



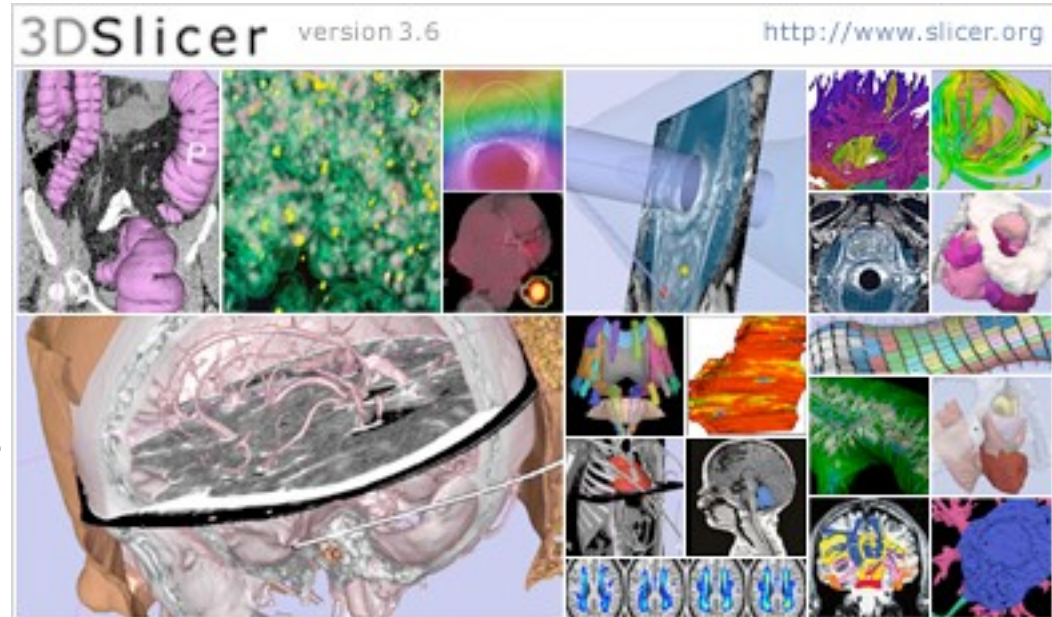
*Leonardo da Vinci (1452-1519), Virgin and Child  
Alte Pinakothek, München*

# **Data Loading & and Visualization**

Sonia Pujol, Ph.D.

Surgical Planning Laboratory  
Harvard Medical School

- 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 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



The screenshot shows the 3DSlicer website's download page. At the top left is the 3DSlicer logo and the URL 'www.slicer.org'. To the right is a Google Custom Search bar with a 'GO' button. A left sidebar contains a 'Slicer Wiki' section with links for 'About Slicer' (Home, Introduction, Acknowledgments, Contact Us) and 'Resources' (Download Slicer, For Users, For Developers, Commercial Use, NCIA, Publication DB, Image Gallery, Slicer Community, Source Code, Licensing, Mailing Lists, Web Archive). The main content area is titled 'Slicer Downloads' and includes a paragraph about the download page, a 'LICENSE AGREEMENT' section with a link to the license, and a 'DOWNLOADS' section. The 'DOWNLOADS' section features three dropdown menus: 'Type of download:' set to 'Stable Releases', 'Operating System:' set to 'Windows', and 'File to download:'. Below these is a green 'Download' button. To the right of the dropdowns is a grey box with the text 'June 2010: Slicer 3.6 released to download, select stable releases and your platform'. Below the 'DOWNLOADS' section is a 'NOTES' section with three bullet points: 'Stable Releases: Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download. See also the release notes.', 'Snapshots: Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.', and 'Nightly builds: This contains a week's worth of nightly builds. Nightly builds are'. To the right of the 'NOTES' section is a small image gallery titled '3DSlicer version 3.6' with the URL 'http://www.slicer.org', showing various medical image processing results.

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.



www.slicer.org

Google Custom Search

GO

## Select the Type of download Stable Releases.

### Resources

- Download Slicer
- For Users
- For Developers
- Commercial Use
- NCIA
- Publication DB
- Image Gallery
- Slicer Community
- Source Code
- Licensing
- Mailing Lists
- Web Archive

### DOWNLOADS

Type of download: **Stable Releases**

Operating System: **Windows**

File to download:

**Download**

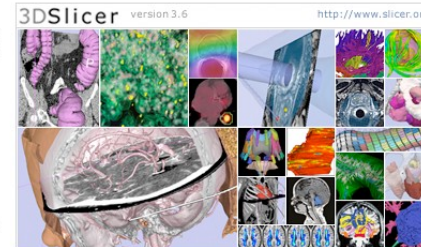
you are looking for the source code, please click [here](#).

releases of Slicer.

**June 2010: Slicer 3.6 released**  
to download, select stable releases and your platform

### NOTES

- **Stable Releases:** Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download. See also [the release notes](#).
- **Snapshots:** Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.
- **Nightly builds:** This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- **x86** means Intel or AMD processors, **Darwin** is for Mac OS X, **PPC** means PowerPC processors.
- **Mac:** Darwin is the OpenSource software environment for Apple's Mac OS X
- **Hardware/OS requirement:** Either Windows XP or more recent, Linux (x86 or x86\_64), Mac OS X (ppc or Intel), min 2 GB of RAM and a dedicated graphic accelerator with at least 128 MB of on-board graphic memory (512 or more recommended). Shared memory graphics will result in slow render speeds.
- **X11 for Mac:** On Mac OS X you will need to install X11 from the CD. As an alternative, we had good experience with [xquartz](#).
- **Collaboration with the University of Szeged in Hungary** has resulted in a port of slicer3 to the current generation of the Oracle (formerly Sun) Solaris operating system. More information, including binary downloads, is available at the [Solaris page](#).



# Download Slicer3.6



www.slicer.org

Google Custom Search

GO

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

## Resources

- Download Slicer
- For Users
- For Developers
- Commercial Use
- NCIA
- Publication DB
- Image Gallery
- Slicer Community
- Source Code
- Licensing
- Mailing Lists
- Web Archive

## DOWNLOADS

Type of download:

Operating System:

File to download:

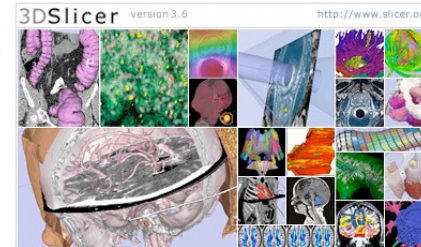
you are looking for the source code, please click [here](#).

releases of Slicer.

**June 2010: Slicer 3.6 released**  
to download, select stable releases and your platform

## NOTES

- **Stable Releases:** Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download. See also [the release notes](#).
- **Snapshots:** Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.
- **Nightly builds:** This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- **x86** means Intel or AMD processors, **Darwin** is for Mac OS X, **PPC** means PowerPC processors.
- **Mac:** Darwin is the OpenSource software environment for Apple's Mac OS X
- **Hardware/OS requirement:** Either Windows XP or more recent, Linux (x86 or x86\_64), Mac OS X (ppc or Intel), min 2 GB of RAM and a dedicated graphic accelerator with at least 128 MB of on-board graphic memory (512 or more recommended). Shared memory graphics will result in slow render speeds.
- **X11 for Mac:** On Mac OS X you will need to install X11 from the CD. As an alternative, we had good experience with [xquartz](#).
- **Collaboration with the University of Szeged in Hungary** has resulted in a port of slicer3 to the current generation of the Oracle (formerly Sun) Solaris operating system. More information, including binary downloads, is available at the [Solaris page](#).



# Download Slicer3.6

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

[For Users](#)  
[For Developers](#)  
[Commercial Use](#)  
[NCIA](#)  
[Publication DB](#)  
[Image Gallery](#)  
[Slicer Community](#)  
[Source Code](#)  
[Licensing](#)  
[Mailing Lists](#)  
[Web Archive](#)

Type of download:

Operating System:

File to download:

## NOTES

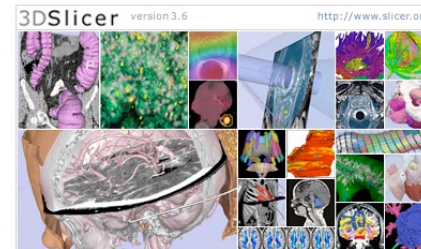
- **Stable Releases:** Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download. See also [the release notes](#).
- **Snapshots:** Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.
- **Nightly builds:** This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- **x86** means Intel or AMD processors, **Darwin** is for Mac OS X, **PPC** means PowerPC processors.
- **Mac:** Darwin is the OpenSource software environment for Apple's Mac OS X
- **Hardware/OS requirement:** Either Windows XP or more recent, Linux (x86 or x86\_64), Mac OS X (ppc or Intel), min 2 GB of RAM and a dedicated graphic accelerator with at least 128 MB of on-board graphic memory (512 or more recommended). Shared memory graphics will result in slow render speeds.
- **X11 for Mac:** On Mac OS X you will need to install X11 from the CD. As an alternative, we had good experience with [xquartz](#).
- Collaboration with the University of Szeged in Hungary has resulted in a port of slicer3 to the current generation of the Oracle (formerly Sun) Solaris operating system. More information, including binary downloads, is available at the [Solaris page](#).

Google Custom Search

Looking for the source code, please click [here](#).

of Slicer.

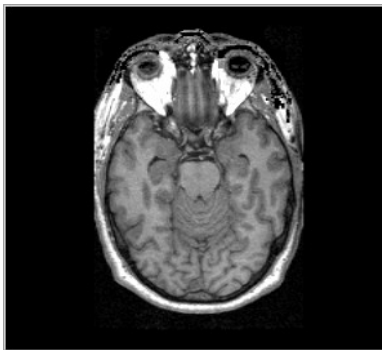
**June 2010: Slicer 3.6 released**  
to download, select stable releases and your platform



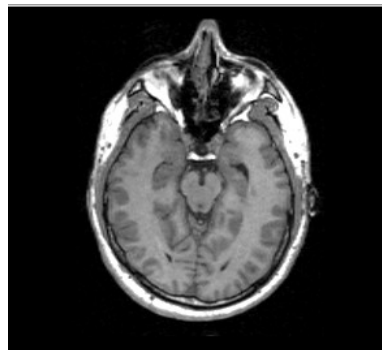
# Download the training dataset

---

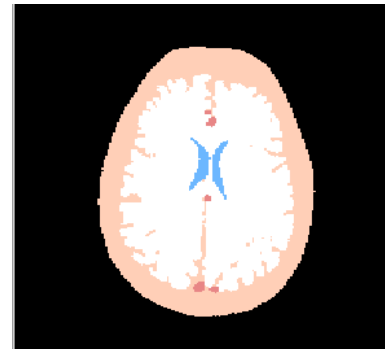
- This course is built upon three datasets of a single healthy subject brain:



MR DICOM  
GRASS



MR Nrrd  
SPGR



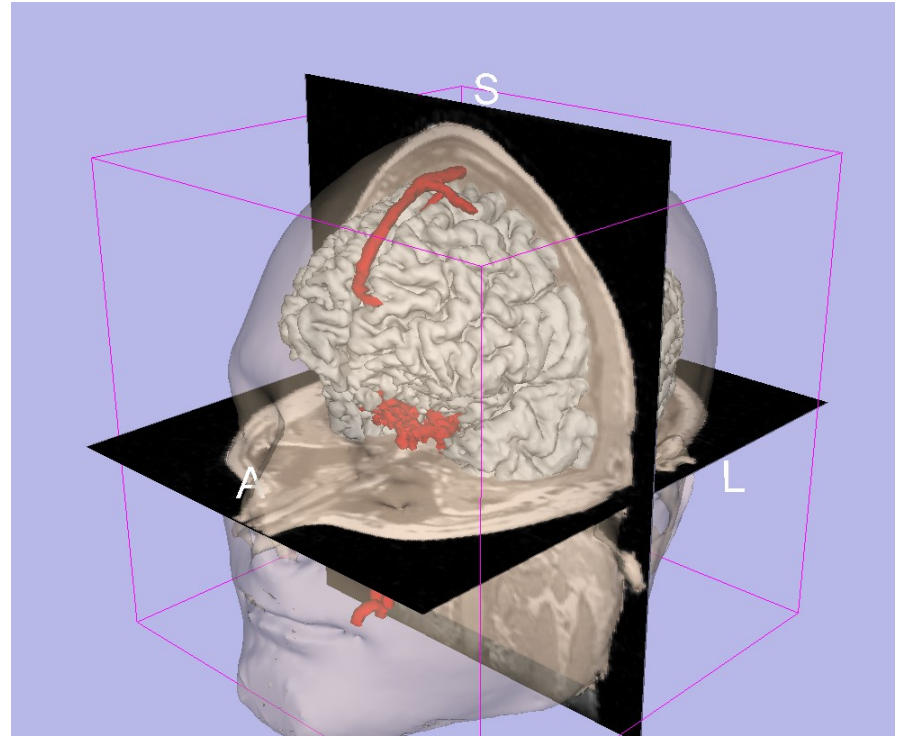
Pre-computed  
Label Map

- Download and unzip the training dataset  
Slicer3VisualizationDataset.zip

[http://www.slicer.org/slicerWiki/index.php/Slicer 3.6:Training](http://www.slicer.org/slicerWiki/index.php/Slicer%203.6: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.





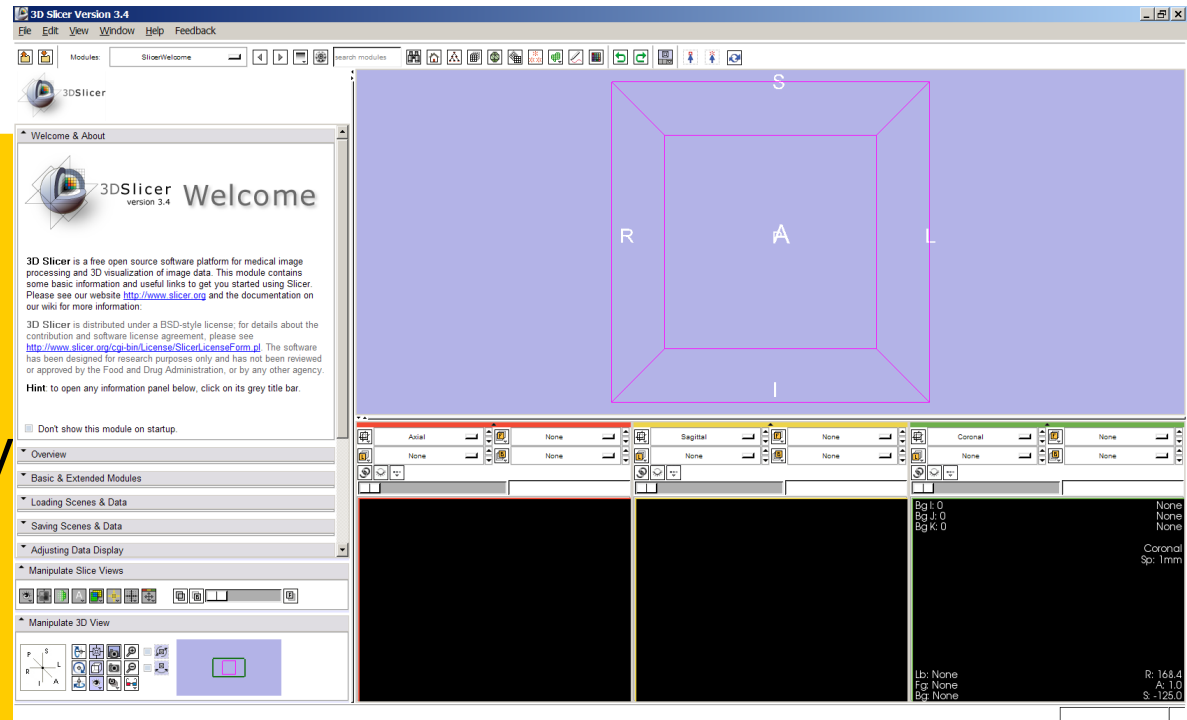


# Start Slicer3

**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.

3D Slicer Version 3.4

File Edit View Window Help Feedback

Modules: SlicerWelcome

3DSlicer

Welcome & About

3DSlicer version 3.4 Welcome

3D Slicer is a free open source software platform for medical image processing and 3D visualization of image data. This module contains some basic information and useful links to get you started using Slicer. Please see our website <http://www.slicer.org> and the documentation on our wiki for more information.

3D Slicer is distributed under a BSD-style license; for details about the contribution and software license agreement, please see <http://www.slicer.org/cgi-bin/license/SlicerLicenseForm.pl>. The software has been designed for research purposes only and has not been reviewed or approved by the Food and Drug Administration, or by any other agency.

Hint: to open any information panel below, click on its grey title bar.

☐ Don't show this module on startup.

Overview

Basic & Extended Modules

Loading Scenes & Data

Saving Scenes & Data

Adjusting Data Display

Manipulate Slice Views

Manipulate 3D View

Axial None None

Sagittal None None

Coronal None None

Bg I: 0 None  
Bg J: 0 None  
Bg K: 0 None

Coronal Sp: 1mm

Lb: None R: 168.4  
Fg: None A: 1.0  
Bg: None S: -125.0



# 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

Modules Menu

Menu Toolbar

Module GUI Panel

3DViewer

2D Slice Controllers

Slice Viewer

3DView Controllers

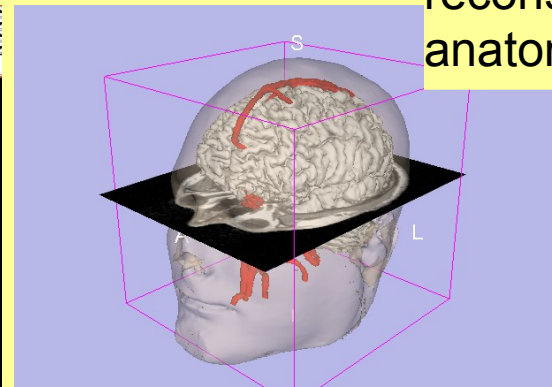
Progress and Error Log

# Overview

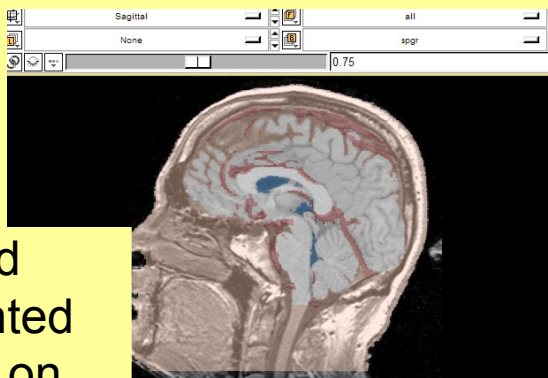
**Part 1.** Loading and visualizing multiple volumes simultaneously



**Part 3.** Visualizing 3D reconstructions of anatomical surfaces

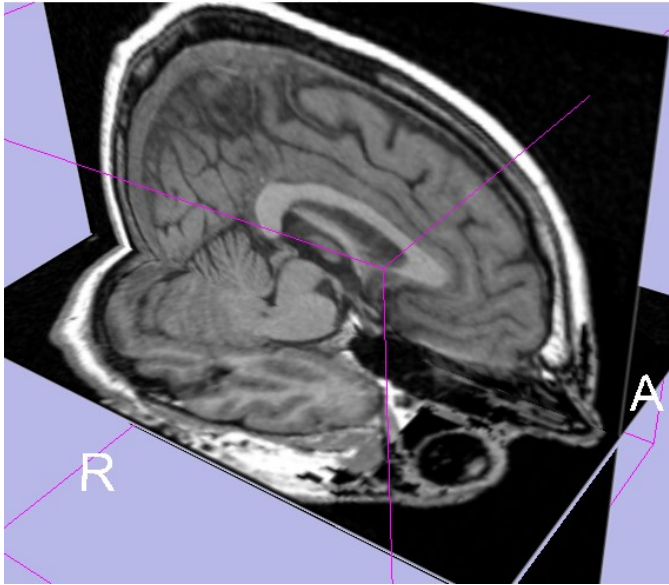


**Part 2.** Loading and visualizing segmented structures overlaid on grayscale images



**Part 4.** The lightbox viewer

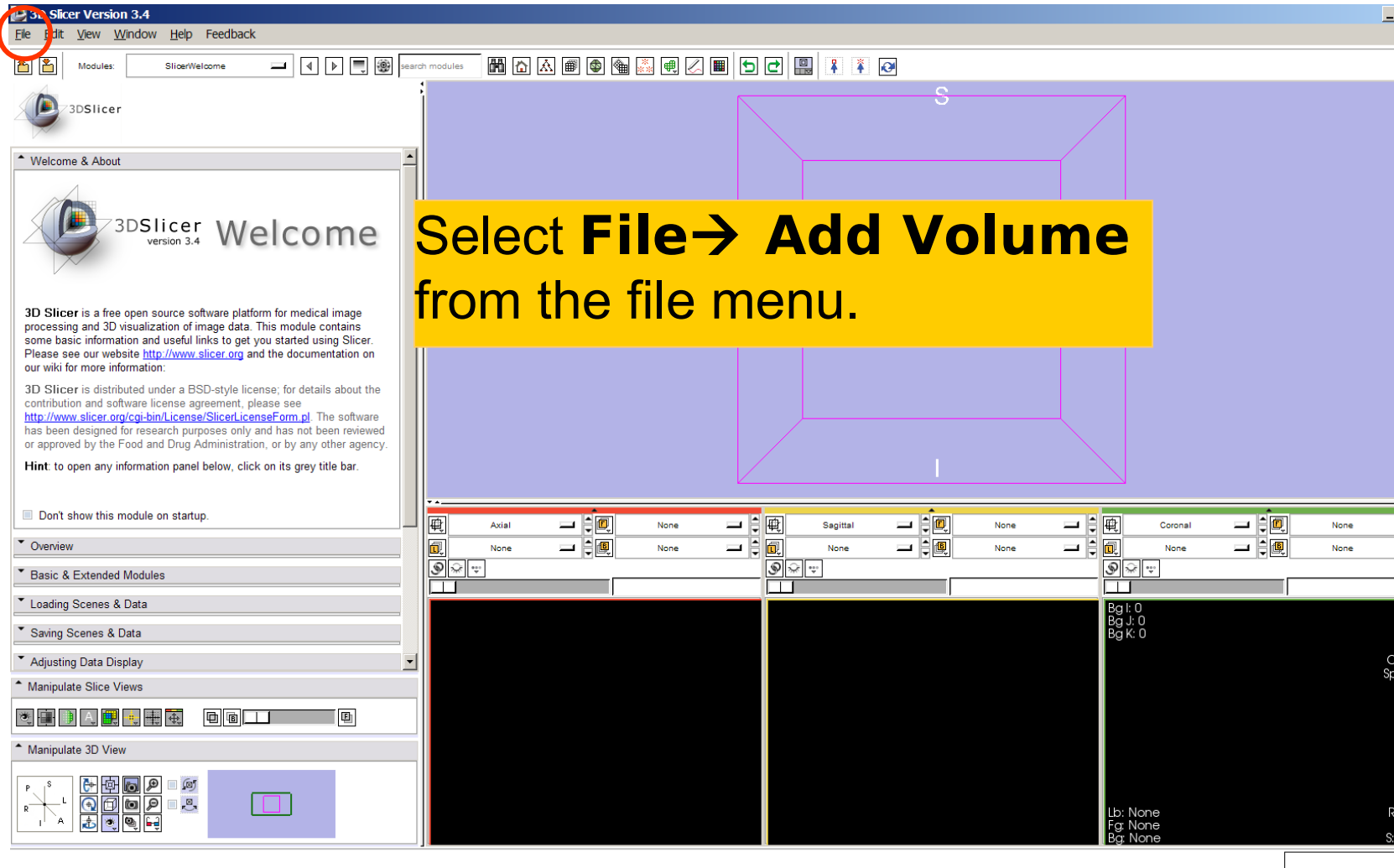
**Part 5.** Saving data



## Part 1: Loading and visualizing multiple volumes simultaneously

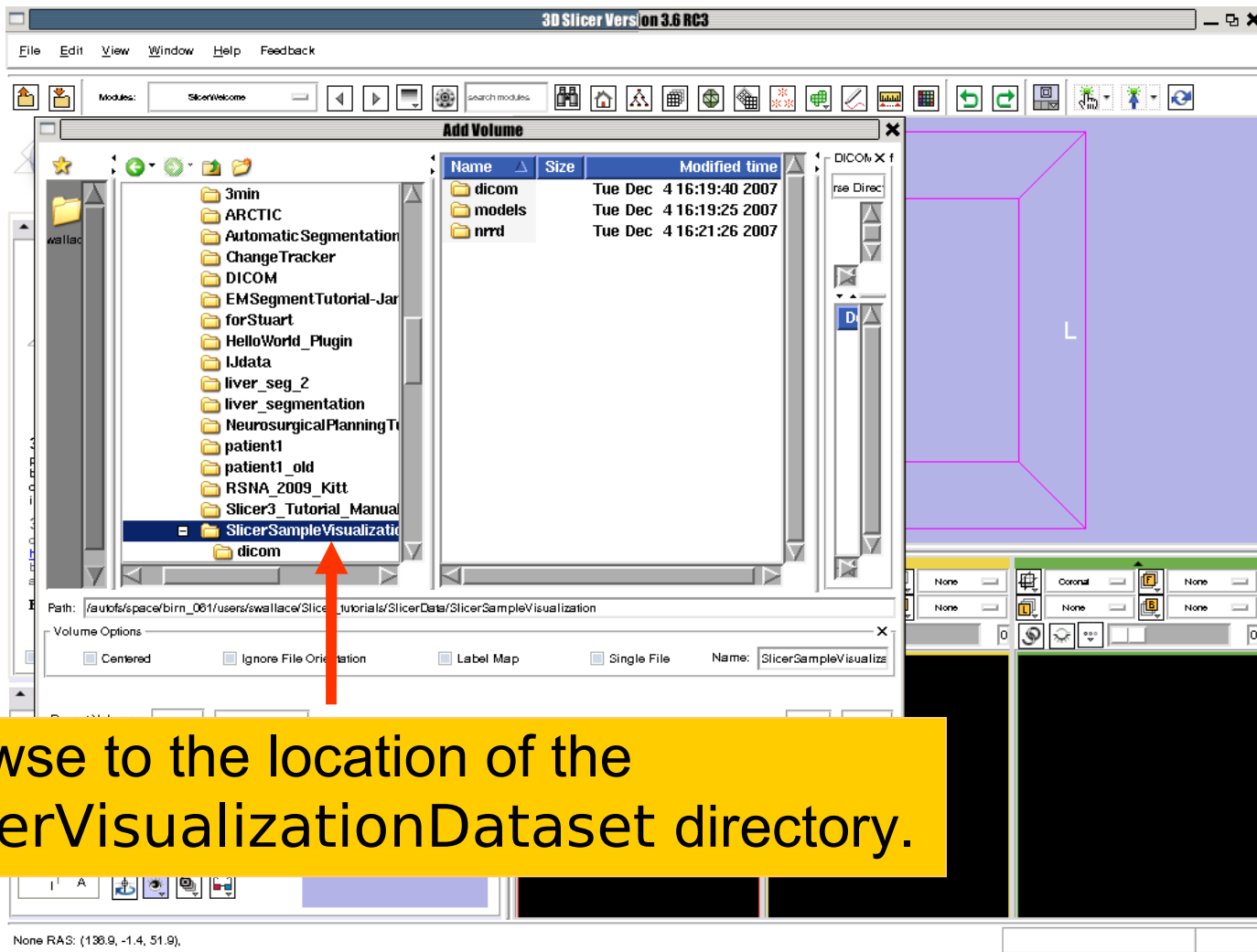


# Loading Volumes



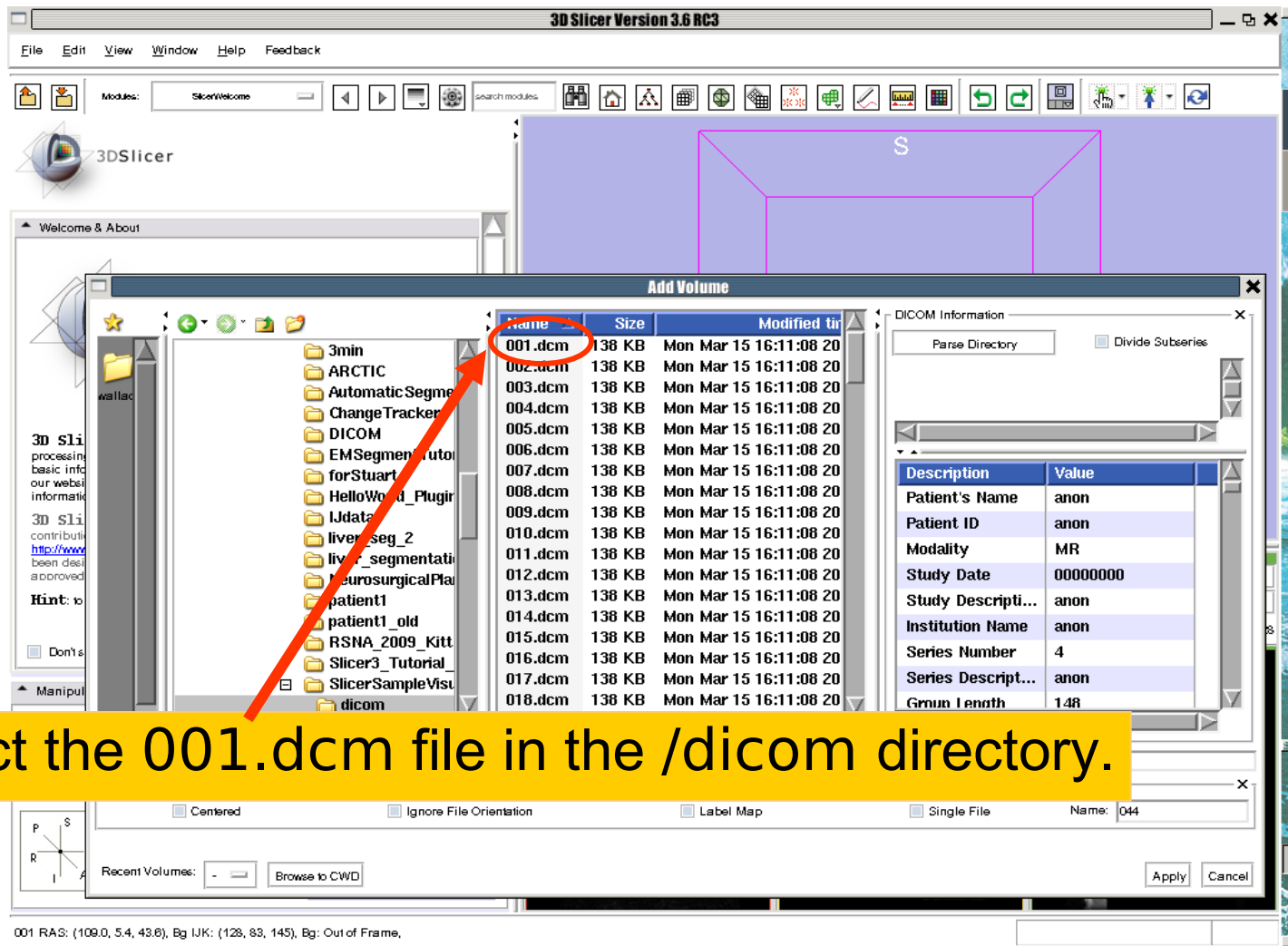


# Loading Volumes



Browse to the location of the SlicerVisualizationDataset directory.

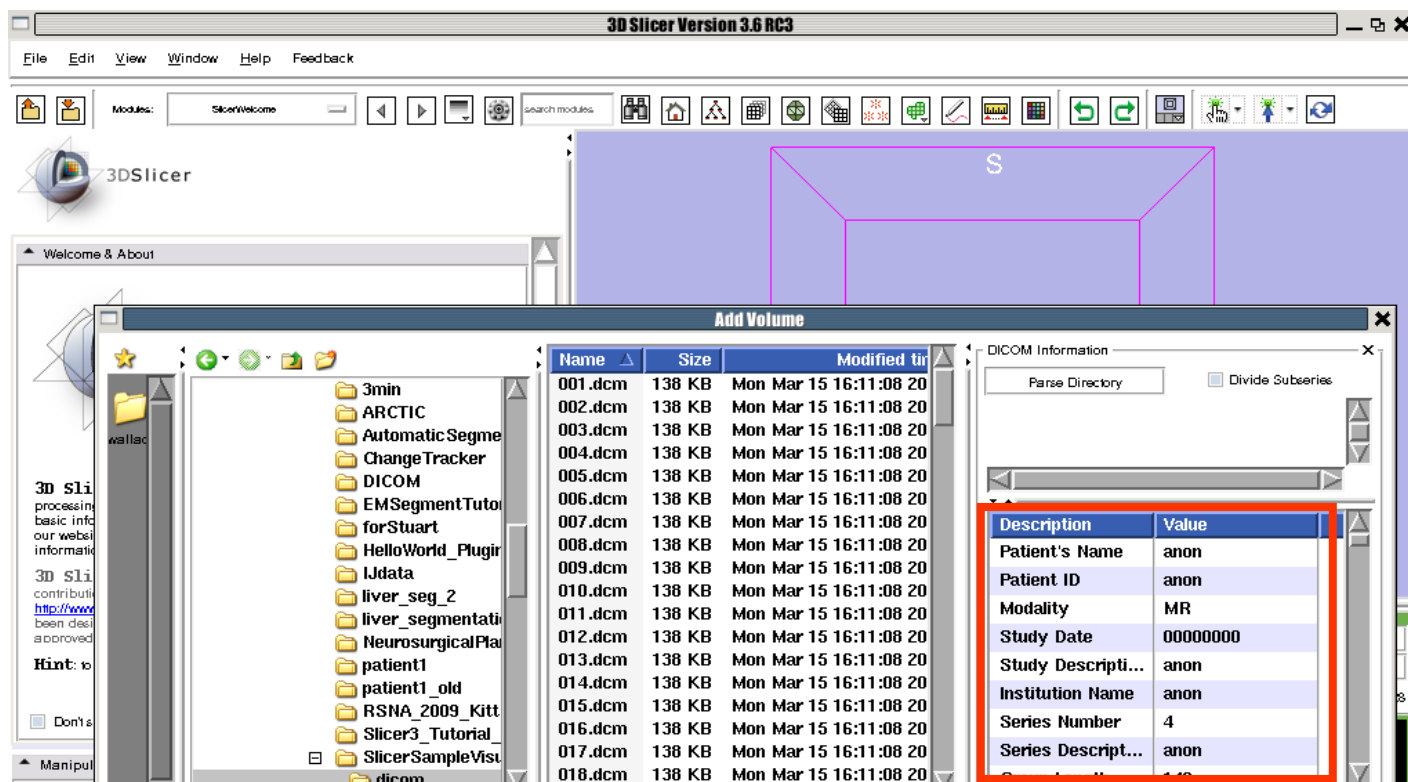
# Loading Volumes



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

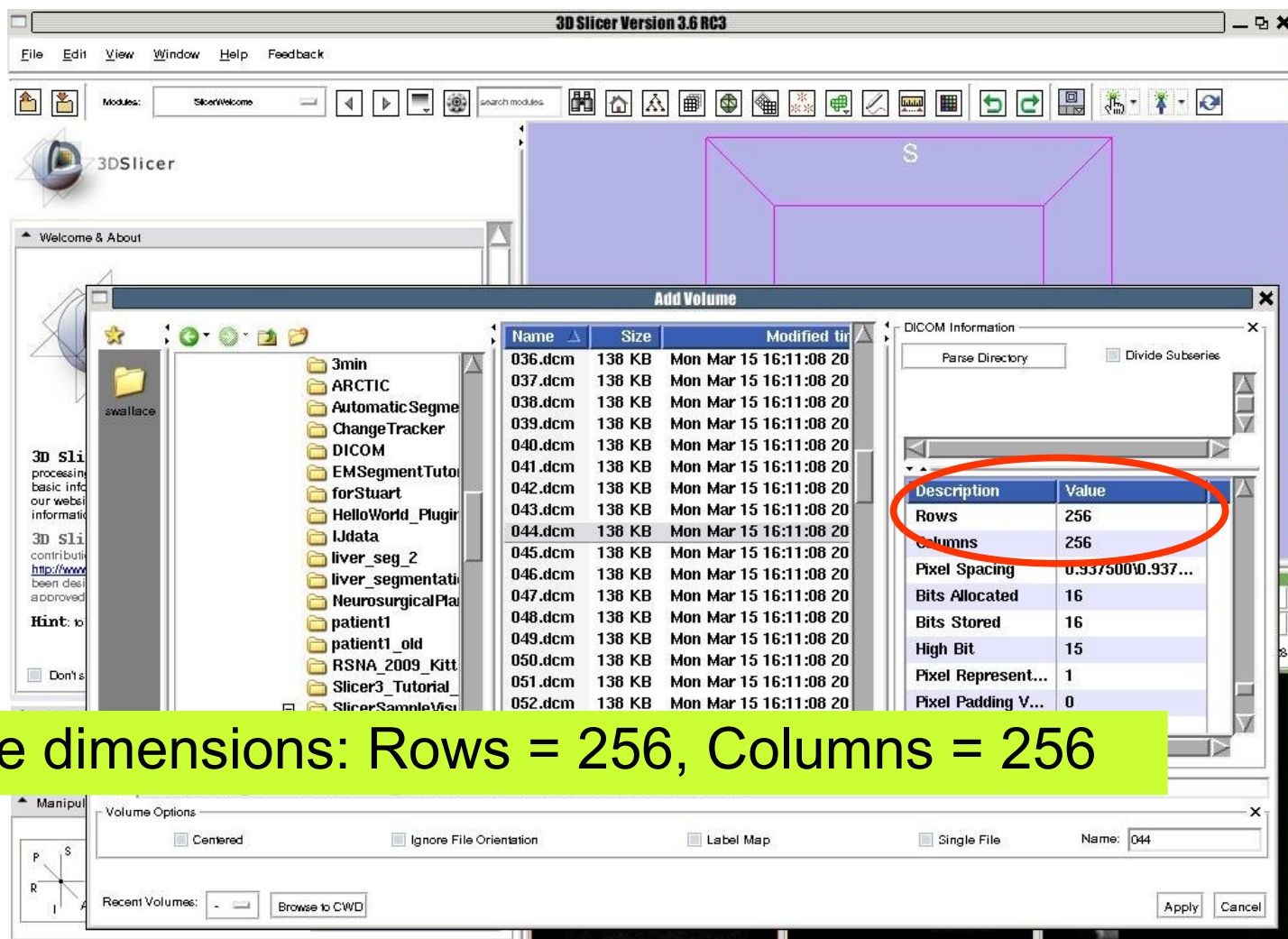


# Loading Volumes

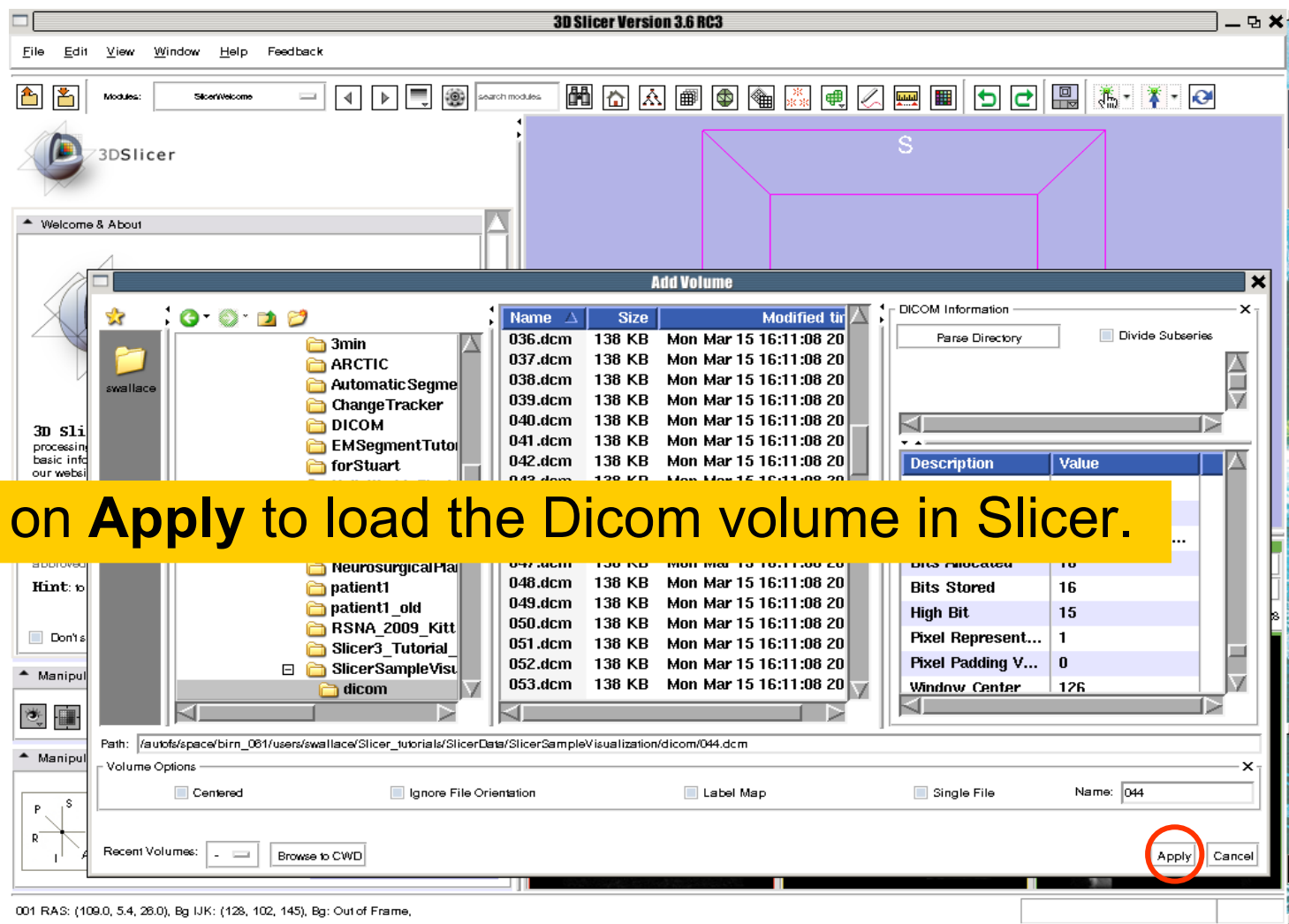


Slicer displays the Dicom header information of the images. Browse through the Dicom information panel to display the dimensions of the images.

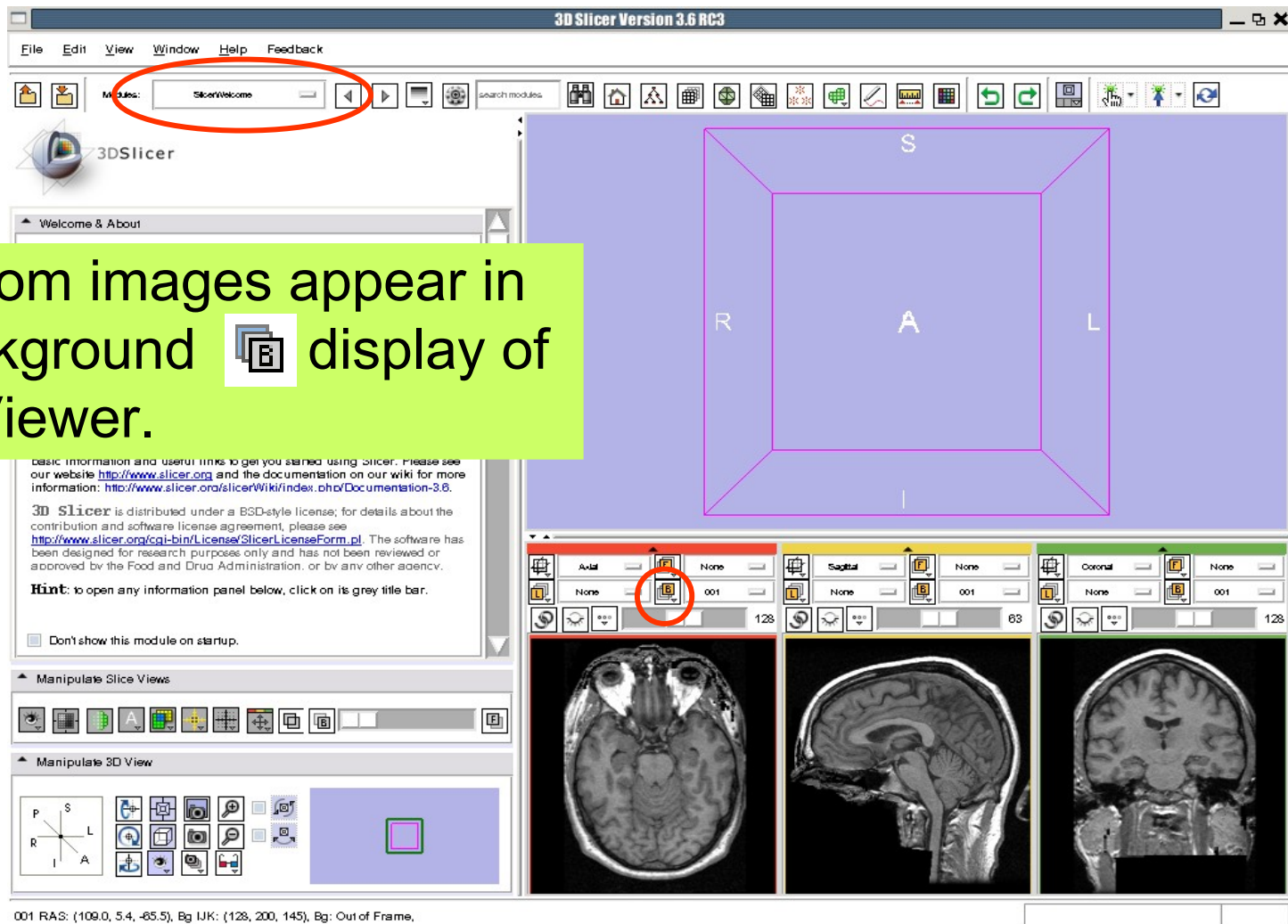
# Loading Volumes




# Loading Volumes



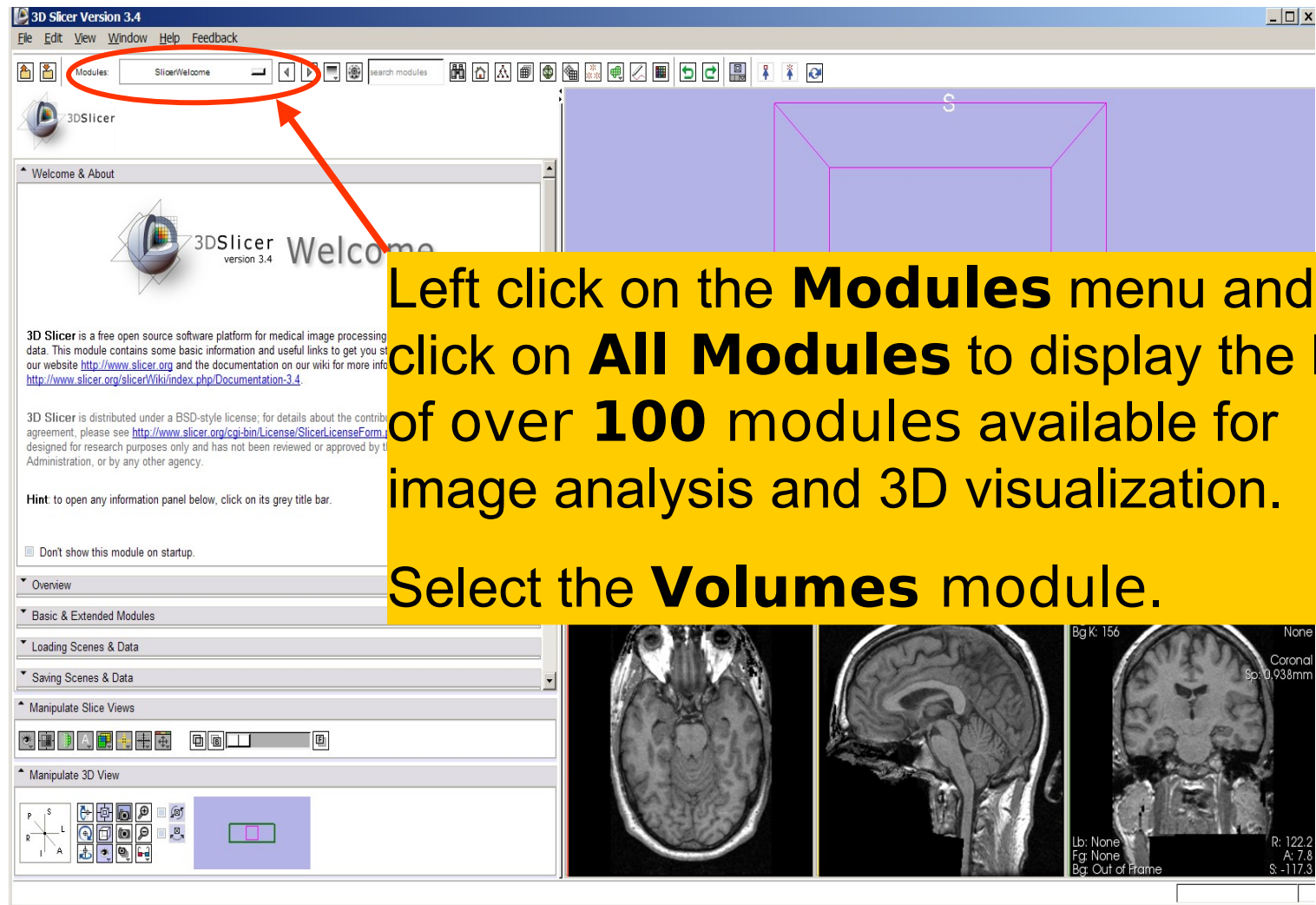
# Loading Volumes



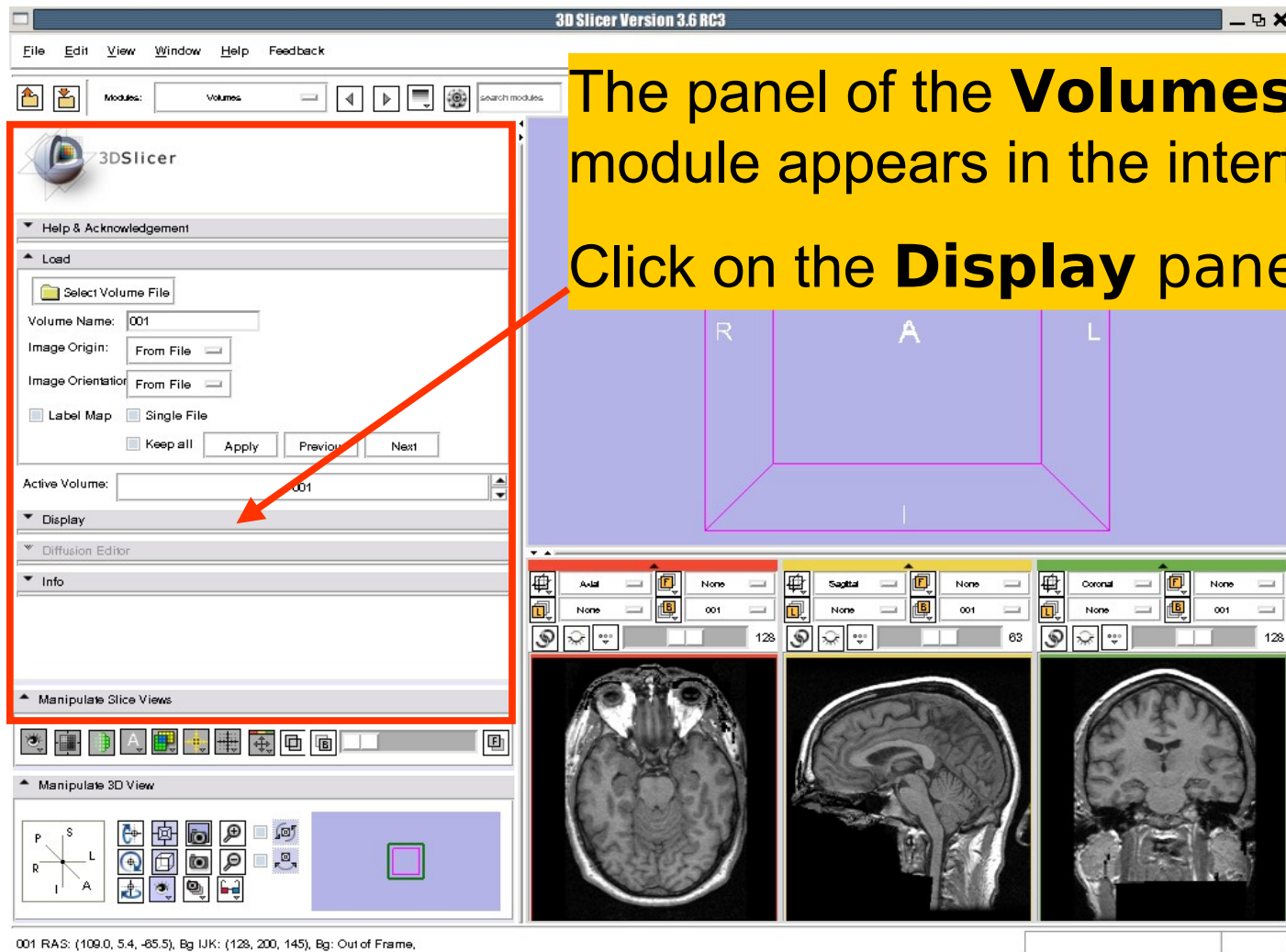
The Dicom images appear in the Background  display of the 2DViewer.



# Loading Volumes

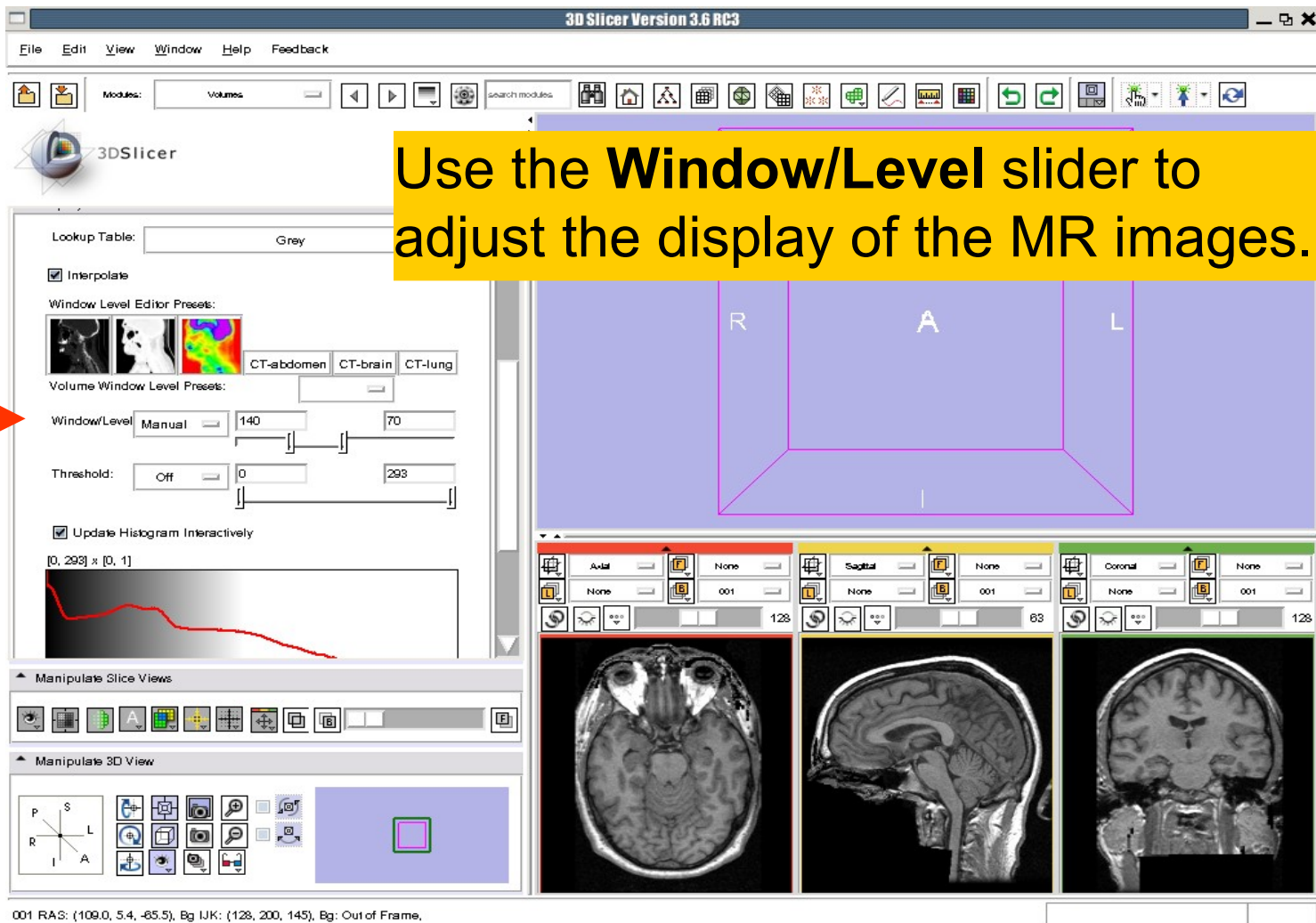


# Loading Volumes

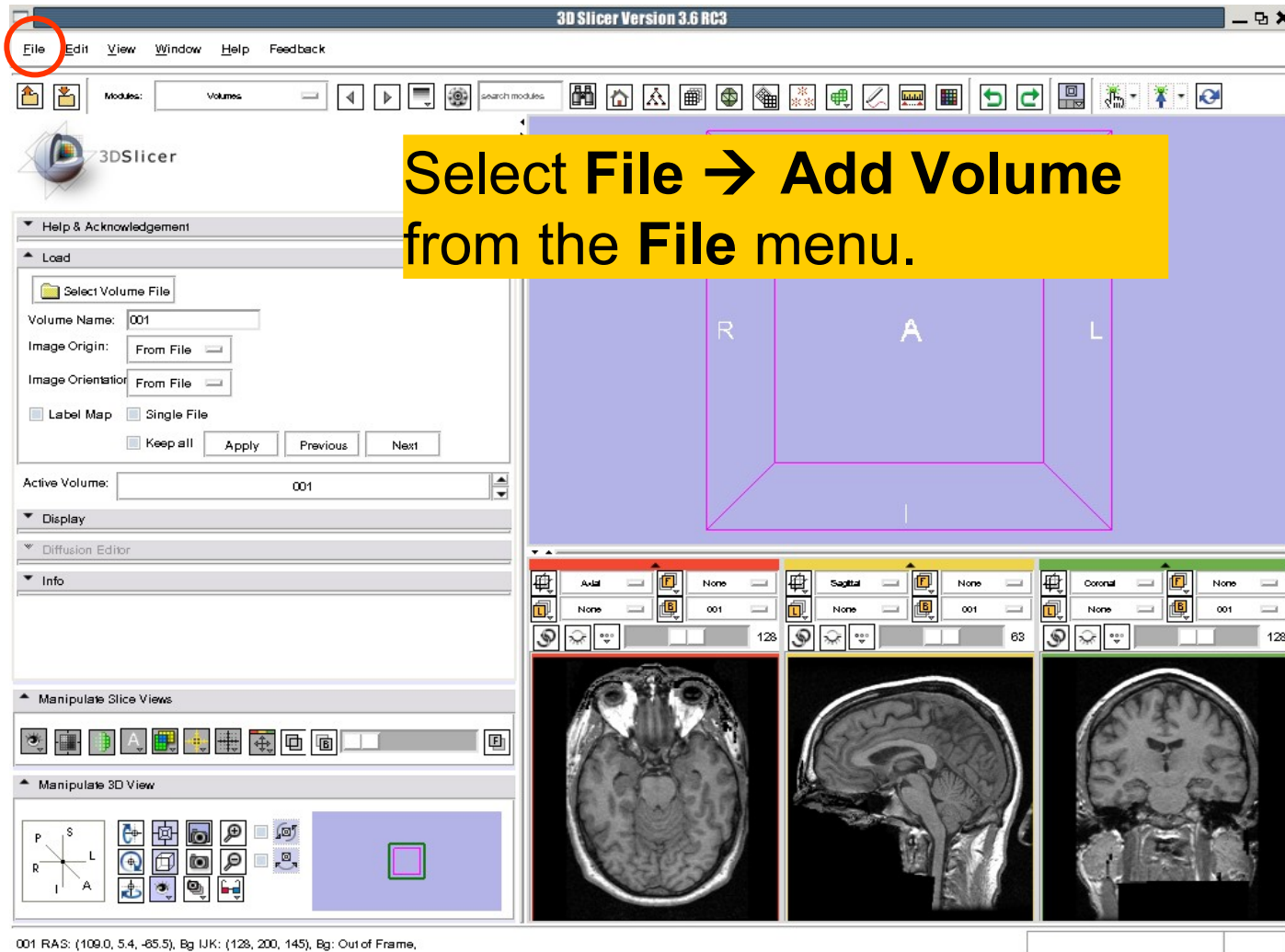


# Loading Volumes

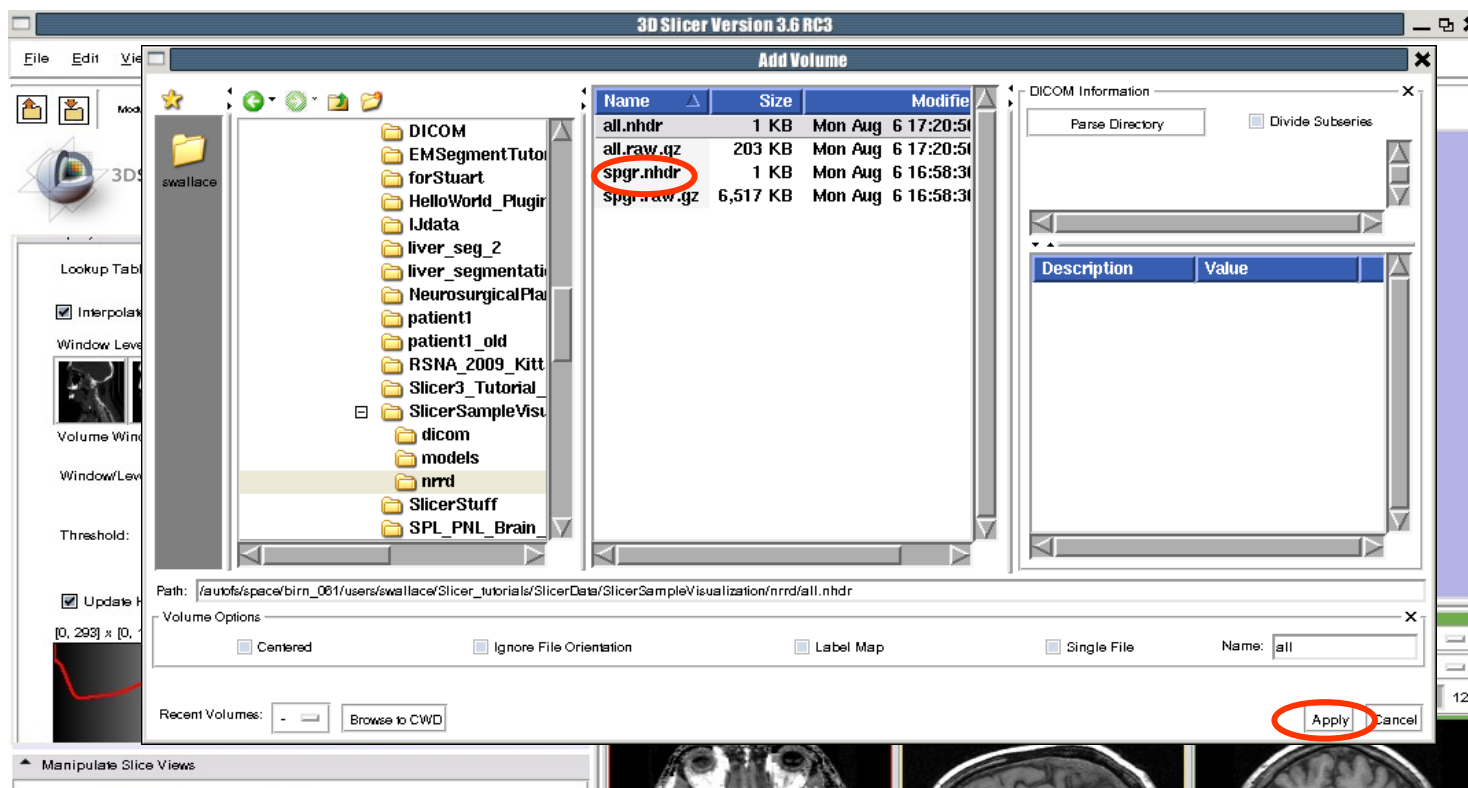
Use the **Window/Level** slider to adjust the display of the MR images.



# Loading Volumes



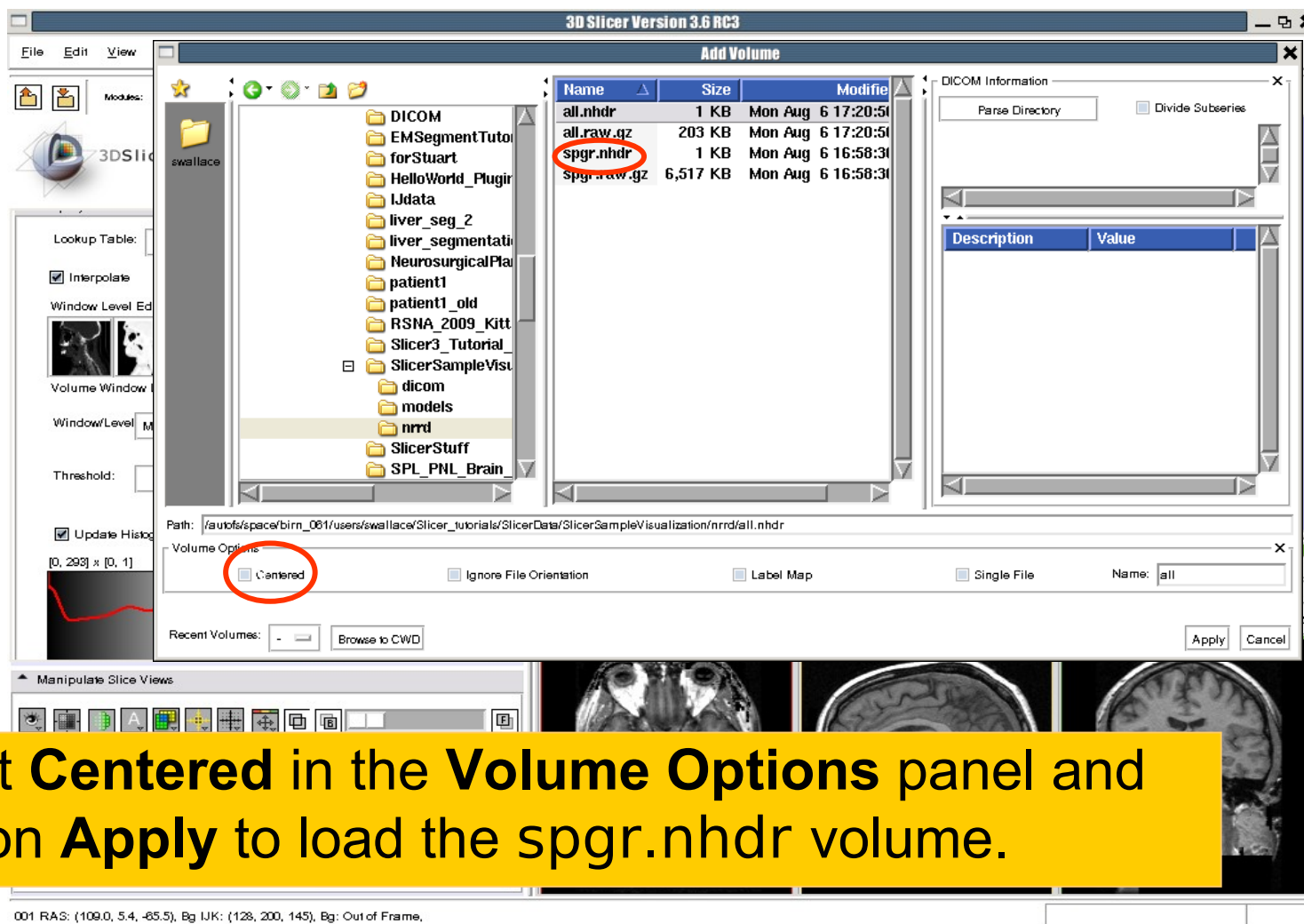
# Loading Volumes



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

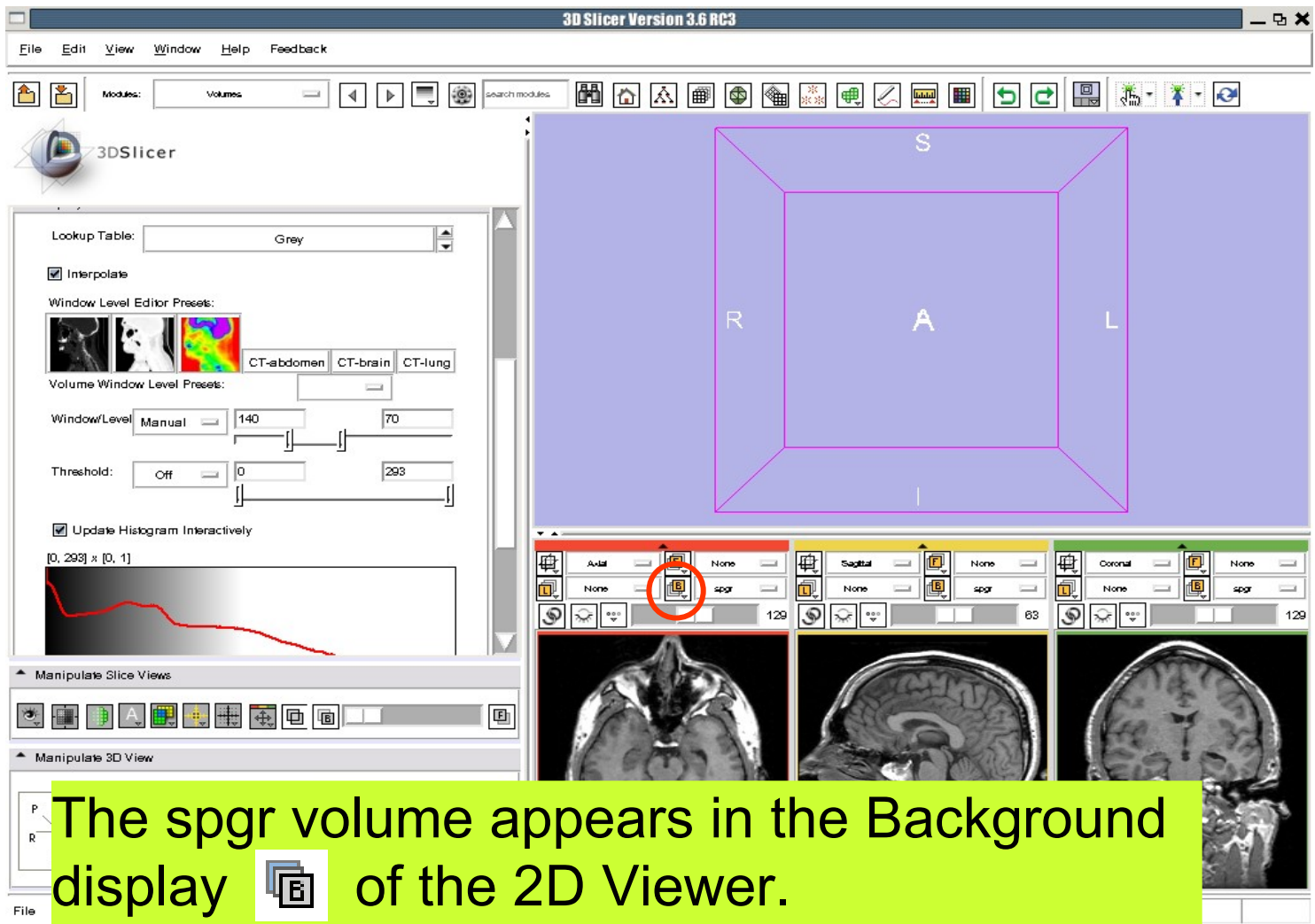
Left RAS: (100,0, 54, -65.3), Left LIR: (125, 200, 145), Left OIR: (100, 0, 54, -65.3)

# Loading Volumes



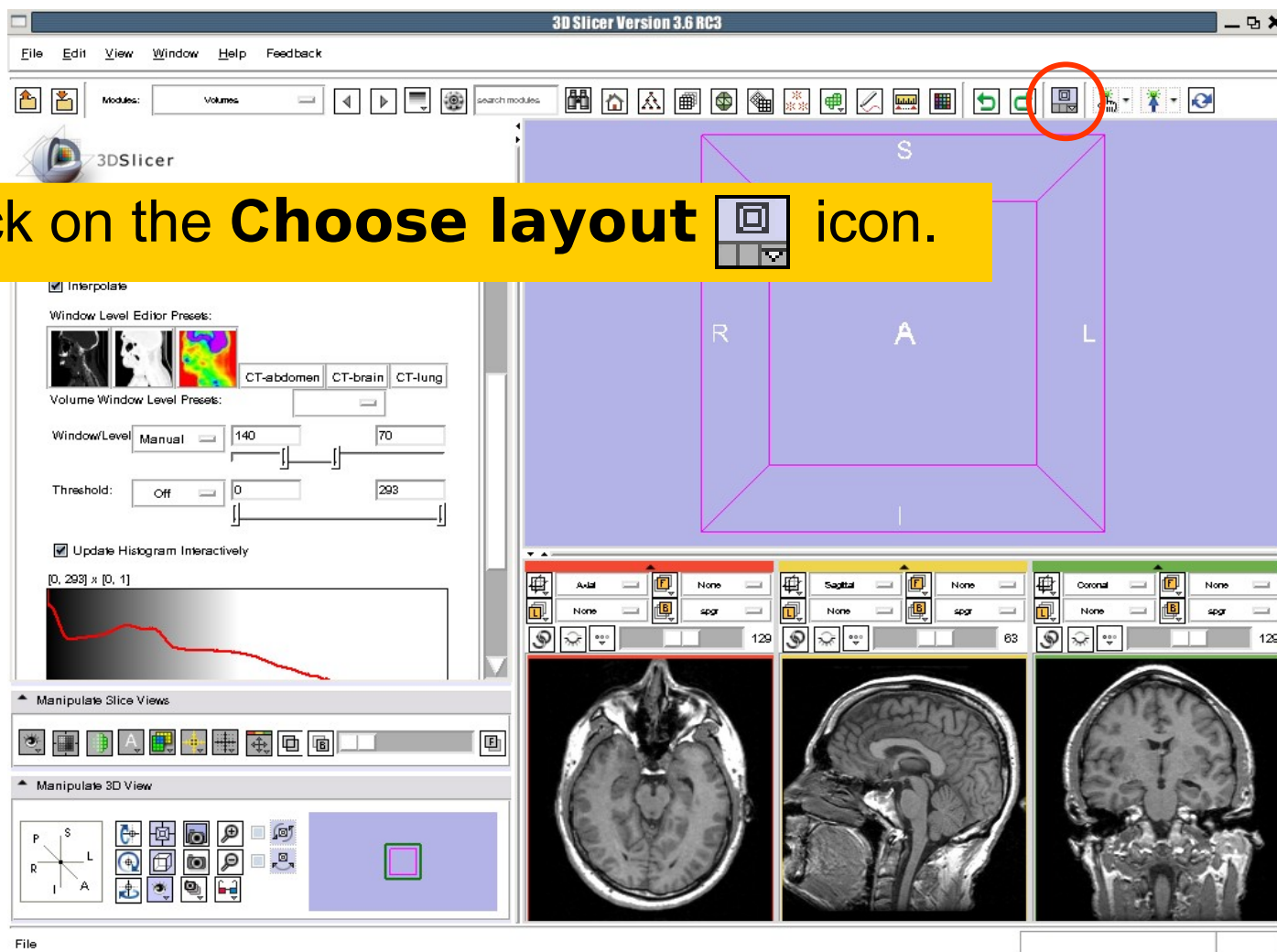


# Loading Volumes

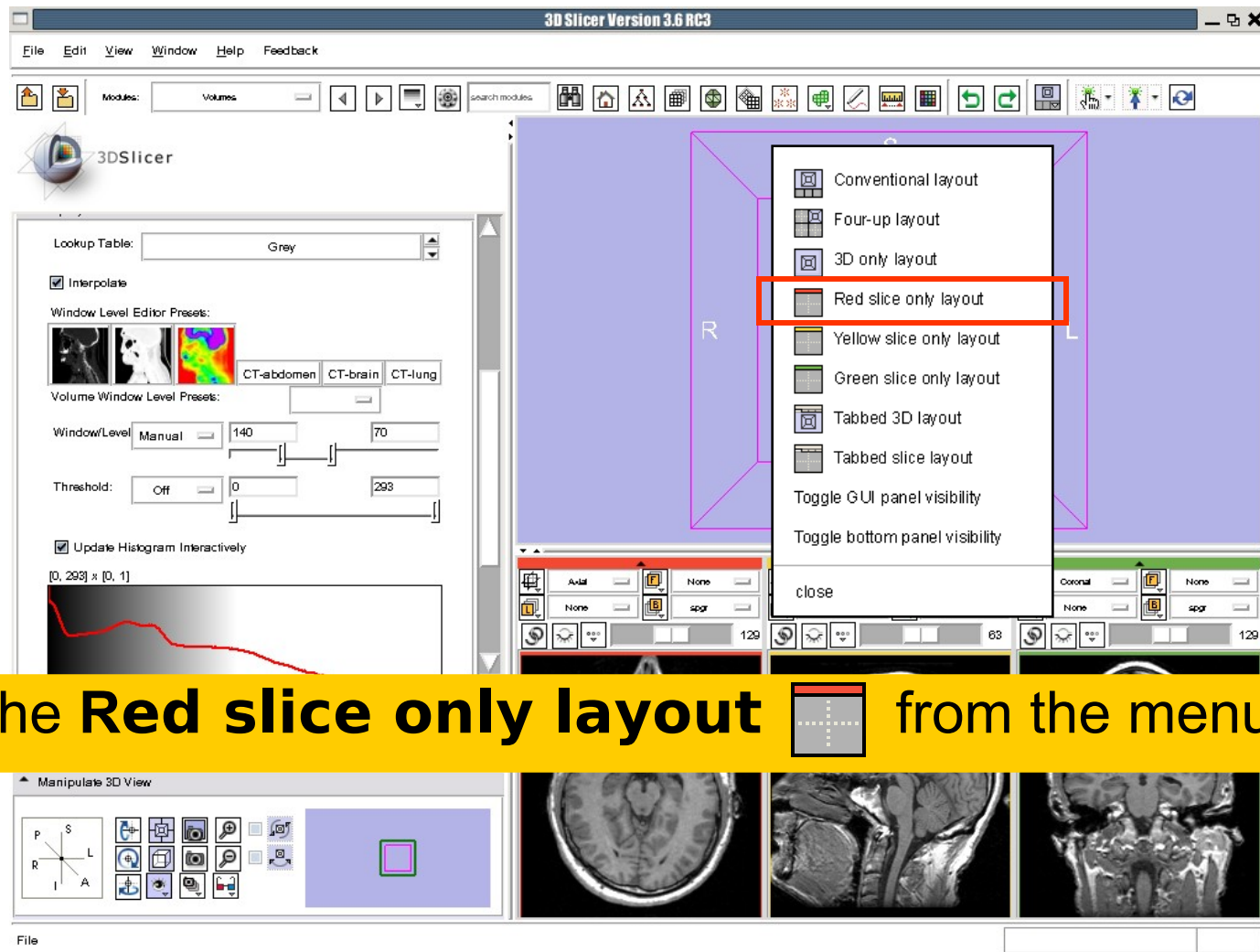


# Exploring the data

Left click on the **Choose layout** icon.



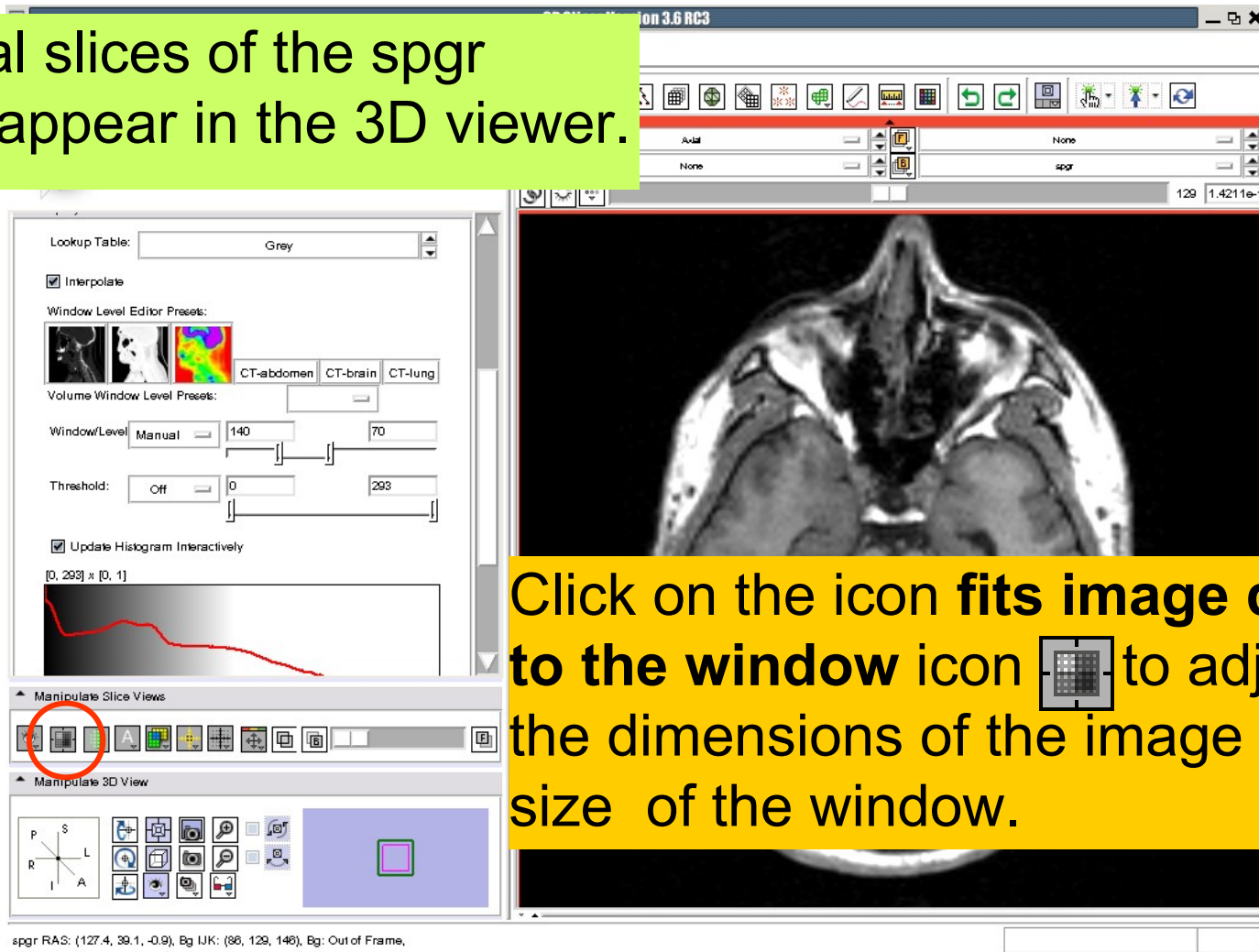
# Exploring the data



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

# Exploring the data


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

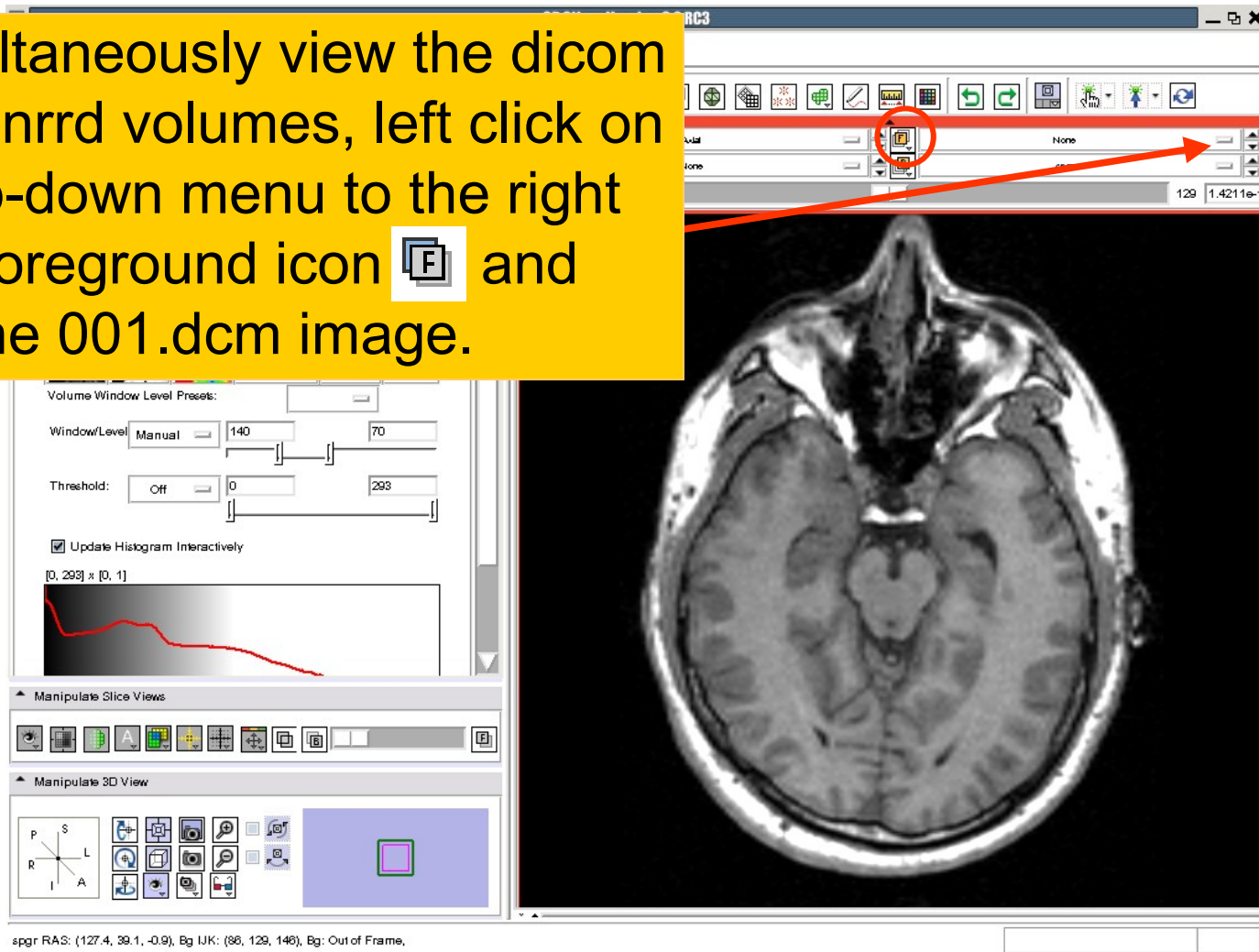


Click on the icon **fits image data to the window** to adjust the dimensions of the image to the size of the window.



spgr RAS: (127.4, 39.1, -0.9), Bg UK: (96, 129, 146), Bg: Out of Frame,

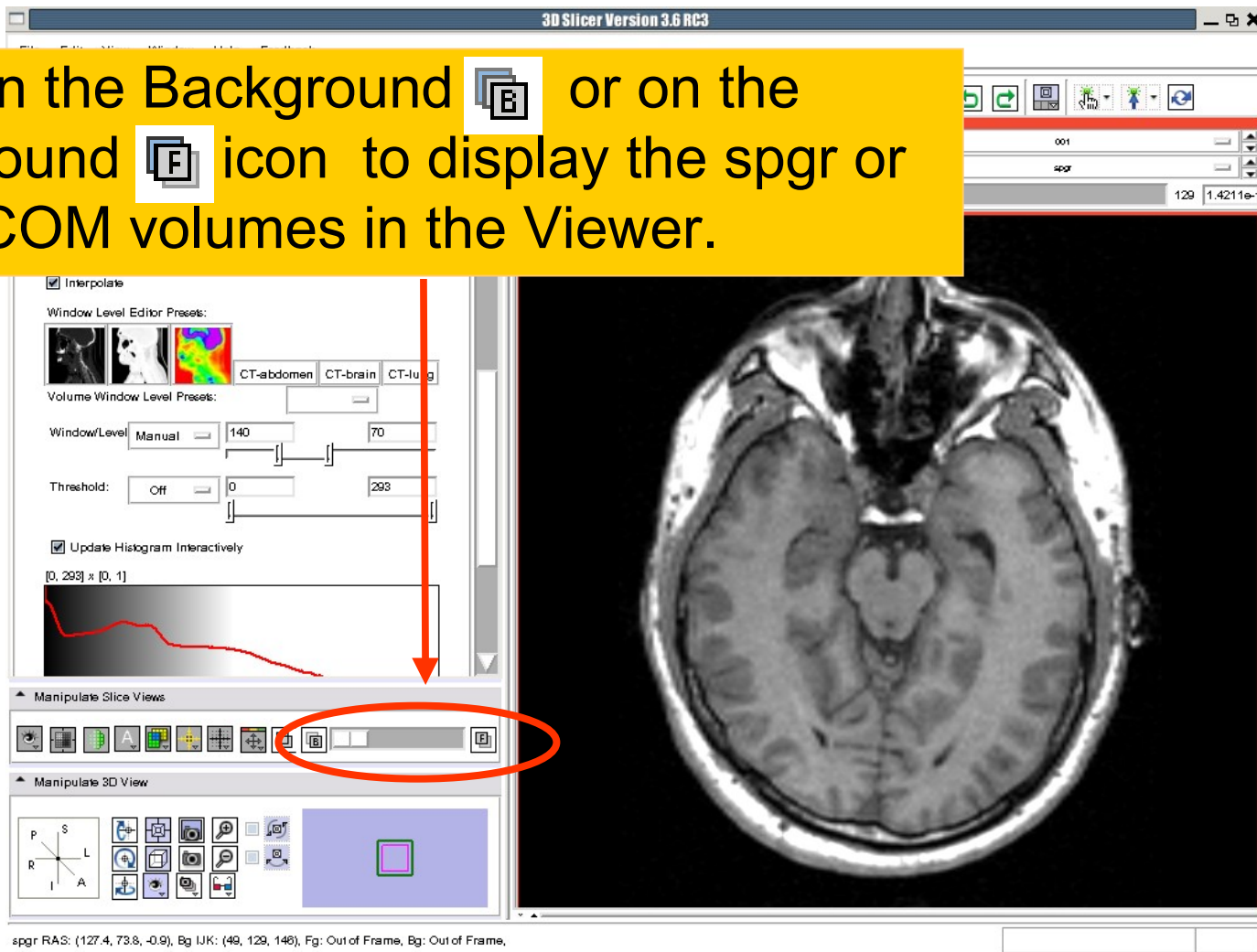
# Exploring the data

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

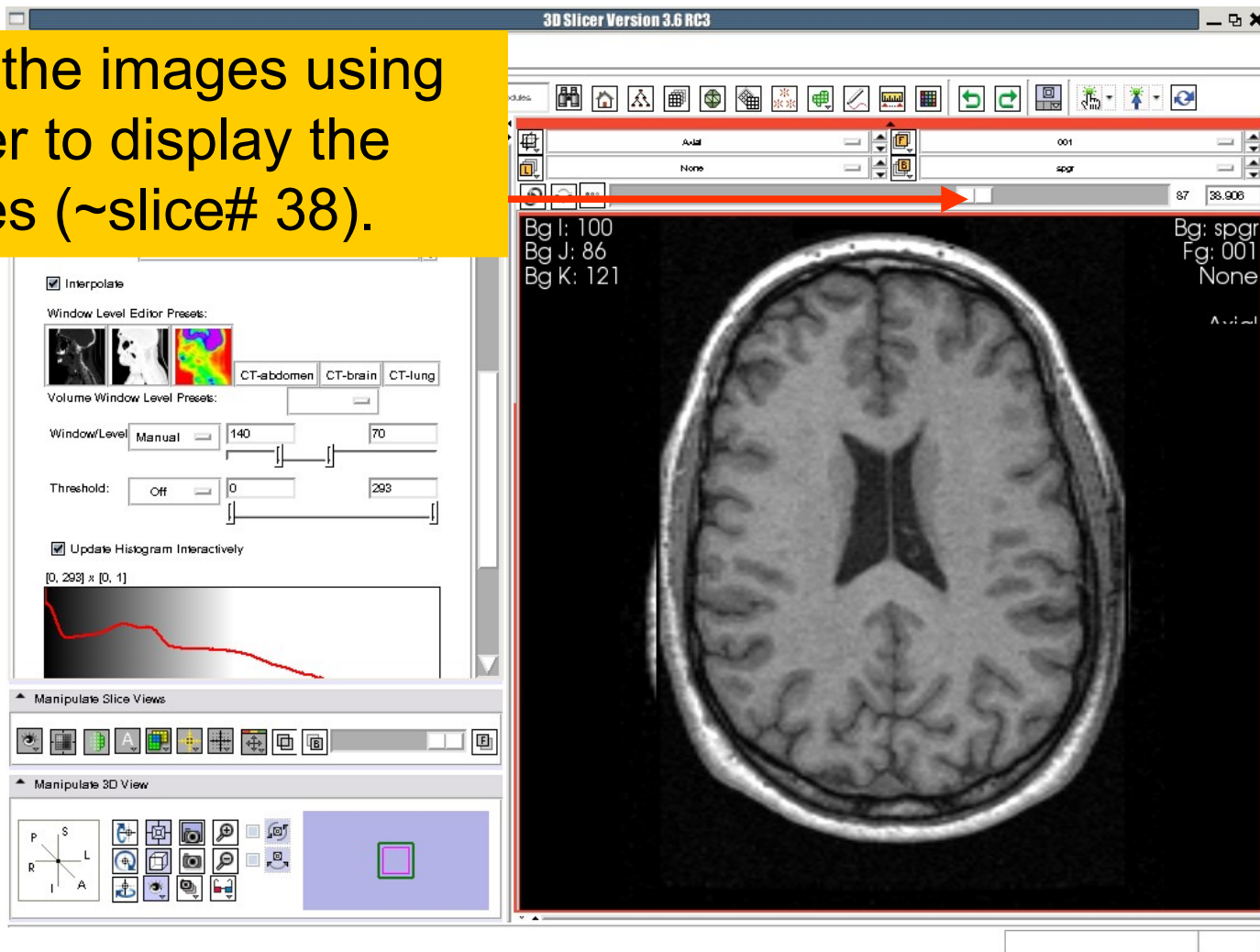
Click on the Background  or on the Foreground  icon to display the spgr or the DICOM volumes in the Viewer.






# Exploring the data

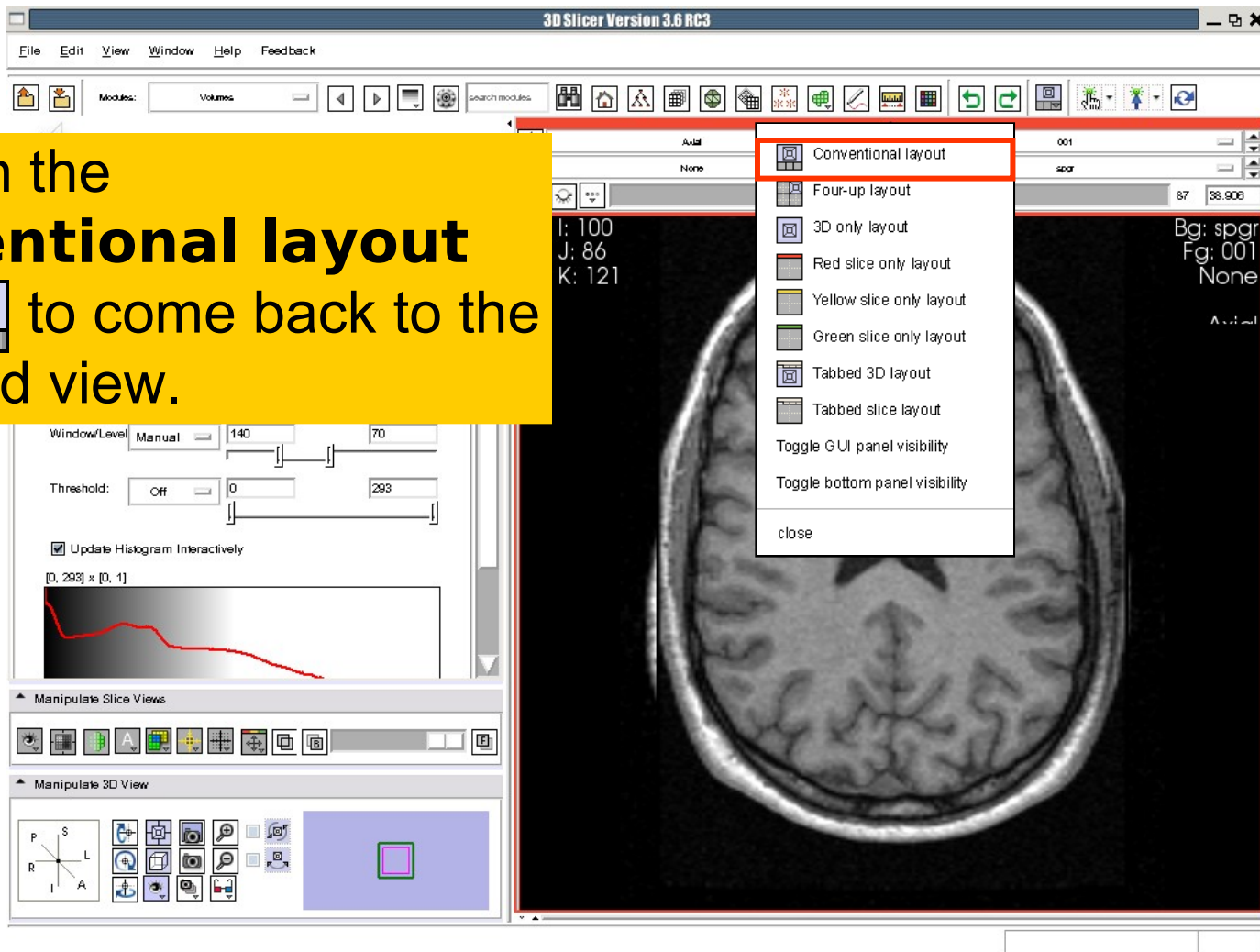
Browse the images using the slider to display the ventricles (~slice# 38).






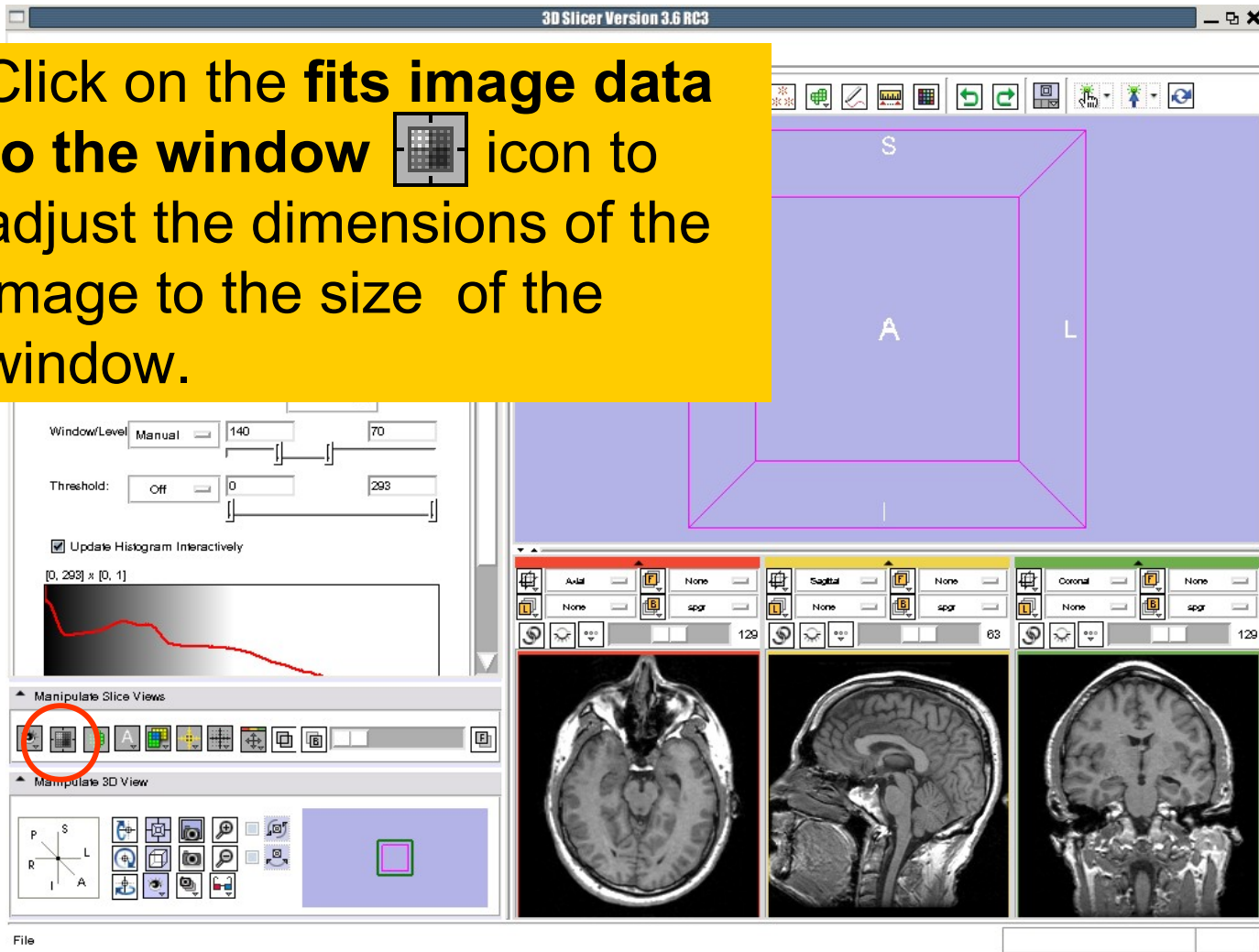
# Exploring the data

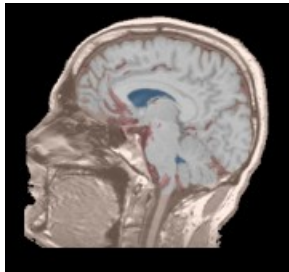
Click on the **Conventional layout** icon  to come back to the standard view.



# 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.



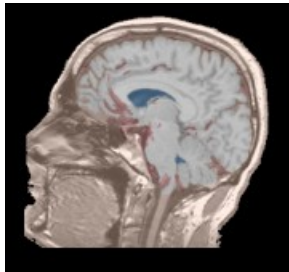


## Part 2: Loading and visualizing segmented structures overlaid on grayscale images

# Label map

---

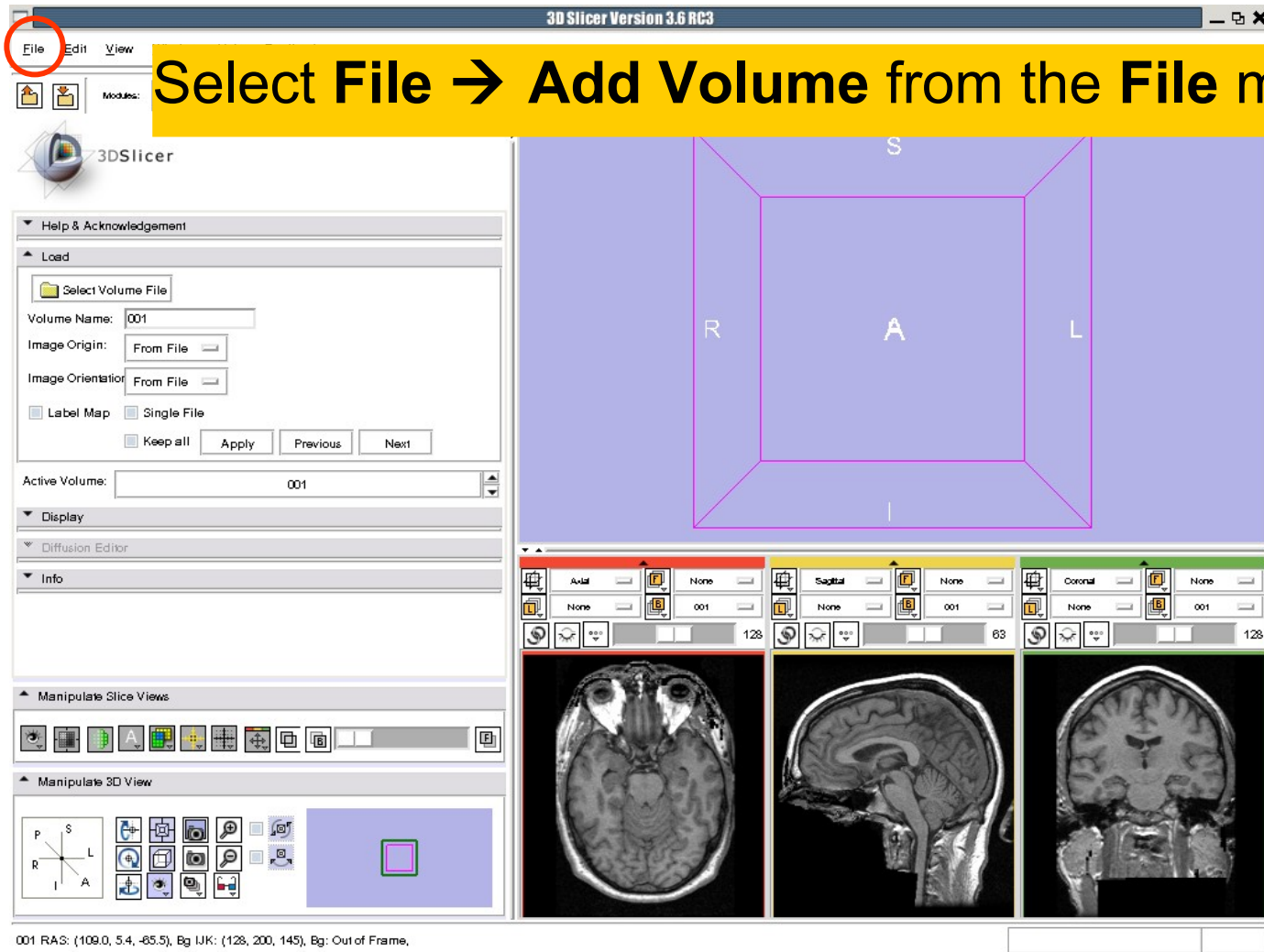
- **Image segmentation** is the extraction of structural information of particular interest from surrounding image.



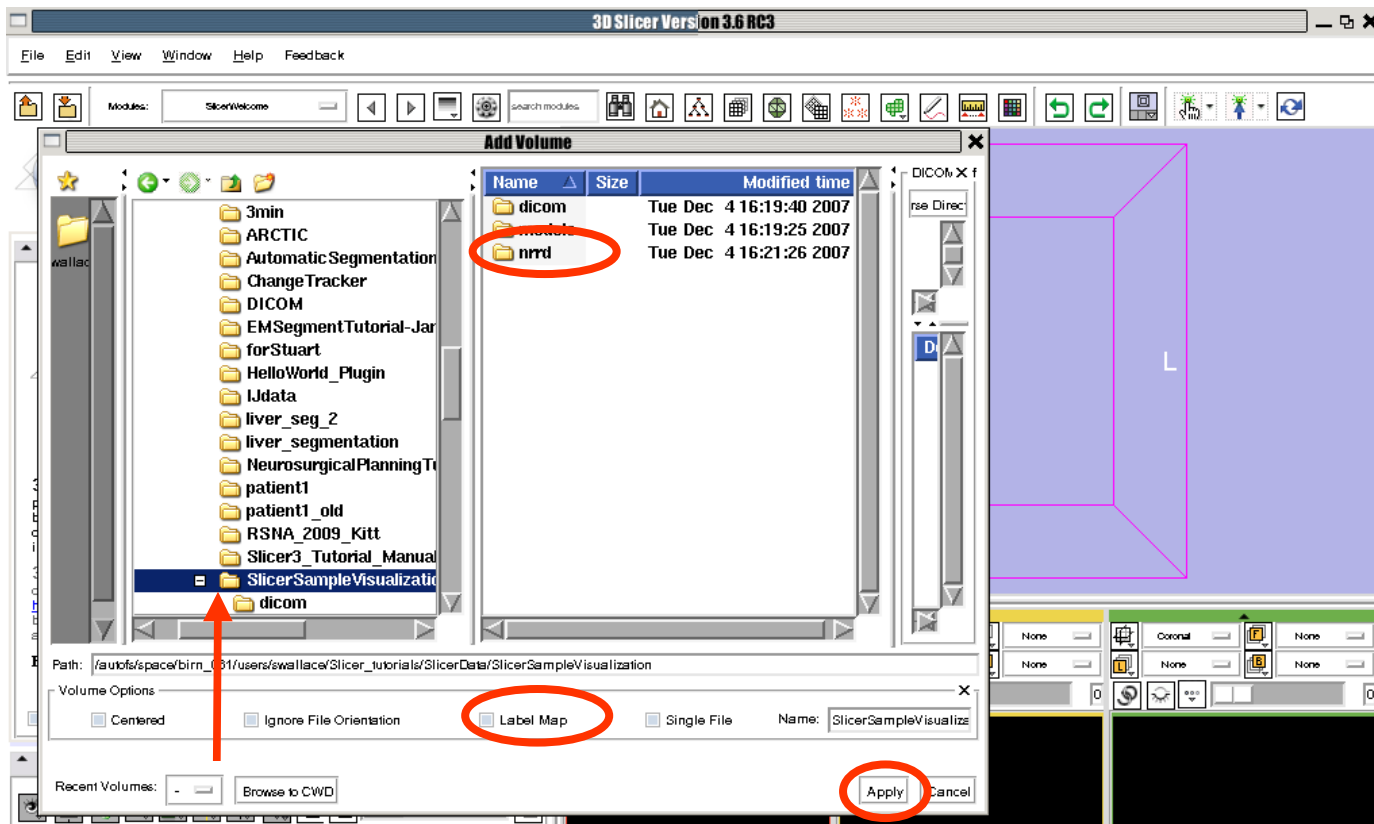
- Each pixel is assigned a specific **label value** which corresponds to the anatomical structure that it belongs to.
- The three-dimensional result of the segmentation is a binary array called **label map**.



# Loading a label map




# Loading a label map

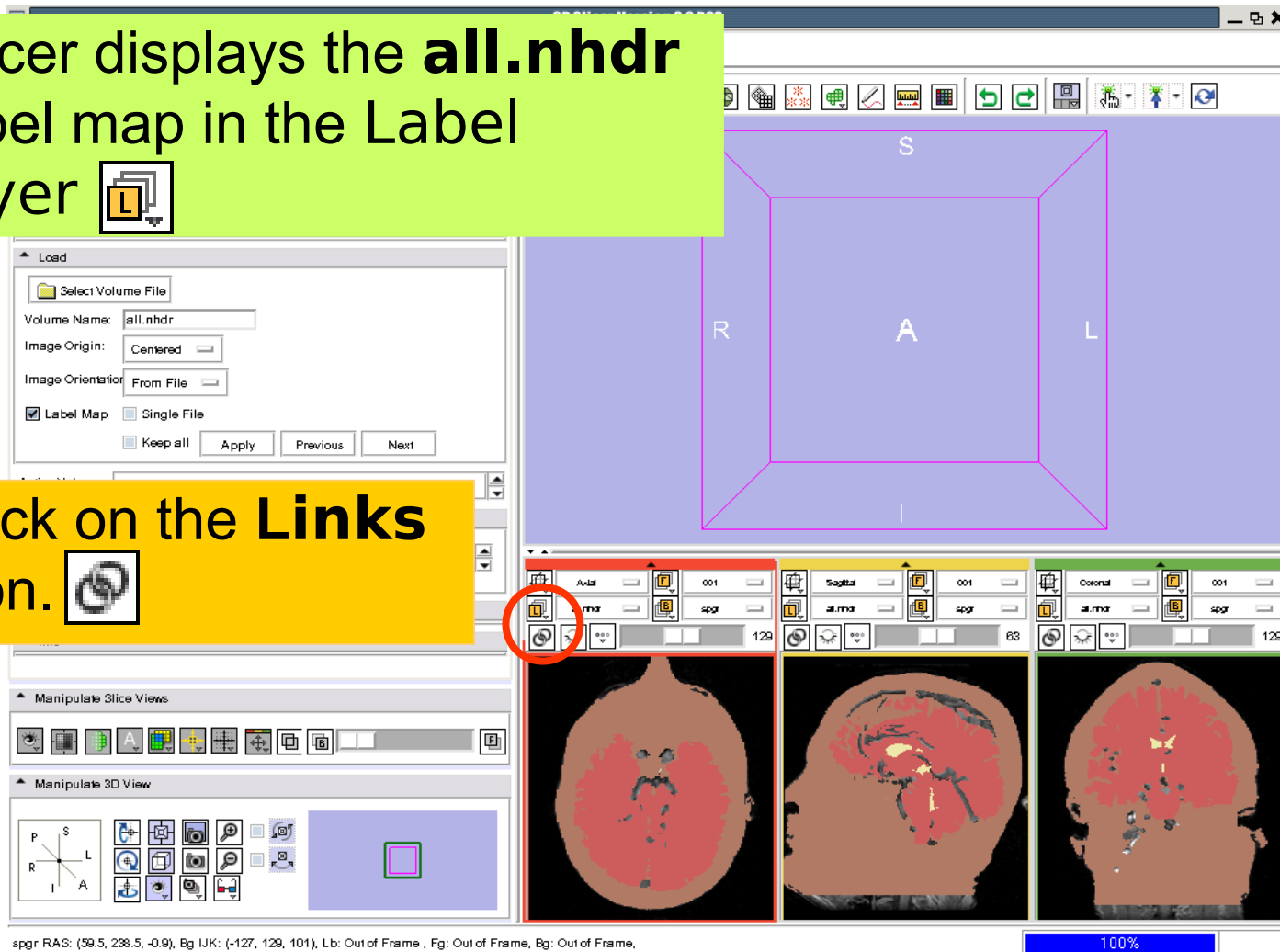


Browse to find the header file (all.nhdr) of the label map dataset located in the SlicerSampleVisualization/nrrd directory set **Volume options** to **Label Map** and click on **Apply**.

# Visualizing a label map

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


Click on the **Links** icon. 

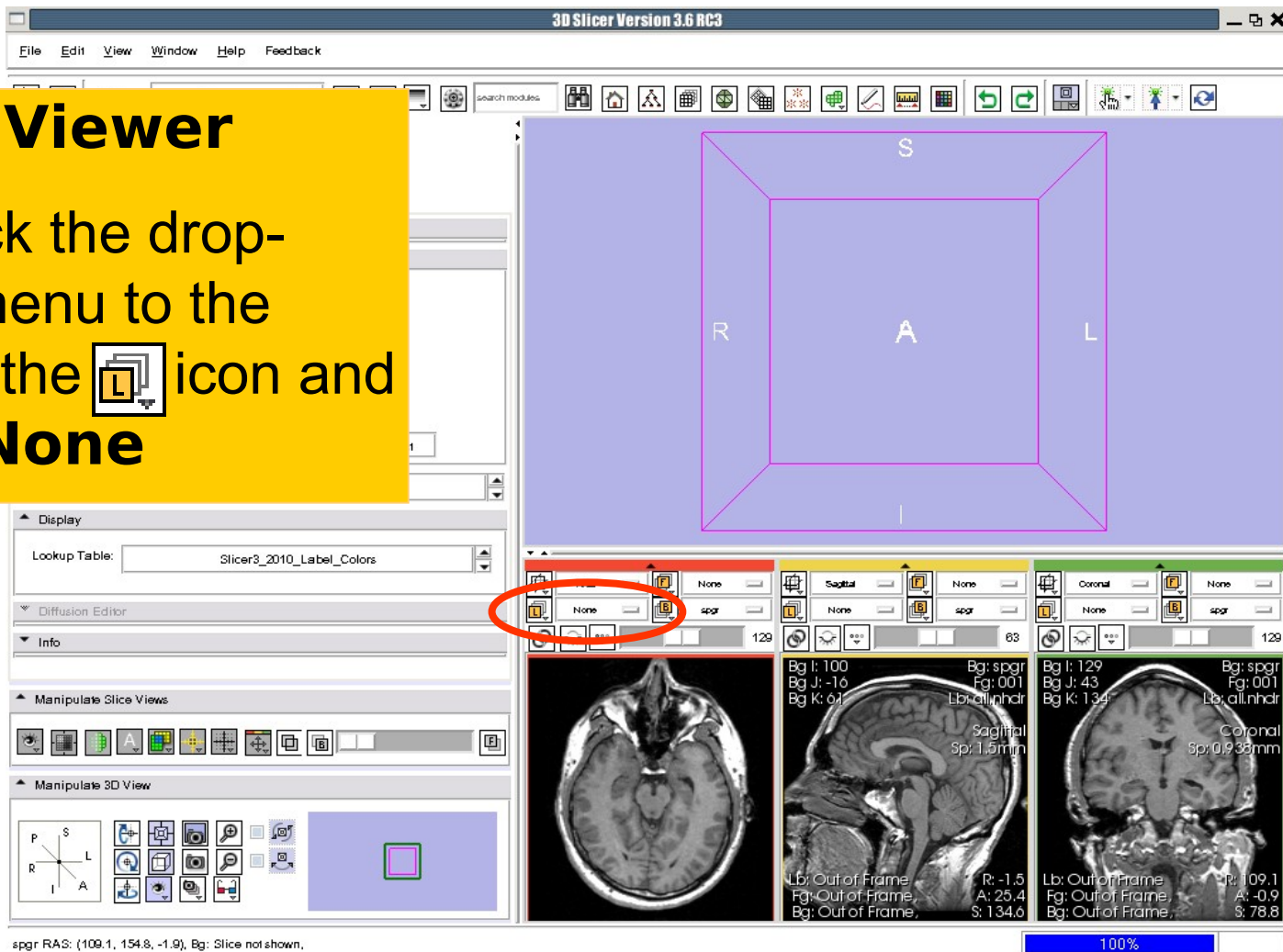




# Visualizing Multiple Volumes


## Label Viewer

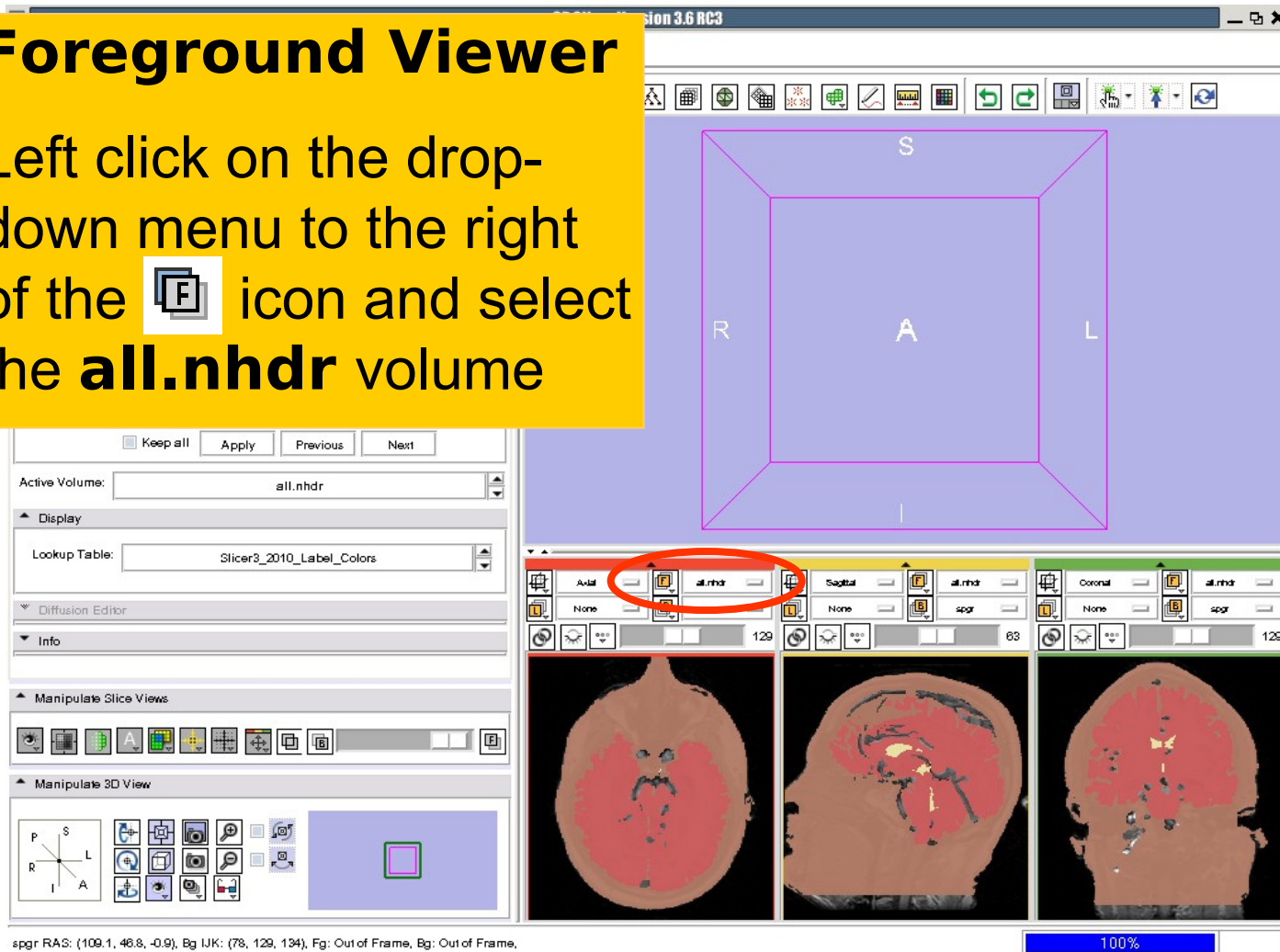
Left click the drop-down menu to the right of the  icon and select **None**



# Visualizing Multiple Volumes

## Foreground Viewer

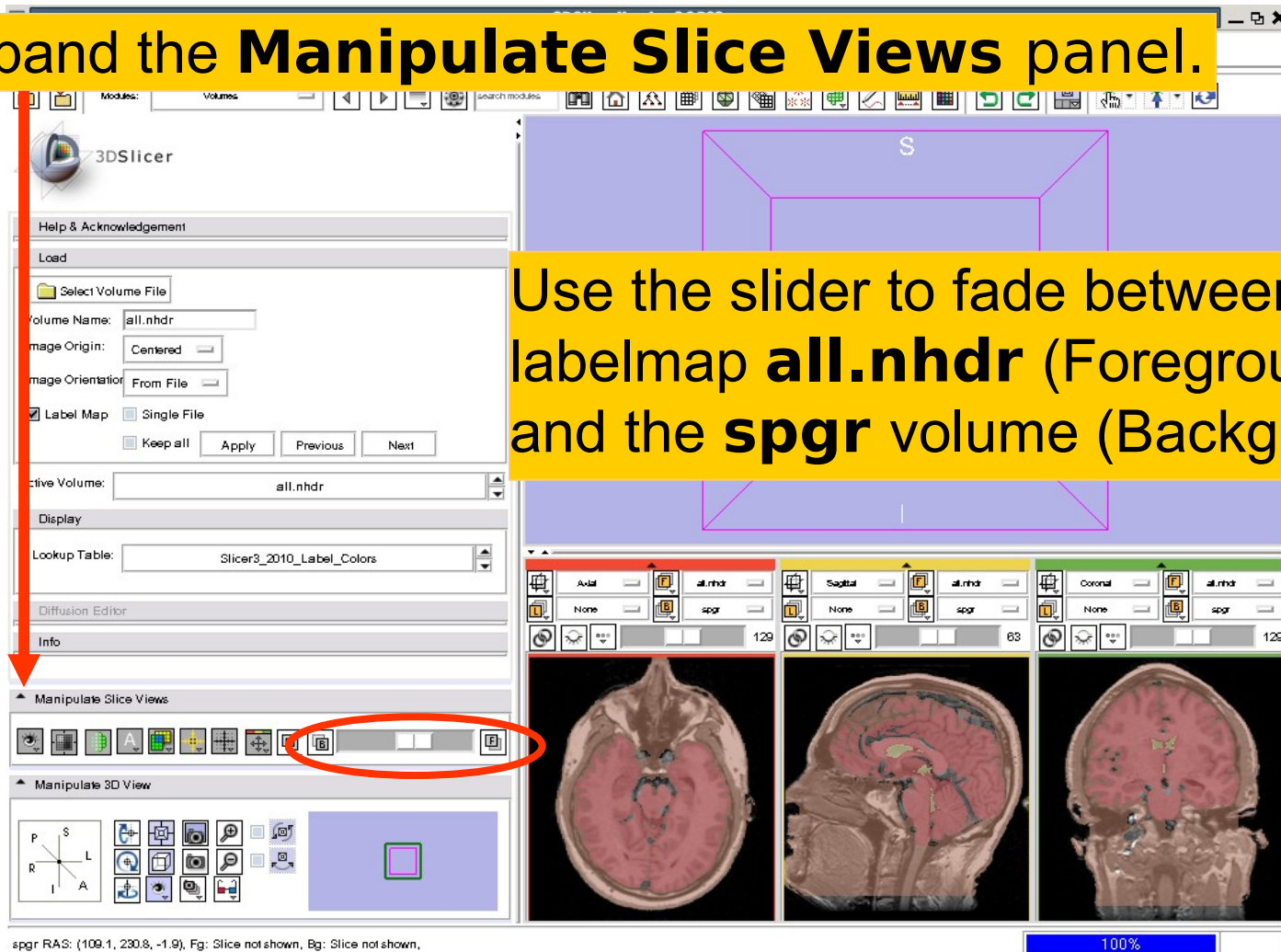
Left click on the drop-down menu to the right of the  icon and select the **all.nhdr** volume



# Visualizing Multiple Volumes

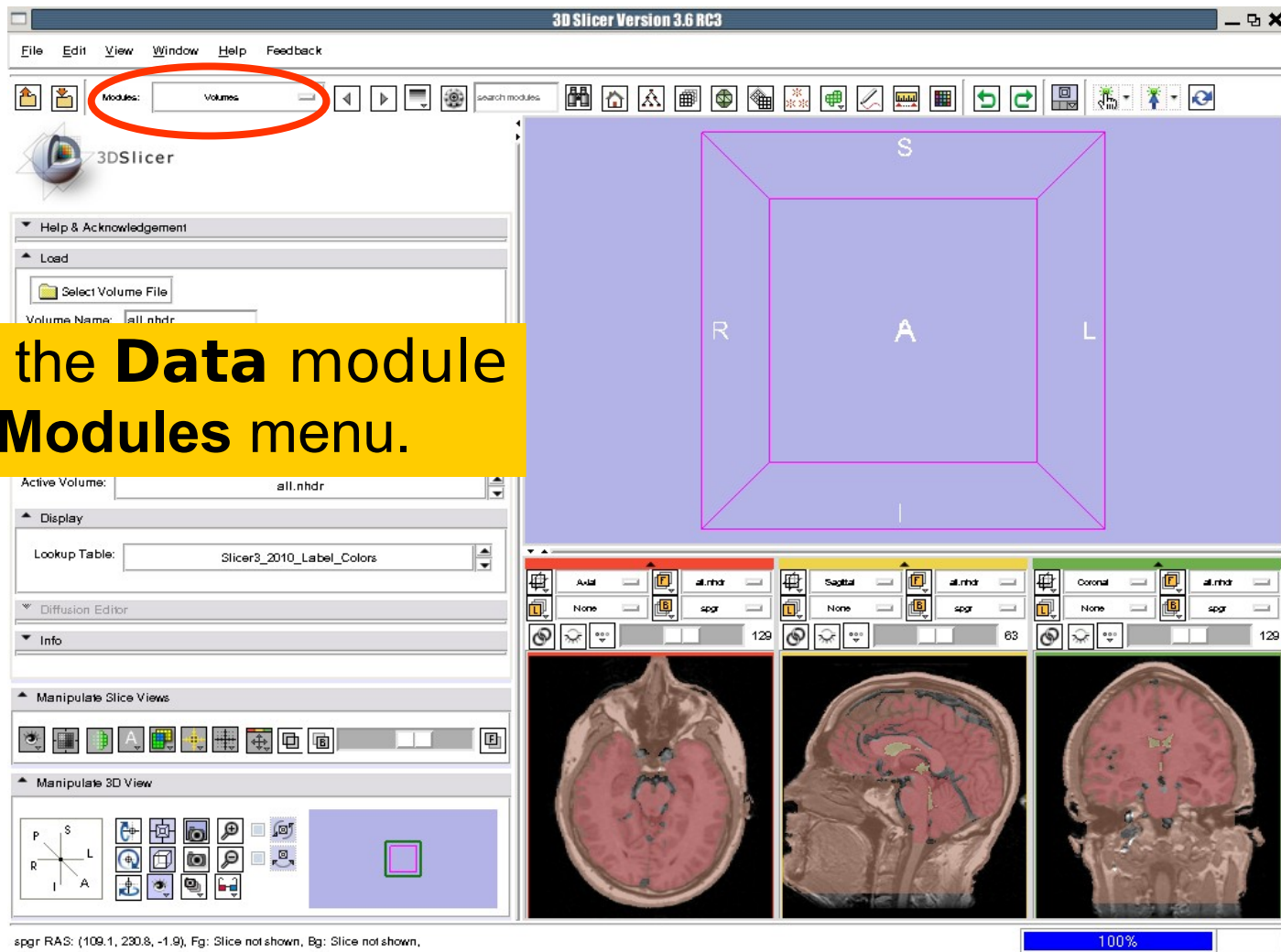
Expand the **Manipulate Slice Views** panel.

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

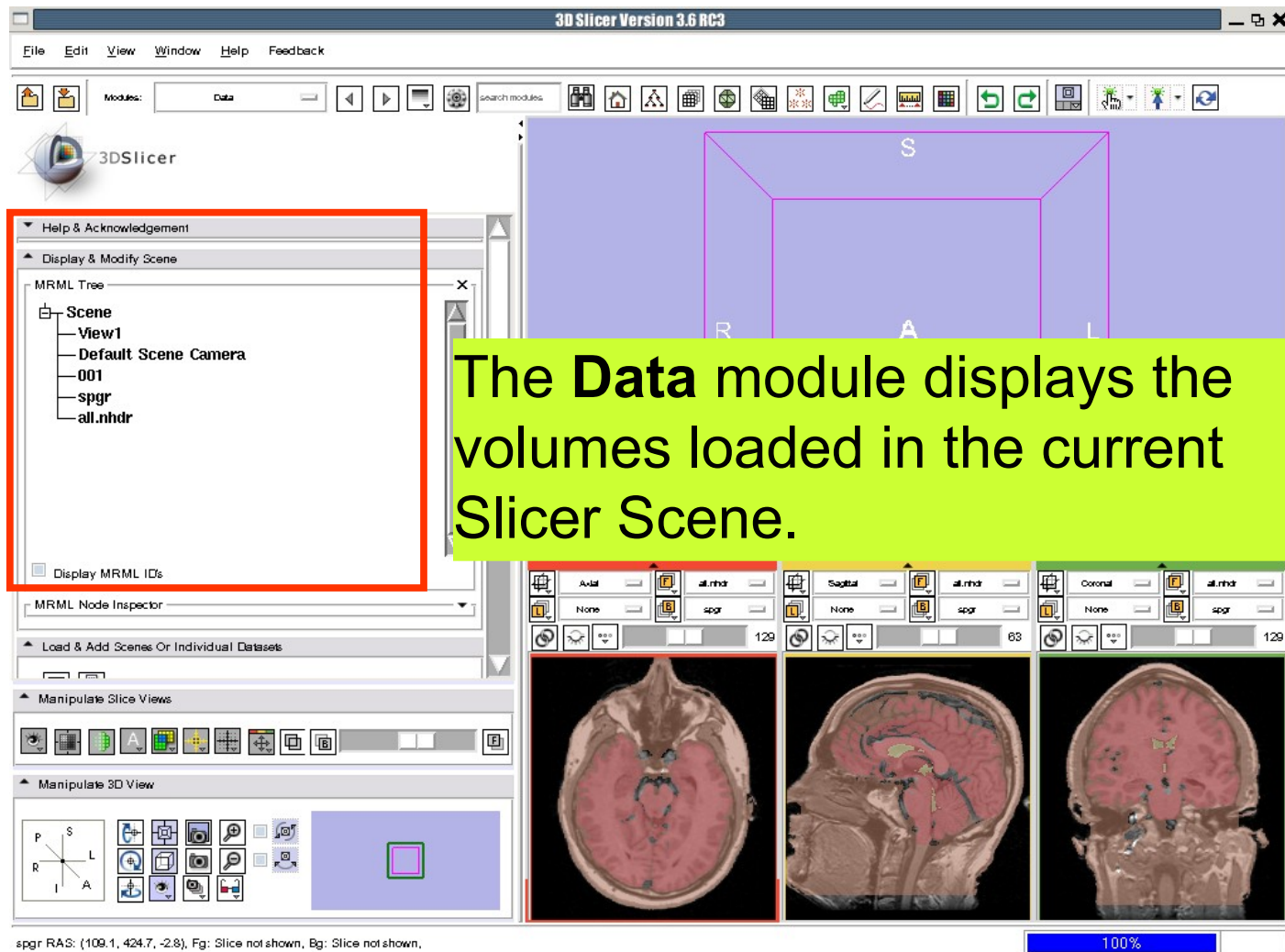


# 3D Visualization

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

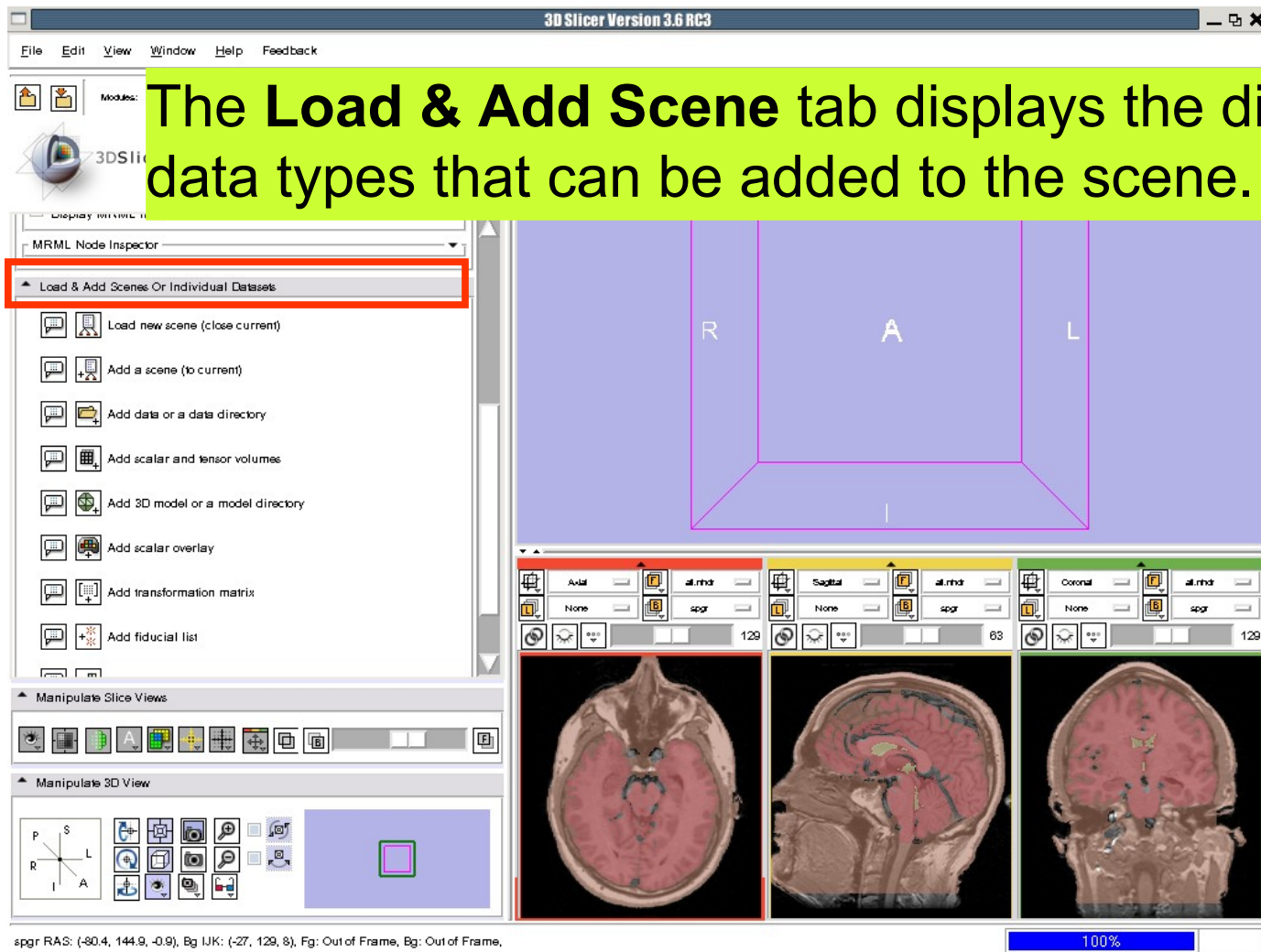


# 3D Visualization

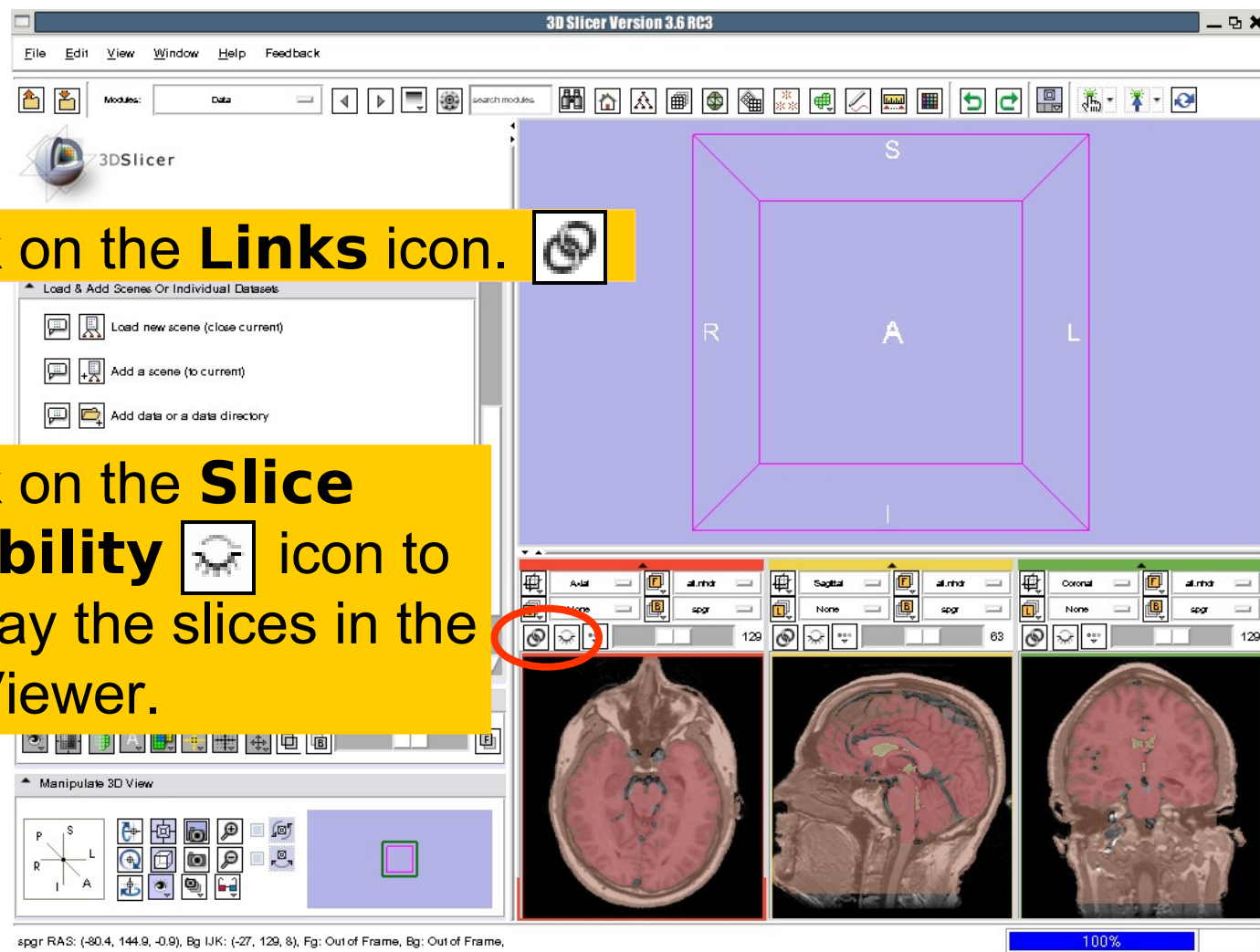




# 3D Visualization

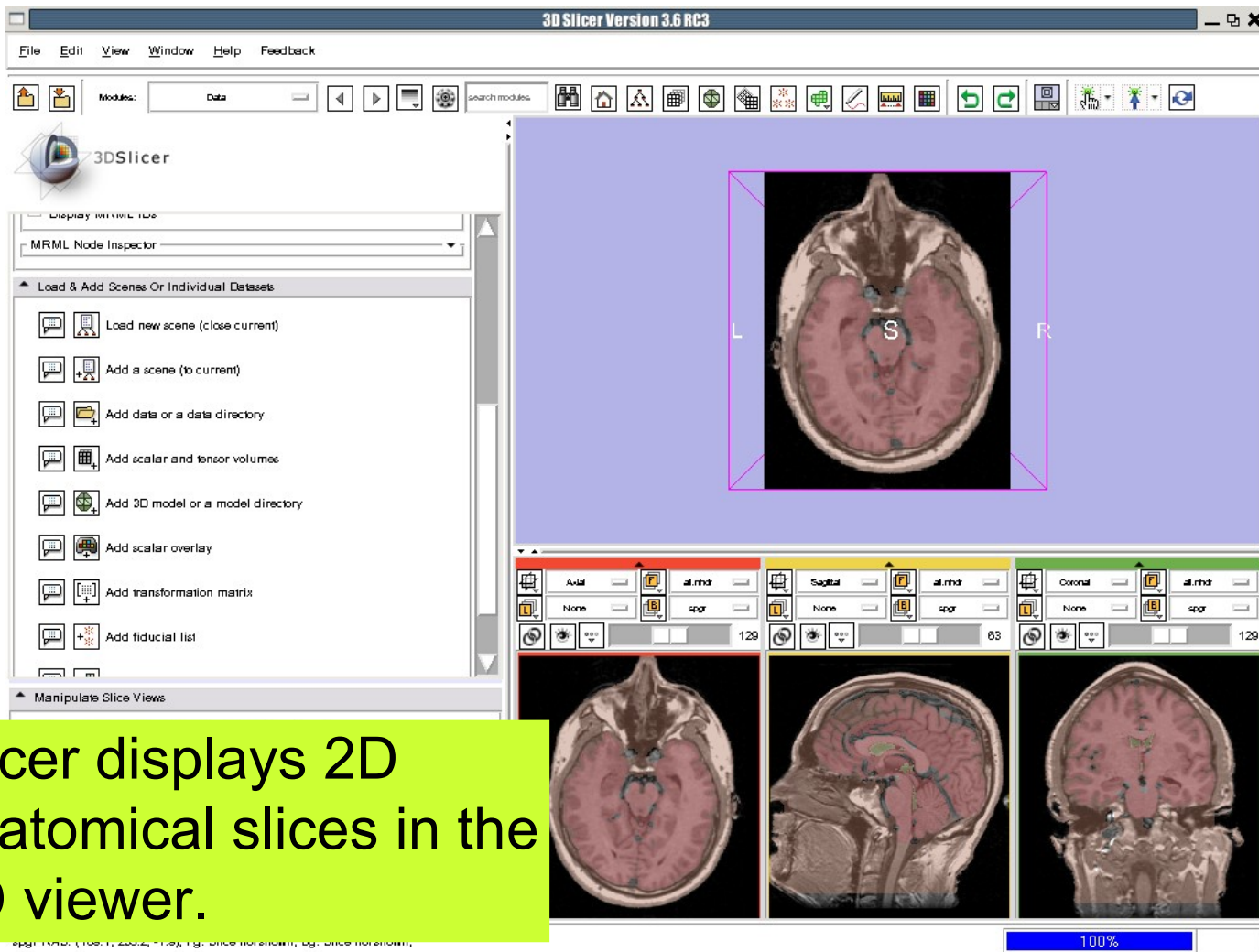


# 3D Visualization



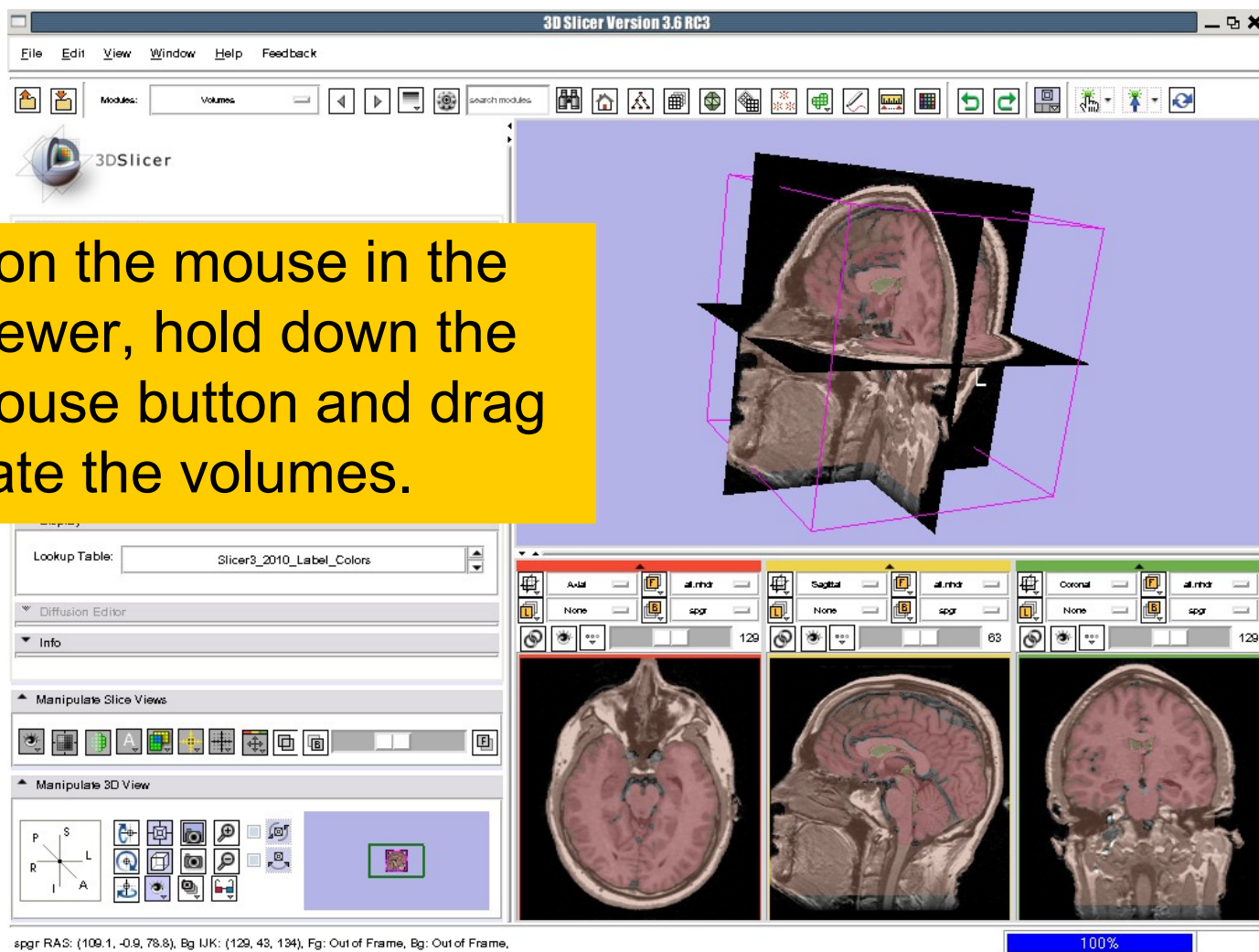


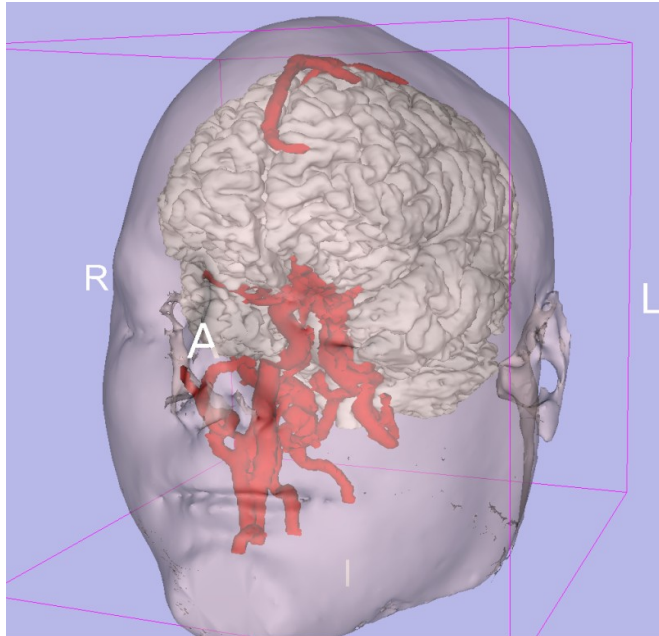
# 3D Visualization



# 3D Visualization

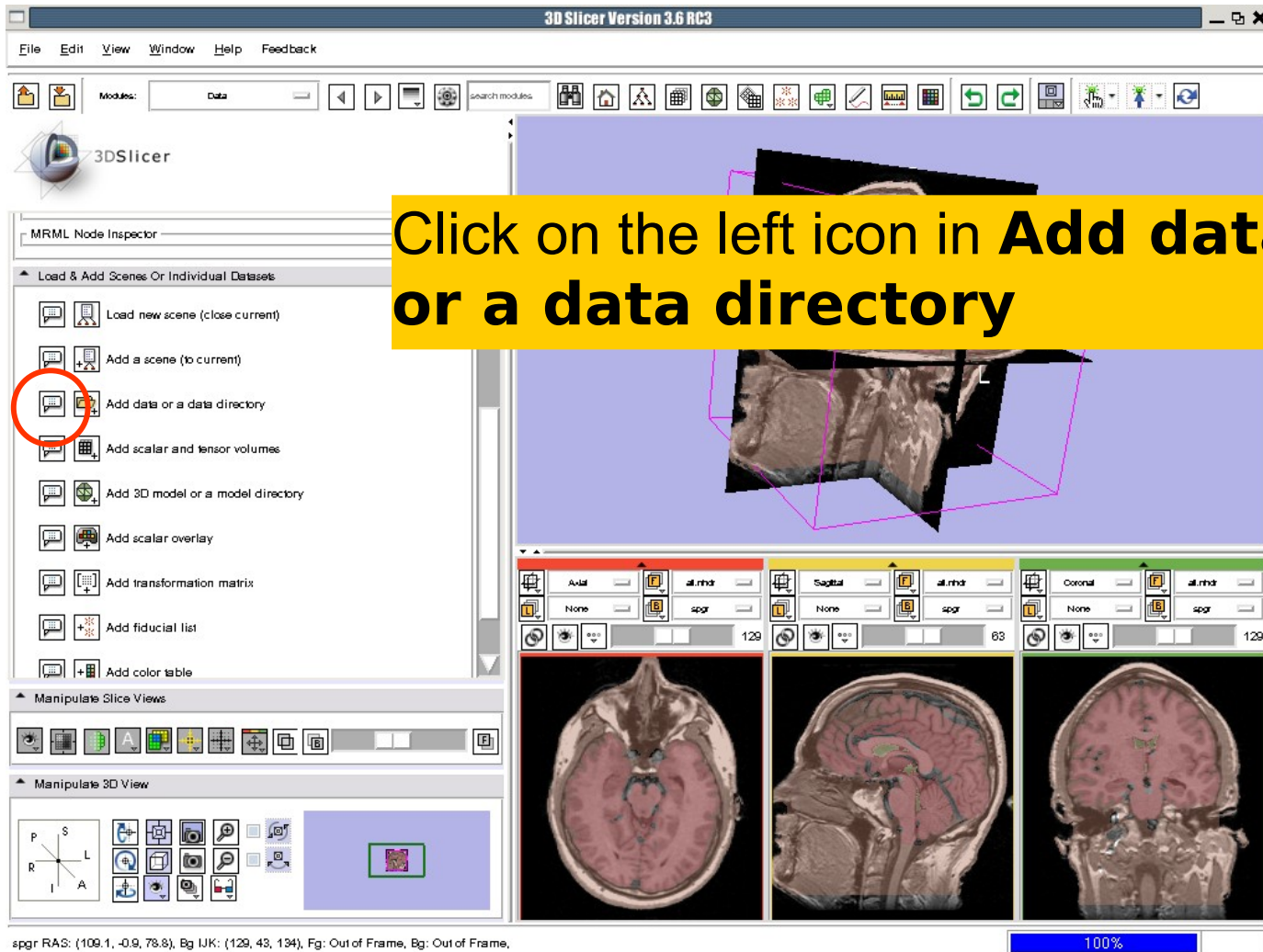
Position the mouse in the 3D Viewer, hold down the left mouse button and drag to rotate the volumes.



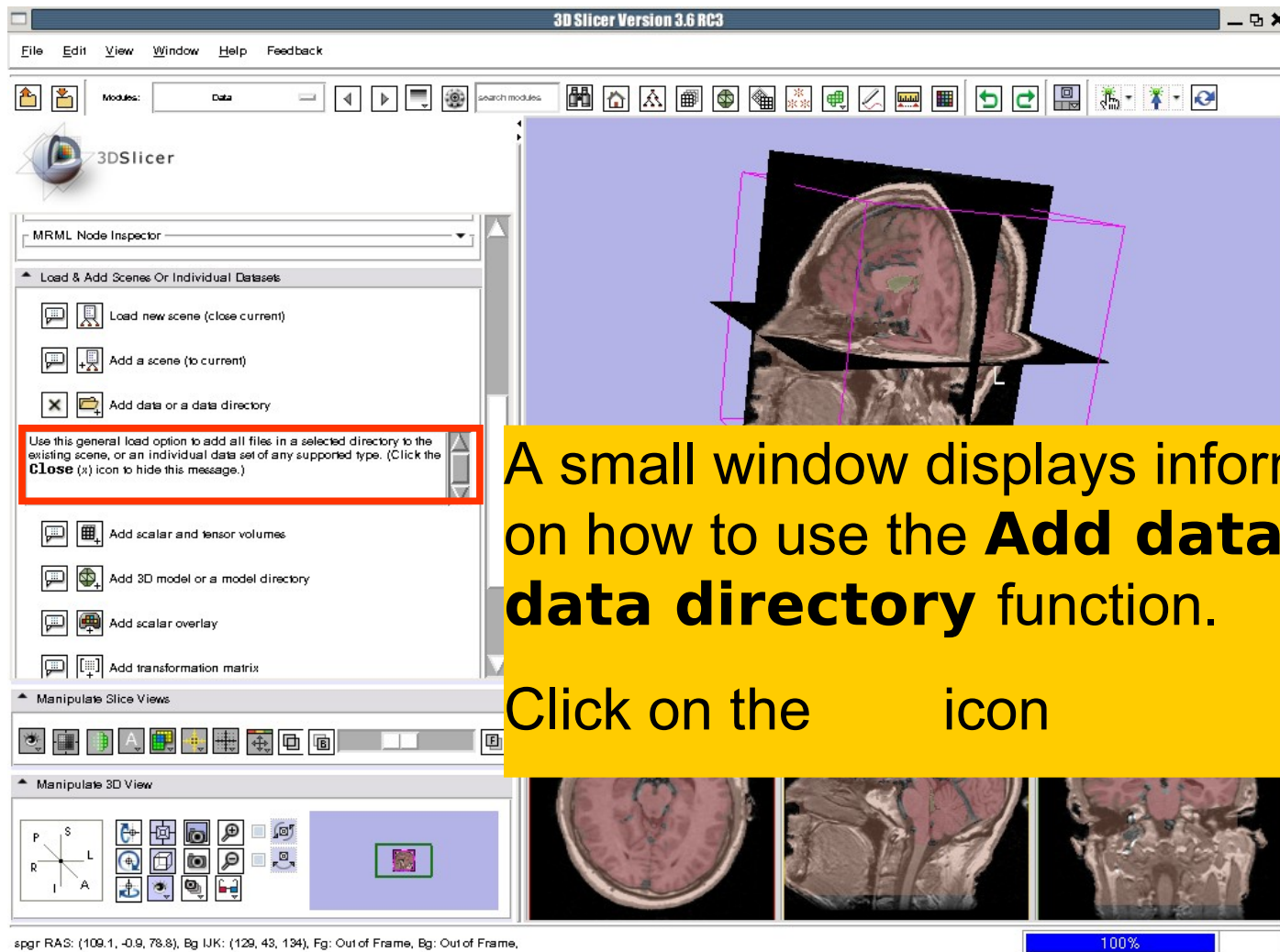


## Part 3: Loading and visualizing 3D models of the anatomy

# 3D Visualization



# 3D Visualization

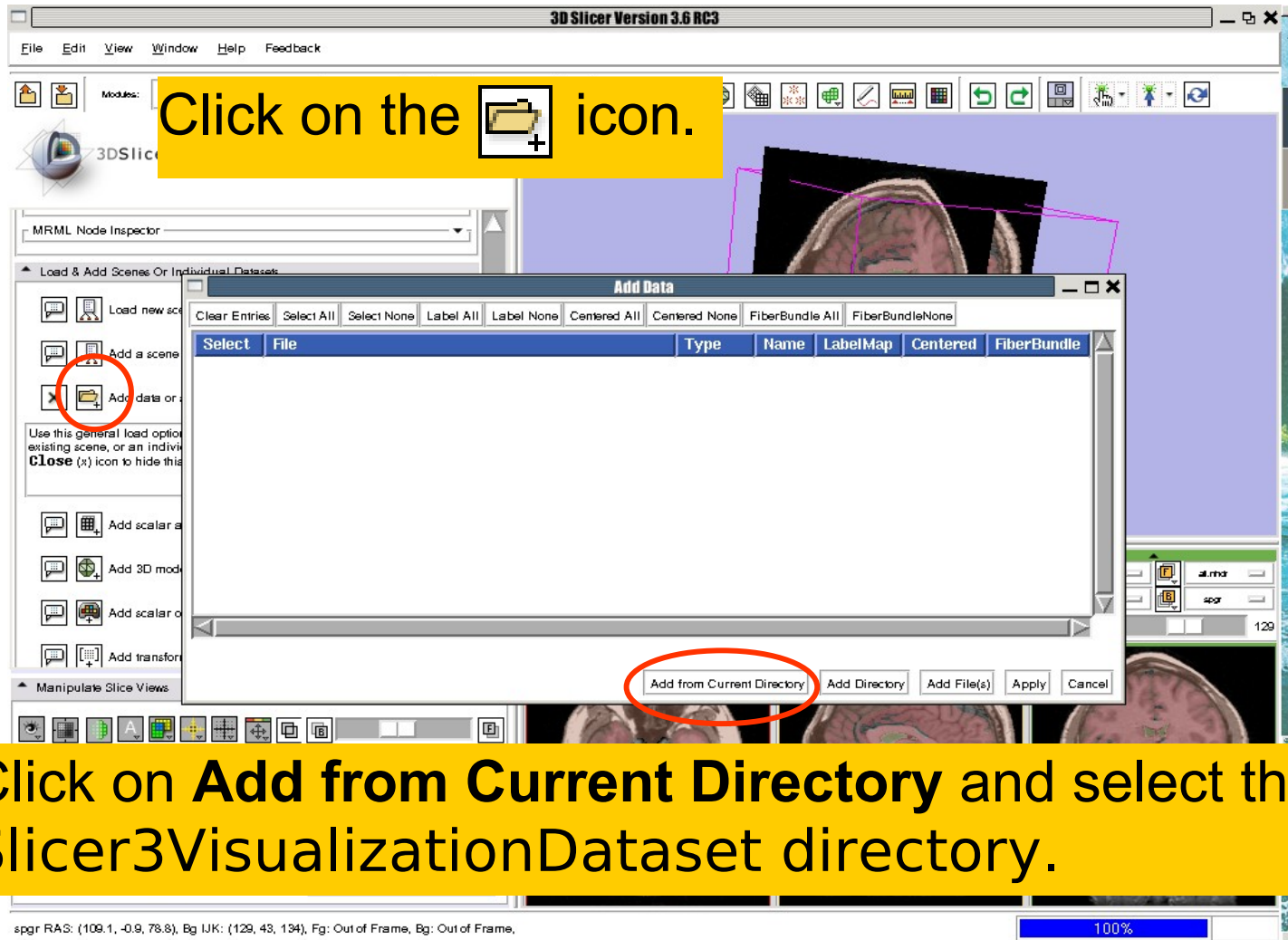


A small window displays information on how to use the **Add data or data directory** function.

Click on the icon

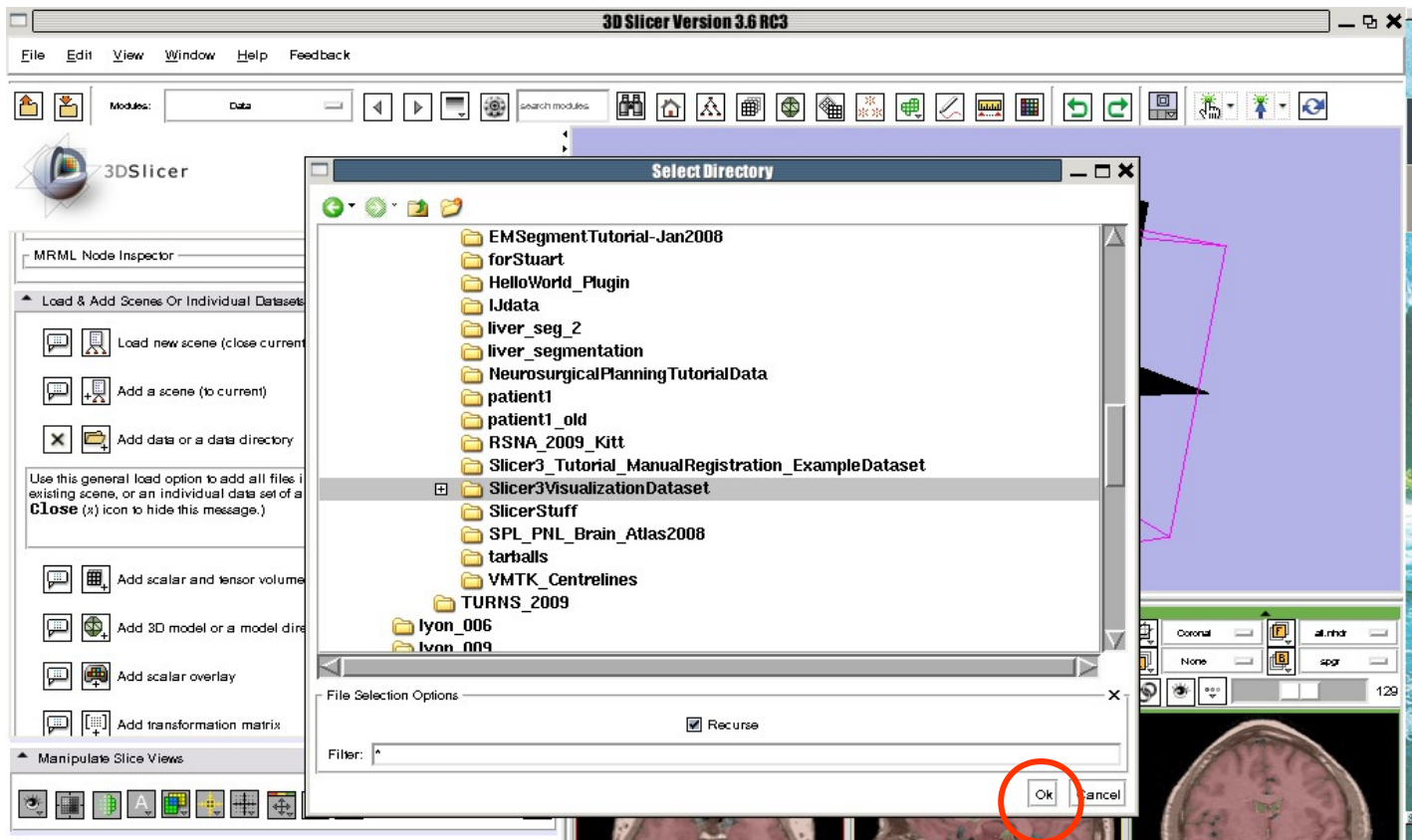


# 3D Visualization



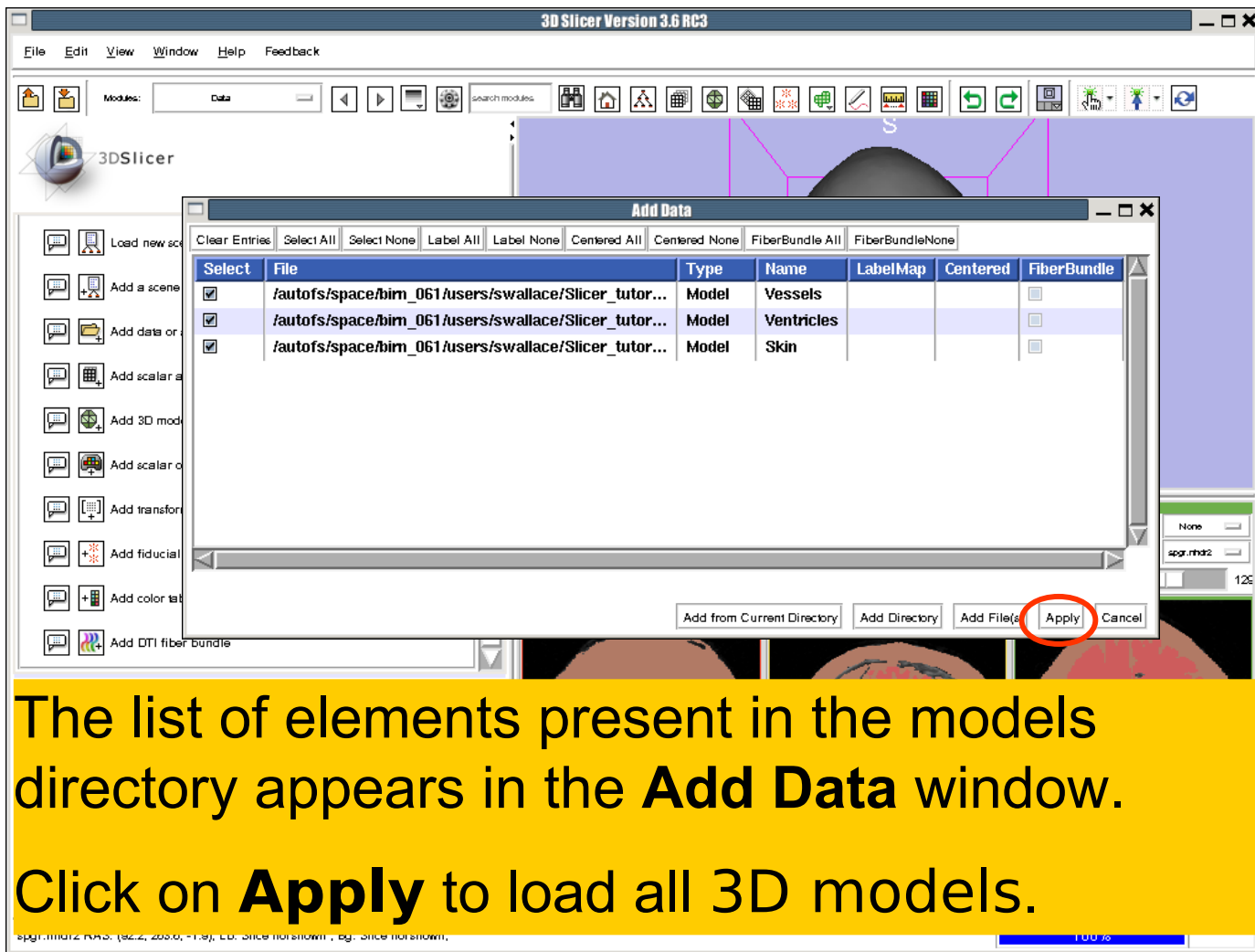


# Loading 3D models



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

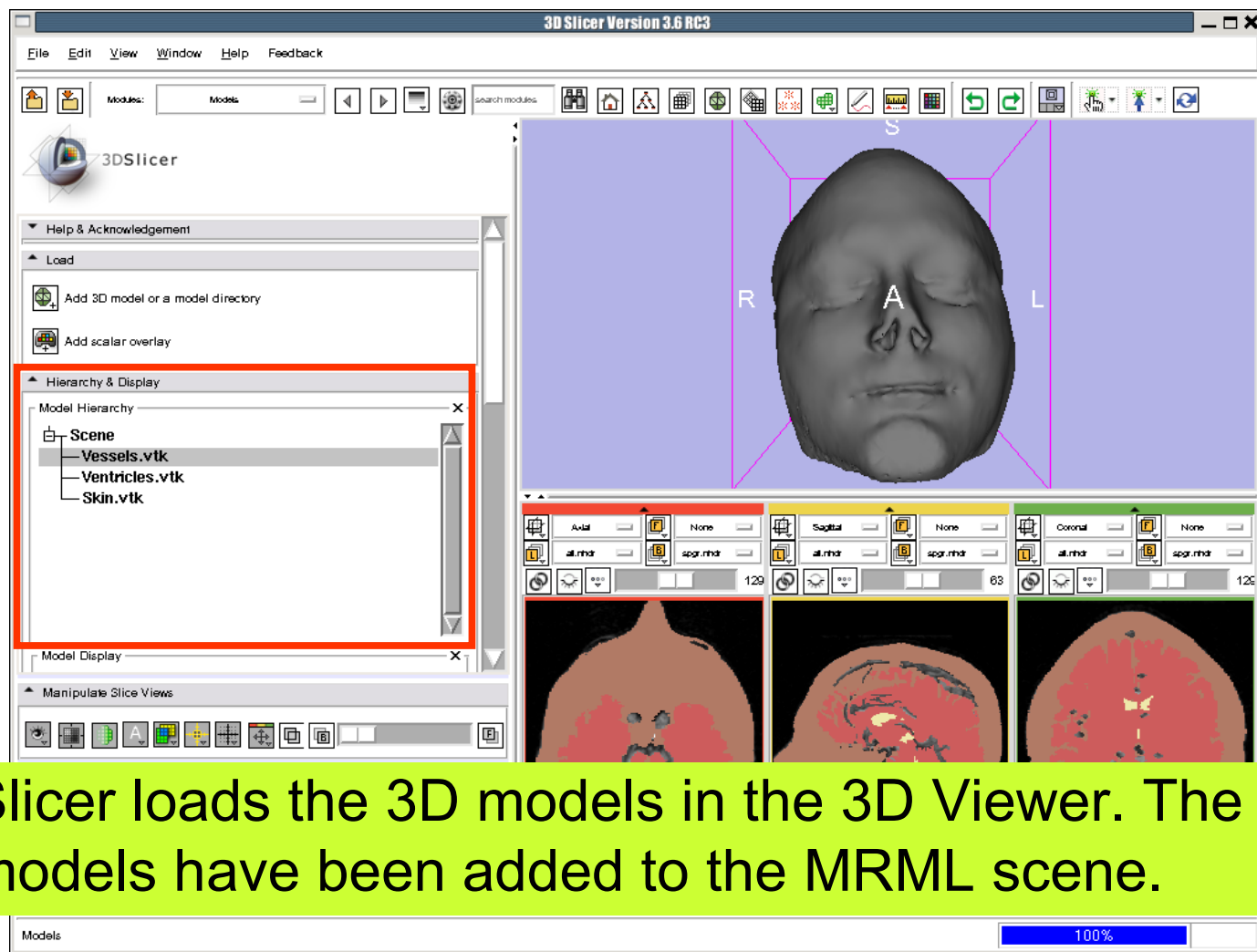
# Loading 3D models



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

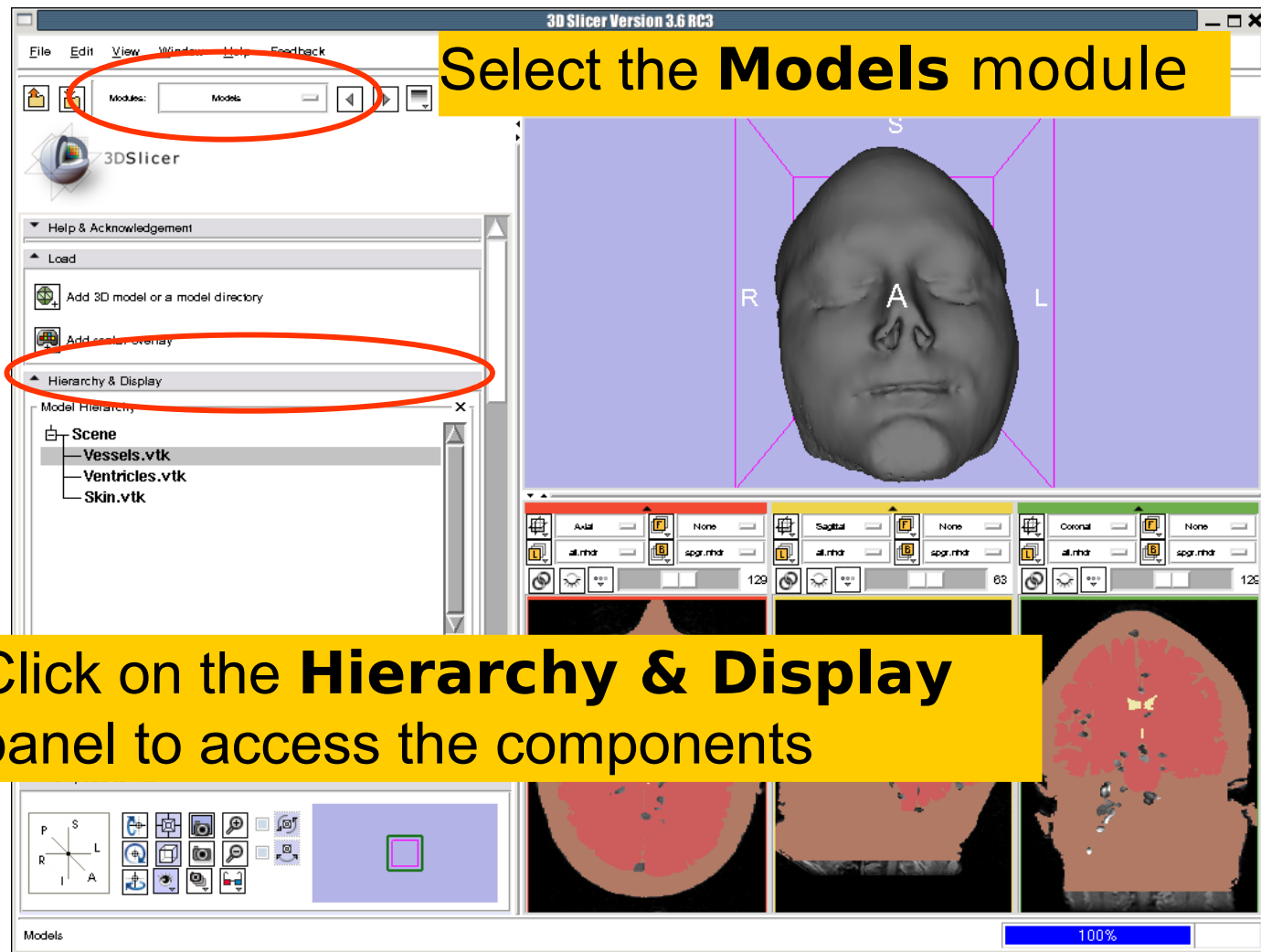
Click on **Apply** to load all 3D models.

# Loading 3D models



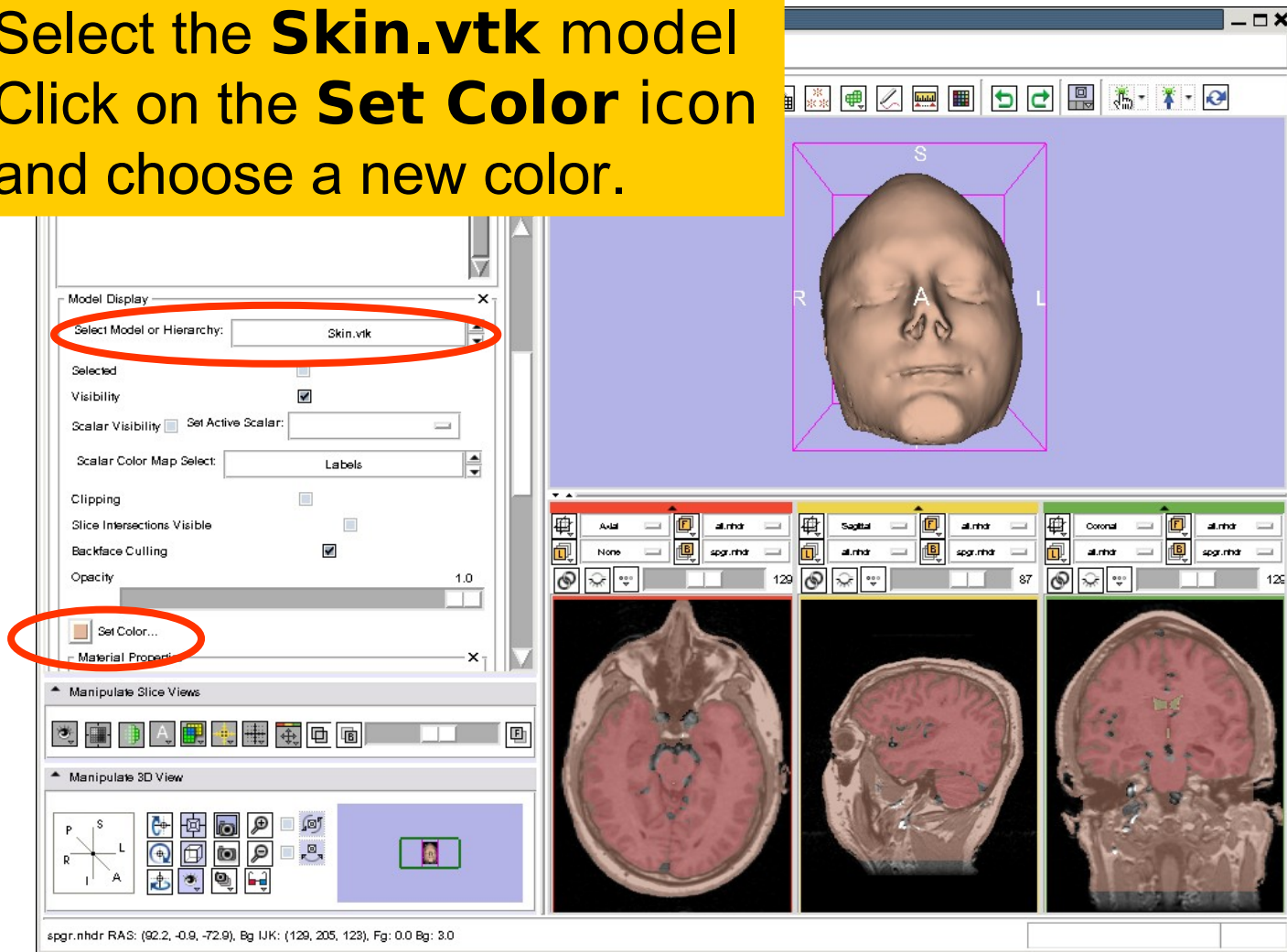
Slicer loads the 3D models in the 3D Viewer. The models have been added to the MRML scene.

# Loading 3D models



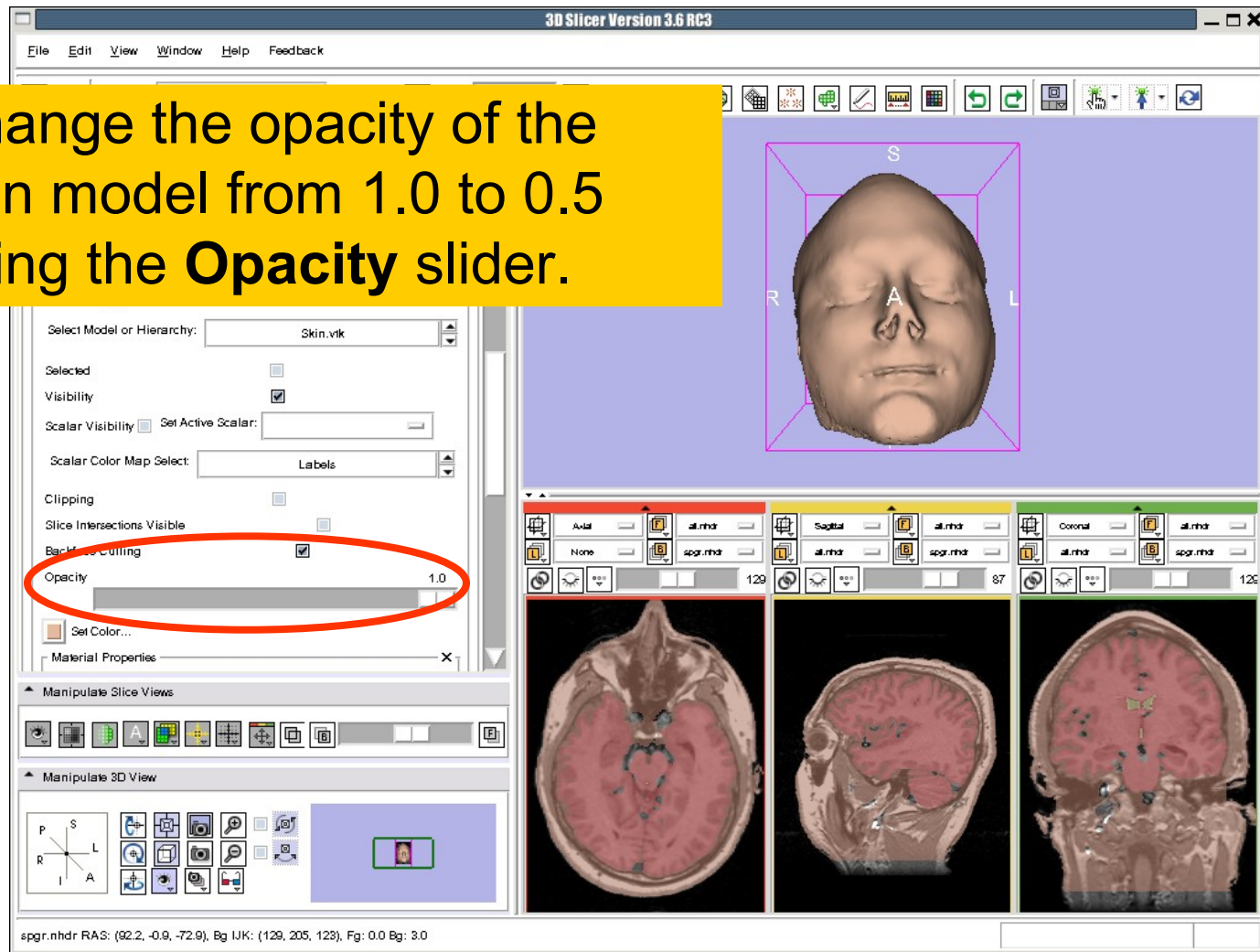
# Visualizing a 3D model

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



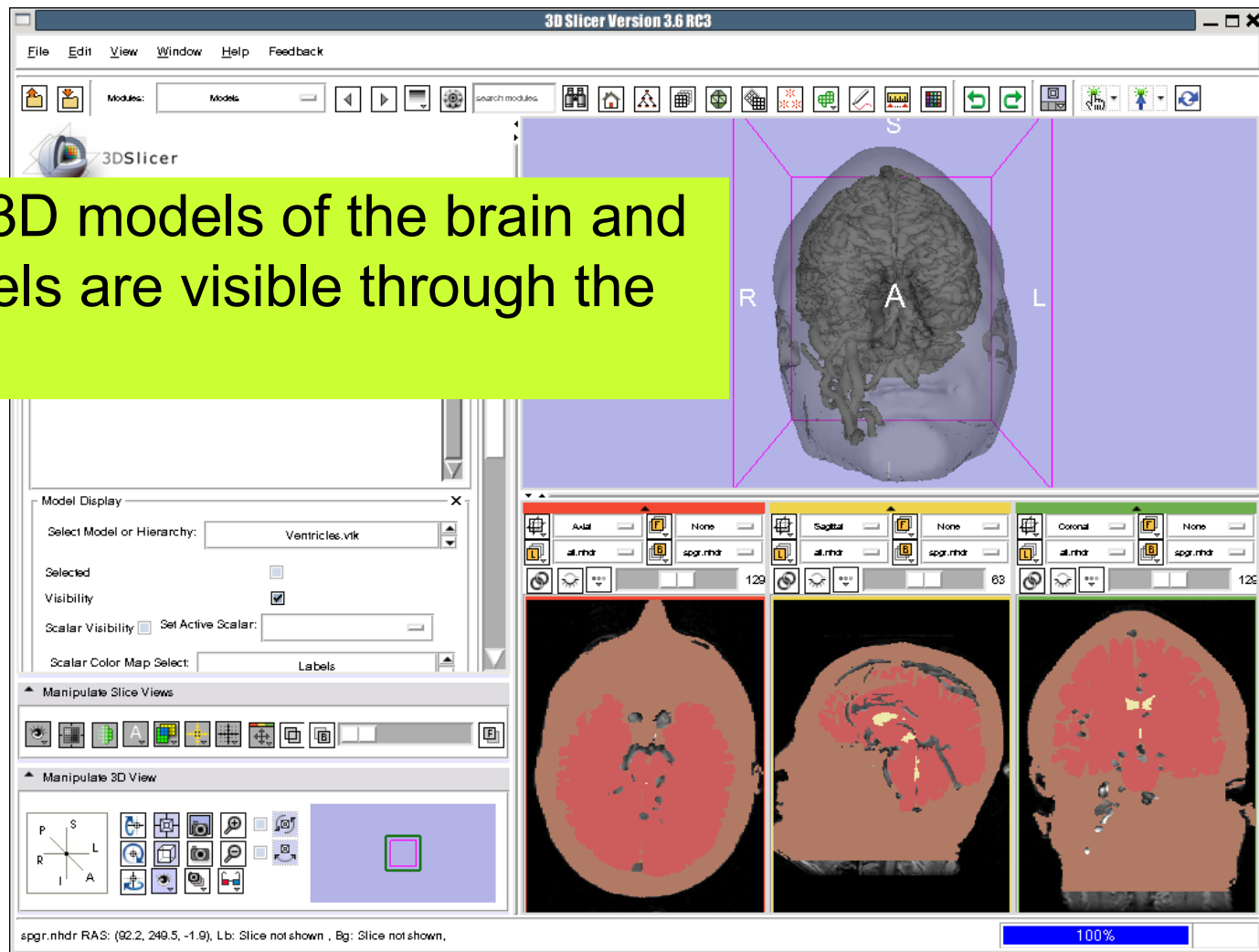
# Visualizing a 3D model

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



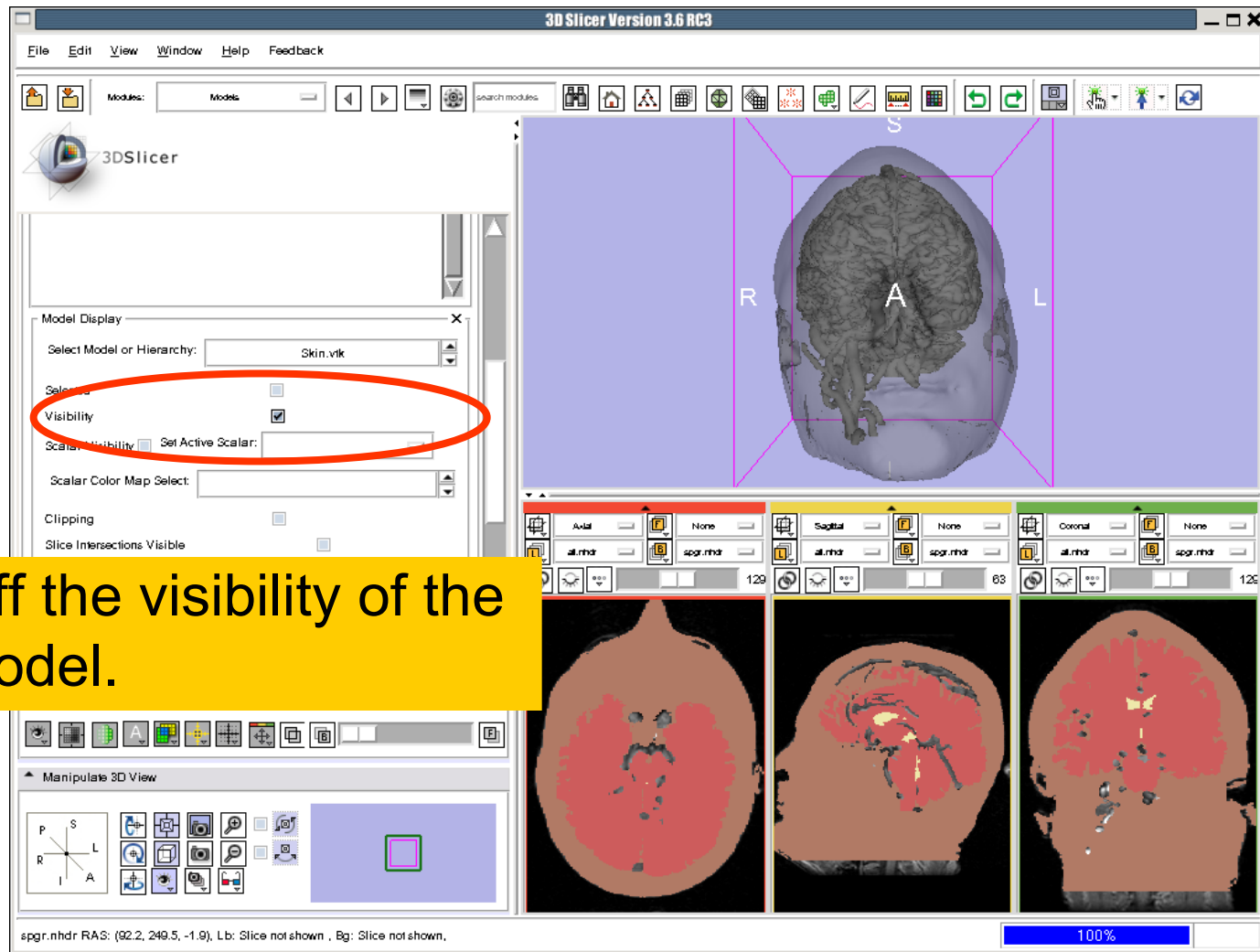
# Visualizing a 3D model

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

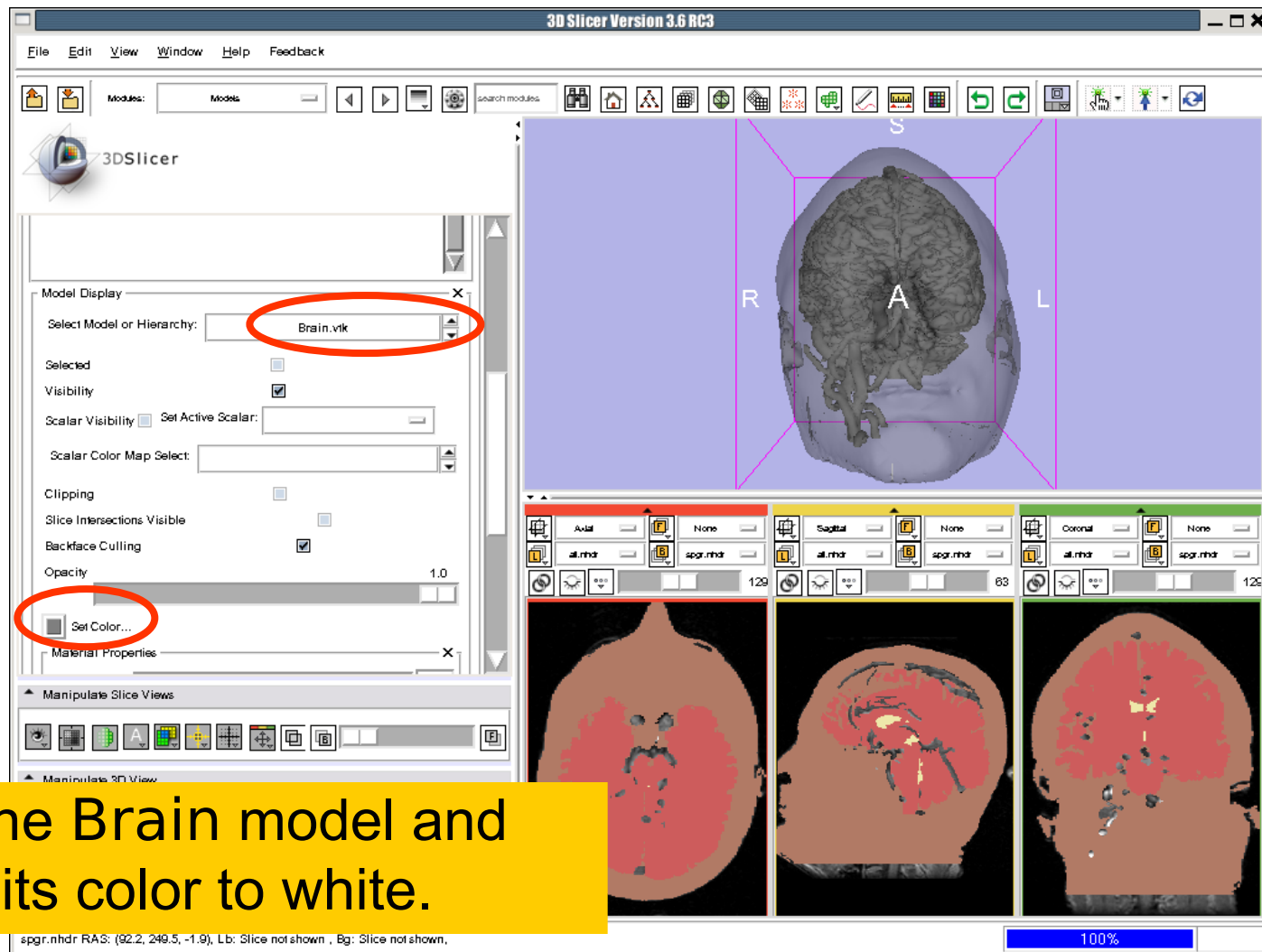




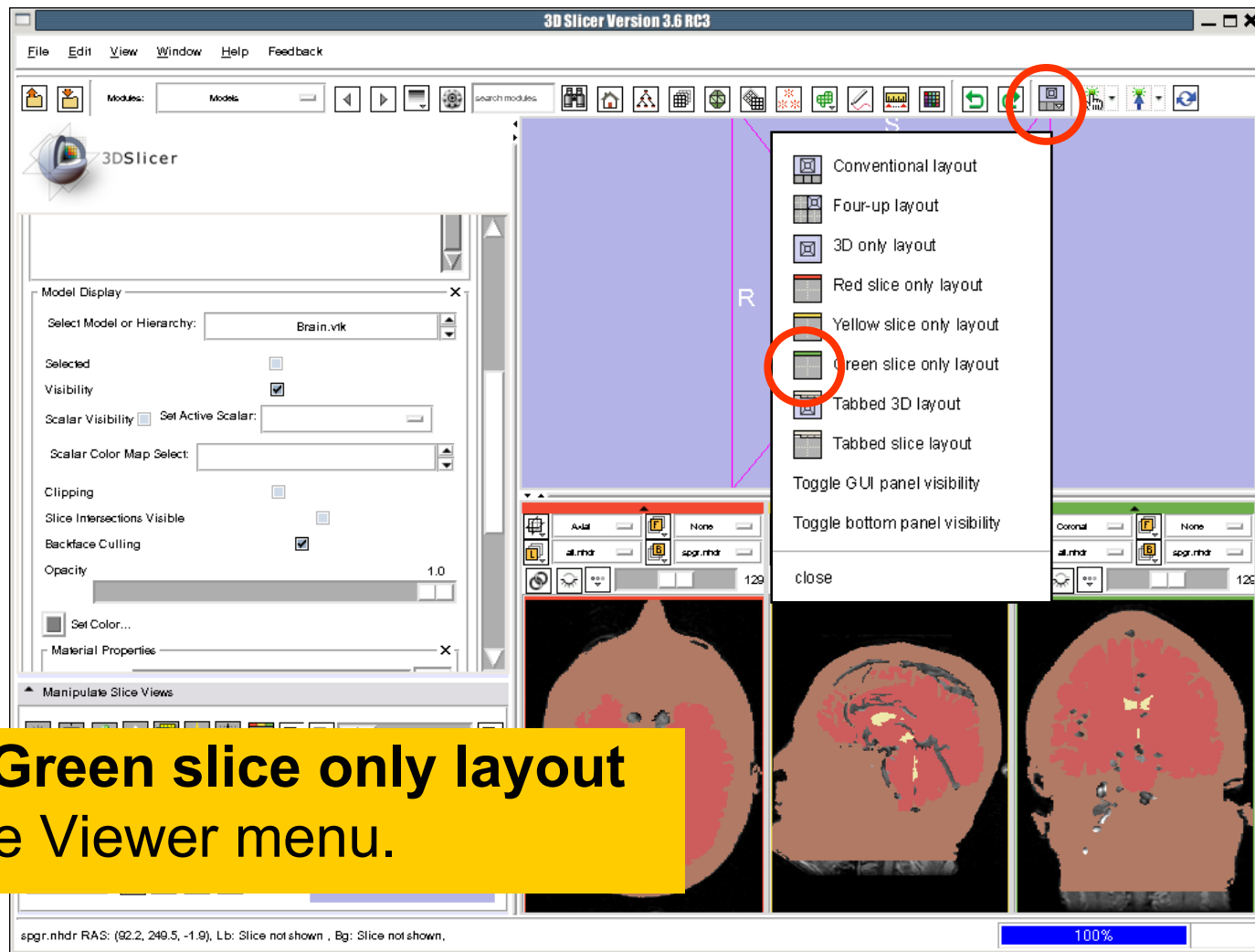
# Visualizing a 3D model



# Visualizing a 3D model




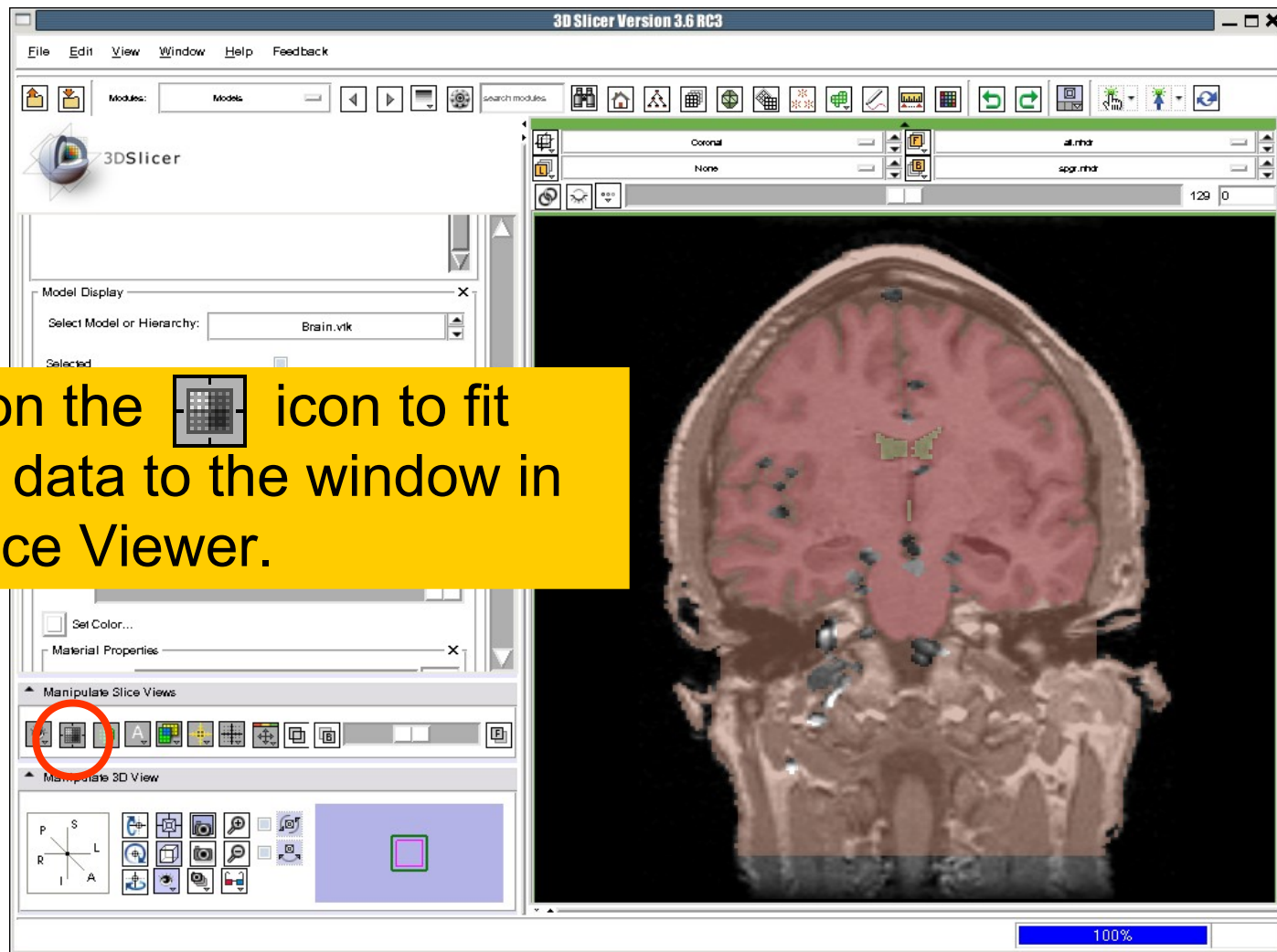
# Visualizing a 3D model



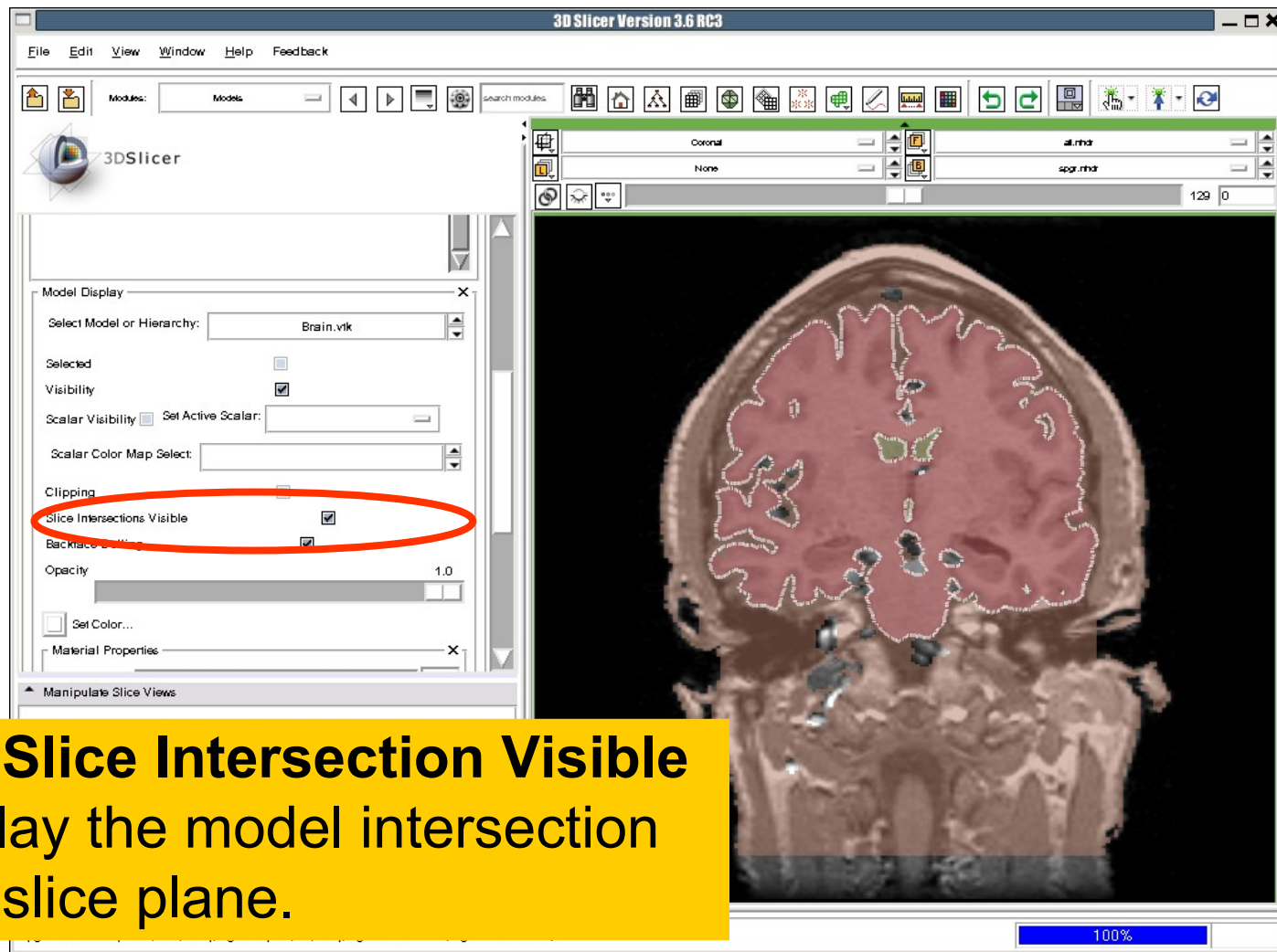
Select **Green slice only layout** from the Viewer menu.

# Visualizing a 3D model

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

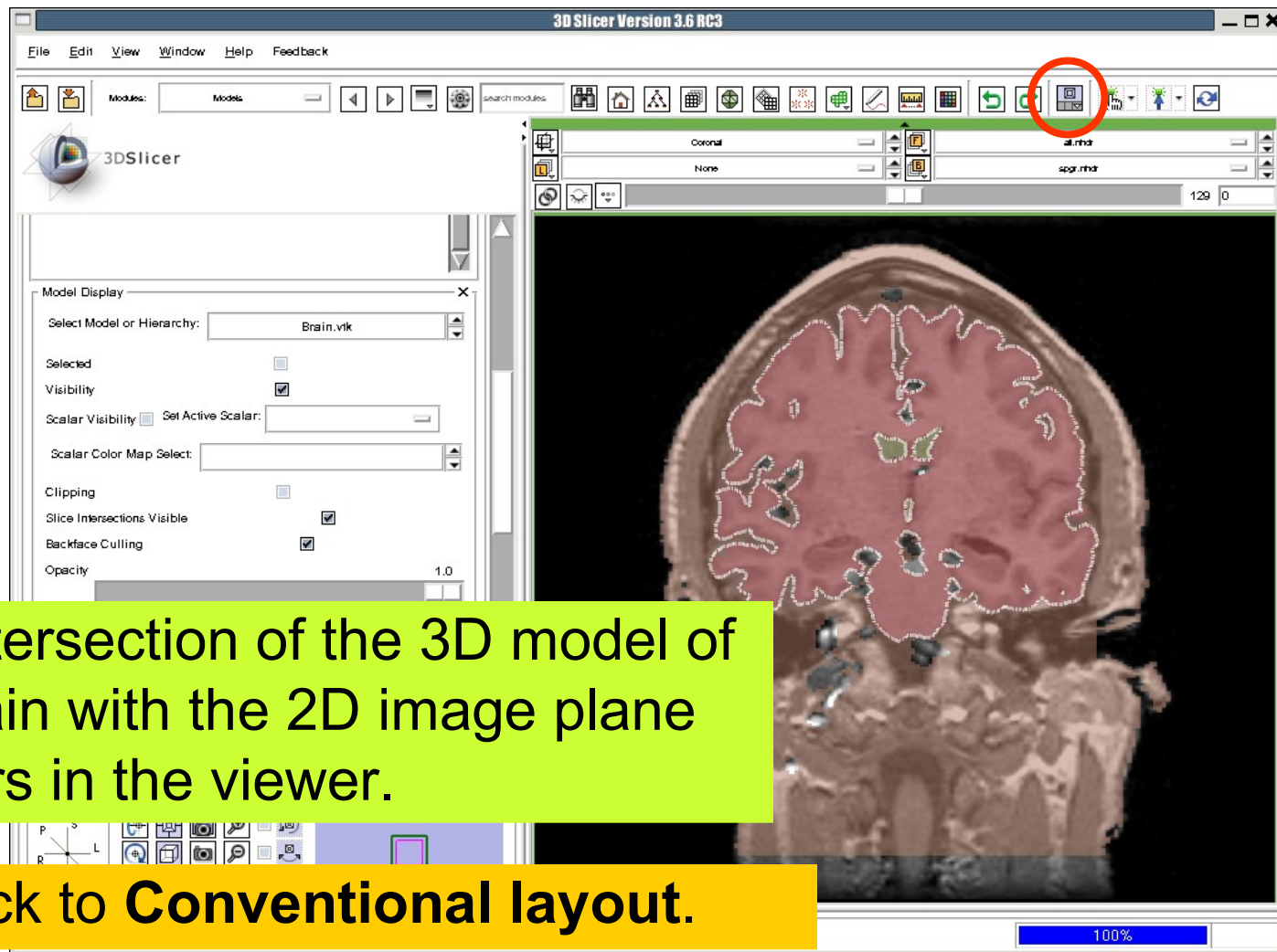


# Visualizing a 3D model



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

# Visualizing a 3D model

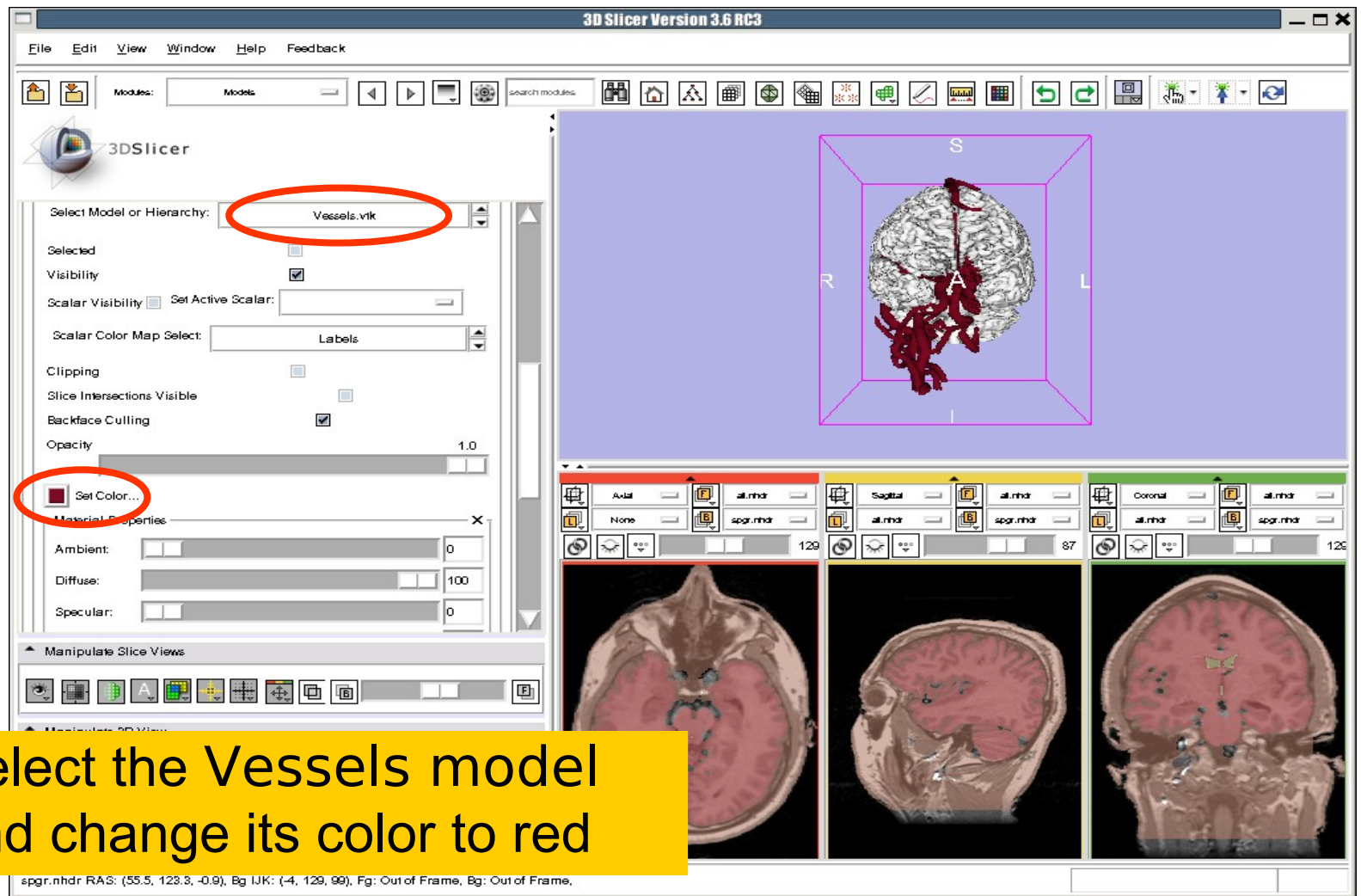


The intersection of the 3D model of the brain with the 2D image plane appears in the viewer.

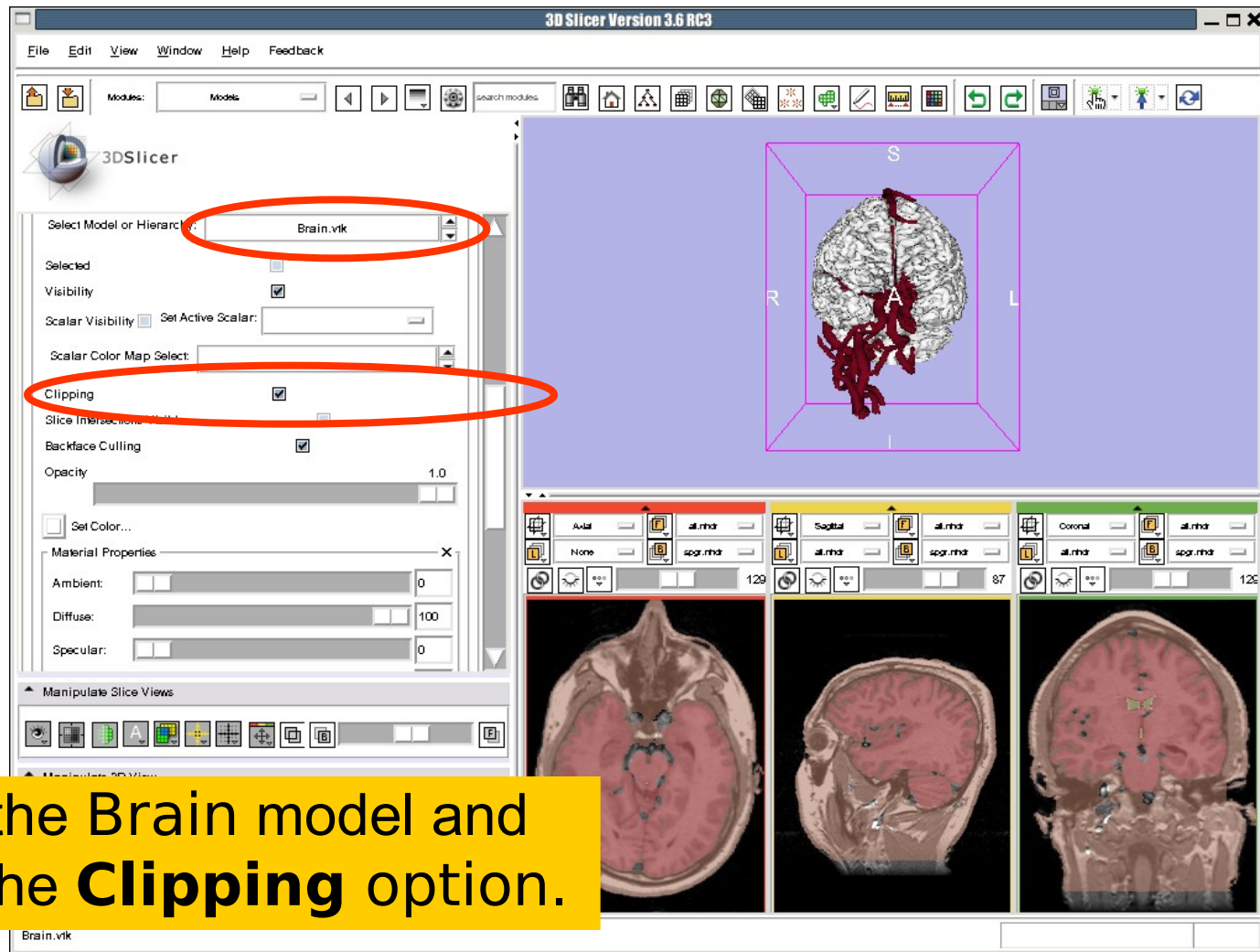
Go back to **Conventional** layout.



# Visualizing a 3D model

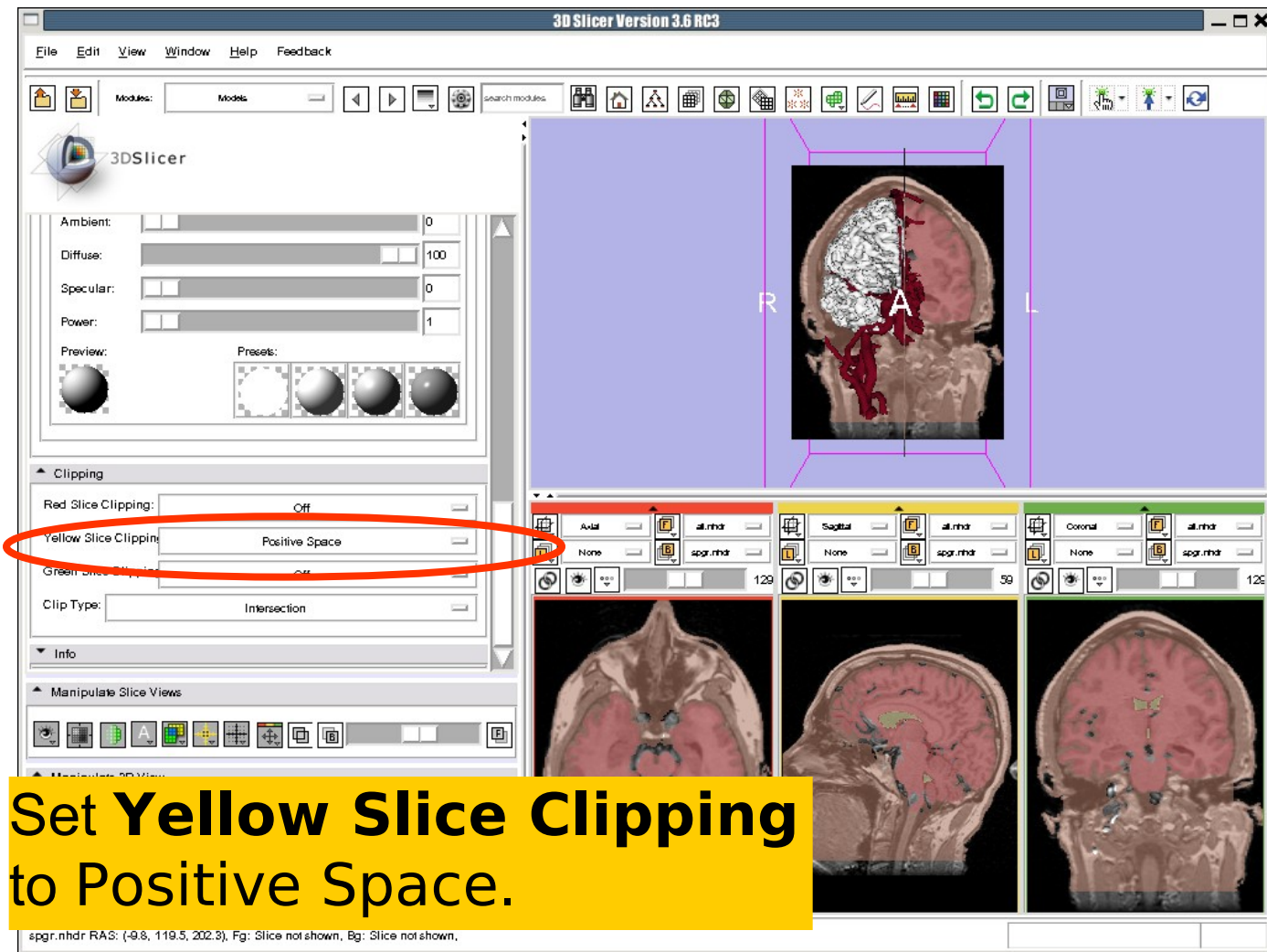


# Visualizing a 3D model



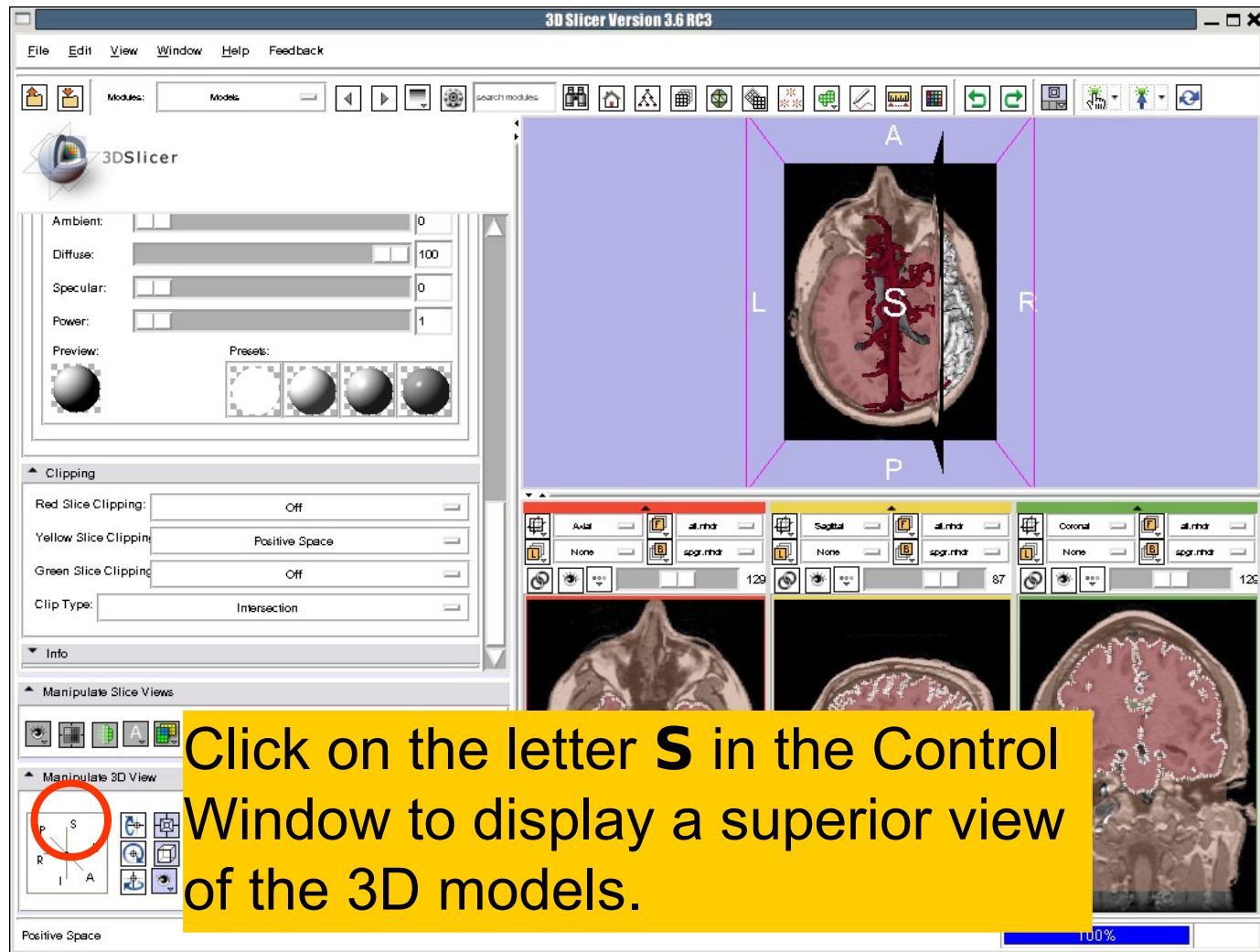
Select the Brain model and select the **Clipping** option.

# Visualizing a 3D model



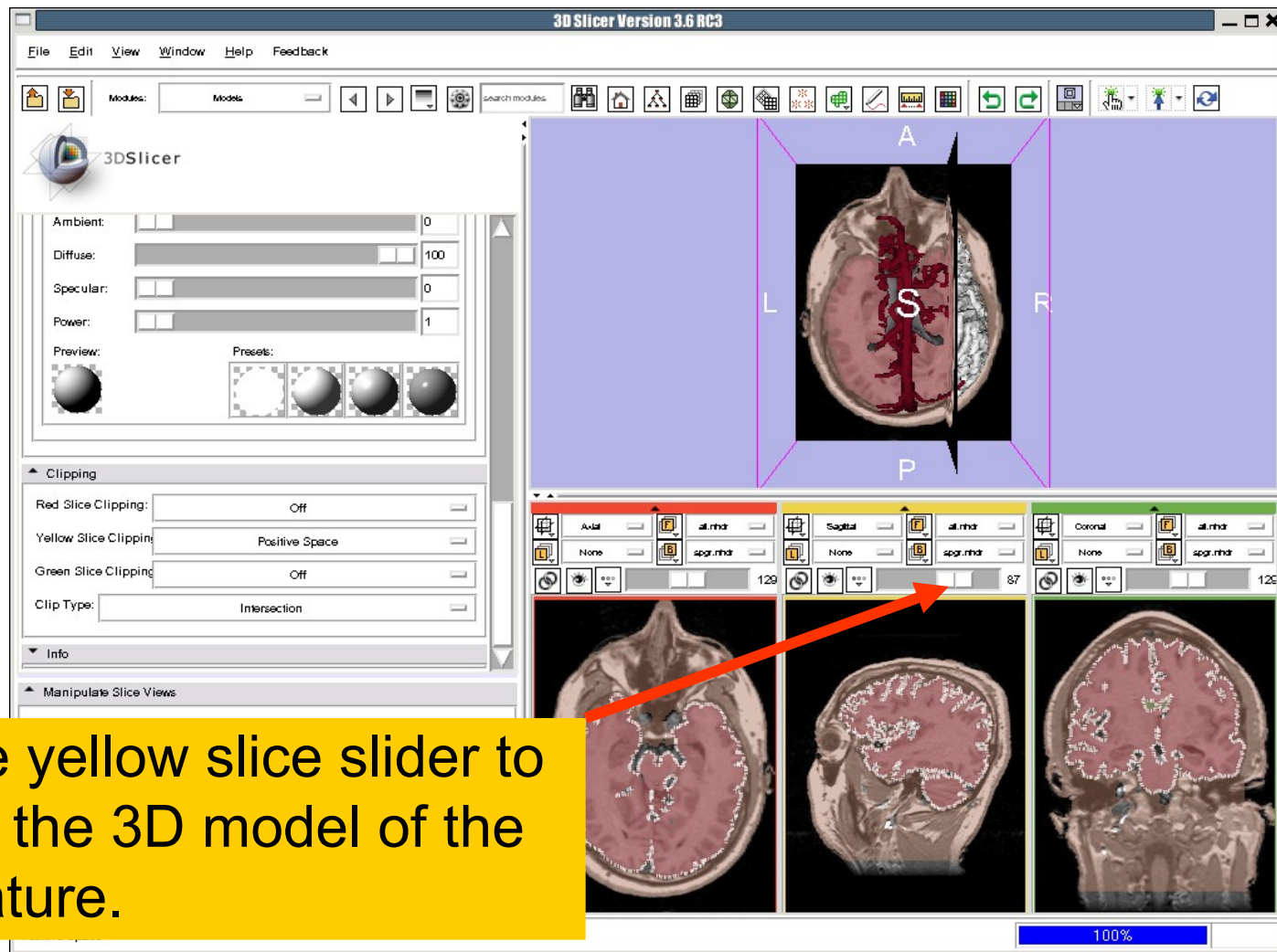
**Set Yellow Slice Clipping to Positive Space.**

# Visualizing a 3D model



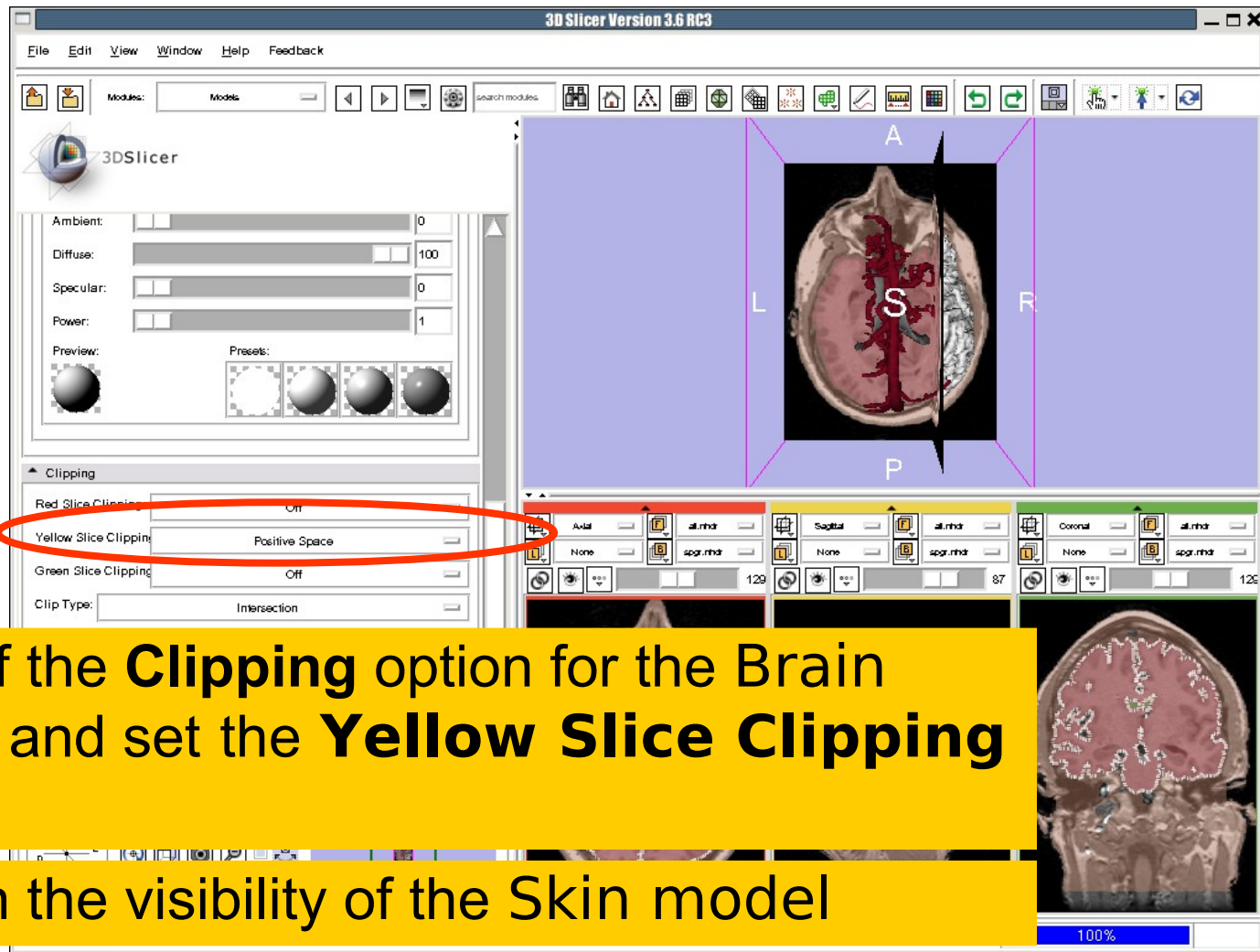


# Visualizing a 3D model



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

# Visualizing a 3D model

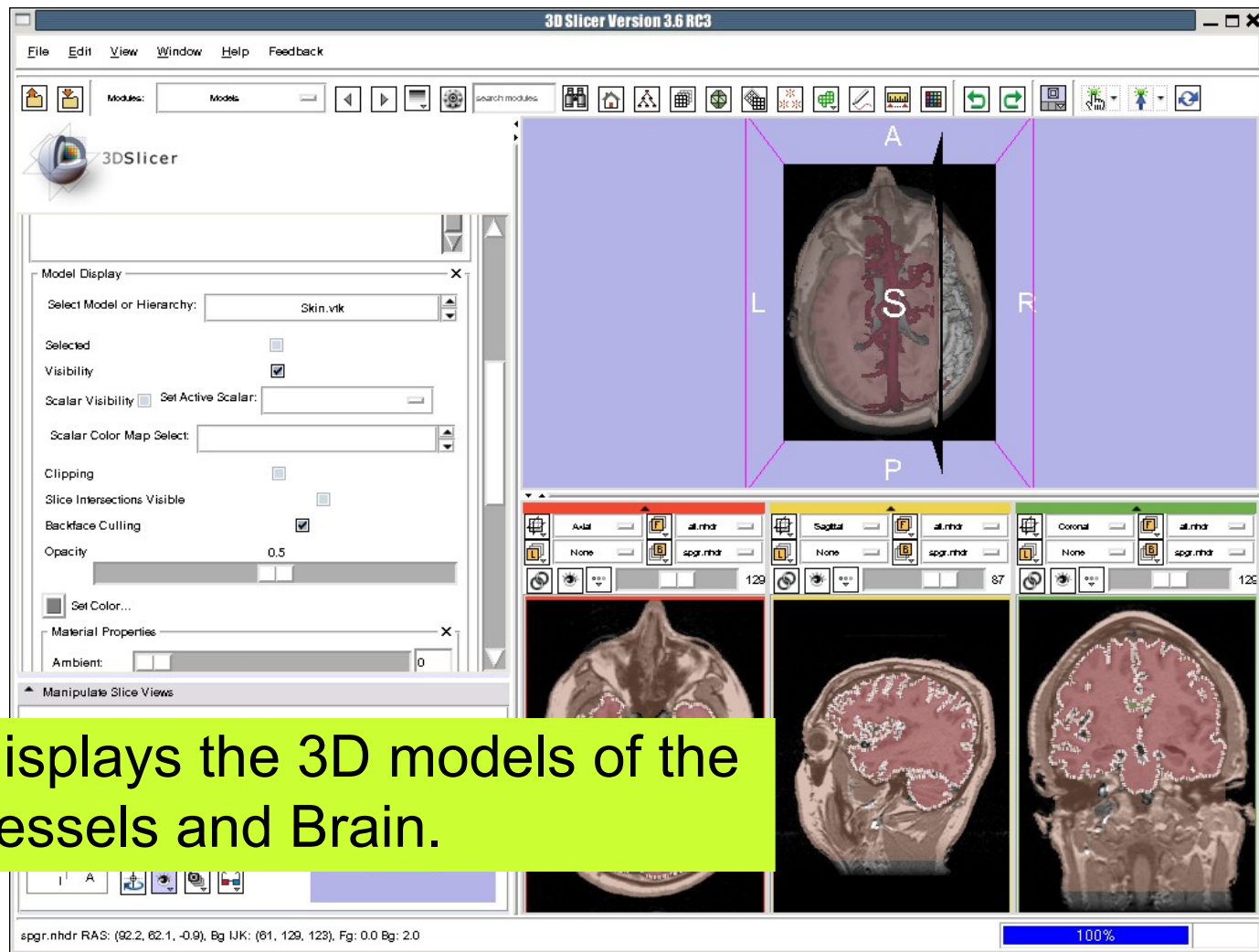


Turn off the **Clipping** option for the Brain model and set the **Yellow Slice Clipping** to **Off**

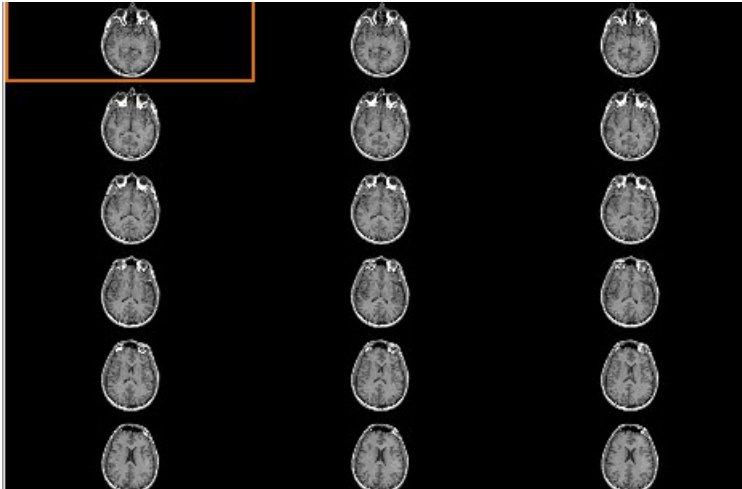
Turn on the visibility of the Skin model



# Visualizing a 3D model

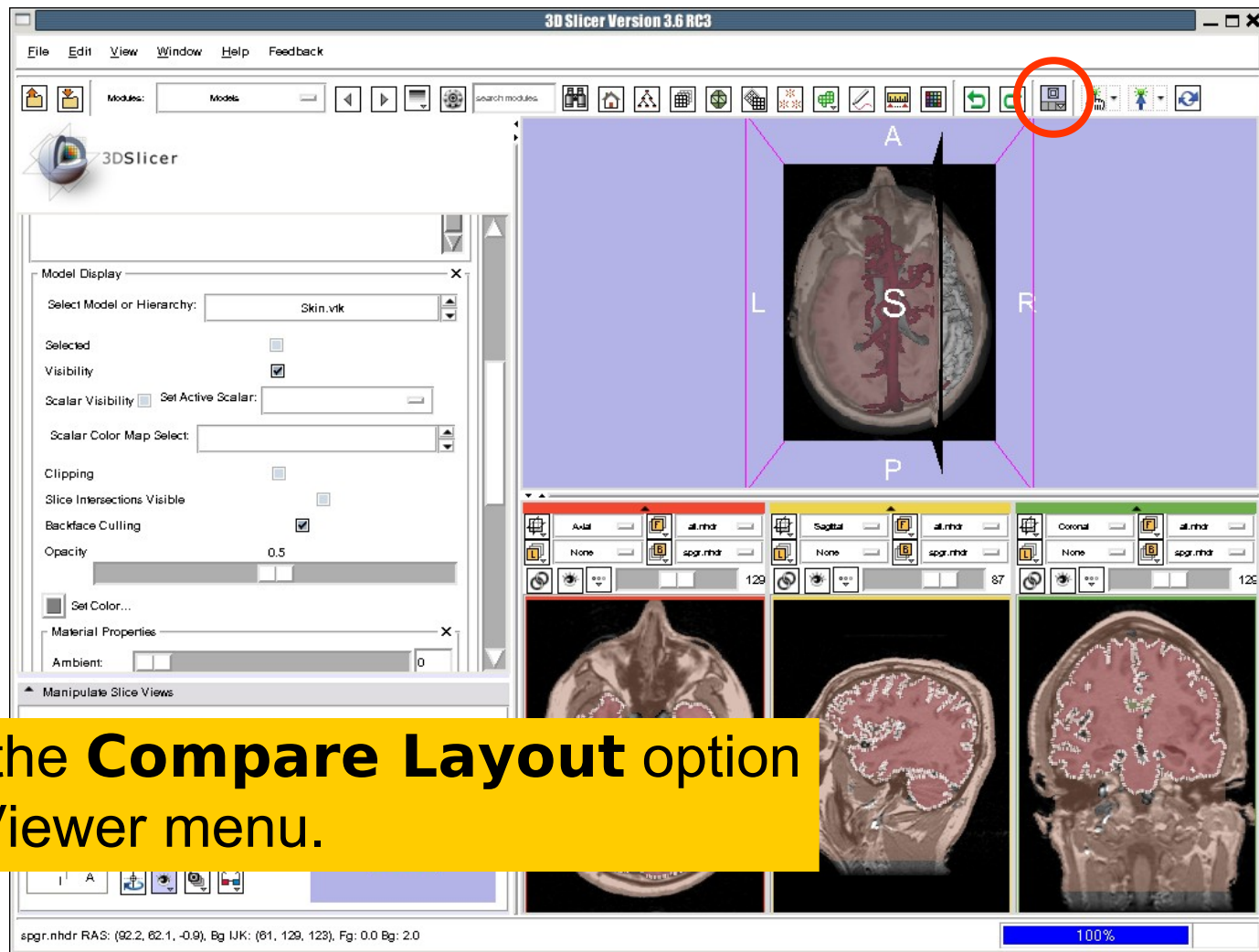


Slicer displays the 3D models of the Skin, Vessels and Brain.



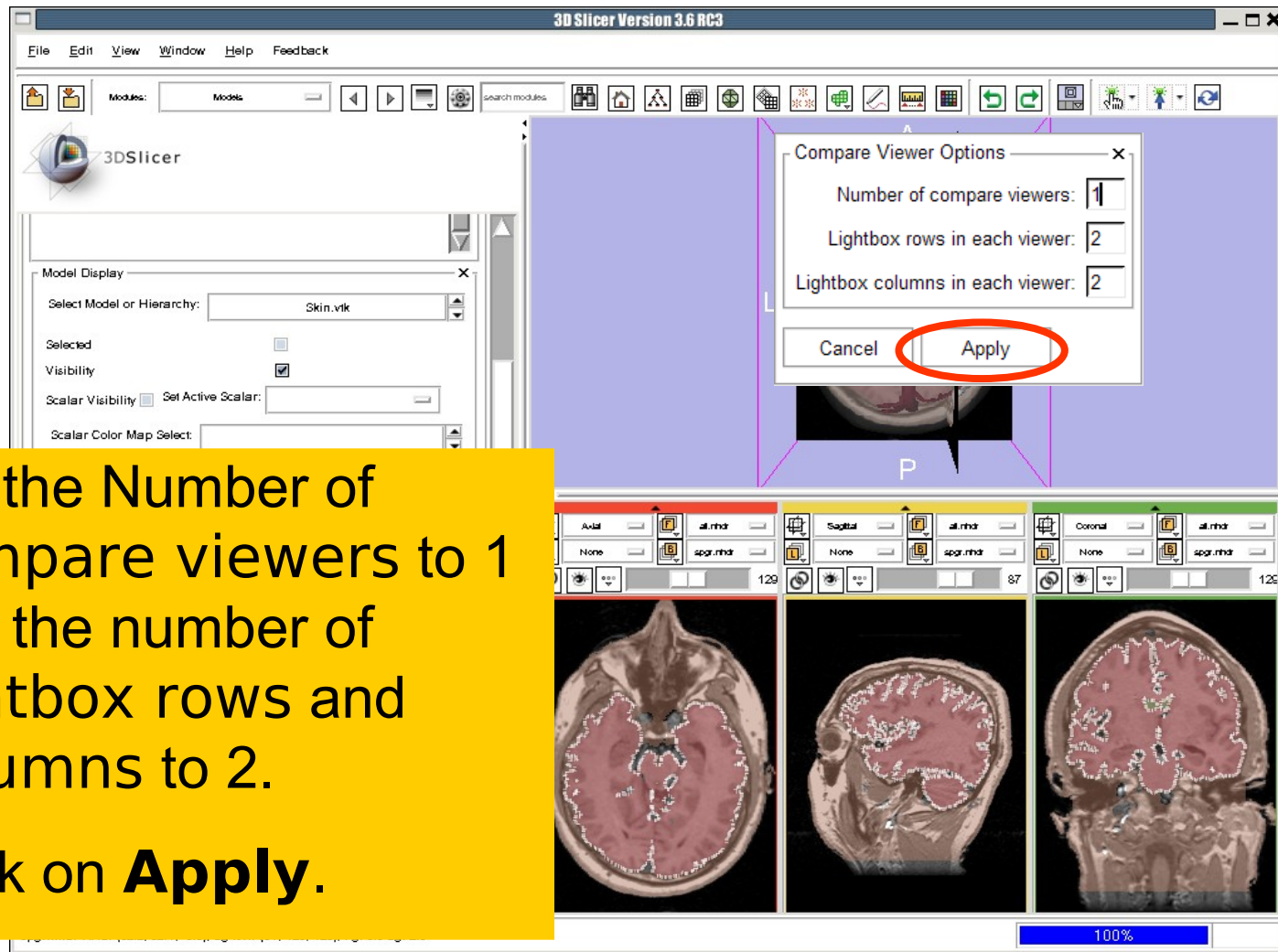
## Part 4: Lightbox viewer

# 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.

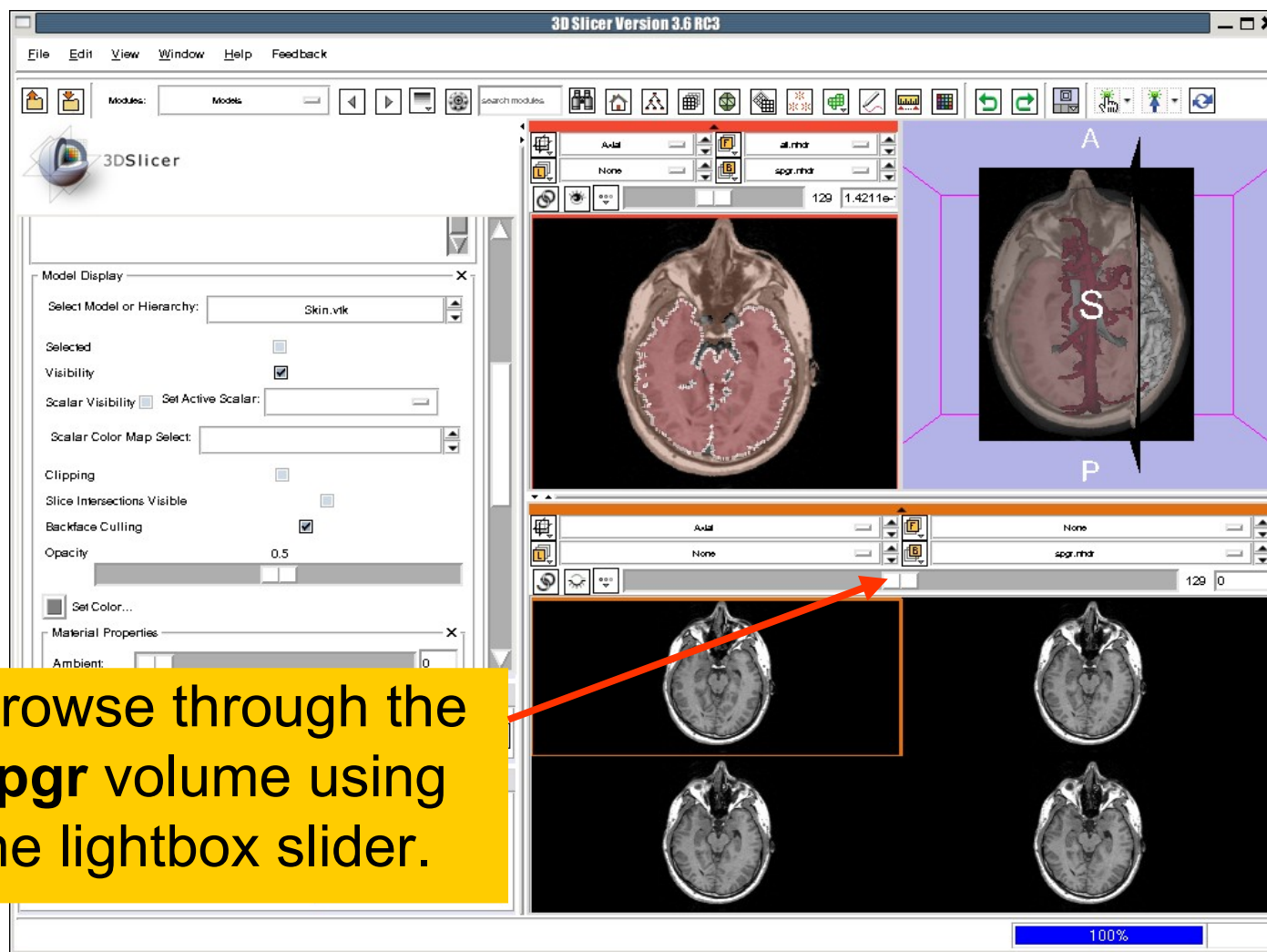
Click on **Apply**.

# Lightbox viewer



Slicer displays a lightbox view of the Background dataset.

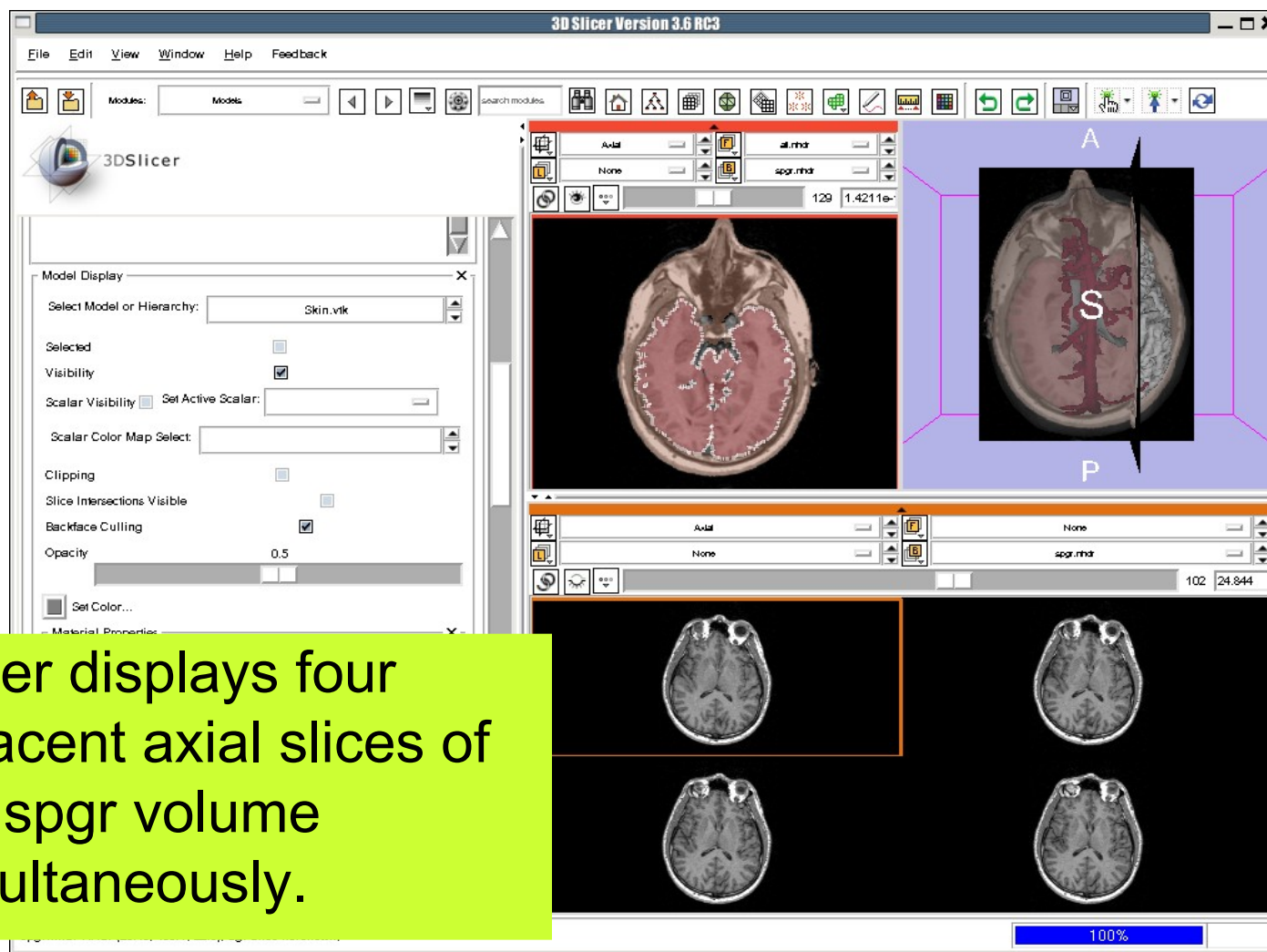
# Lightbox viewer



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

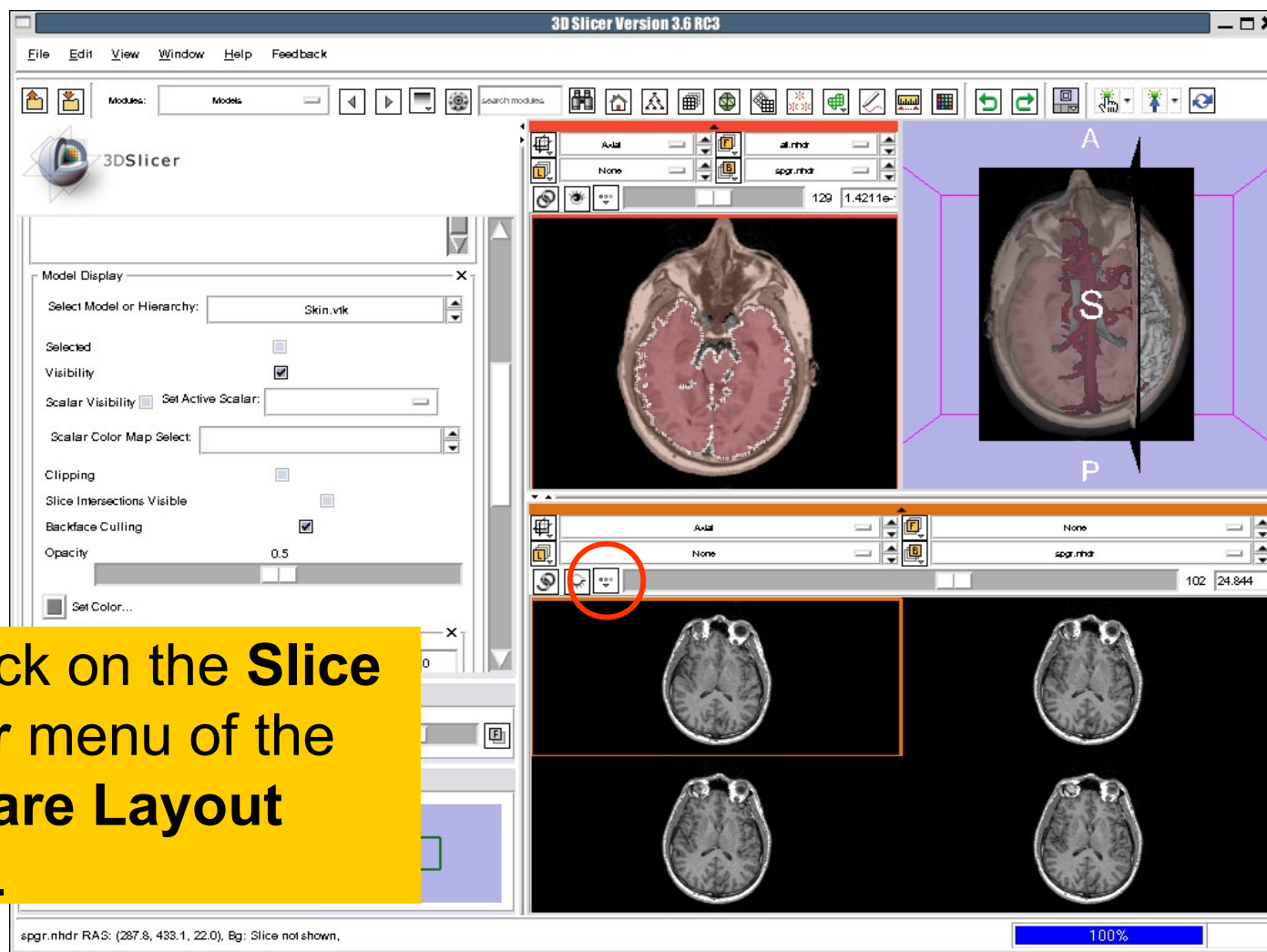


# Lightbox viewer



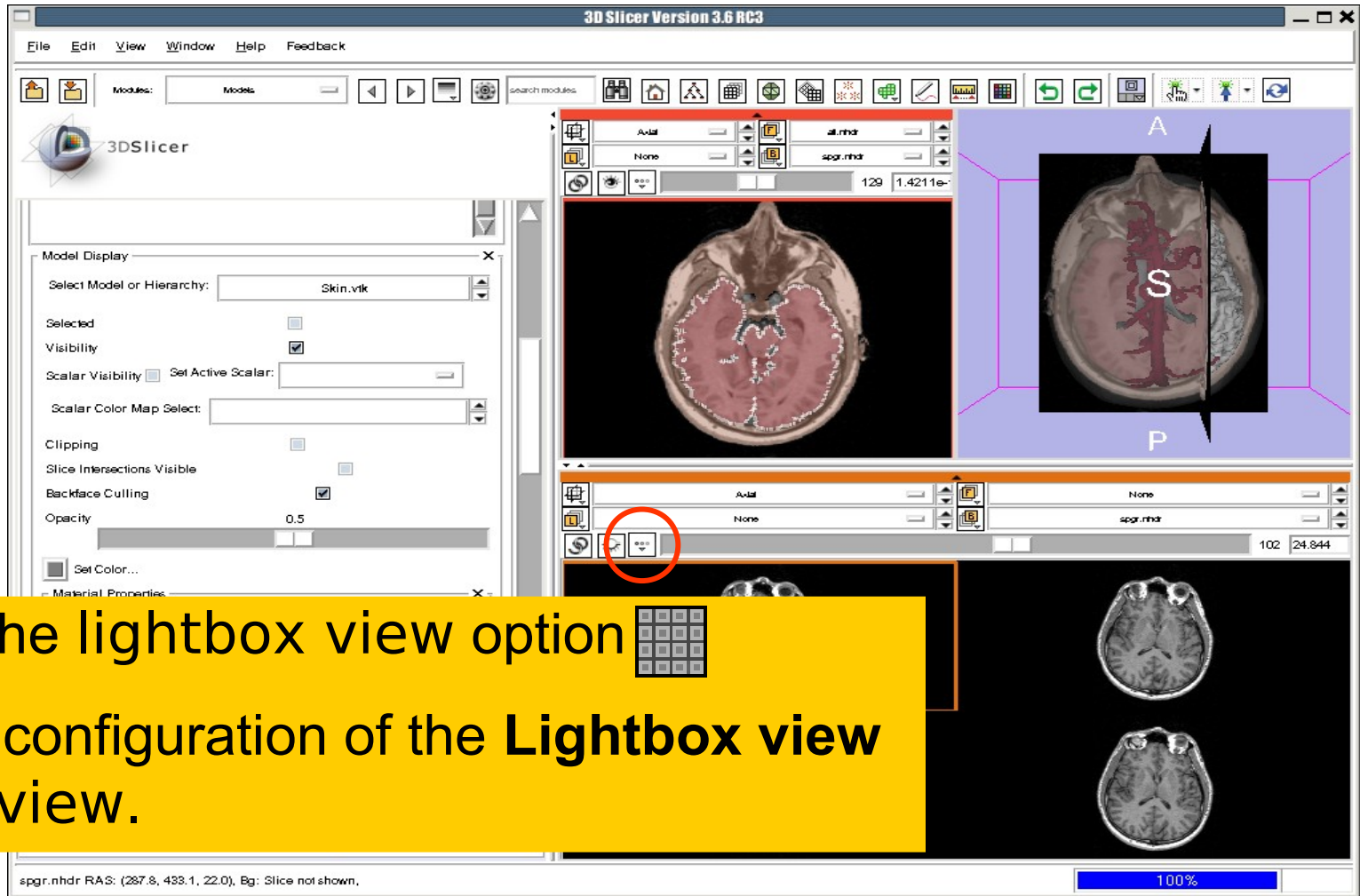
Slicer displays four adjacent axial slices of the spgr volume simultaneously.

# Lightbox viewer



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

# Lightbox viewer

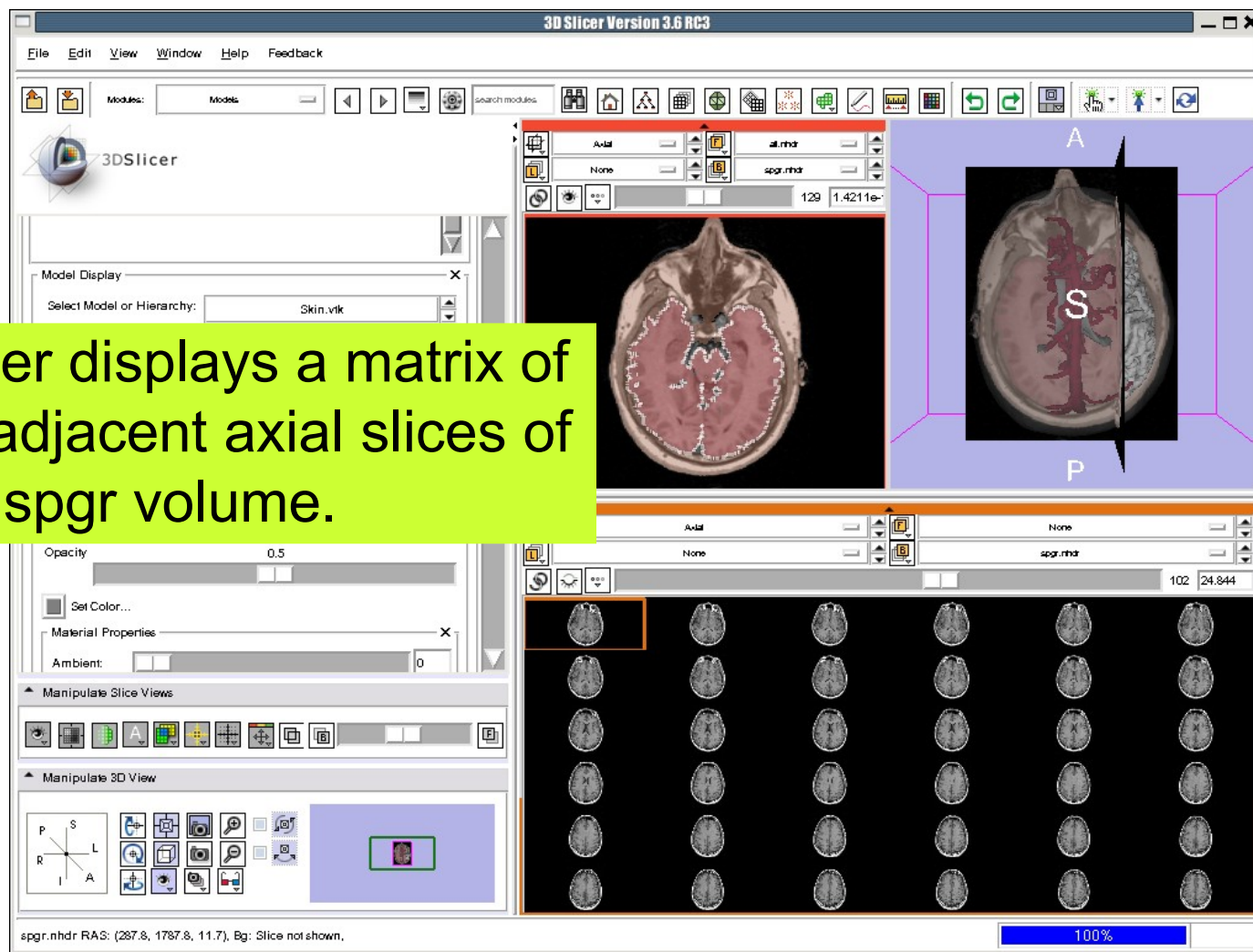


Select the lightbox view option 

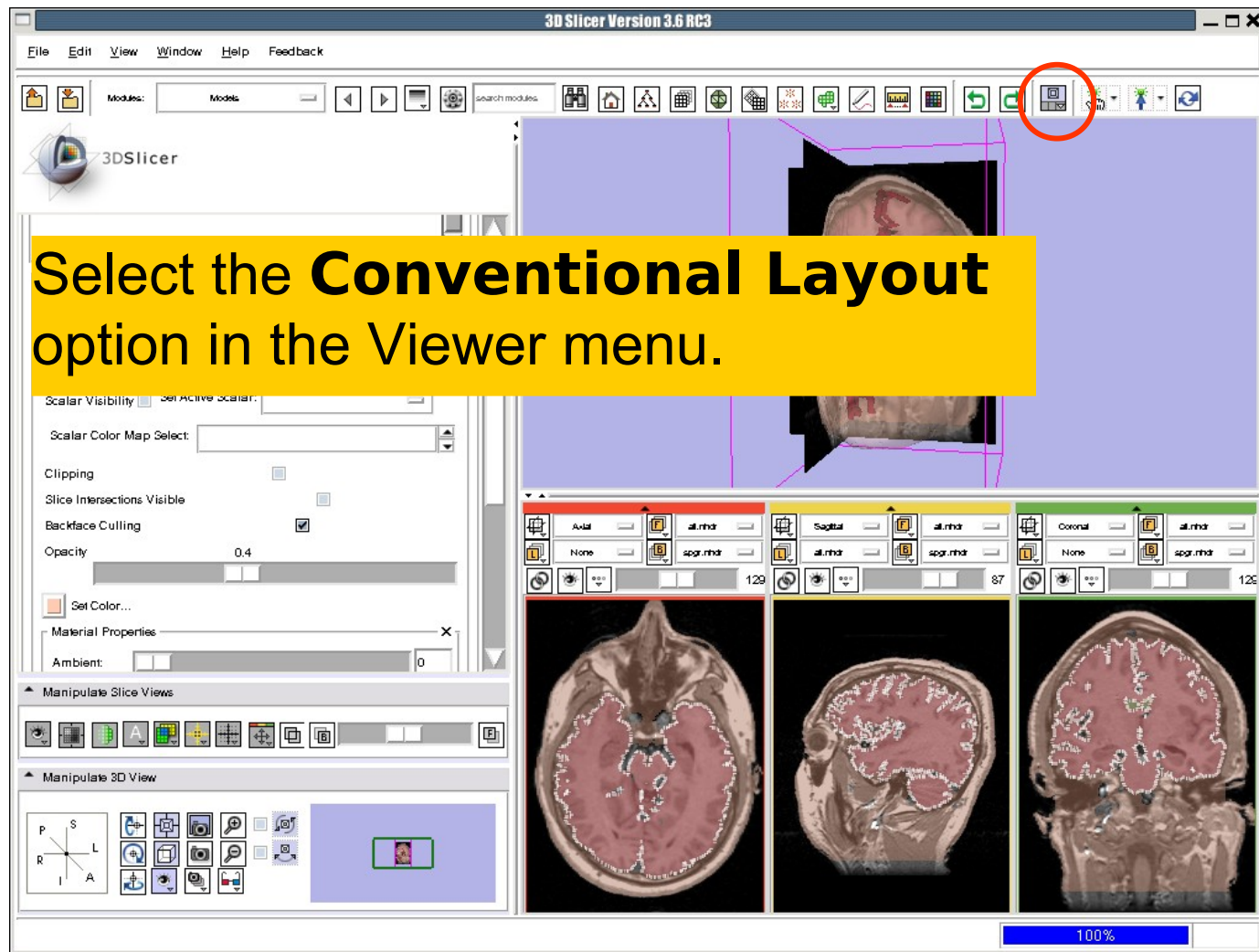
Set the configuration of the **Lightbox view** to 6x6 view.

# Lightbox viewer

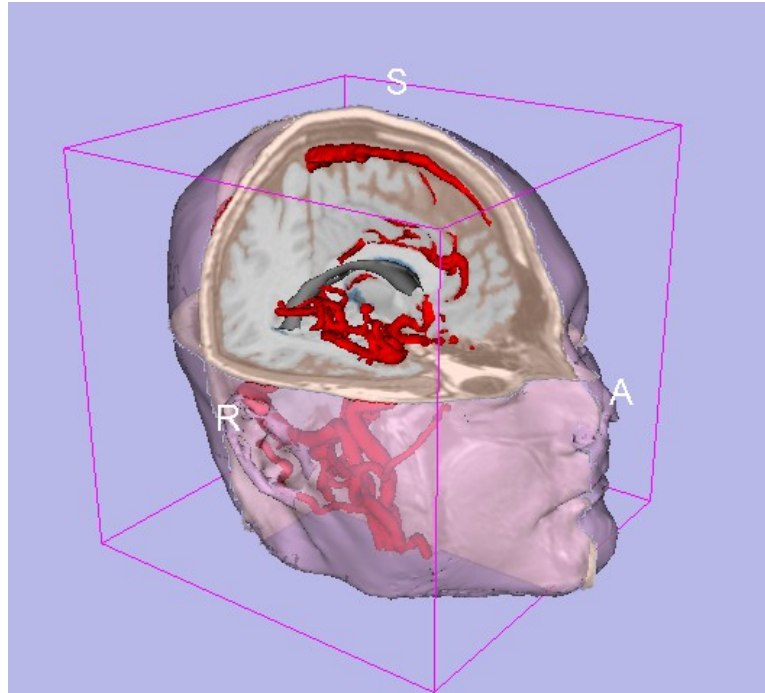
Slicer displays a matrix of 36 adjacent axial slices of the spgr volume.



# Lightbox viewer



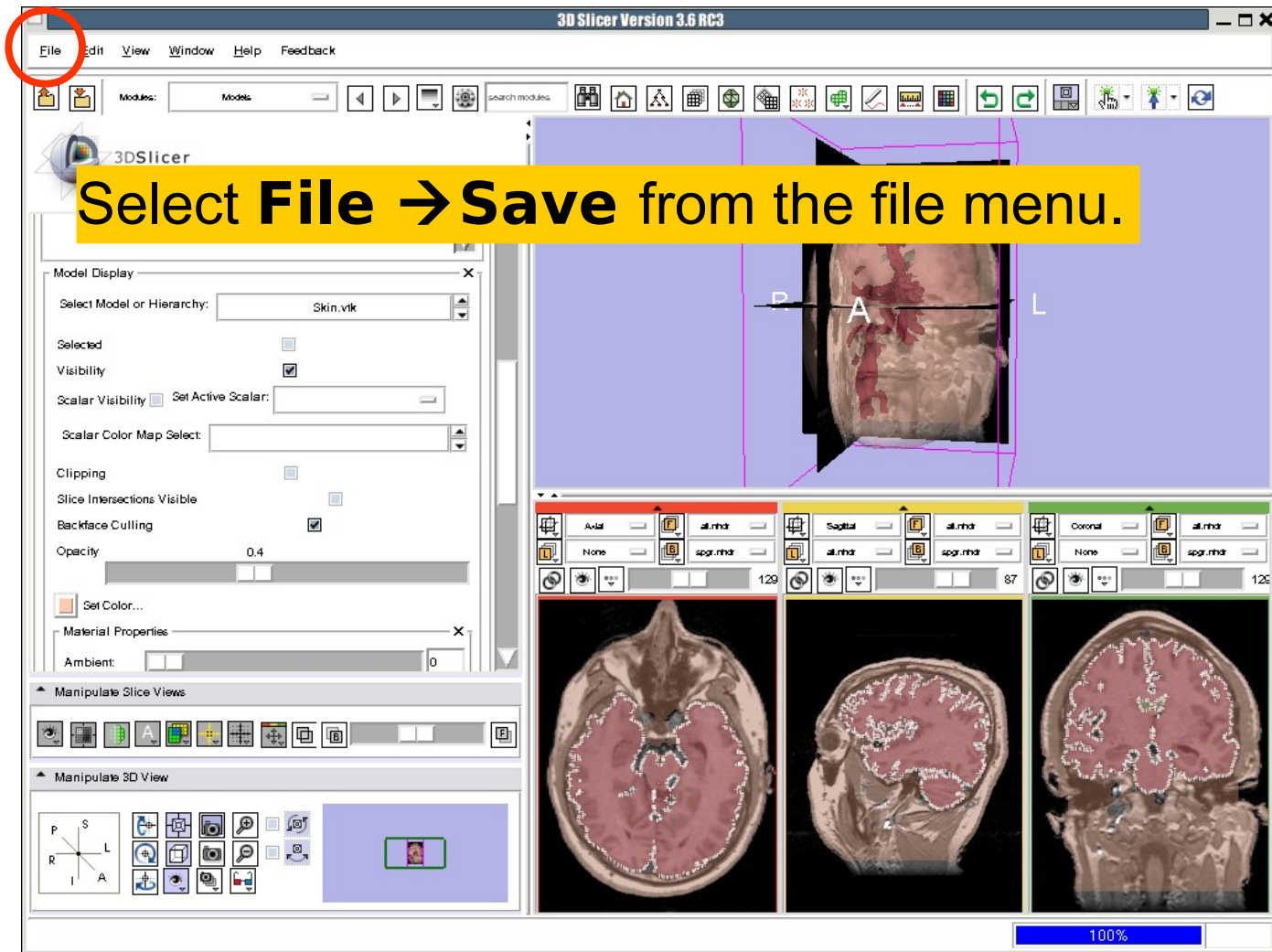




## Part 5: Loading and saving a Scene

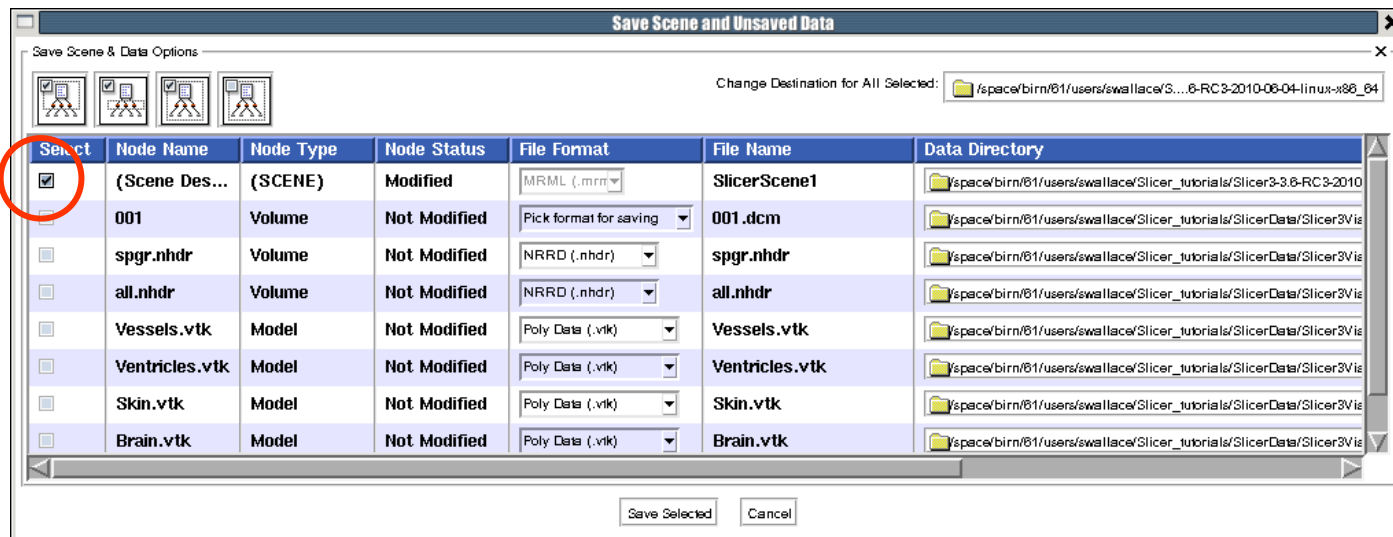


# Saving Data



# Saving Data

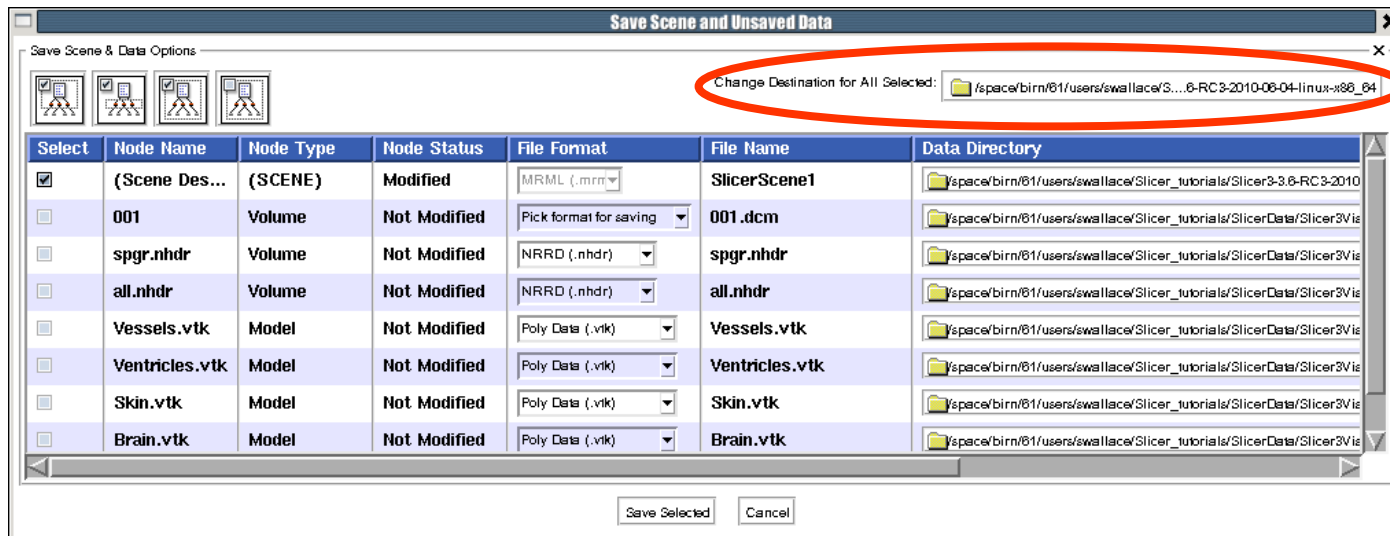
The list of elements currently loaded into Slicer3 appears.



Make sure only the first check box is selected.

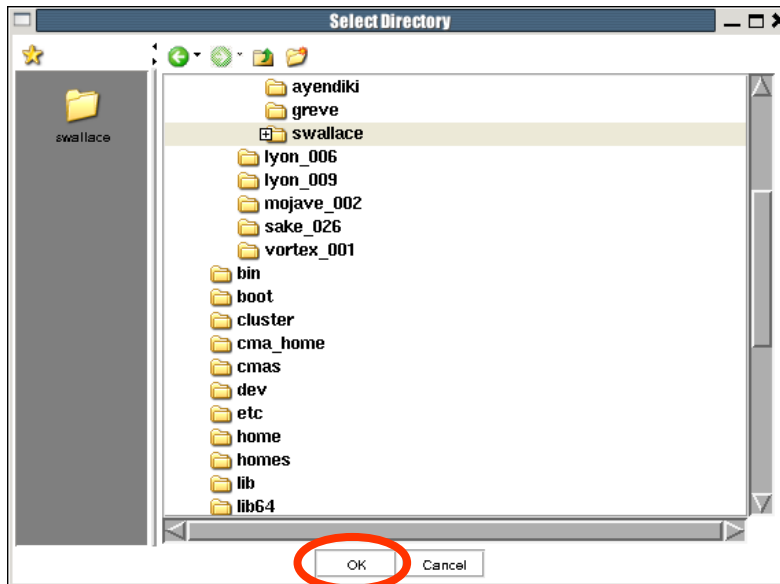
# Saving Data

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



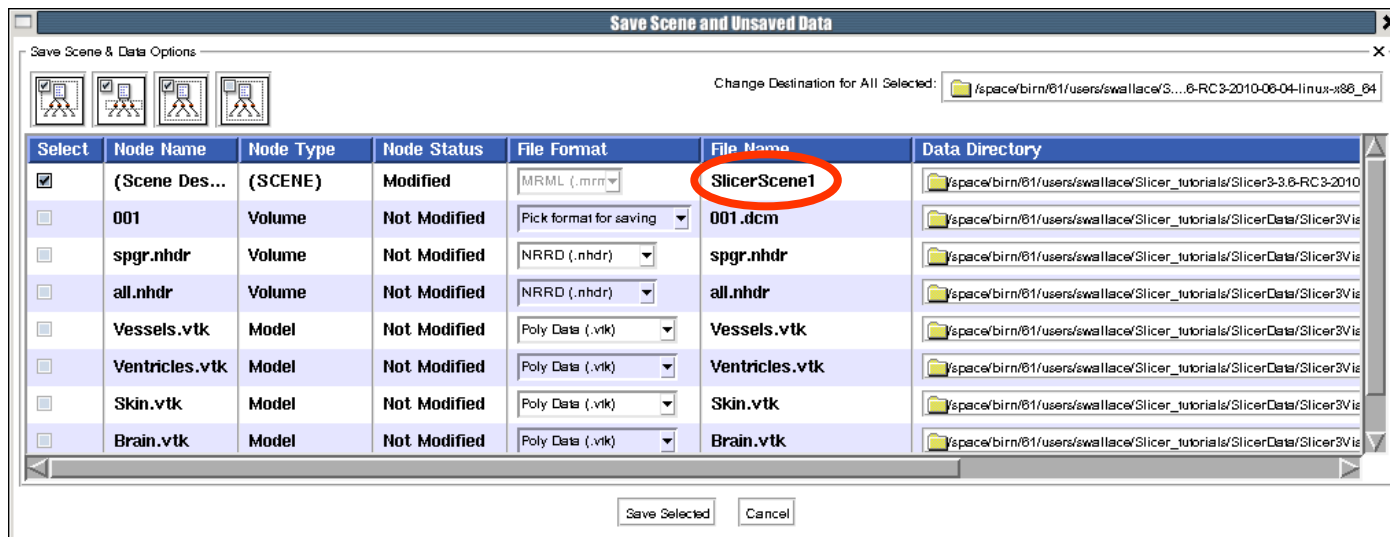
# Saving Data

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



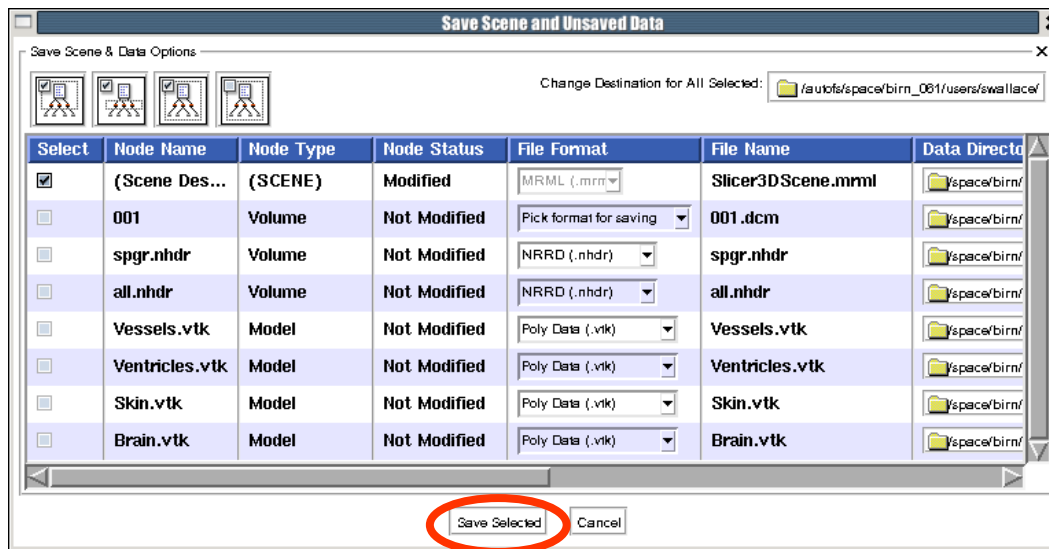
# Saving Data

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



# Saving Data

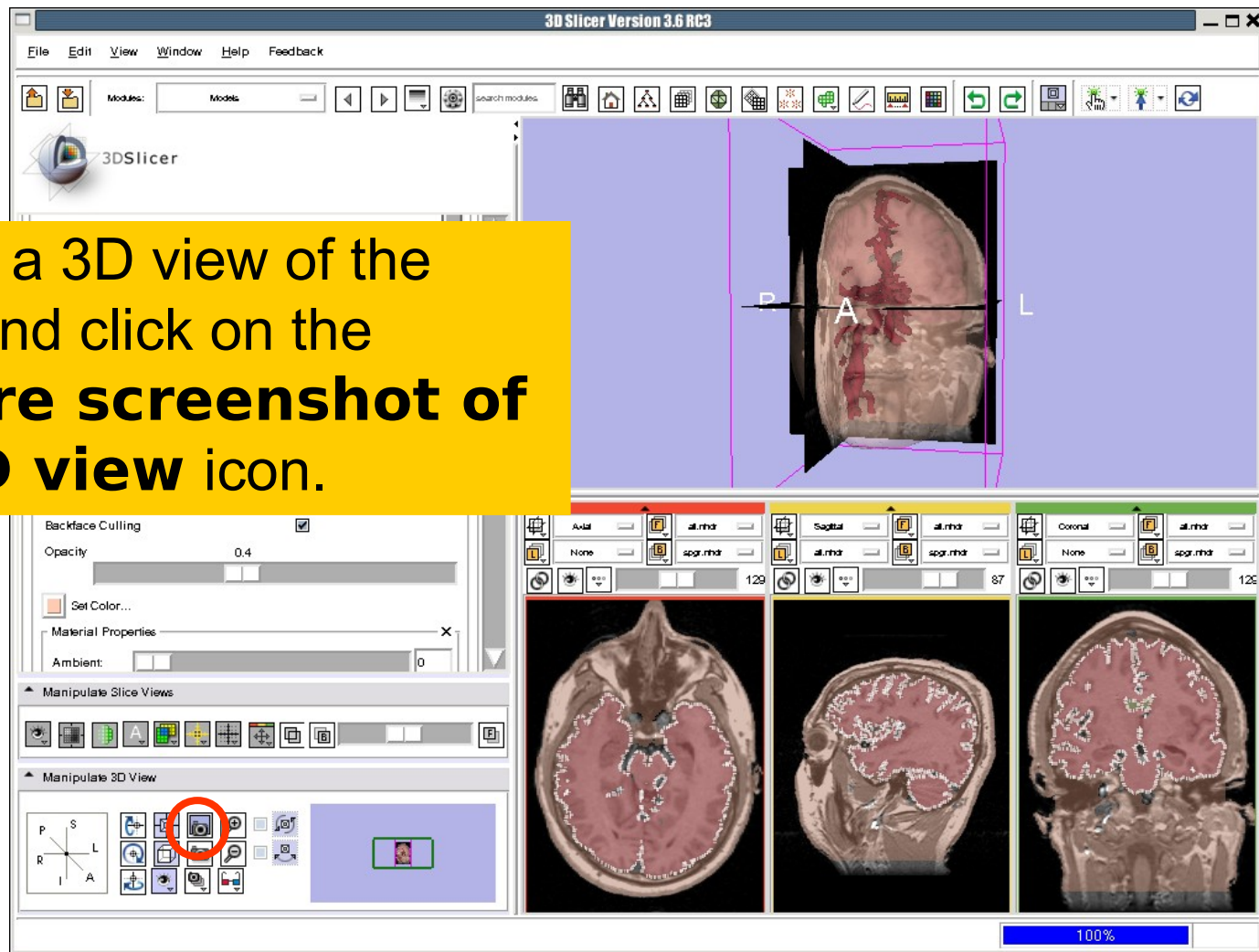
Click on **Save Selected.**





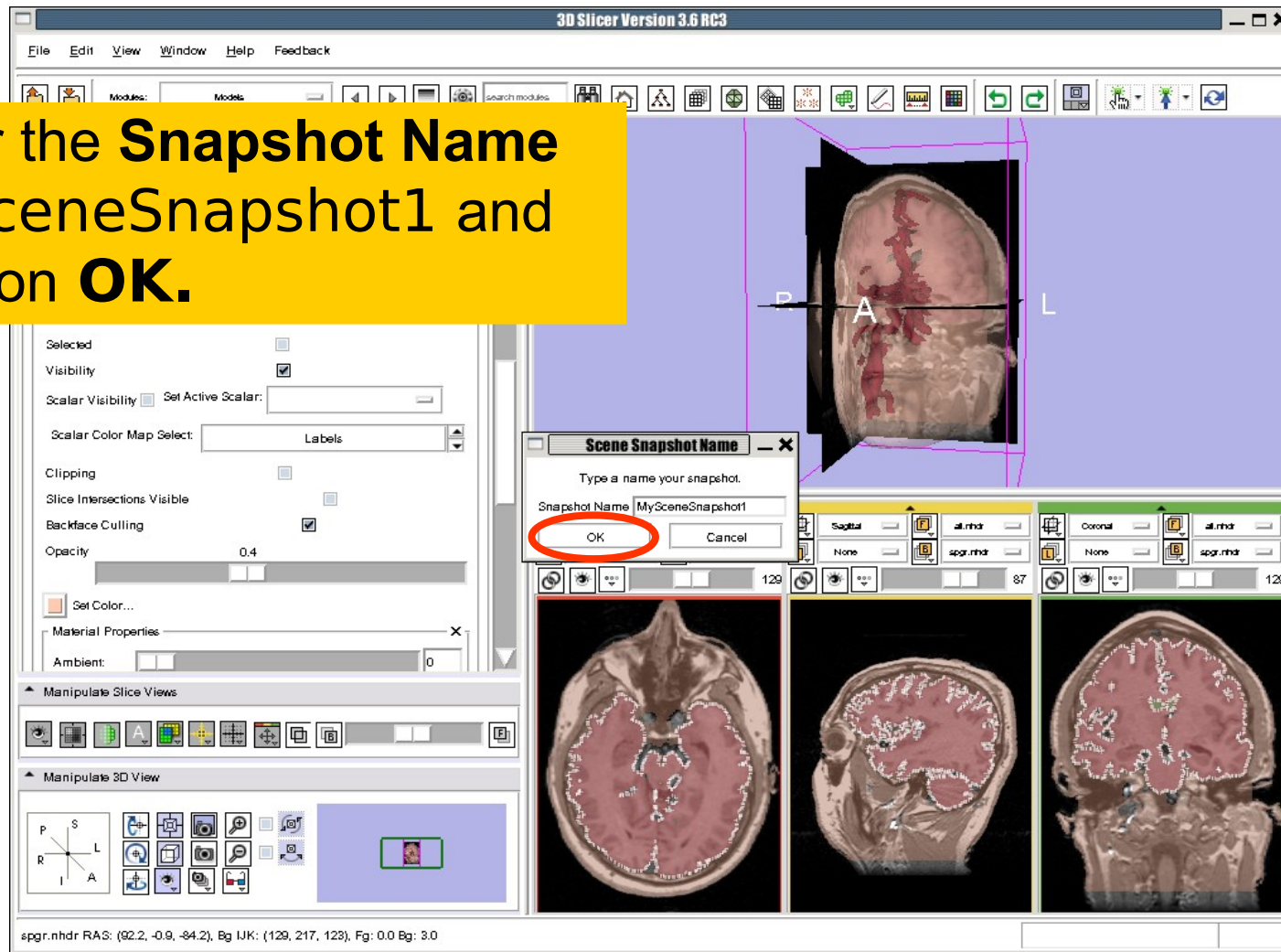
# Creating Scene Snapshots

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



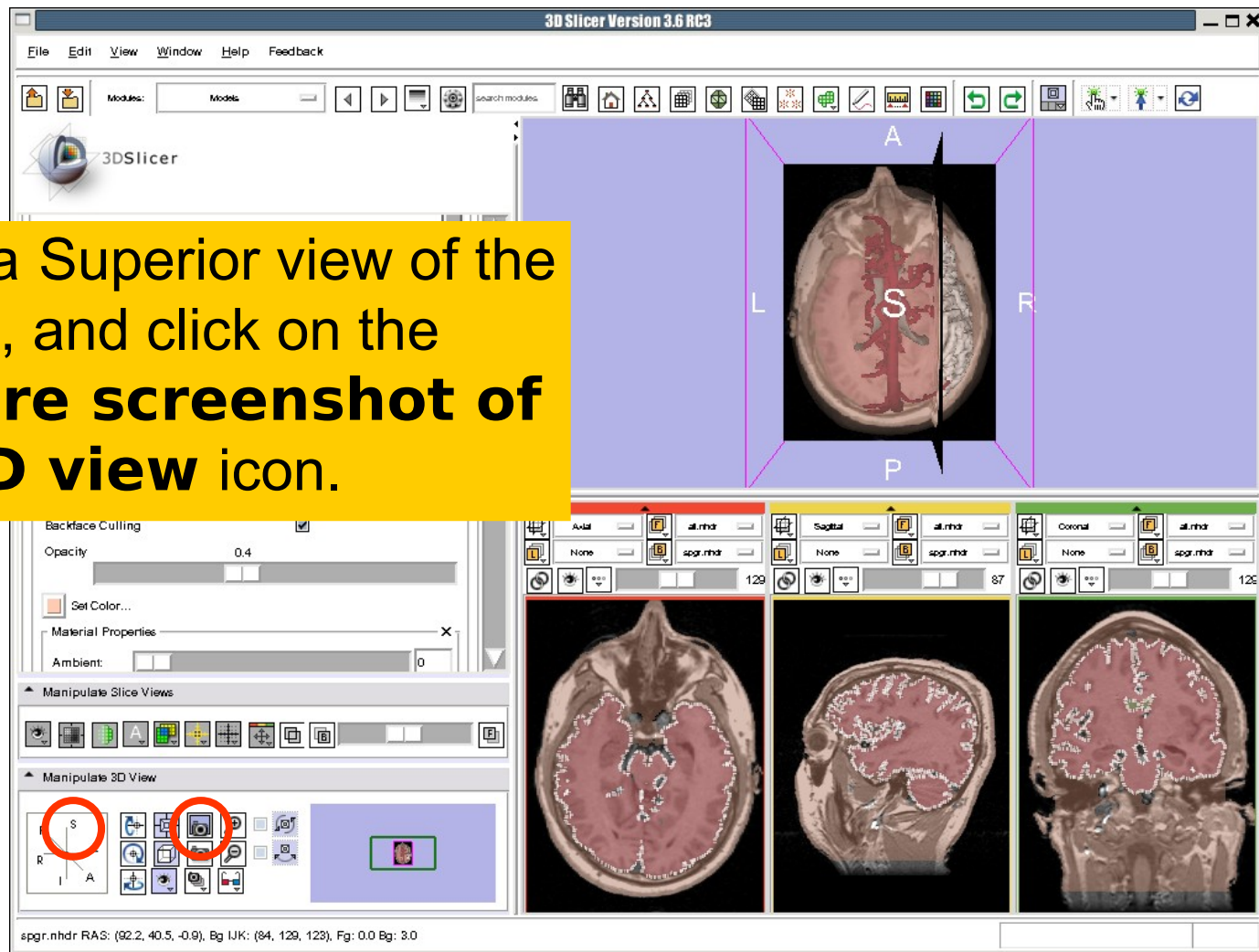
# Creating Scene Snapshots

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



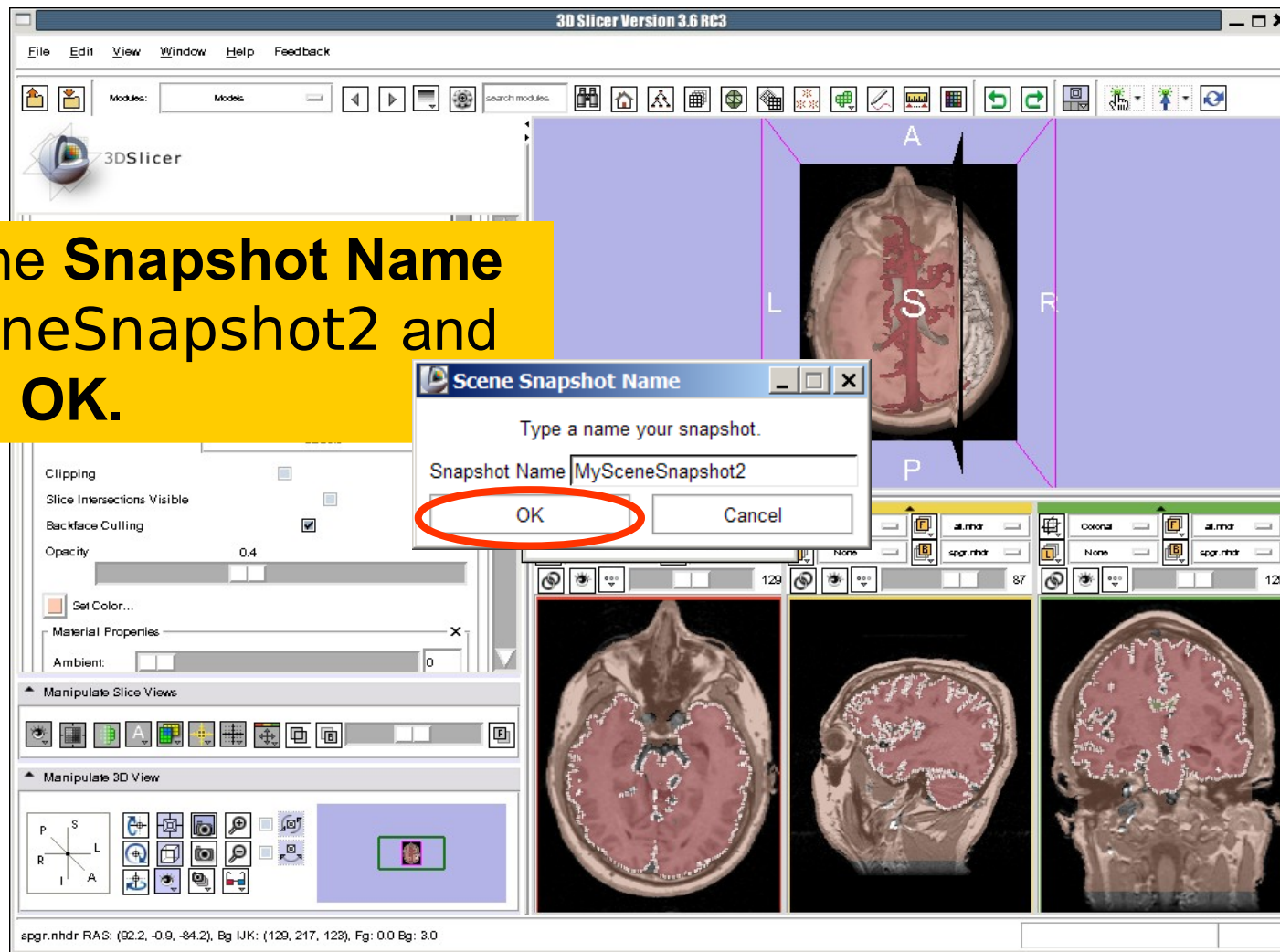
# Creating Scene Snapshots

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



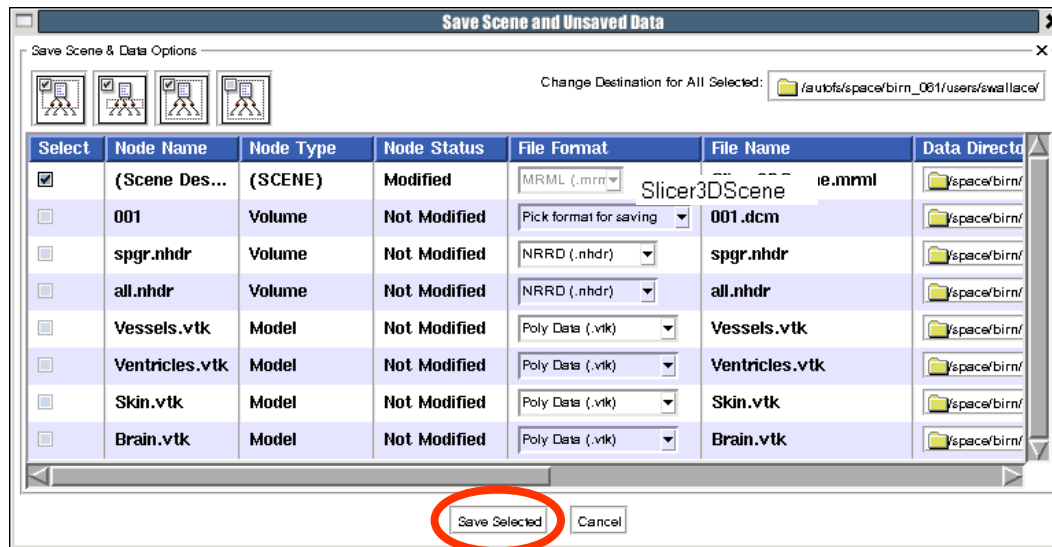
# Creating Scene Snapshots

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



# Creating Scene Snapshots

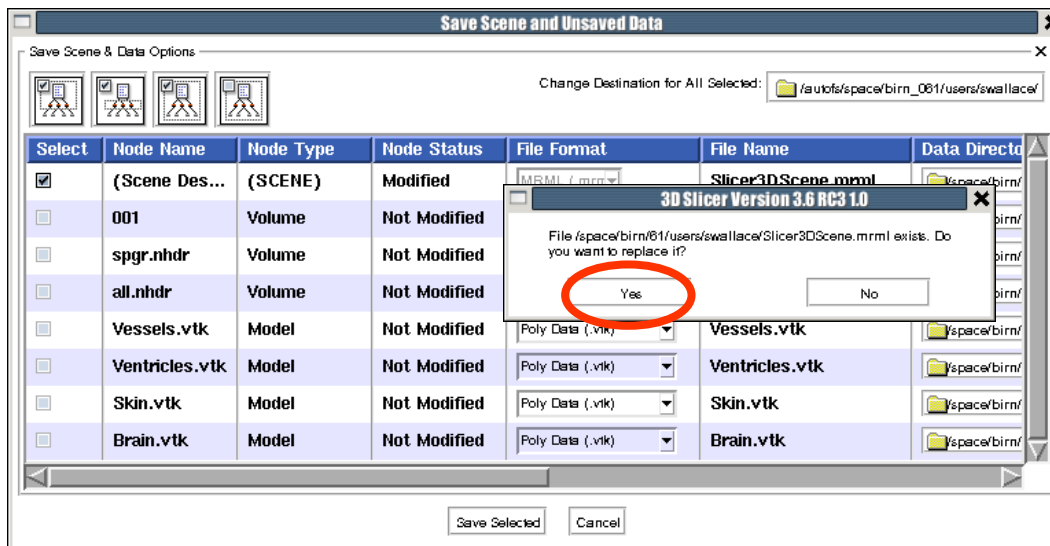
Select **File**→**Save** and click on **Save Selected** to include the two scene snapshots in the saved scene.





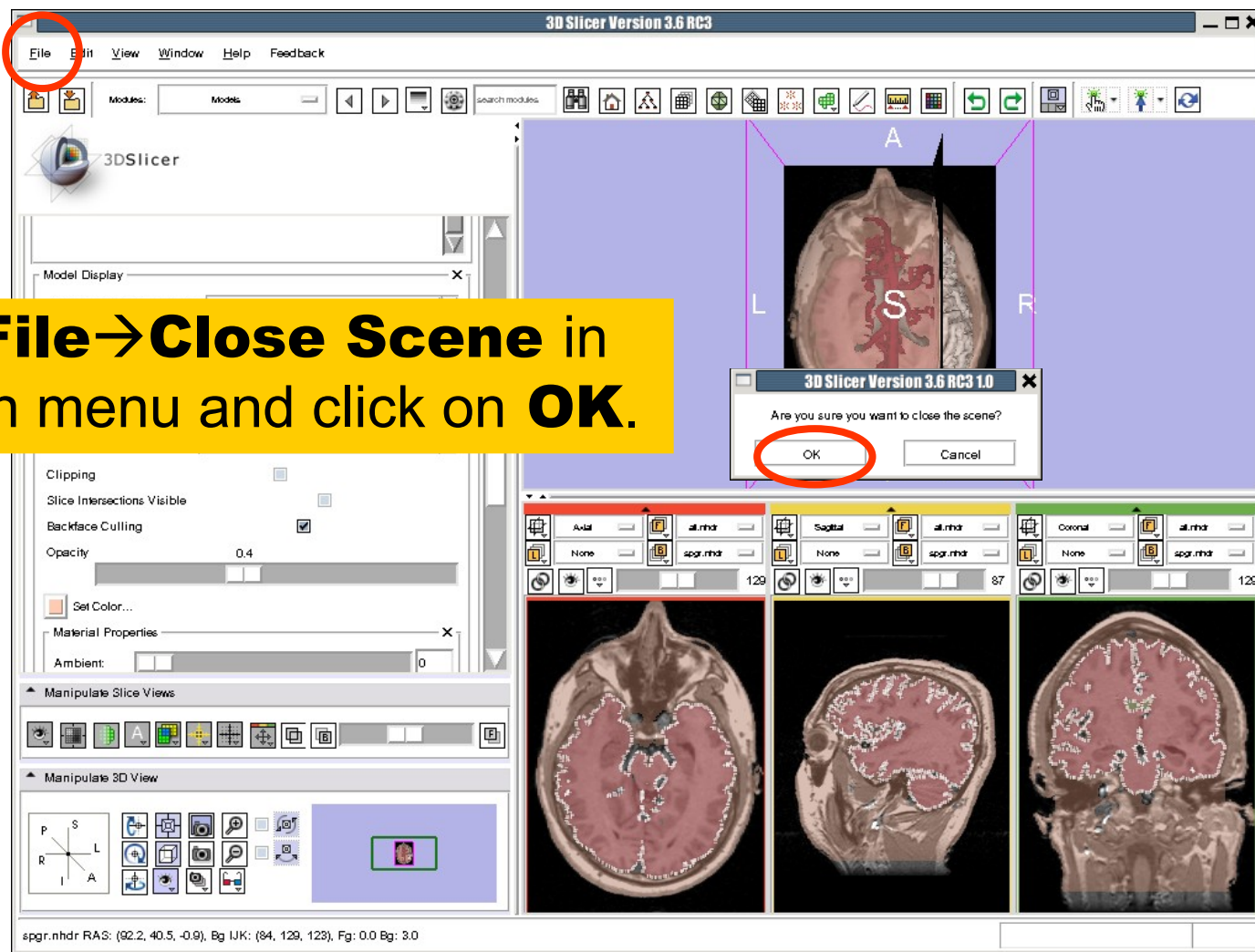
# Creating Scene Snapshots

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

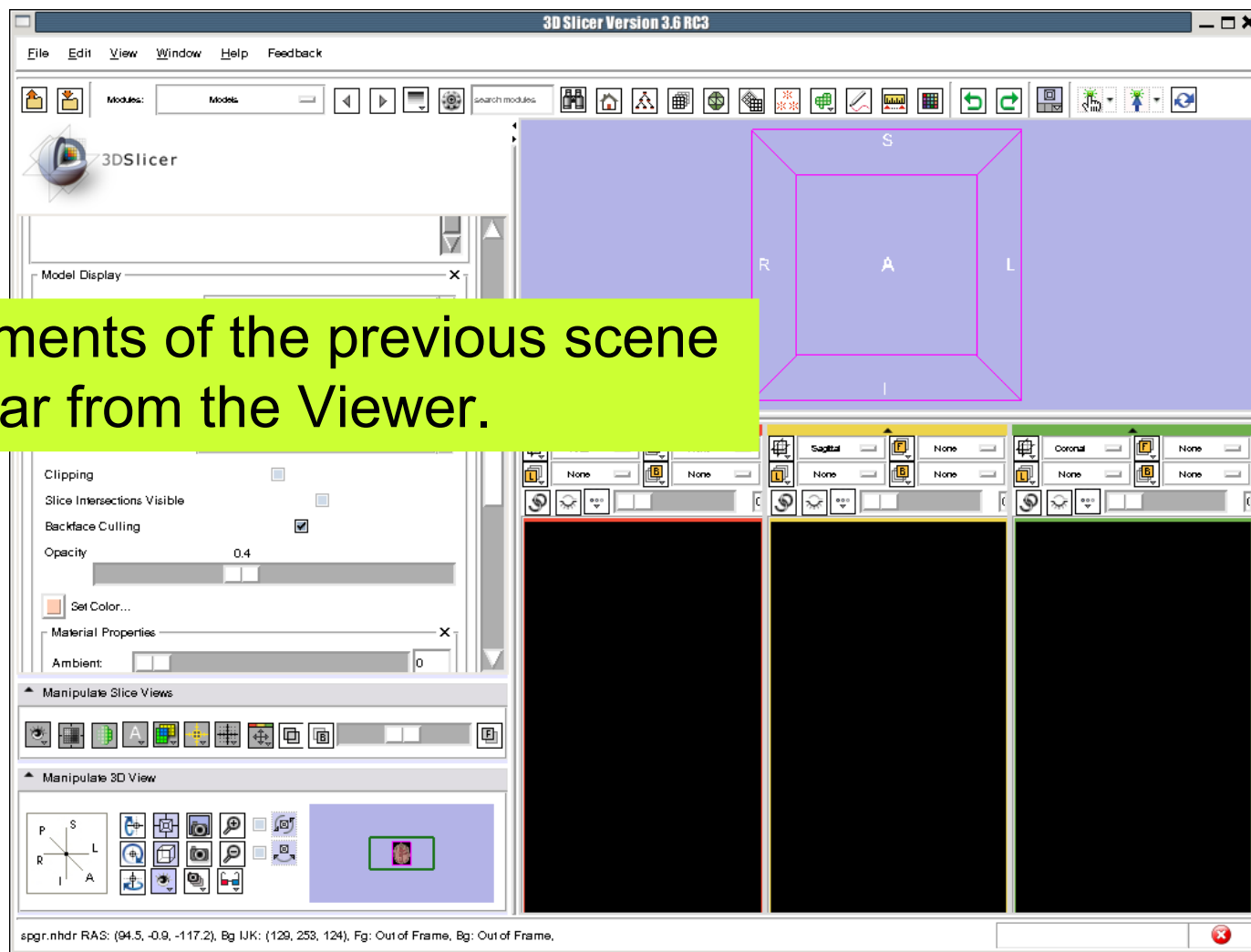




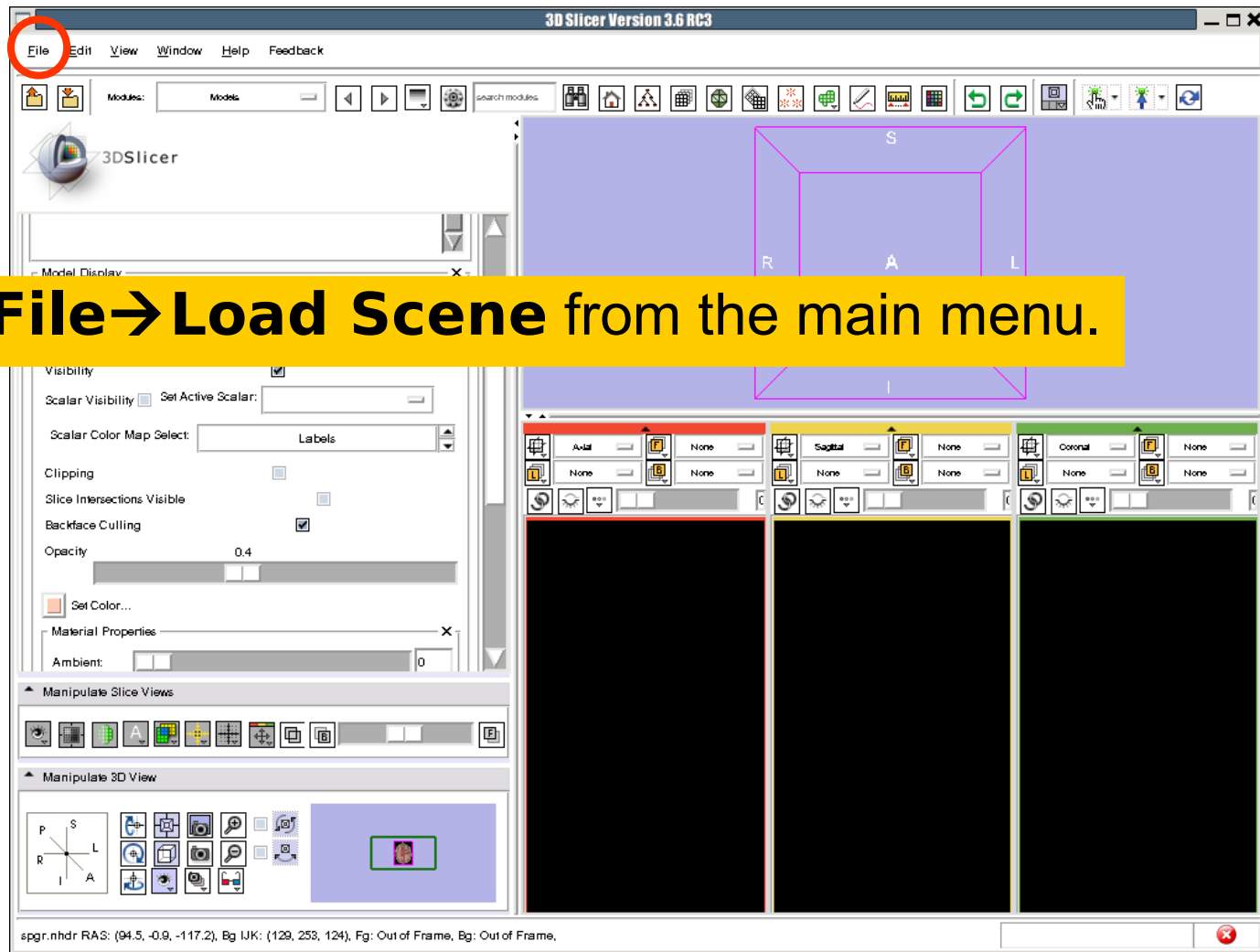
# Saving Data



# Saving Data

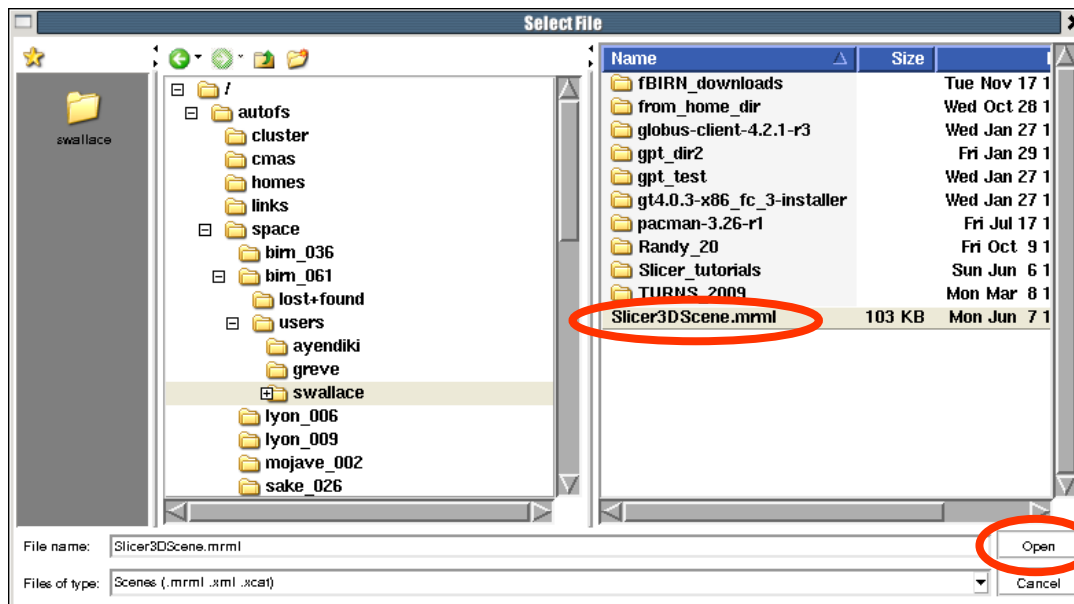


# Saving Data

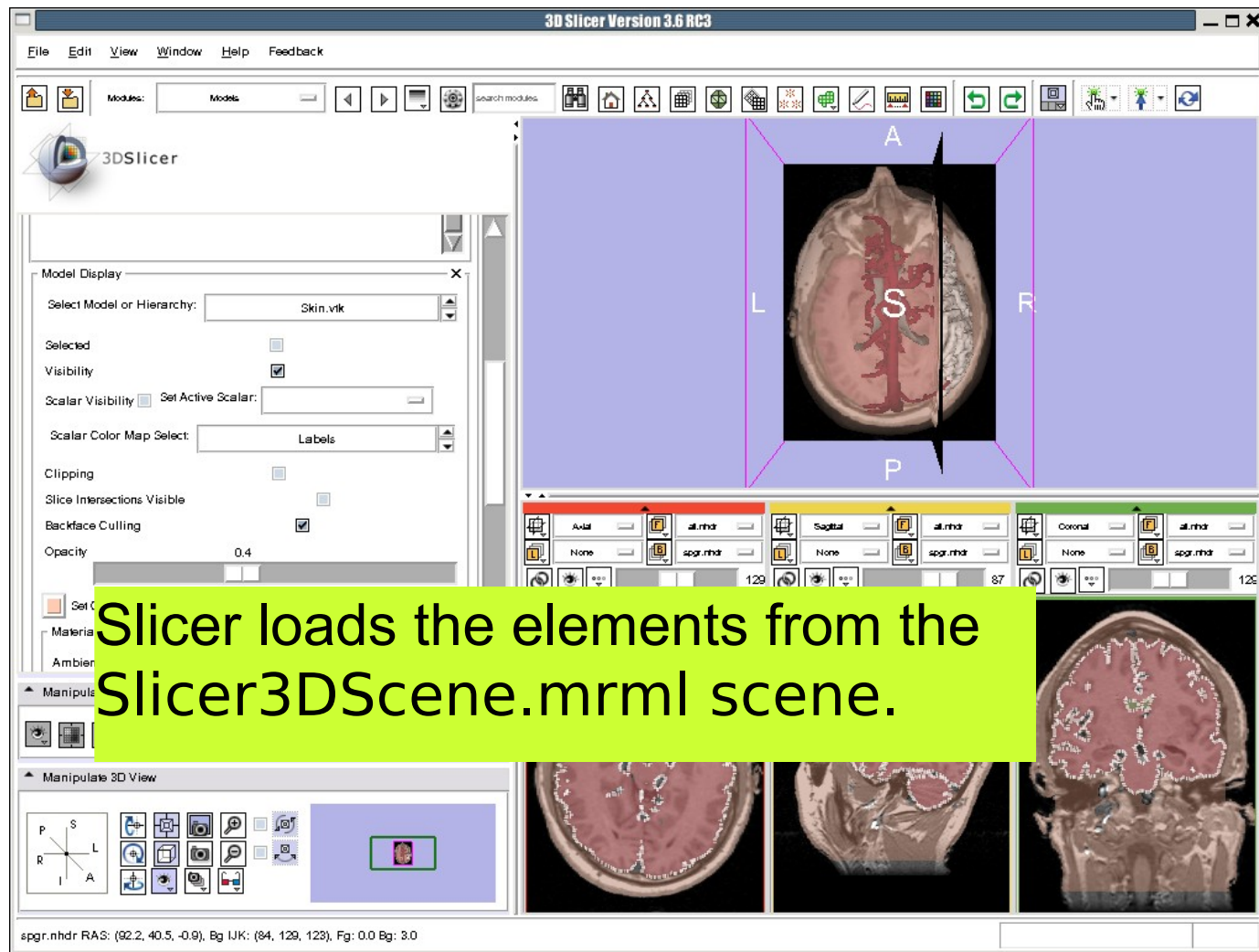


# Saving Data

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



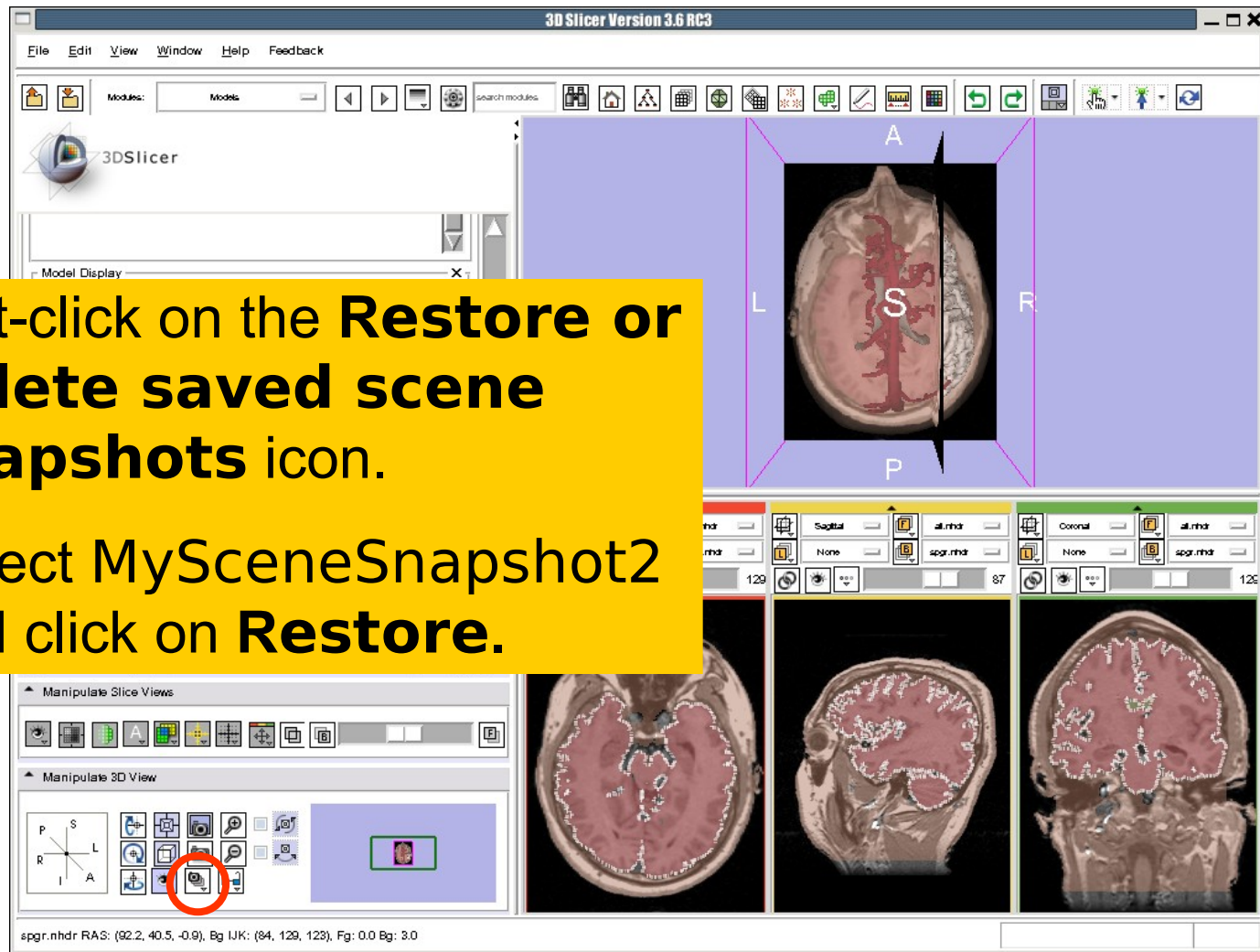
# Loading a Scene



# Loading a Scene

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

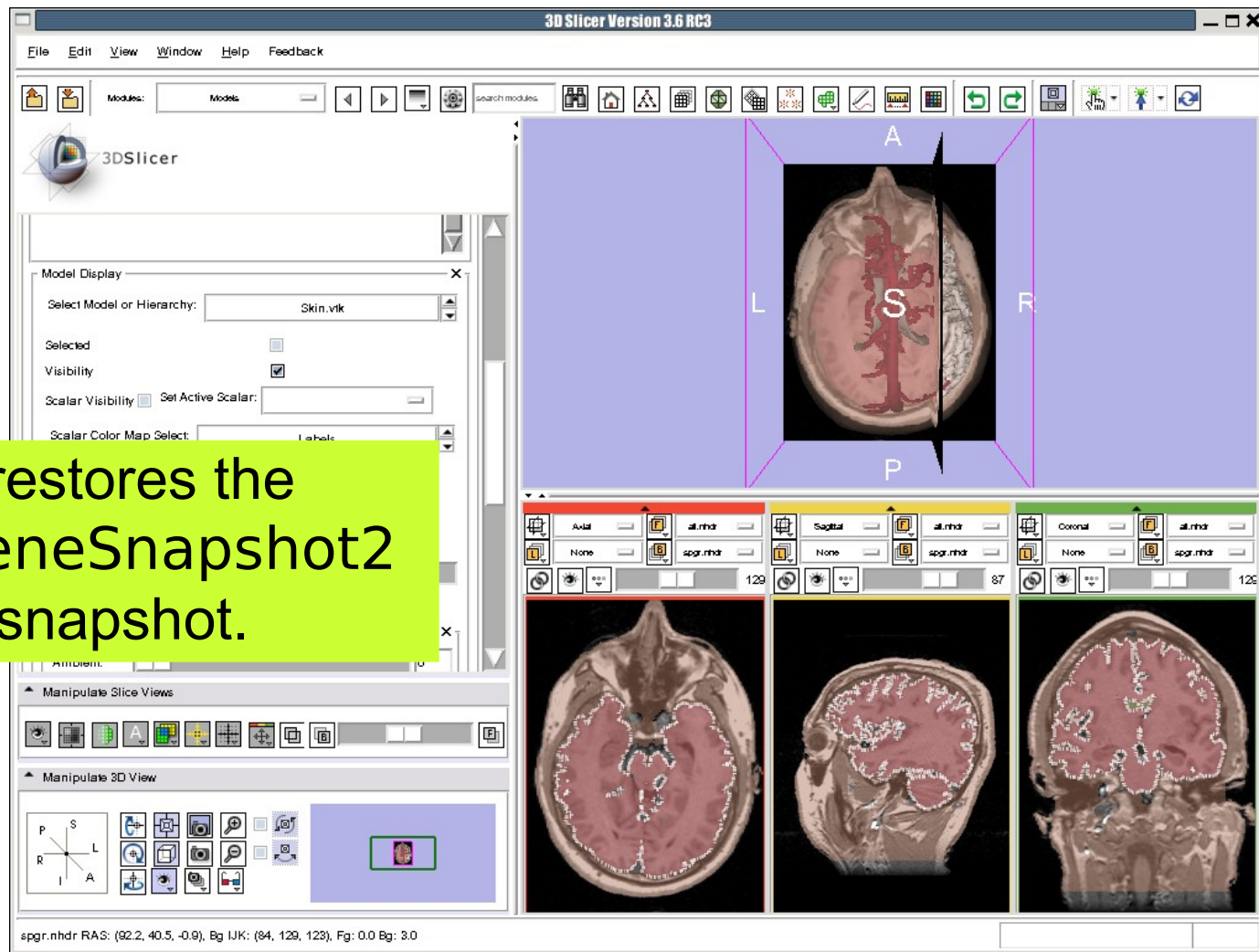
Select MySceneSnapshot2 and click on **Restore**.



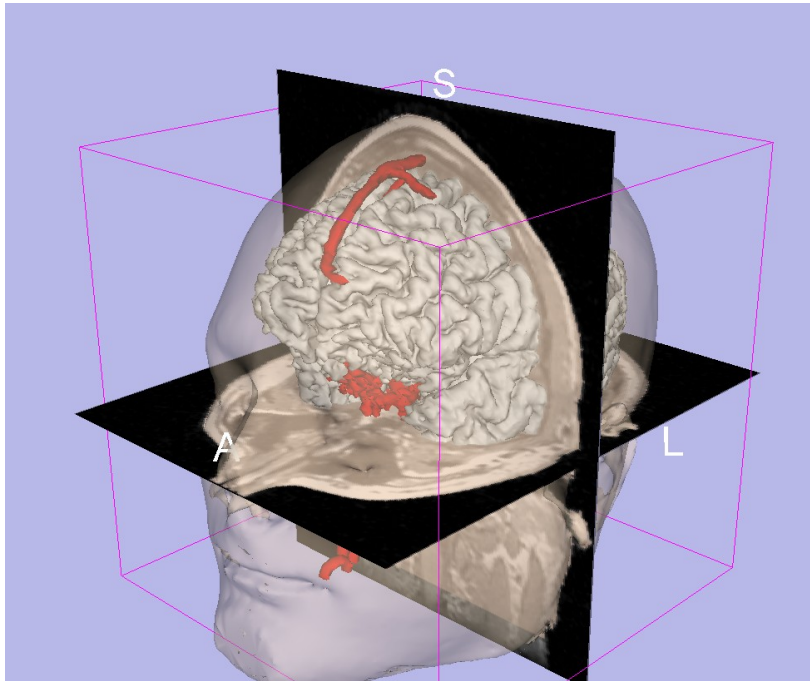


# Loading a Scene

Slicer restores the MySceneSnapshot2 scene snapshot.



# Conclusion



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

# Acknowledgments

---



National Alliance for Medical  
Image Computing  
NIH U54EB005149



Neuroimage Analysis Center  
NIH P41RR013218