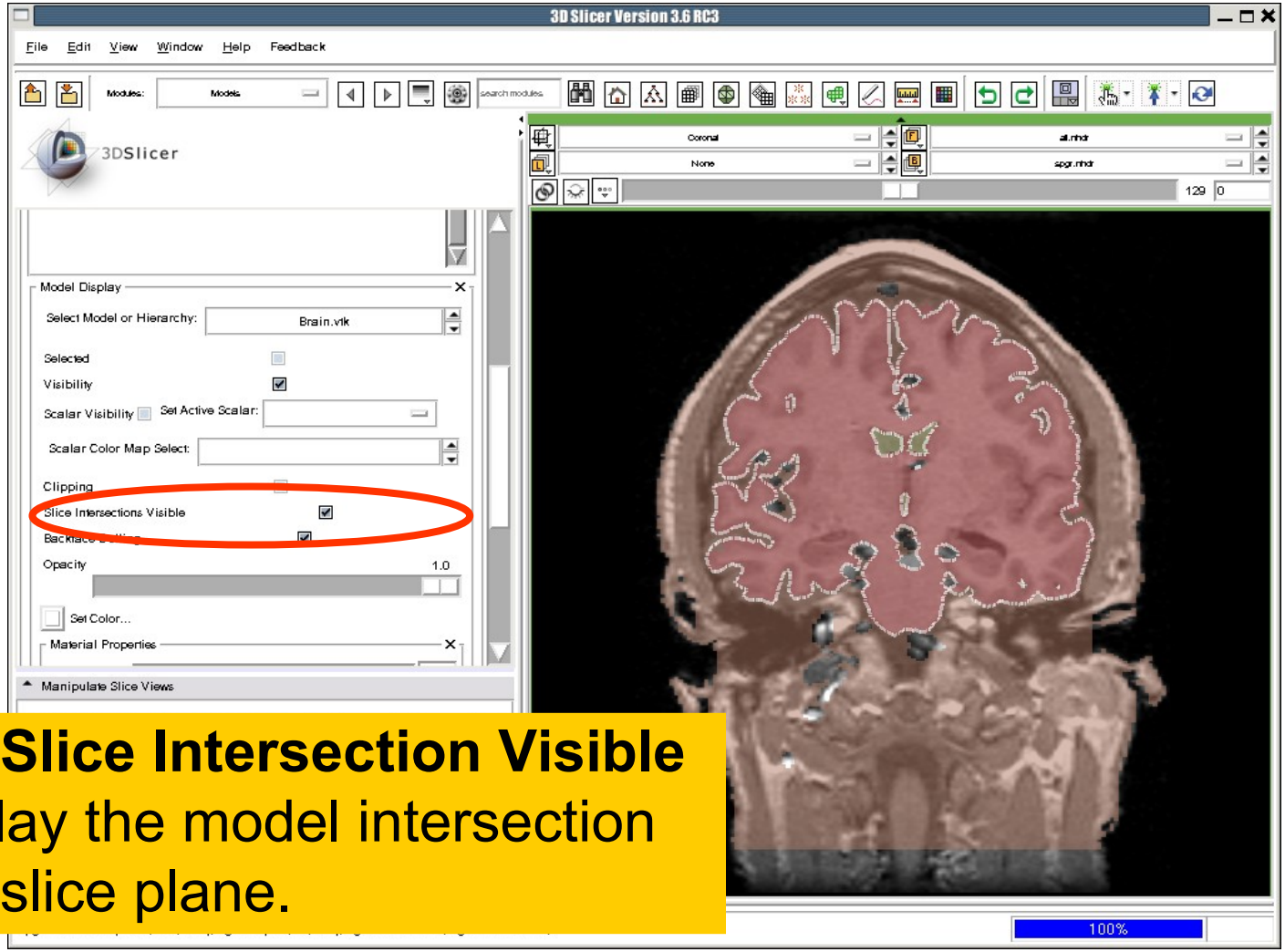
Select **Green slice only layout** from the Viewer menu.

Visualizing a 3D model



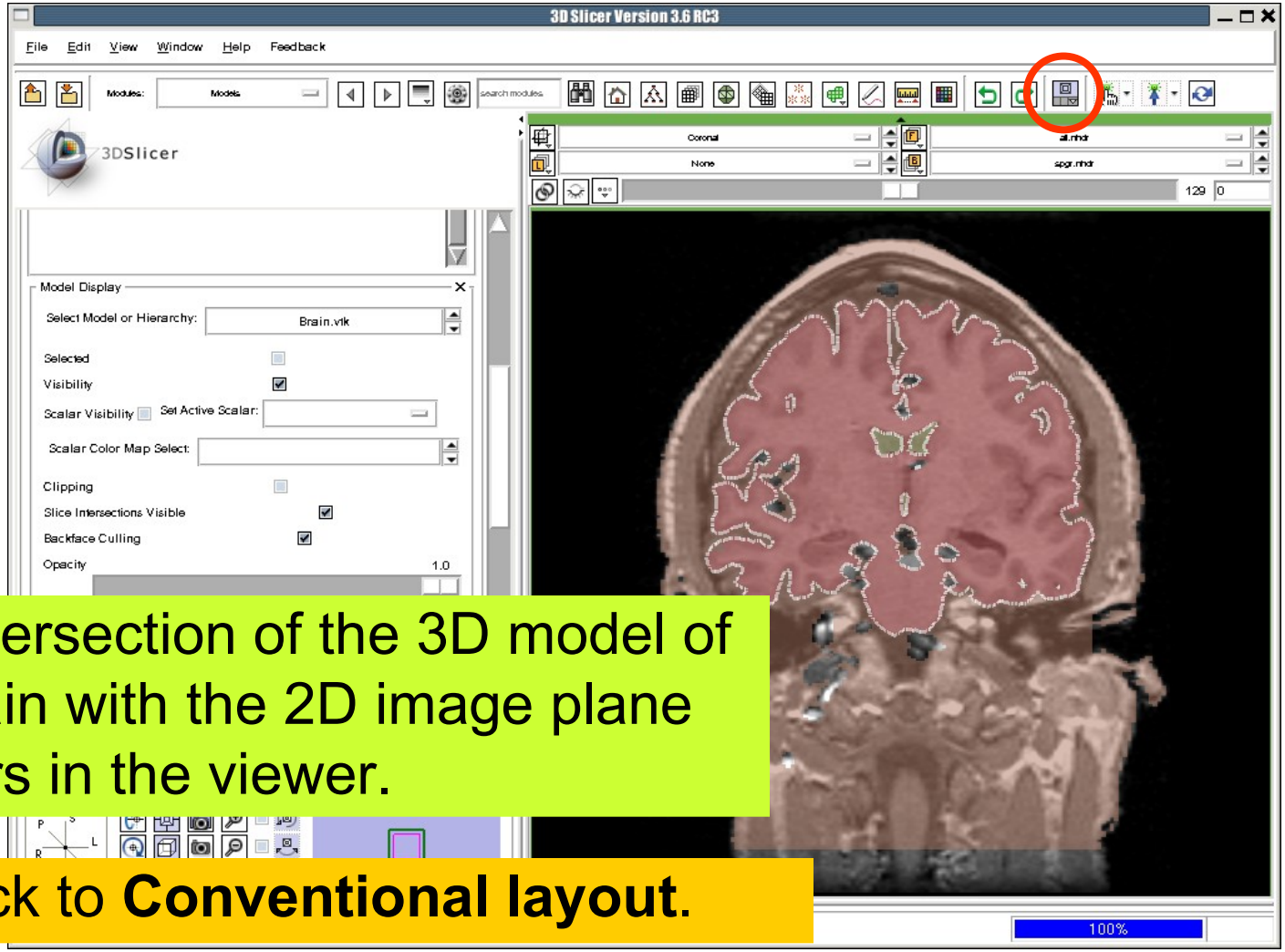
Click on the icon to fit image data to the window in the Slice Viewer.

Visualizing a 3D model



Select **Slice Intersection Visible** to display the model intersection on the slice plane.

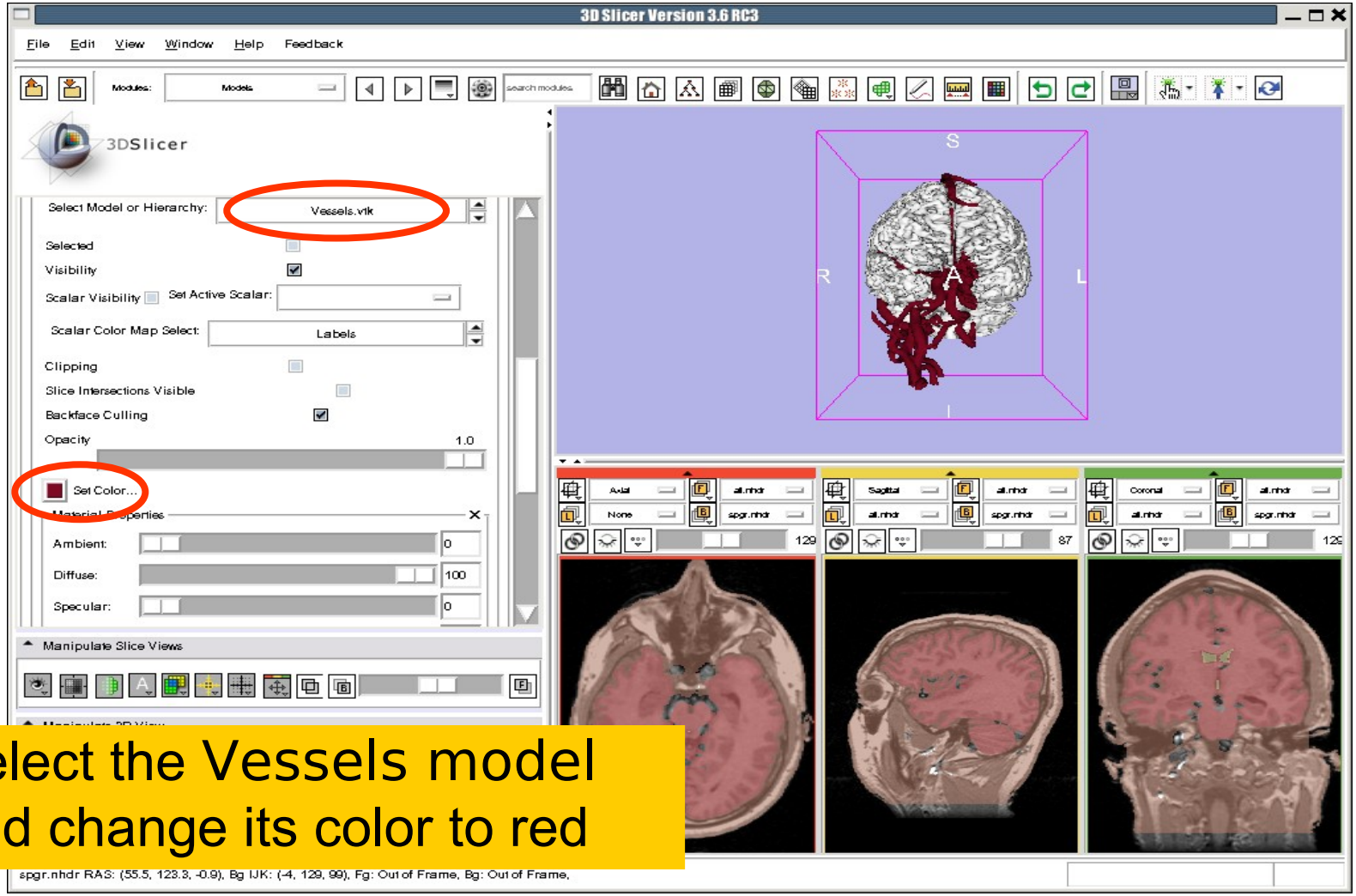
Visualizing a 3D model



The intersection of the 3D model of the brain with the 2D image plane appears in the viewer.

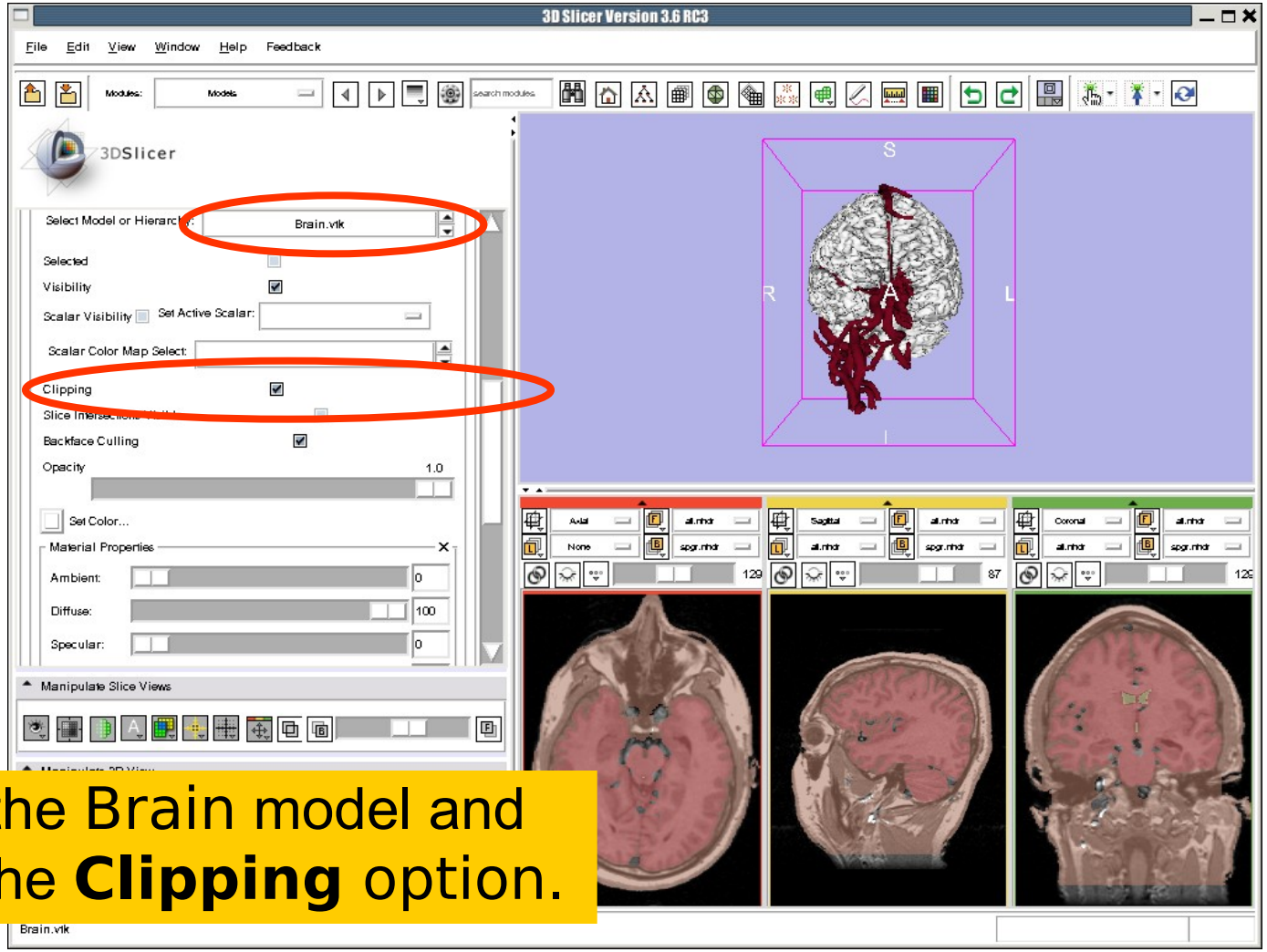
Go back to **Conventional layout**.

Visualizing a 3D model



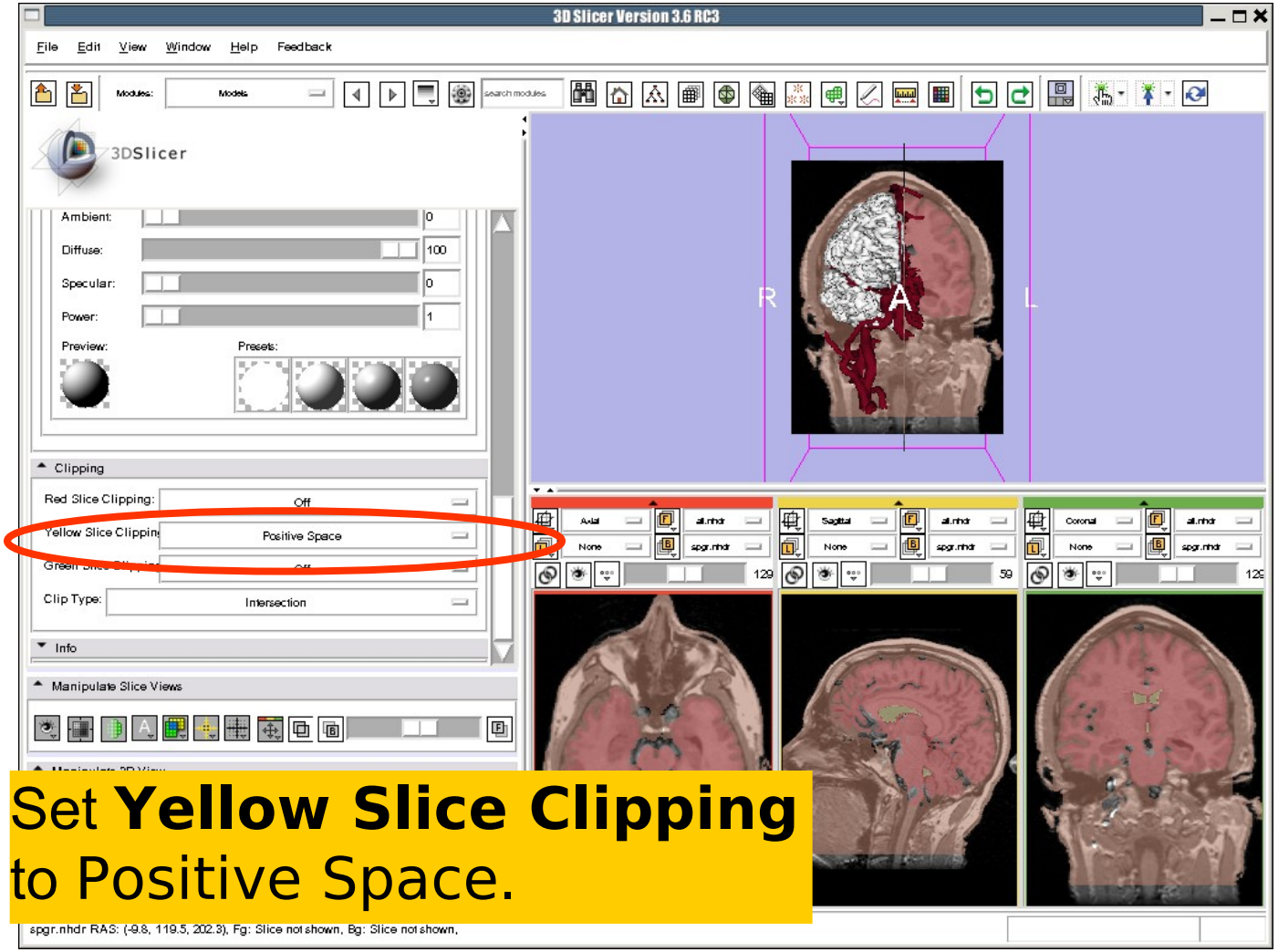
Select the Vessels model and change its color to red

Visualizing a 3D model



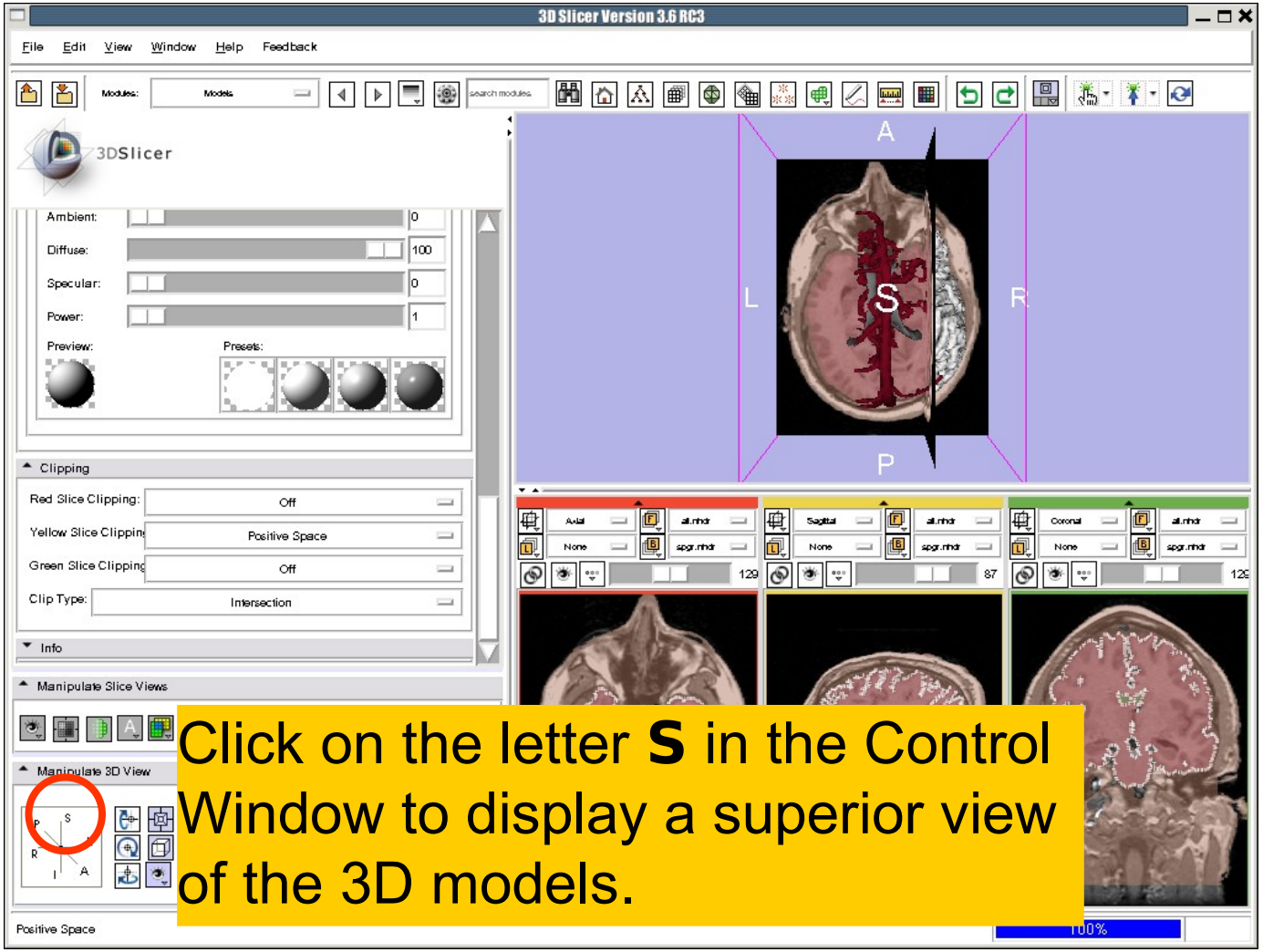
Select the Brain model and select the **Clipping** option.

Visualizing a 3D model



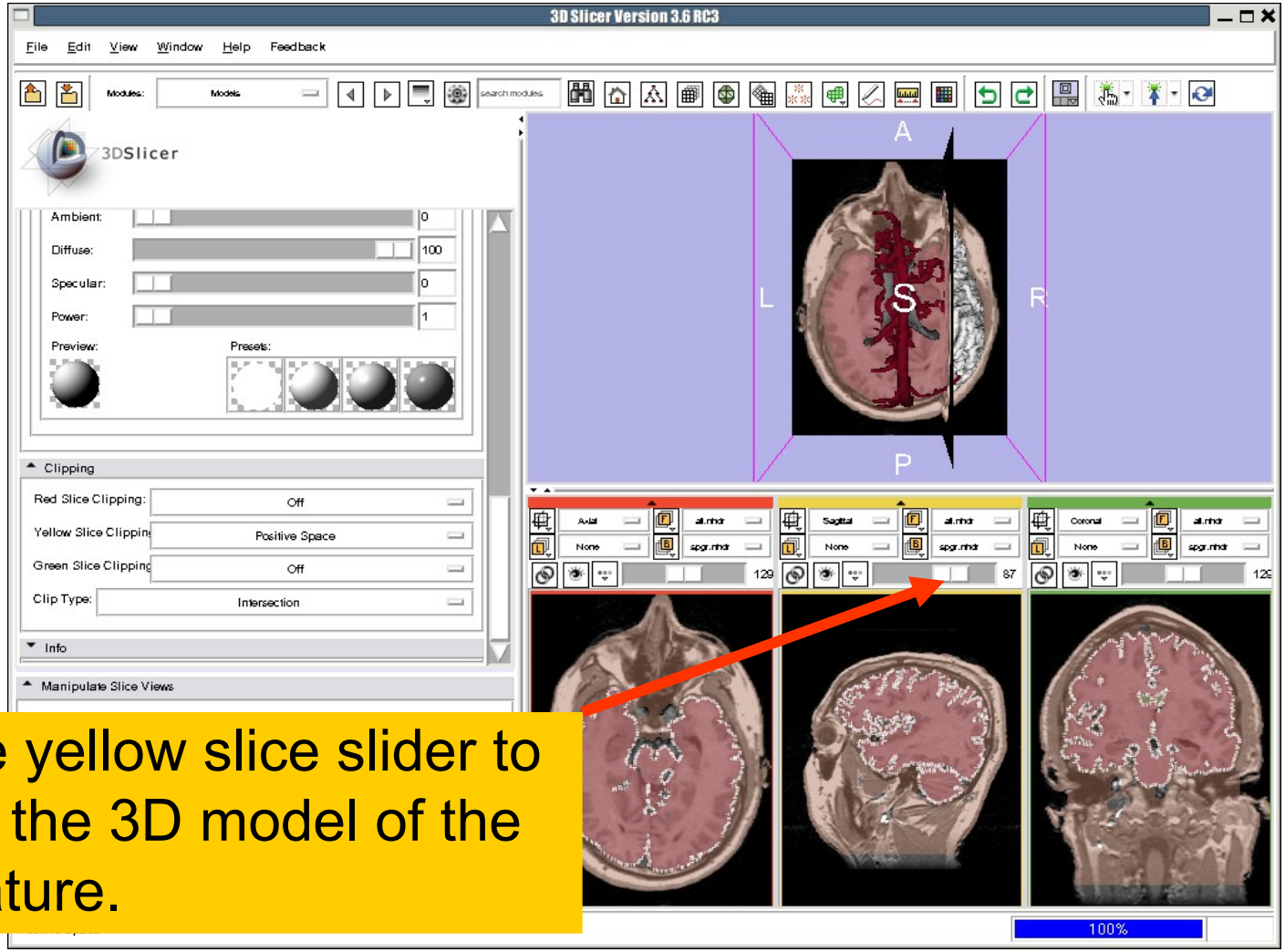
Set **Yellow Slice Clipping** to Positive Space.

Visualizing a 3D model



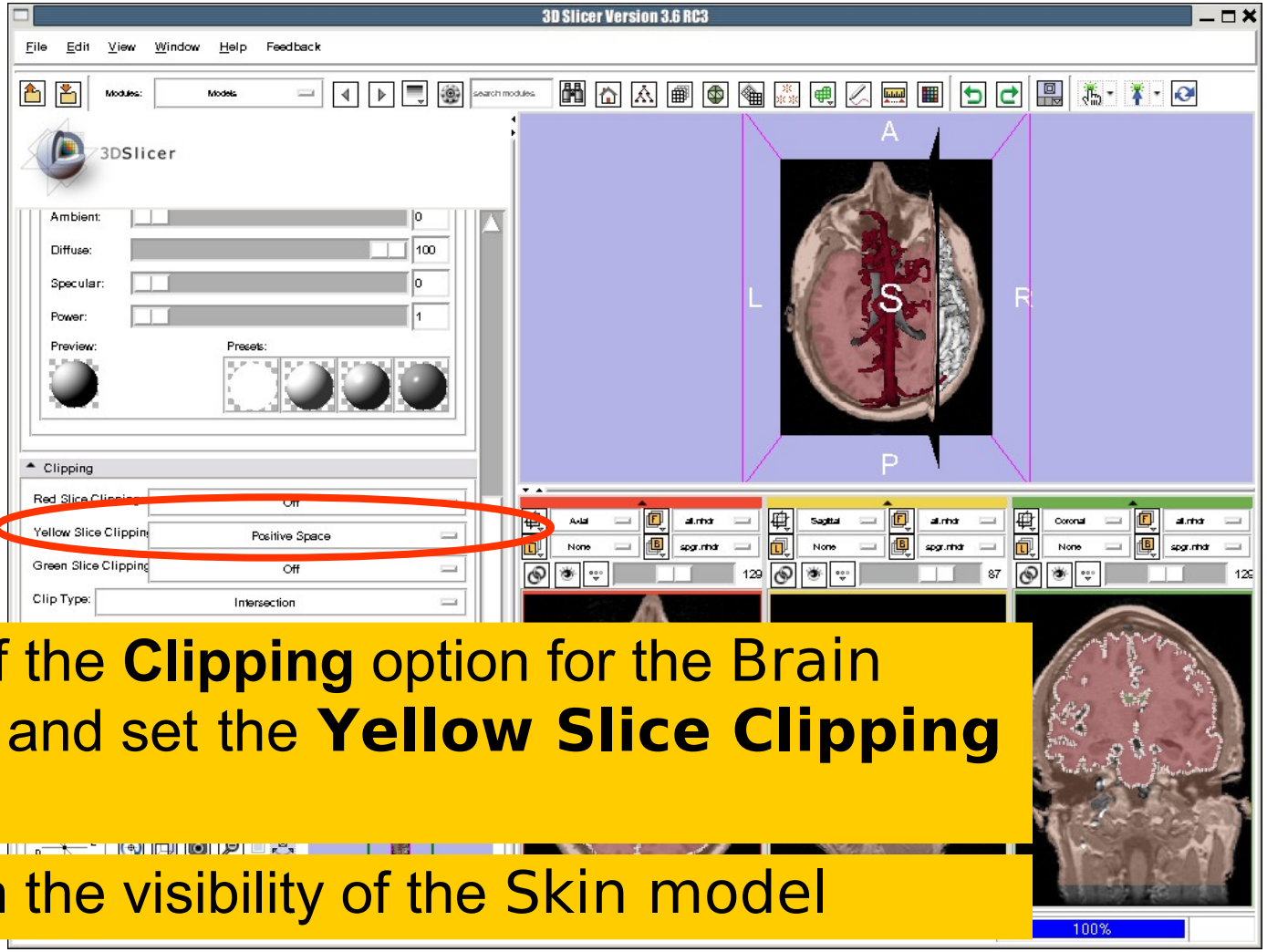
Click on the letter **S** in the Control Window to display a superior view of the 3D models.

Visualizing a 3D model



Use the yellow slice slider to expose the 3D model of the vasculature.

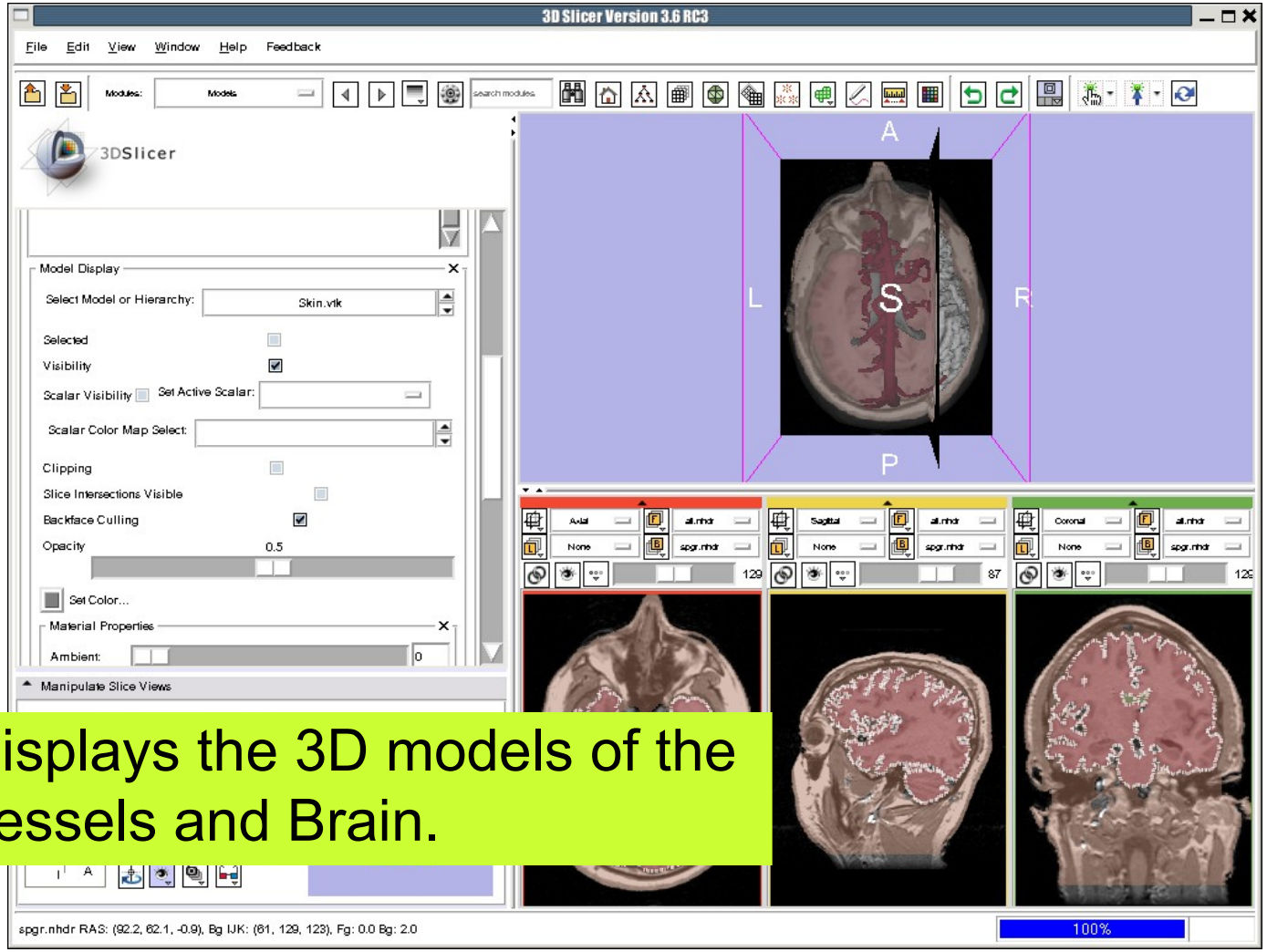
Visualizing a 3D model



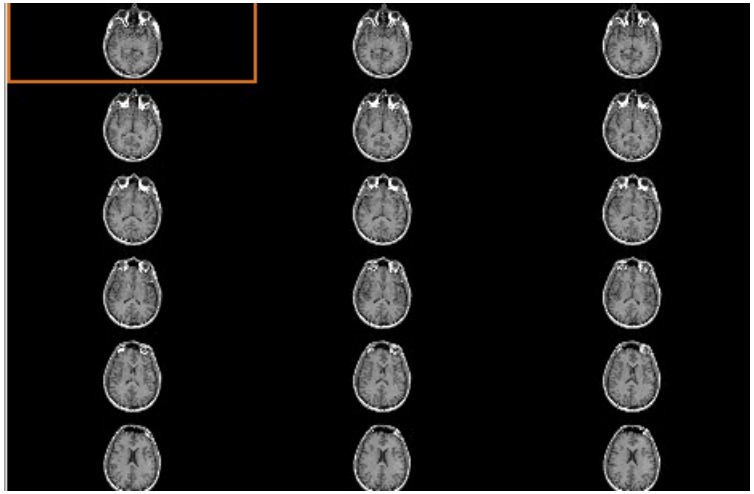
Turn off the **Clipping** option for the Brain model and set the **Yellow Slice Clipping** to **Off**

Turn on the visibility of the Skin model

Visualizing a 3D model

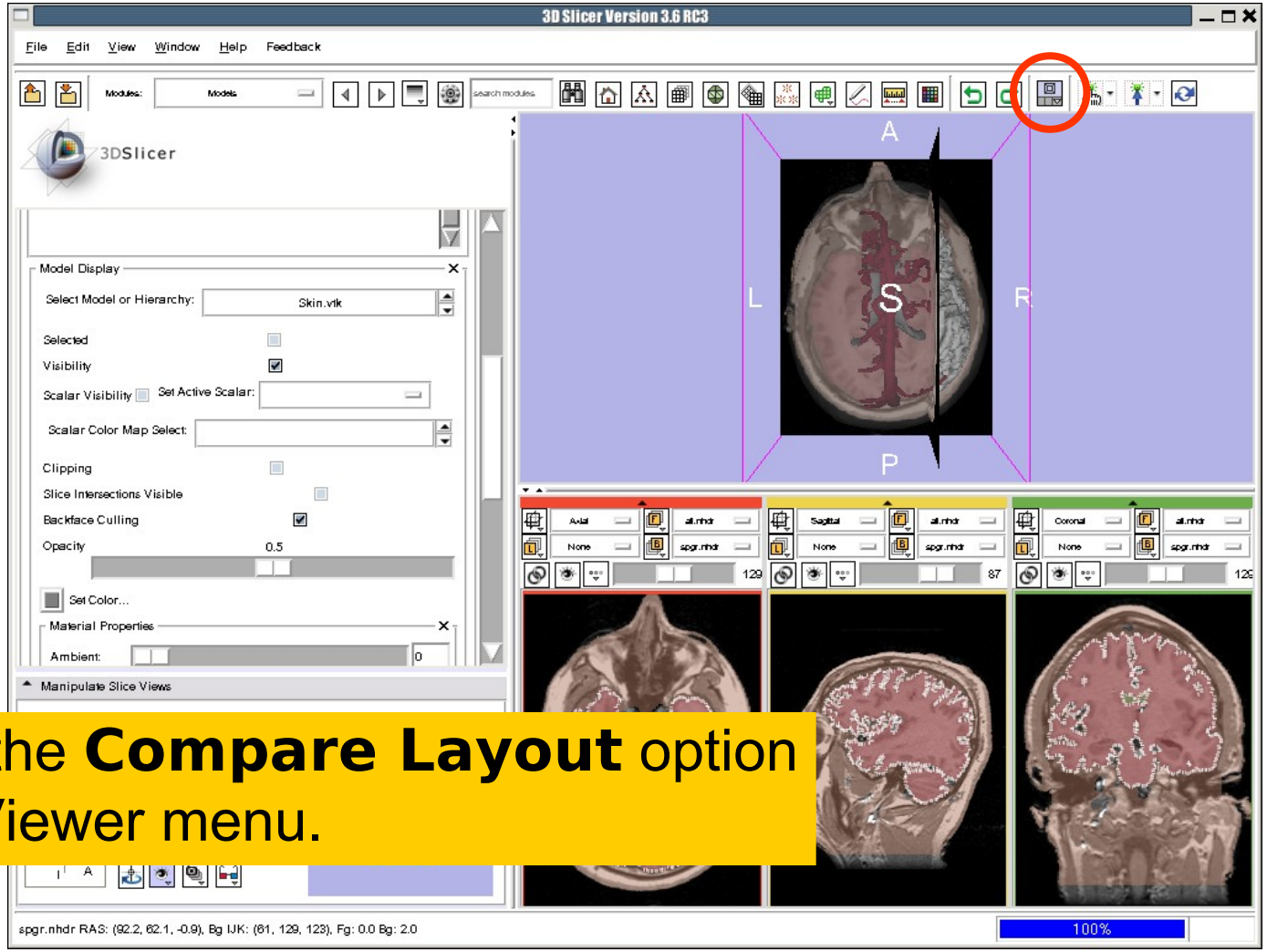


Slicer displays the 3D models of the Skin, Vessels and Brain.



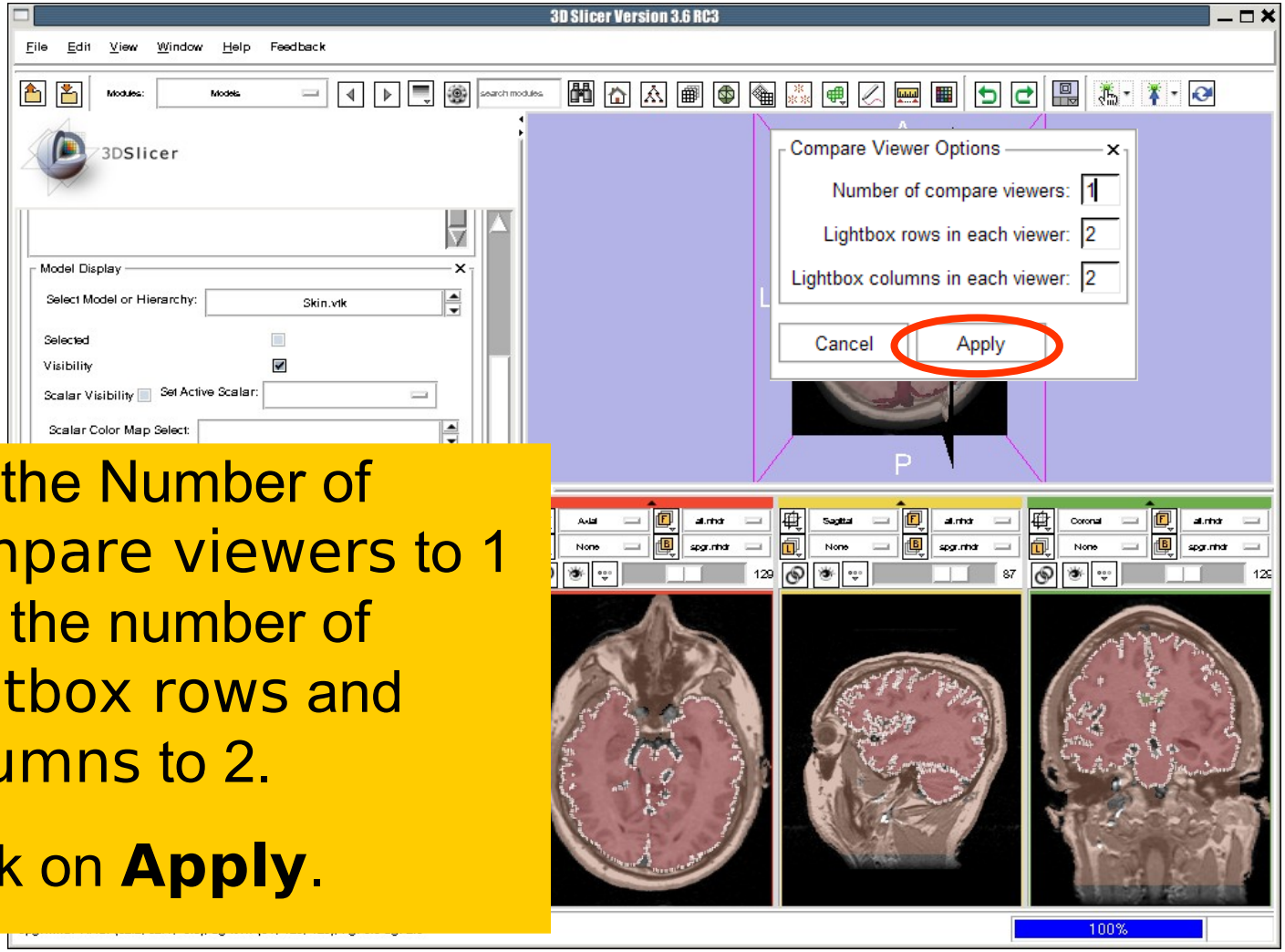
Part 4: Lightbox viewer

Visualizing a 3D model



Select the **Compare Layout** option in the Viewer menu.

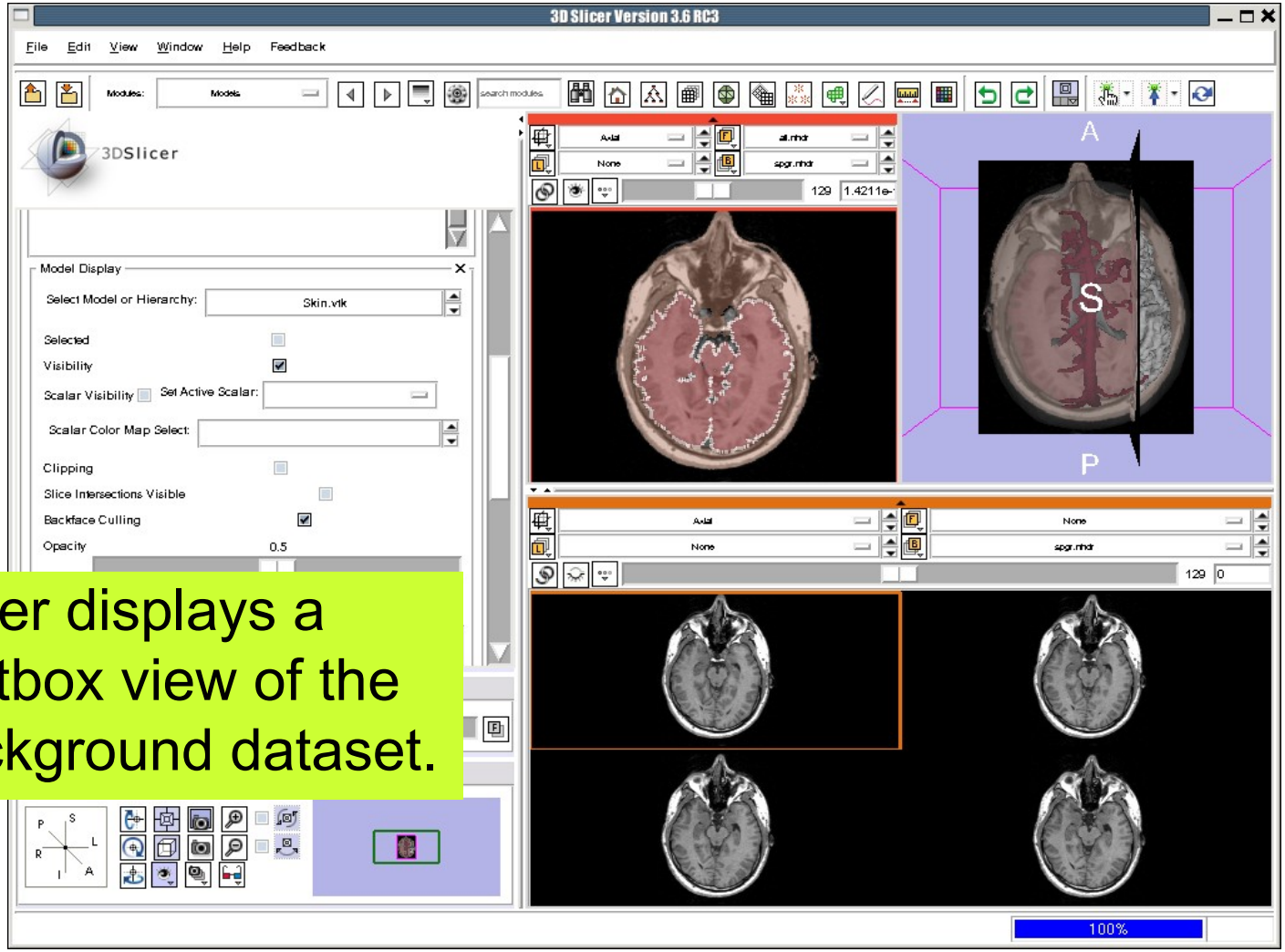
Visualizing a 3D model



Set the Number of compare viewers to 1 and the number of lightbox rows and columns to 2.

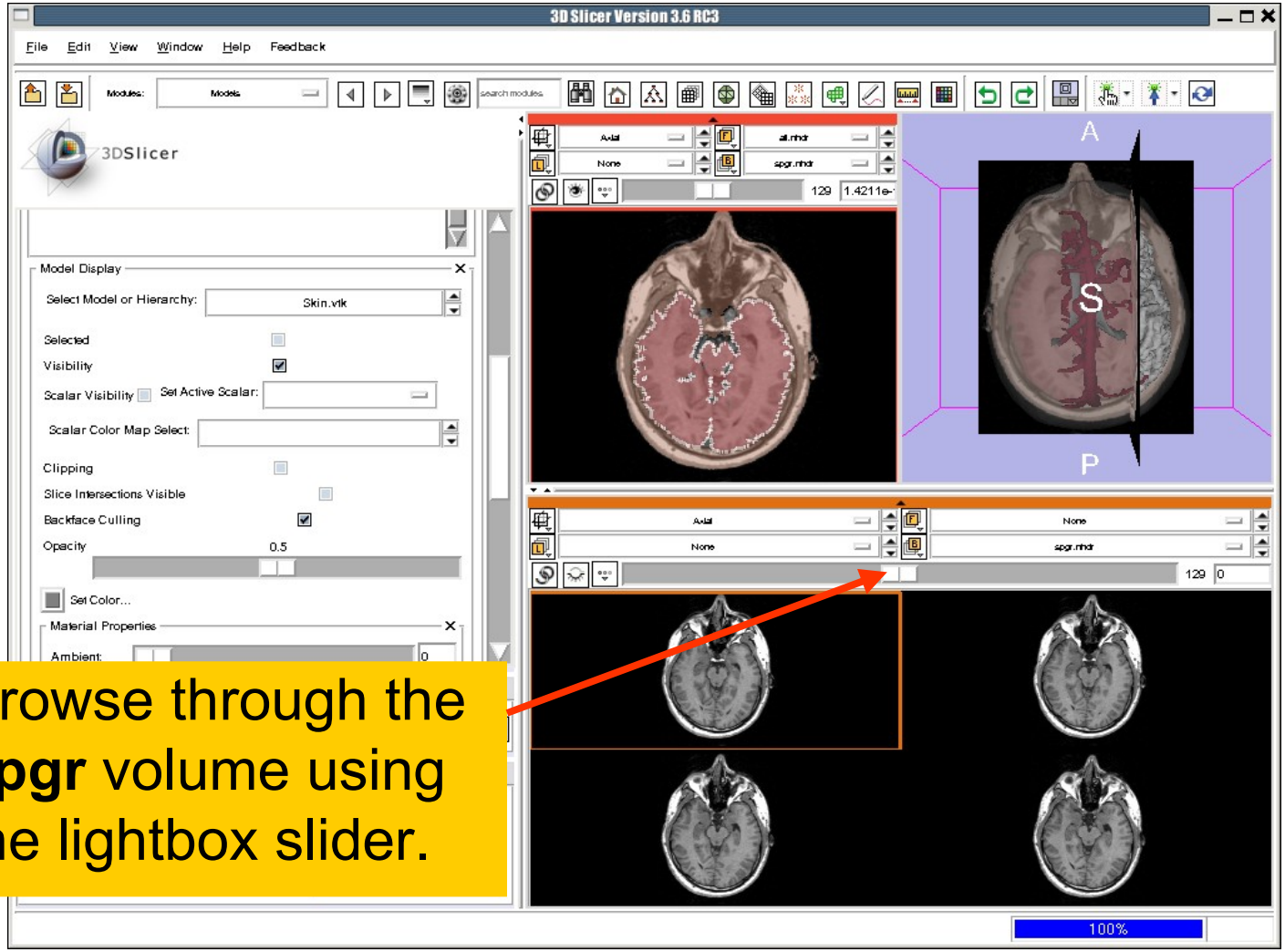
Click on **Apply**.

Lightbox viewer



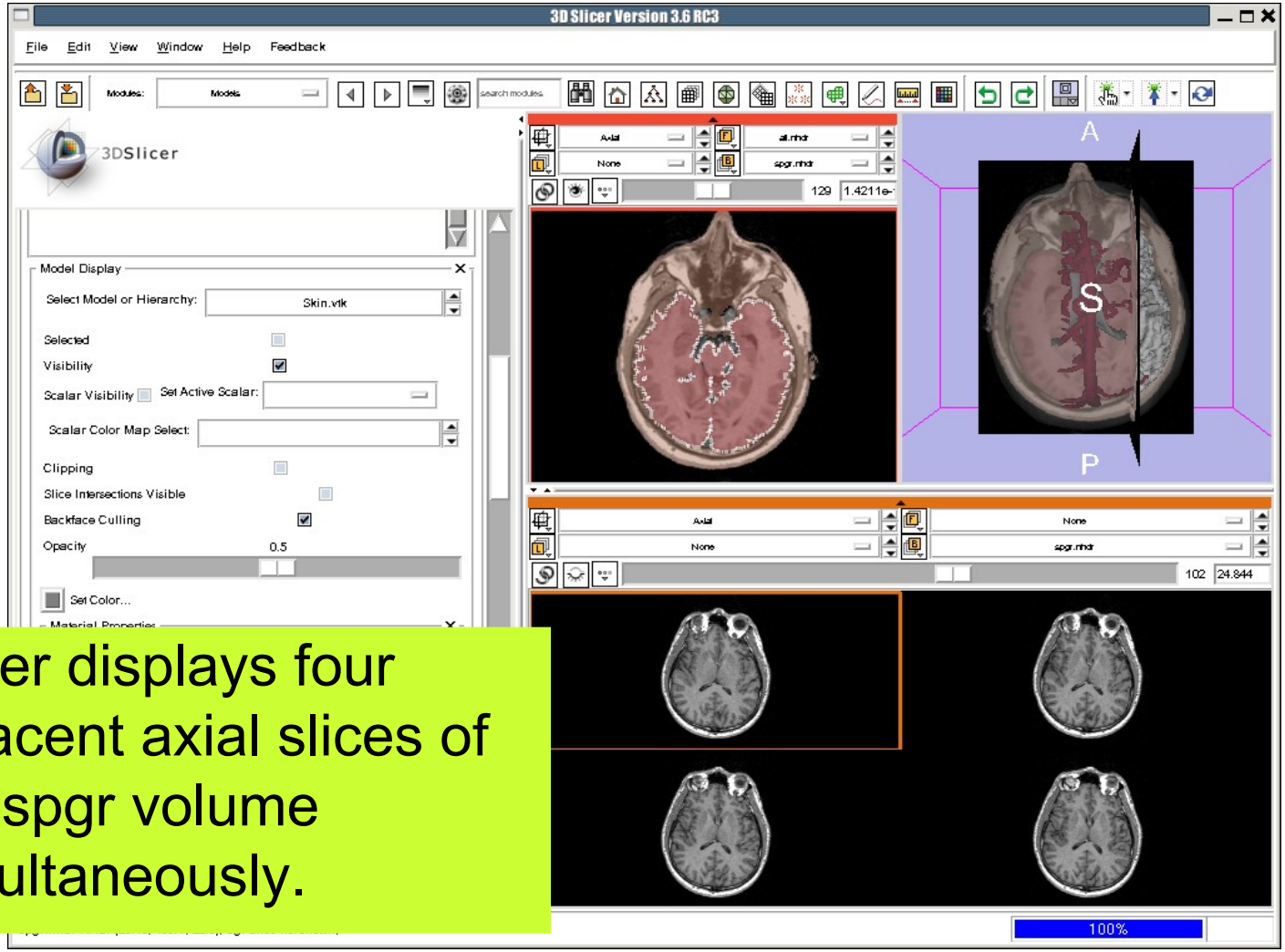
Slicer displays a lightbox view of the Background dataset.

Lightbox viewer



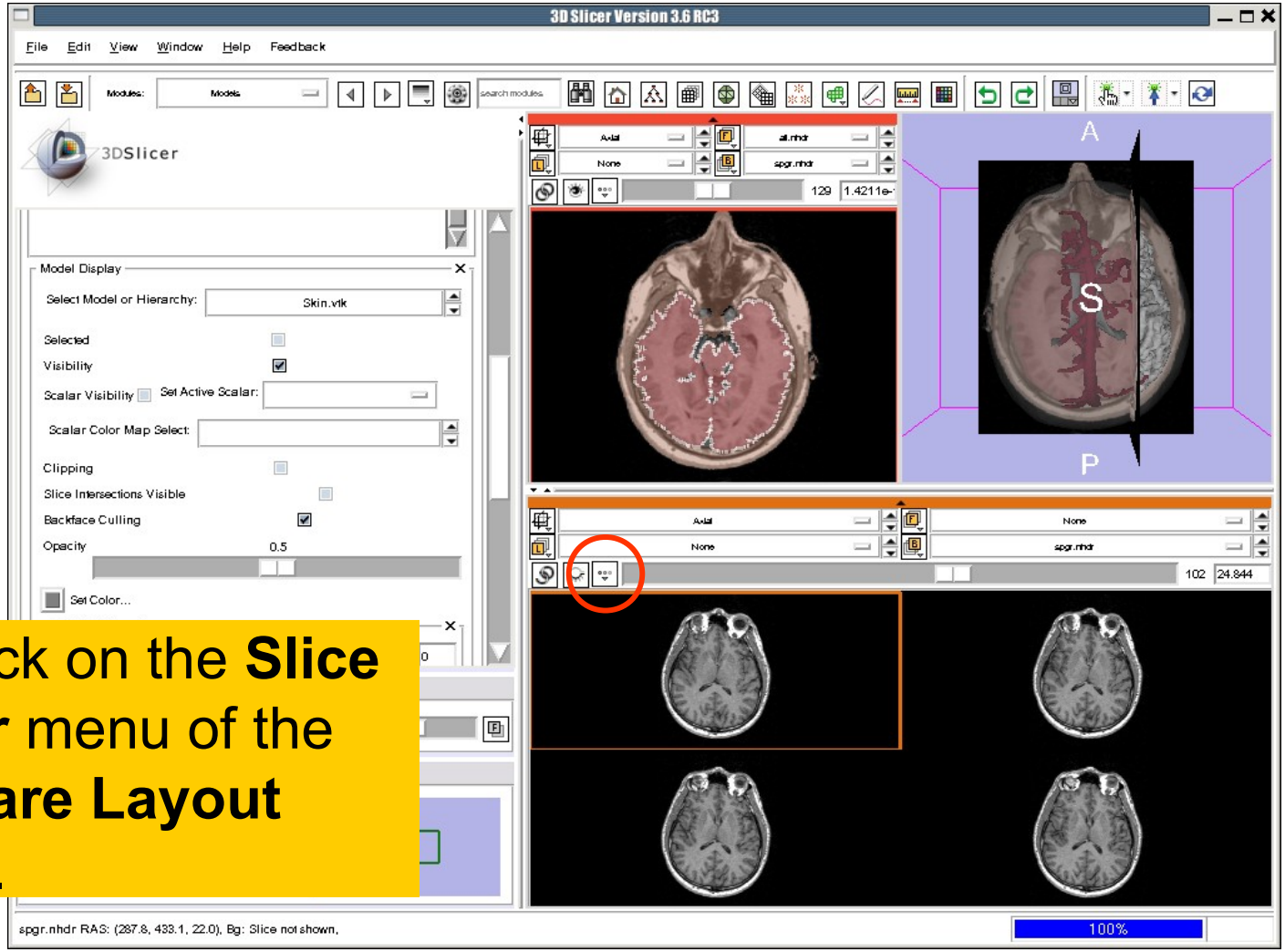
Browse through the **spgr** volume using the lightbox slider.

Lightbox viewer



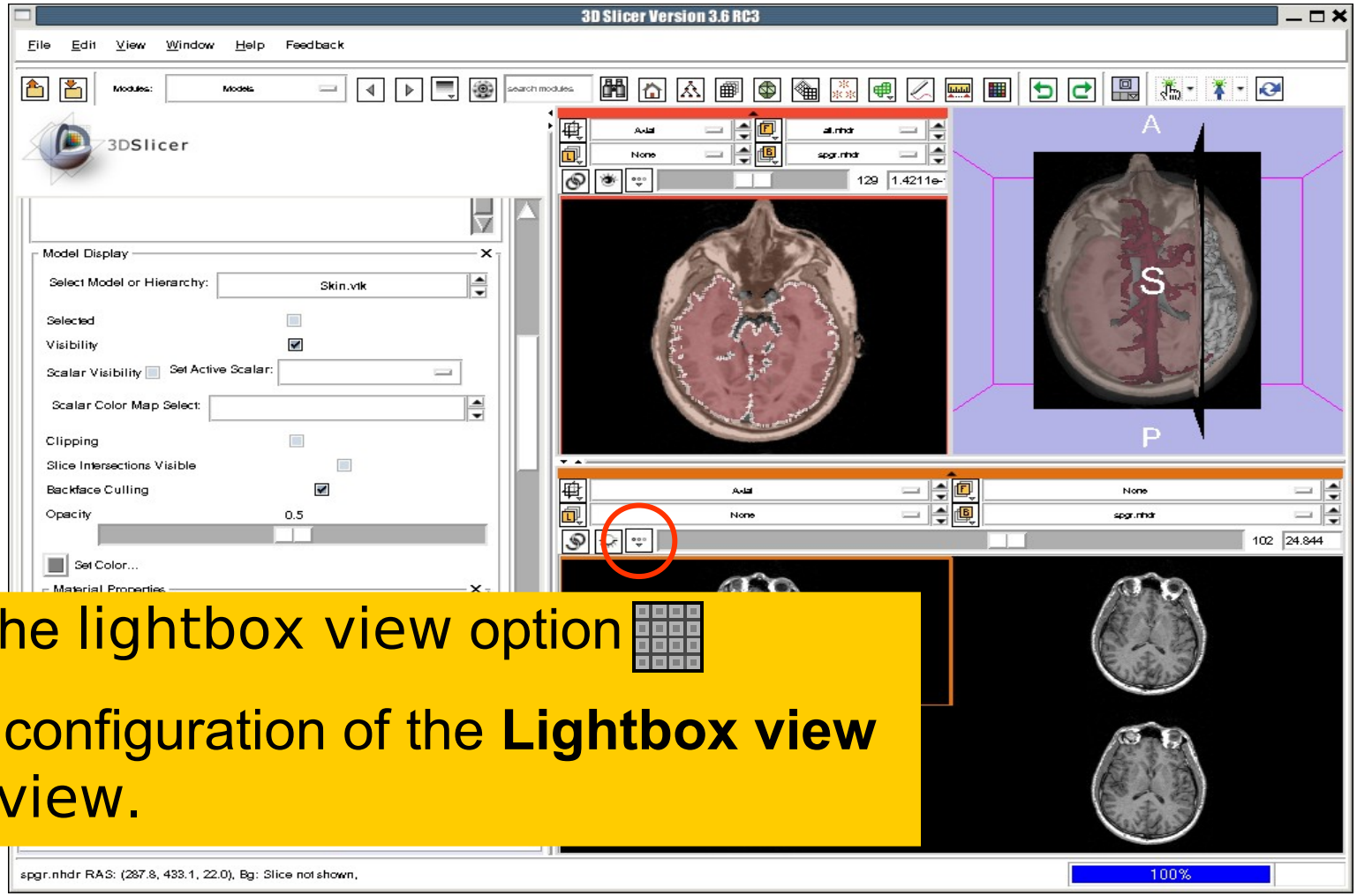
Slicer displays four adjacent axial slices of the spgr volume simultaneously.

Lightbox viewer



Left click on the **Slice Viewer** menu of the **Compare Layout** viewer.

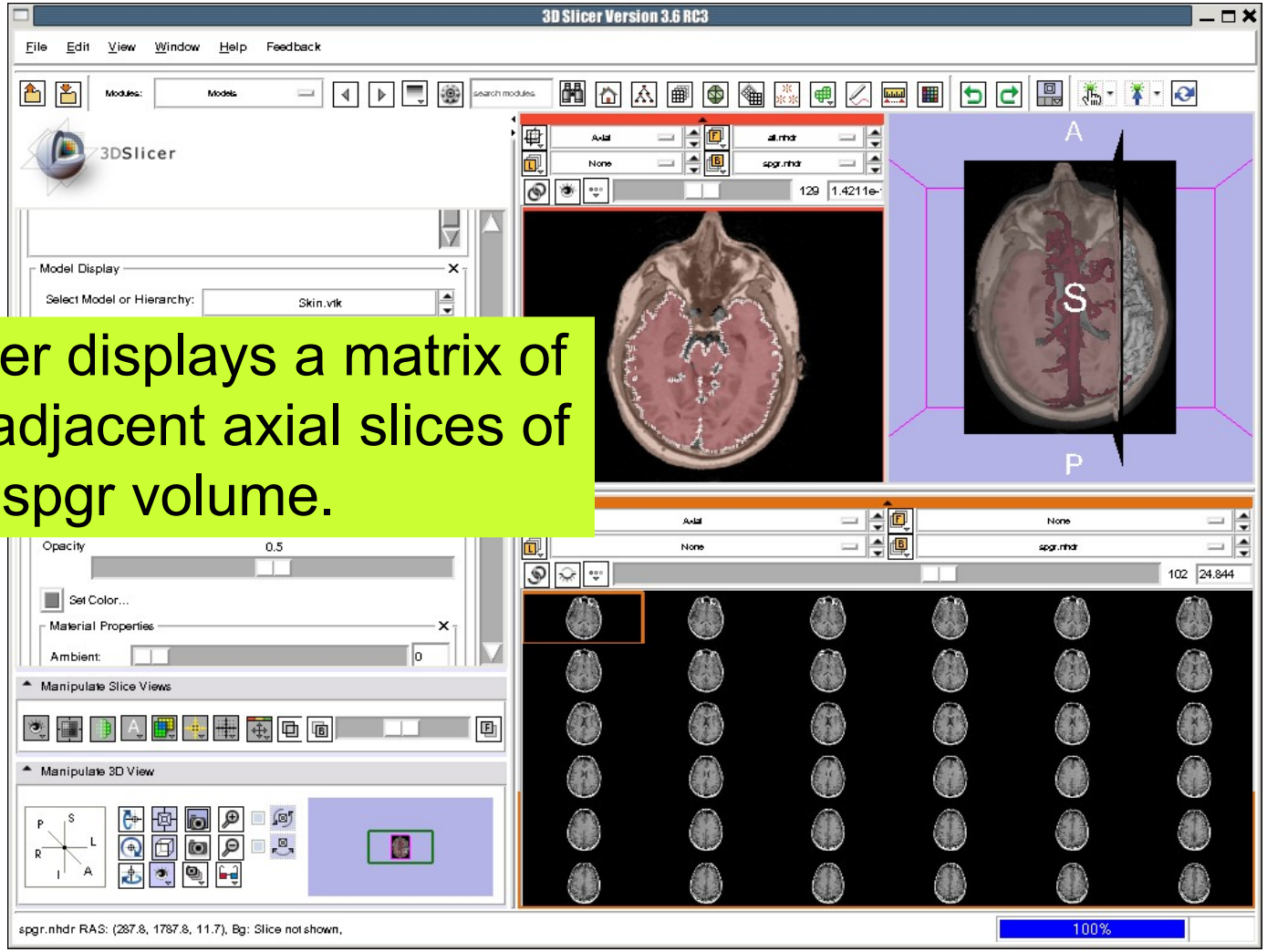
Lightbox viewer



Select the lightbox view option

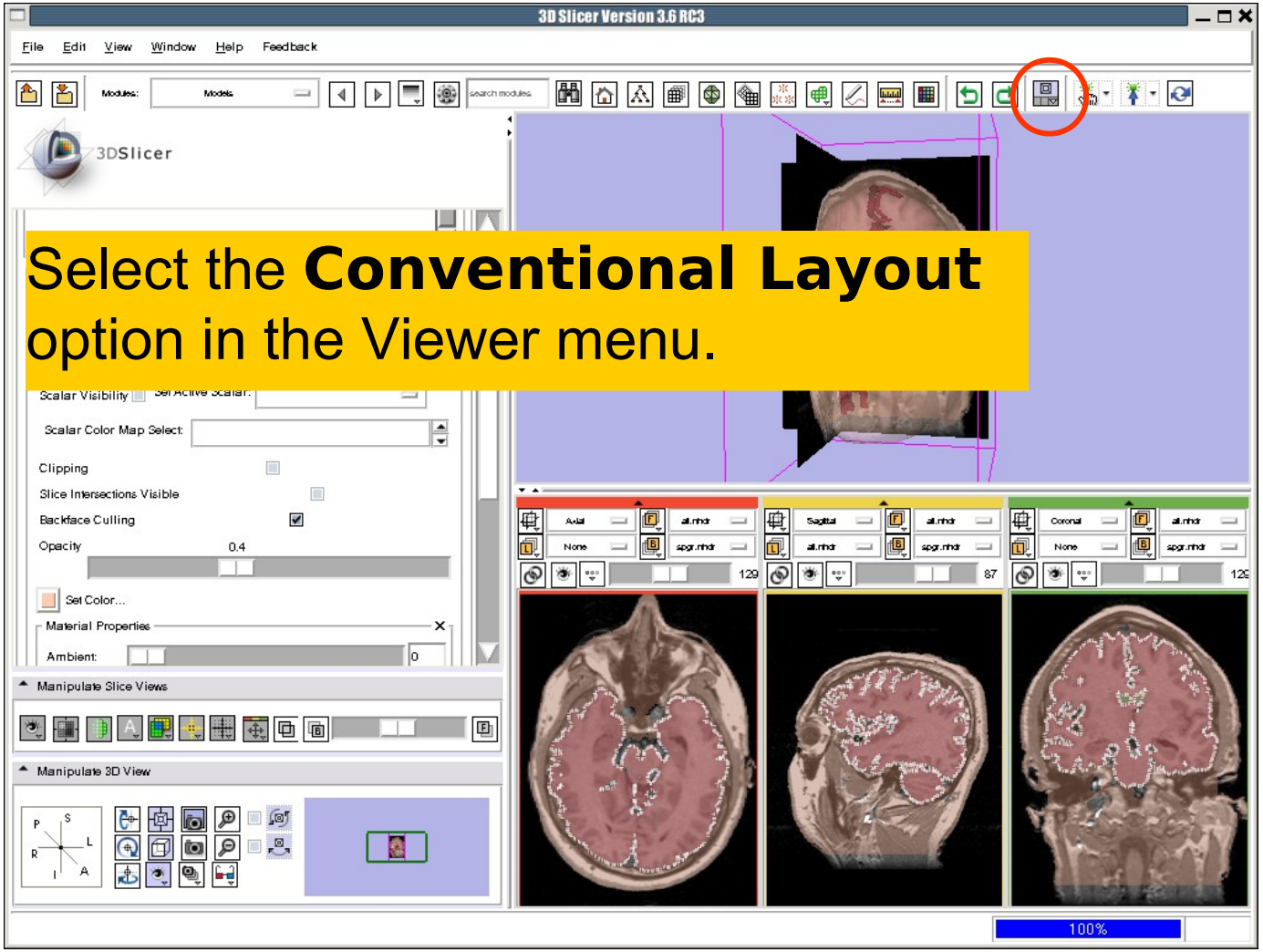
Set the configuration of the **Lightbox view** to 6x6 view.

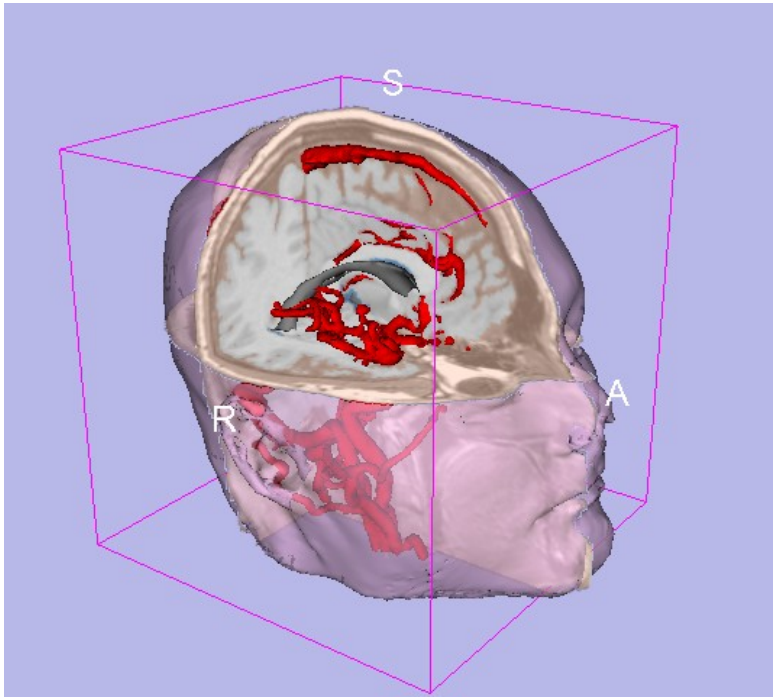
Lightbox viewer



Slicer displays a matrix of 36 adjacent axial slices of the spgr volume.

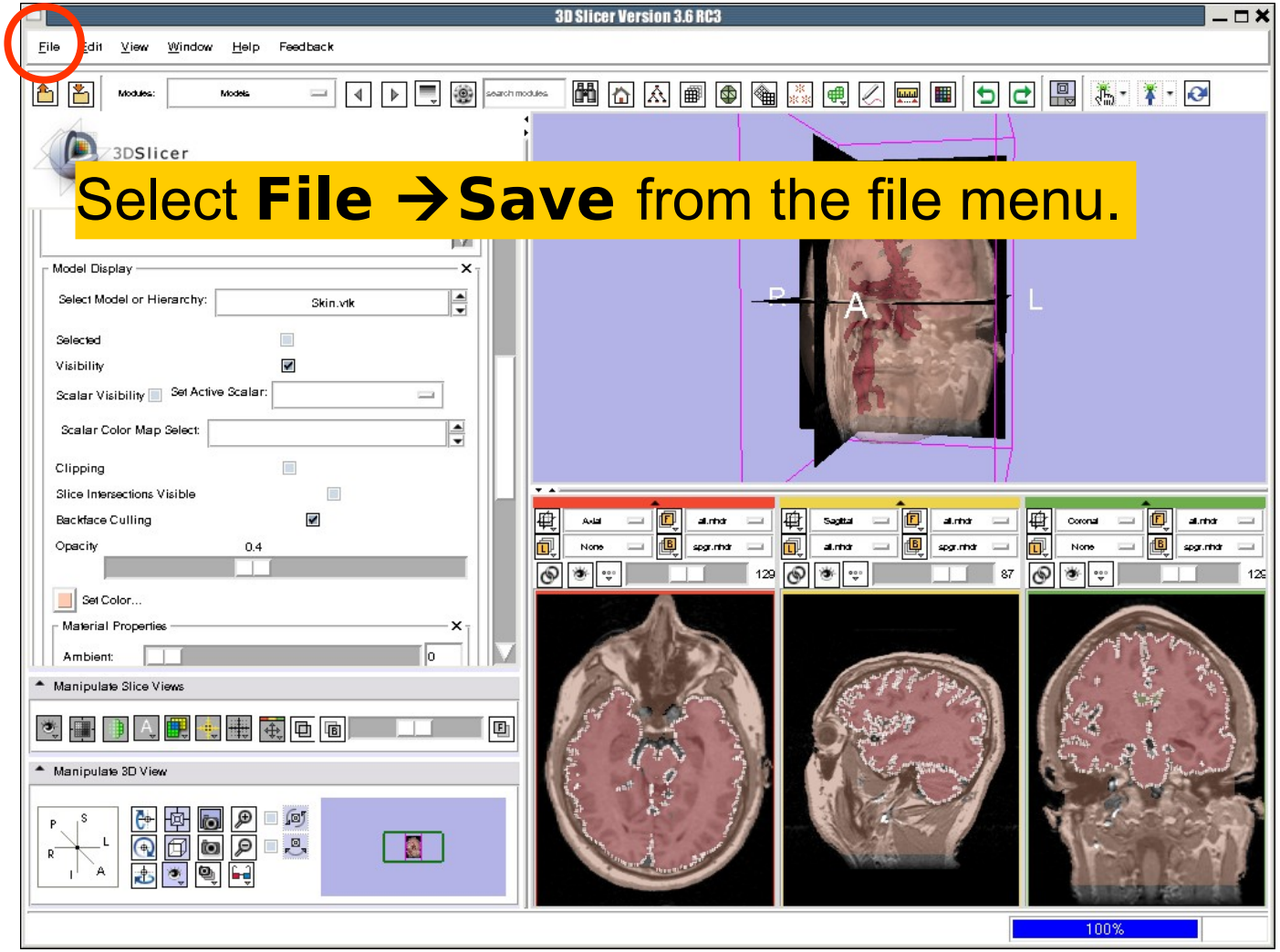
Lightbox viewer





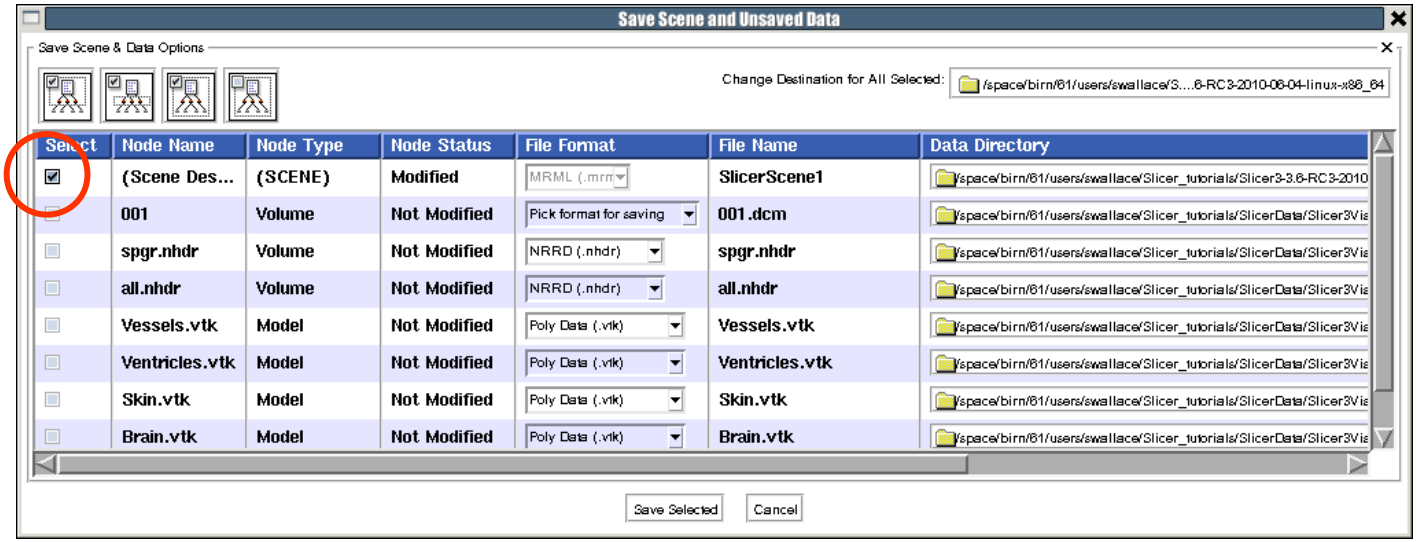
Part 5: Loading and saving a Scene

Saving Data



Saving Data

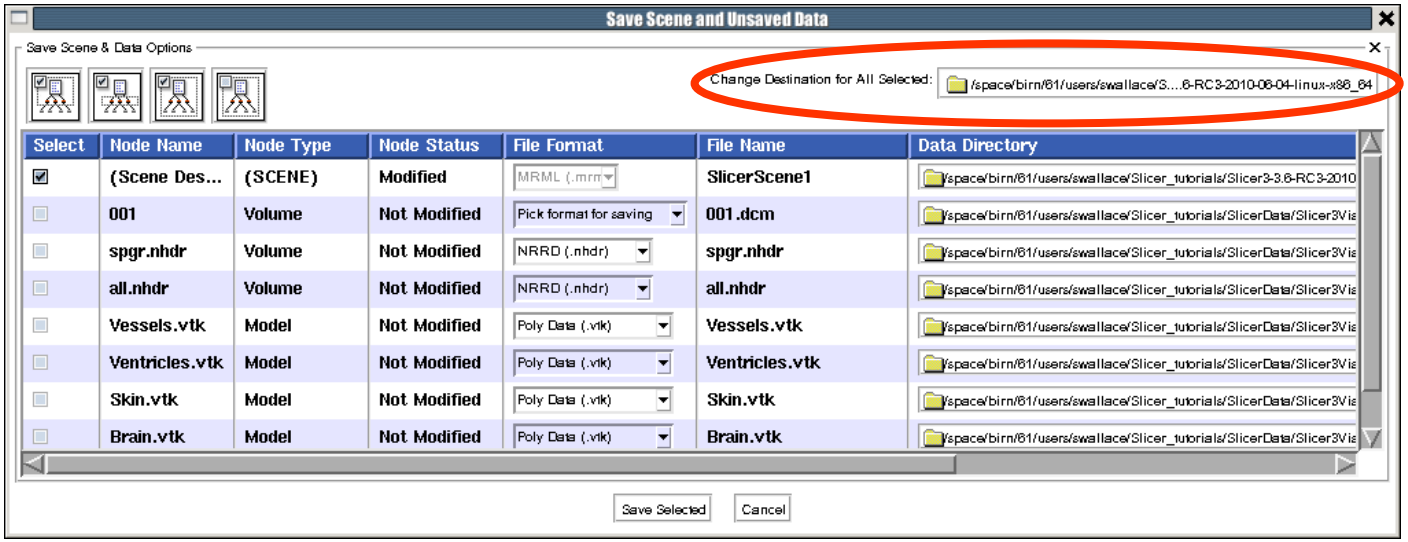
The list of elements currently loaded into Slicer3 appears.



Make sure only the first check box is selected.

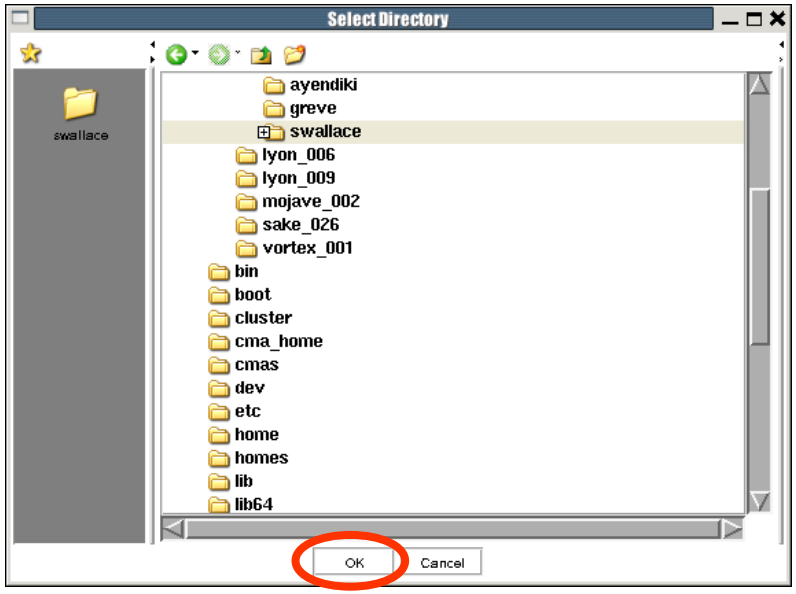
Saving Data

Click on **Change Destination for All Selected** and browse to the location where the scene will be saved.



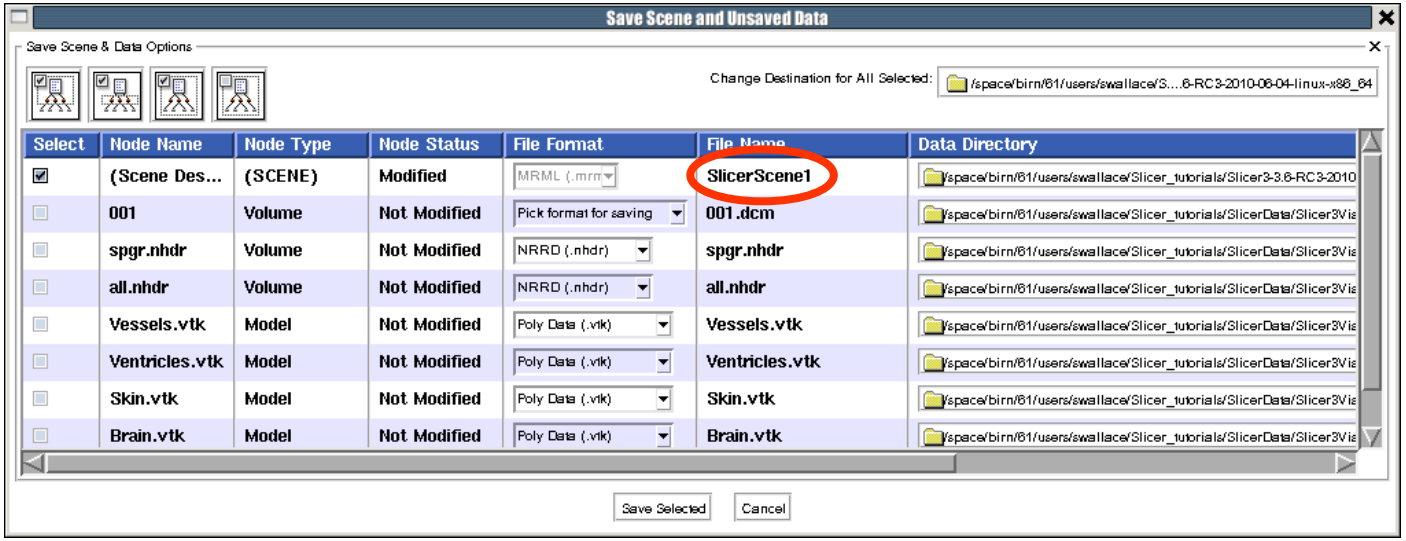
Saving Data

Browse to the directory where you would like to save your scene and click **OK.**



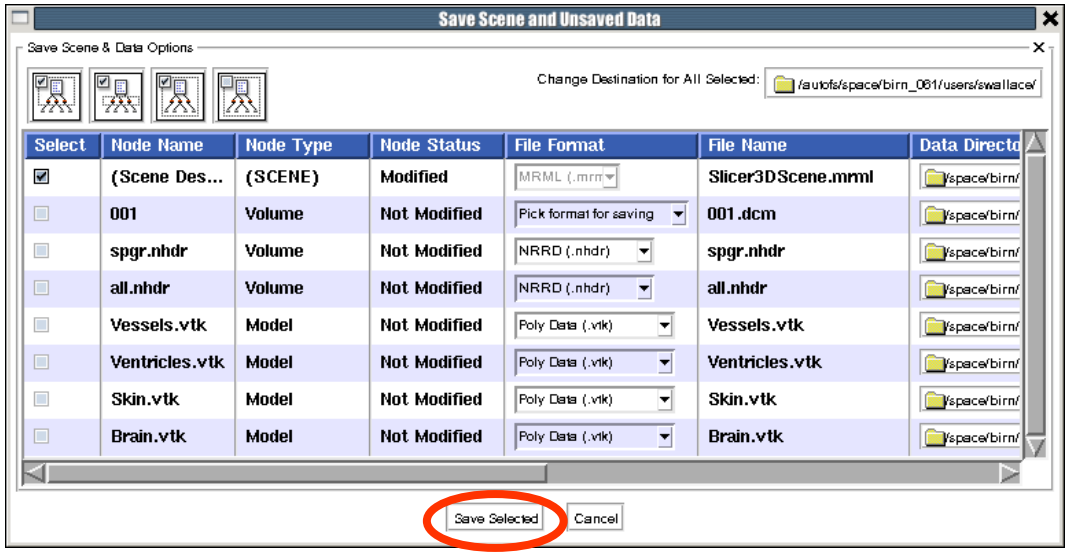
Saving Data

Double click on the file name SlicerScene1 and change it to Slicer3DScene.

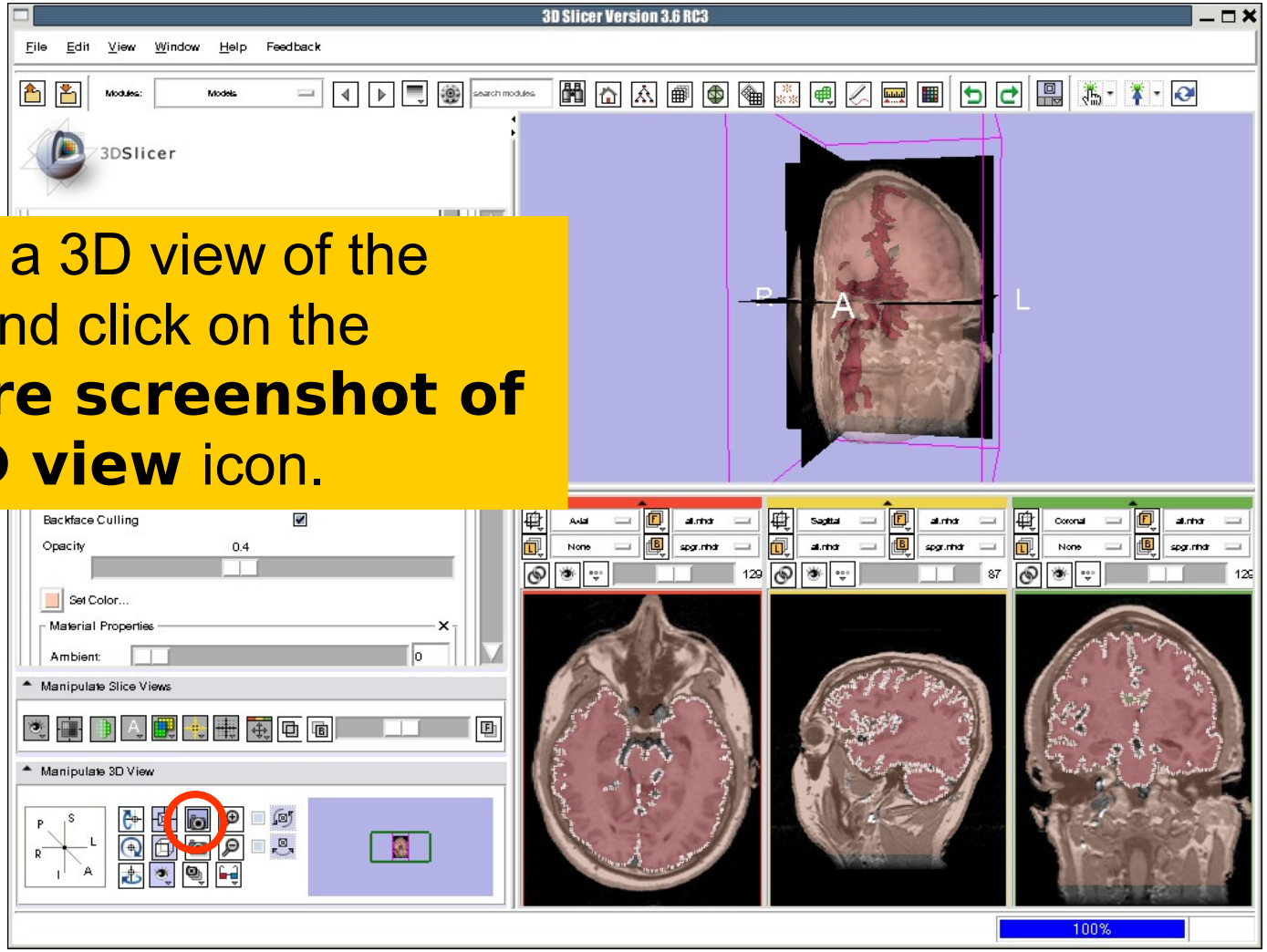


Saving Data

Click on **Save Selected.**



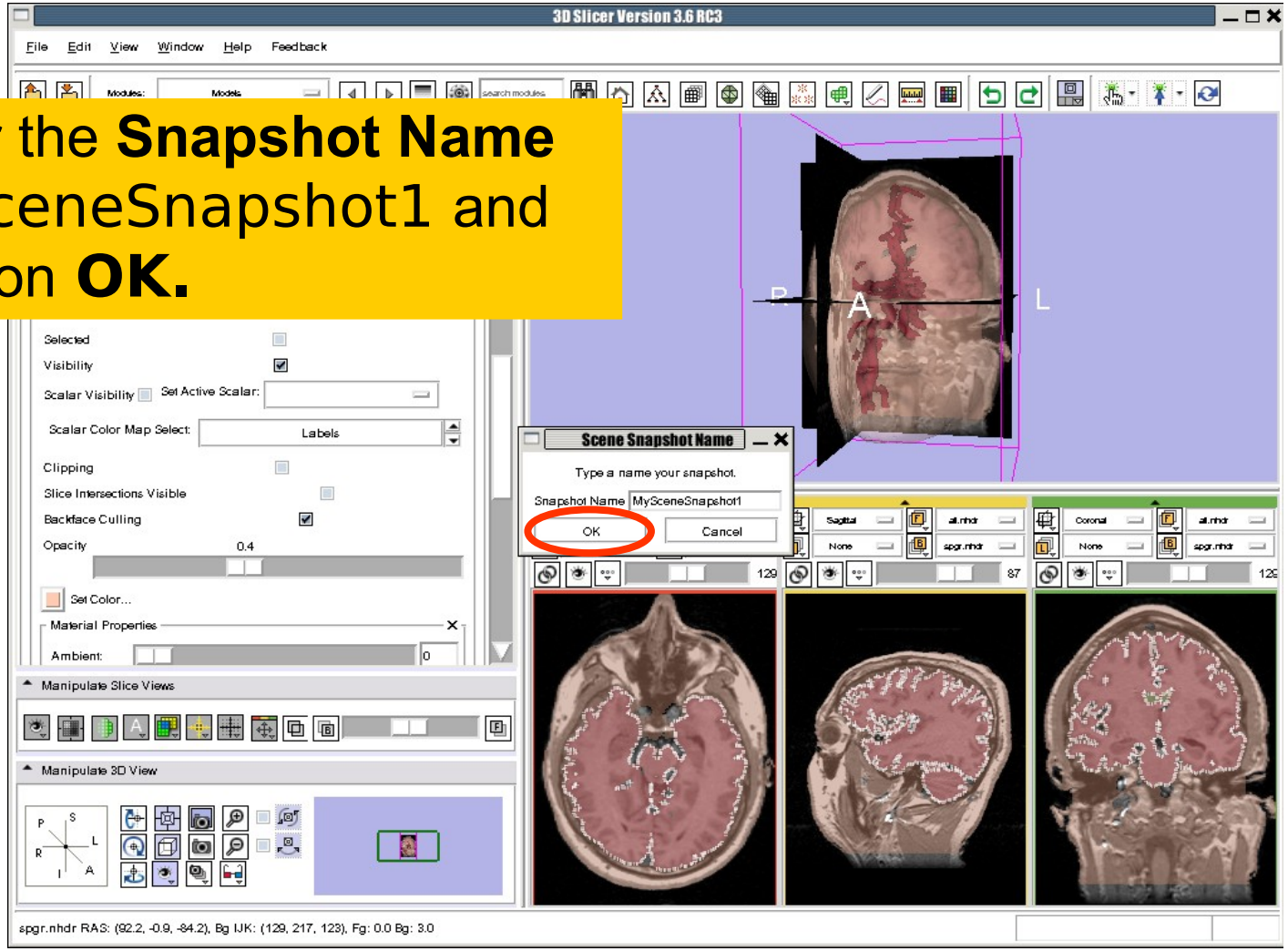
Creating Scene Snapshots



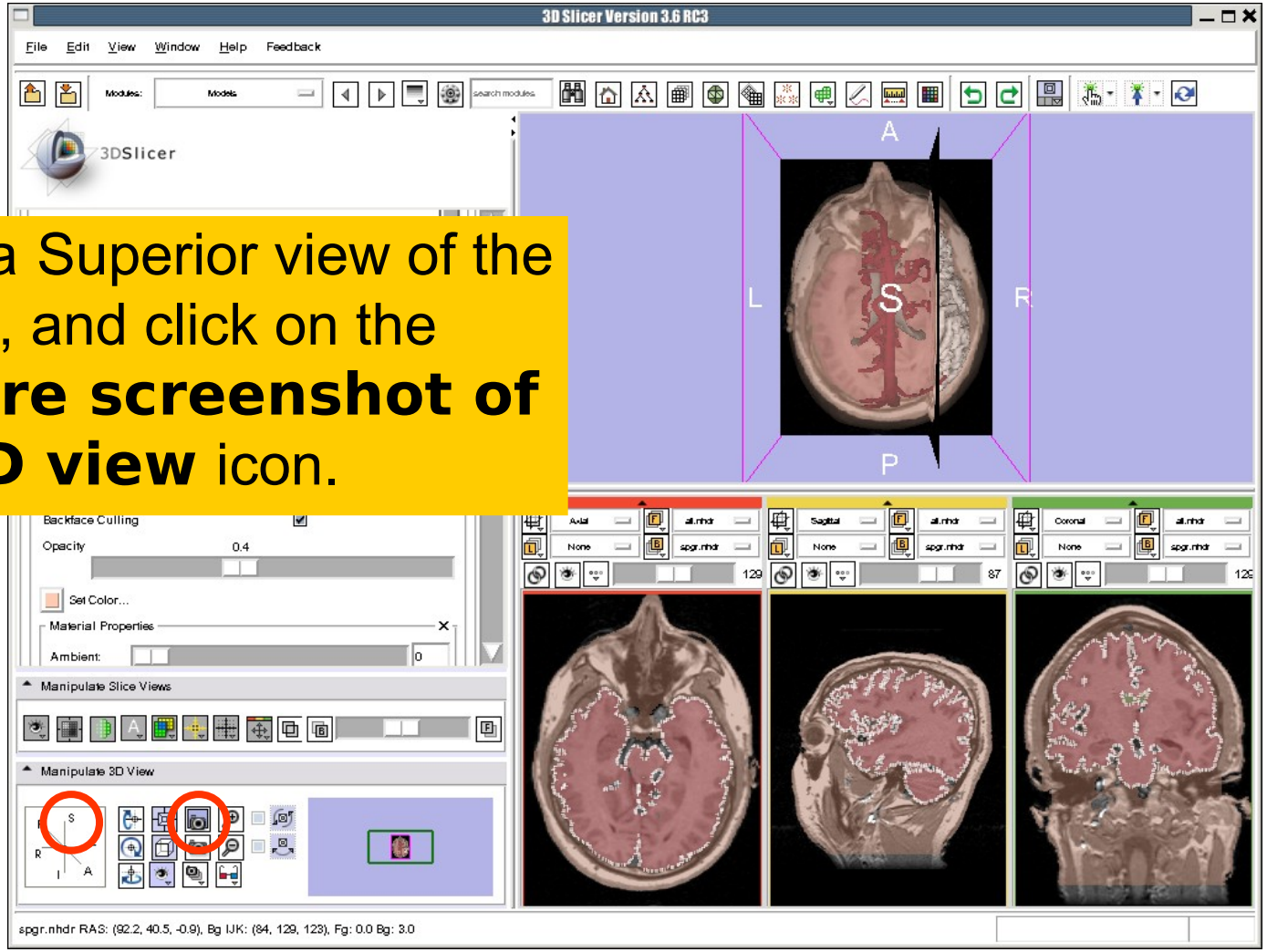
Choose a 3D view of the scene and click on the **Capture screenshot of the 3D view** icon.

Creating Scene Snapshots

Enter the **Snapshot Name** MySceneSnapshot1 and click on **OK.**



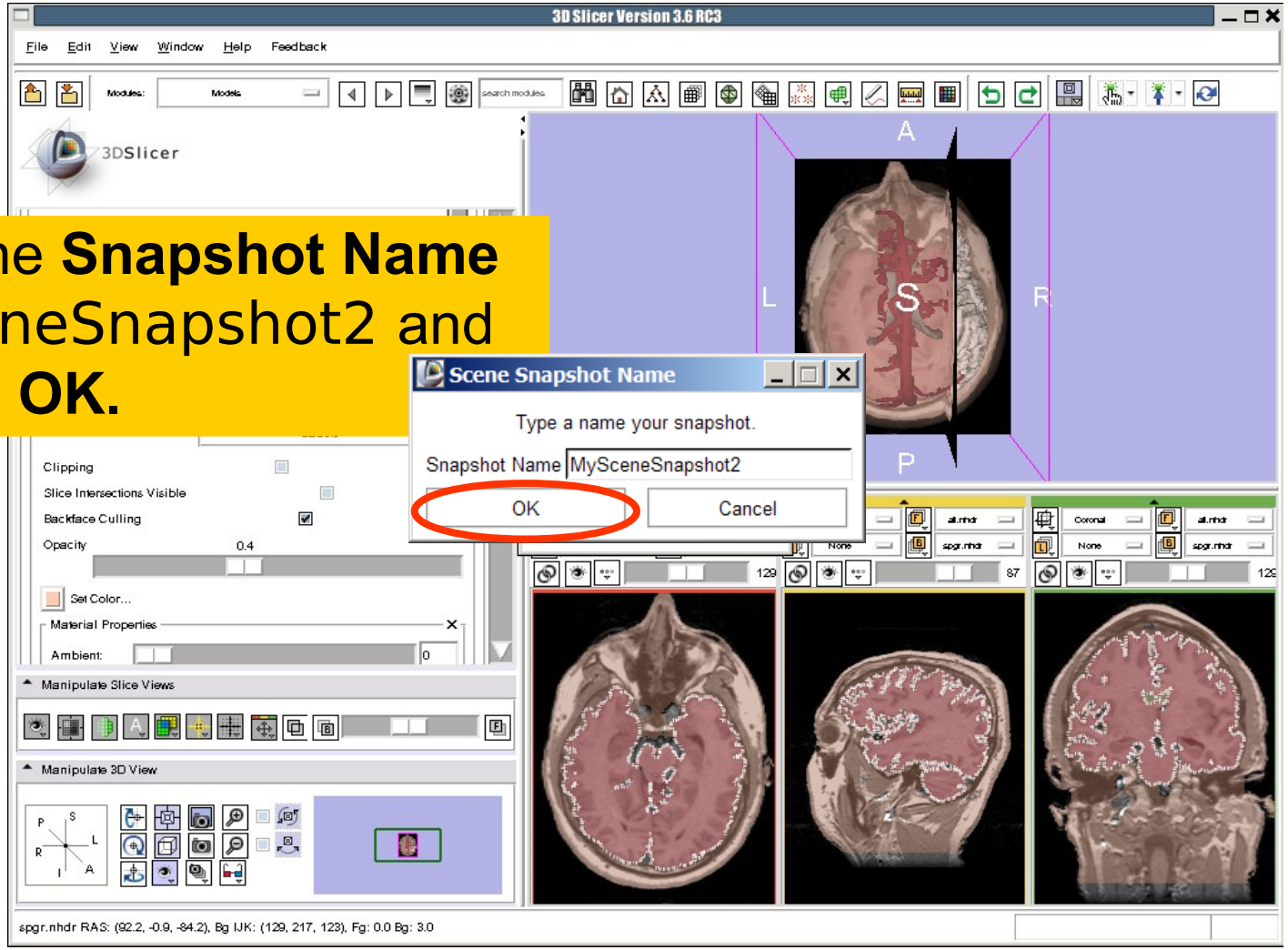
Creating Scene Snapshots



Select a Superior view of the dataset, and click on the **Capture screenshot of the 3D view** icon.

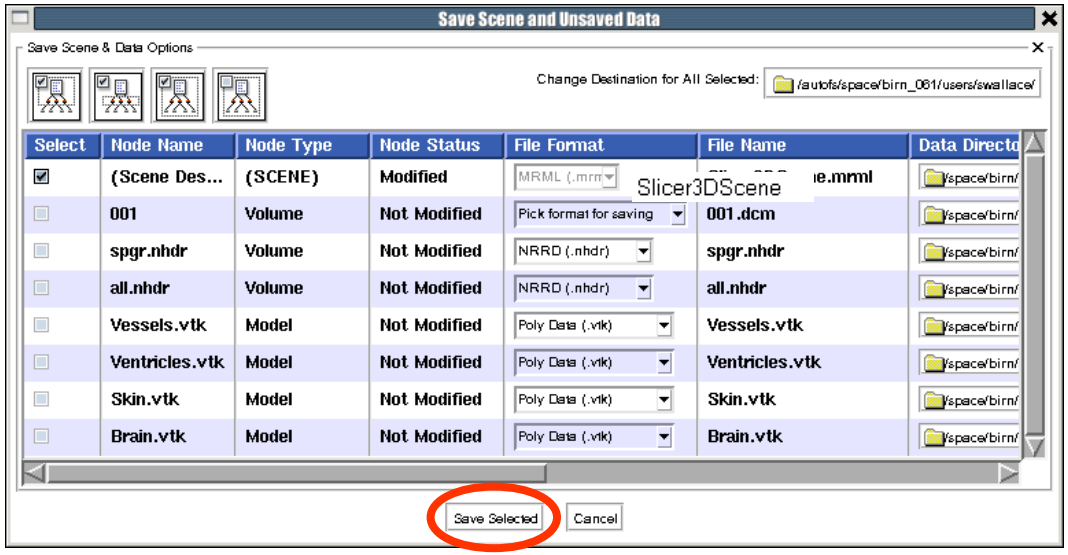
Creating Scene Snapshots

Enter the **Snapshot Name** MySceneSnapshot2 and click on **OK.**



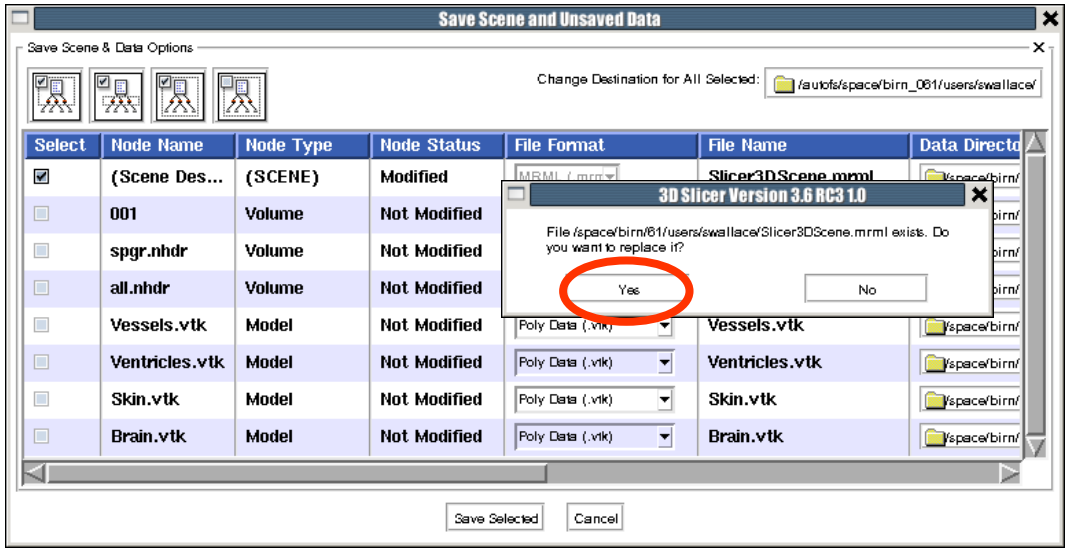
Creating Scene Snapshots

Select **File→Save** and click on **Save Selected** to include the two scene snapshots in the saved scene.

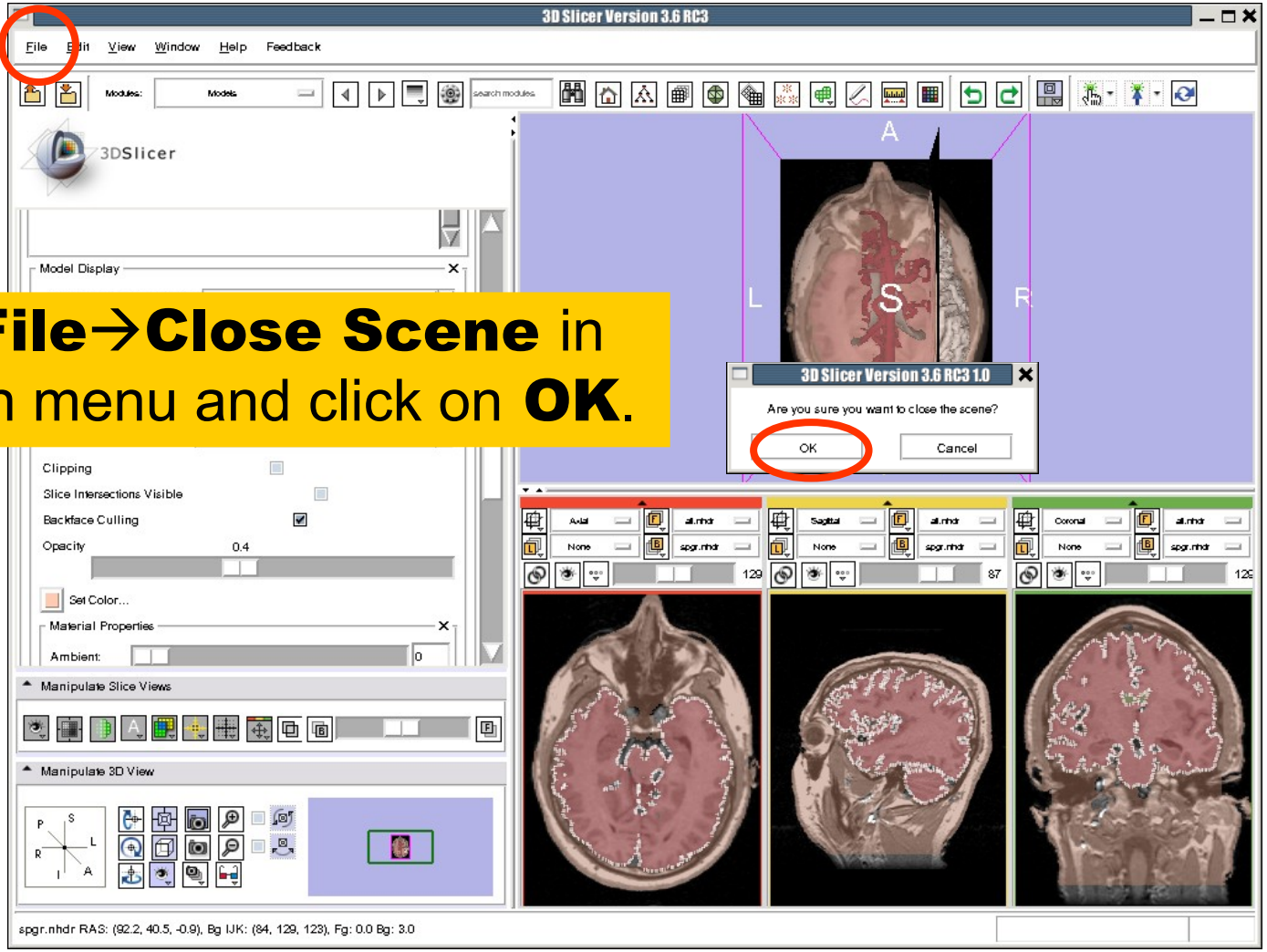


Creating Scene Snapshots

Click **Yes** to overwrite the file with a new file that contains the scene snapshots.

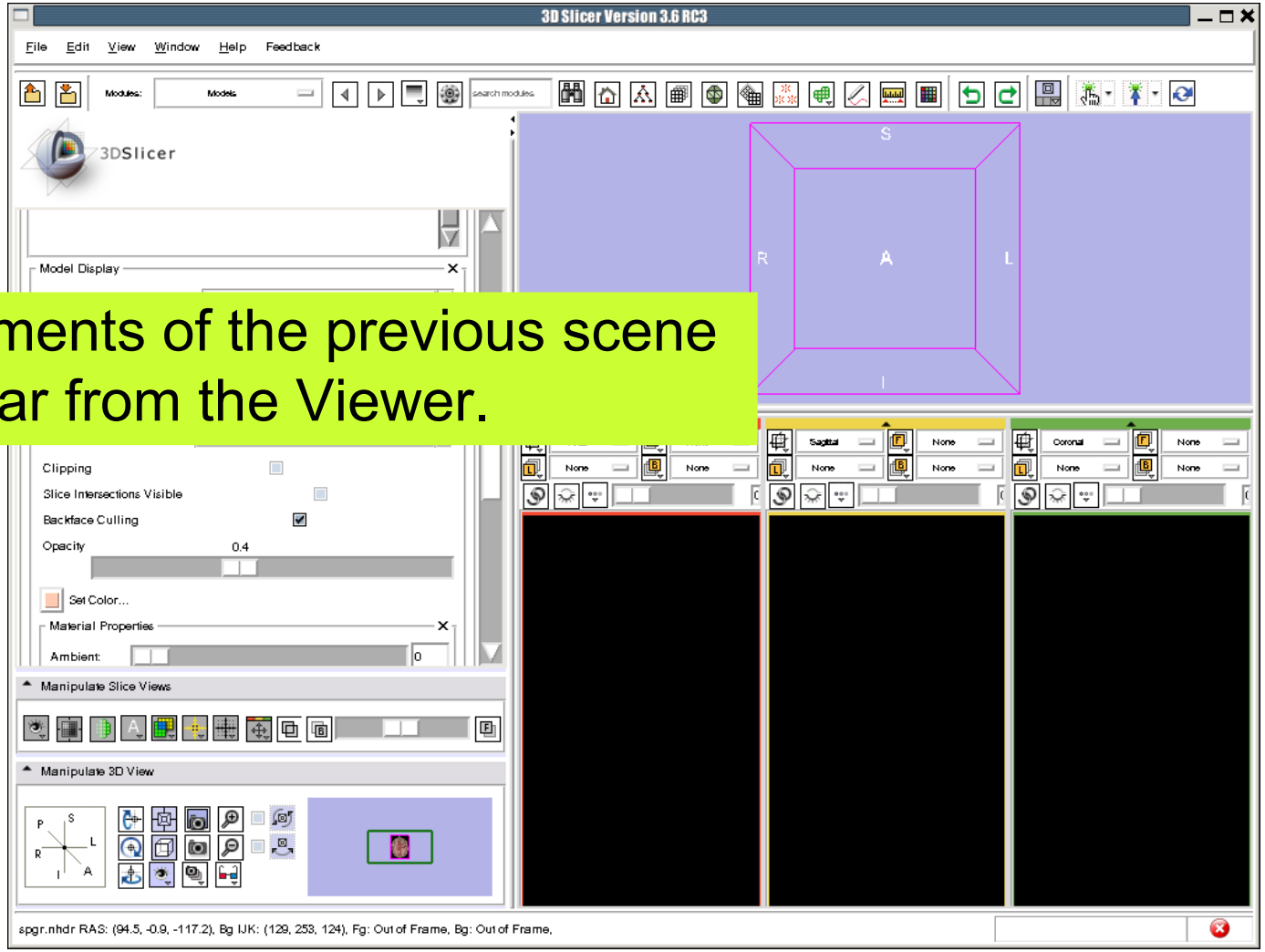


Saving Data



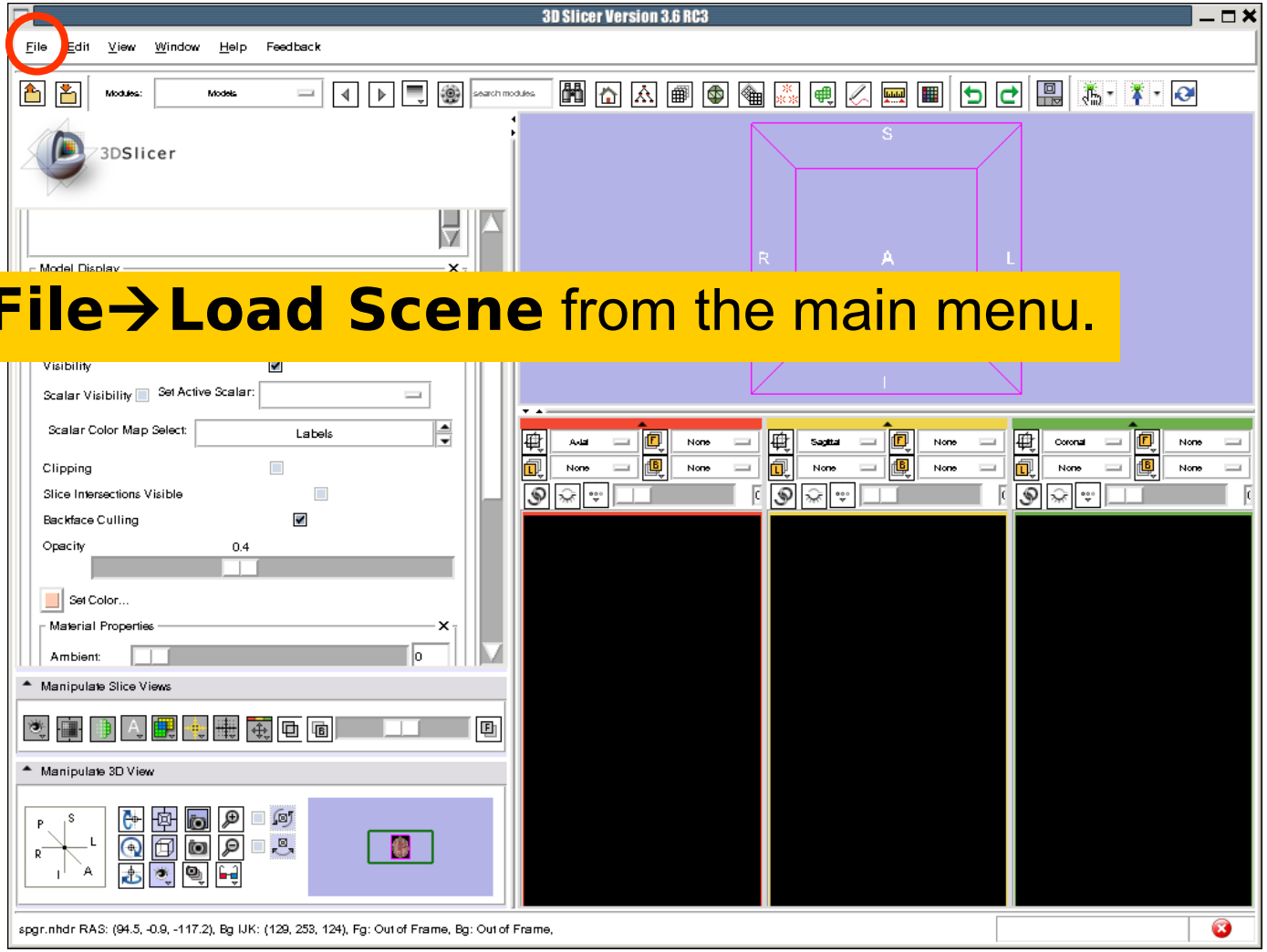
Select **File→Close Scene** in the main menu and click on **OK**.

Saving Data



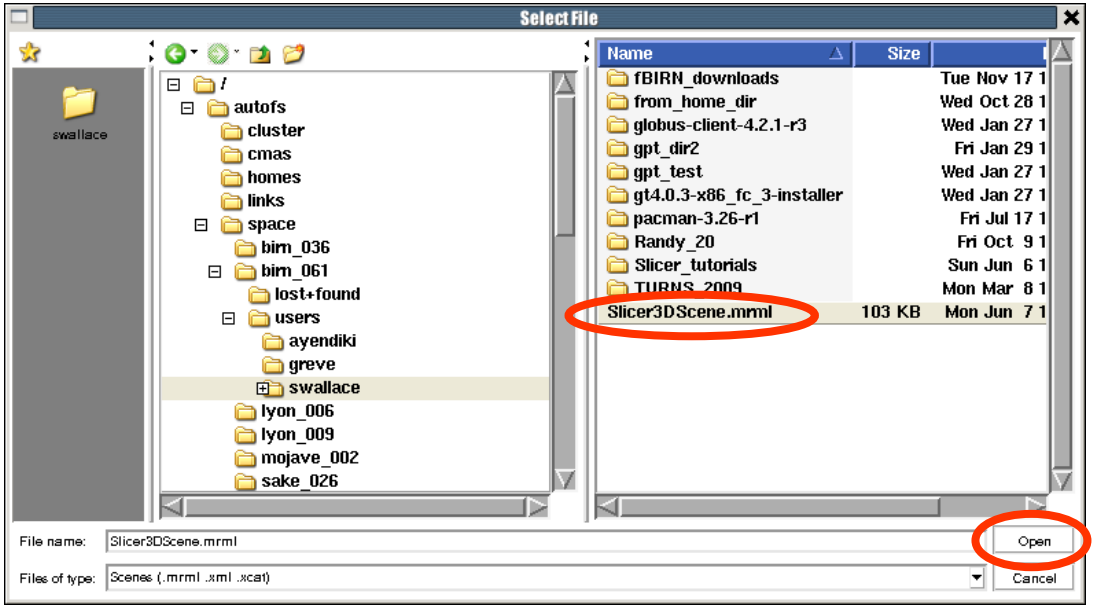
The elements of the previous scene disappear from the Viewer.

Saving Data

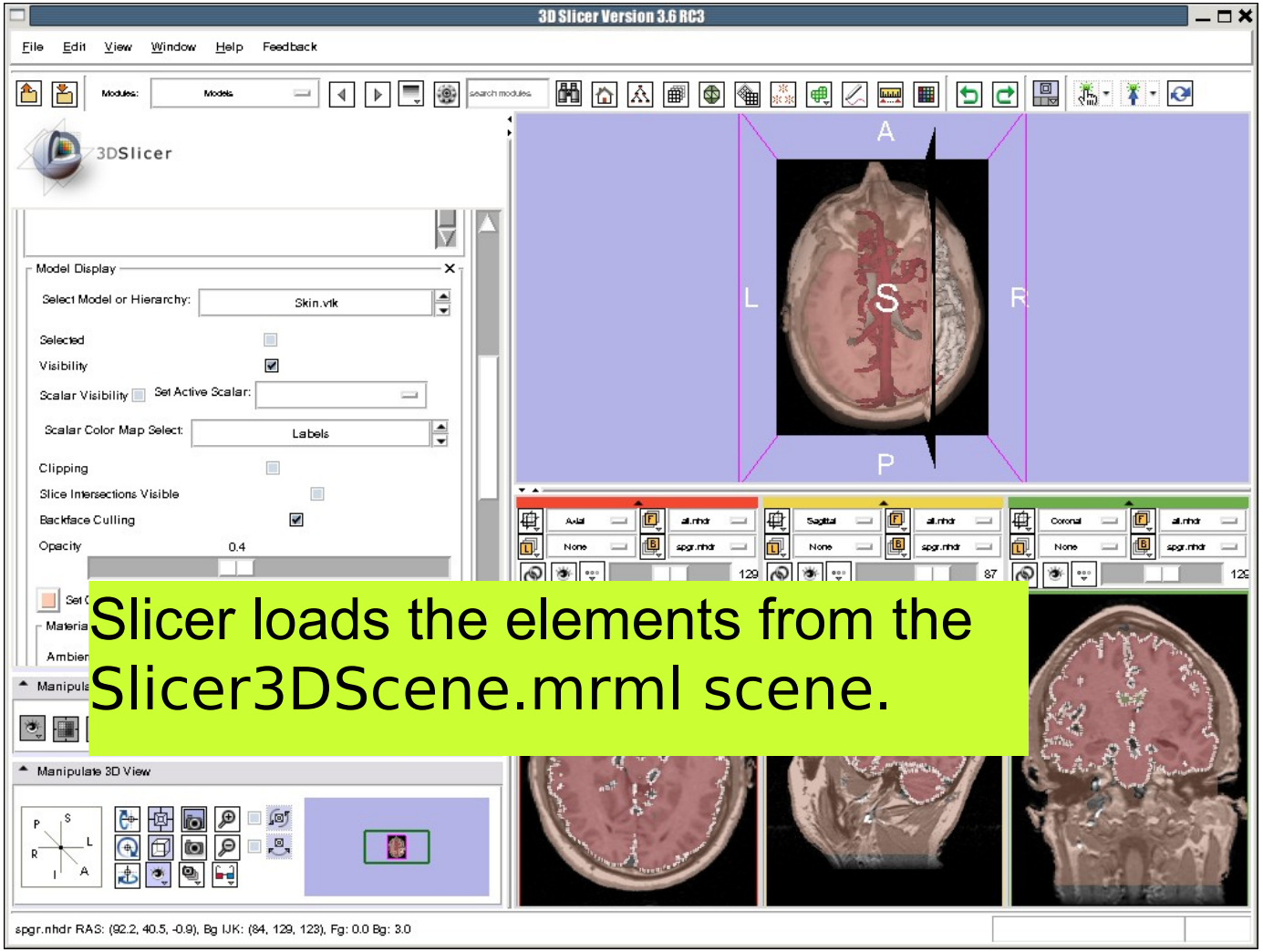


Saving Data

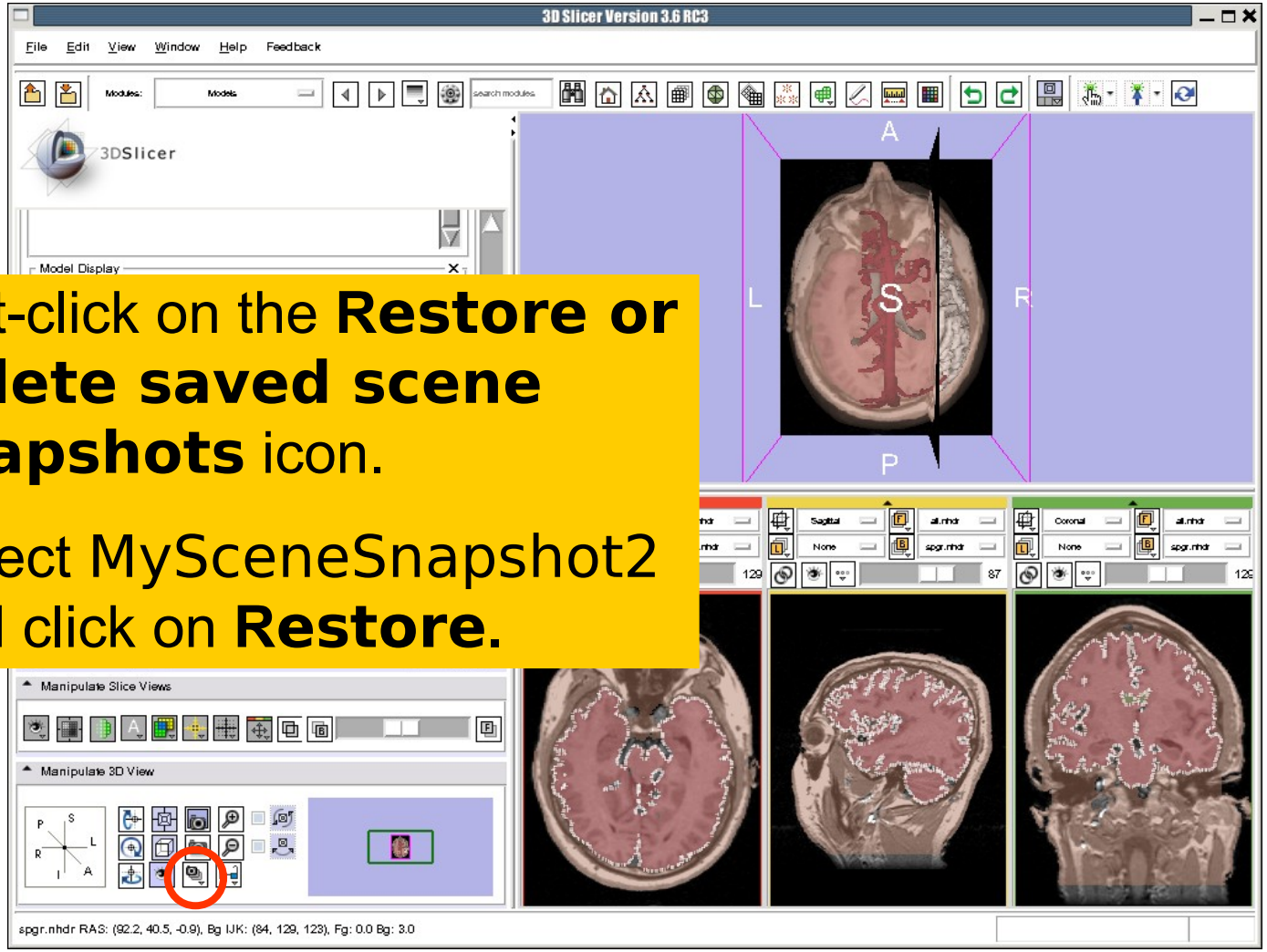
Browse to find the **Slicer3DScene.mrml** file and click on **Open**.



Loading a Scene



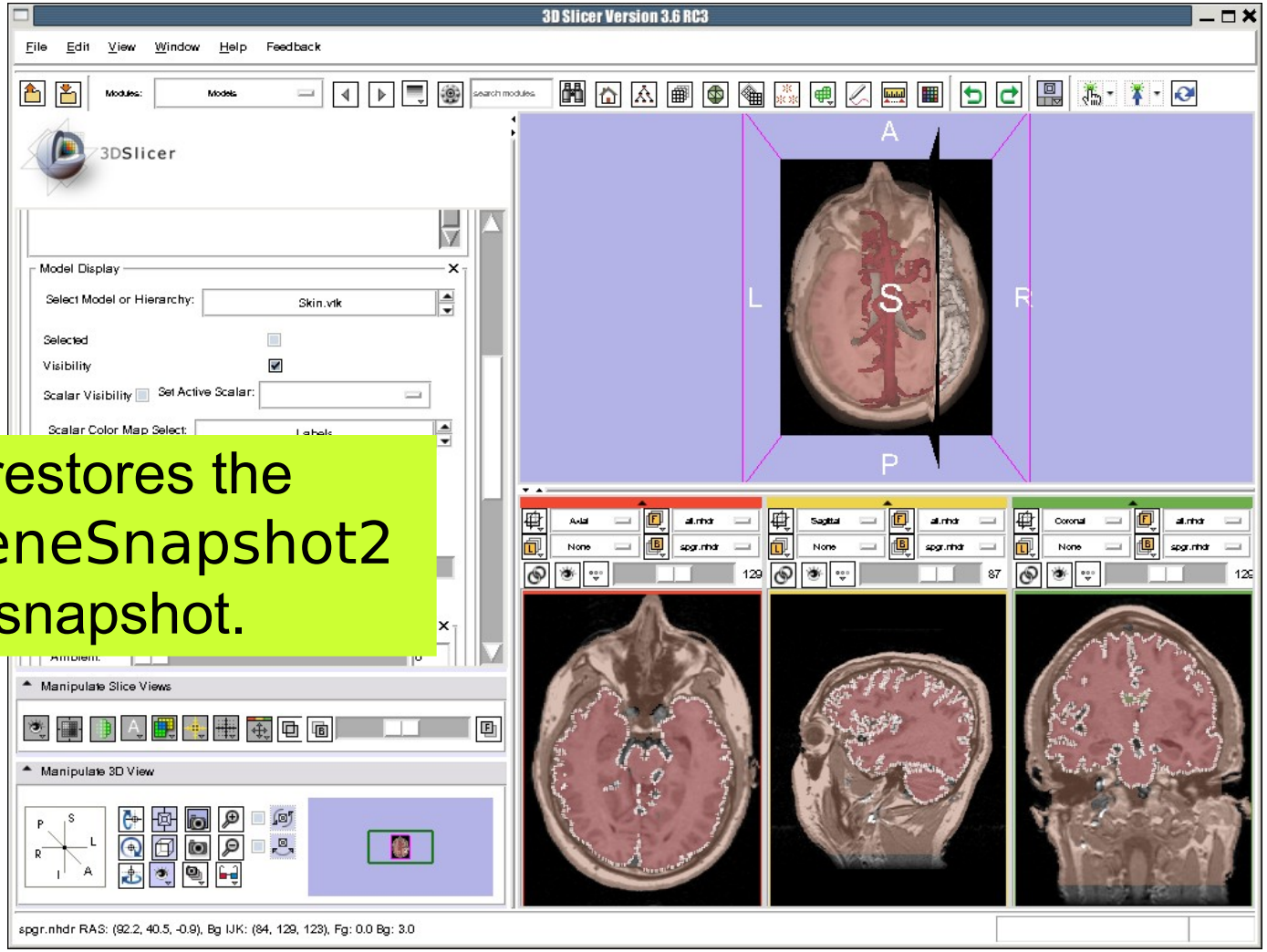
Loading a Scene



Left-click on the **Restore or delete saved scene snapshots** icon.

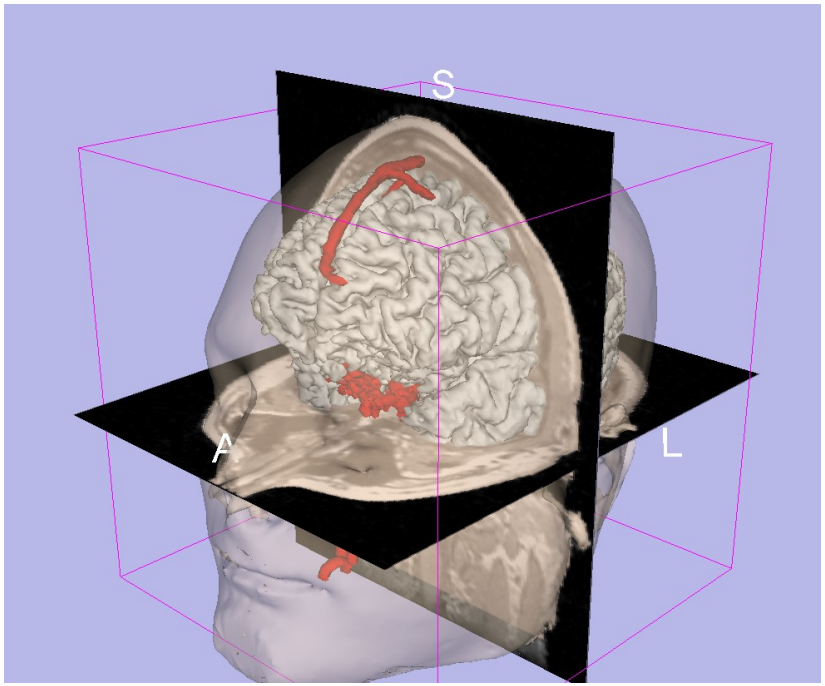
Select MySceneSnapshot2 and click on **Restore.**

Loading a Scene



Slicer restores the MySceneSnapshot2 scene snapshot.

Conclusion



- 3D visualization of anatomical surface reconstructions
- 3D interaction with volumes and models
- Open-source platform

Acknowledgments

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NIH P41RR013218