



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

Data Loading & 3D 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

- Slicer3 is a **multi-platform** software that is developed and maintained on:
 - Windows XP
 - Linux x86_64
 - Linux x86
 - Mac OSX – Darwin x86-Intel
 - Mac OSX – Darwin Power PC



Download Slicer 3.4

- 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 3DSlicer to comply with both the terms of the license and with the applicable laws, regulations and rules.



Download Slicer3.4

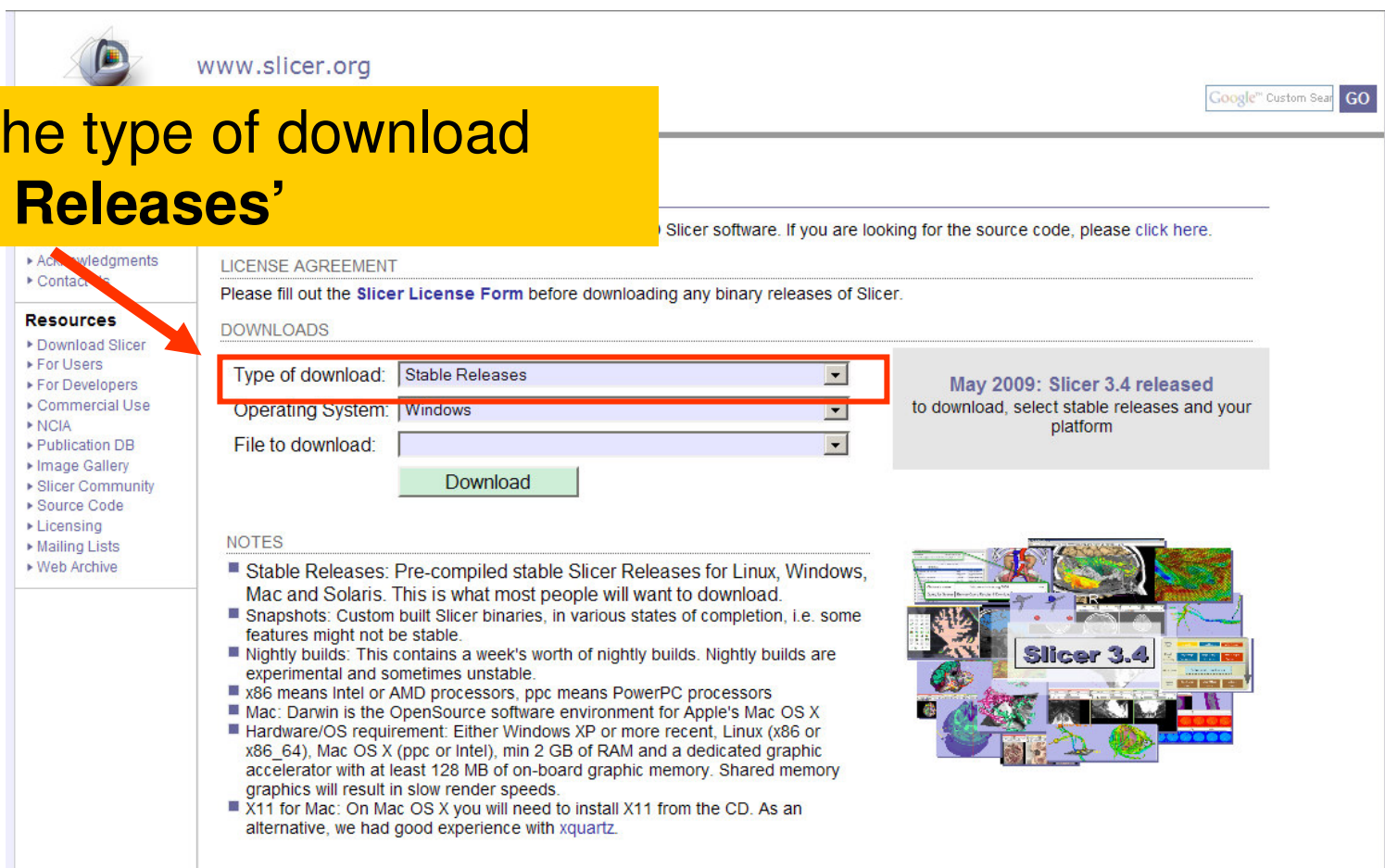


The screenshot shows the 'Slicer Downloads' page on the website www.slicer.org. The page has a sidebar on the left with links for 'About Slicer' (Home, Introduction, Acknowledgments, Contact Us) and 'Resources' (Download Slicer, For Users, For Developers, Commercial Use, NCIA, Publication DB, Image Gallery, Slicer Community, Source Code, Licensing, Mailing Lists, Web Archive). The main content area is titled 'Slicer Downloads' and includes a Google Custom Search bar. Below the title, there is a message about downloading compiled versions and a link to the source code. A 'LICENSE AGREEMENT' section follows, with a note to fill out the 'Slicer License Form' before downloading. The 'DOWNLOADS' section features three dropdown menus: 'Type of download' (set to 'Stable Releases'), 'Operating System' (set to 'Windows'), and 'File to download'. A green 'Download' button is positioned below these menus. To the right of the dropdowns, a grey box contains the text: 'May 2009: Slicer 3.4 released to download, select stable releases and your platform'. At the bottom of the page, there is a 'NOTES' section with two bullet points: 'Stable Releases: Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download.' and 'Snapshots: Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.' A collage of medical image analysis screenshots is visible at the bottom right of the page.

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 **Slicer3.4 release version**.

Download Slicer3.4

Select the type of download
'Stable Releases'



The screenshot shows the 3DSlicer website with the URL www.slicer.org. A yellow box highlights the instruction to select 'Stable Releases' from the 'Type of download' dropdown menu. The dropdown menu is currently set to 'Stable Releases'. Below it, the 'Operating System' is set to 'Windows' and the 'File to download' is empty. A green 'Download' button is visible. To the right, a grey box announces 'May 2009: Slicer 3.4 released' and instructs users to select stable releases and their platform. At the bottom right, there is a collage of images related to Slicer 3.4.

www.slicer.org

Google Custom Search GO

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

Resources

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

LICENSE AGREEMENT

Please fill out the [Slicer License Form](#) before downloading any binary releases of Slicer.

DOWNLOADS

Type of download: **Stable Releases**

Operating System: **Windows**

File to download:

Download

NOTES

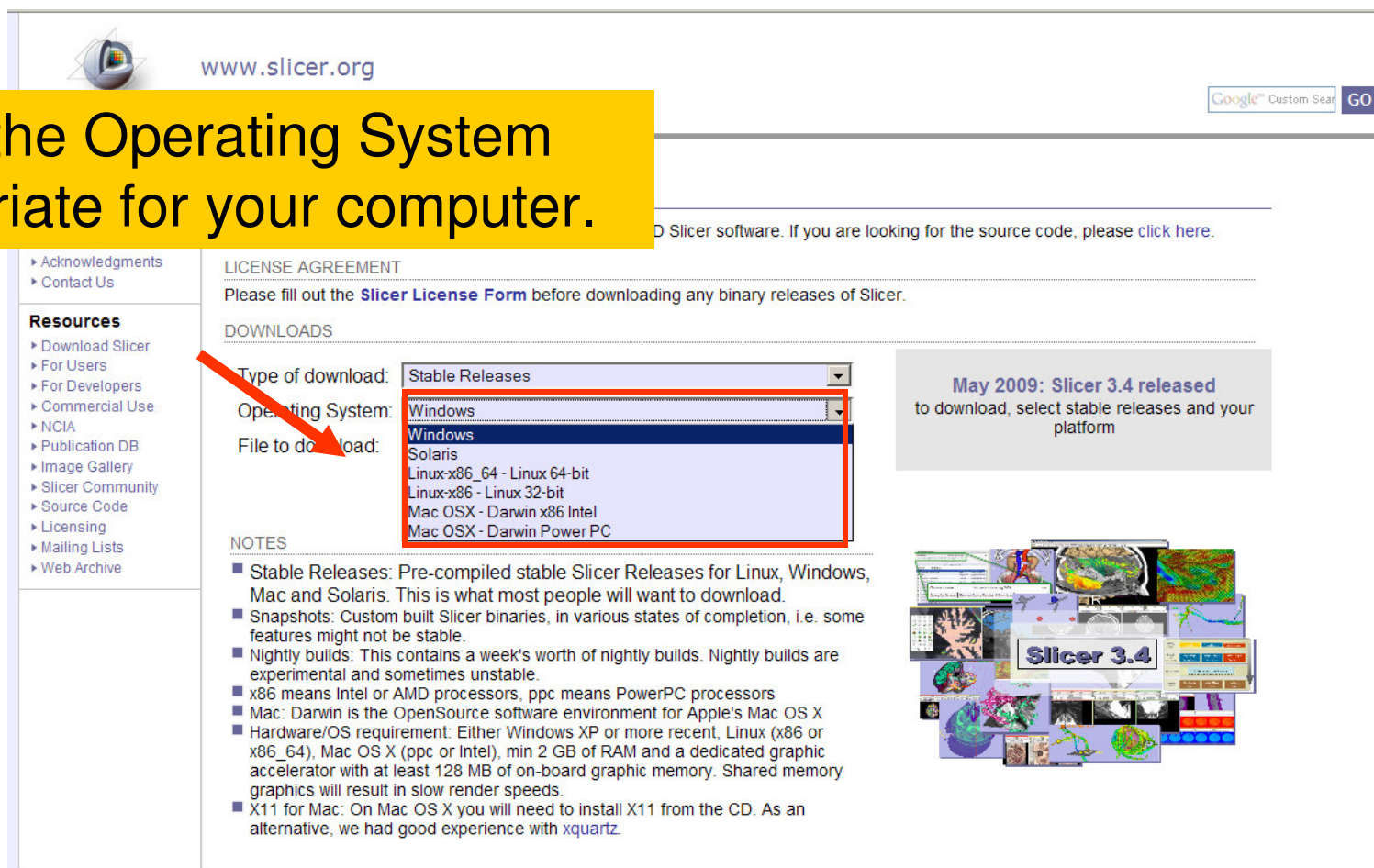
- **Stable Releases:** Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download.
- **Snapshots:** Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.
- **Nightly builds:** This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- **x86** means Intel or AMD processors, **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. 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](#).

May 2009: Slicer 3.4 released
to download, select stable releases and your platform

Slicer 3.4

Download Slicer3.4

Select the Operating System appropriate for your computer.



The screenshot shows the 3DSlicer website (www.slicer.org) with a red box highlighting the 'Operating System' dropdown menu in the 'DOWNLOADS' section. The dropdown menu is open, showing the following options: Windows, Windows, Solaris, Linux-x86_64 - Linux 64-bit, Linux-x86 - Linux 32-bit, Mac OSX - Darwin x86 Intel, and Mac OSX - Darwin Power PC. A red arrow points to the 'Operating System' label.

Resources

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

LICENSE AGREEMENT

Please fill out the [Slicer License Form](#) before downloading any binary releases of Slicer.

DOWNLOADS

Type of download: Stable Releases

Operating System: **Windows**

File to download:

NOTES

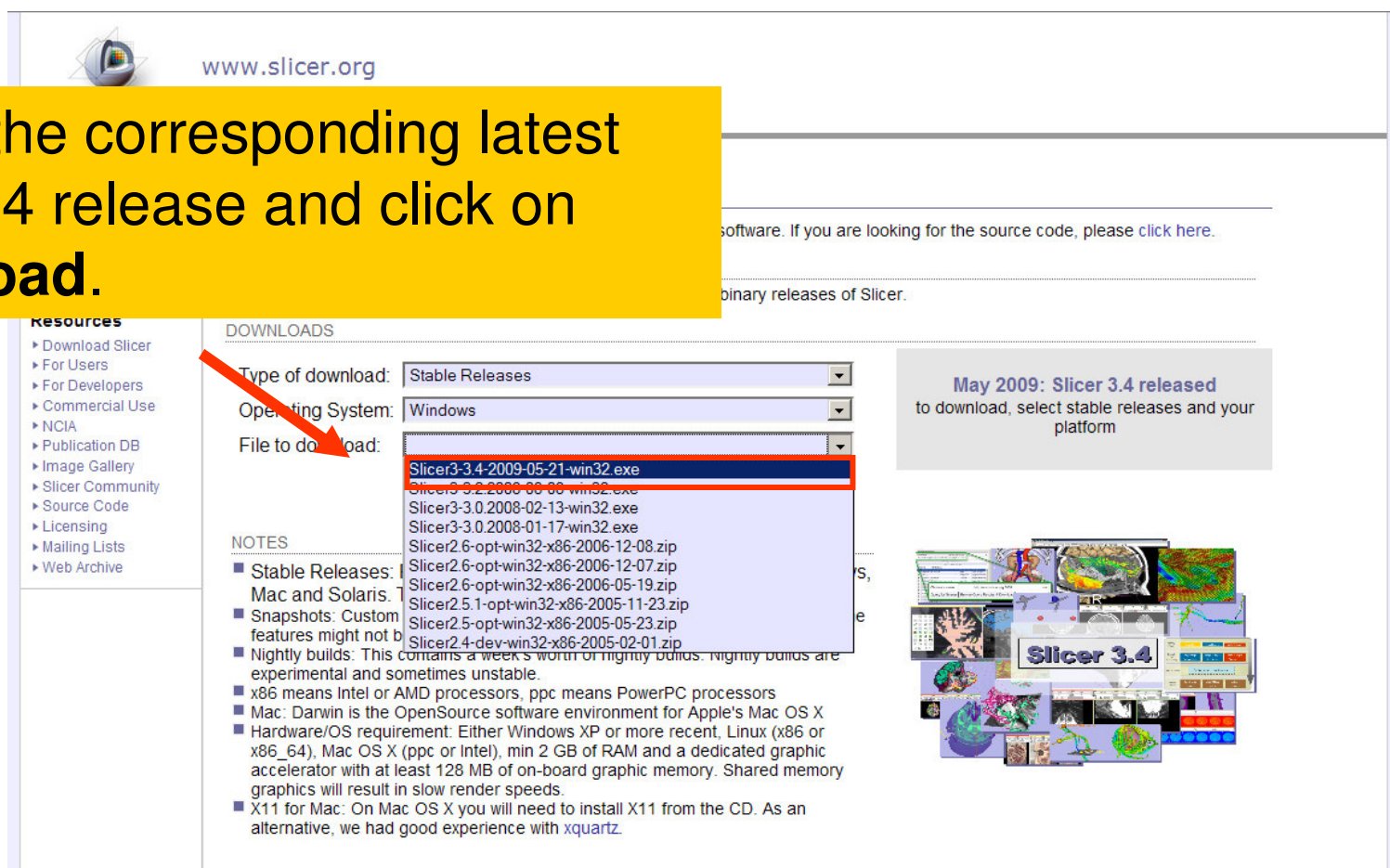
- **Stable Releases:** Pre-compiled stable Slicer Releases for Linux, Windows, Mac and Solaris. This is what most people will want to download.
- **Snapshots:** Custom built Slicer binaries, in various states of completion, i.e. some features might not be stable.
- **Nightly builds:** This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- **x86** means Intel or AMD processors, **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. 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](#).

May 2009: Slicer 3.4 released
to download, select stable releases and your platform

Slicer 3.4

Download Slicer3.4

Select the corresponding latest Slicer3.4 release and click on **Download**.



The screenshot shows the website www.slicer.org with a navigation menu on the left and a 'DOWNLOADS' section in the center. A yellow box highlights the instruction: 'Select the corresponding latest Slicer3.4 release and click on Download.' A red arrow points to the 'File to download' dropdown menu, which is open and shows a list of files. The top file, 'Slicer3-3.4-2009-05-21-win32.exe', is highlighted with a red border. To the right of the download section, a grey box contains the text: 'May 2009: Slicer 3.4 released to download, select stable releases and your platform'. Below this, there is a collage of images showing various medical imaging and visualization results, with 'Slicer 3.4' text overlaid.

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:

- Slicer3-3.4-2009-05-21-win32.exe
- Slicer3-3.2-2008-08-08-win32.exe
- Slicer3-3.0-2008-02-13-win32.exe
- Slicer3-3.0-2008-01-17-win32.exe
- Slicer2.6-opt-win32-x86-2006-12-08.zip
- Slicer2.6-opt-win32-x86-2006-12-07.zip
- Slicer2.6-opt-win32-x86-2006-05-19.zip
- Slicer2.5.1-opt-win32-x86-2005-11-23.zip
- Slicer2.5-opt-win32-x86-2005-05-23.zip
- Slicer2.4-dev-win32-x86-2005-02-01.zip

NOTES

- Stable Releases: Mac and Solaris.
- Snapshots: Custom features might not be available.
- Nightly builds: This contains a week's worth of nightly builds. Nightly builds are experimental and sometimes unstable.
- x86 means Intel or AMD processors, 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. 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](#).

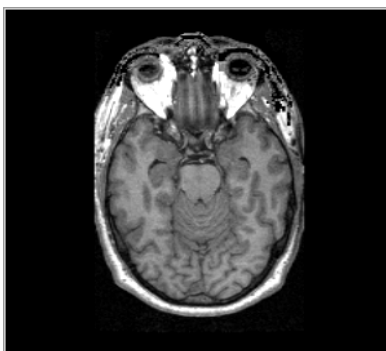
May 2009: Slicer 3.4 released
to download, select stable releases and your platform

Slicer 3.4

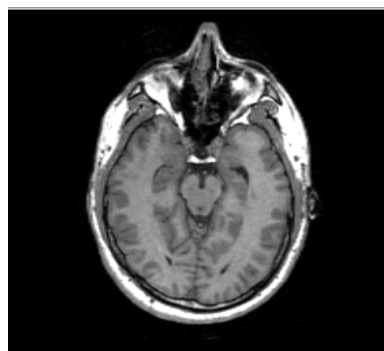


Download the training dataset

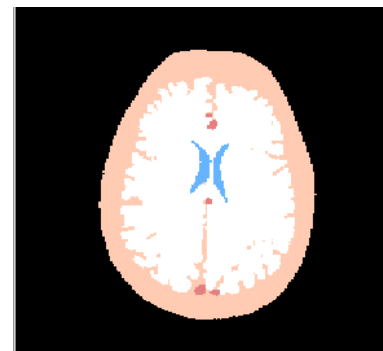
- This course is built upon three datasets of a single healthy subject brain:



MR DICOM
GRASS



MR Nrrd
SPGR

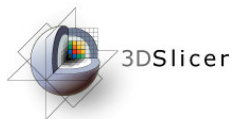


Pre-computed
Label Map

- Download and unzip the training dataset

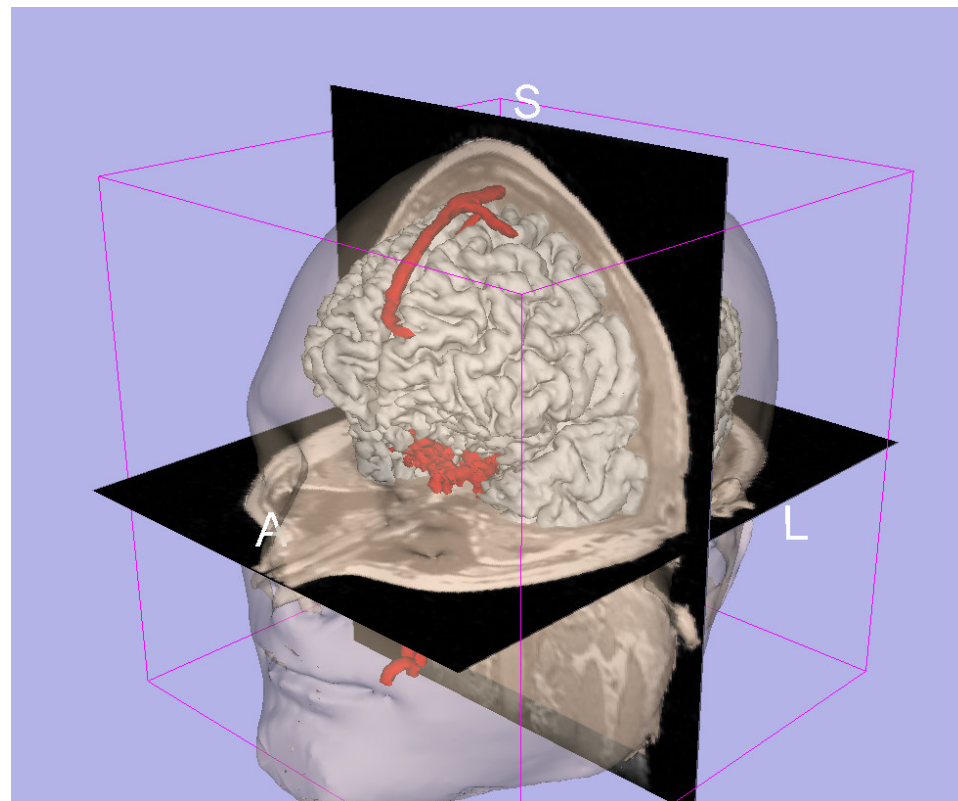
Slicer3VisualizationDataset.zip

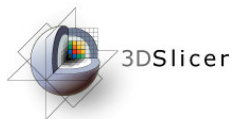
<http://www.slicer.org/slicerWiki/index.php/Slicer3.4:Training>



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.

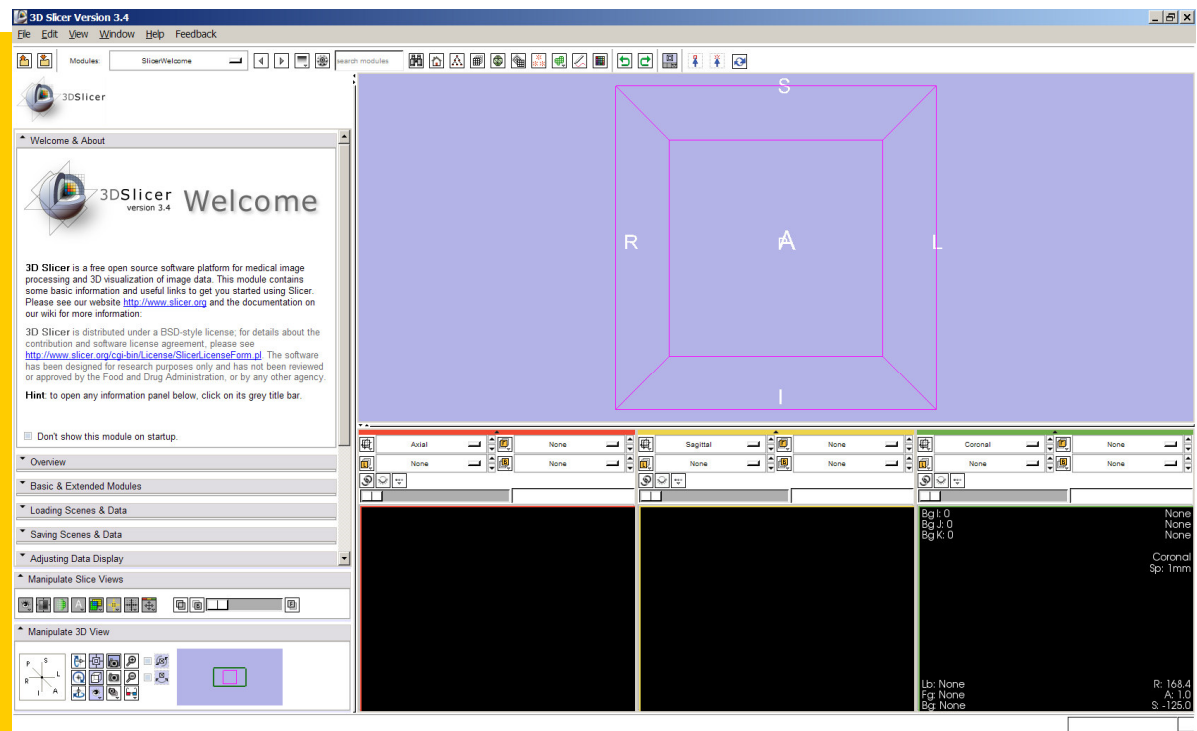




Start Slicer3

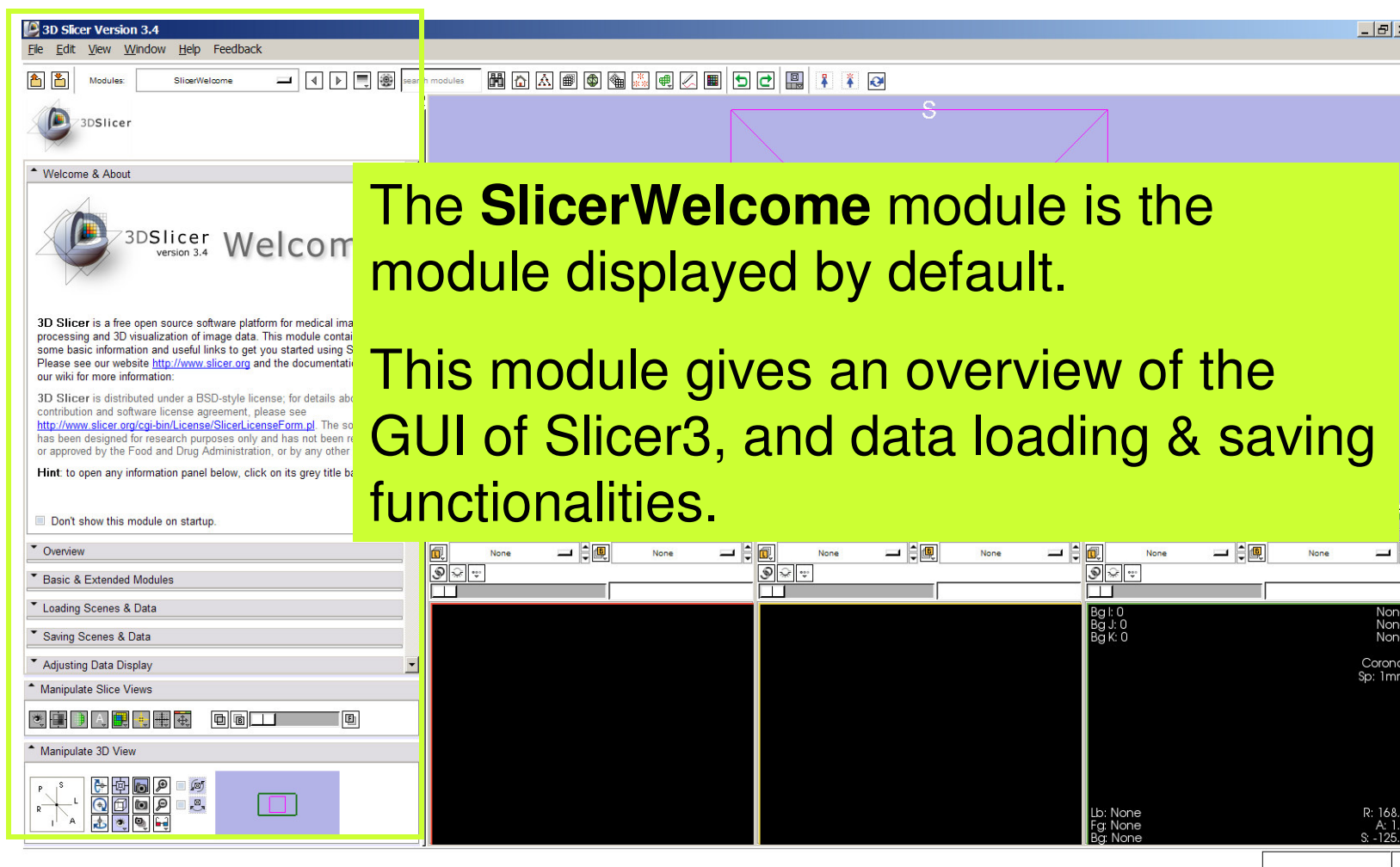
Linux/Mac users
Launch the Slicer3
executable located in
the Slicer3.4 directory

Windows users
Select
Start → All Programs
→ Slicer3 3.4 2009-05-21 → Slicer3





Slicer Welcome

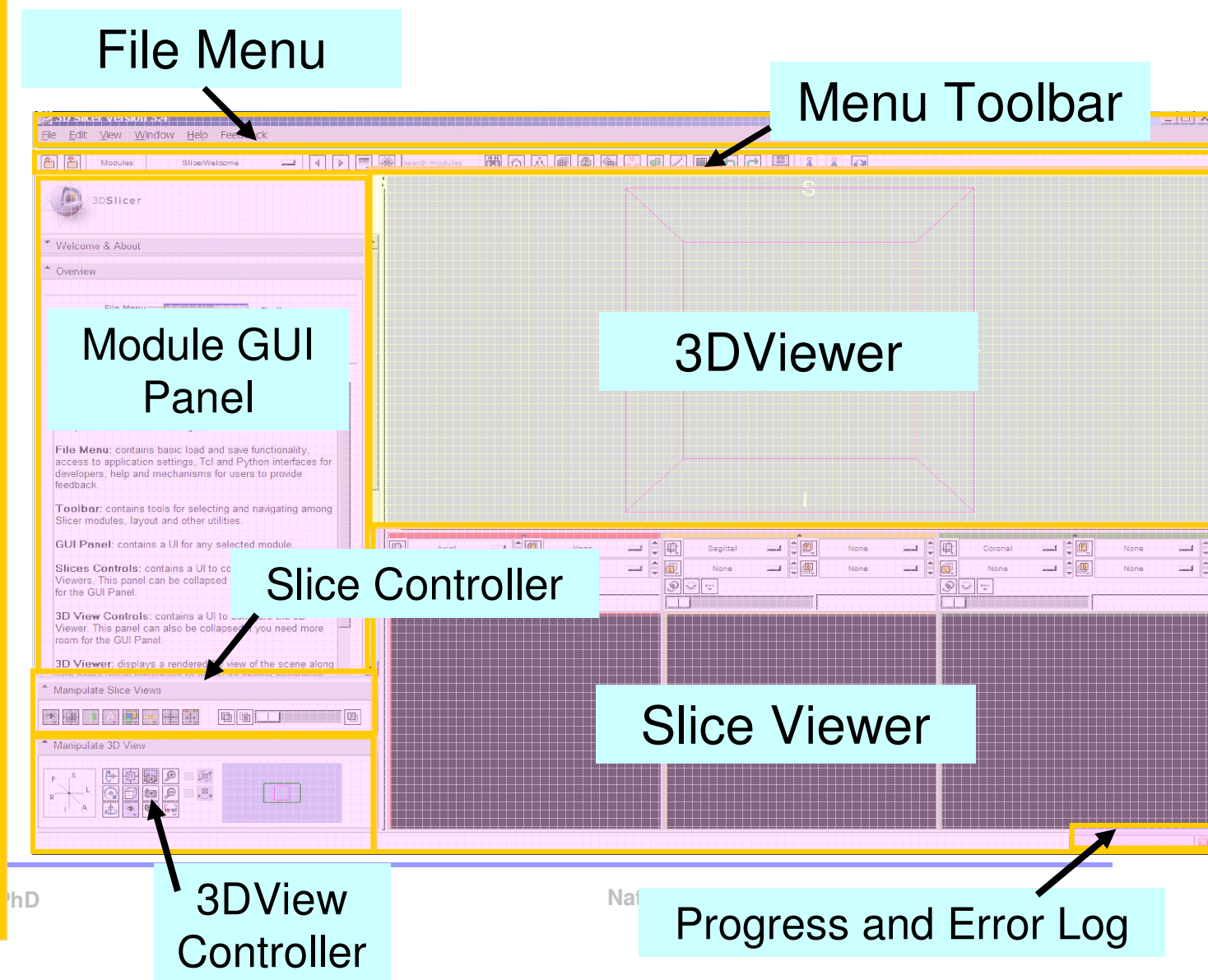




Slicer3 GUI

The Graphical User Interface (GUI) of Slicer3.4 integrates 8 main components:

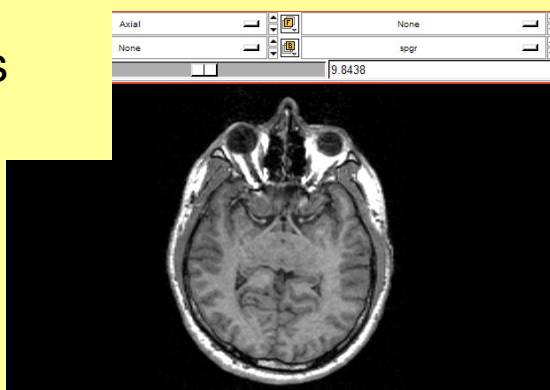
- the File Menu
- the Menu Toolbar
- the Module GUI Panel
- the 3D Viewer
- the Slice Viewer
- the Slice Controller
- the 3D View Controller



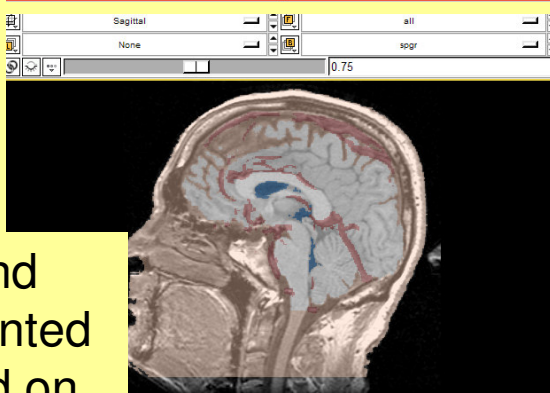


Overview

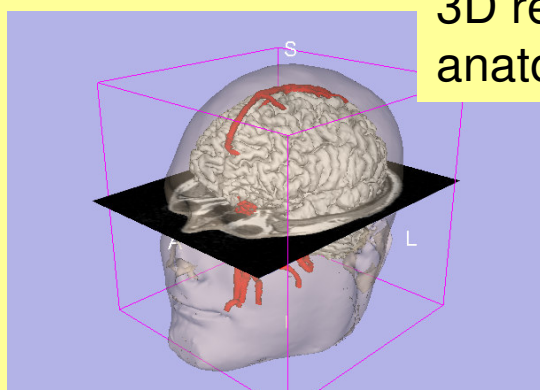
Part 1. Loading and visualizing multiple volumes simultaneously



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



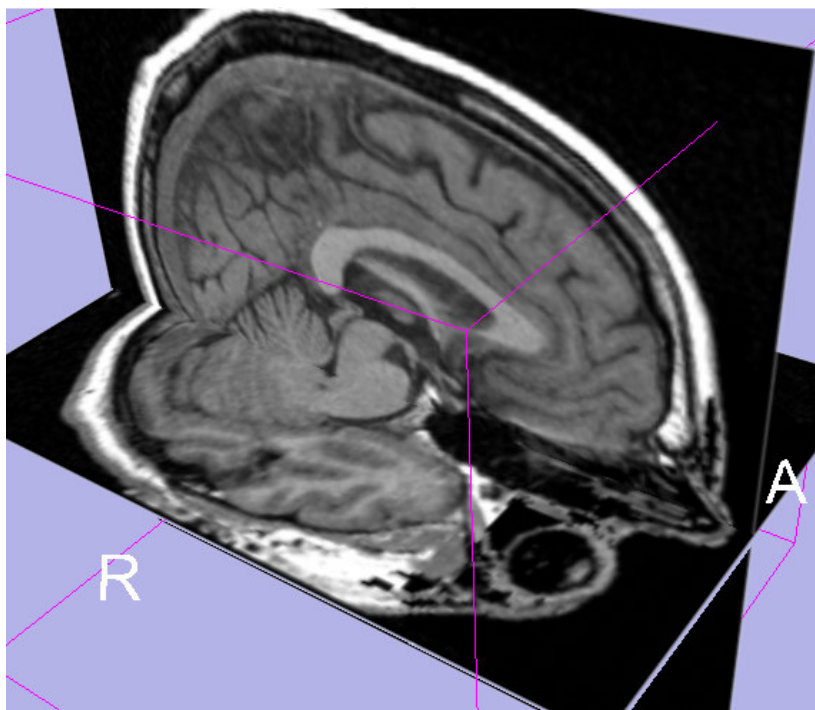
Part 3. Visualizing 3D reconstructions of anatomical surfaces



Part 4. The lightbox viewer



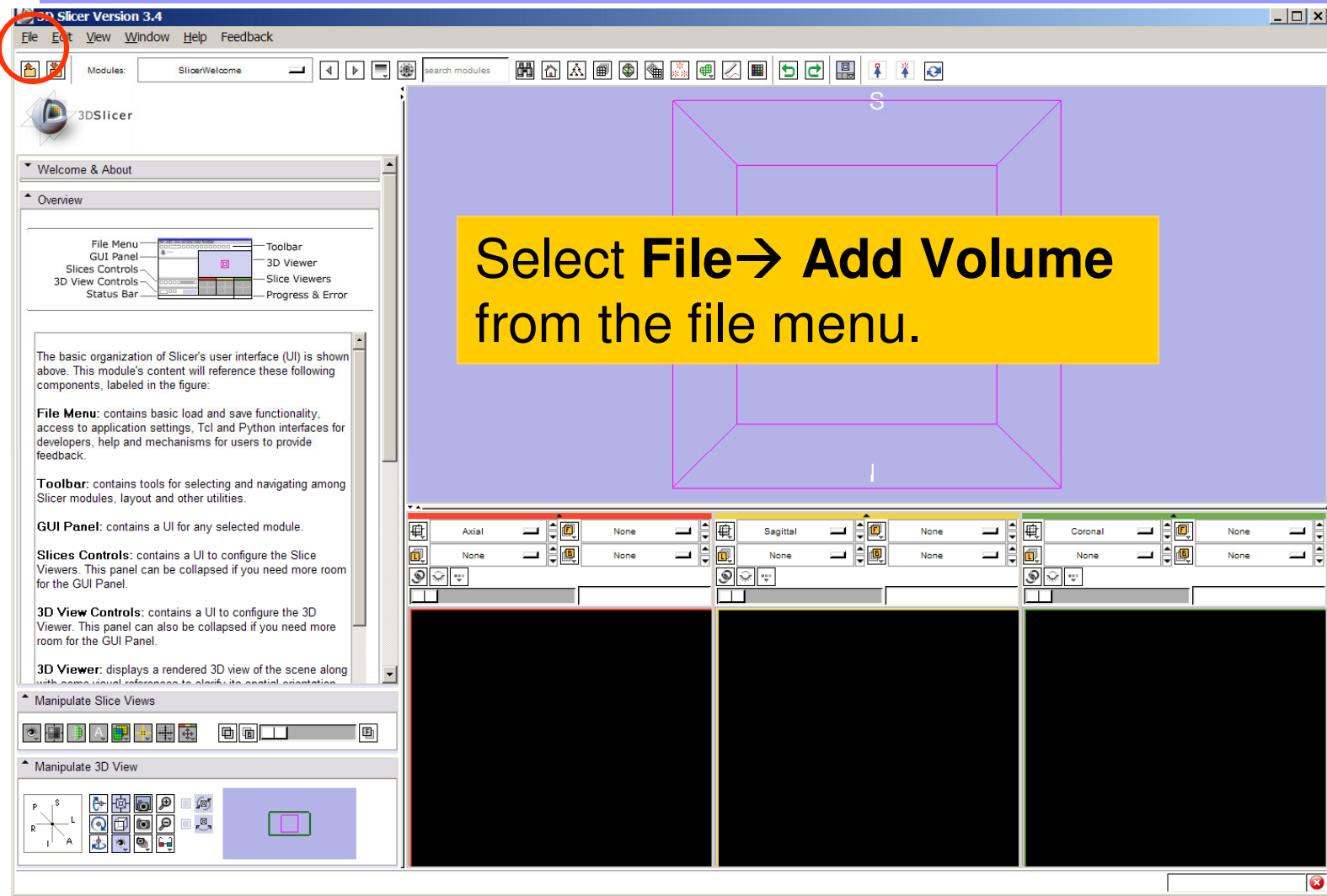
Part 5. Saving data



Part 1: Loading and visualizing multiple volumes simultaneously

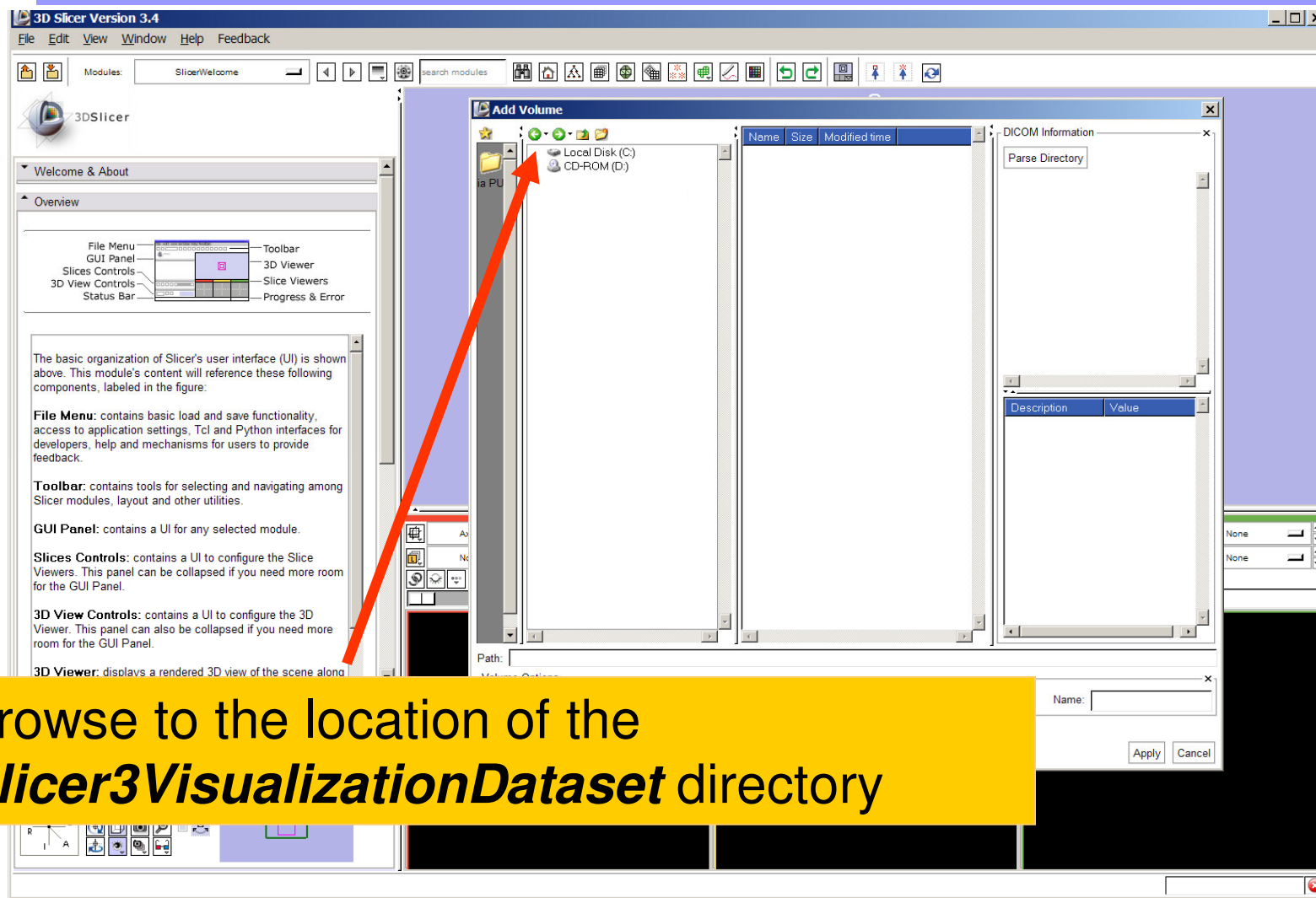


Loading Volumes



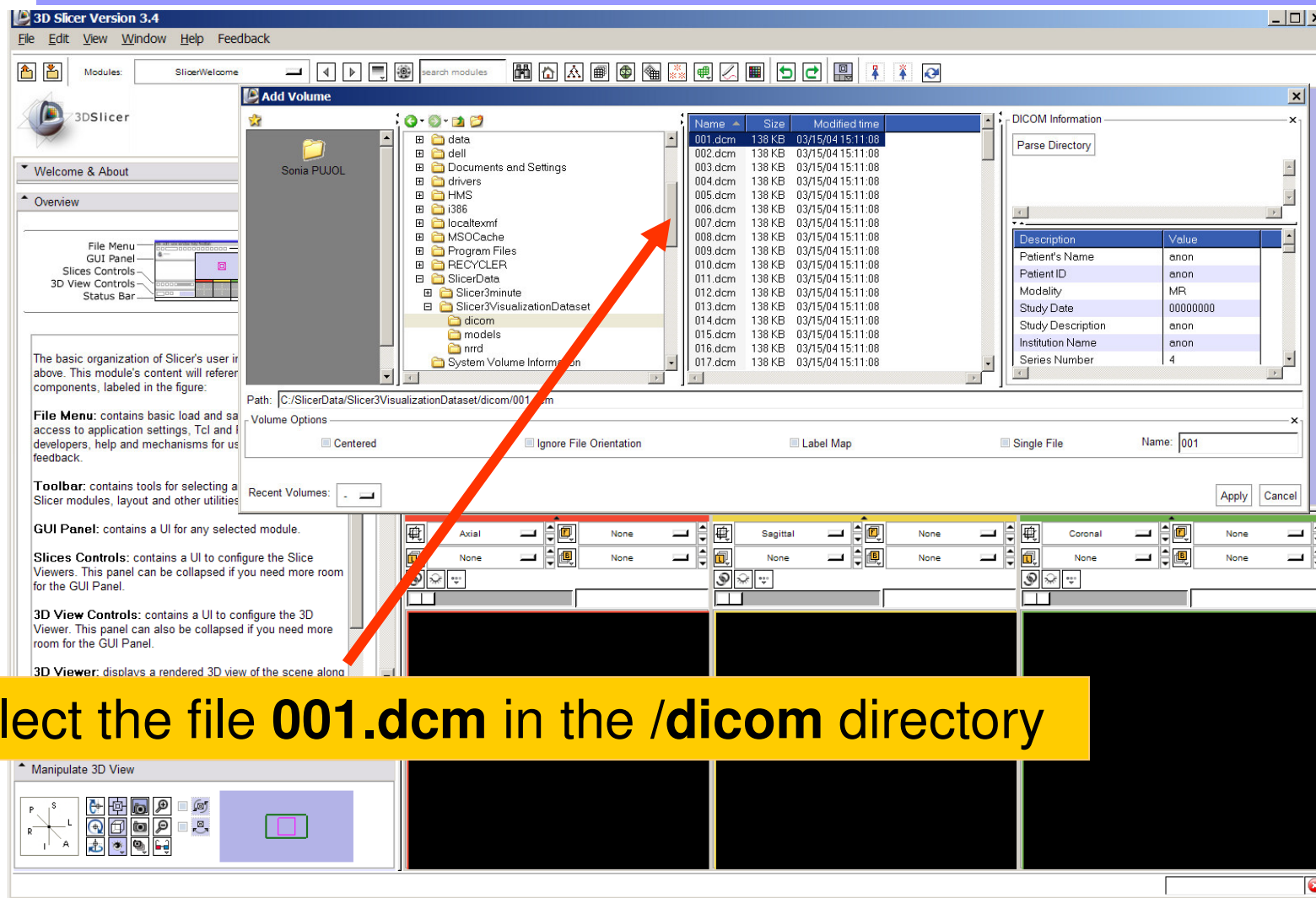


Loading Volumes





Loading Volumes





Loading Volumes

The screenshot shows the 3D Slicer 3.4 interface. The 'Add Volume' dialog is open, displaying a file list with columns for Name, Size, and Modified time. The 'DICOM Information' panel is also visible, showing a table of DICOM header information. A red arrow points from the 'DICOM Information' panel to the 3D viewer area.

Description	Value
Patient's Name	anon
Patient ID	anon
Modality	MR
Study Date	00000000
Study Description	anon
Institution Name	anon
Series Number	4

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



Loading Volumes

3D Slicer Version 3.4

File Edit View Window Help Feedback

Modules: SlicerWelcome

Add Volume

Path: C:/SlicerData/Slicer3VisualizationDataset/dicom/001.dcm

Volume Options: ☐ Centered ☐ Ignore File Orientation ☐ Label Map ☐ Single File Name: 001

Recent Volumes: -

DICOM Information

Description	Value
Rows	256
Columns	256
Pixel Spacing	0.937500 0.9375...
Bits Allocated	16
Bits Stored	16
High Bit	15
Pixel Representation	1

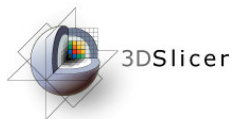
Image dimensions: Rows = 256, Columns = 256



Loading Volumes

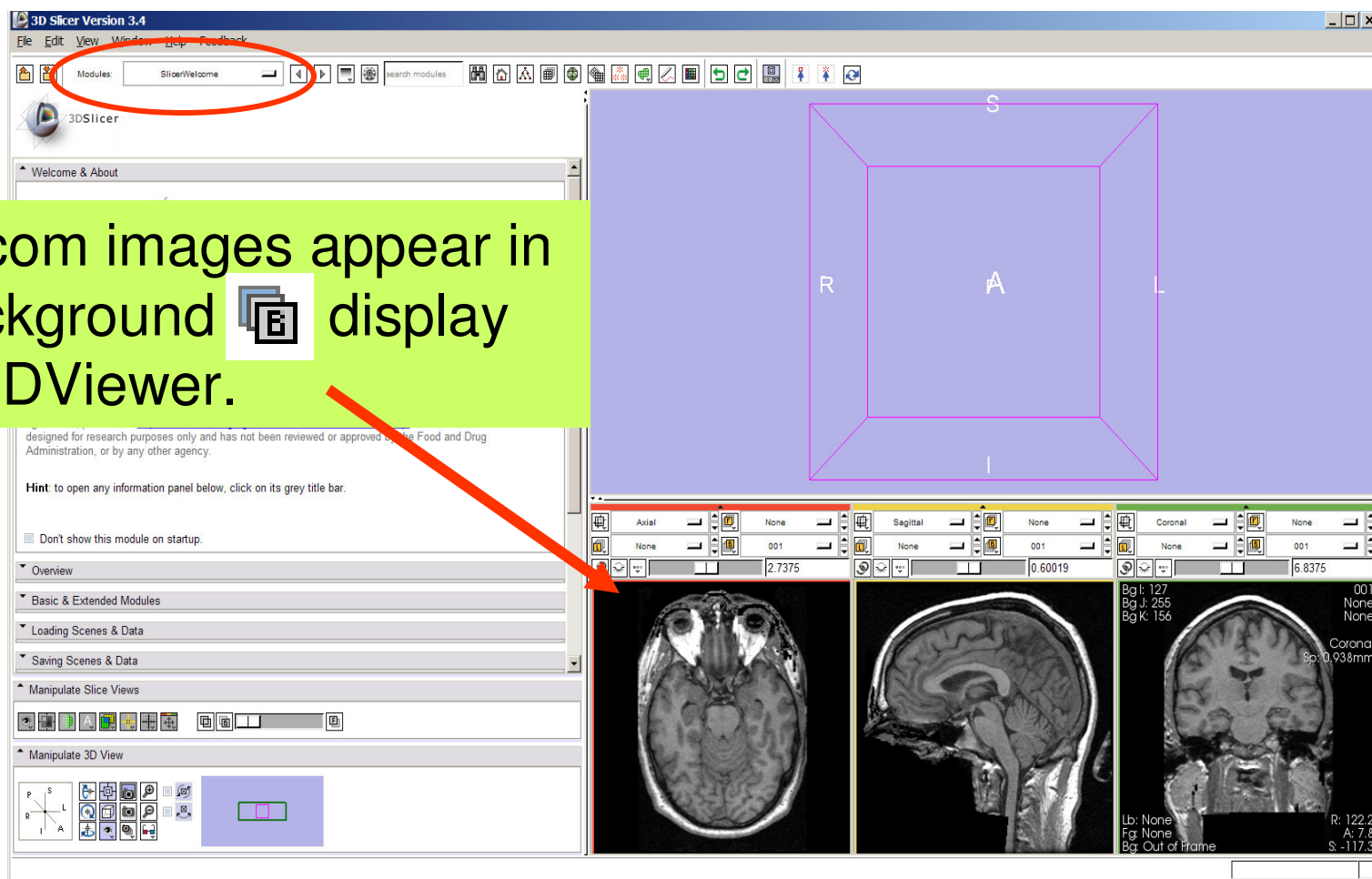
The screenshot shows the 3D Slicer 3.4 application window. The 'Add Volume' dialog is open, displaying a file explorer view of the 'Sonia PUJOL' directory. A list of DICOM files (001.dcm to 017.dcm) is shown with columns for Name, Size, and Modified time. The 'DICOM Information' panel on the right shows details for the selected file (001.dcm), including Rows (256), Columns (256), Pixel Spacing (0.937500, 0.9375...), Bits Allocated (16), Bits Stored (16), High Bit (15), and Pixel Representation (1). The 'Volume Options' section at the bottom of the dialog has checkboxes for 'Centered', 'Ignore File Orientation', 'Label Map', and 'Single File', with 'Name: 001' displayed. The 'Apply' button is circled in red. A red arrow points from the 'Apply' button to the '3D View' section of the main interface, which is highlighted by a yellow box.

Click on Apply to load the Dicom volume in Slicer.



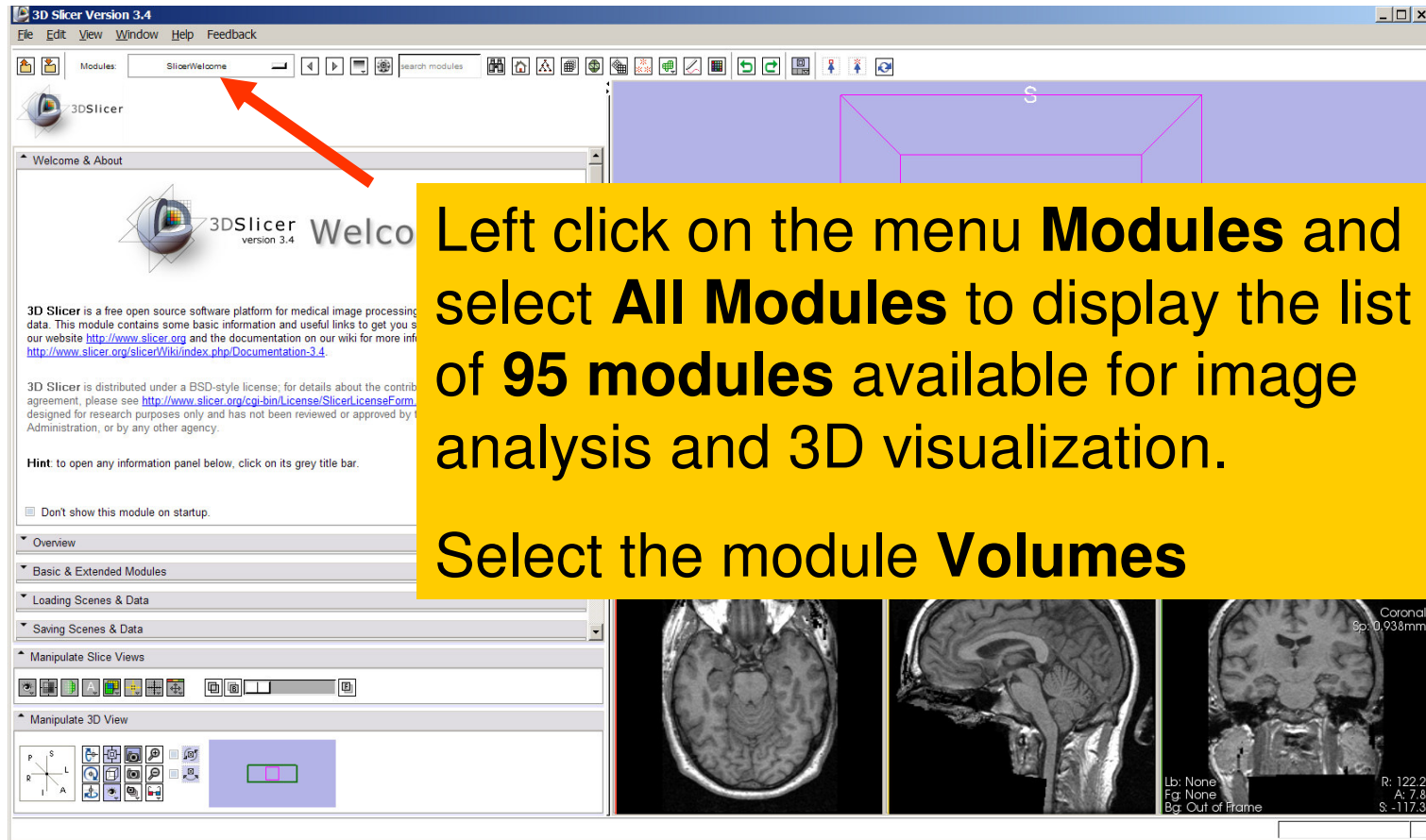
Loading Volumes

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



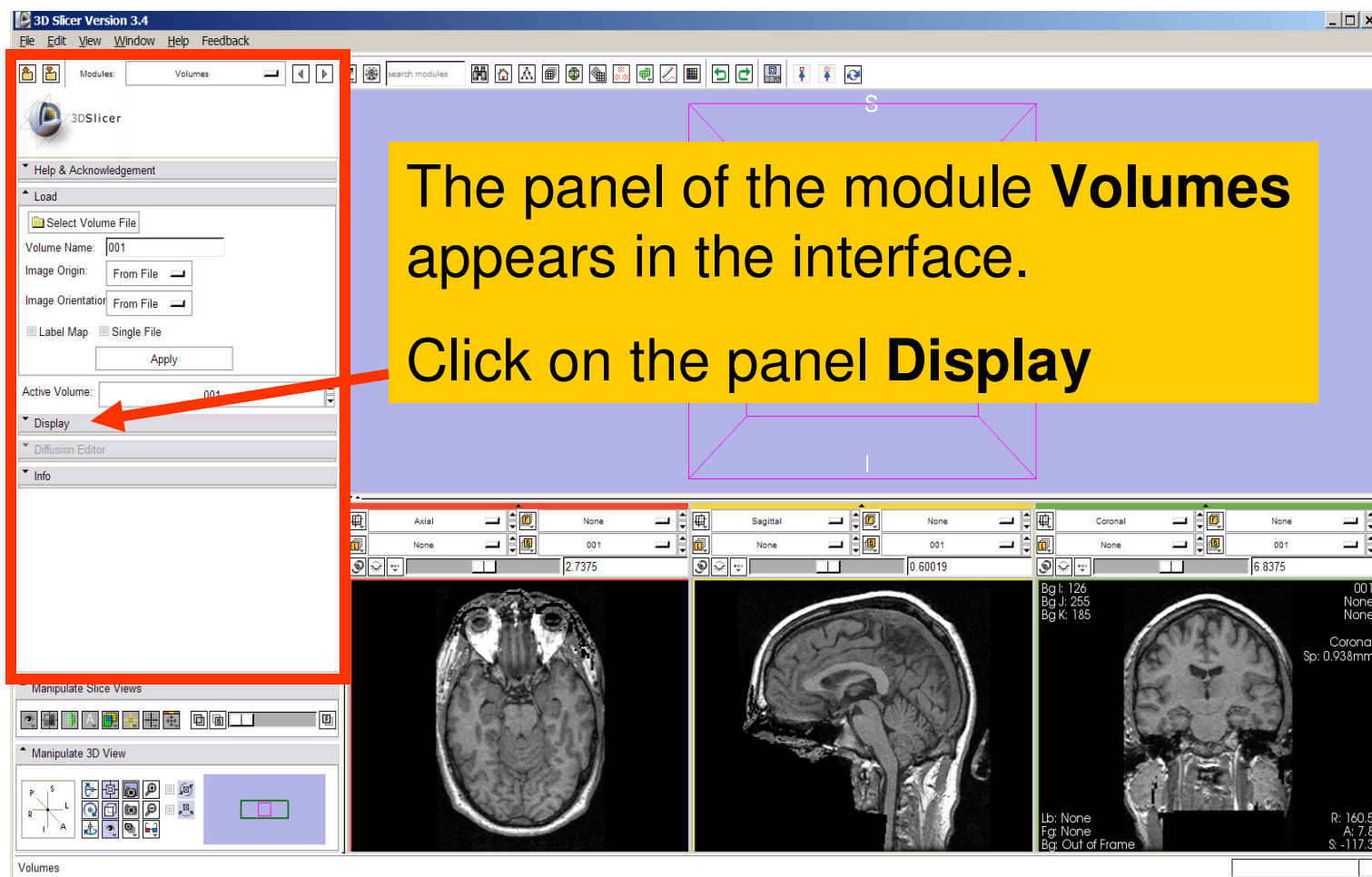


Loading Volumes



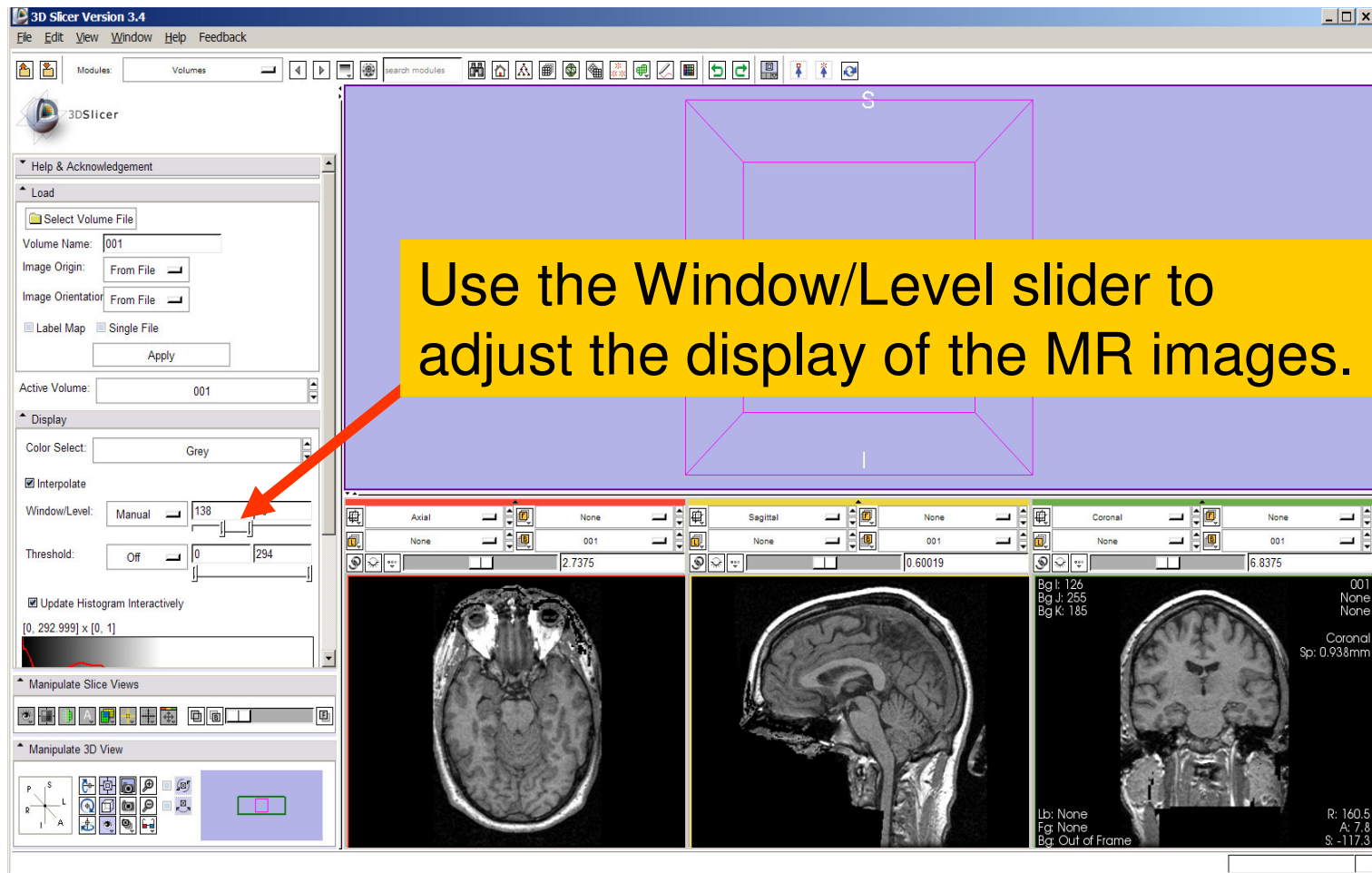


Loading Volumes



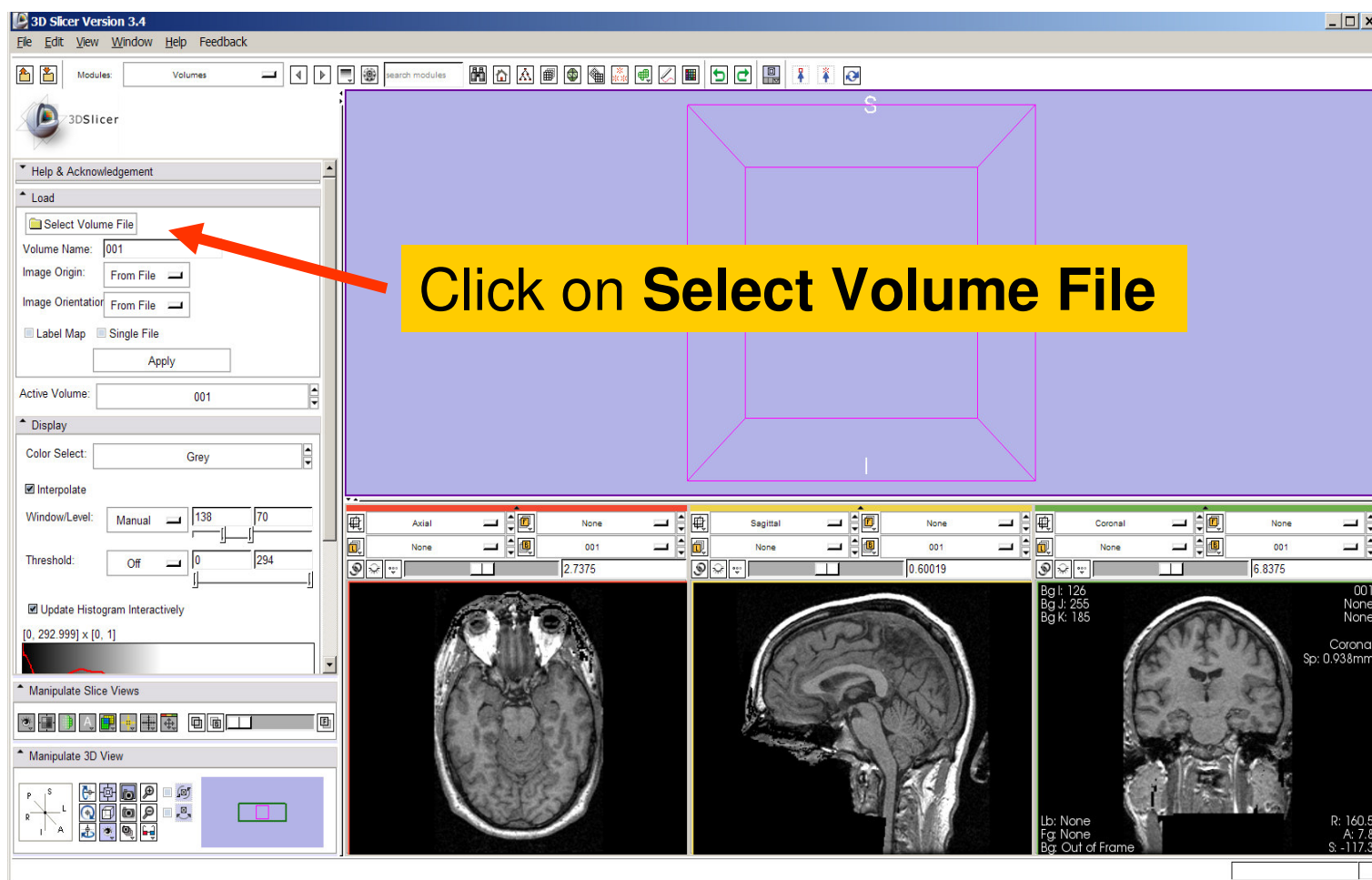


Loading Volumes

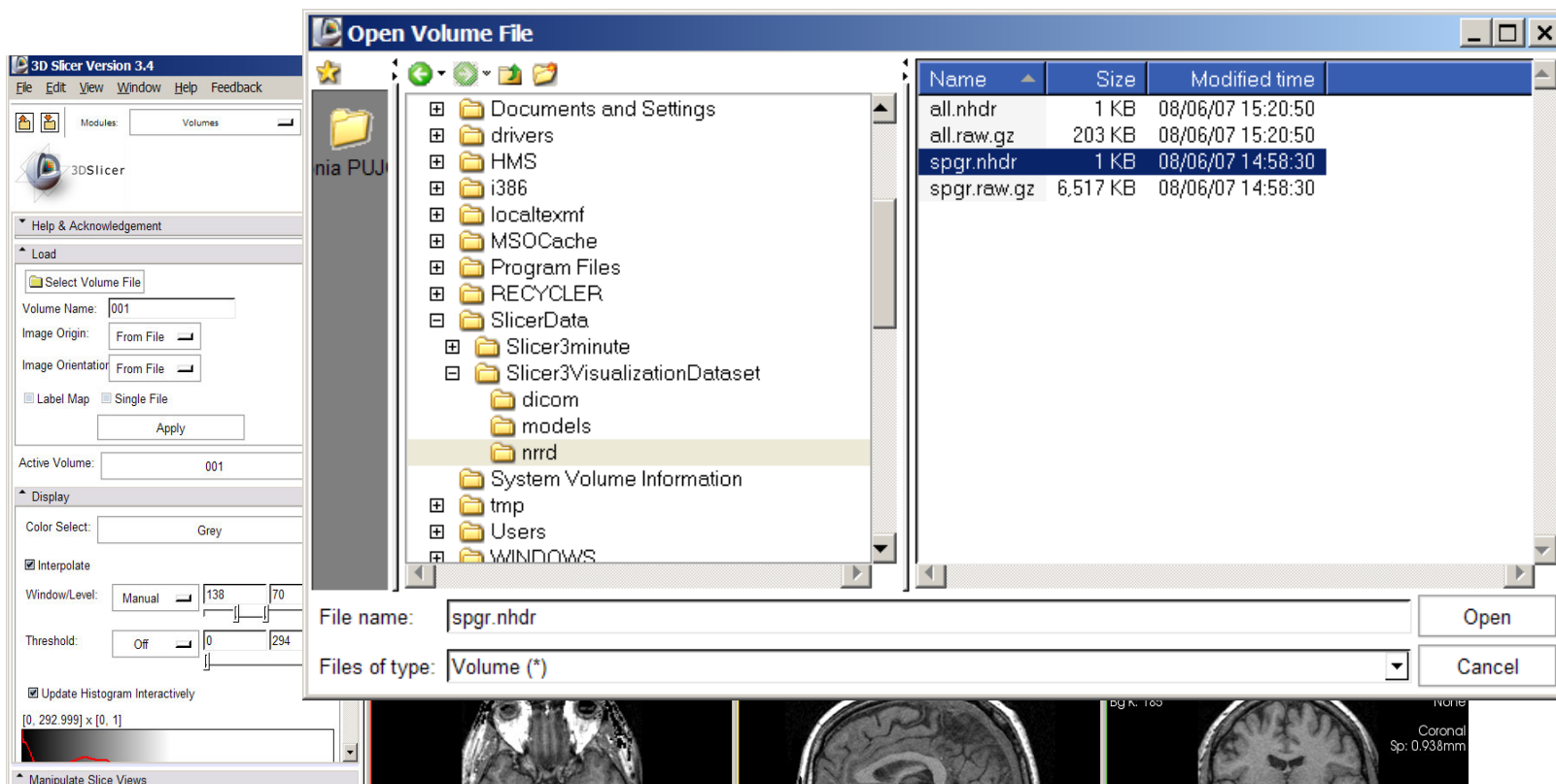




Loading Volumes



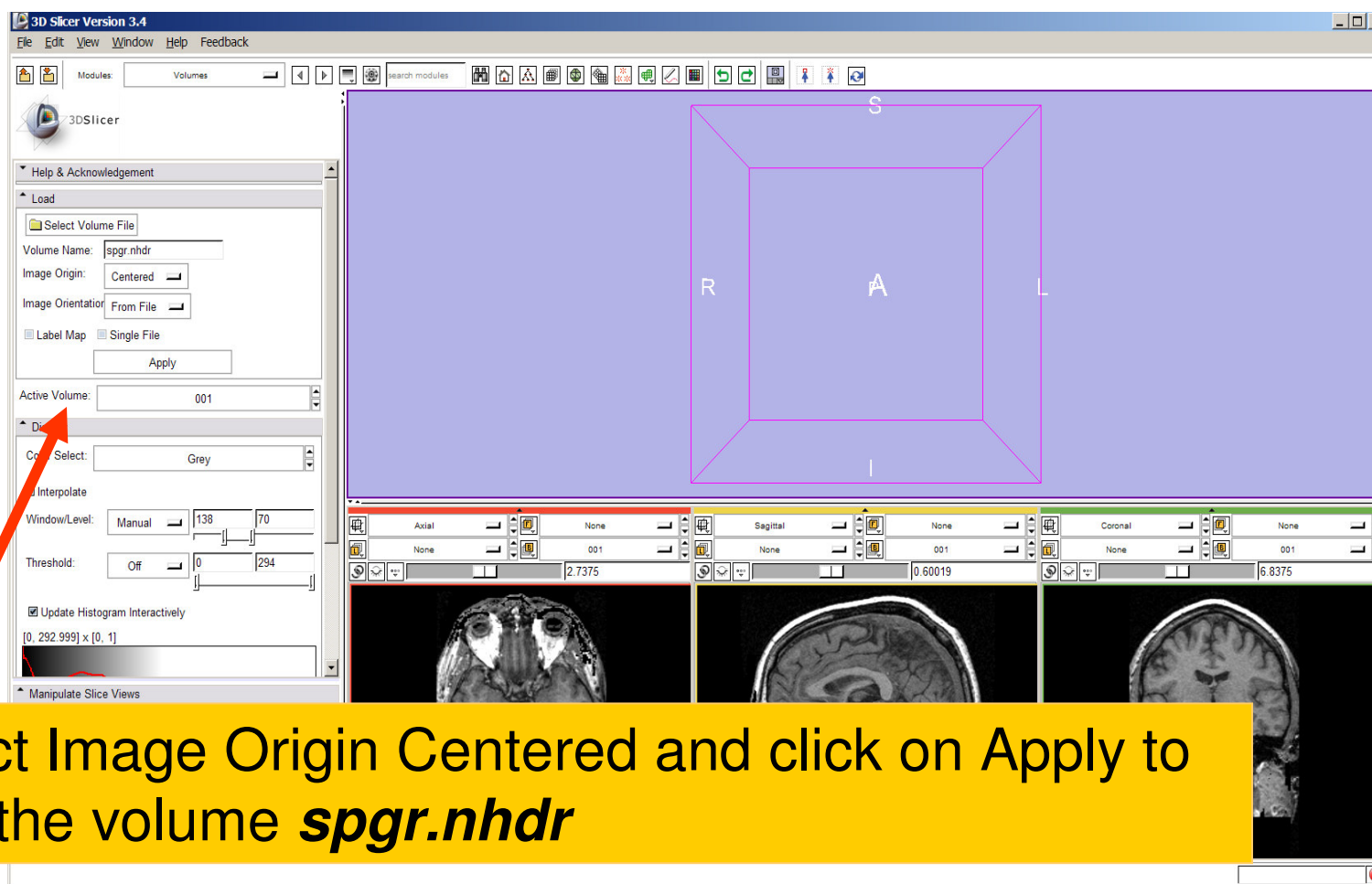
Loading Volumes



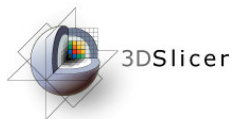
Browse to find the header file of the spgr volume ***spgr.nhdr*** located in the directory ***Slicer3VisualizationDataset/nrrd*** and click on **Open**.



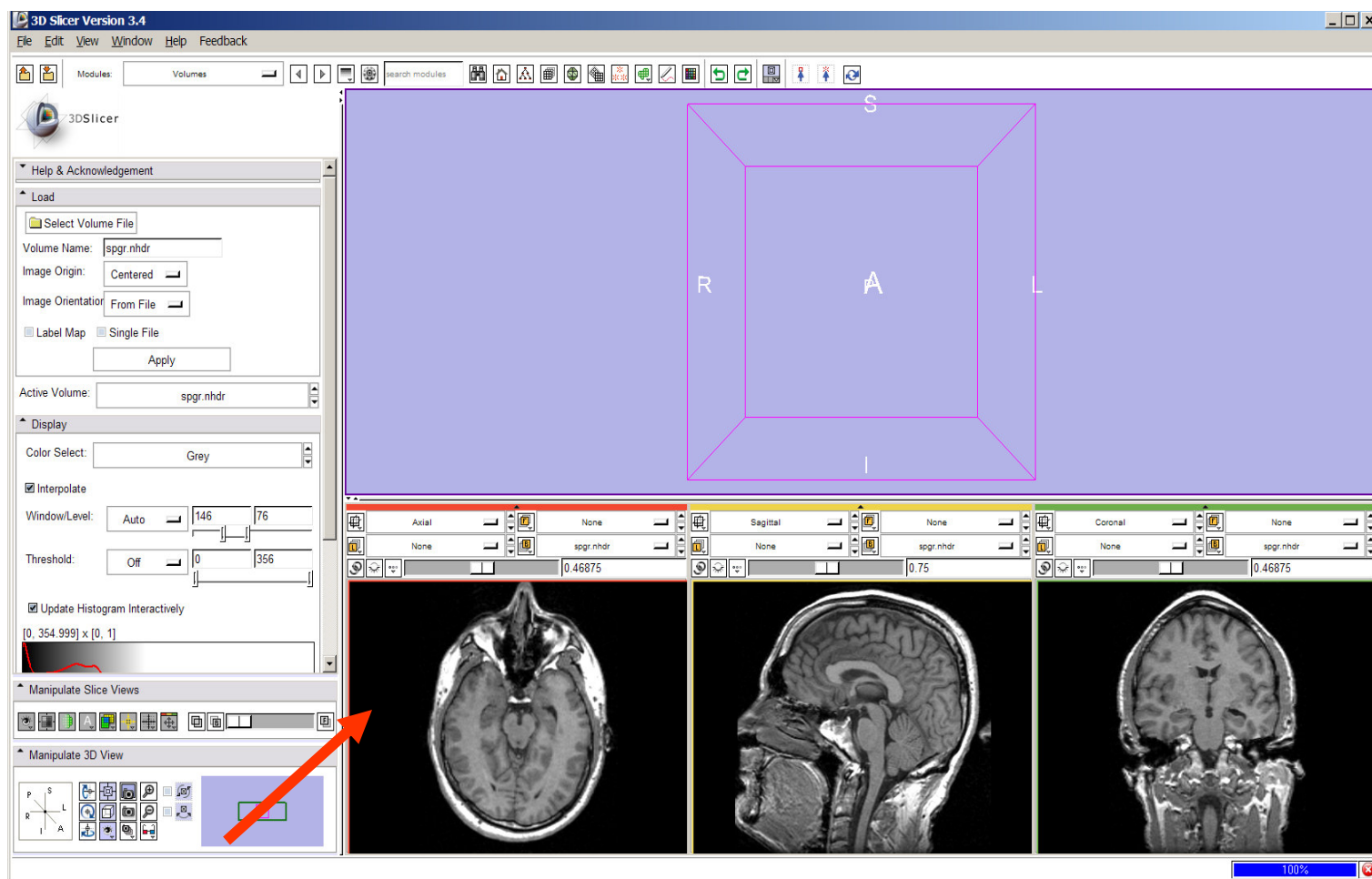
Loading Volumes



Select Image Origin Centered and click on Apply to load the volume ***spgr.nhdr***



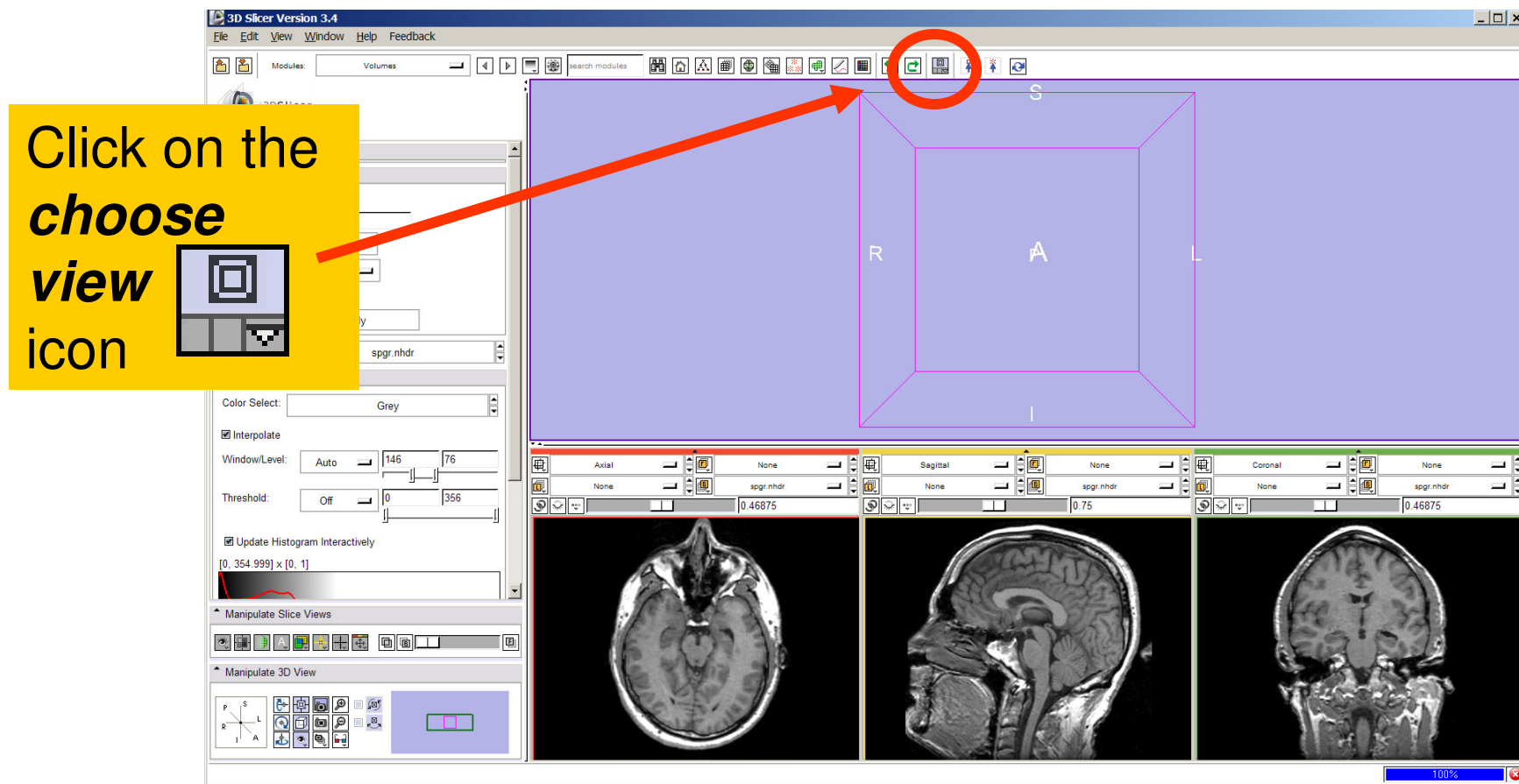
Loading Volumes



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

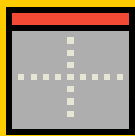


Exploring the data

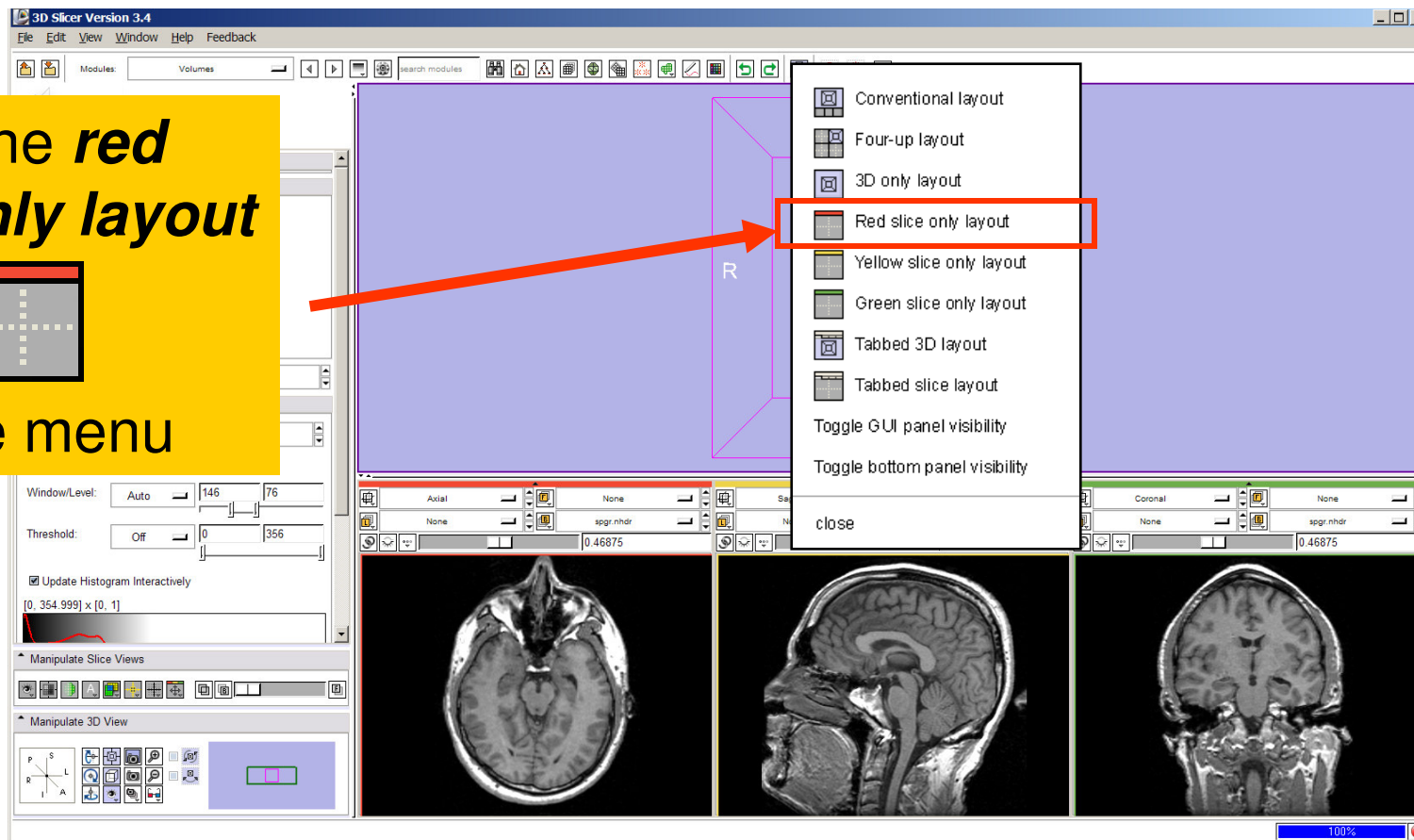


Exploring the data

Select the **red slice only layout**

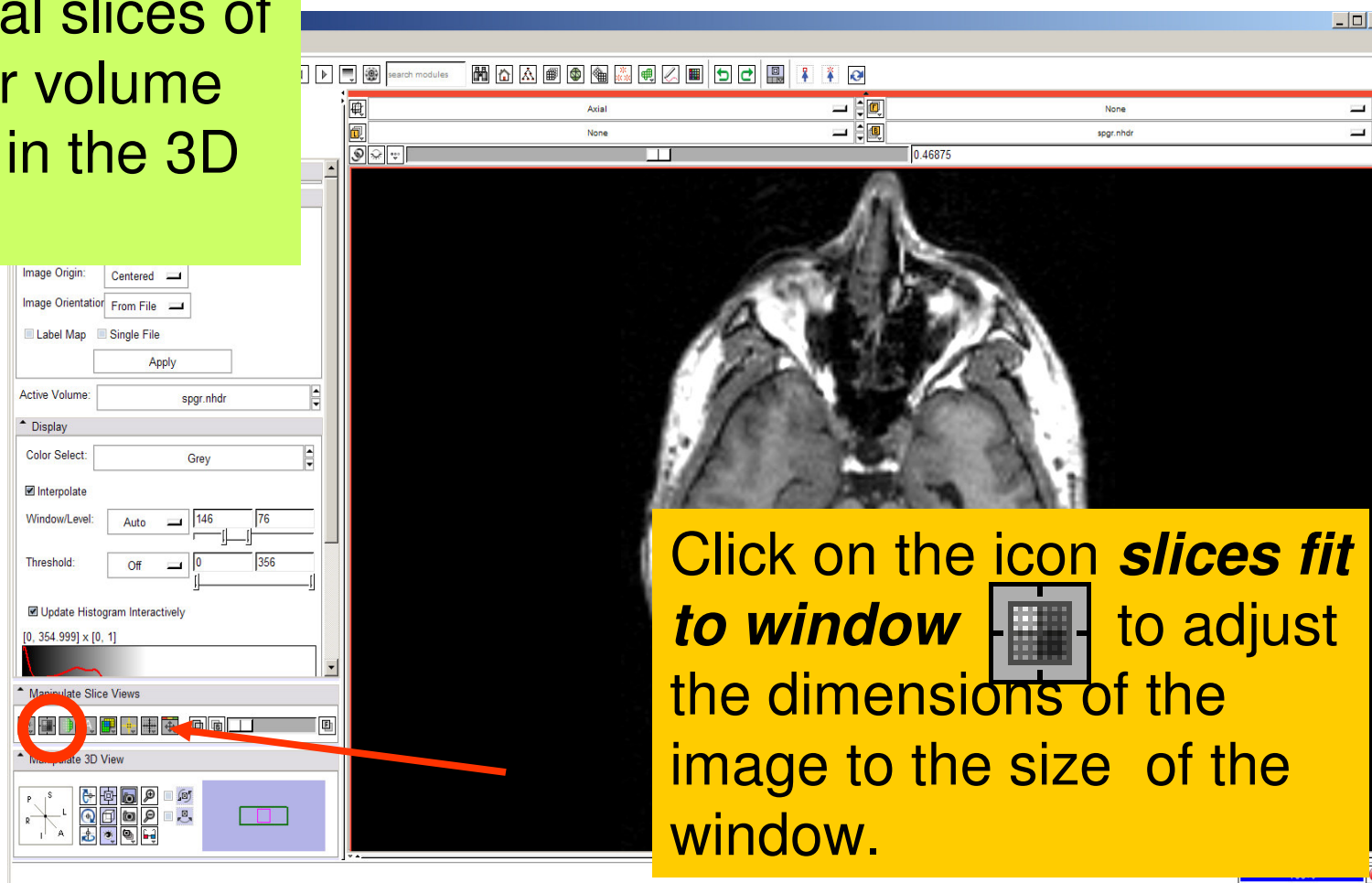


from the menu




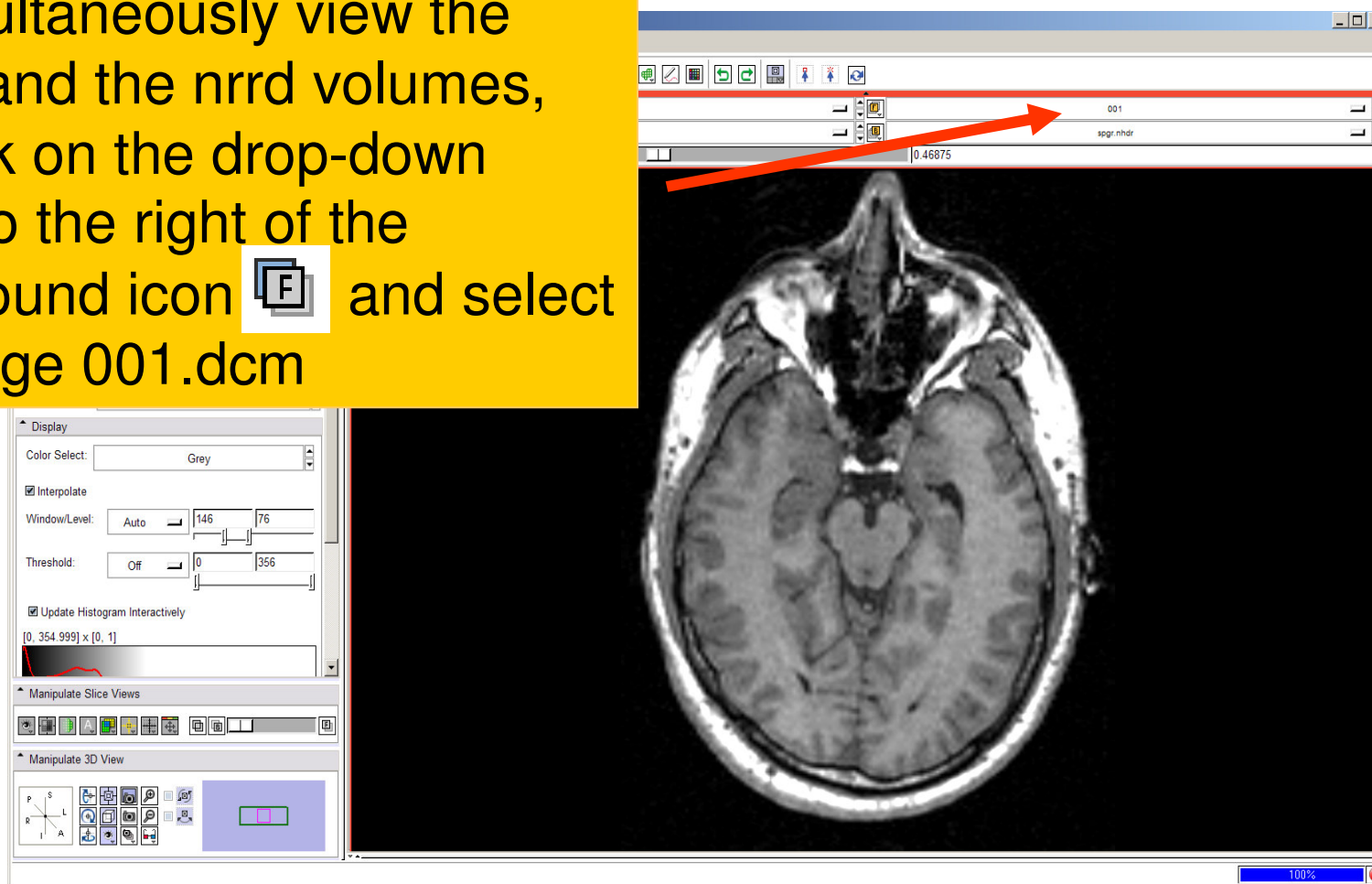
Exploring the data

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





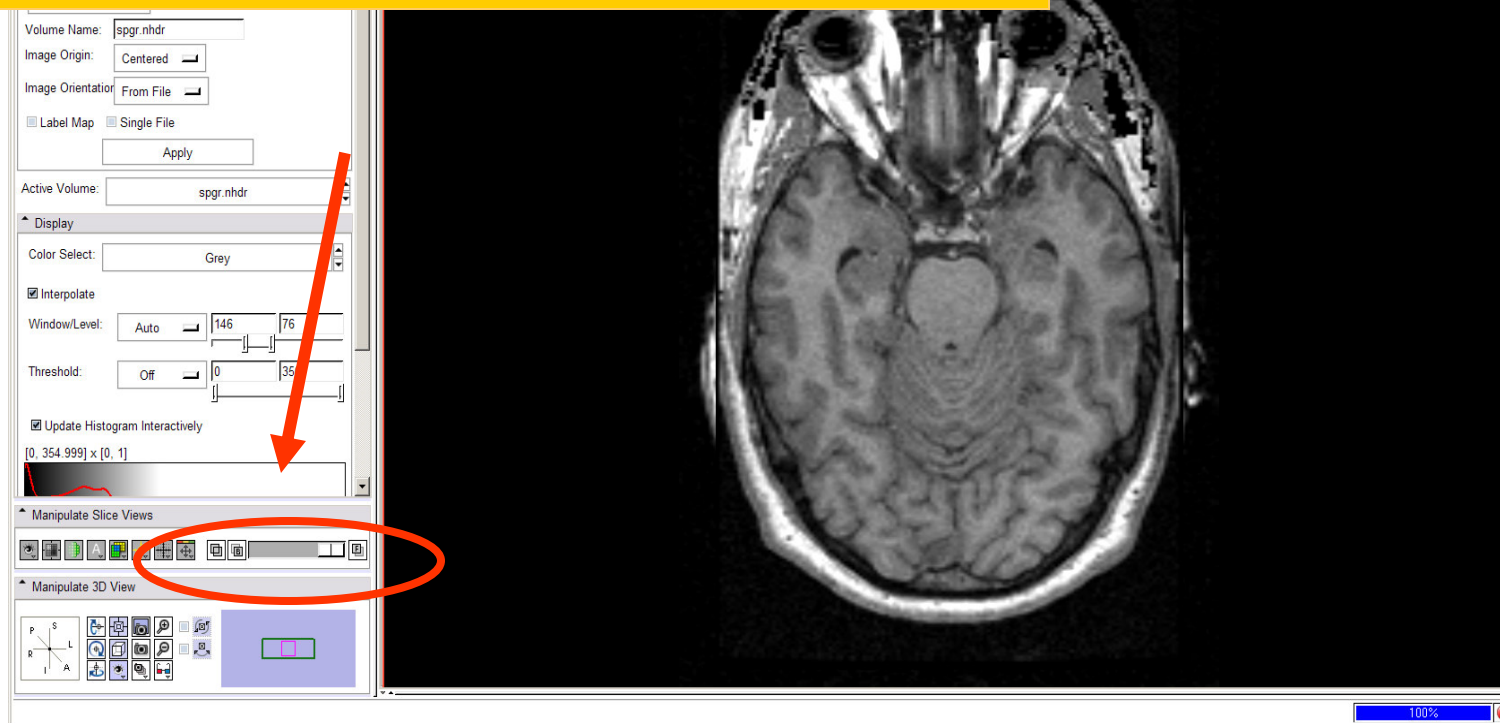
Exploring the data

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 image 001.dcm



Exploring the data

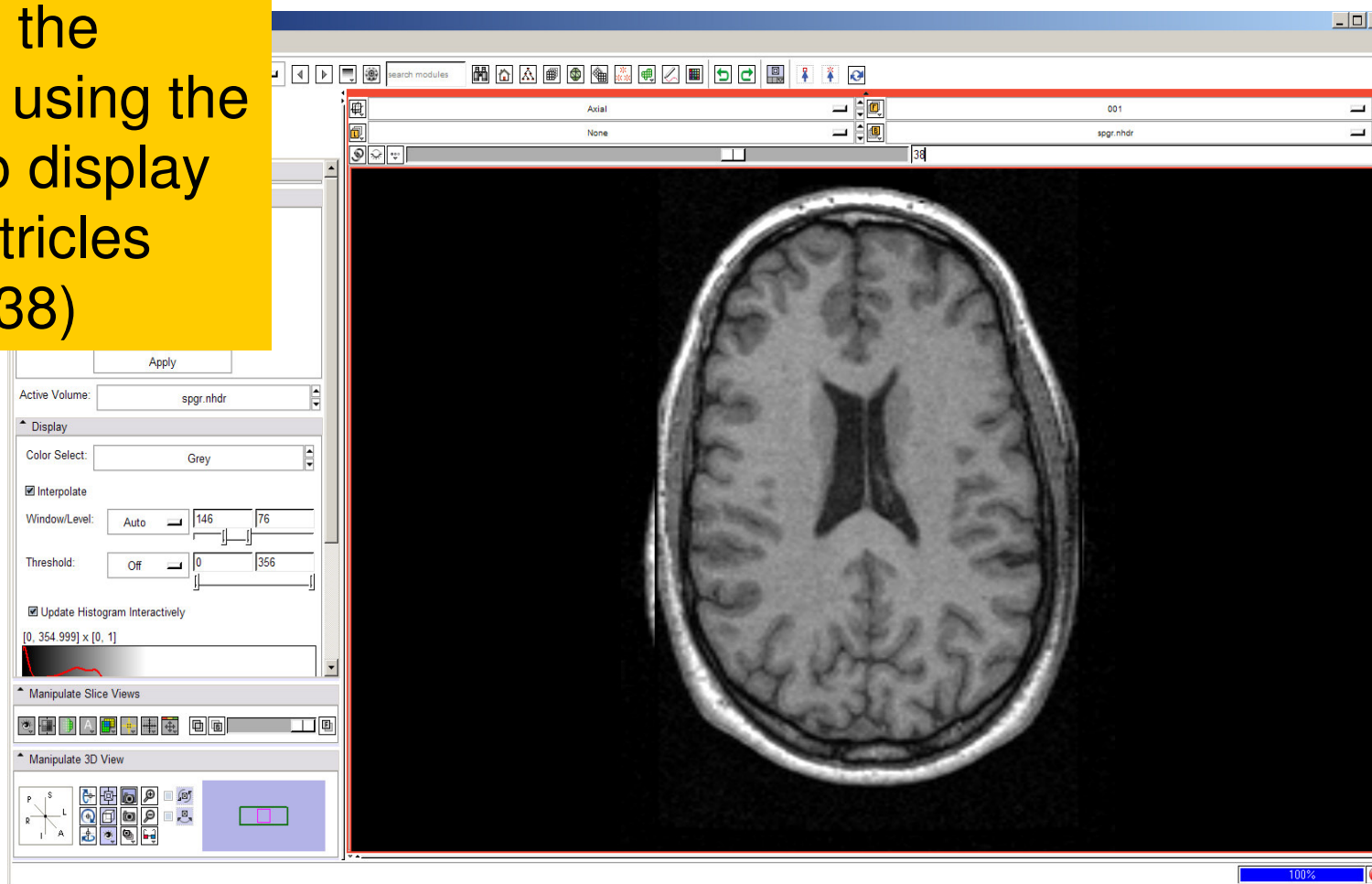
Click on the Background  icon or the Foreground  icon to display the spgr or the DICOM volumes in the Viewer





Exploring the data

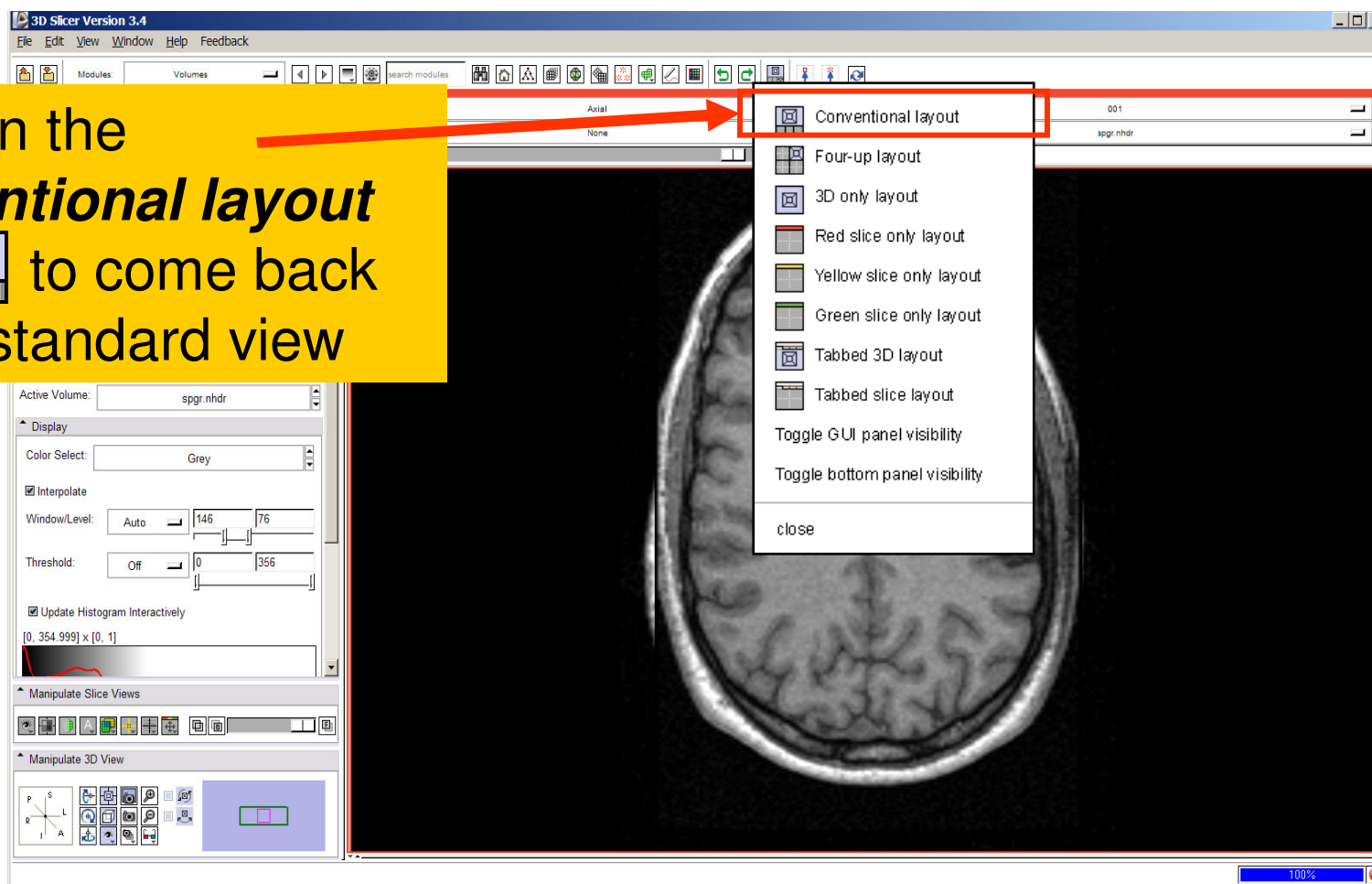
Browse the images using the slider to display the ventricles (~slice 38)






Exploring the data

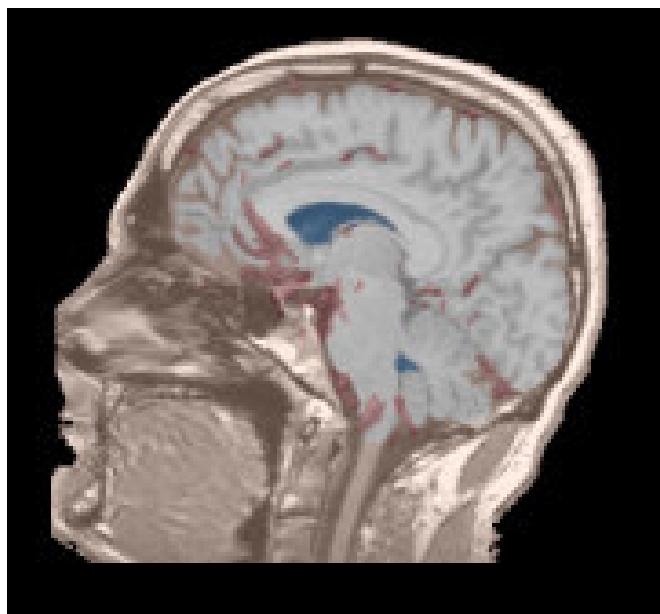
Click on the **conventional layout icon** to come back to the standard view



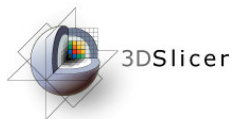
Loading Volumes

Click on the icon ***slices fit to window***  to adjust the dimensions of the image to the size of the window.



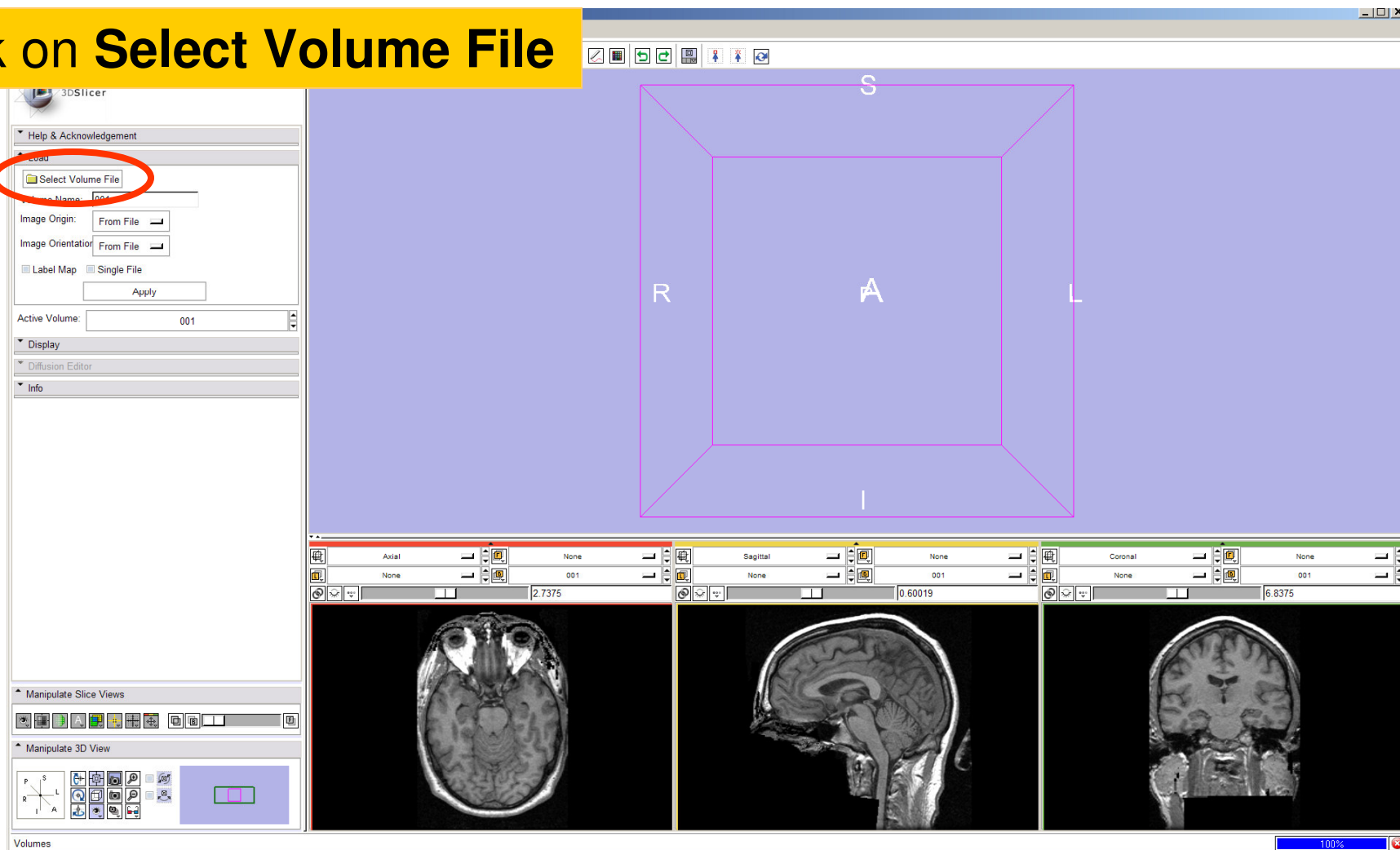


Part 2: Loading and visualizing segmented structures overlaid on grayscale images



Loading a label map

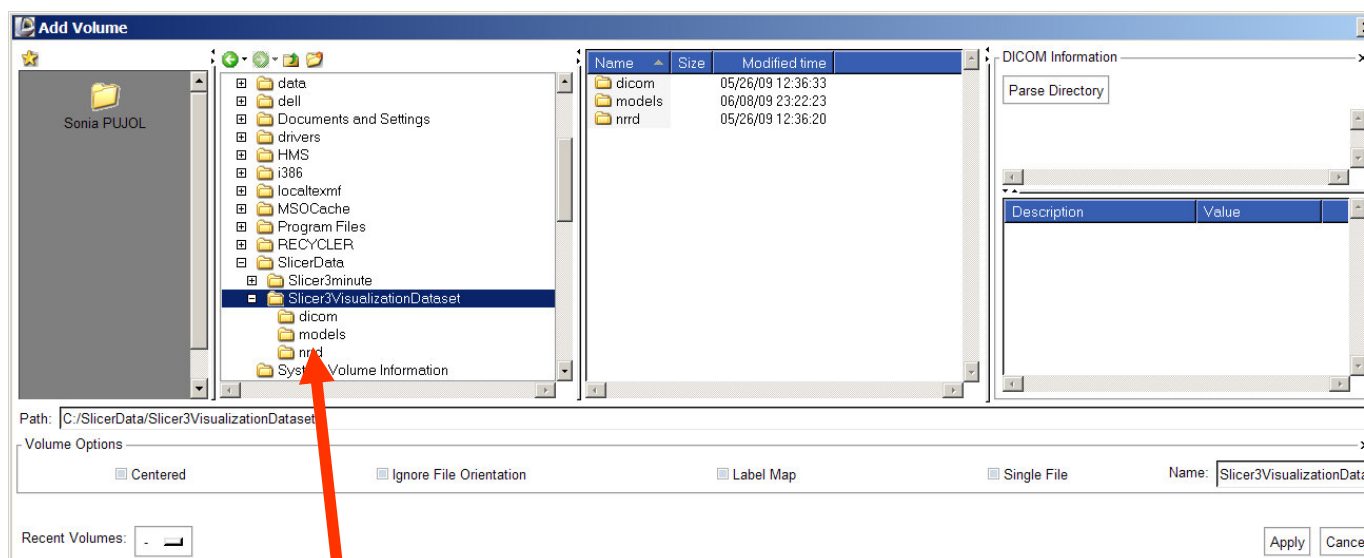
Click on **Select Volume File**



Sonia Pujol, PhD

National Alliance for Medical Image Computing
Neuroimage Analysis Center

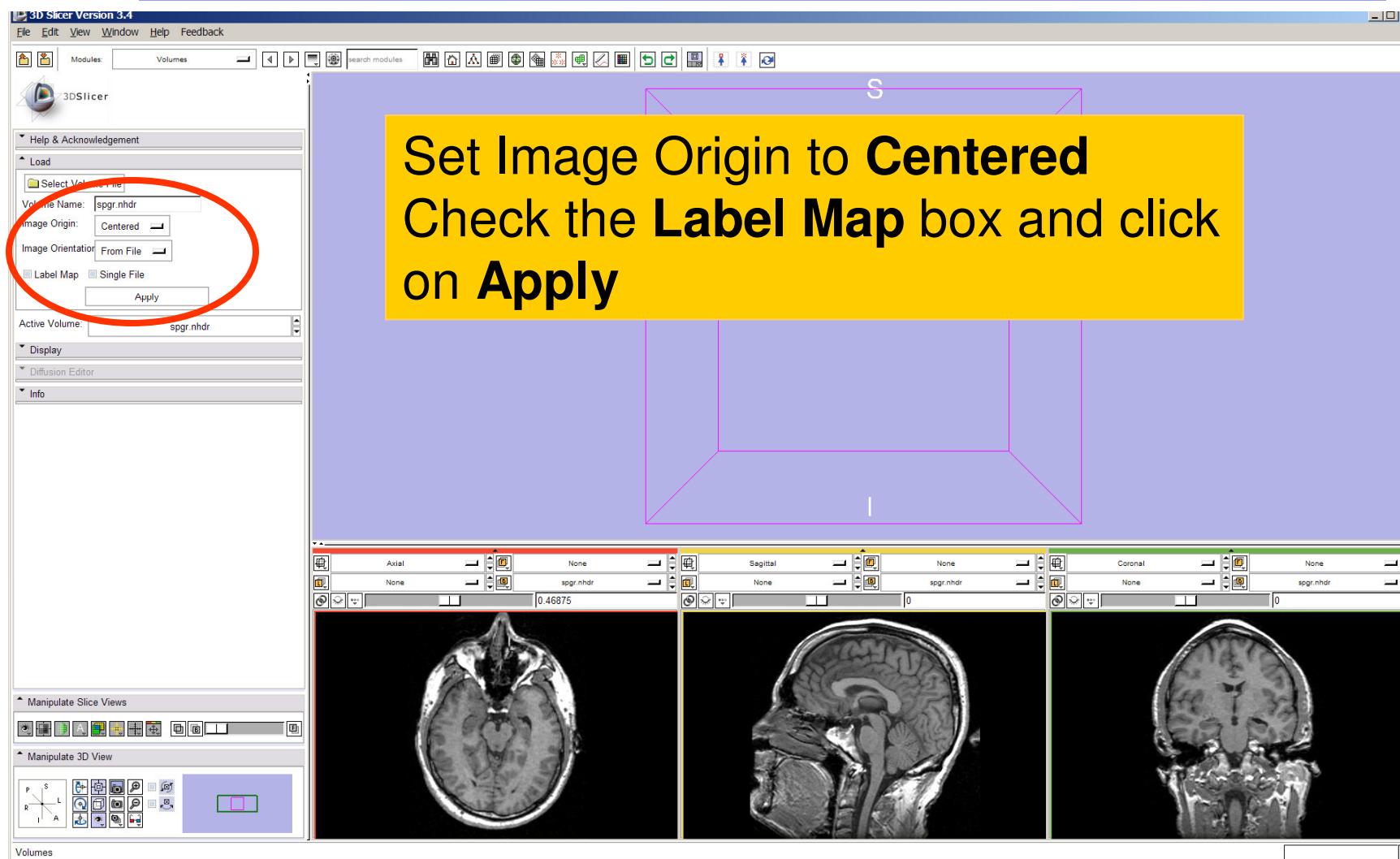
Loading a label map



Browse to find the header file ***all.nhdr*** of the label map dataset located in the directory ***Slicer3VisualizationDataset/nrrd*** and click on **Open**



Visualizing a label map





Visualizing a label map

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



Click on the *links* icon.

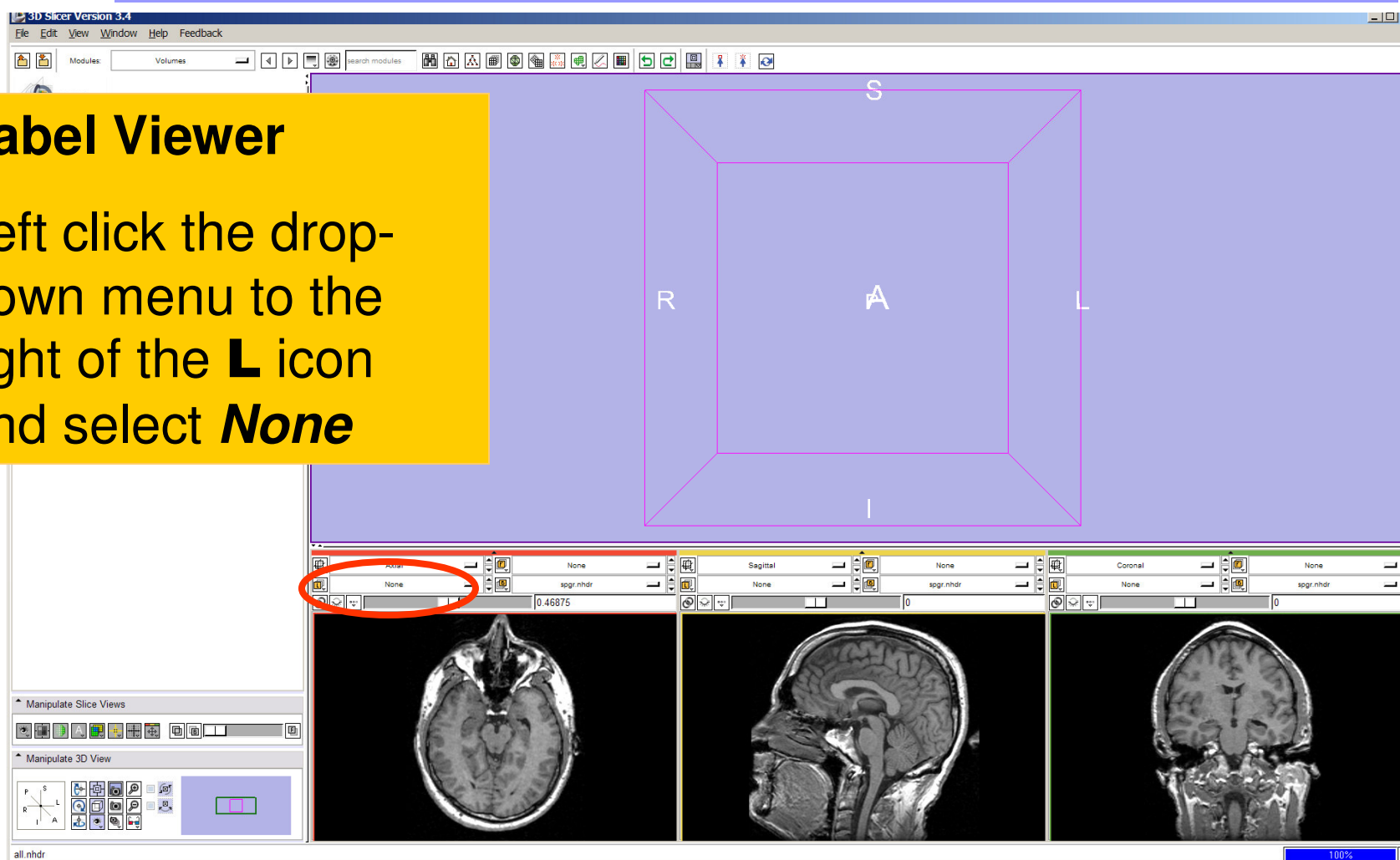




Visualizing Multiple Volumes

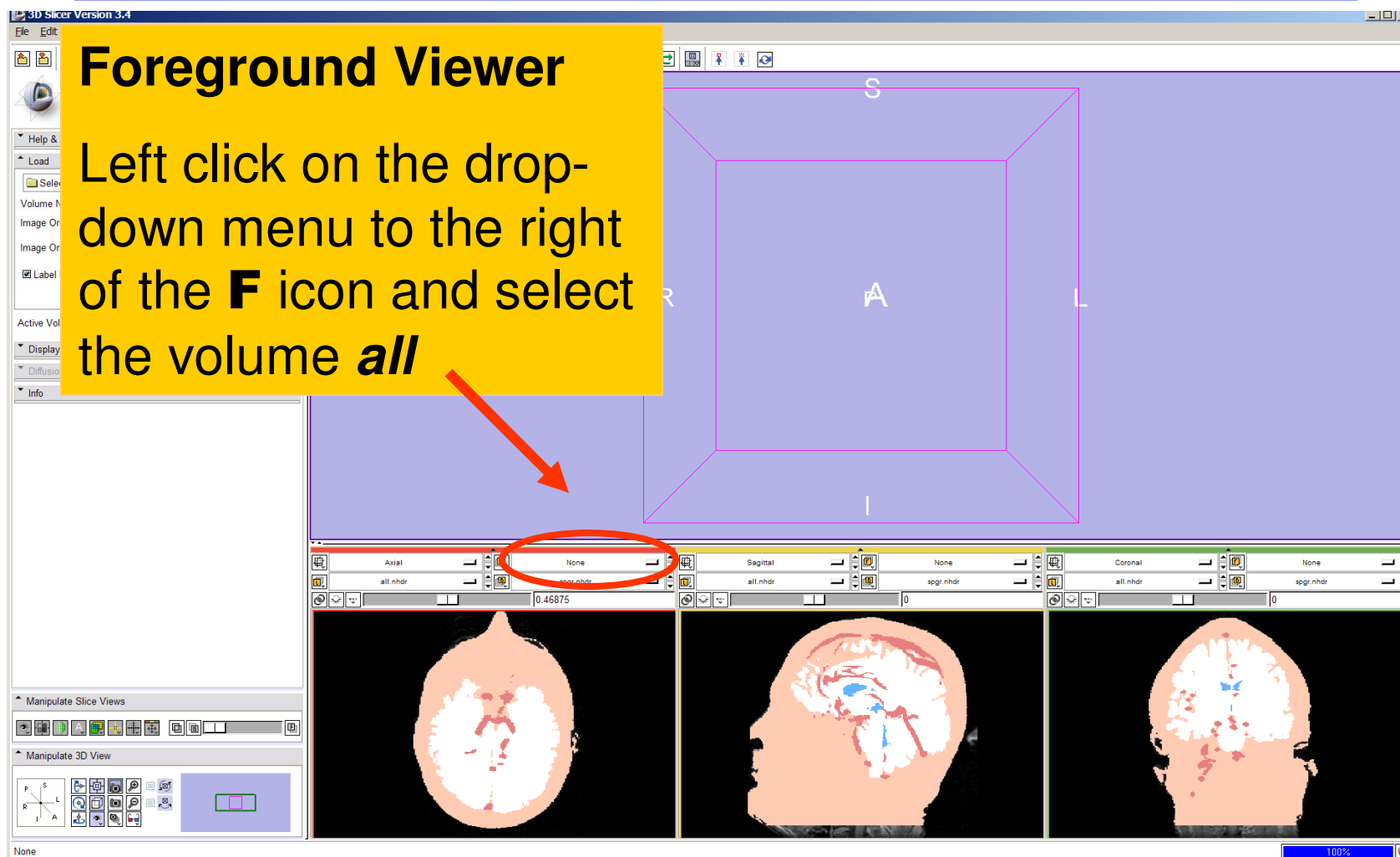
Label Viewer

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





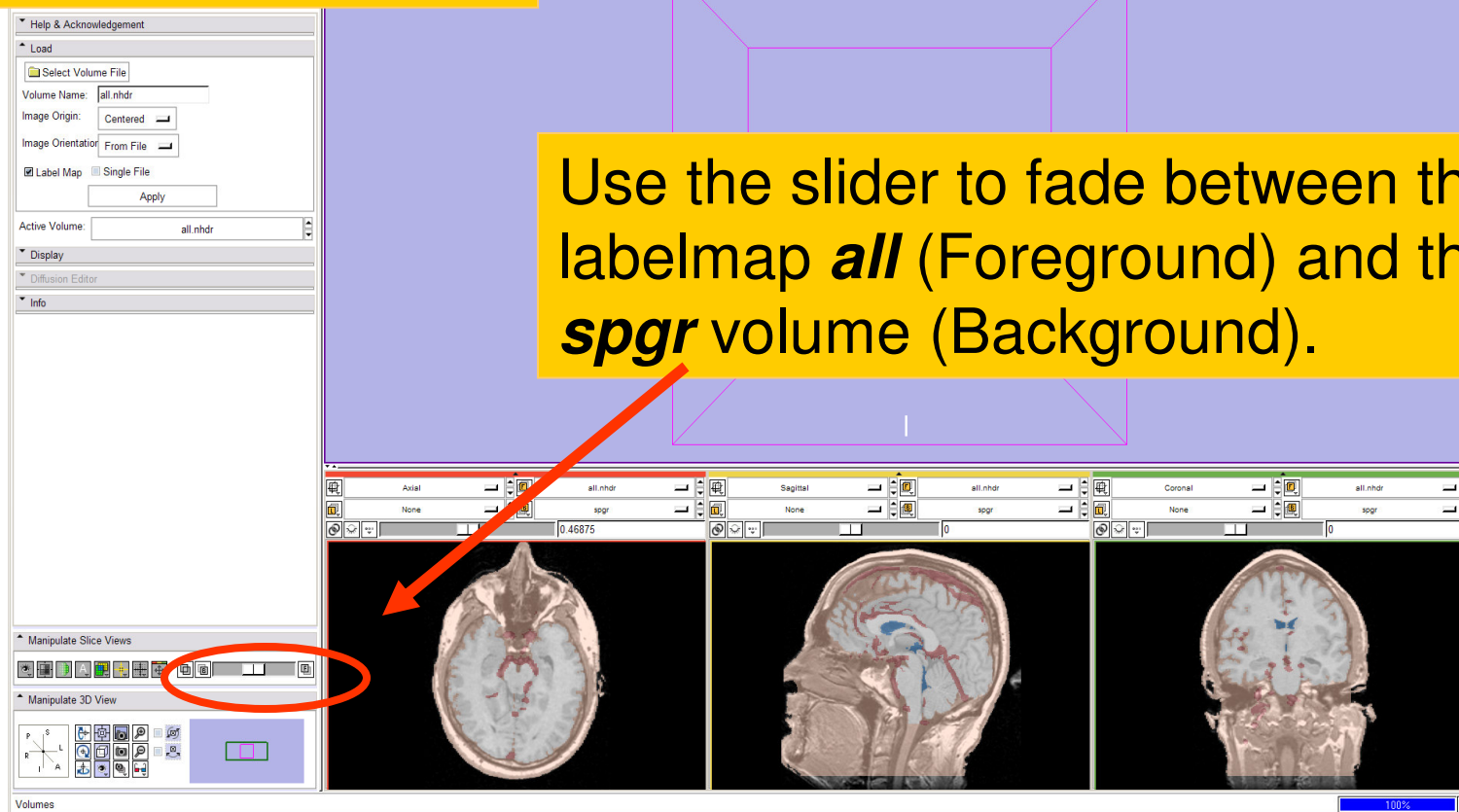
Visualizing Multiple Volumes





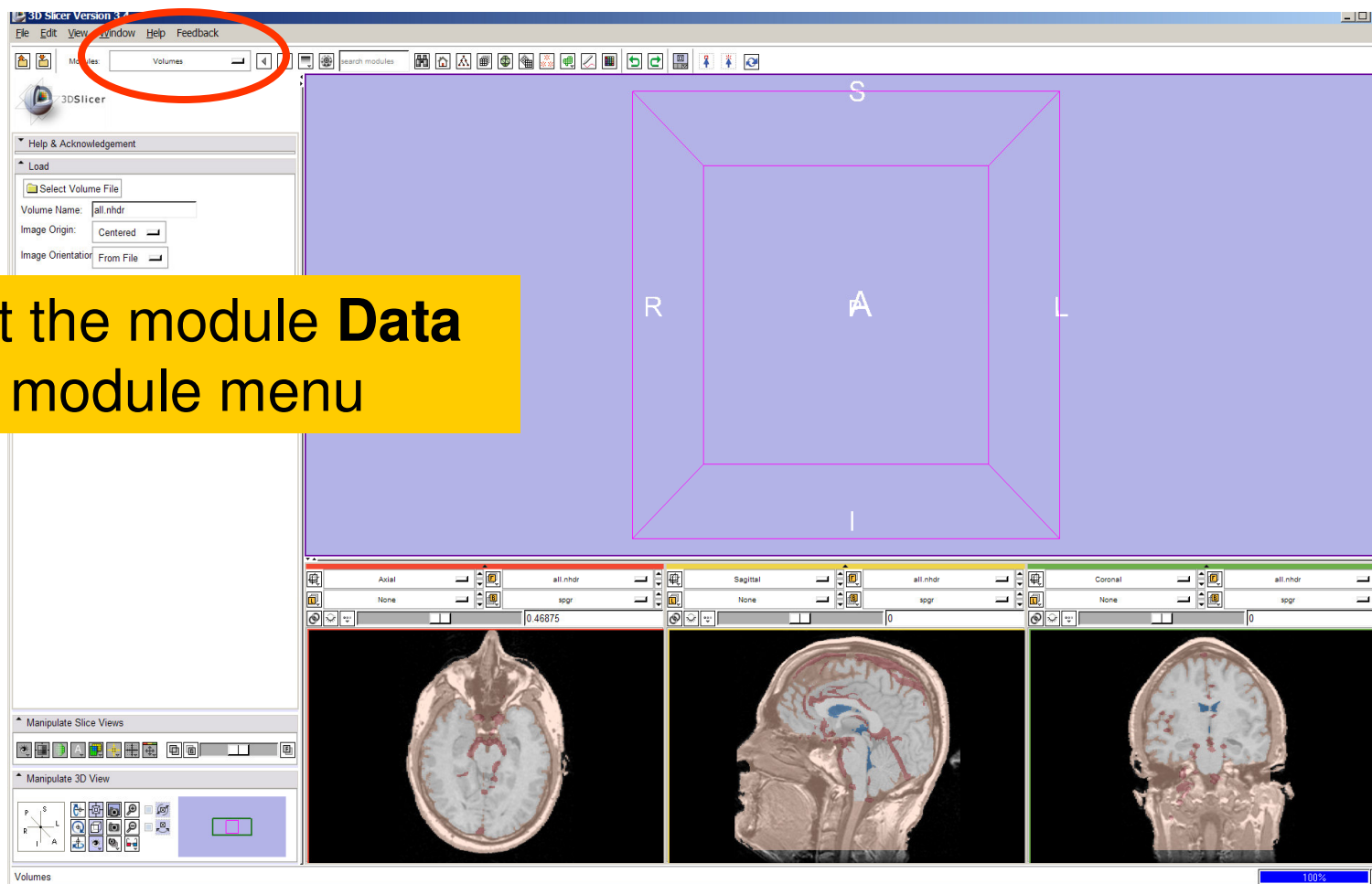
Visualizing Multiple Volumes

Select Manipulate Slice Views





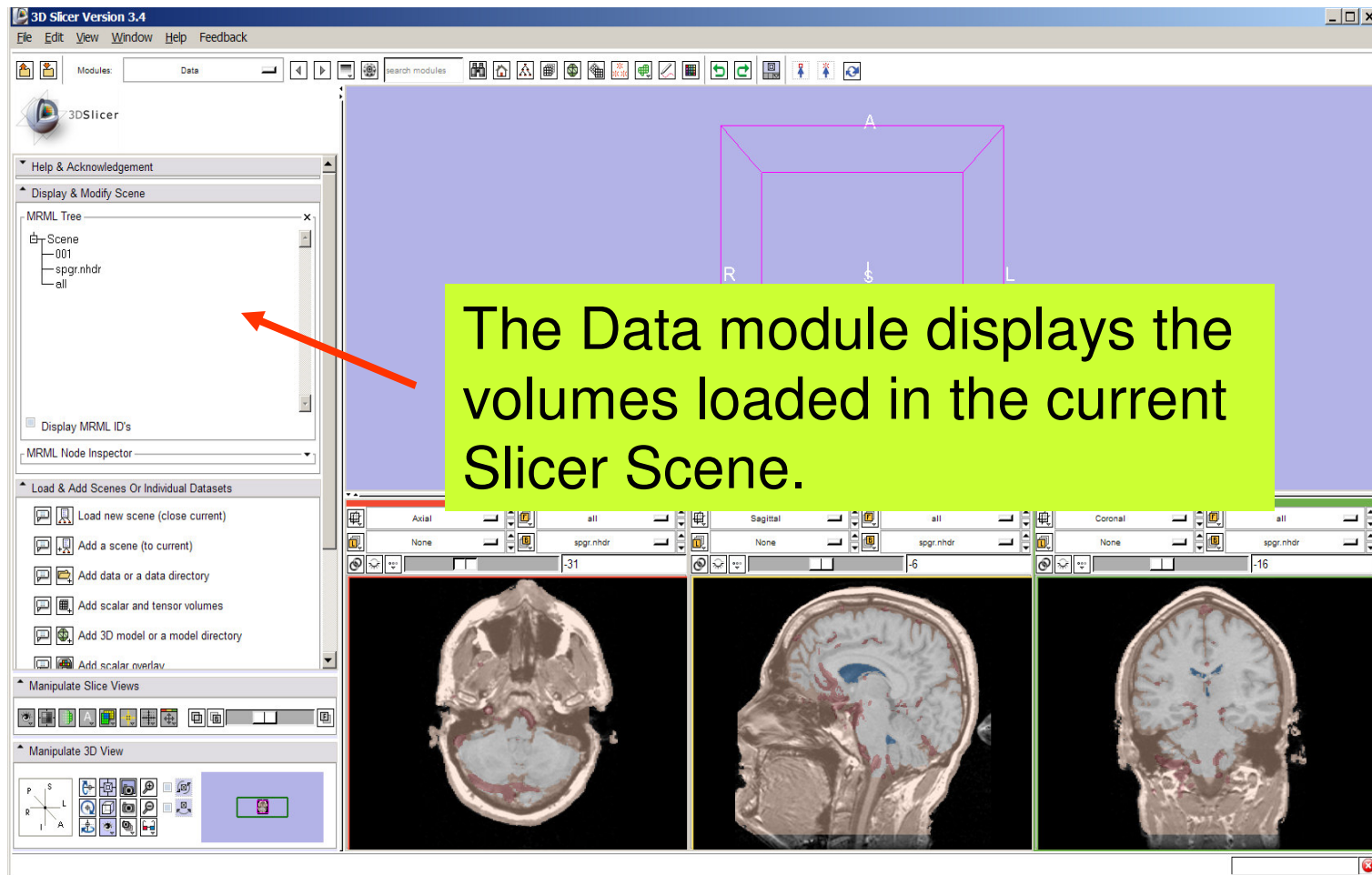
3D Visualization



Select the module **Data**
in the module menu

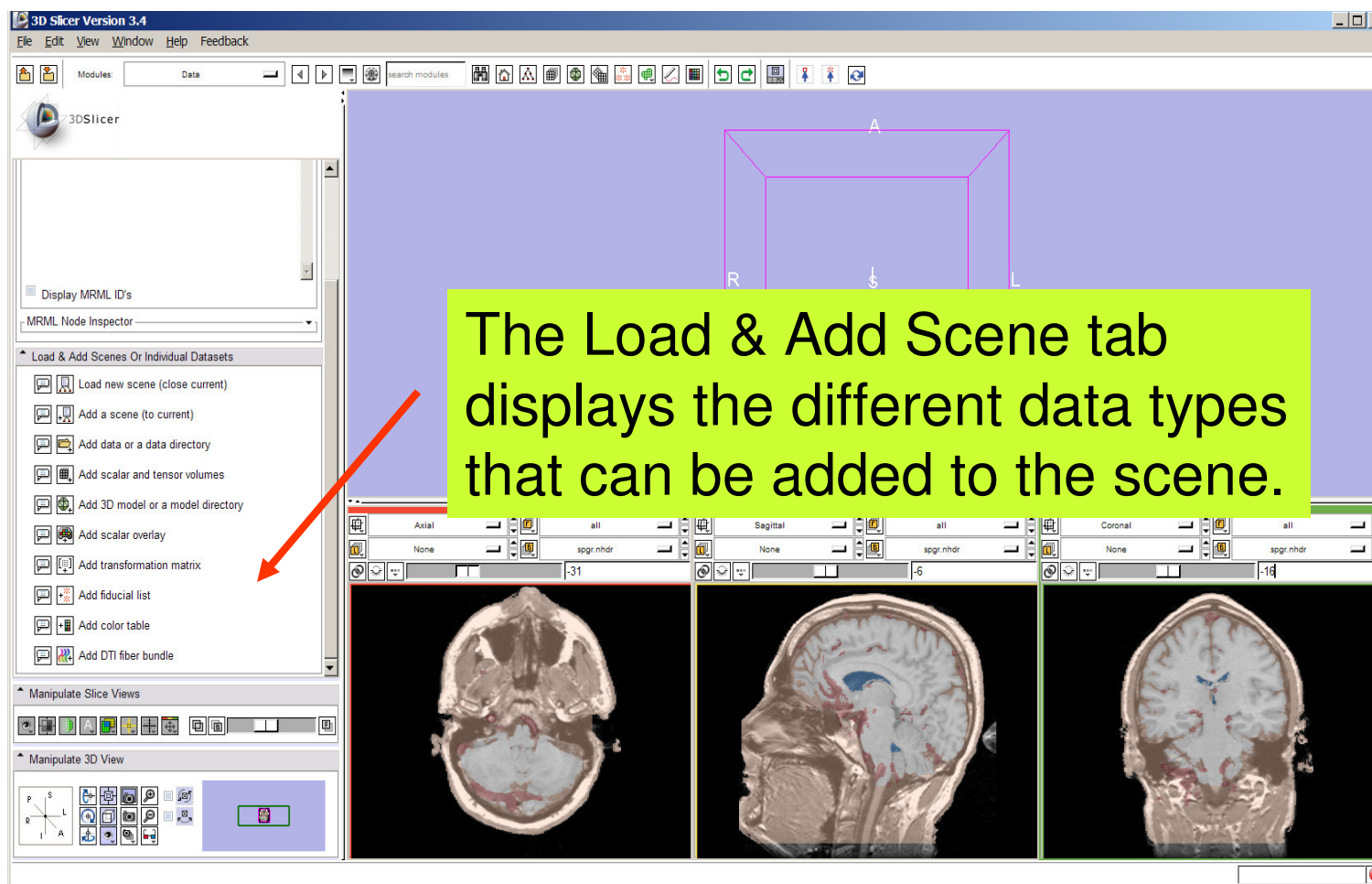


3D Visualization



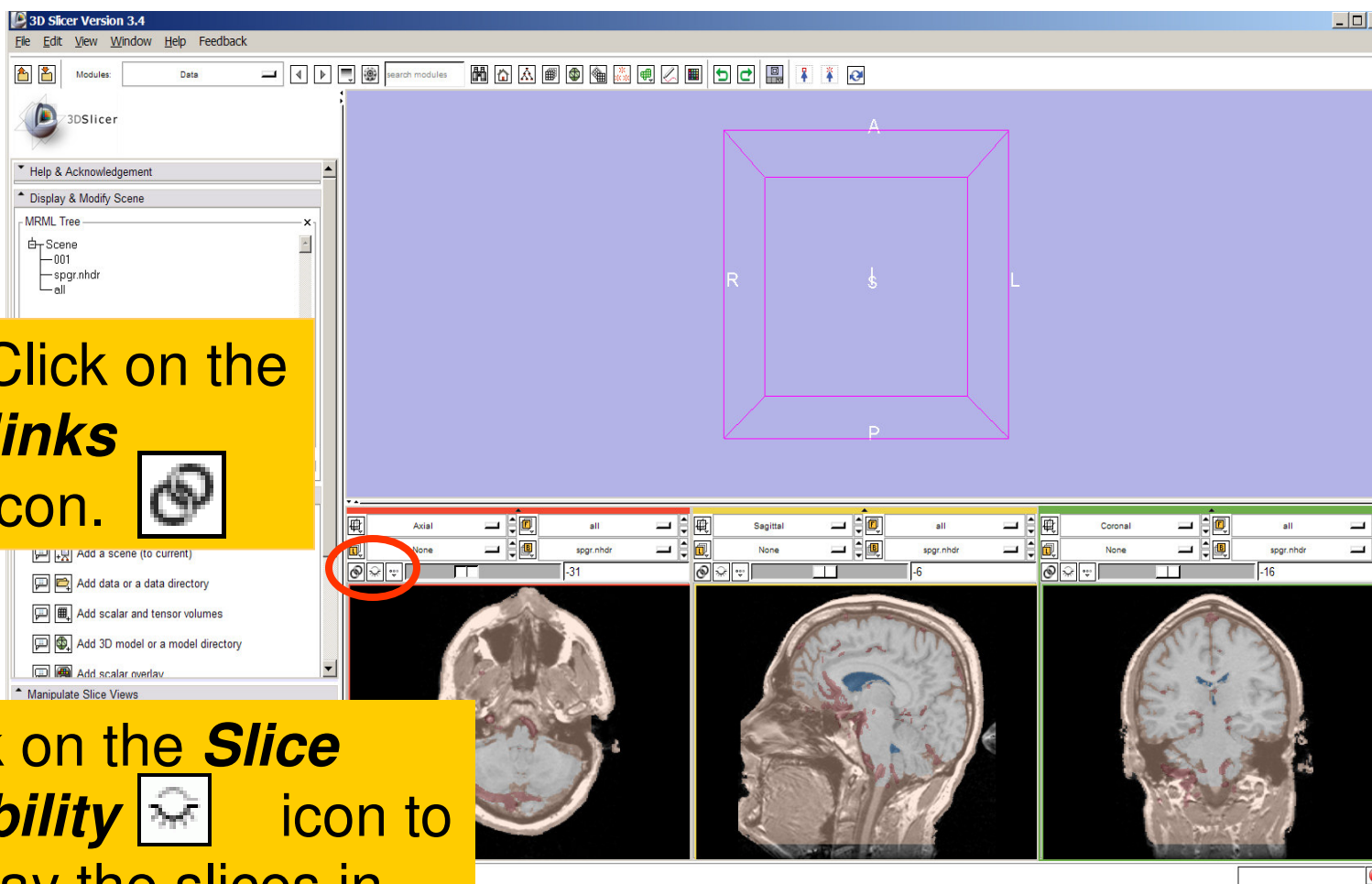


3D Visualization





3D Visualization



Click on the **links** icon.

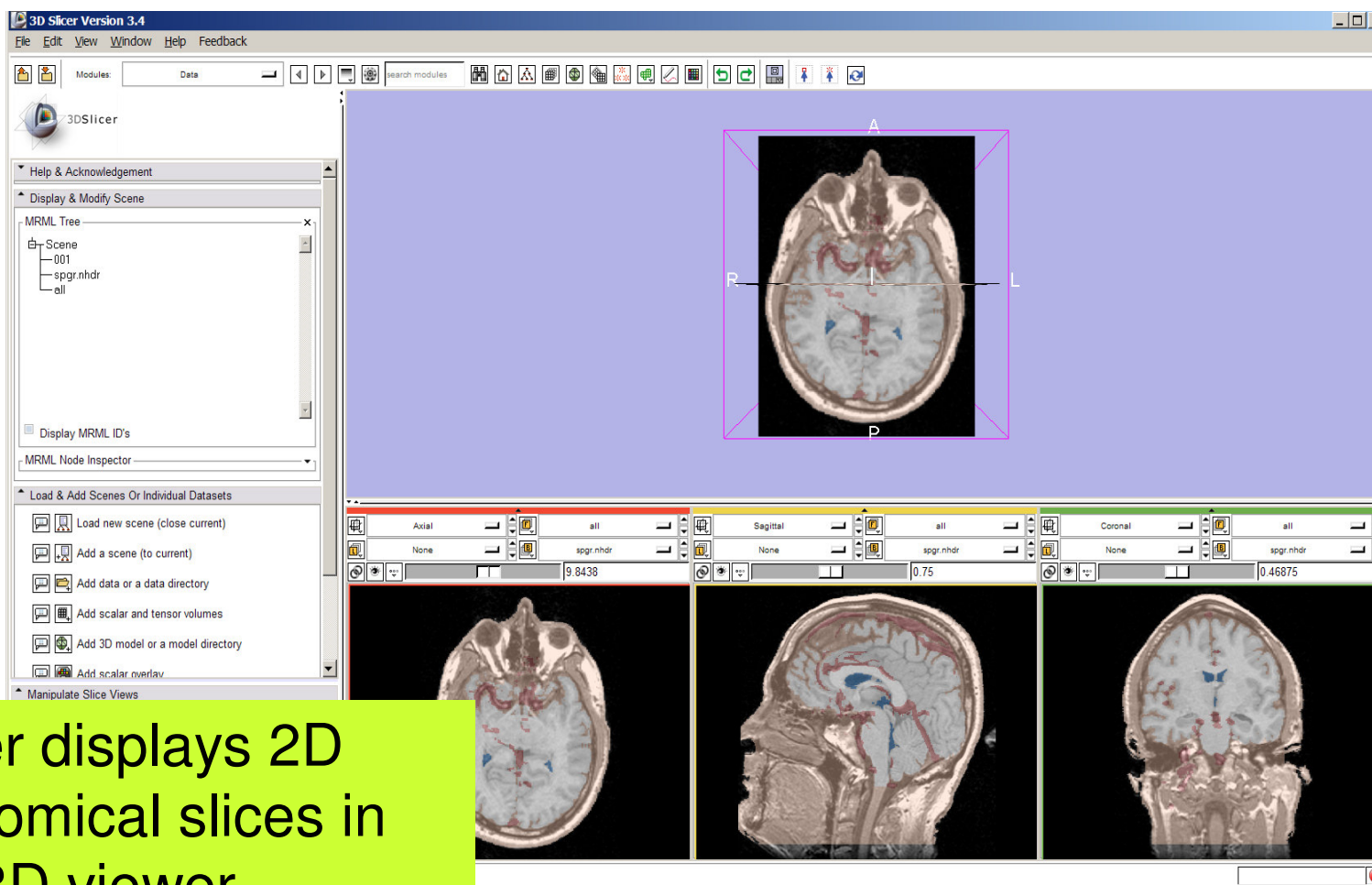


Click on the **Slice Visibility** icon to display the slices in the 3D Viewer





3D Visualization



Slicer displays 2D anatomical slices in the 3D viewer

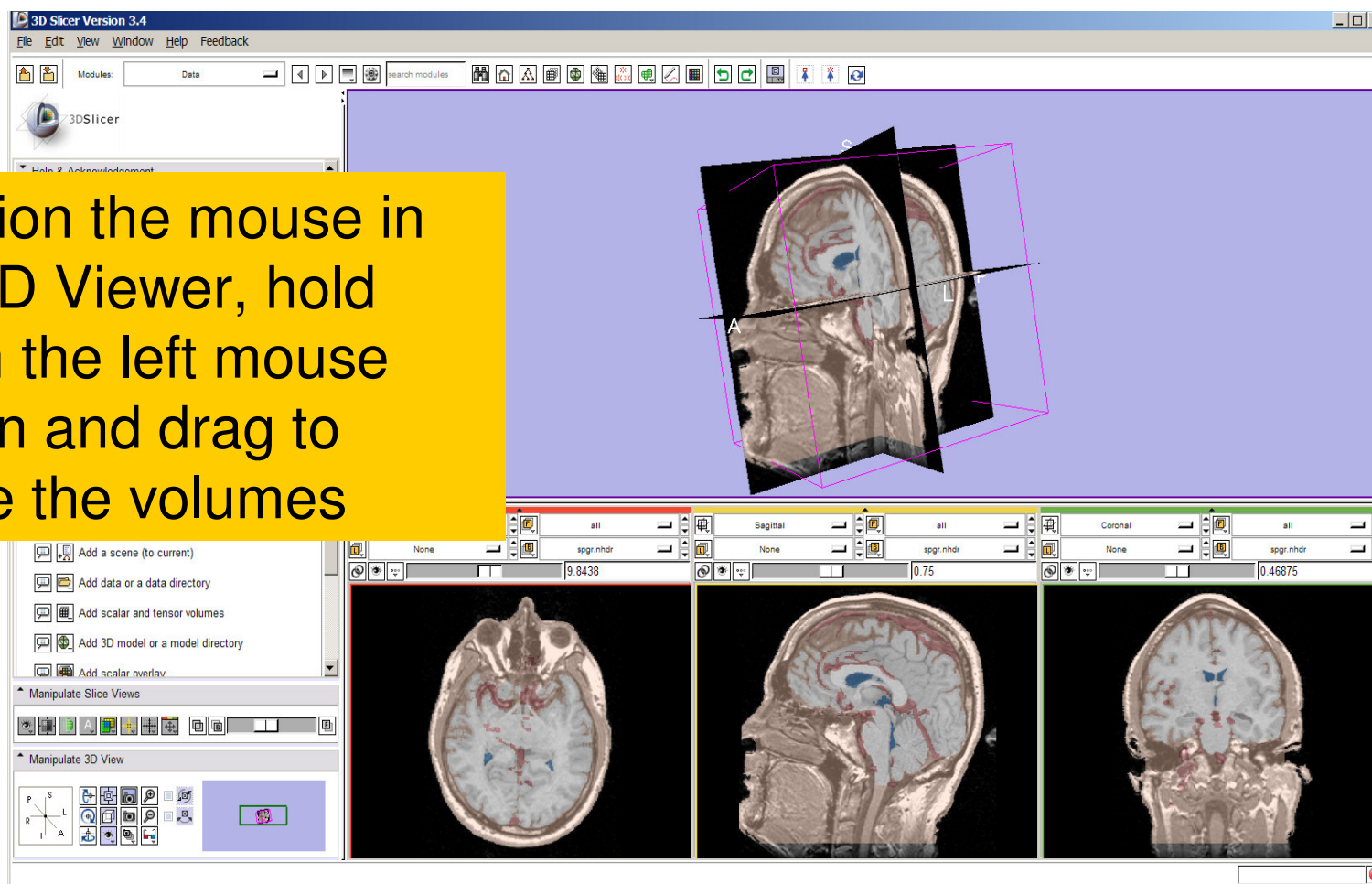
Sonia Pujol, PhD

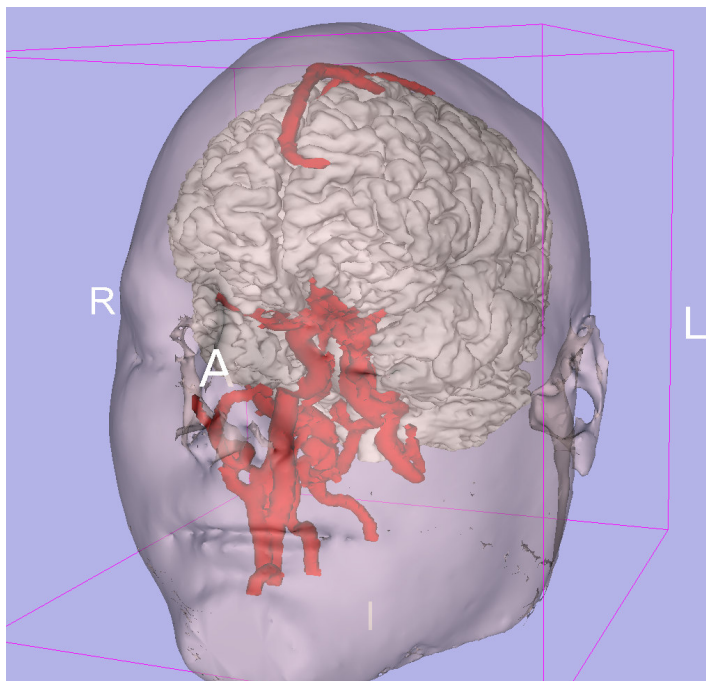
National Alliance for Medical Image Computing
Neuroimage Analysis Center



3D Visualization

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

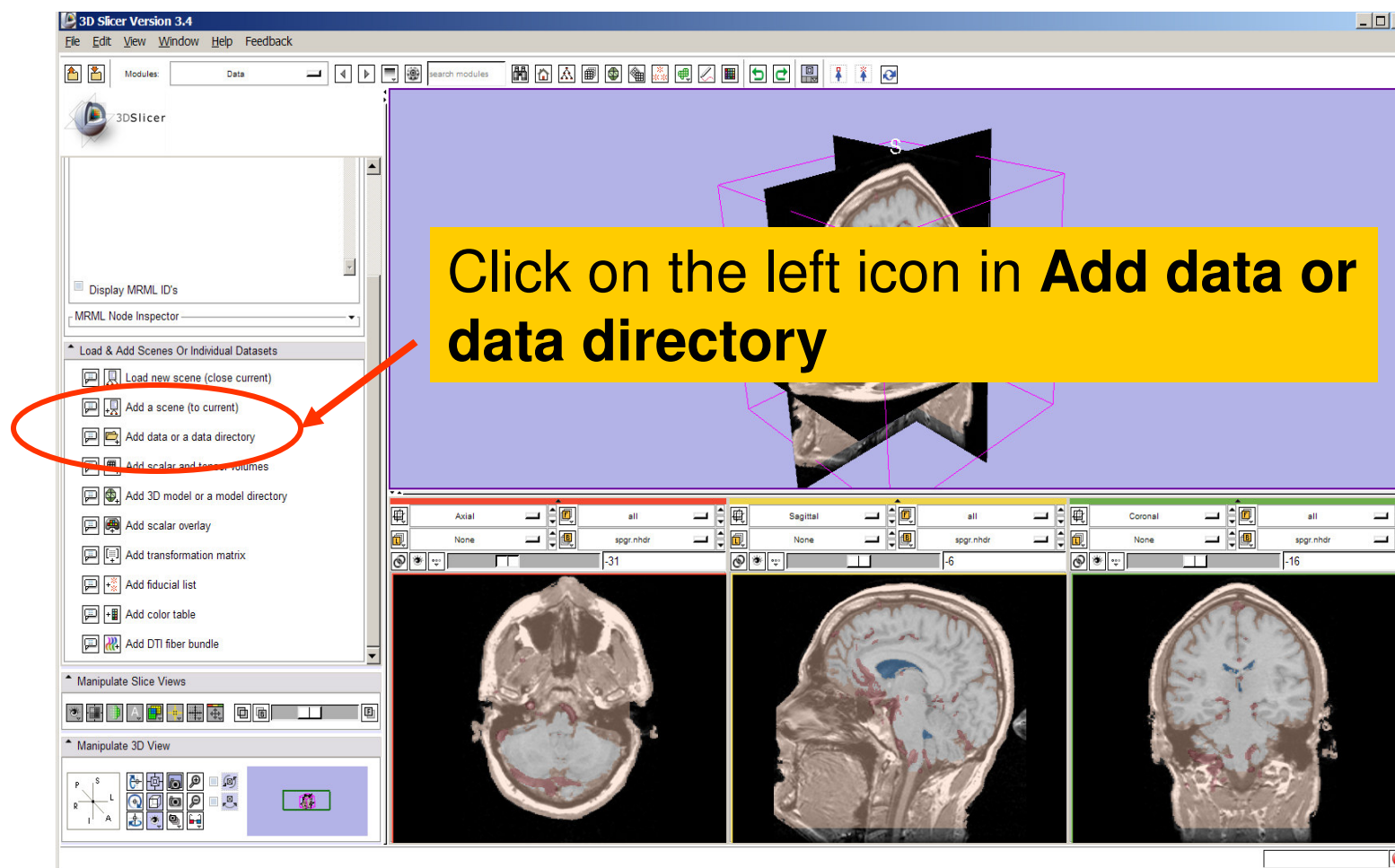




Part 3: Loading and visualizing 3D models of the anatomy

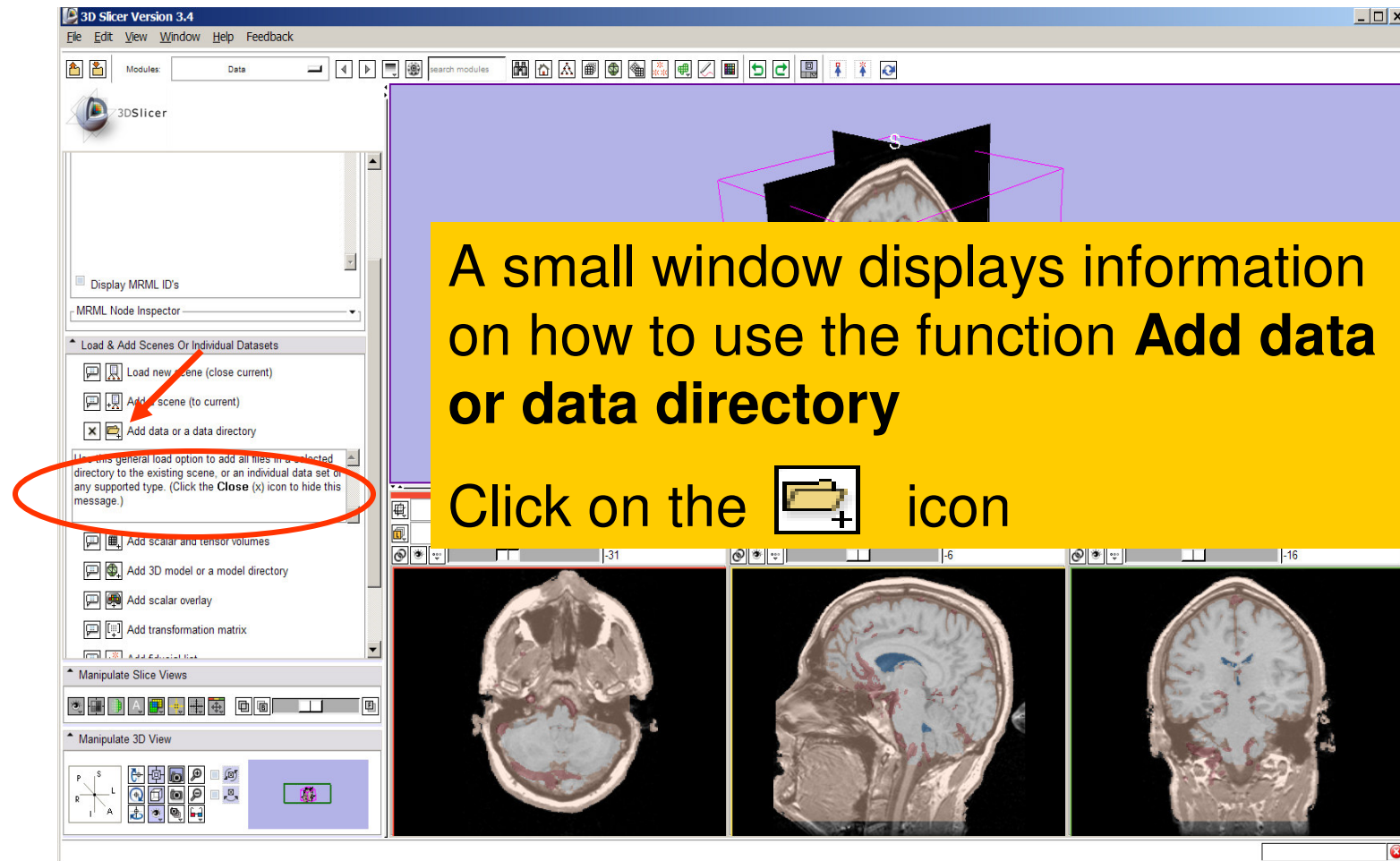


3D Visualization






3D Visualization

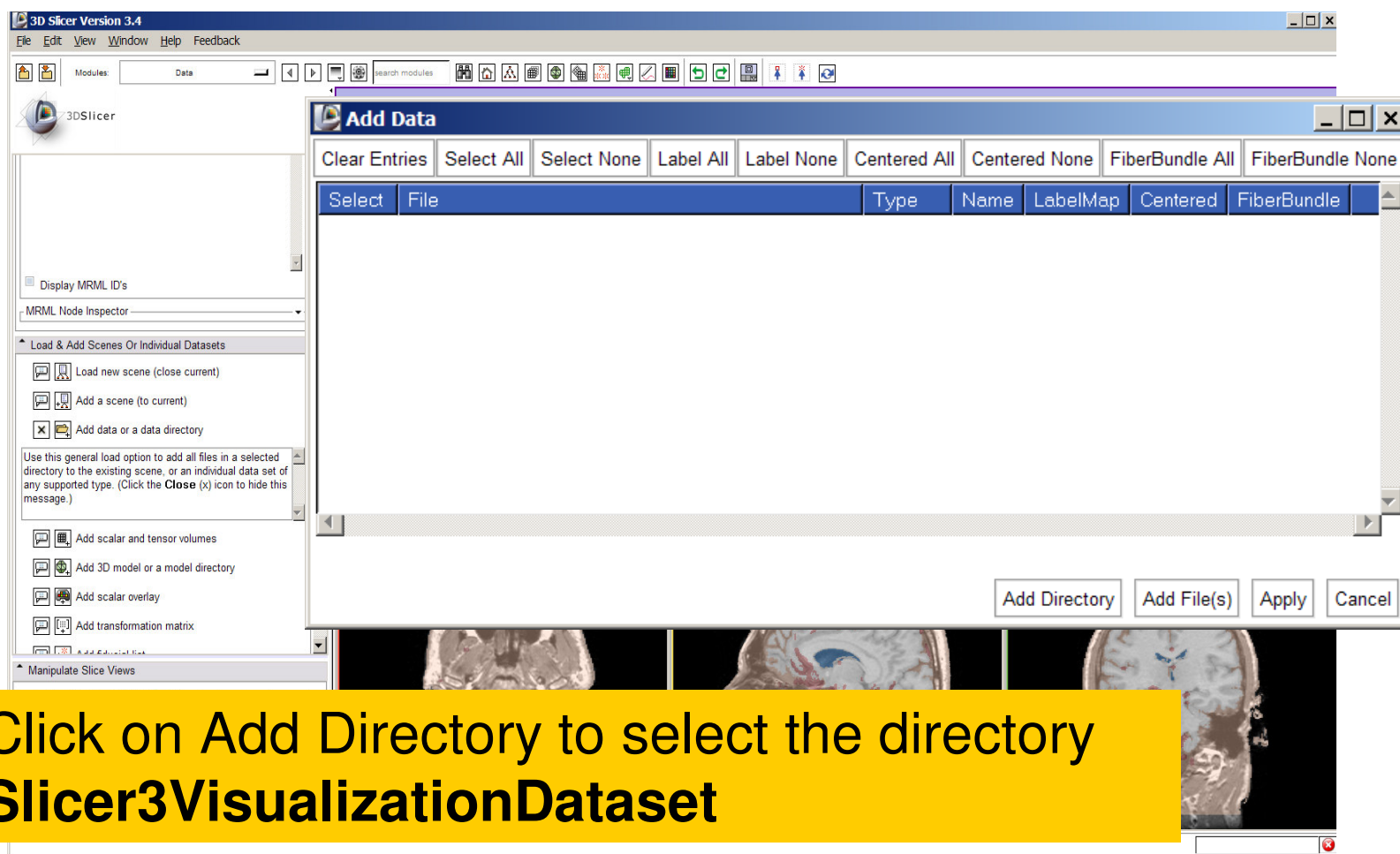


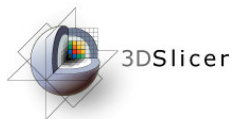
A small window displays information on how to use the function **Add data or data directory**

Click on the  icon

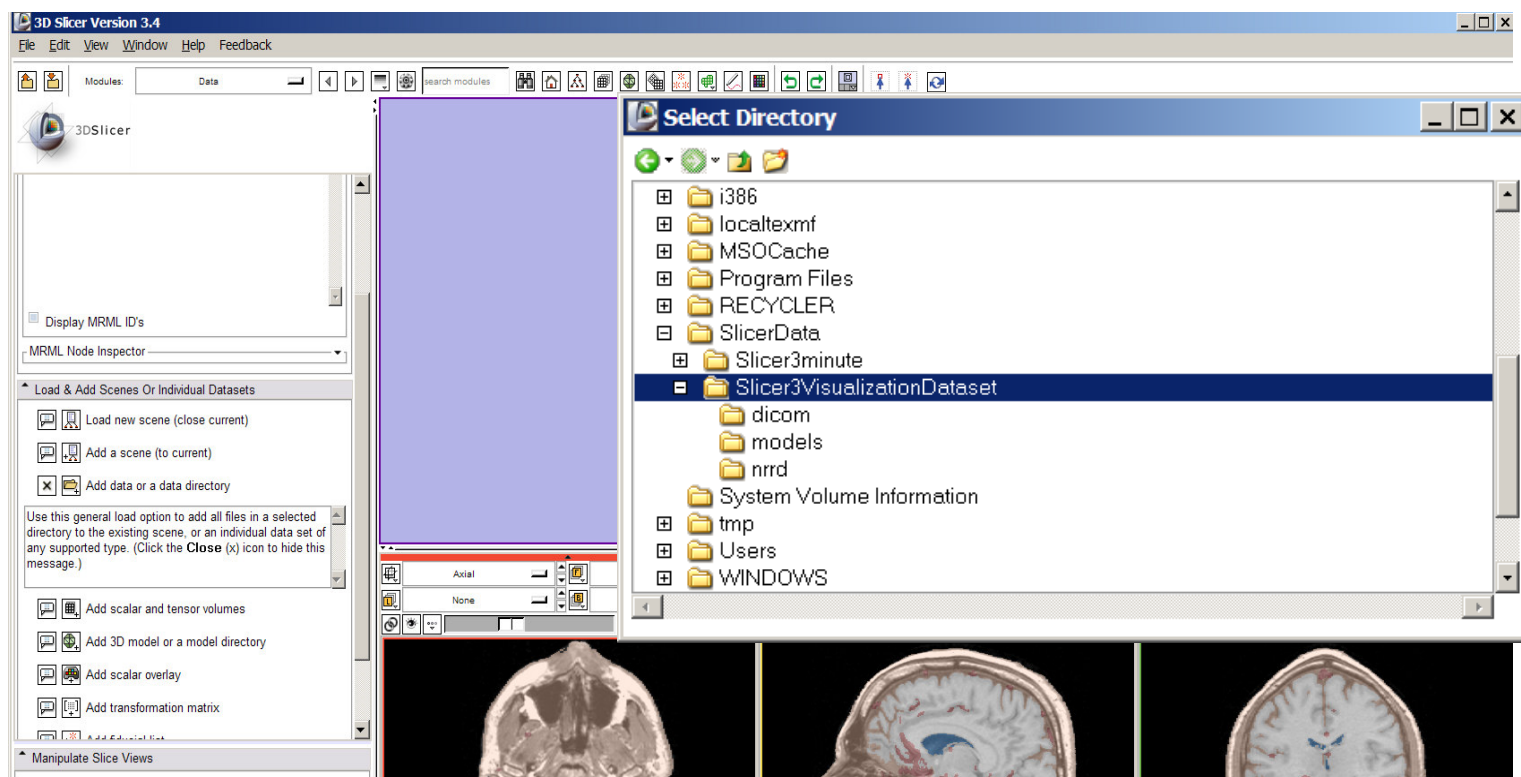


3D Visualization





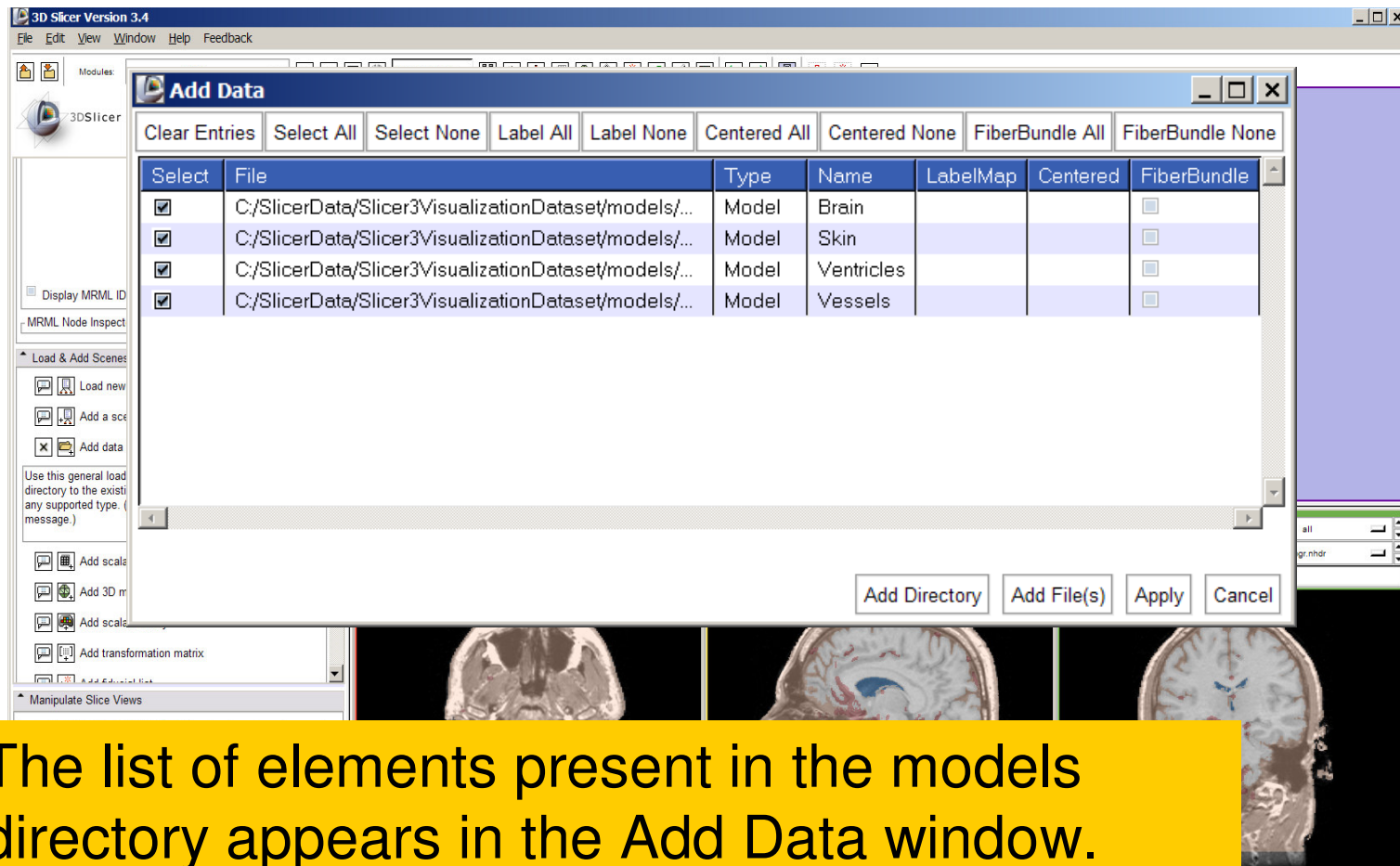
Loading 3D models



Select the directory
Slicer3VisualizationDataset/models and click on OK



Loading 3D models

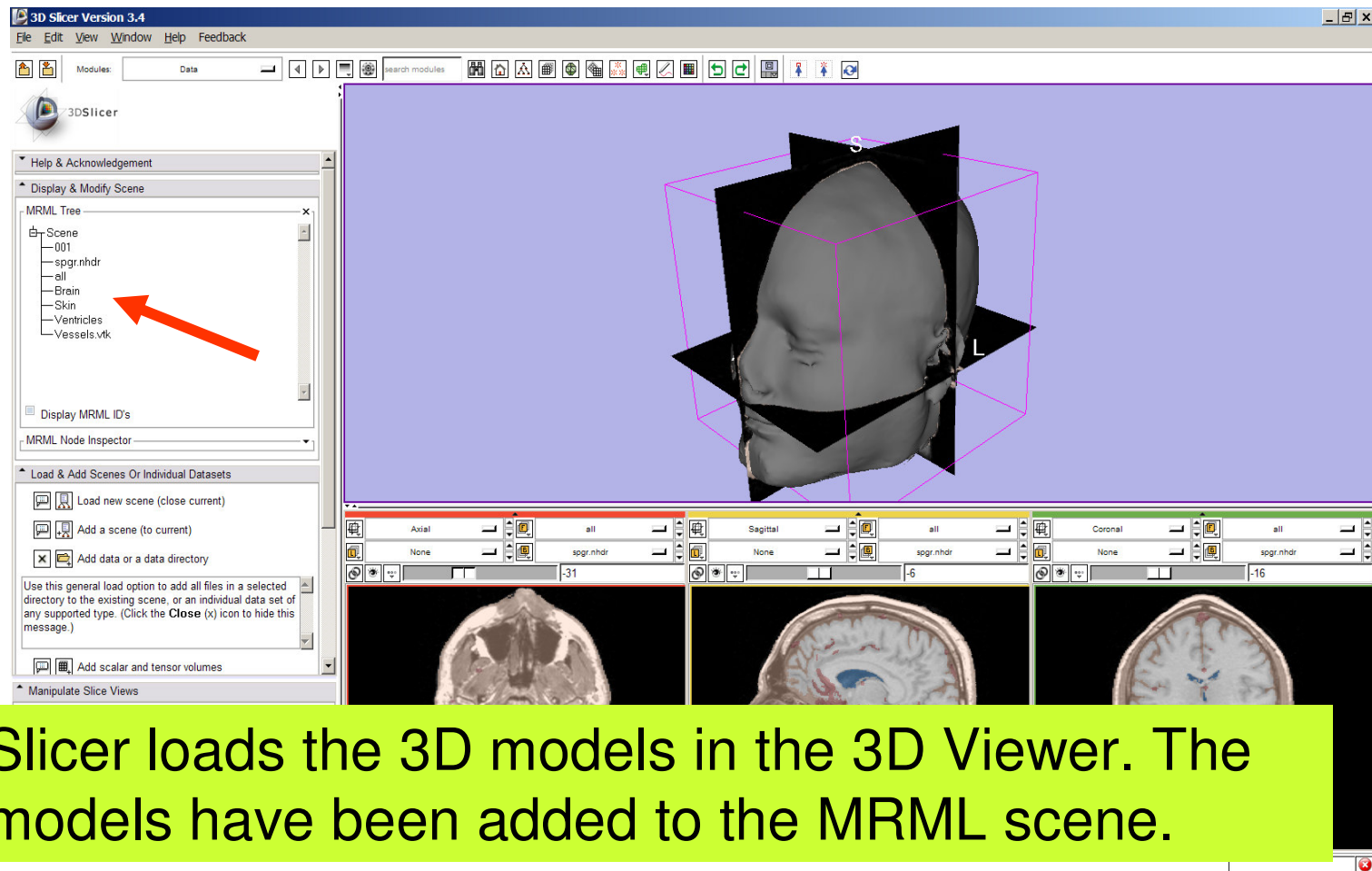


The list of elements present in the models directory appears in the Add Data window.

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

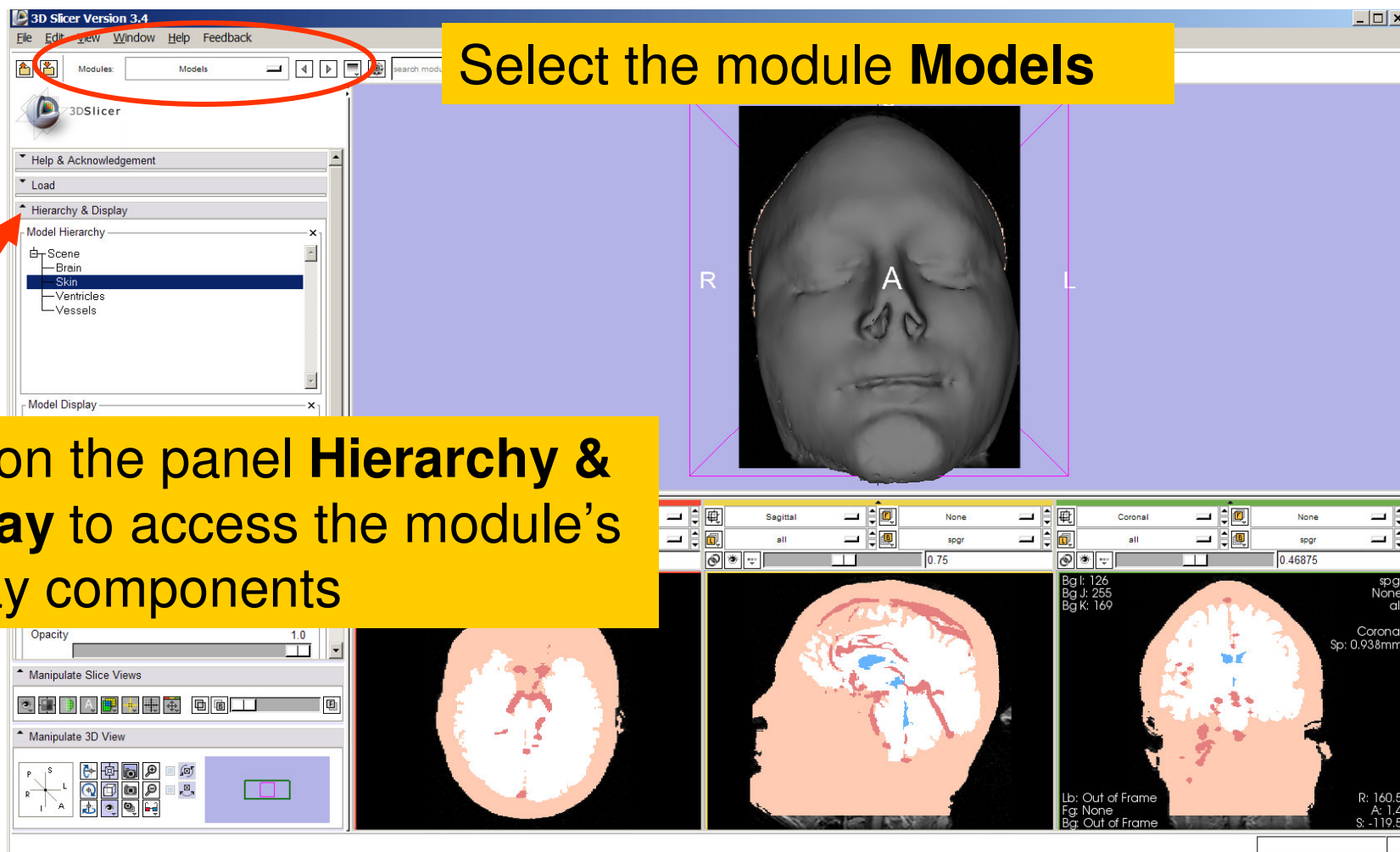


Loading 3D models





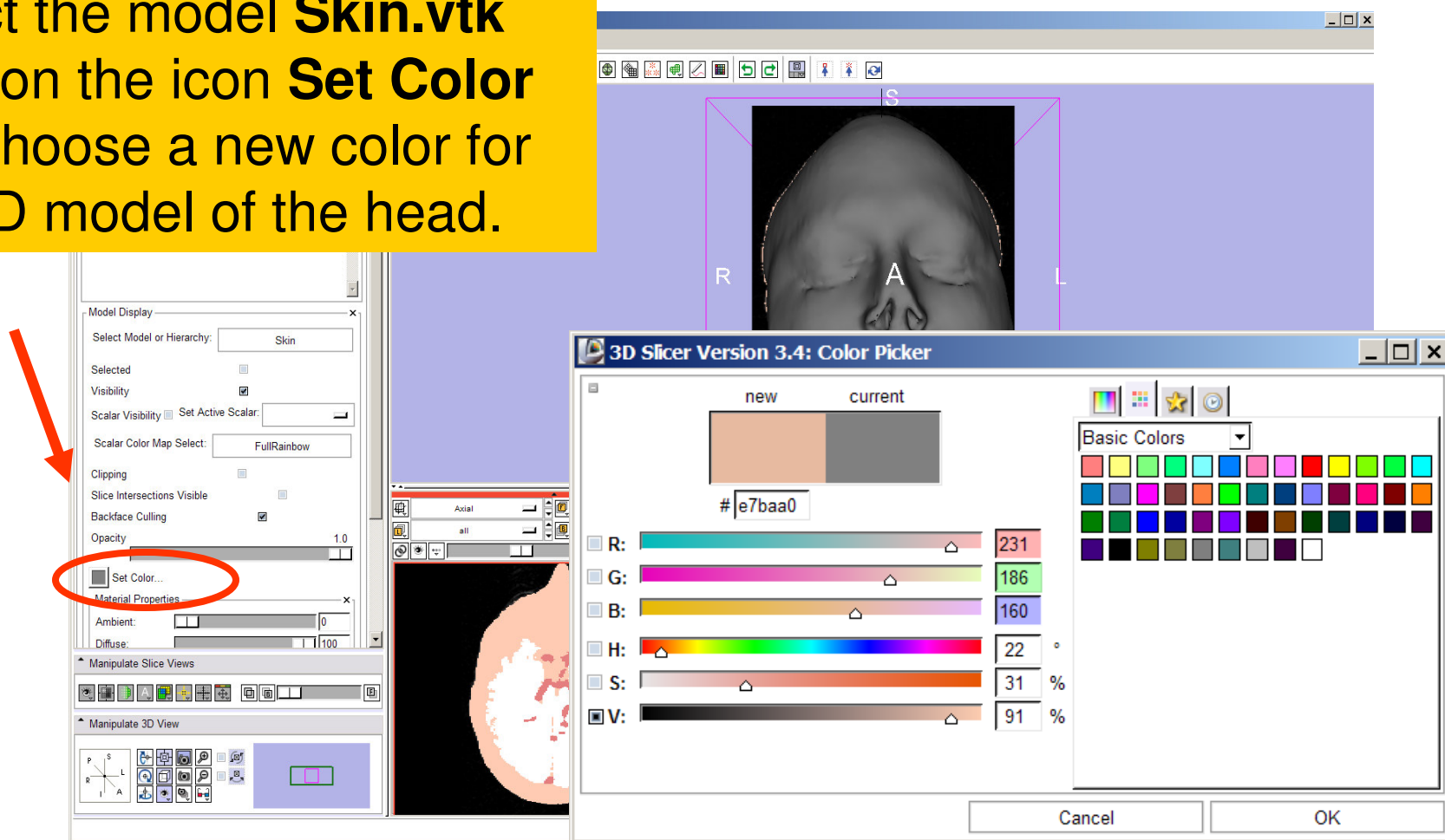
Loading a 3D model





Visualizing a 3D model

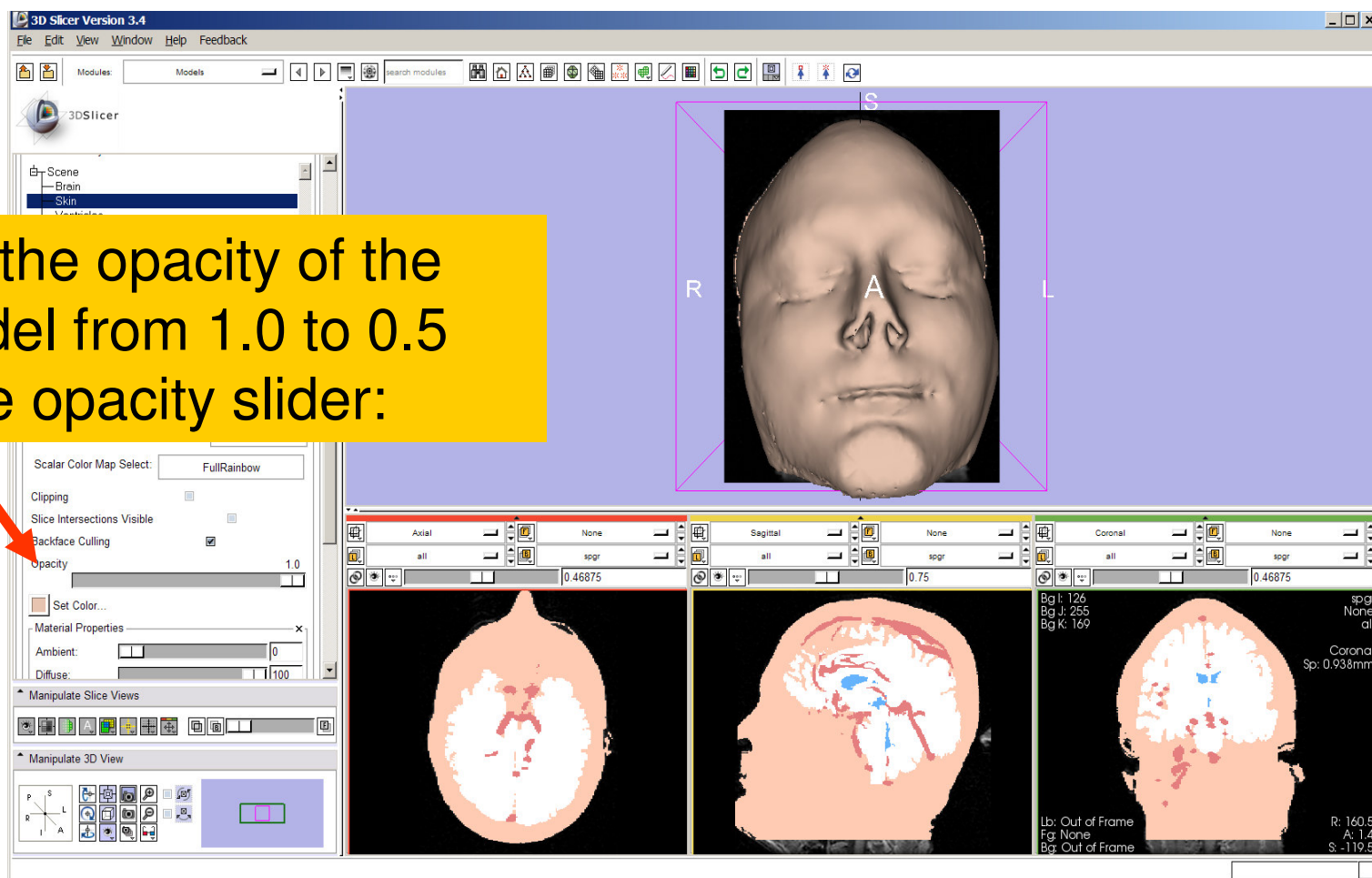
Select the model **Skin.vtk**
Click on the icon **Set Color**
and choose a new color for
the 3D model of the head.

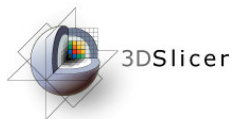




Visualizing a 3D model

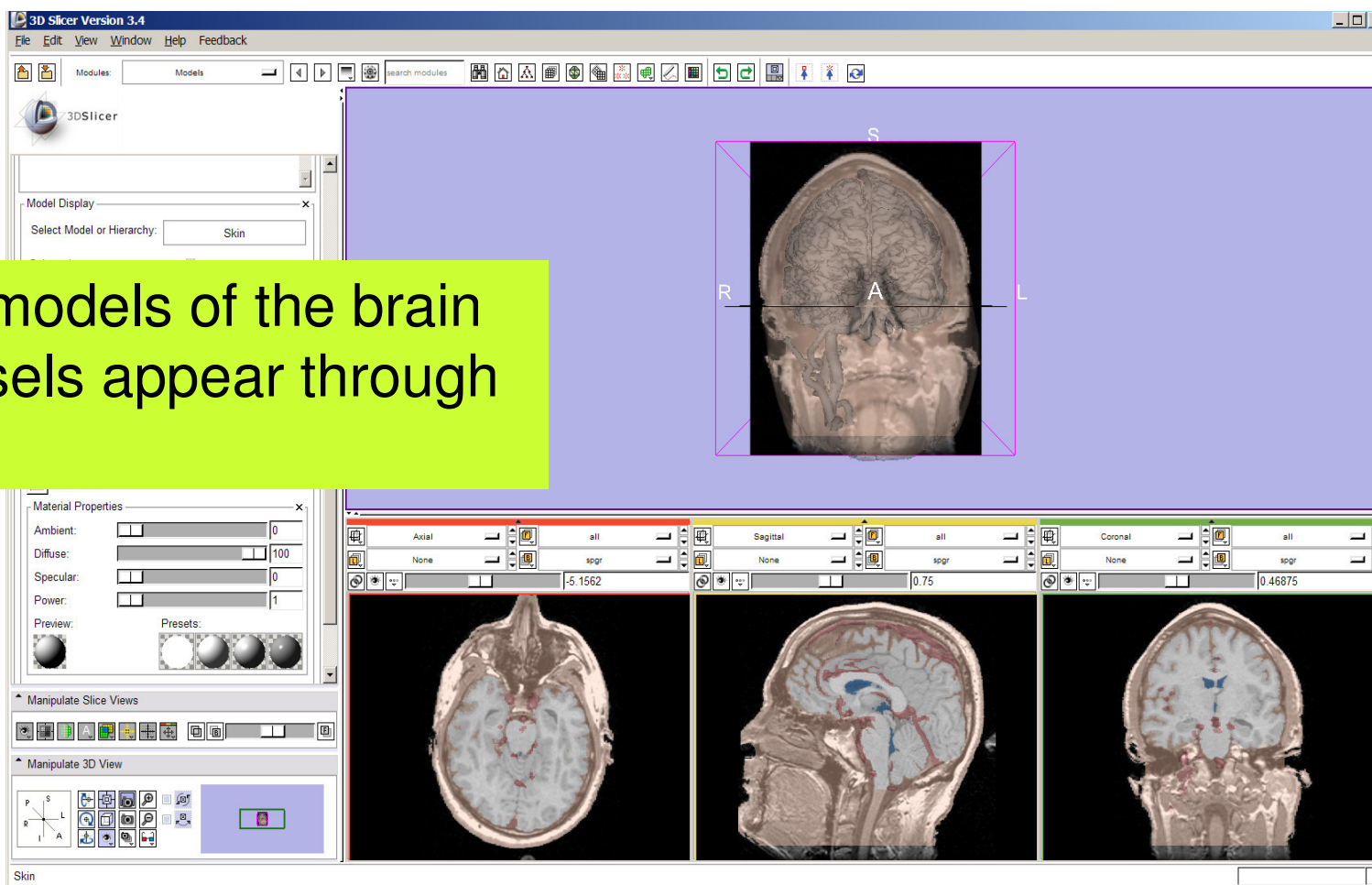
Change the opacity of the skin model from 1.0 to 0.5 using the opacity slider:





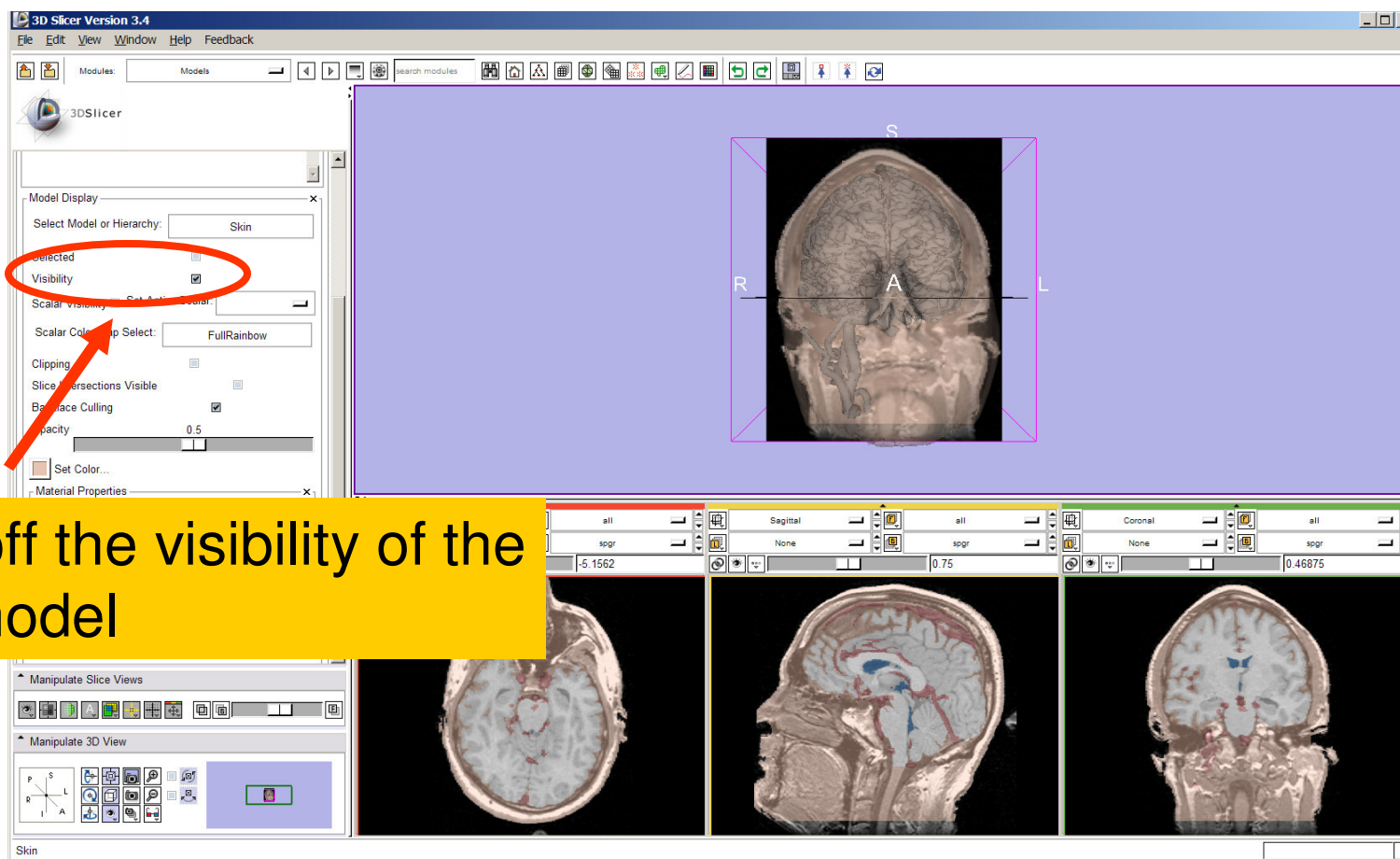
Visualizing a 3D model

The 3D models of the brain and vessels appear through the skin



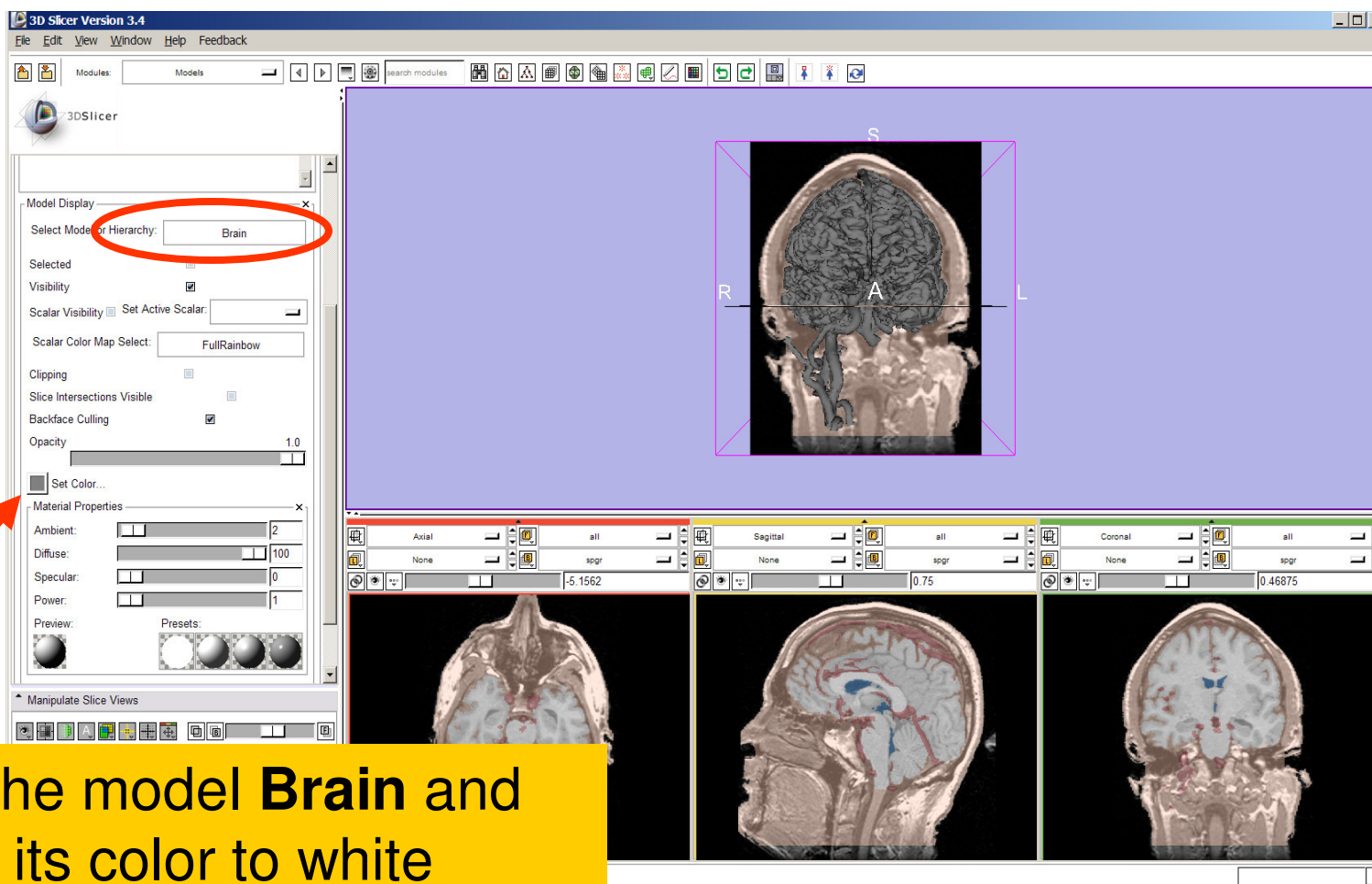


Visualizing a 3D model



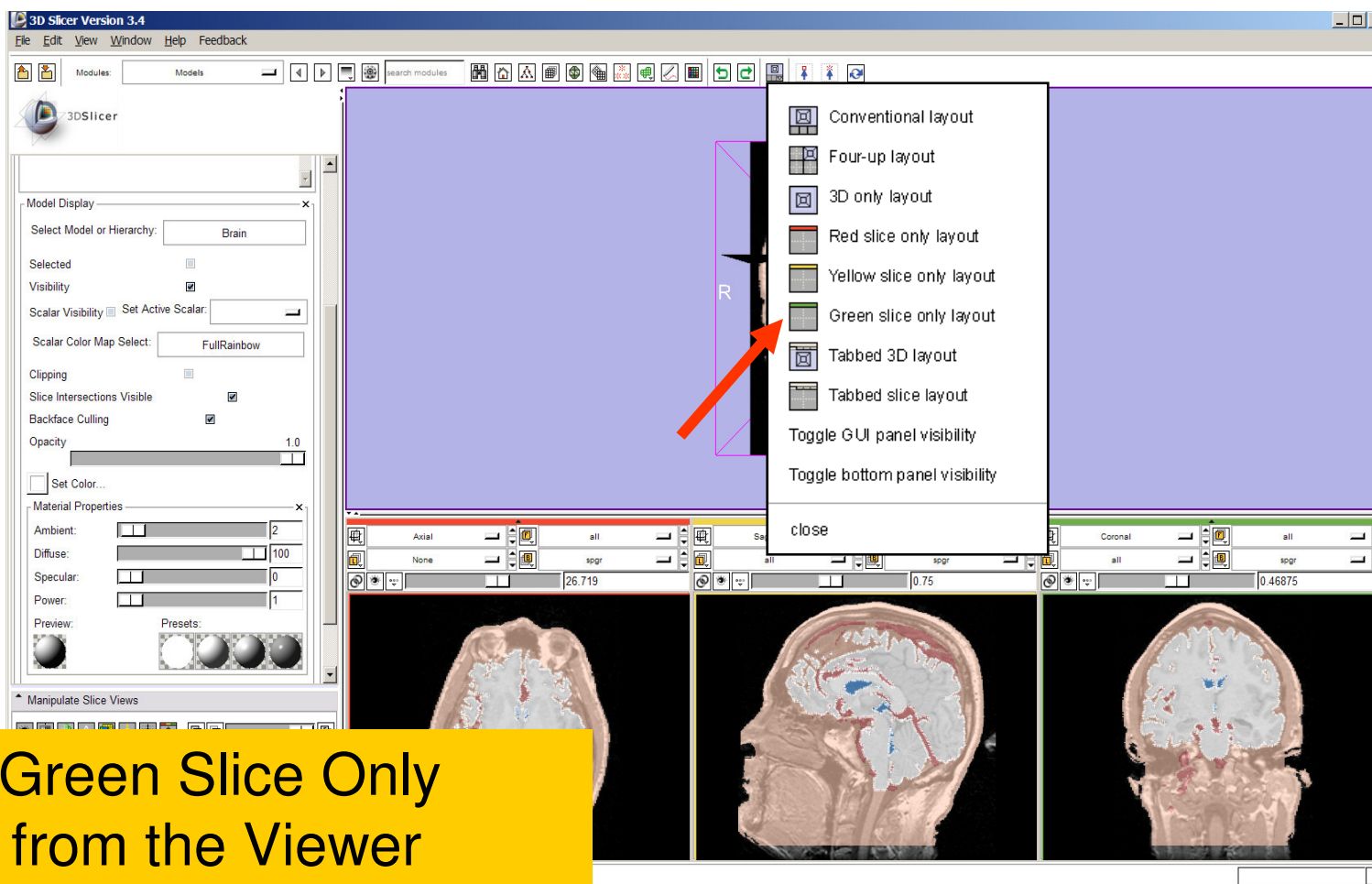


Visualizing a 3D model





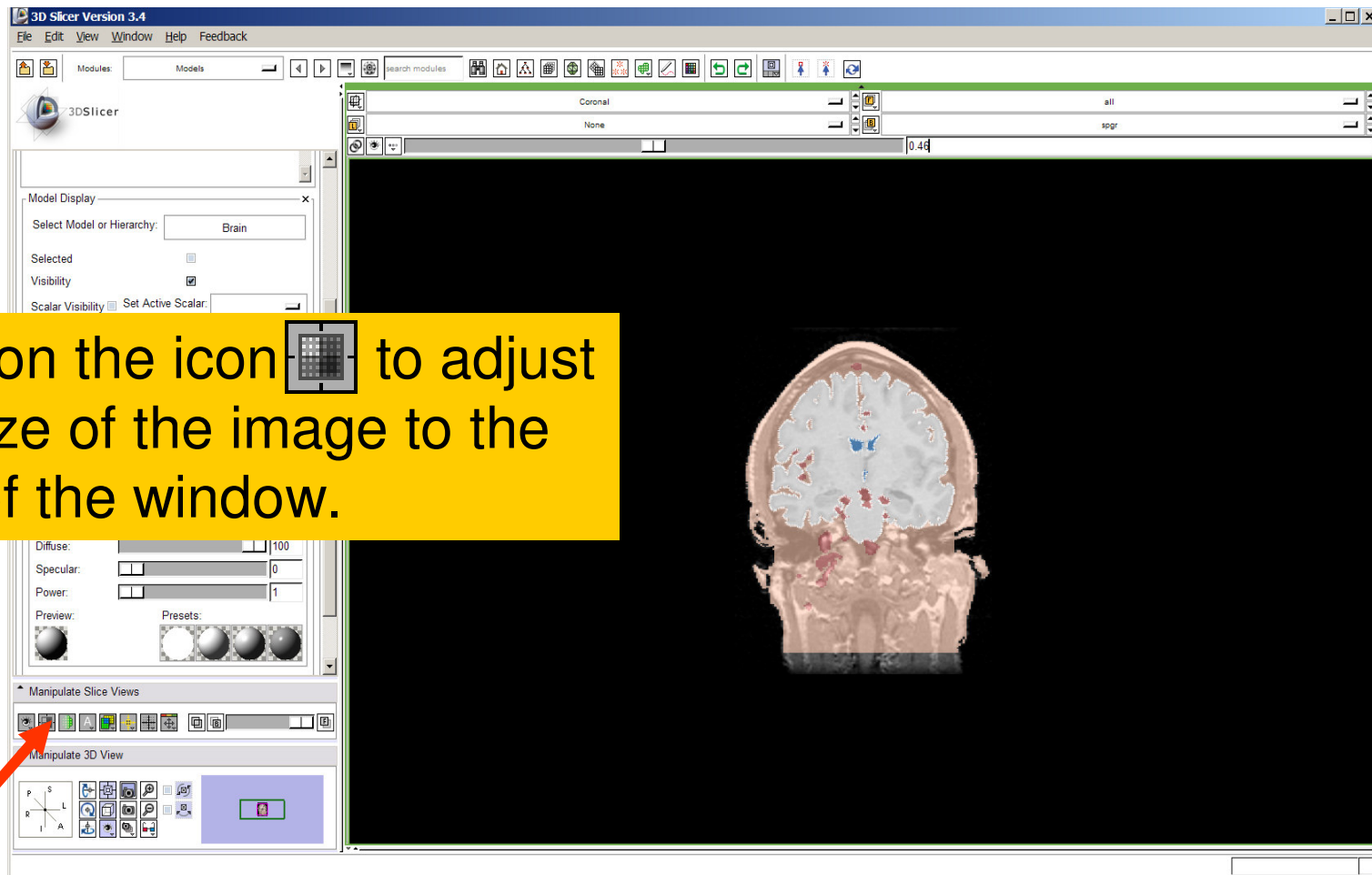
Visualizing a 3D model



Select Green Slice Only Layout from the Viewer menu



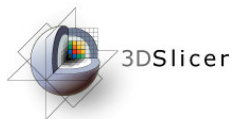
Visualizing a 3D model



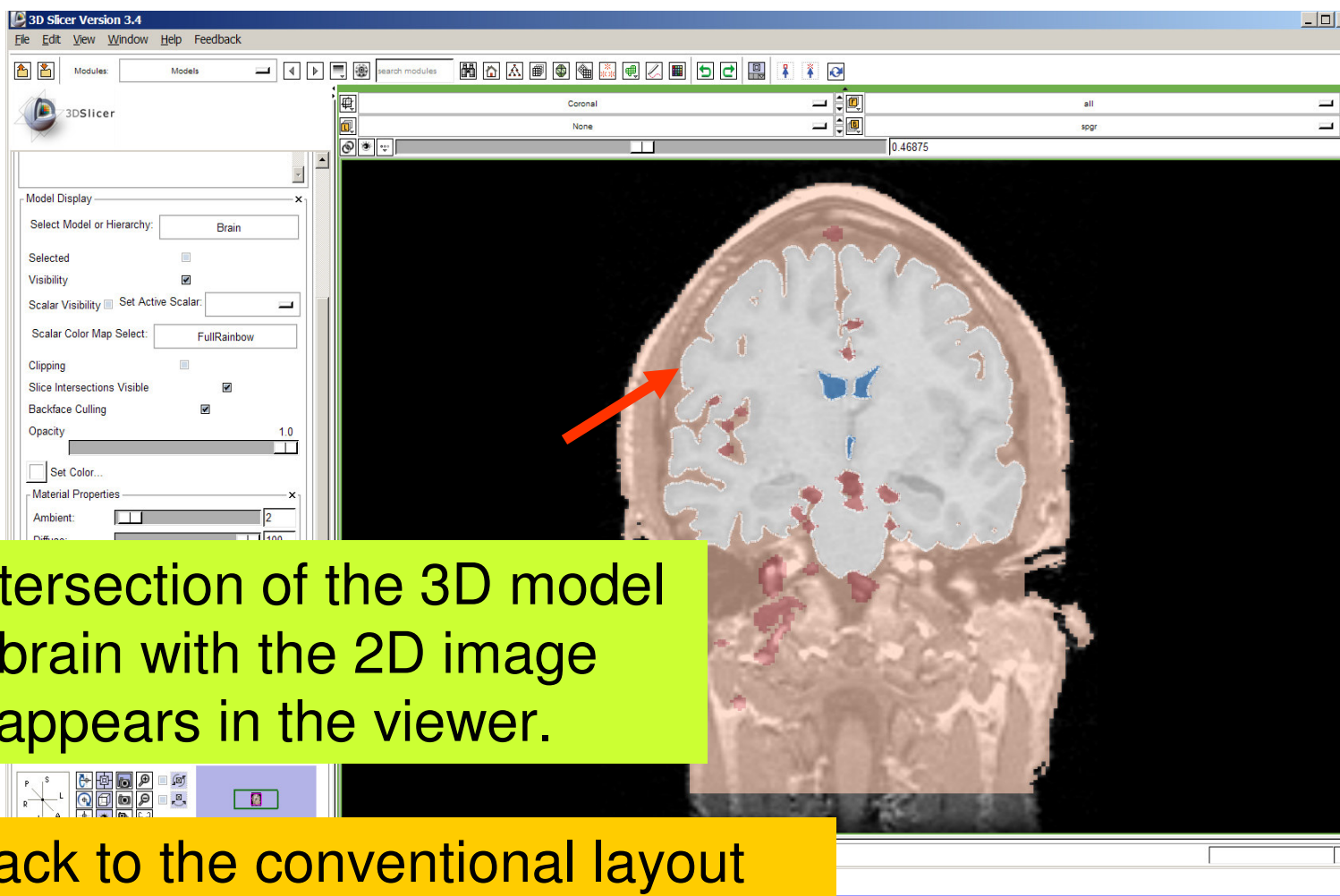


Visualizing a 3D model



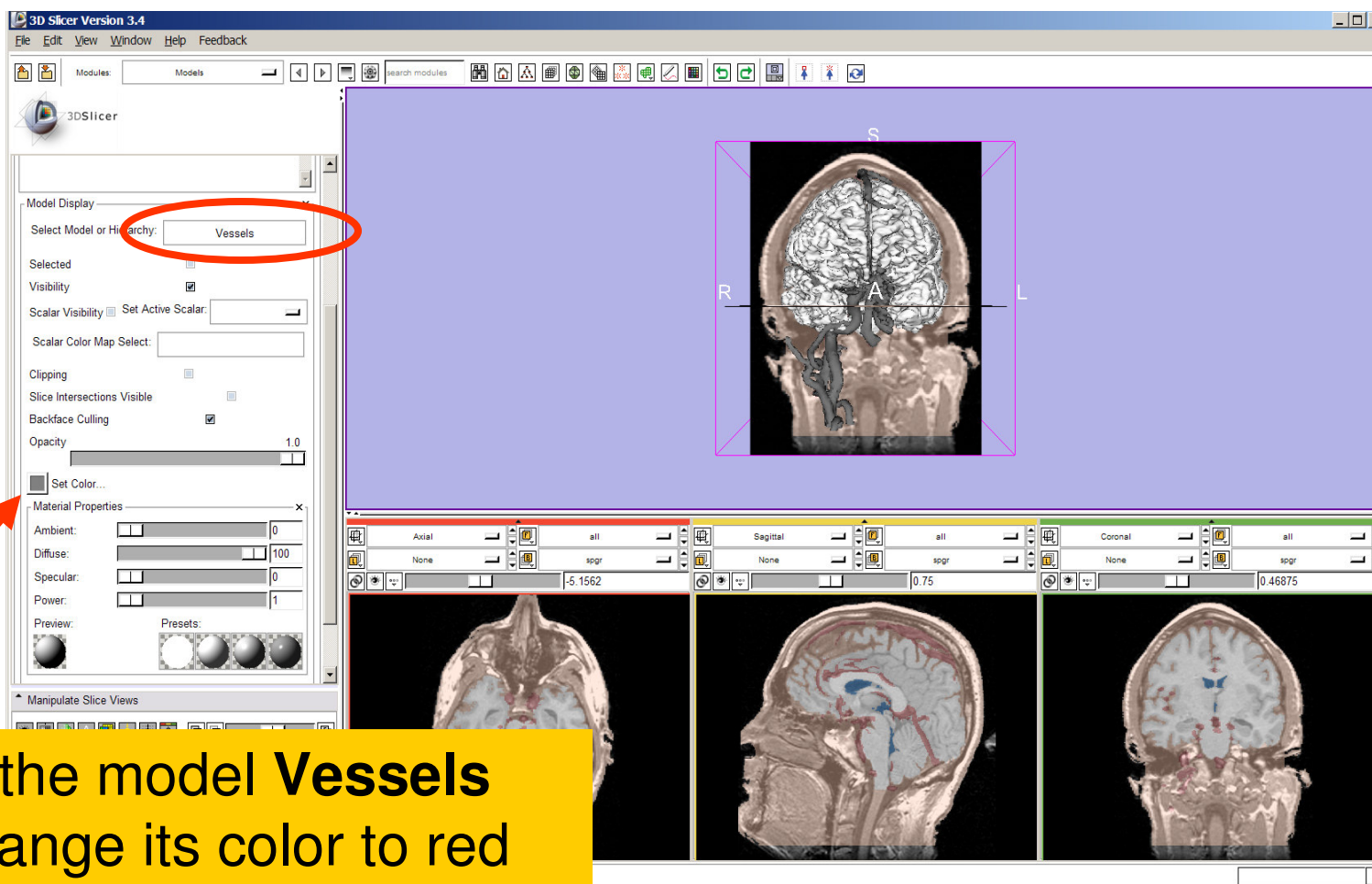


Visualizing a 3D model



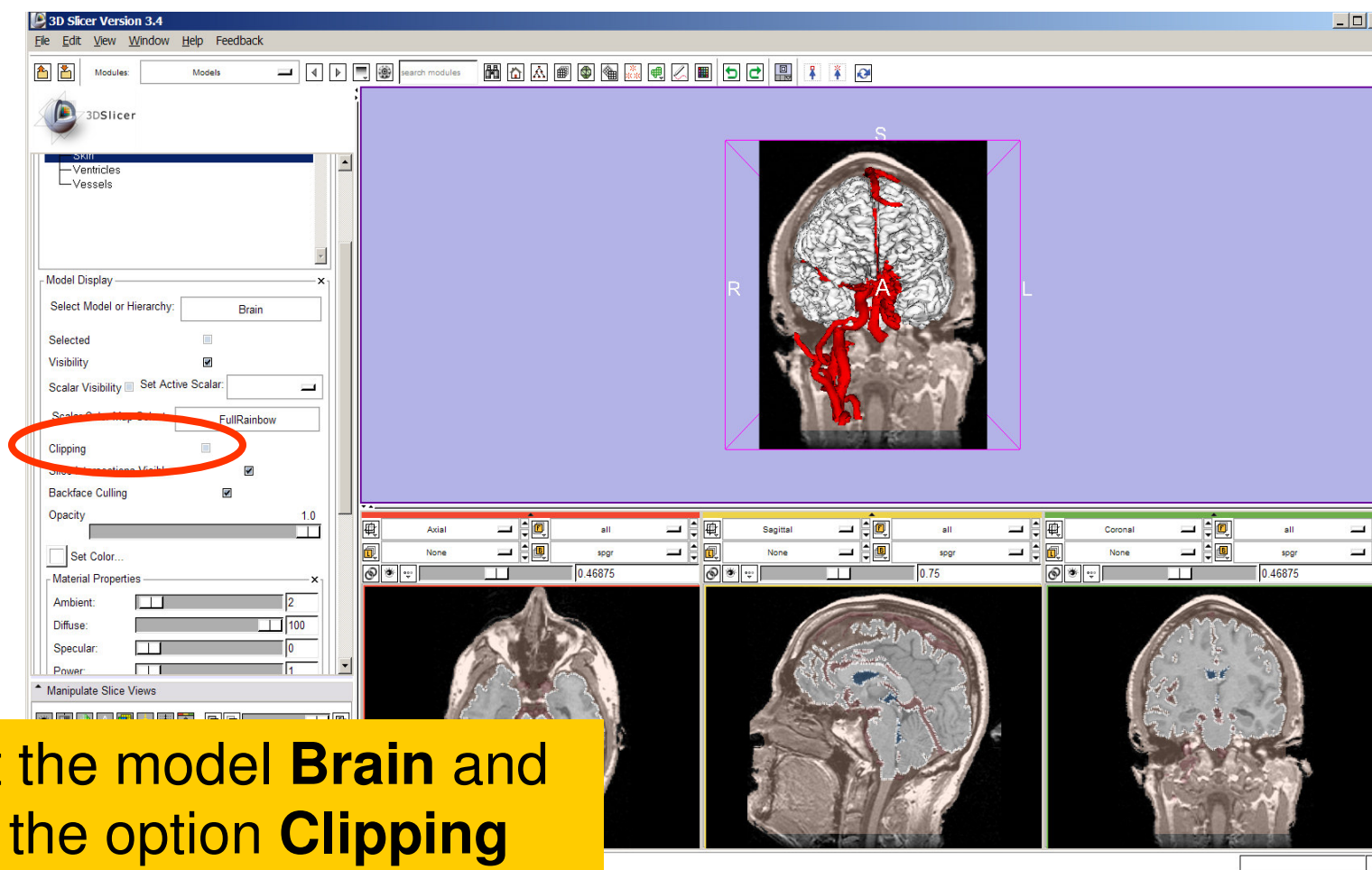


Visualizing a 3D model



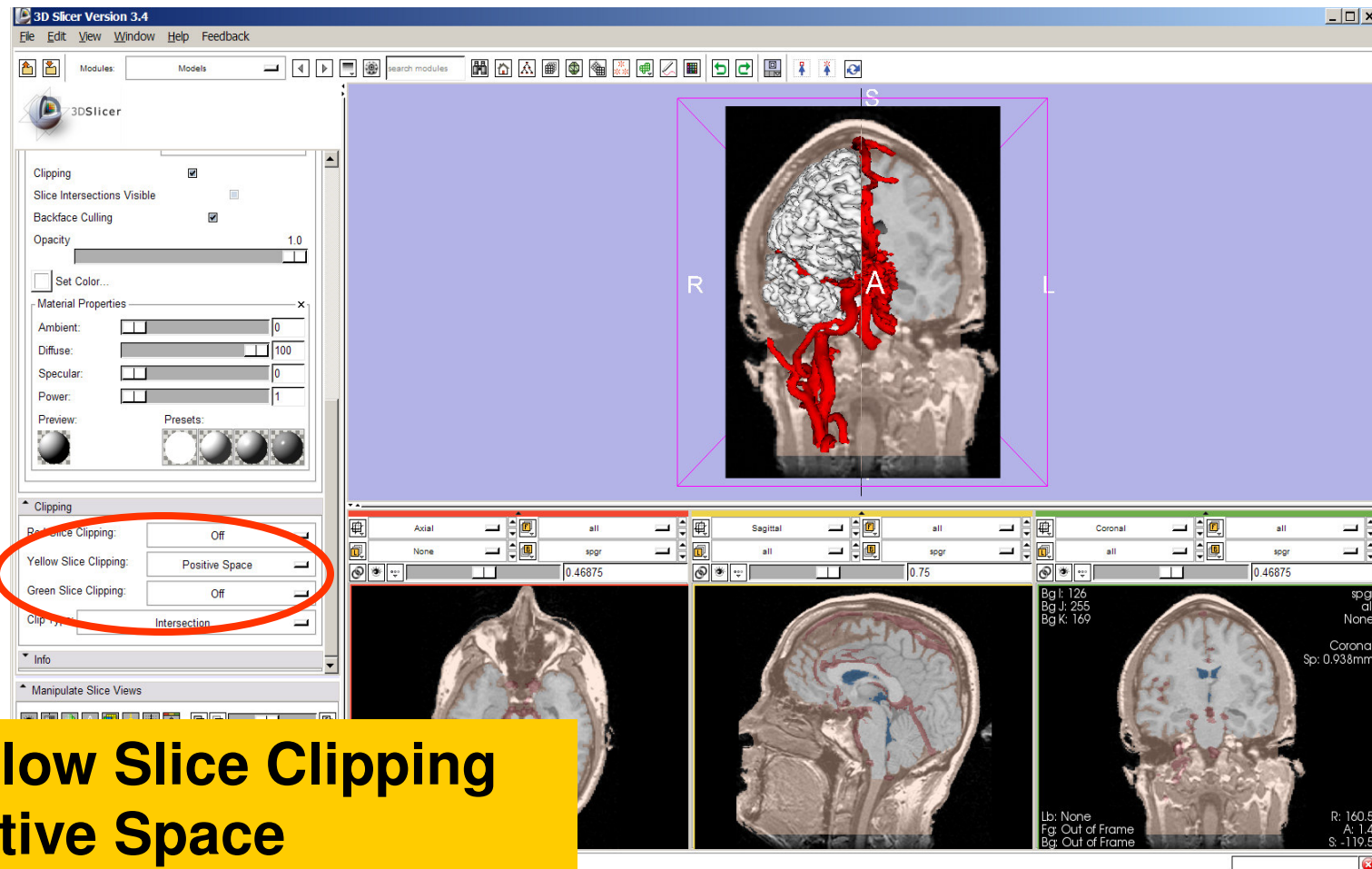


Visualizing a 3D model



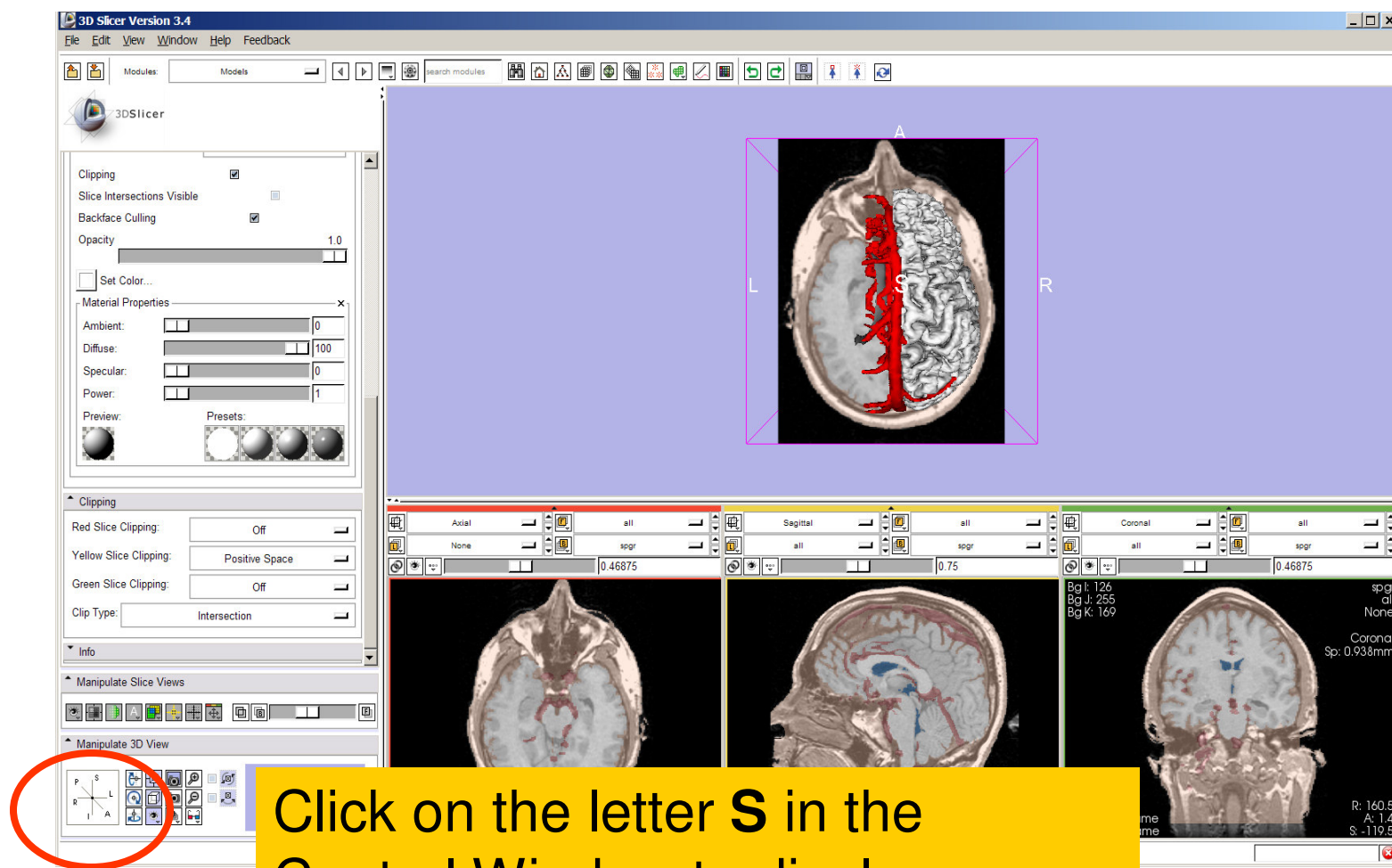


Visualizing a 3D model





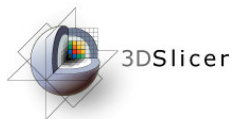
Visualizing a 3D model



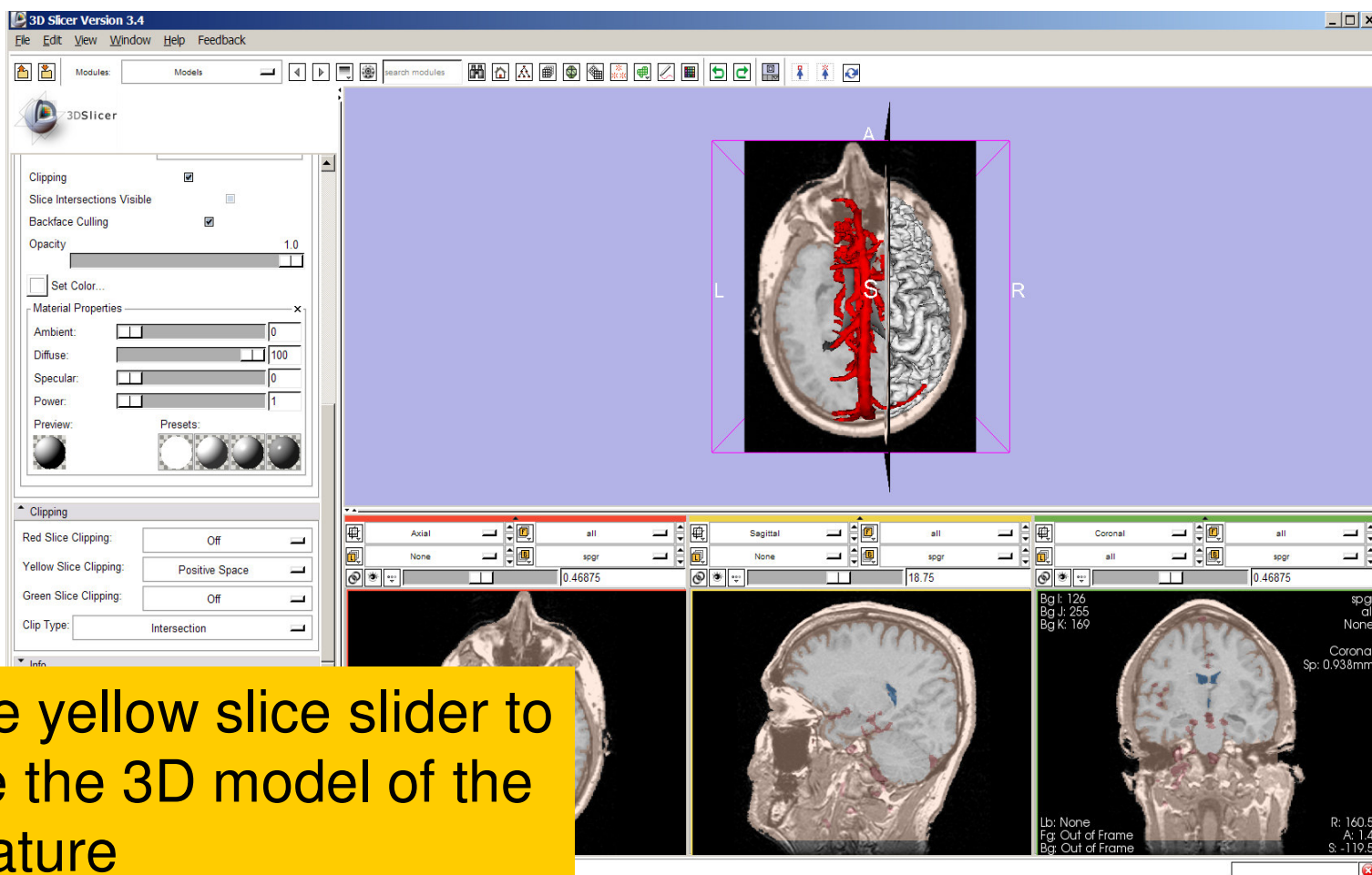
Sonia Pujol, PhD

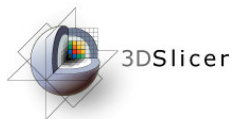
Click on the letter **S** in the Control Window to display a superior view of the 3D models

Medical Image Computing
Image Analysis Center

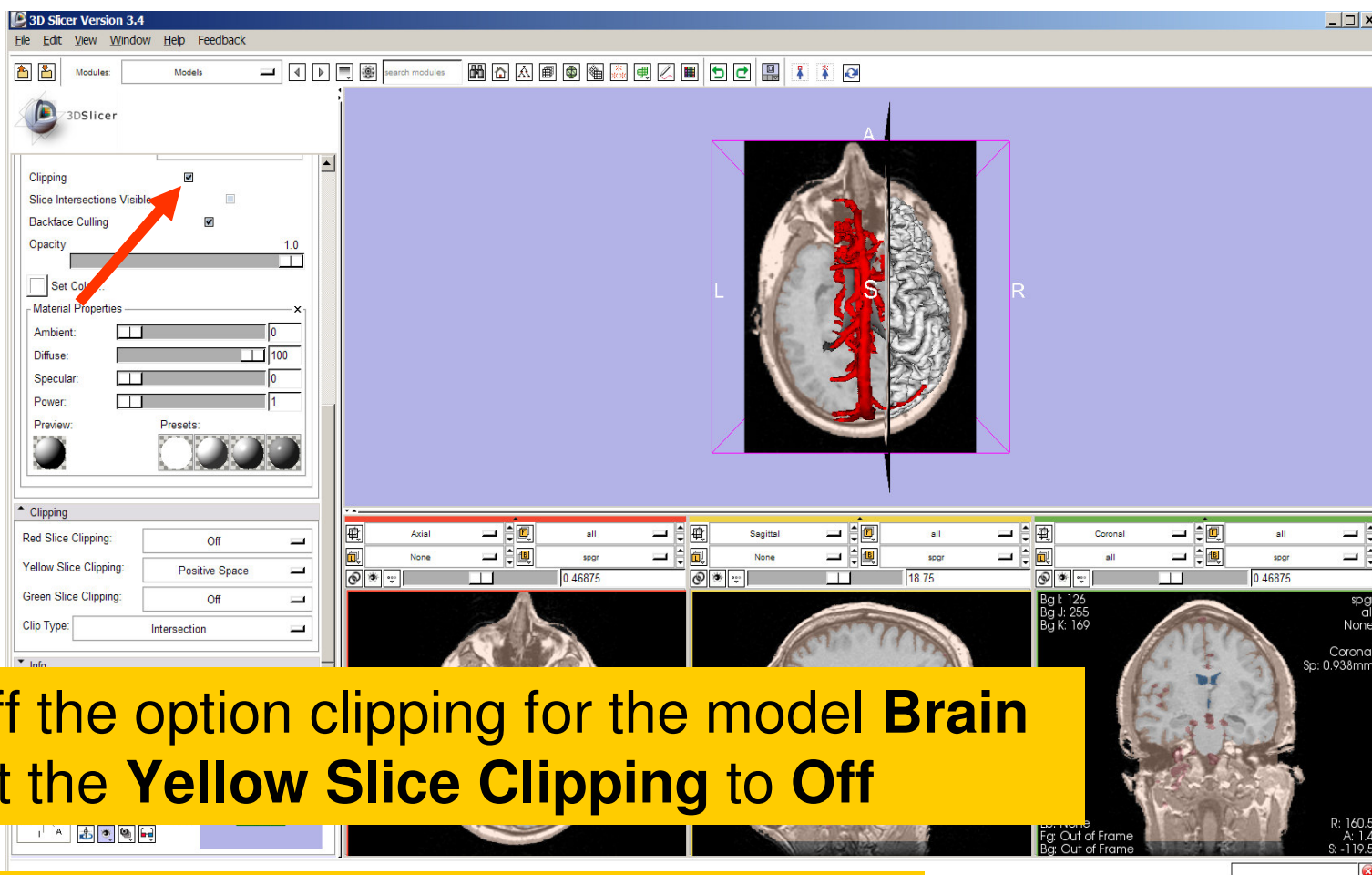


Visualizing a 3D model





Visualizing a 3D model

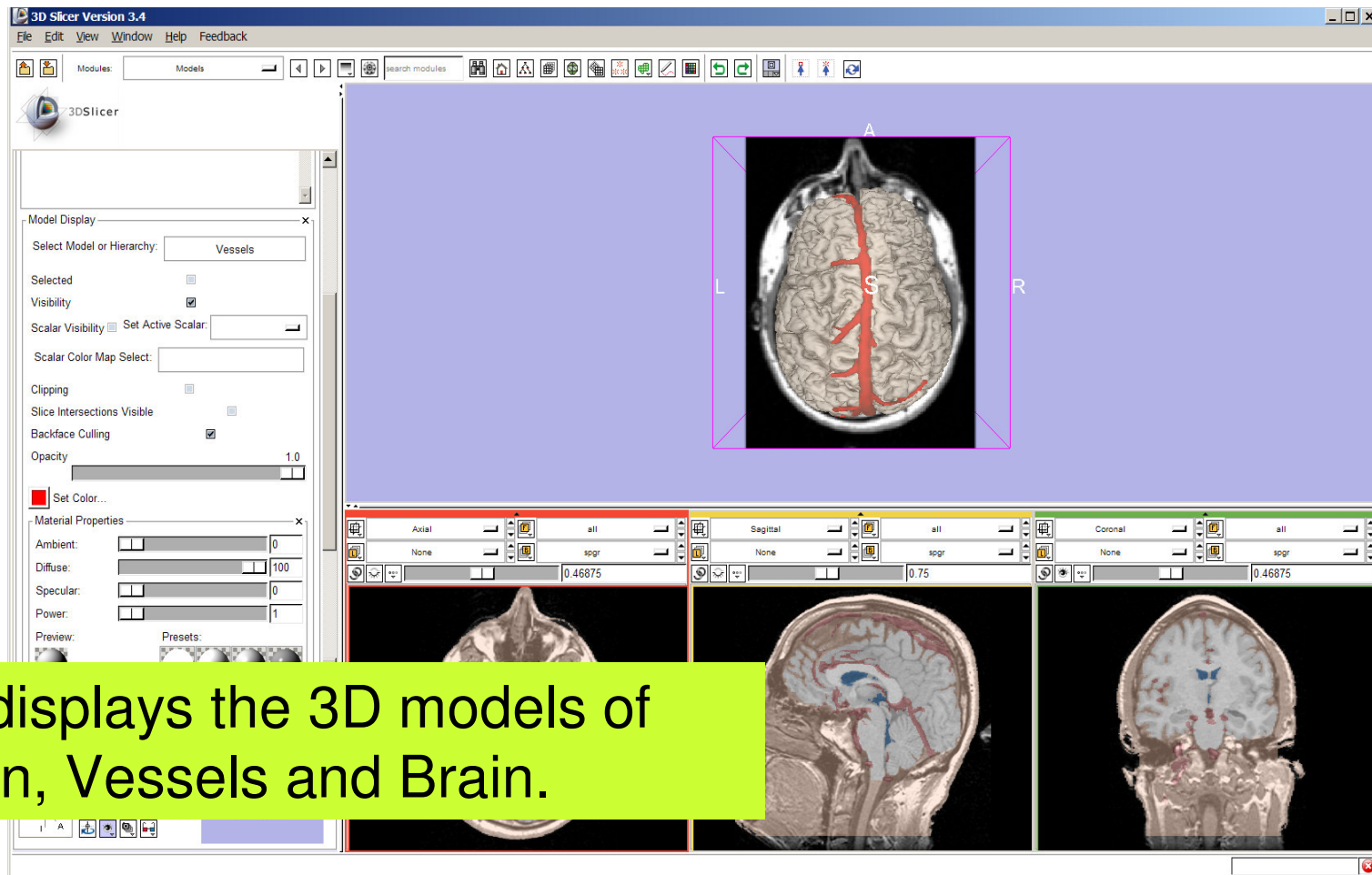


Turn off the option clipping for the model **Brain** and set the **Yellow Slice Clipping** to **Off**

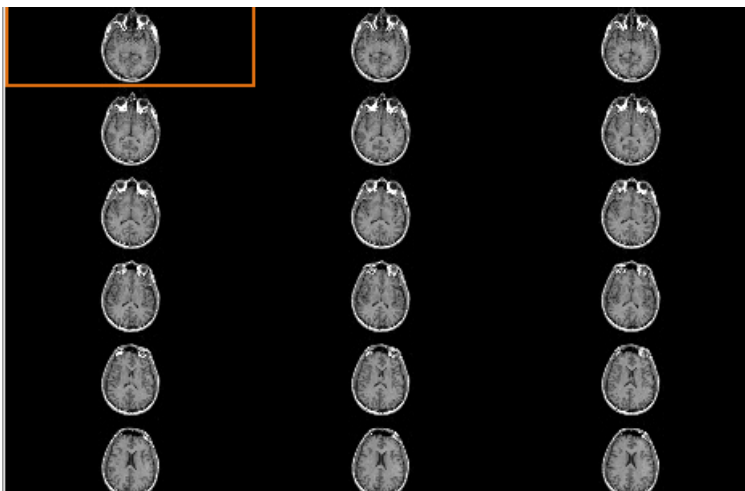
Turn on the visibility of the model **Skin**



Visualizing a 3D model



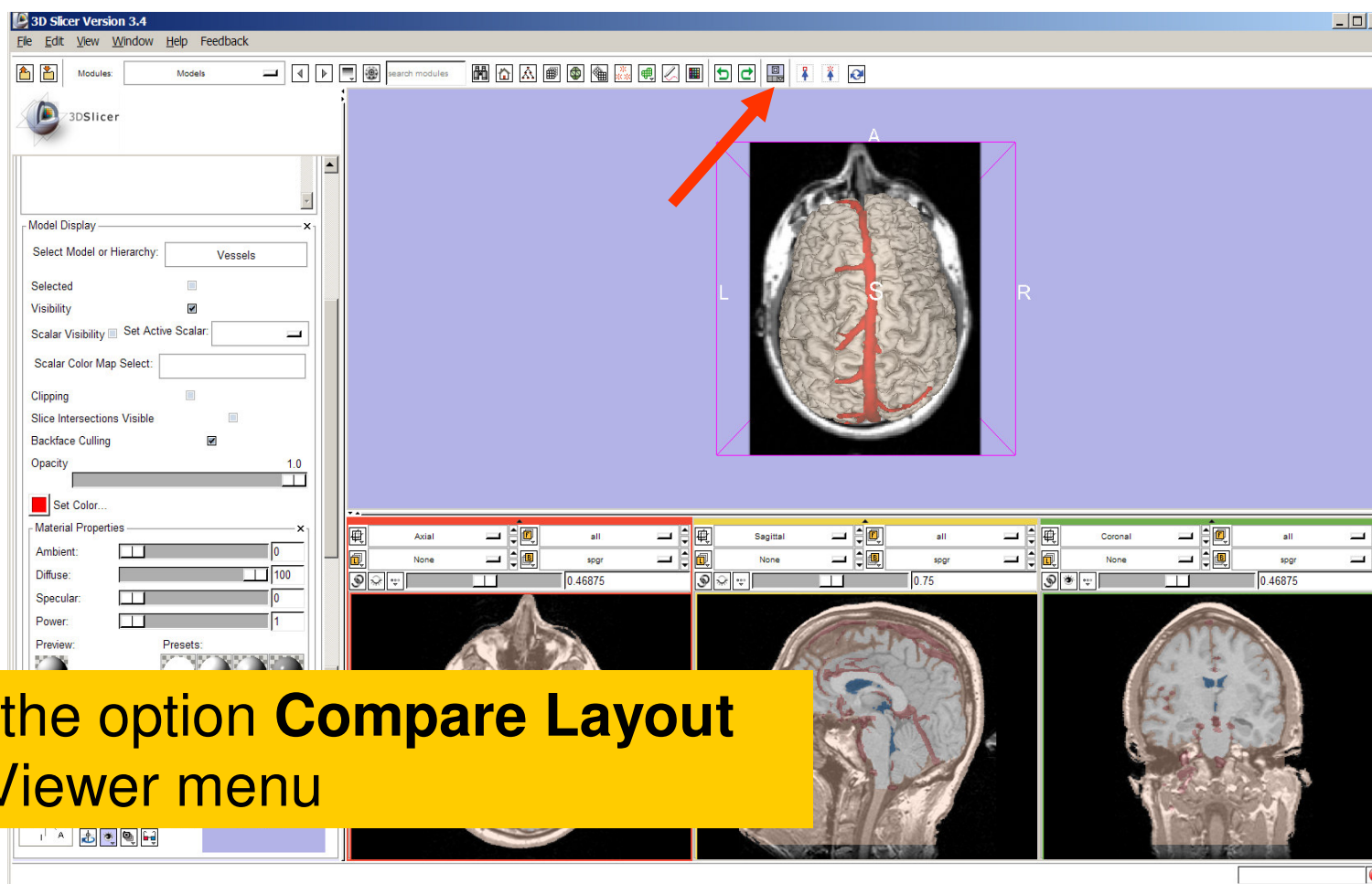
Slicer displays the 3D models of the Skin, Vessels and Brain.



Part 4: Lightbox viewer



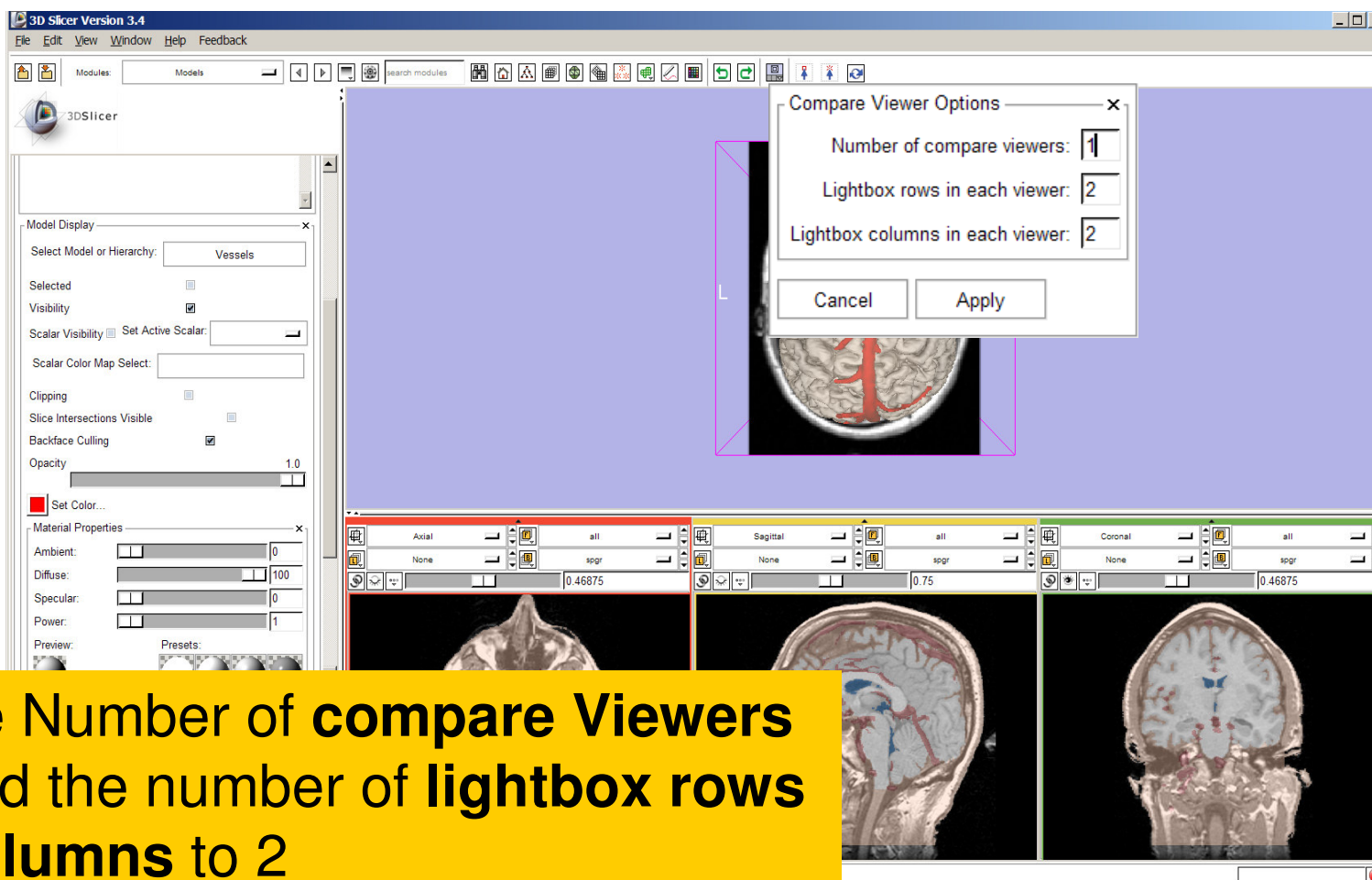
Visualizing a 3D model



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



Visualizing a 3D model

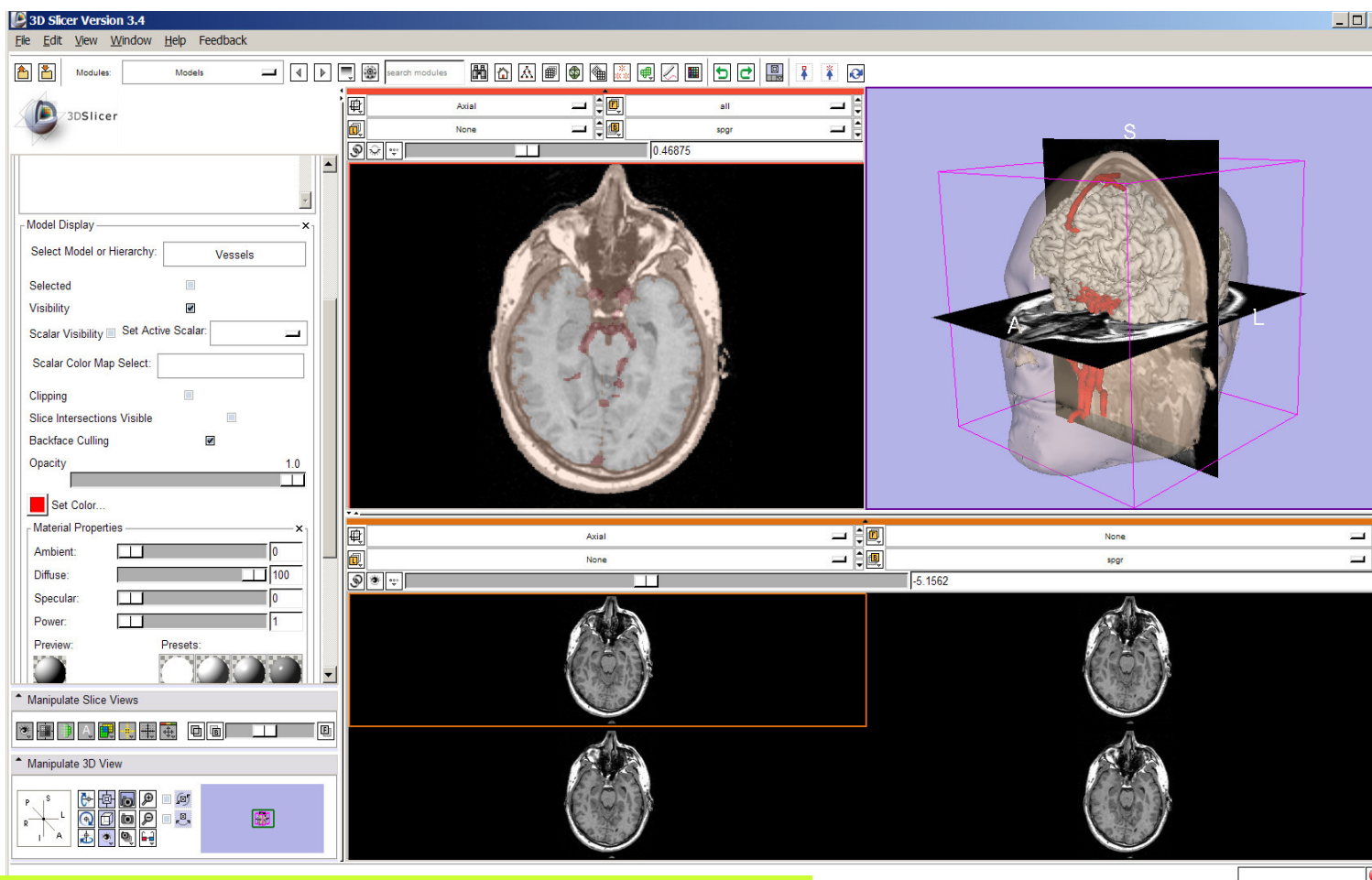


Set the Number of **compare Viewers** to 1 and the number of **lightbox rows** and **columns** to 2

Click on **Apply**



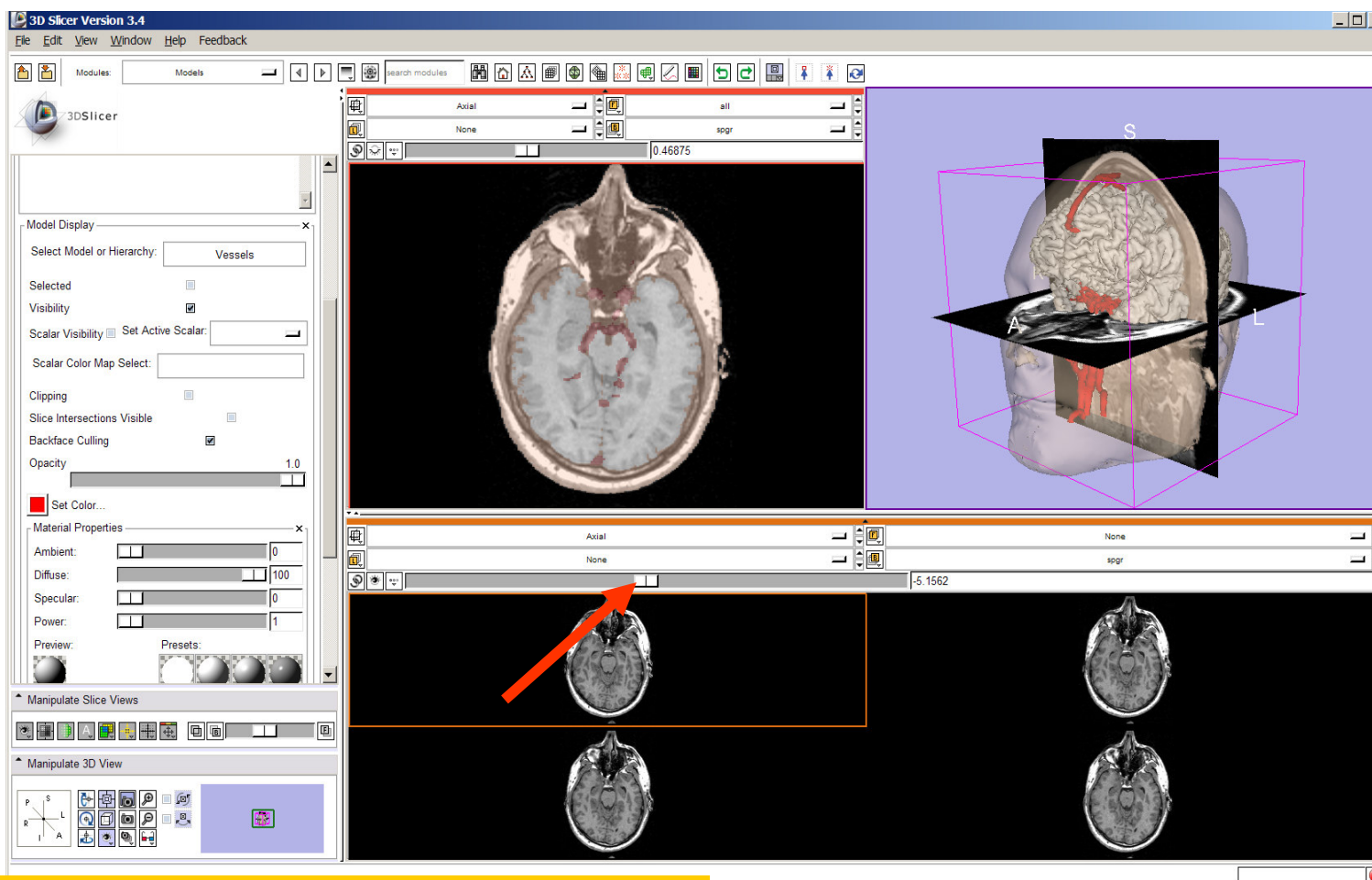
Lightbox viewer



Slicer displays a lightbox view of the Background dataset.



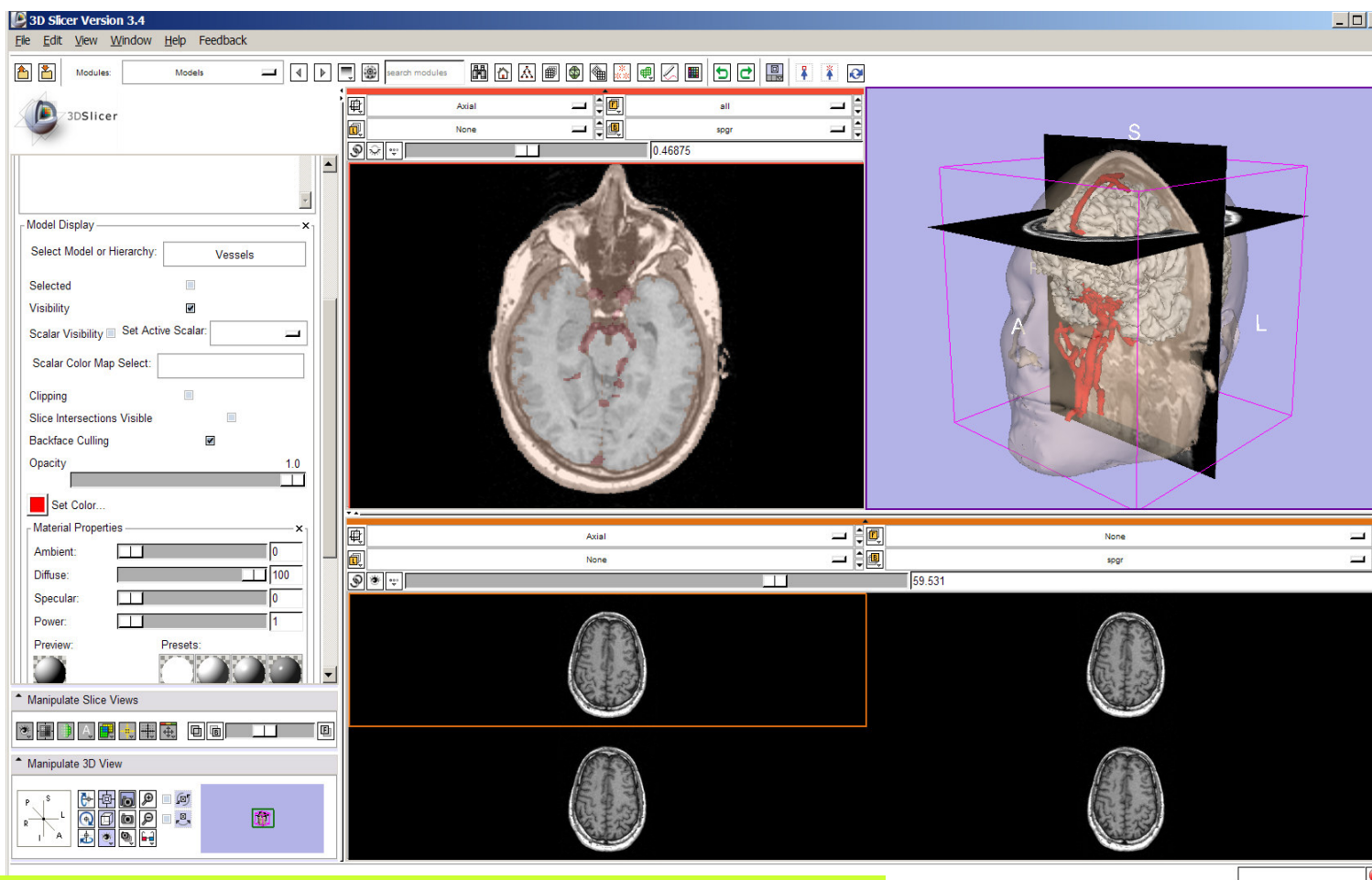
Lightbox viewer



Browse through the spgr volume using the lightbox slider



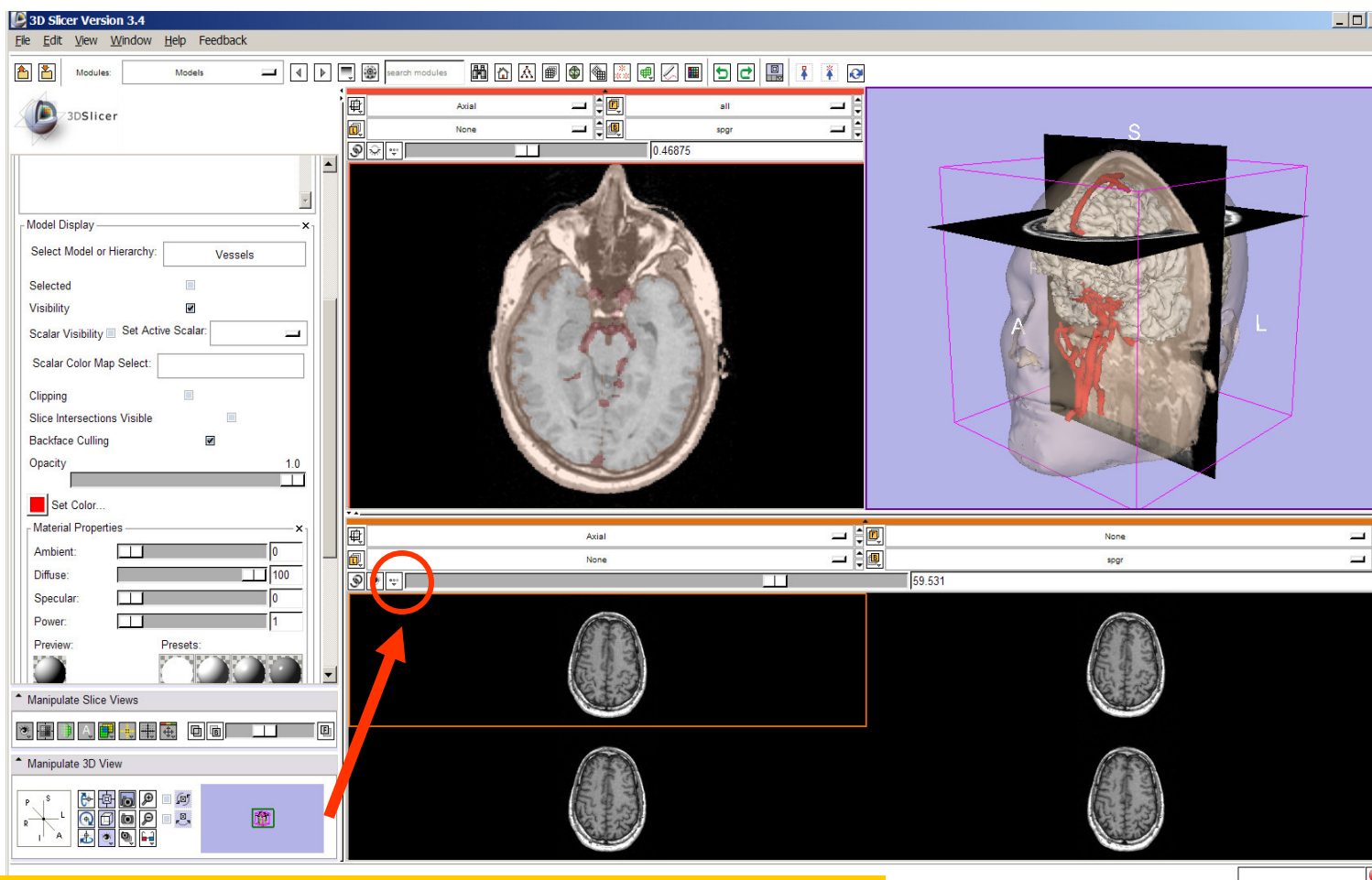
Lightbox viewer



Slicer displays 4 adjacent axial slices of the spgr volume simultaneously



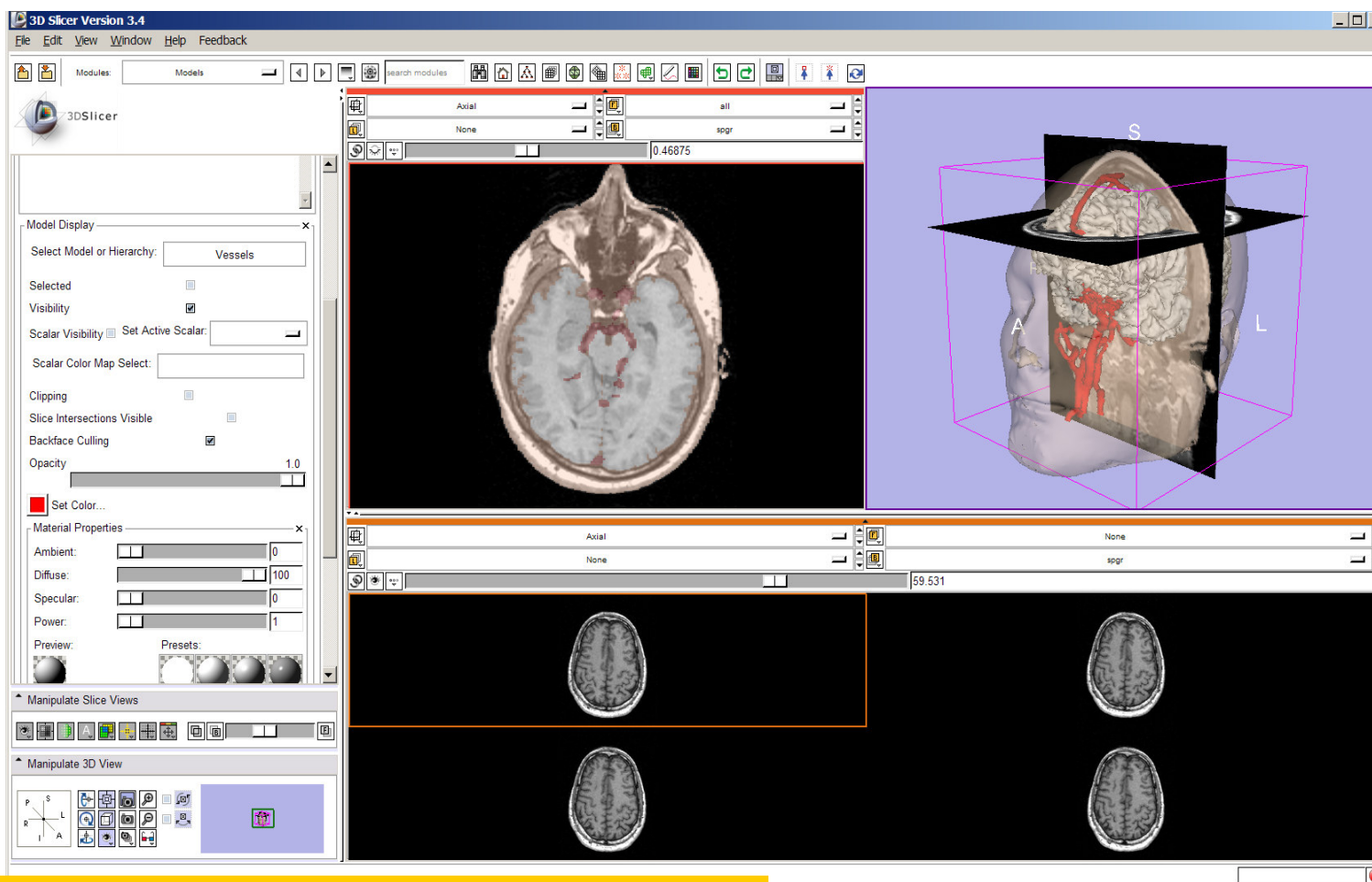
Lightbox viewer



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



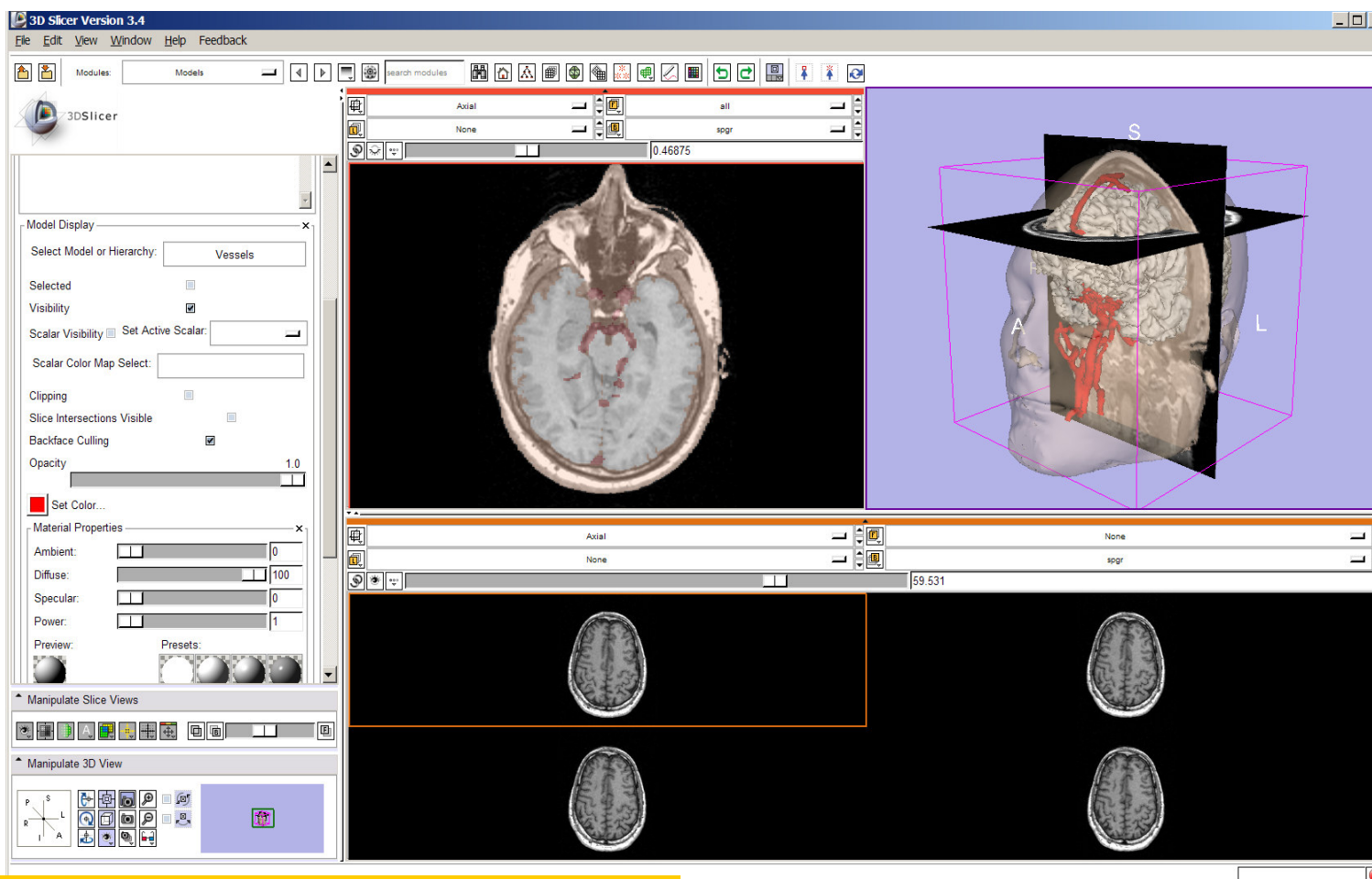
Lightbox viewer



Select the **lightbox** view option



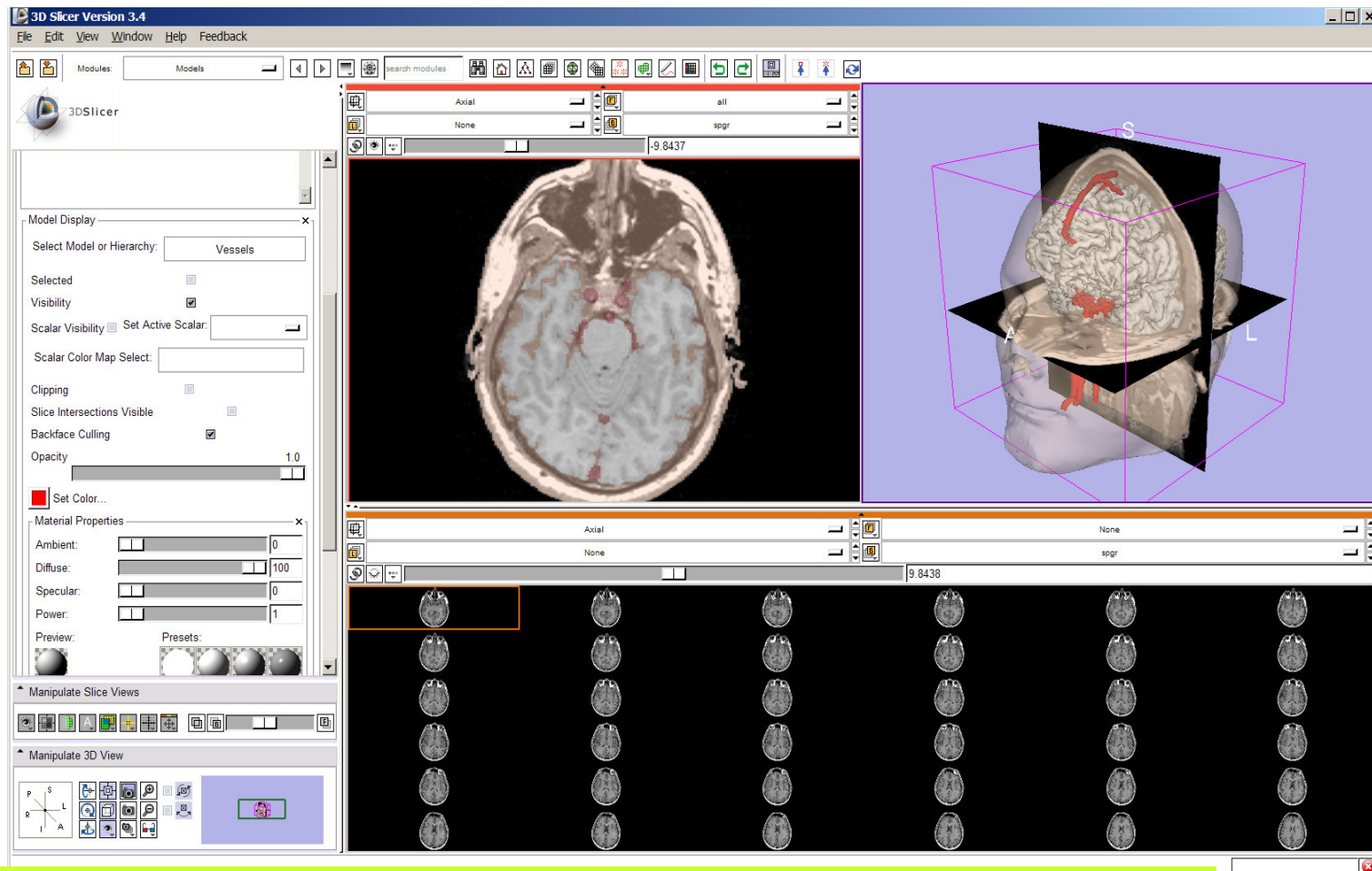
Lightbox viewer



Set the configuration of the light box view to **6x6**



Lightbox viewer

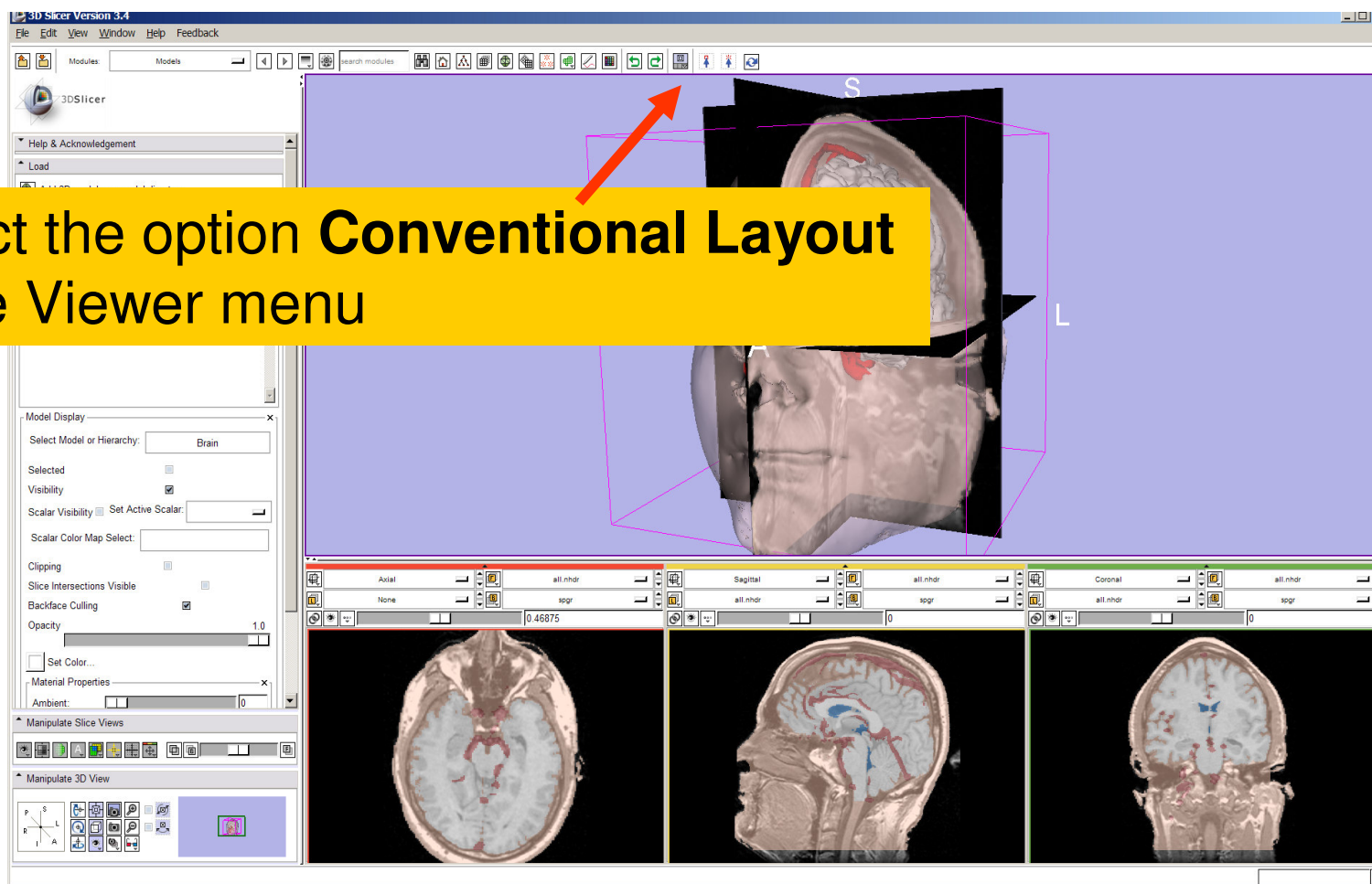


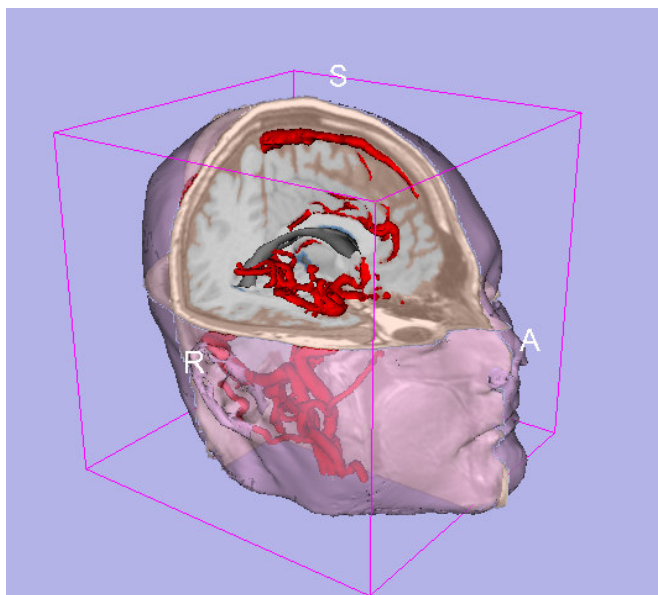
Slicer displays a matrix of 36 adjacent axial slices of the spgr volume.



Lightbox viewer

Select the option **Conventional Layout** in the Viewer menu

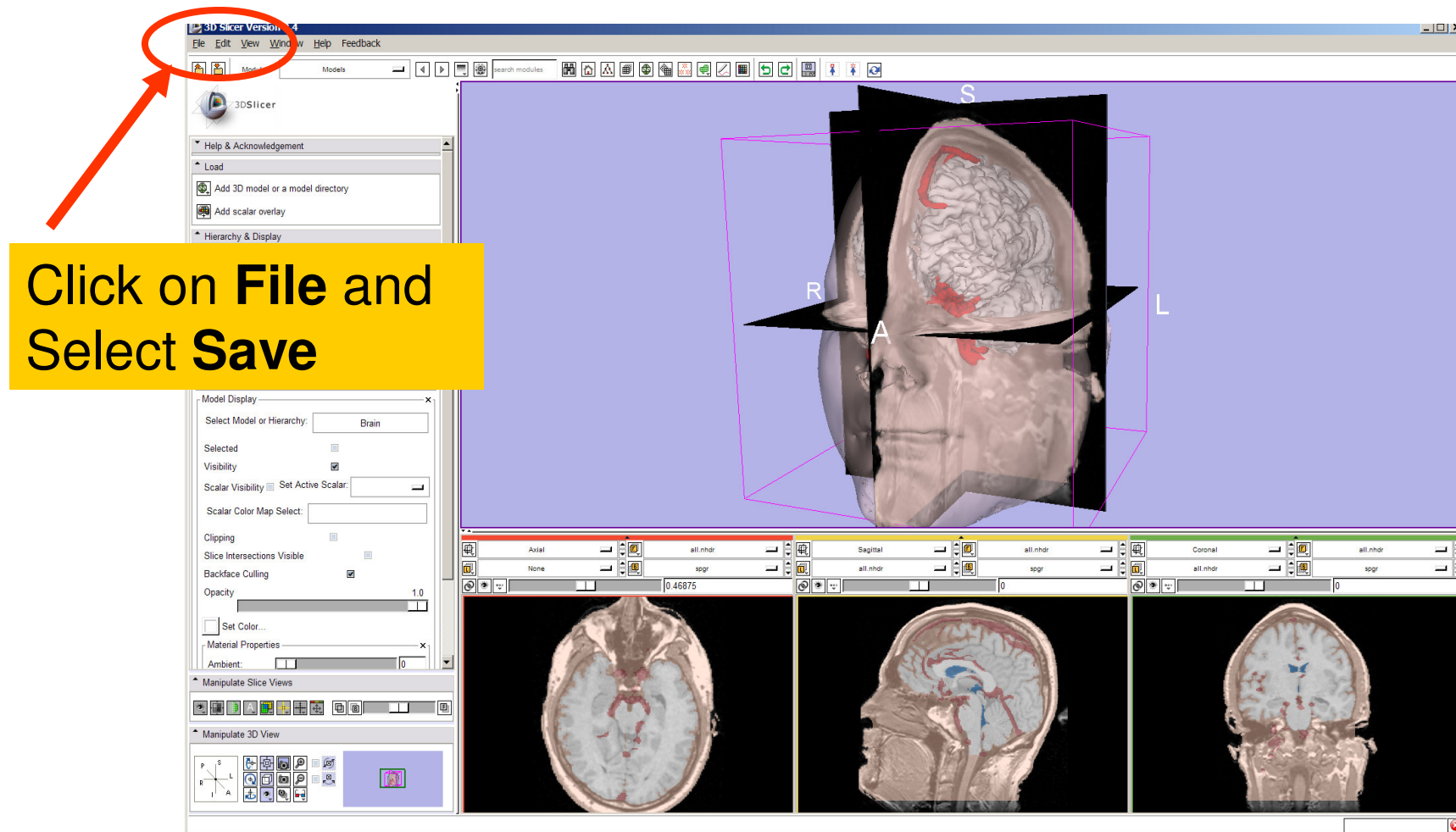




Part 5: Loading and saving a Scene



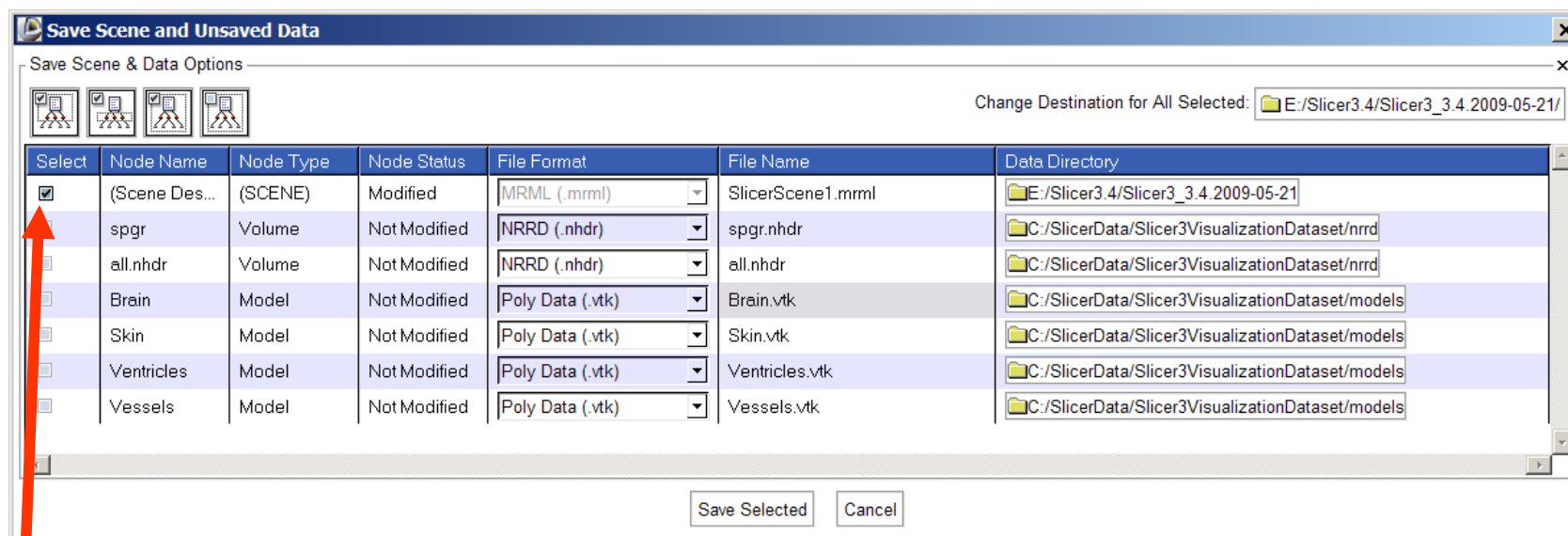
Saving Data





Saving Data

The list of elements currently loaded into Slicer3 appears.

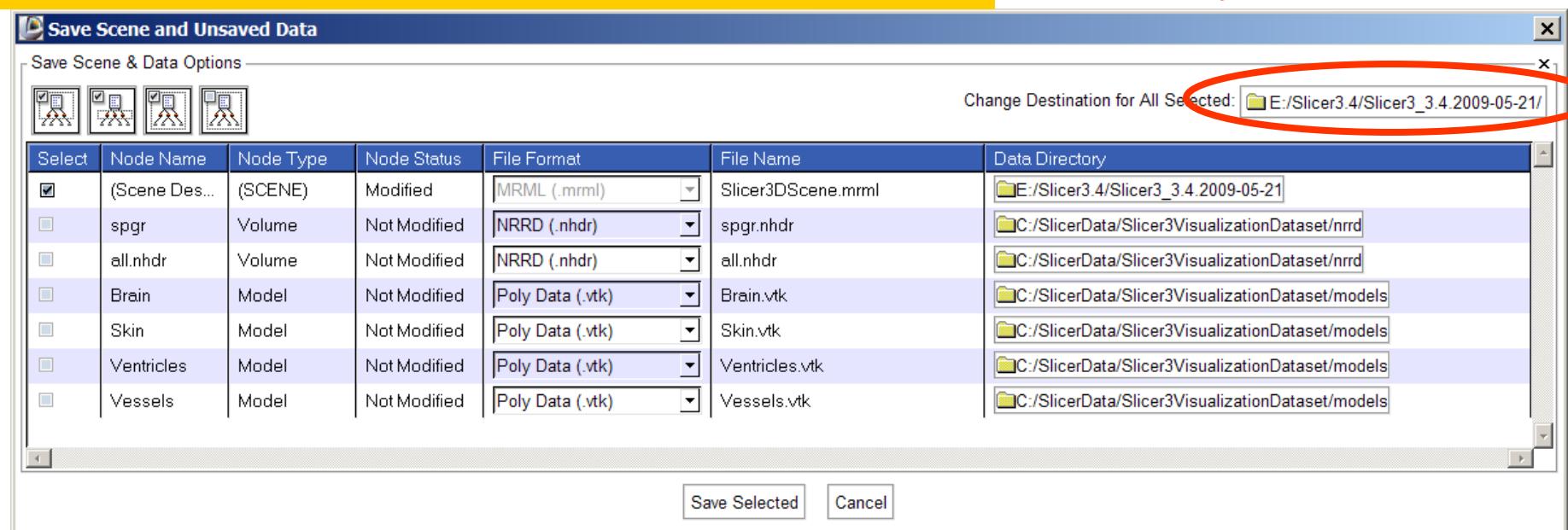


Make sure only the first check box is selected



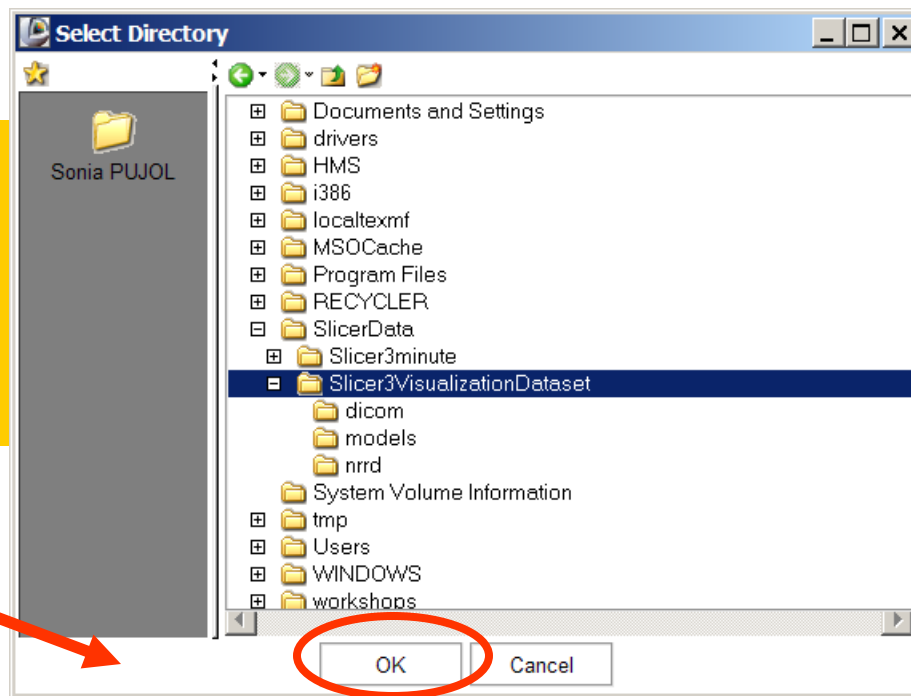
Saving Data

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



Saving Data

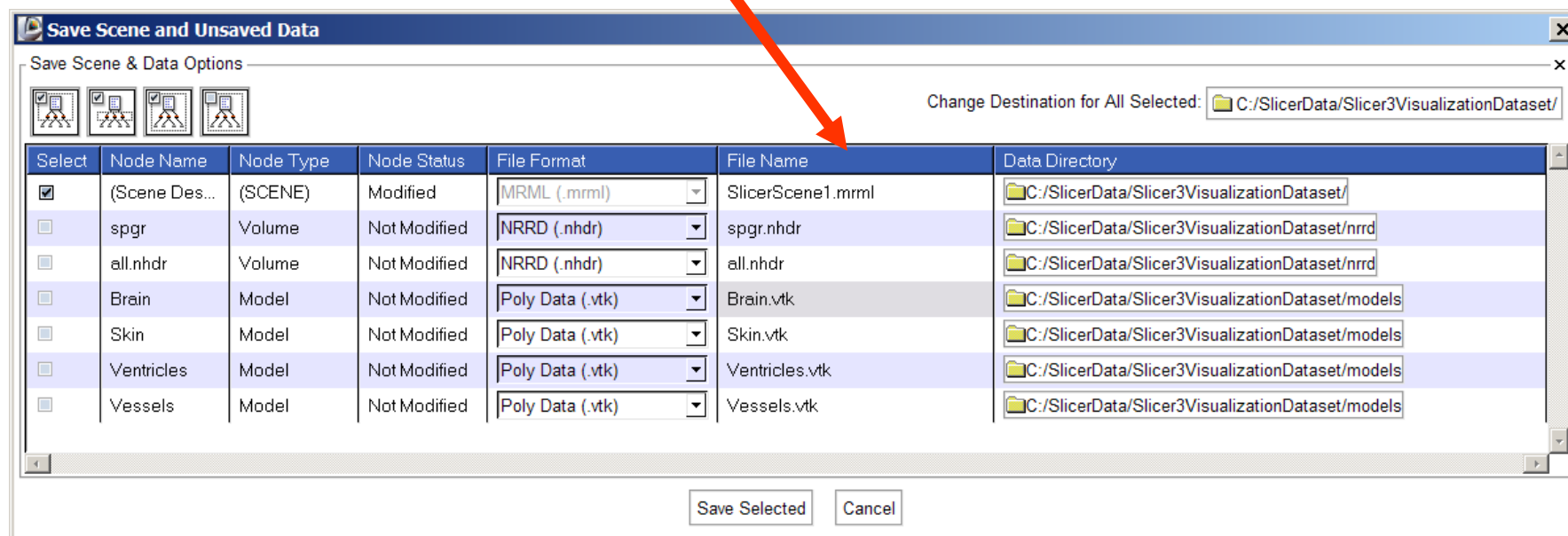
Browse to the directory where you would like to save your scene and click OK





Saving Data

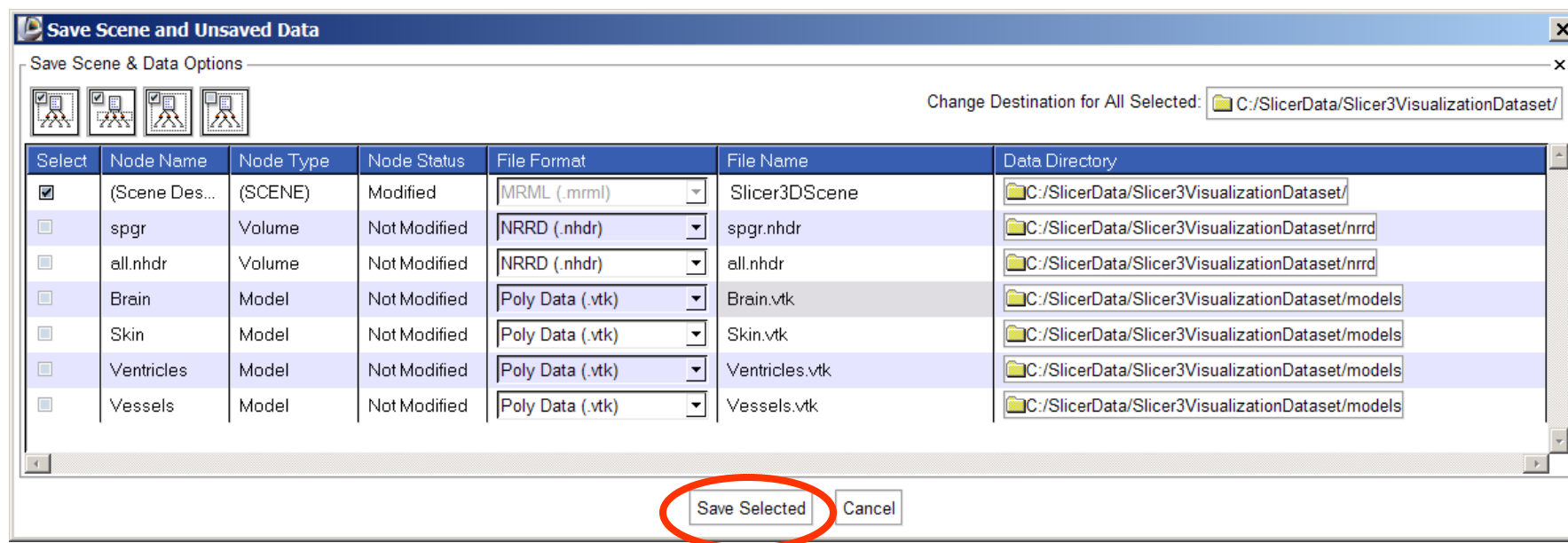
Double click on the file name **SlicerScene1** and change it to **Slicer3DScene**





Saving Data

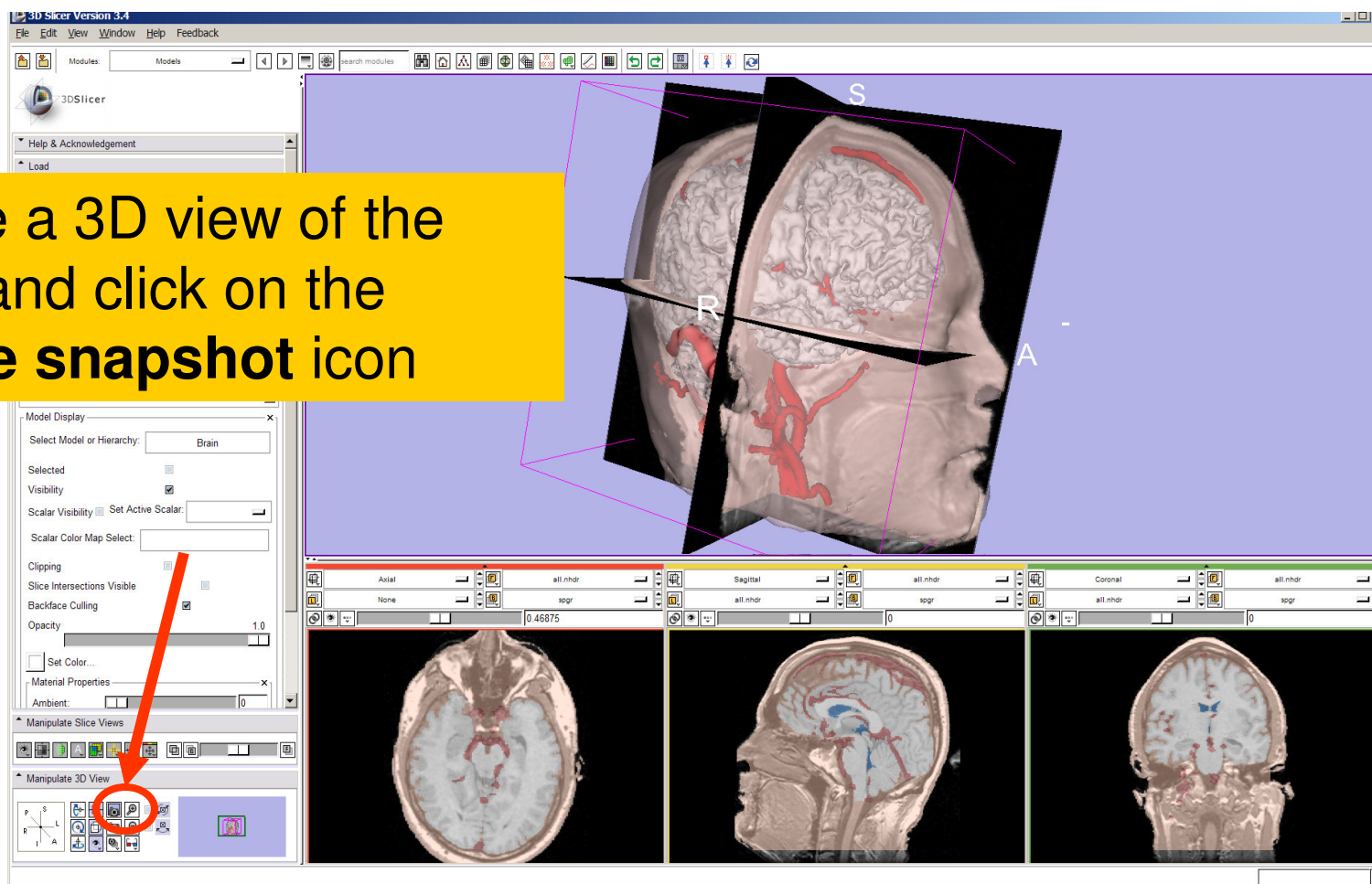
Click on **Save Selected**





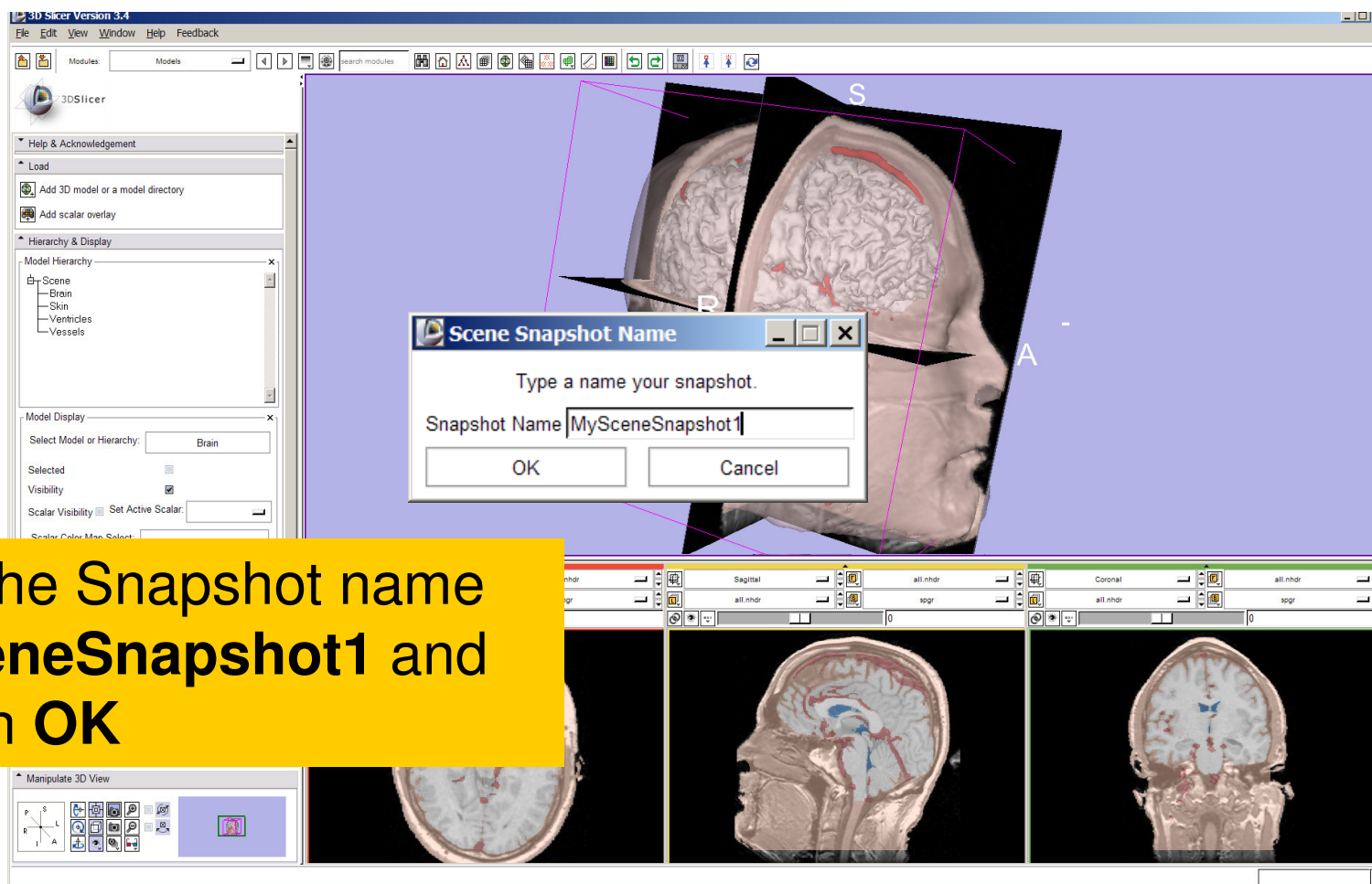
Creating Scene Snapshots

Choose a 3D view of the scene and click on the **capture snapshot** icon





Creating Scene Snapshots

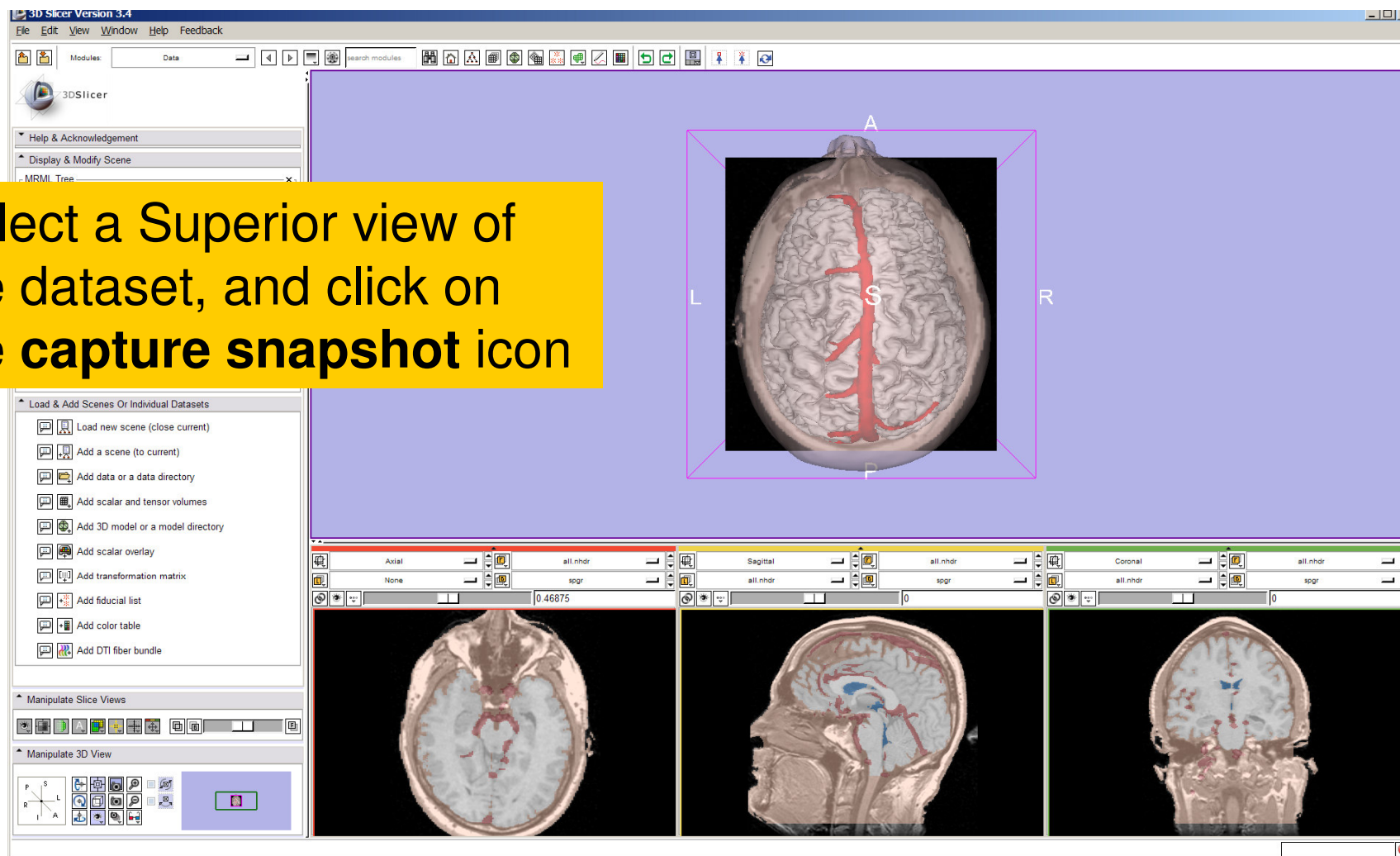


Enter the Snapshot name
MySceneSnapshot1 and
click on **OK**



Creating Scene Snapshots

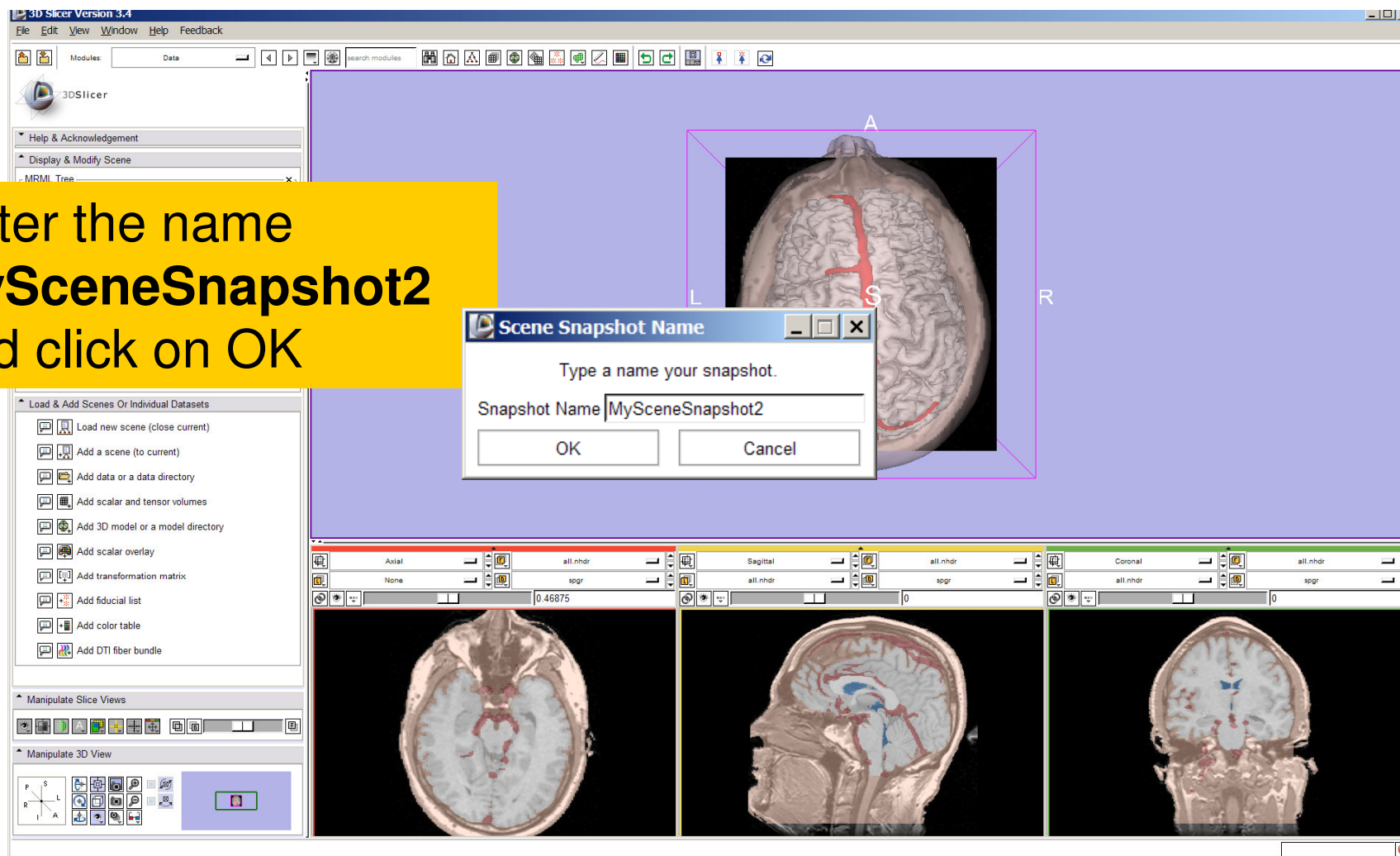
Select a Superior view of the dataset, and click on the **capture snapshot** icon





Creating Scene Snapshots

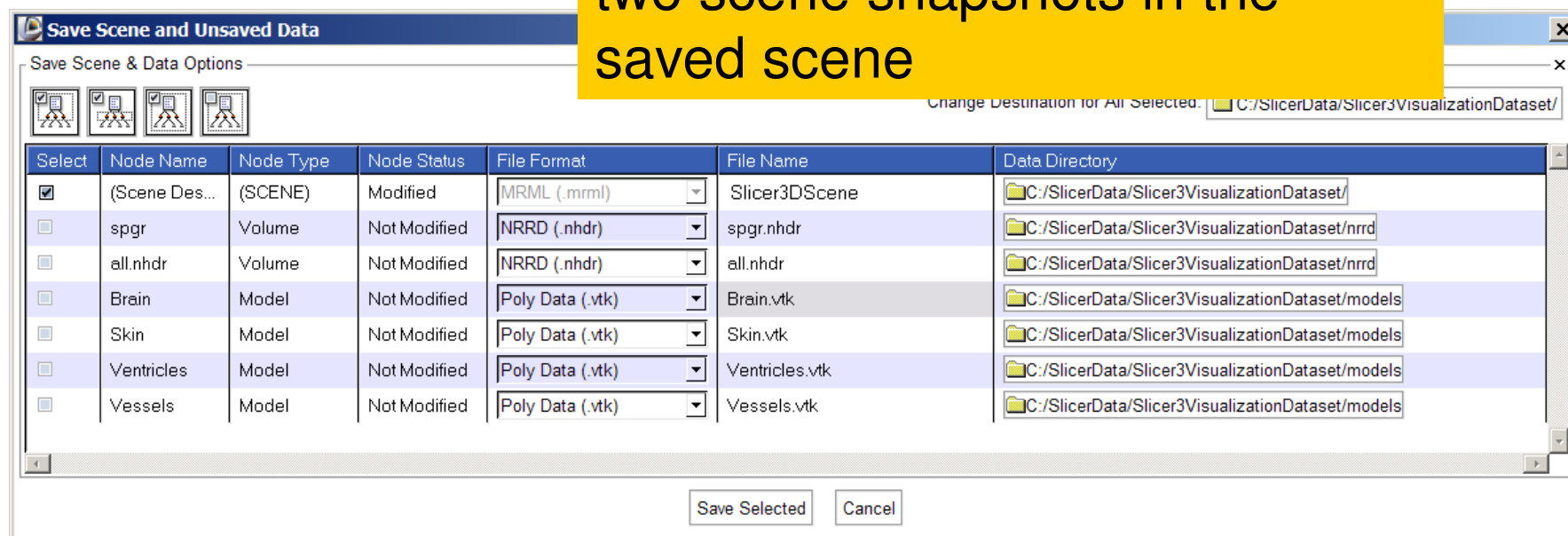
Enter the name
MySceneSnapshot2
and click on OK

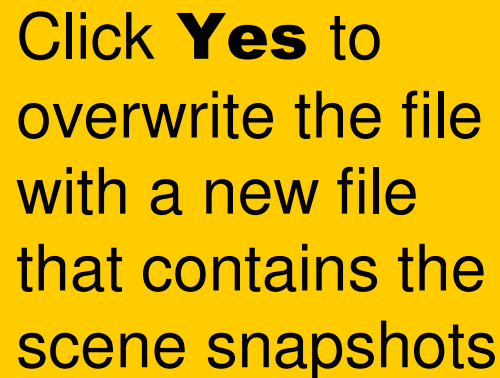




Creating Scene Snapshots

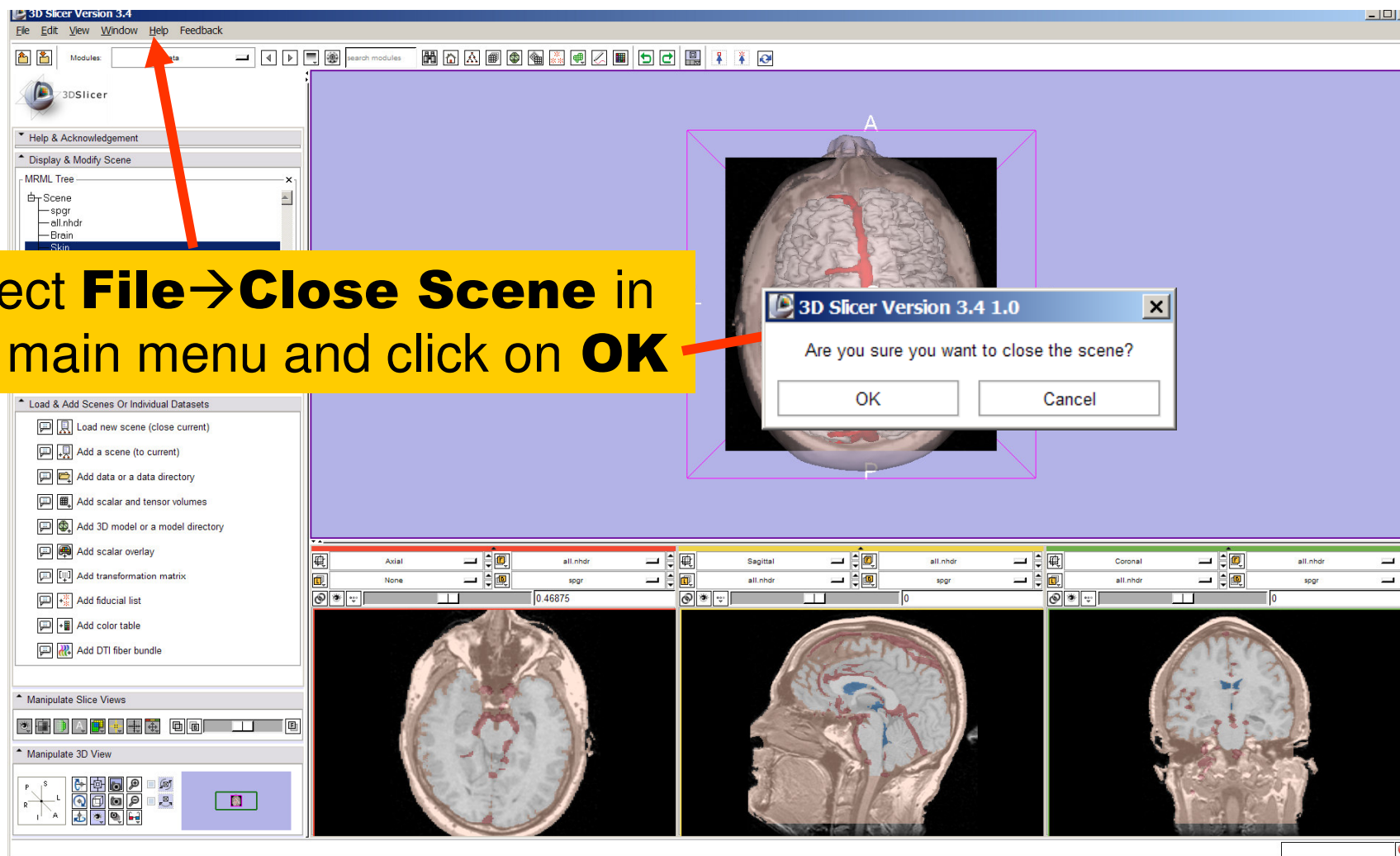
Select **File** → **Save** and click on **Save Selected** to include the two scene snapshots in the saved scene







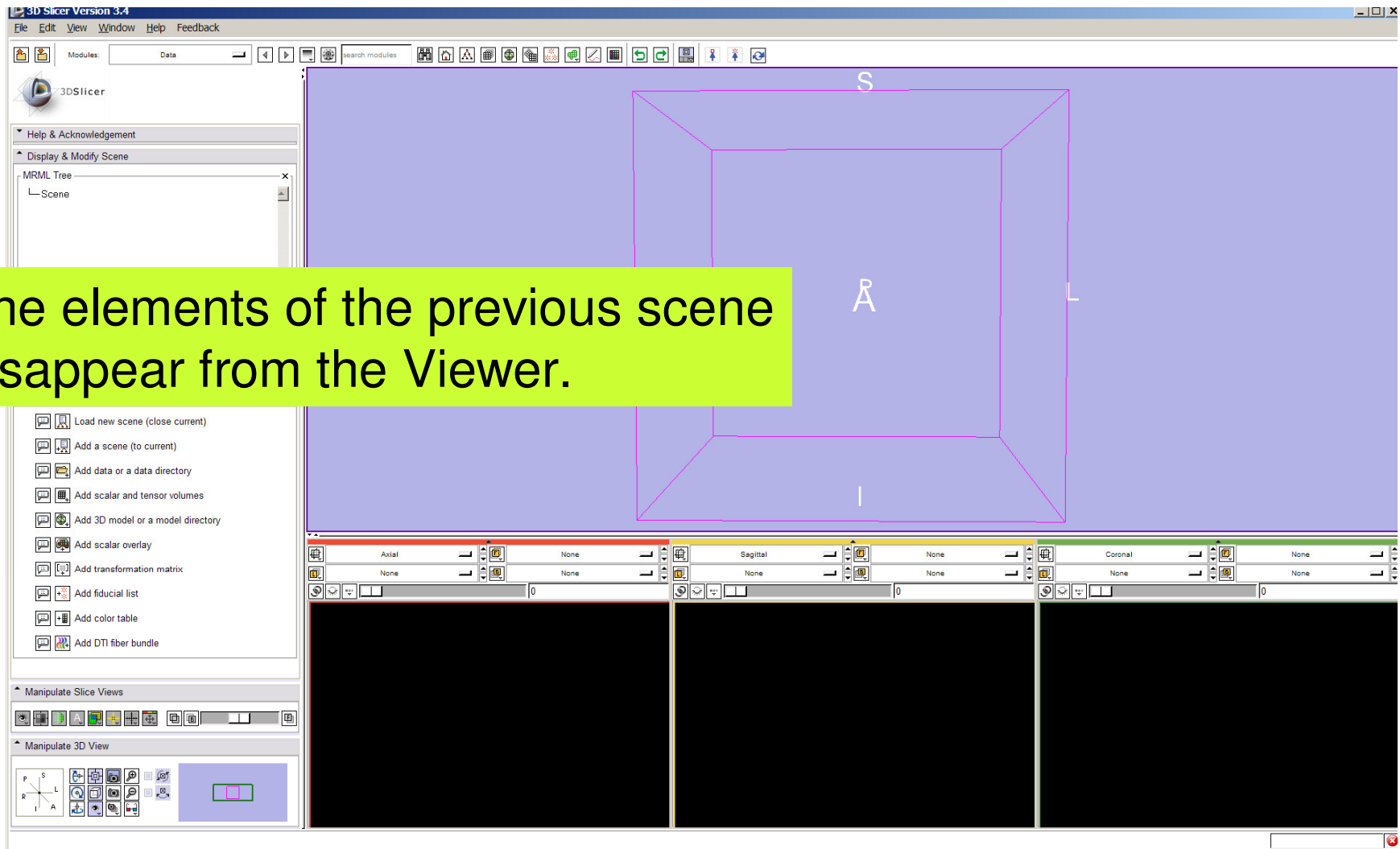
Saving Data





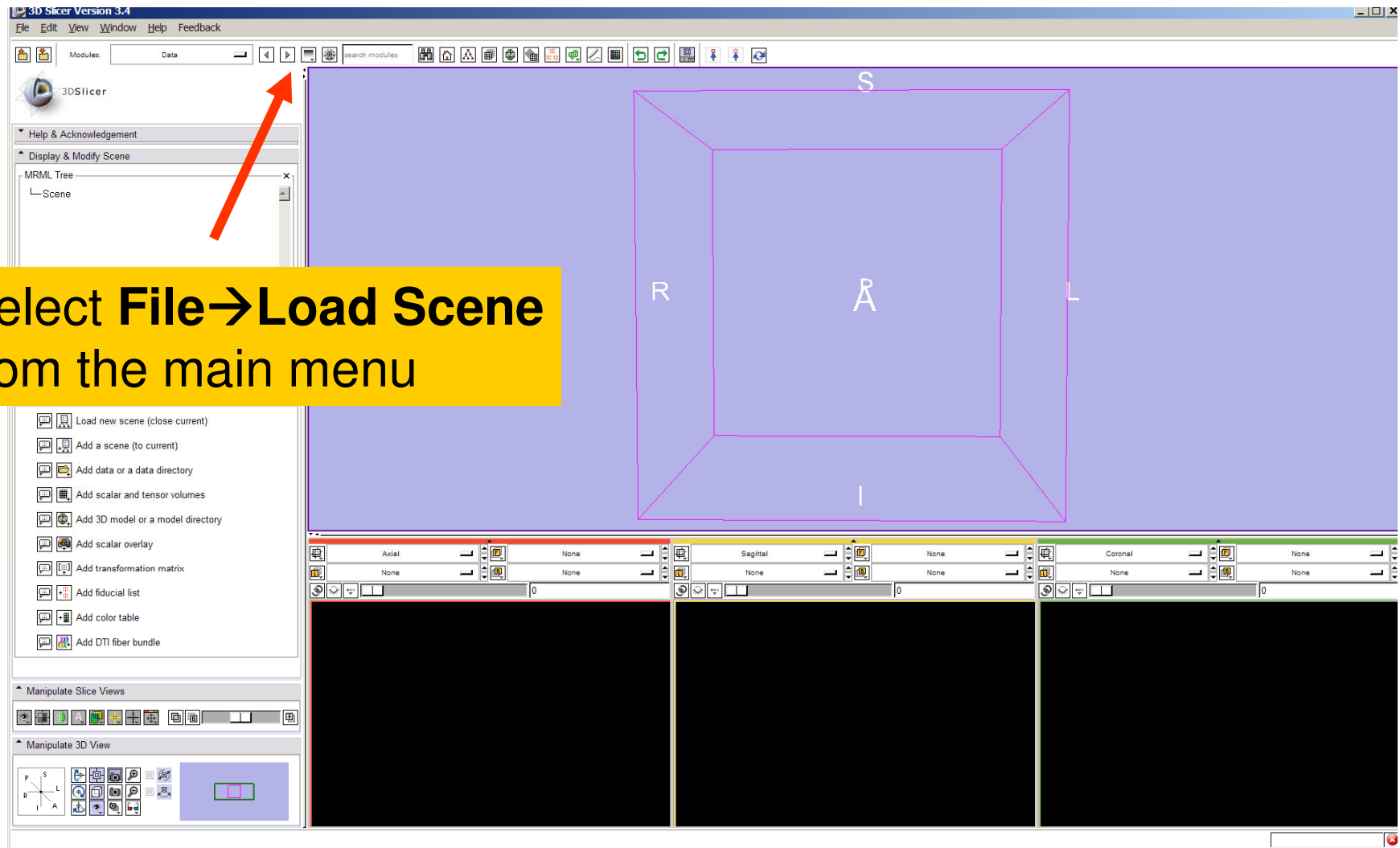
Saving Data

The elements of the previous scene disappear from the Viewer.



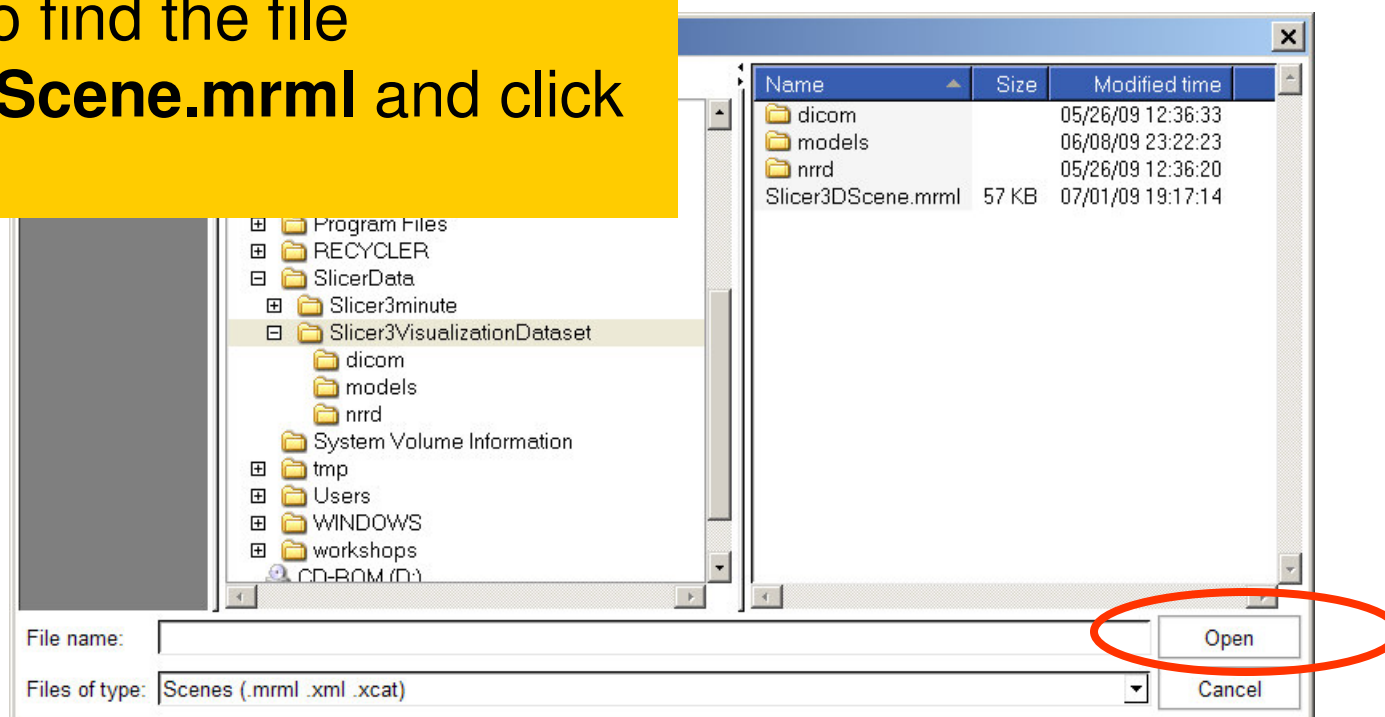


Saving Data



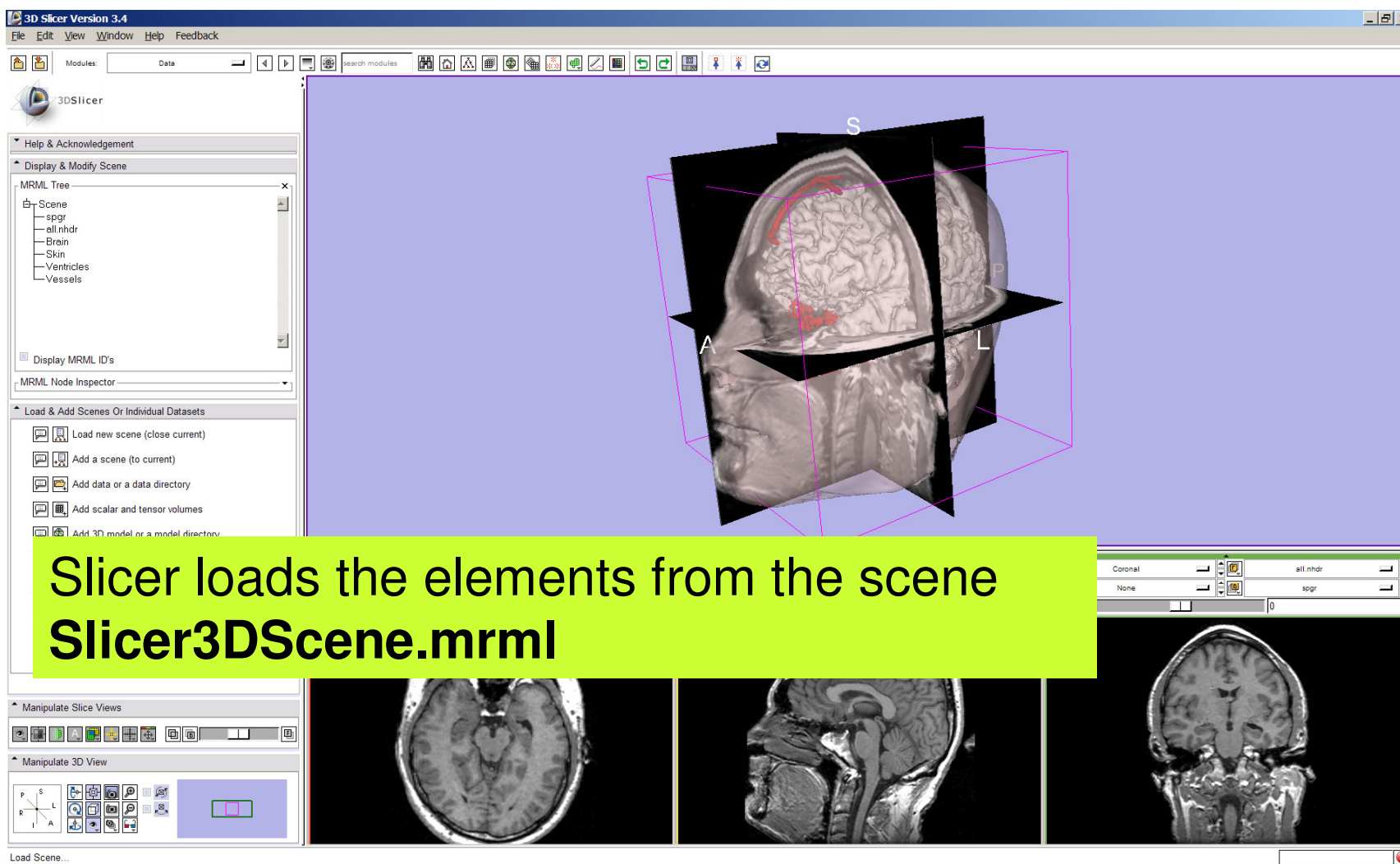
Saving Data

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



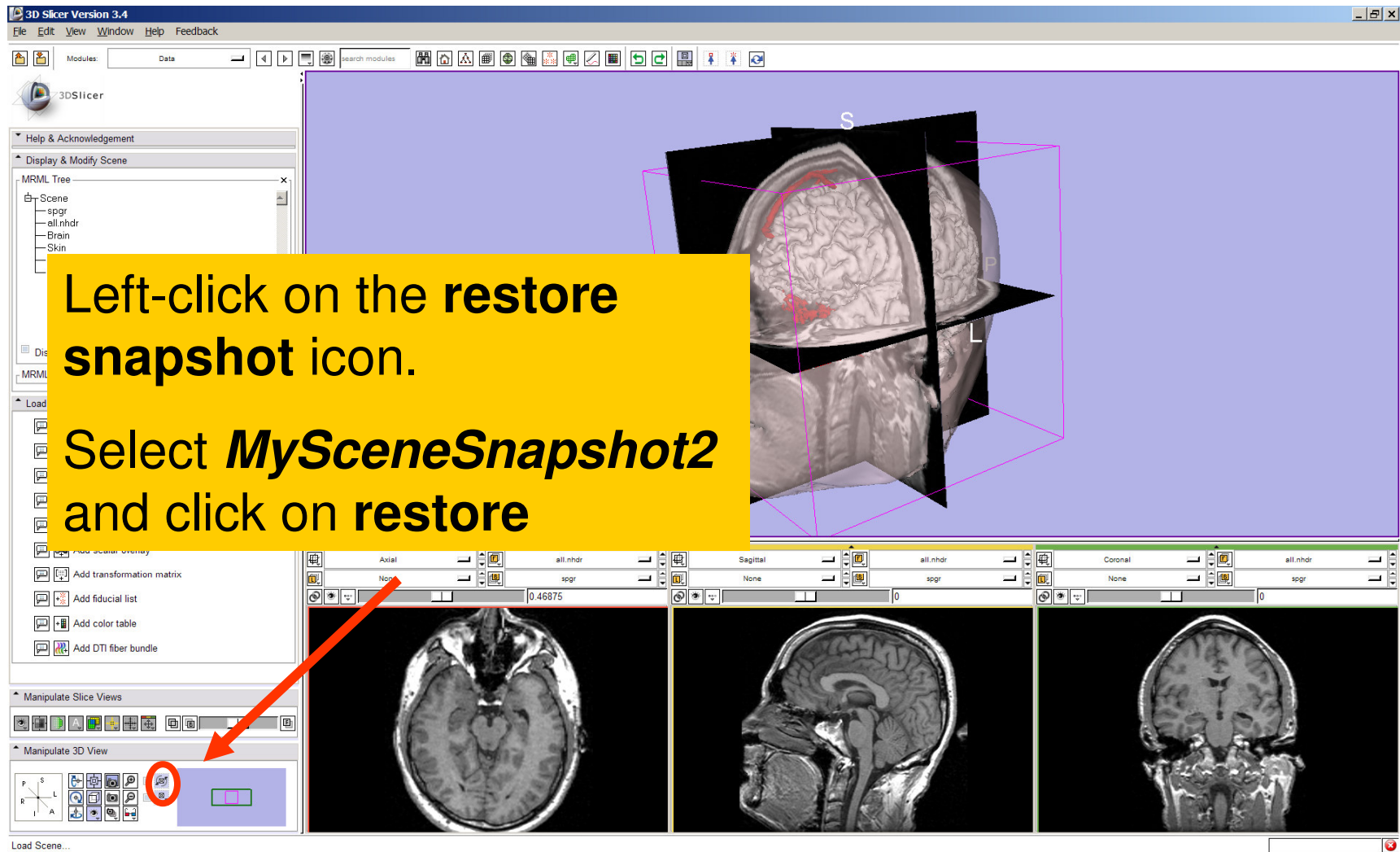


Loading a Scene





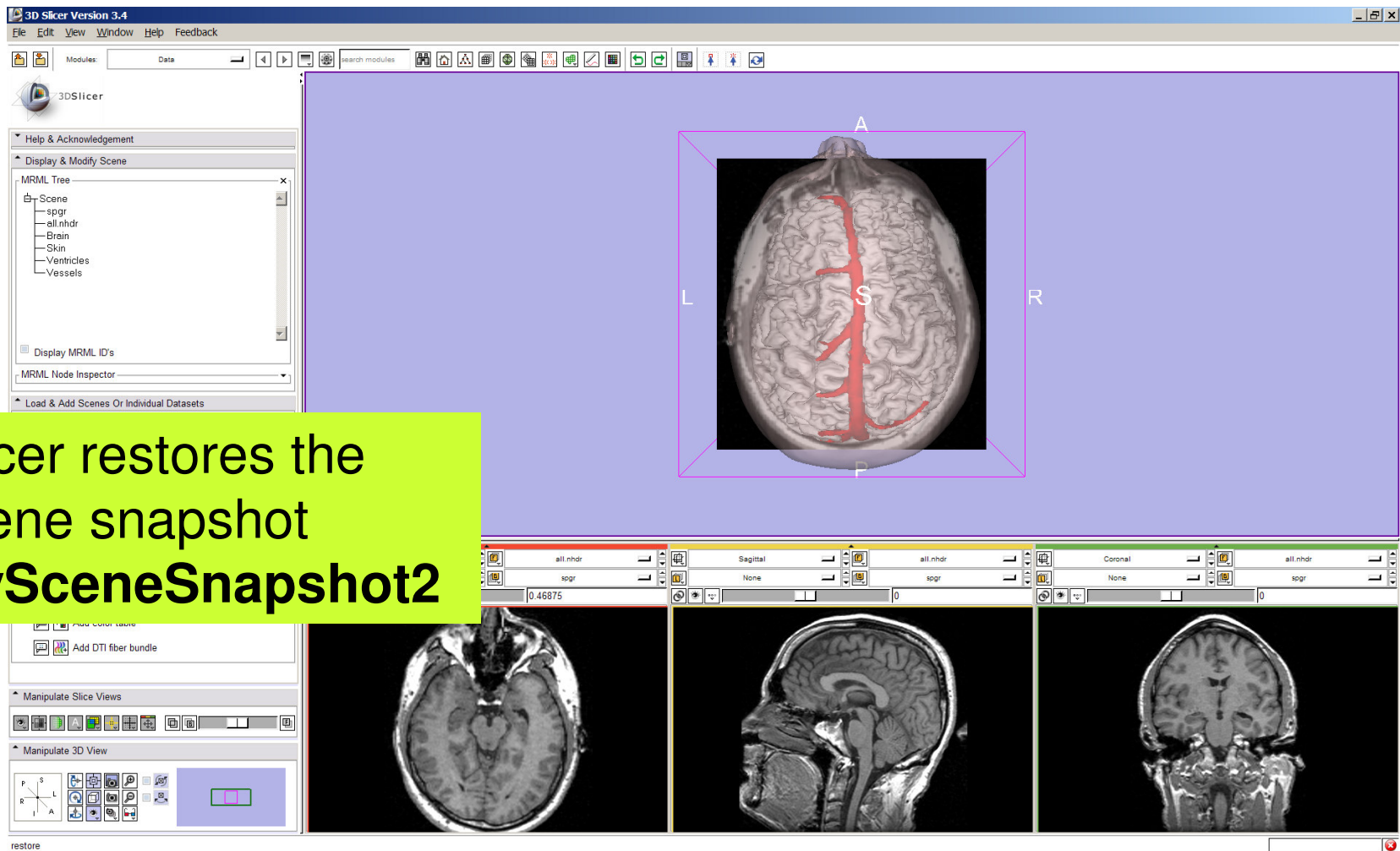
Loading a Scene



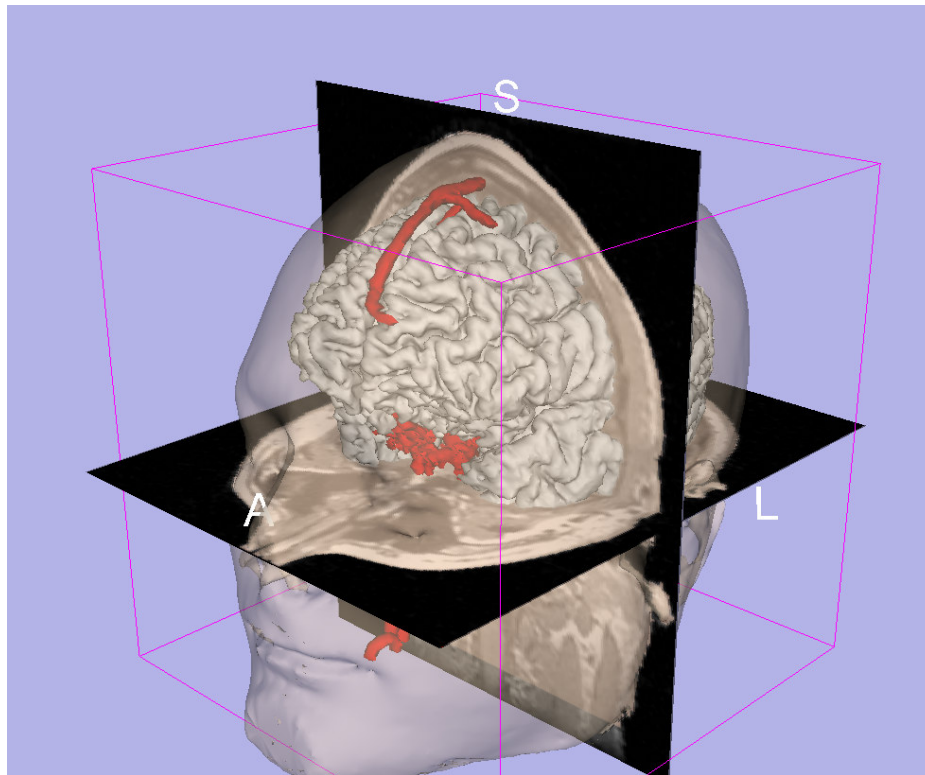


Loading a Scene

Slicer restores the
scene snapshot
MySceneSnapshot2



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