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# **Interactive Editor Tutorial**

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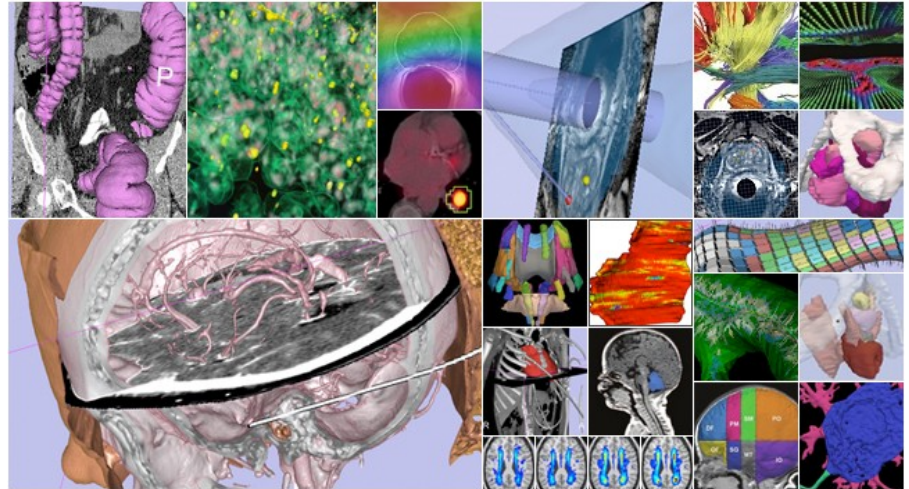
Surgical Planning Laboratory

Harvard Medical School



# Slicer3.6

- 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**

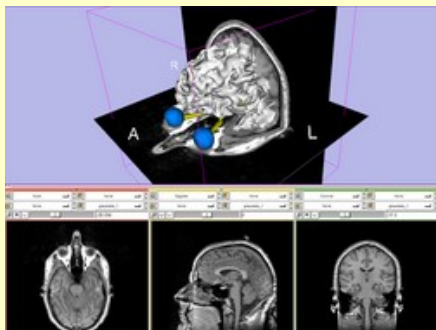




# Pre-requisite

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This course supposes that you have taken the following tutorial:



*'Slicer3 Data Loading and Visualization'*

[http://www.slicer.org/slicerWiki/index.php/Slicer3.6:Training#Software\\_tutorials](http://www.slicer.org/slicerWiki/index.php/Slicer3.6:Training#Software_tutorials)



# Material

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This course requires the following material

- Slicer3.6 release version available at

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

- EditorTutorialData.zip available at

<http://www.slicer.org/slicerWiki/index.php/File:EditorTutorialDataset.zip>

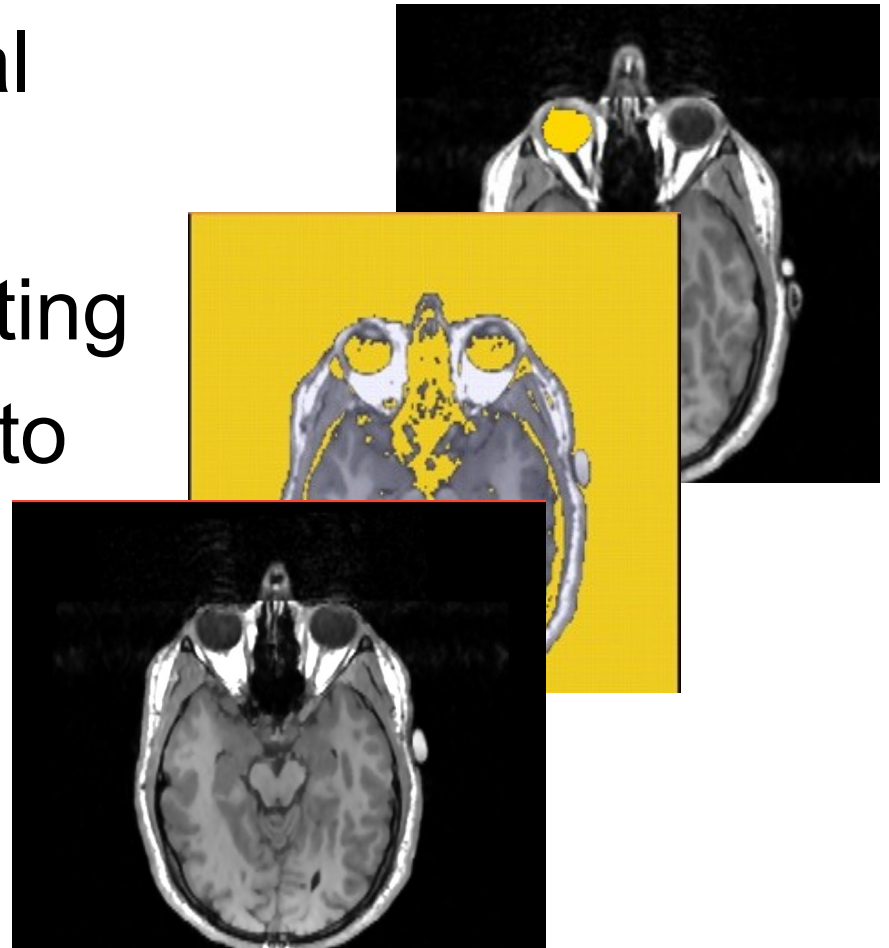
## **Disclaimer**

*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.*



# Learning Objective

The goal of this tutorial to train you to use the suite of interactive editing tools built in Slicer3.6 to create and edit label maps.





# Label map

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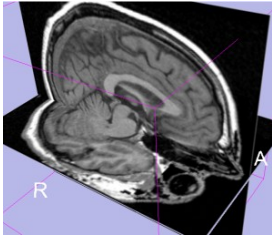


A **label map** has a number at each pixel representing the anatomy present at that point.



# Overview

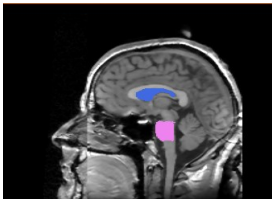
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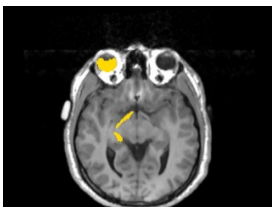
**Part 1:** Creating a single label map

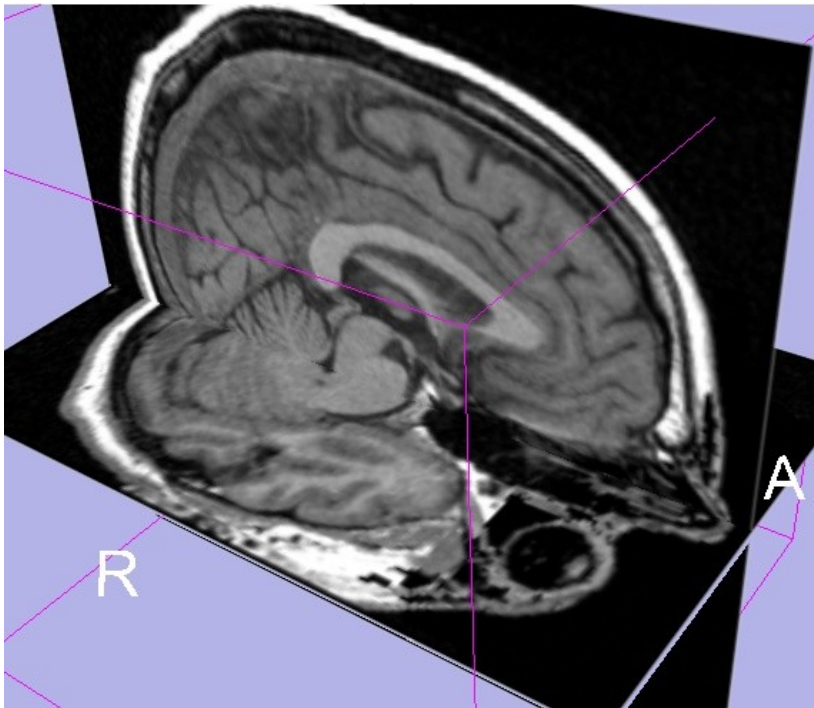


**Part 2:** Editing a single label map



**Part 3:** Creating and editing a label map with multiple labels





## Part 1: Creating a single label map





# Data Loading

3D Slicer Version 3.6 RC1

File Edit View Window Help Feedback

3DSlicer

Welcome & About

3DSlicer version 3.6 Welco

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/wiki/Contributing/SlicerLicenseForm>. 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

**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

Configuring Viewers & Layout

Mouse Modes

Customizing Slicer

Other Useful Hints

Community

Manipulate Slice Views

Manipulate 3D View

Select File → Add Volume and load the dataset grayscale.nrrd

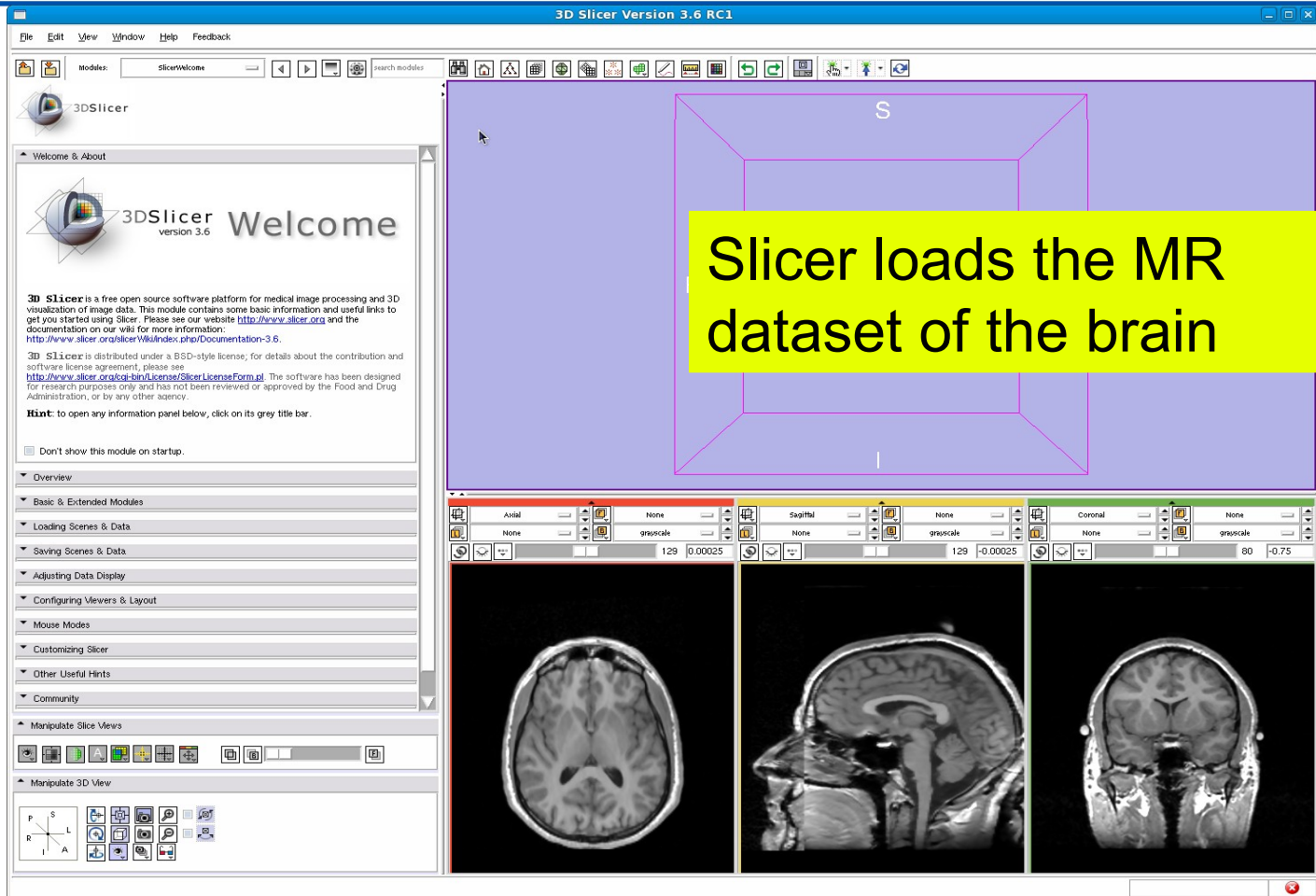
Axial None None

Sagittal None None

Coronal None None

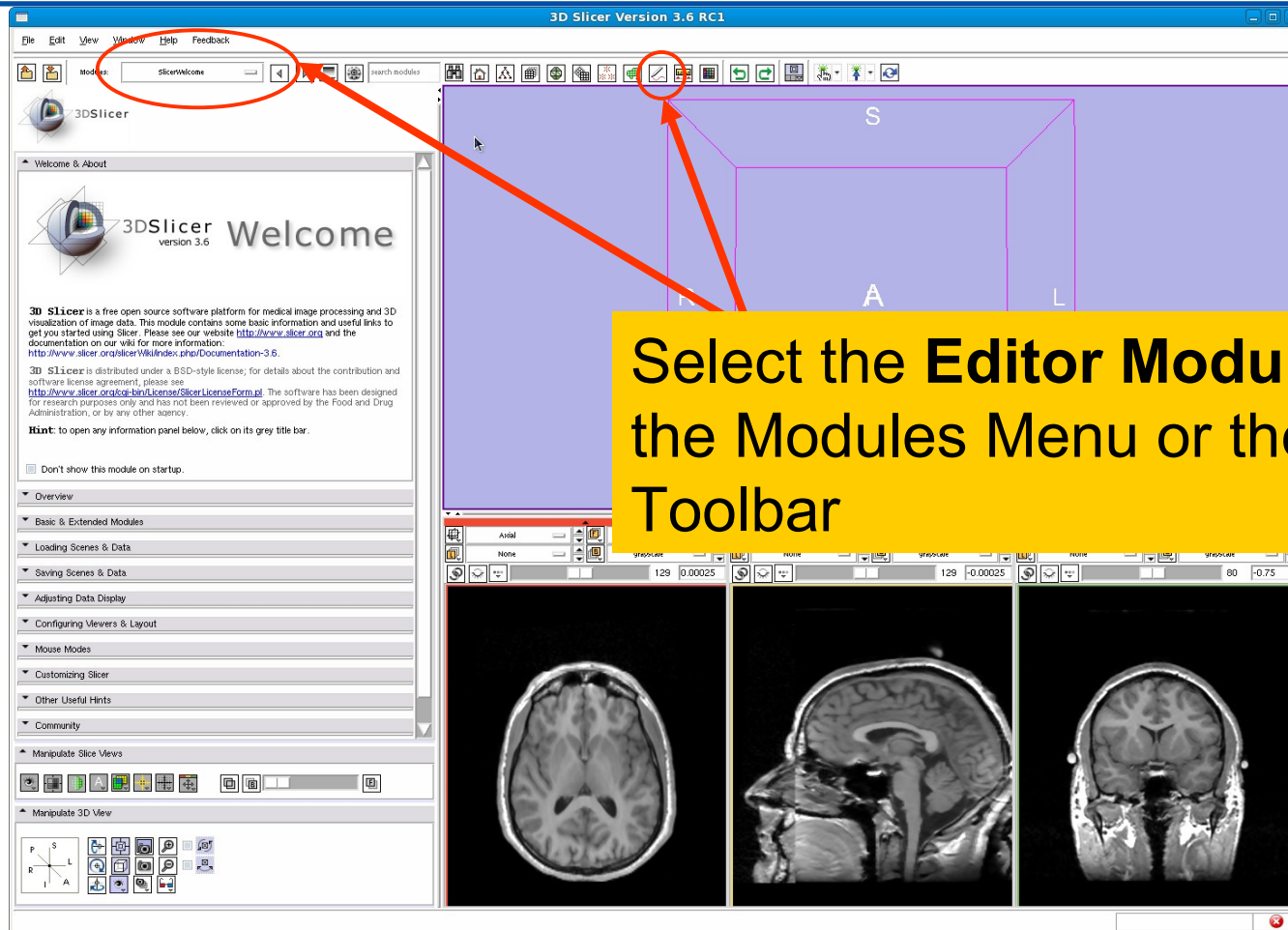


# Data Loading





# Data Loading





# Editor Module

The Editor module GUI is composed of two parts:

- the upper part contains the functionalities for creating single or multiple label maps,
- the lower part contains the functionalities for editing label maps.



# Label Map Creation

The screenshot displays the 3D Slicer software interface. The title bar reads "3D Slicer Version 3.6 RC1". The menu bar includes "File", "Edit", "View", "Window", "Help", and "Feedback". The main interface is divided into several panels:

- Left Panel:** Contains the "3DSlicer" logo and several expandable sections:
  - Help & Acknowledgement**
  - Create & Select Label Maps:** This section is highlighted with a red border. It includes a "Master Volume:" dropdown menu currently set to "None", a "Merge Volume:" field set to "None" with a "Set" button, and a "Per-Structure Volumes" dropdown.
  - Edit Selected Label Map**
  - Manipulate Slice Views:** Contains various icons for slice manipulation.
  - Manipulate 3D View:** Contains a 3D orientation diagram and various icons for 3D view manipulation.
- Top Right Panel:** A large purple area with a yellow callout box containing the text "Select the Master Volume grayscale". Below this callout, a purple wireframe box is overlaid on a 3D view, with axes labeled "R", "A", "L", and "I".
- Bottom Panel:** Displays three orthogonal slice views (Axial, Sagittal, Coronal) of a brain MRI. Each view has its own toolbar and a "None" dropdown menu. Below the views are numerical scales: "129 0.00025" for the Axial view, "129 -0.00025" for the Sagittal view, and "80 -0.75" for the Coronal view.



# Label Map Creation

3D Slicer Version 3.6

File Edit View Window Help Feedback

modules: Editor

3DSlicer

Help & Acknowledgement

Create & Select Label Maps

Master Volume: grayscale

Merge Volume: None

Per-Structure Volumes

Edit Selected Label Map

3D Slicer Version 3.6 1.0

Create a merge label map for selected master volume grayscale. New volume will be grayscale-label. Select the color table node will be used for segmentation labels.

Color Table: GenericAnatomyColors

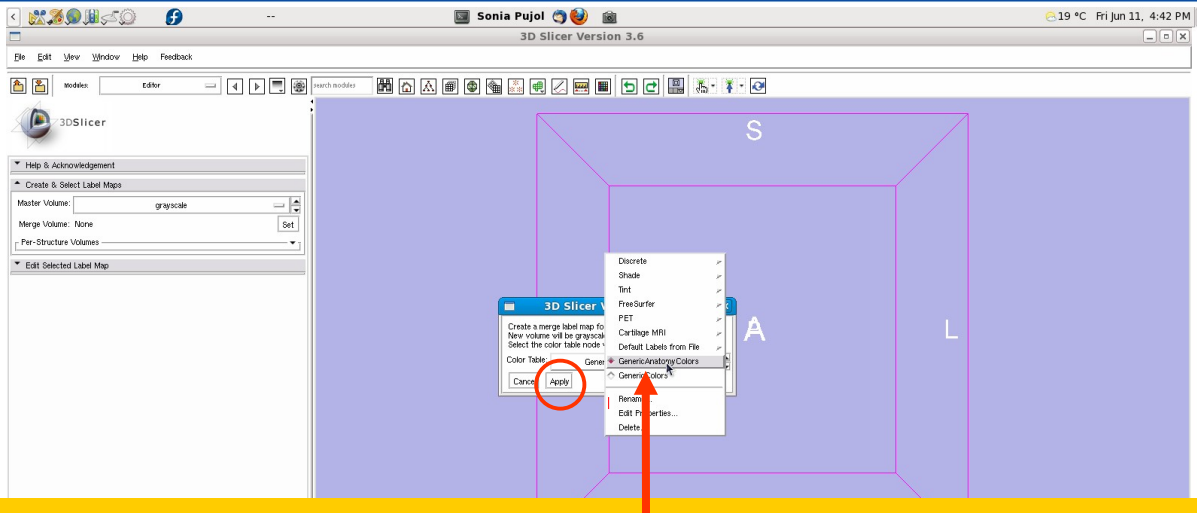
Cancel Apply

**GenericAnatomyColors is the default color map.**

**Click on the color map menu to display the list of available color maps.**



# Label Map Creation



Select the default color map **GenericAnatomyColors**  
Click on **Apply** to select it.

Note: You may use the Colors module if you need a custom or application specific color map

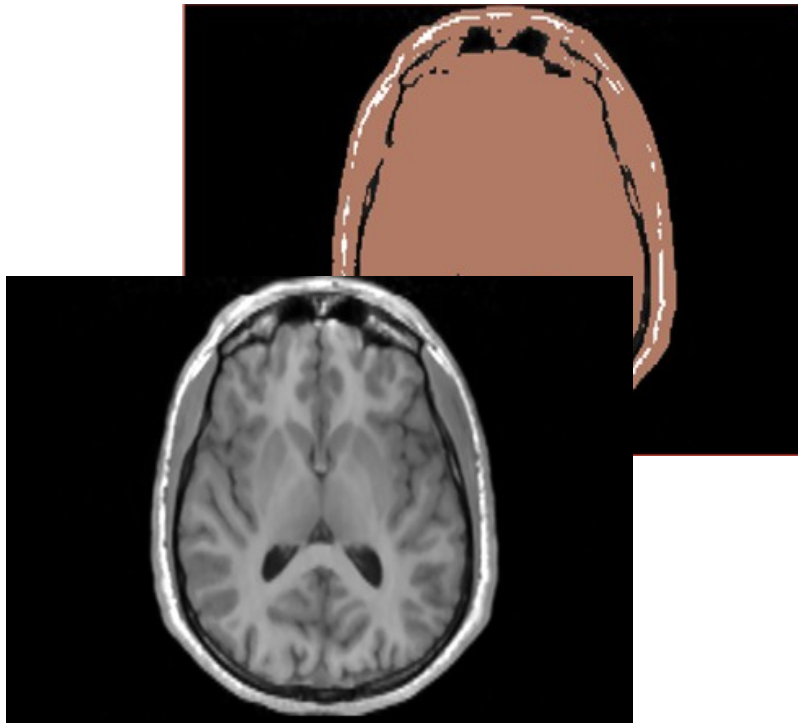


# Label Map Creation

Slicer creates the empty label map **grayscale-label** and displays the frame which contains the different tools for interactive editing.

The screenshot shows the 3D Slicer software interface. The 'Create & Select Label Maps' panel is visible on the left, with the 'Active Tool' section circled in red. The main 3D view shows a grayscale label map of a brain slice. The bottom of the interface displays three orthogonal views (Axial, Sagittal, Coronal) of the label map. The status bar at the bottom indicates the grayscale RAS coordinates: (-0.9, 153.5, -15.3), Bg IJK: (129, 111, 182), Bg: Out of Frame.

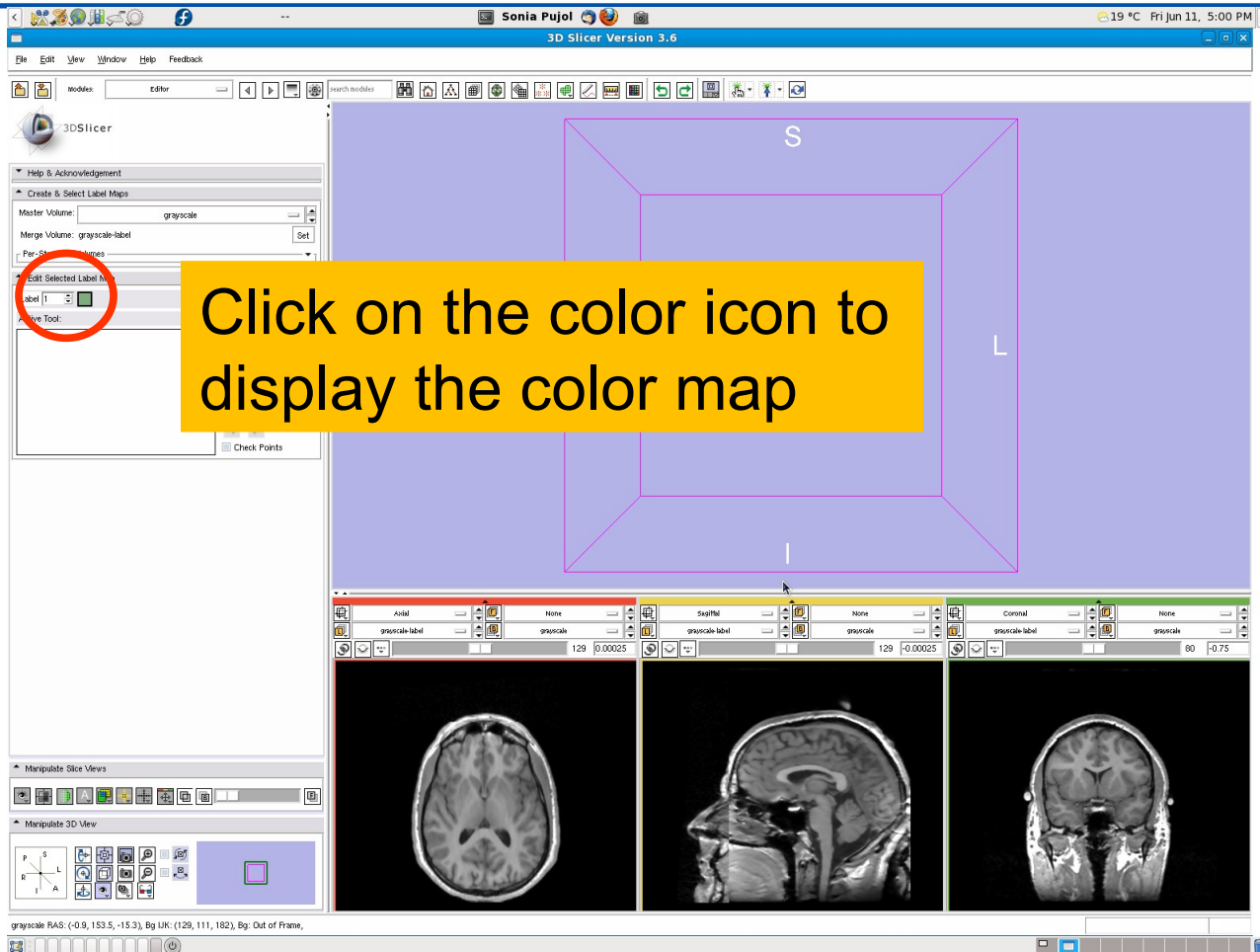




## Part 2: Editing a single label map



# Label Map Editing





# Label Map Editing

The screenshot shows the 3D Slicer software interface. A 'Color Box' dialog is open, displaying a table of color maps. The table has three columns: 'Number', 'Color', and 'Name'. The rows are as follows:

| Number | Color       | Name              |
|--------|-------------|-------------------|
| 0      | Black       | background        |
| 1      | Green       | tissue            |
| 2      | Orange      | bone              |
| 3      | Brown       | skin              |
| 4      | Light Blue  | connective_tissue |
| 5      | Red         | blood             |
| 6      | Dark Red    | organ             |
| 7      | Light Green | mass              |
| 8      | Dark Red    | muscle            |
| 9      | Yellow      | foreign_object    |

Below the Color Box dialog, a yellow banner contains the text: "Slicer displays the color map GenericAnatomyColors". At the bottom of the screenshot, three MRI slices are visible: an axial view, a sagittal view, and a coronal view.



# Label Map Editing

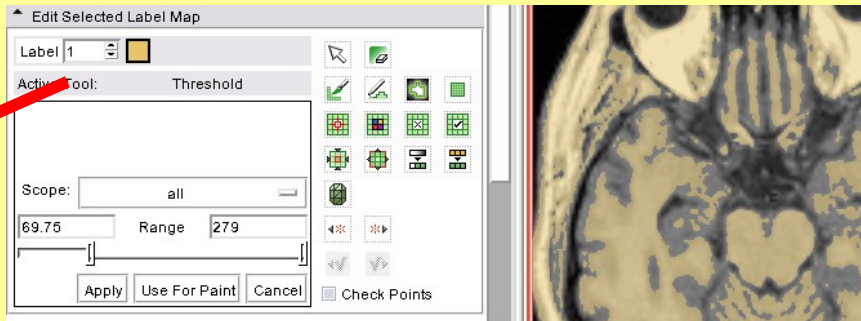
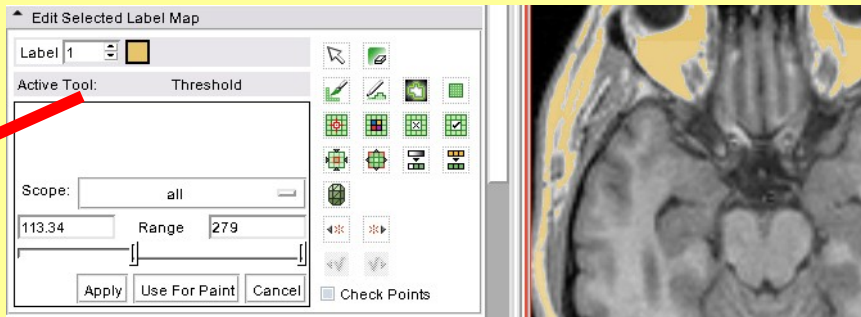
Browse through the list of 307 labels to explore the color map **GenericAnatomyColors**

Select the label #3 **'Skin'**

| Number | Color | Name                     |
|--------|-------|--------------------------|
| 125    |       | pia_mater                |
| 126    |       | muscles_of_head          |
| 127    |       | salivary_glands          |
| 128    |       | lips                     |
| 129    |       | nose                     |
| 130    |       | tongue                   |
| 131    |       | soft_palate              |
| 132    |       | right_inner_ear          |
| 133    |       | left_inner_ear           |
| 134    |       | right_external_ear       |
| 135    |       | left_external_ear        |
| 136    |       | right_middle_ear         |
| 137    |       | left_middle_ear          |
| 138    |       | right_eyeball            |
| 139    |       | left_eyeball             |
| 140    |       | skull                    |
| 141    |       | right_frontal_bone       |
| 142    |       | left_frontal_bone        |
| 143    |       | right_parietal_bone      |
| 144    |       | left_parietal_bone       |
| 145    |       | right_temporal_bone      |
| 146    |       | left_temporal_bone       |
| 147    |       | right_sphenoid_bone      |
| 148    |       | left_sphenoid_bone       |
| 149    |       | right_ethmoid_bone       |
| 150    |       | left_ethmoid_bone        |
| 151    |       | occipital_bone           |
| 152    |       | maxilla                  |
| 153    |       | right_zygomatic_bone     |
| 154    |       | right_lacrimal_bone      |
| 155    |       | vomer_bone               |
| 156    |       | right_palatine_bone      |
| 157    |       | left_palatine_bone       |
| 158    |       | mandible                 |
| 159    |       | neck                     |
| 160    |       | muscles_of_neck          |
| 161    |       | pharynx                  |
| 162    |       | larynx                   |
| 163    |       | thyroid_gland            |
| 164    |       | right_parathyroid_glands |
| 165    |       | left_parathyroid_glands  |



# Threshold



**Description:** The grey level volume voxels for which the intensity is within the specified range will be assigned the same label in the label map.



# Threshold Effect

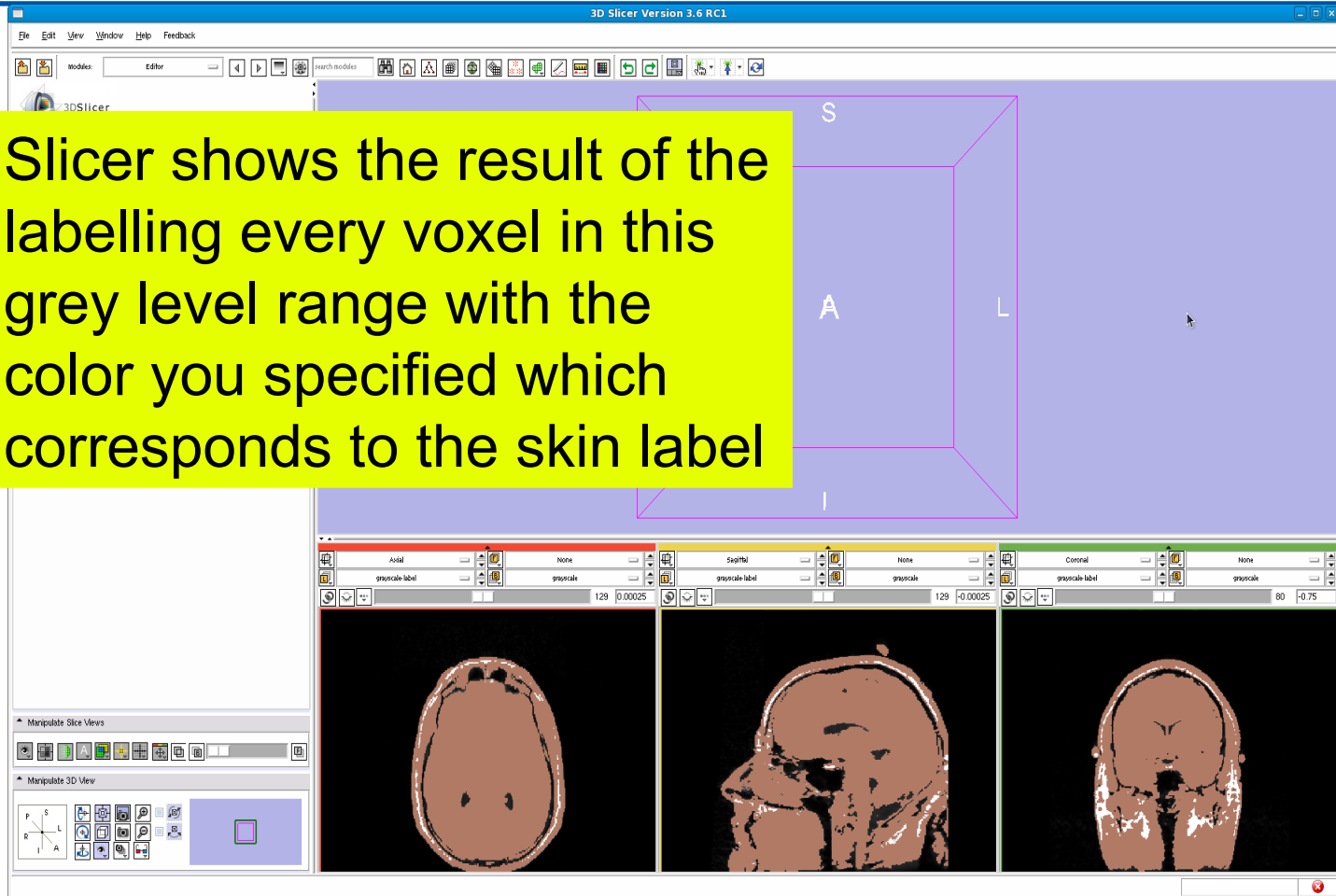
**Select the Threshold tool**

**Use the threshold slider to set the min and max values close to 24 and 120 and click on Apply**



# Threshold Effect

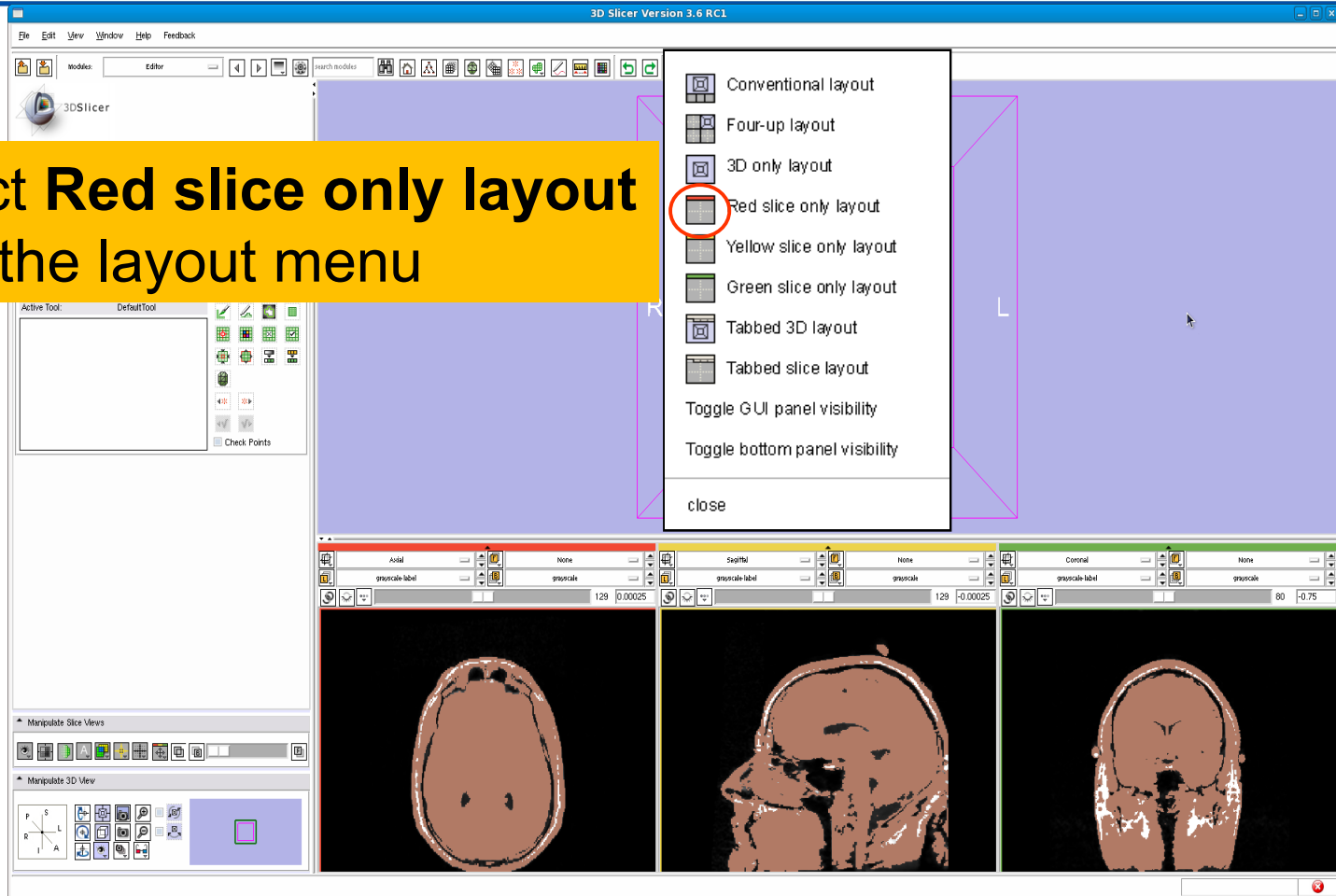
Slicer shows the result of the labelling every voxel in this grey level range with the color you specified which corresponds to the skin label





# Threshold Effect

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







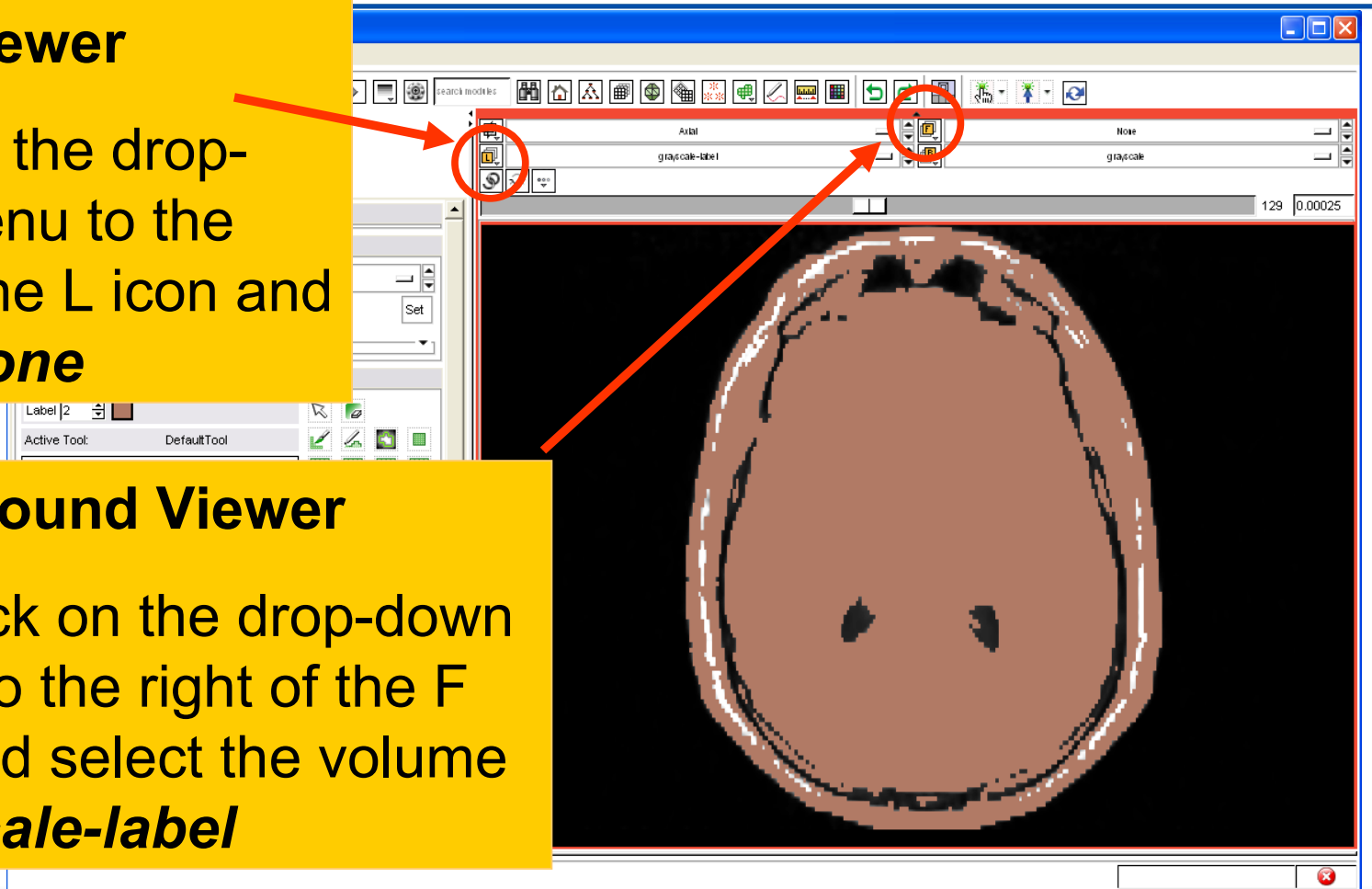
# Threshold Effect

## Label Viewer

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

## Foreground Viewer

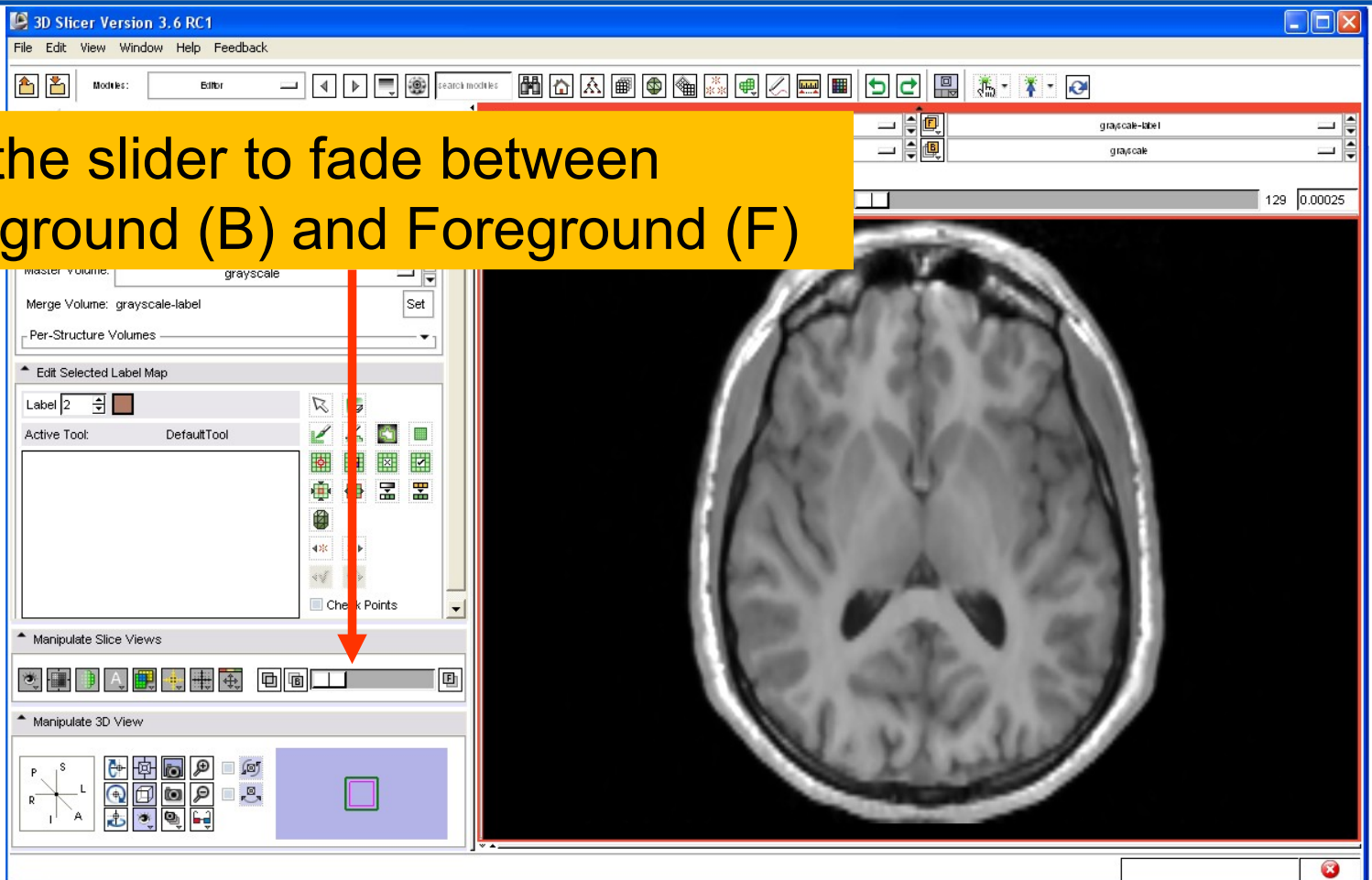
Left click on the drop-down menu to the right of the F icon and select the volume **grayscale-label**





# Threshold Effect

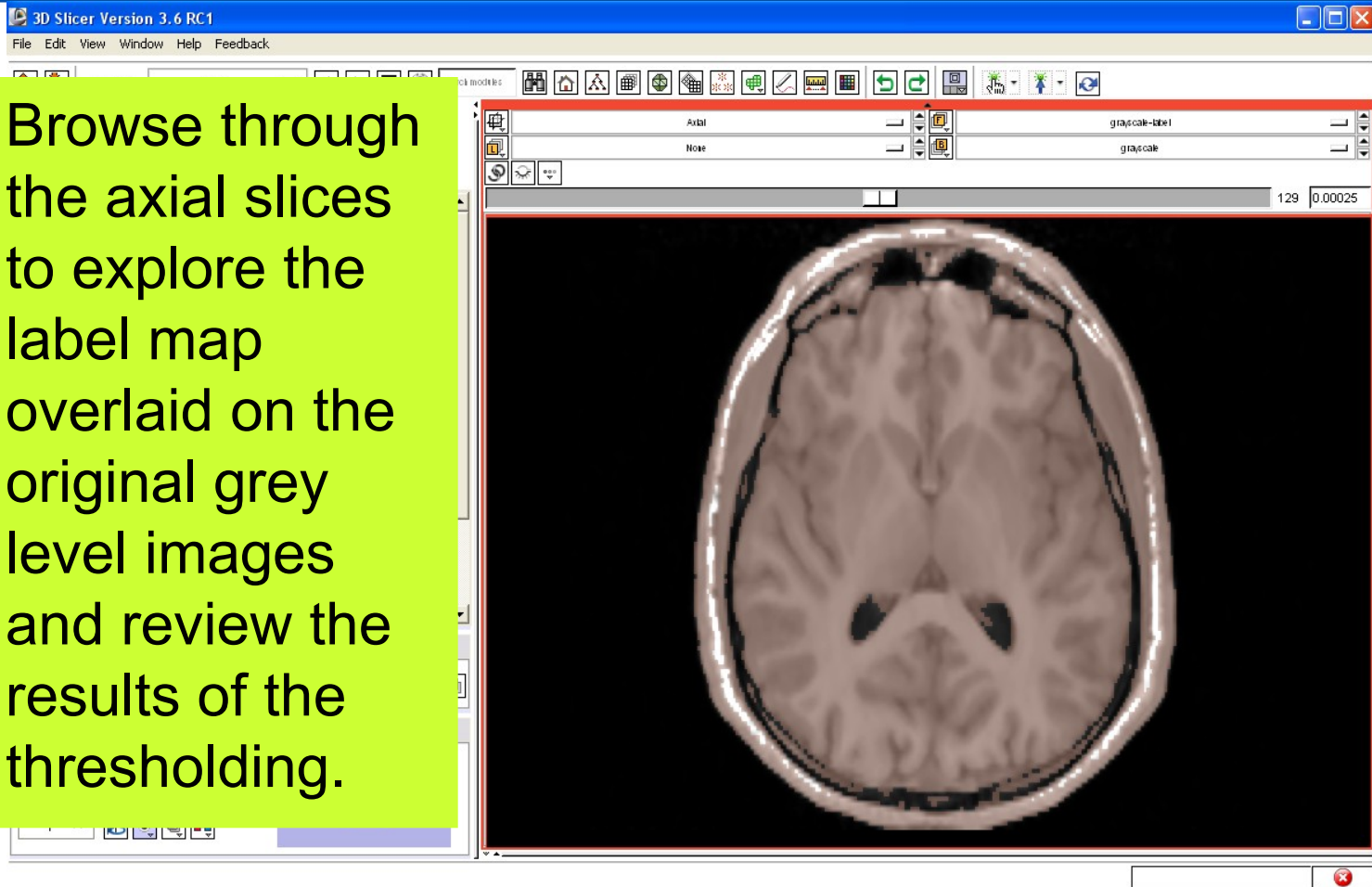
Use the slider to fade between Background (B) and Foreground (F)





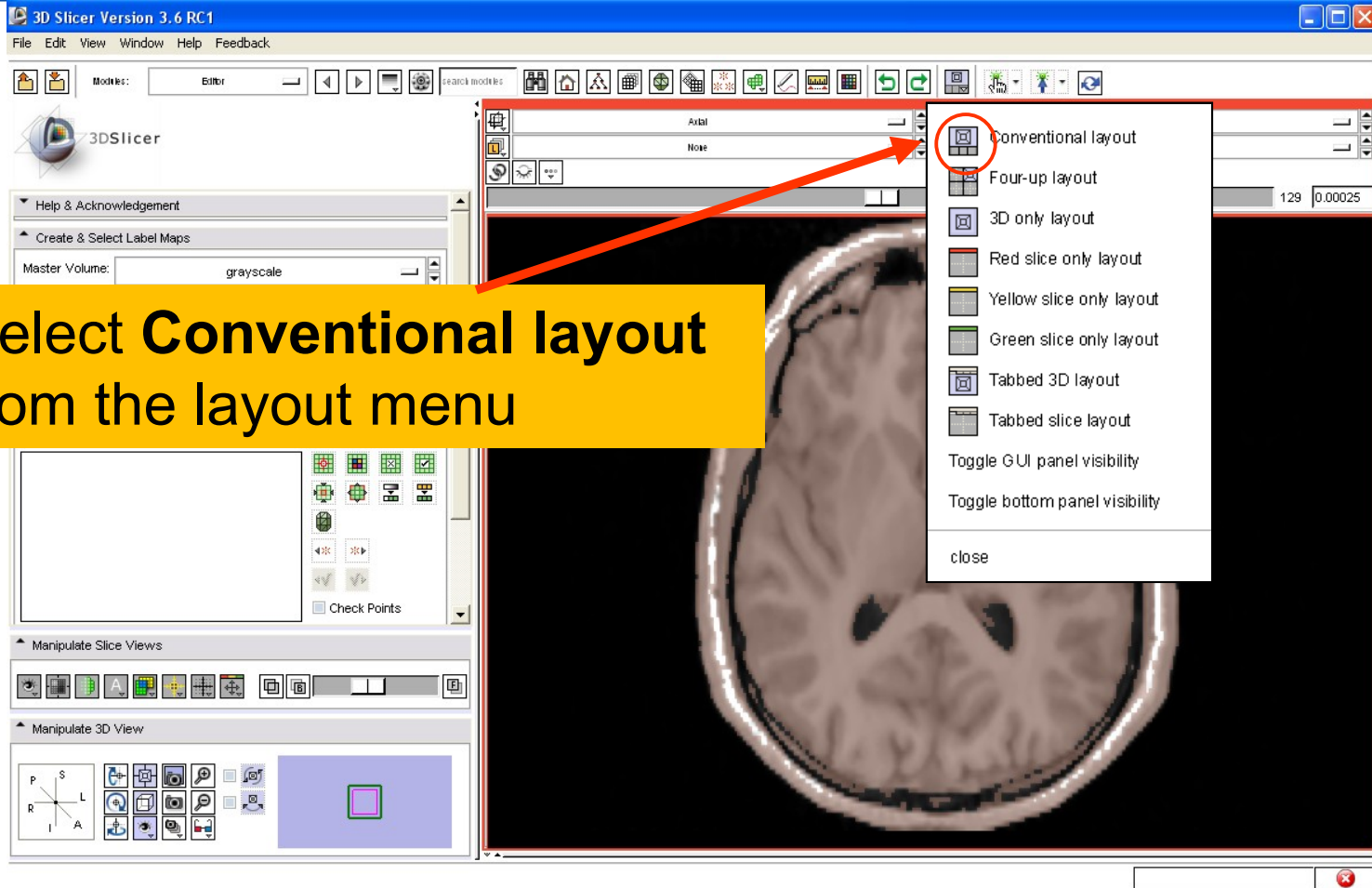
# Exploring the result

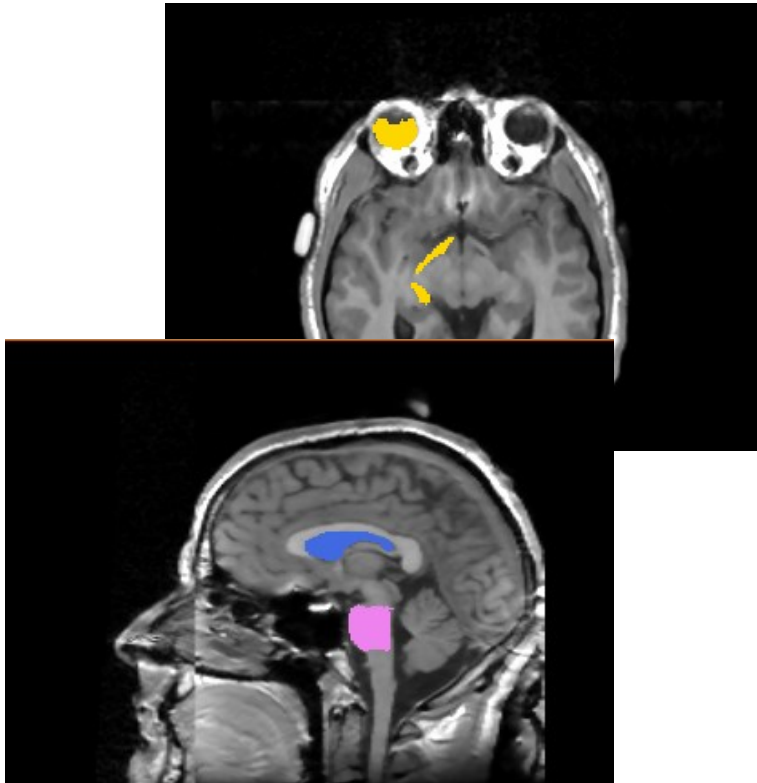
Browse through the axial slices to explore the label map overlaid on the original grey level images and review the results of the thresholding.





# Threshold Effect

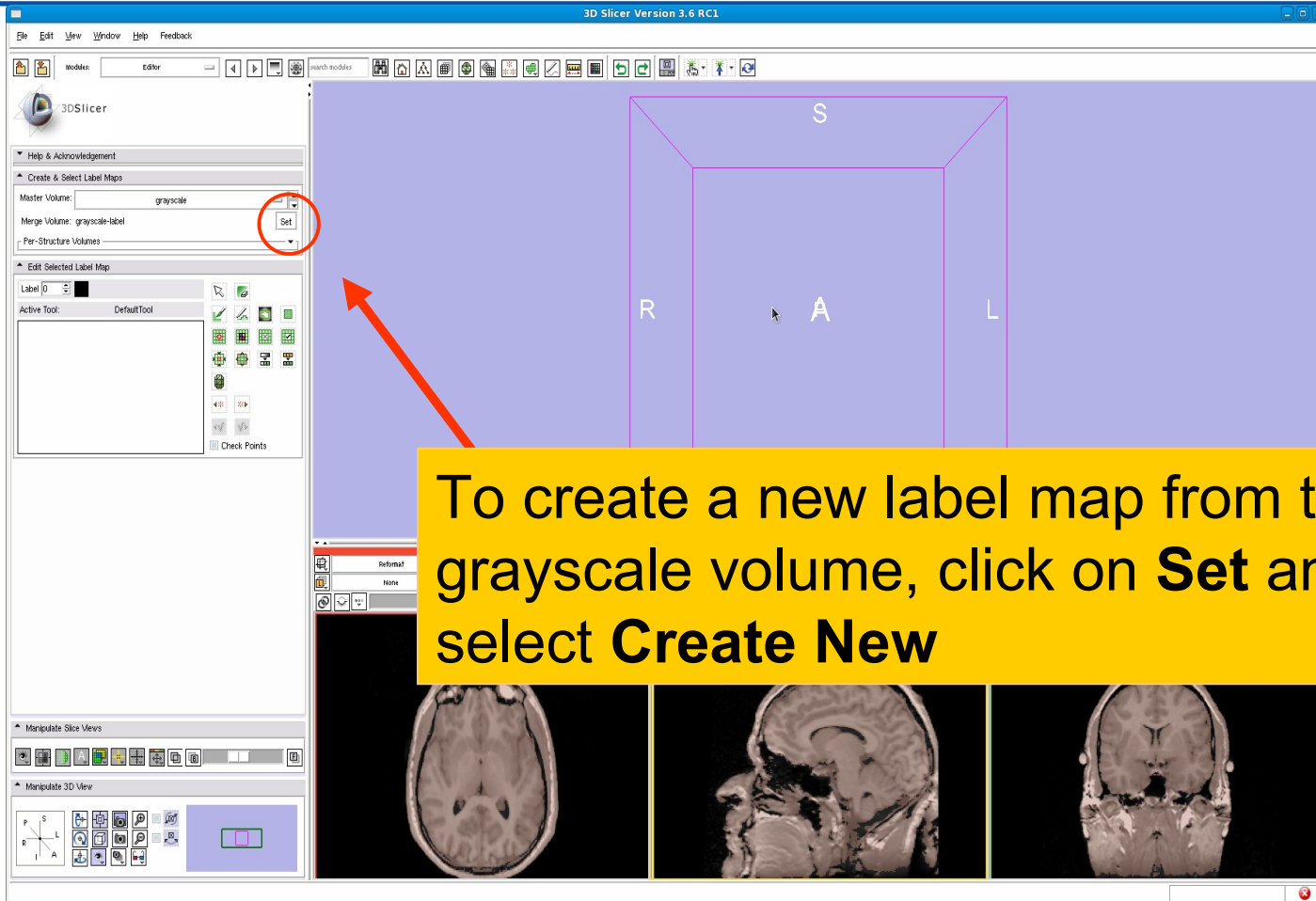




## Part 3: Creating and editing a label map with multiple labels



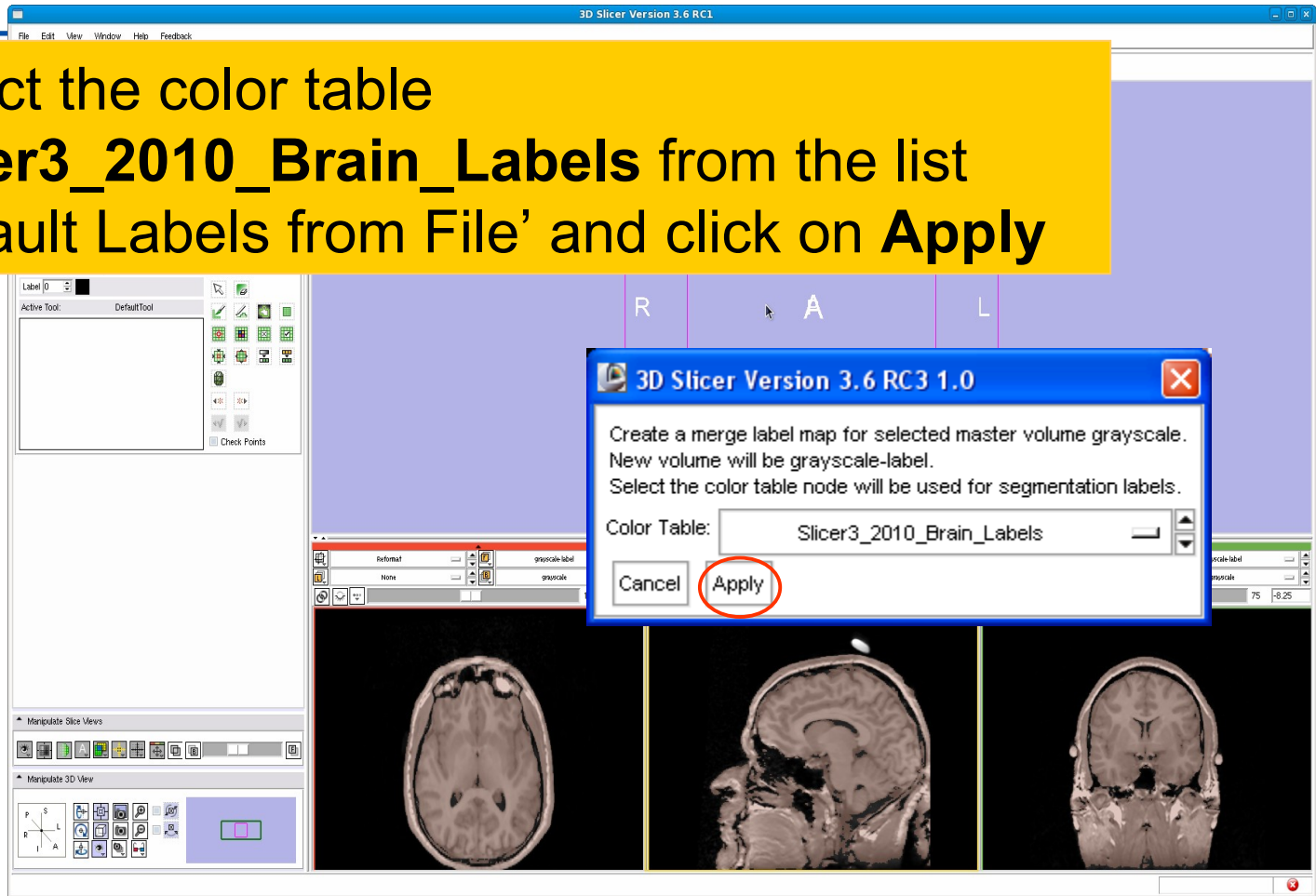
# Creating a map with multiple labels





# Creating a map with multiple labels

Select the color table  
**Slicer3\_2010\_Brain\_Labels** from the list  
'Default Labels from File' and click on **Apply**







# Creating a map with multiple labels

Slicer creates the new label map grayscale-label1

Expand the tab **Per-Structures Volumes**





# Adding a structure

Click on **Add Structure**, browse through the list of labels in the color map and select the color label #14 'Structure\_1'

| Number | Color     | Name         |
|--------|-----------|--------------|
| 6      | Blue      | Ventricles   |
| 7      | Red       | Arteries     |
| 8      | Dark Blue | Veins        |
| 9      | Gray      | Gray_matter  |
| 10     | Yellow    | White_matter |
| 11     | Green     | Tumor        |
| 12     | Cyan      | Edema        |
| 13     | Purple    | Necrosis     |
| 14     | Pink      | Structure_1  |
| 15     | Yellow    | Structure_2  |



# Drawing

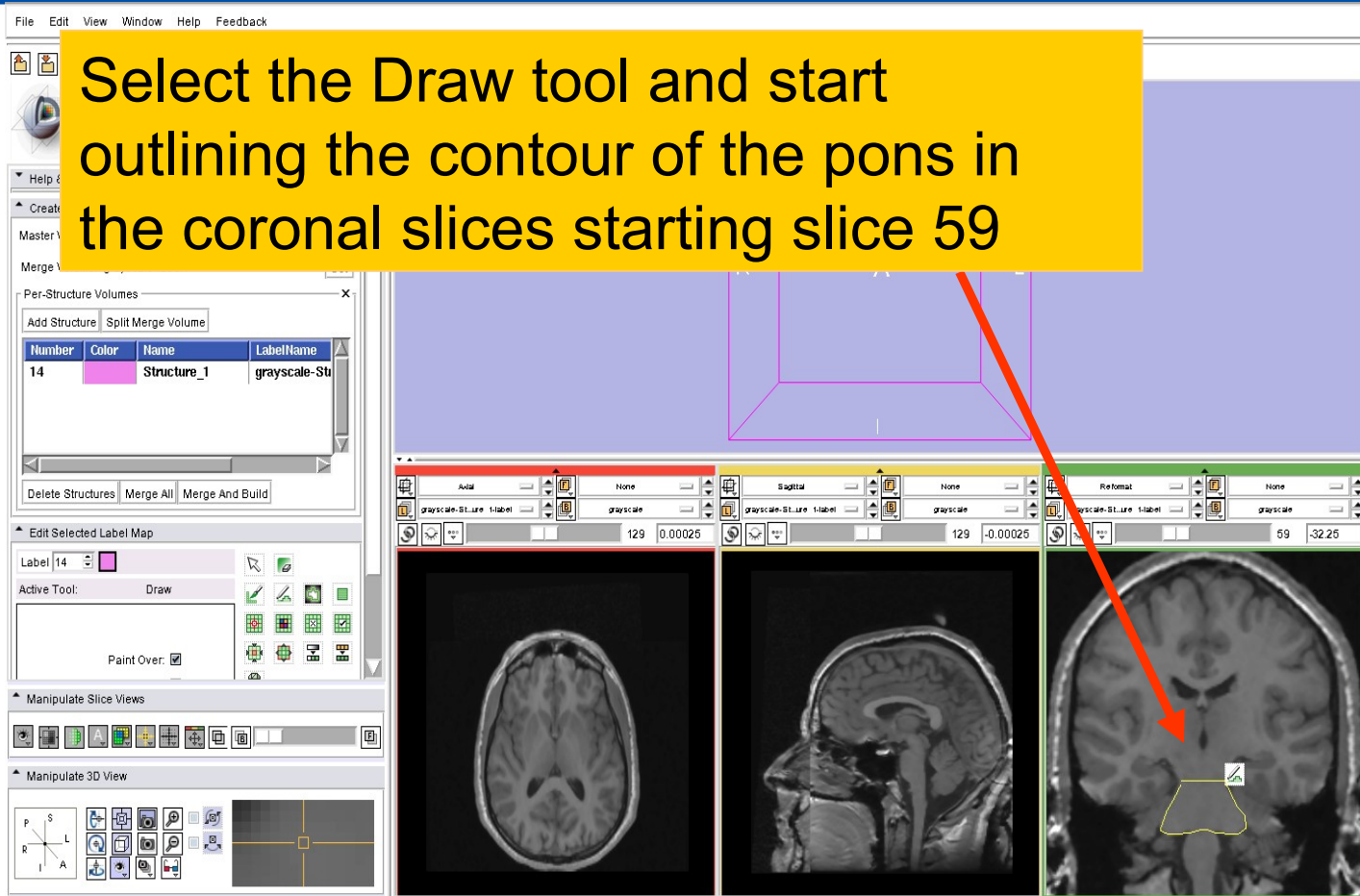


**Description:** The draw tool is an intuitive tool that can be used to manually outline structures in the grey level images.



# Draw Tool

Select the Draw tool and start outlining the contour of the pons in the coronal slices starting slice 59





# Draw Tool

File Edit View Window Help Feedback

3DSlicer

Per-Structure Volumes

| Number | Color | Name        | LabelName     |
|--------|-------|-------------|---------------|
| 14     |       | Structure_1 | grayscale-Stu |

Delete Structures Merge All Merge And Build

Edit Selected Label Map

Label 14

Active Tool: Draw

Paint Over:

Threshold Painting:

Threshold 1

Cancel Apply  Check Points

Manipulate Slice Views

Manipulate 3D View

Click on **Apply** to update the values of the label map pixels

R A L

grayscale-St.ure 1-label grayscale grayscale grayscale-St.ure 1-label grayscale grayscale

129 0.00025 129 -0.00025 60 -30.75

grayscale RAS: (-2.8, 125.1, 204.9), Lb: Slice not shown, Bg: Slice not shown.



# Draw Tool

Repeat the process to draw the outline of the pons from coronal slice between ~ slice 59 and slice 67

The screenshot shows the 3DSlicer software interface. The 'Per-Structure Volumes' panel is open, displaying a table with the following data:

| Number | Color  | Name        | LabelName     |
|--------|--------|-------------|---------------|
| 14     | [Pink] | Structure_1 | grayscale-Stu |

The 'Edit Selected Label Map' panel shows the 'Active Tool' set to 'Draw'. The 'Threshold Painting' section is visible with a 'Threshold' value of 1. The interface also shows three view windows: Axial, Sagittal, and Coronal. The Coronal view shows a pink outline of a structure. The status bar at the bottom indicates 'grayscale RAS: (-2.8, 125.1, 204.9), Lb: Slice not shown, Bg: Slice not shown.'



# Adding a second structure

Click on **Add Structure** and select the label #6 'Ventricles'

| Number | Color | Name        | LabelName     |
|--------|-------|-------------|---------------|
| 14     |       | Structure_1 | grayscale-Stu |

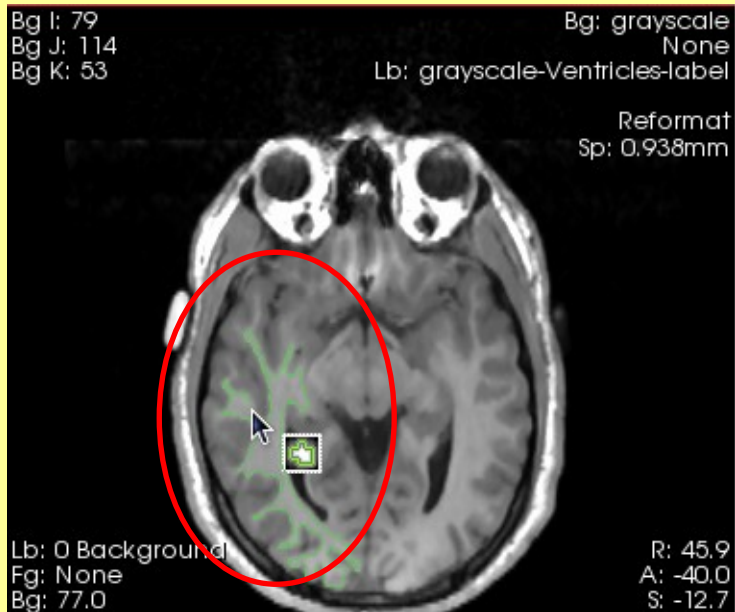
| Number | Color | Name        |
|--------|-------|-------------|
| 0      |       | Background  |
| 1      |       | Bone        |
| 2      |       | Skin        |
| 3      |       | Muscles     |
| 4      |       | Fat         |
| 5      |       | CSF         |
| 6      |       | Ventricles  |
| 7      |       | Arteries    |
| 8      |       | Veins       |
| 9      |       | Gray_matter |

grayscale RAS: (77.3, -27.8, 126.7), Lb: Slice not shown, Bg: Slice not shown.






# Level Tracing

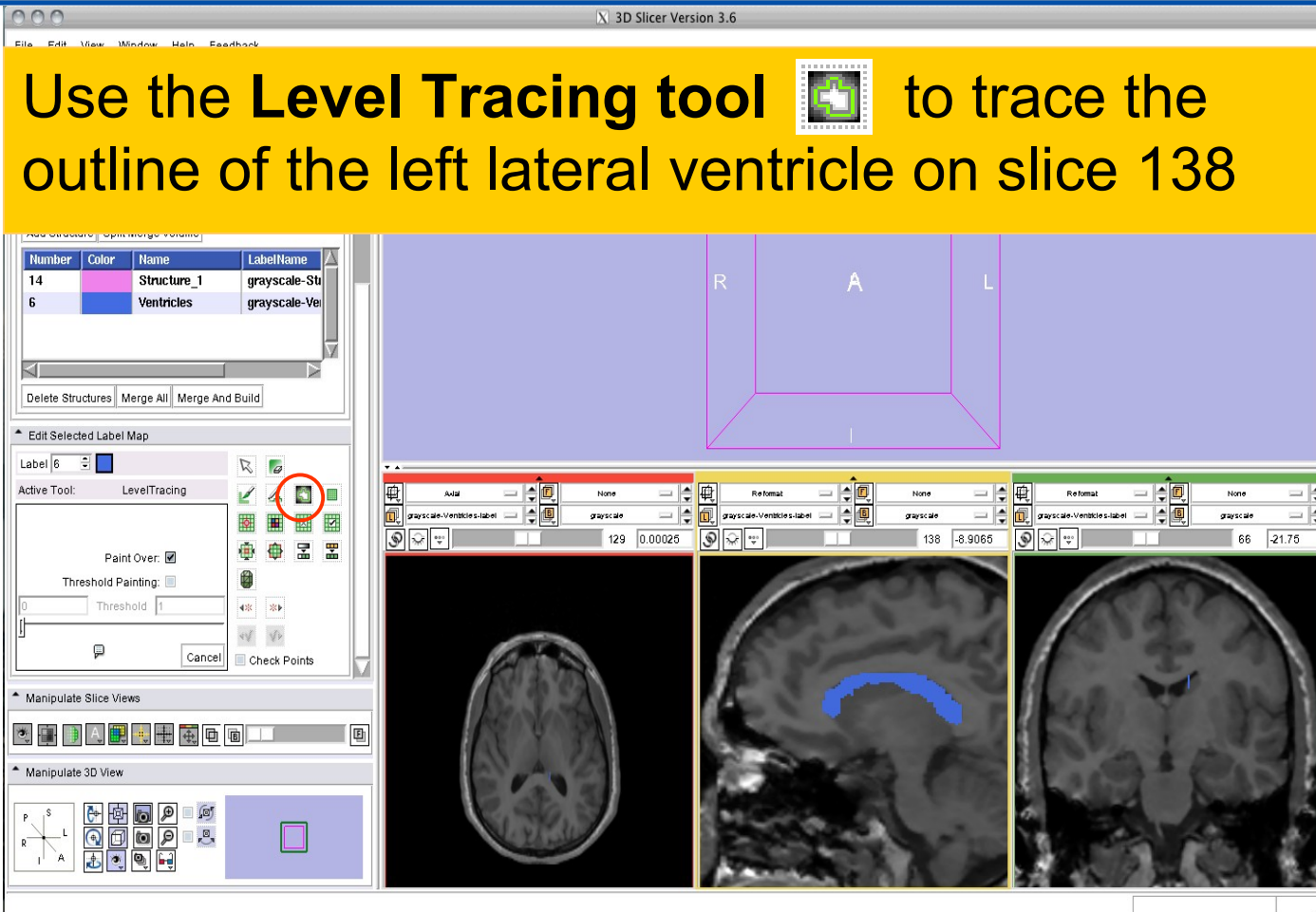


**Description:** By moving the mouse in the grey level images, you'll define in the label map volume an outline where the pixels all have the same value as the current background pixel.



# Level Tracing

Use the **Level Tracing** tool  to trace the outline of the left lateral ventricle on slice 138

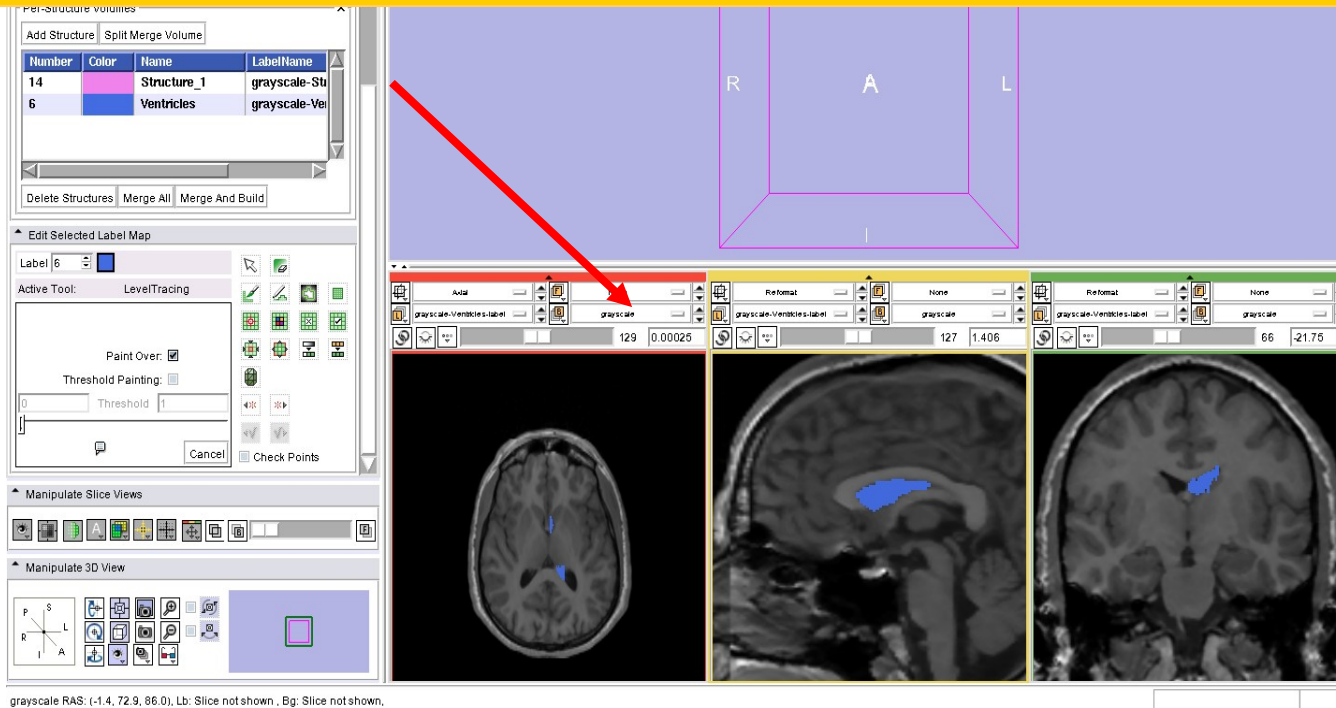






# Level Tracing

Repeat the process using the **Level Tracing tool**  from sagittal slice 163 to slice 127



Per-Structure Volumes

| Number | Color | Name        | LabelName    |
|--------|-------|-------------|--------------|
| 14     |       | Structure_1 | grayscale-St |
| 6      |       | Ventricles  | grayscale-Ve |

Edit Selected Label Map

Label: 6

Active Tool: LevelTracing

Paint Over:

Threshold Painting:

Threshold: 1

Manipulate Slice Views

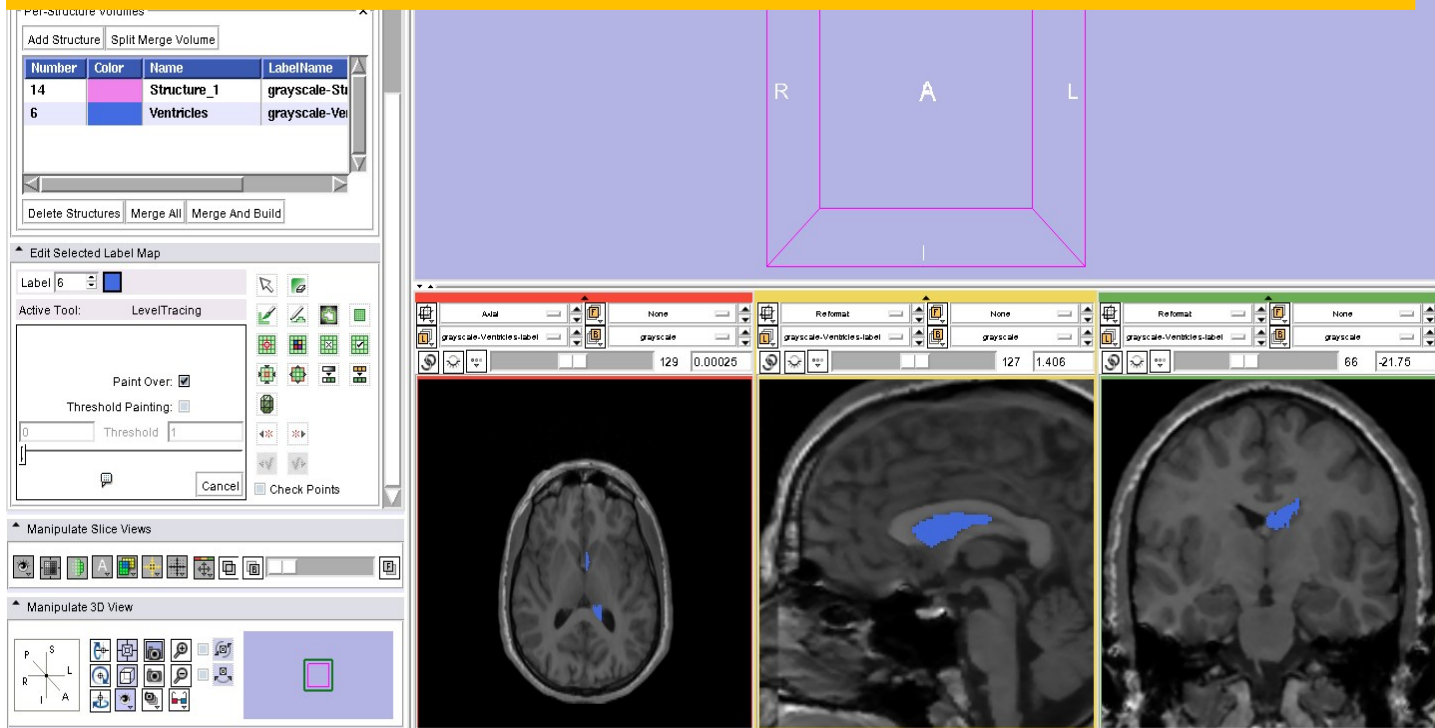
Manipulate 3D View

grayscale RAS: (-1.4, 72.9, 86.0), Lb: Slice not shown, Bg: Slice not shown,



# Level Tracing

Explore the outline of the left lateral ventricles in all three anatomical views



grayscale RAS: (-1.4, 72.9, 86.0), Lb: Slice not shown, Bg: Slice not shown.



# Level Tracing

Repeat the same process to outline the contours of the right ventricle

The screenshot displays the 3D Slicer software interface. A yellow text box at the top reads "Repeat the same process to outline the contours of the right ventricle". The interface includes a "Structure" table, an "Edit Selected Label Map" panel, and three slice views (Axial, Sagittal, Coronal) showing a brain scan with a blue segmented region.

| Number | Color | Name        | LabelName     |
|--------|-------|-------------|---------------|
| 14     |       | Structure_1 | grayscale-Stu |
| 6      |       | Ventricles  | grayscale-Ven |

Active Tool: LevelTracing

Label: 6

Paint Over:

Threshold Painting:

Threshold: 0 to 1

grayscale RAS: (-1.4, 72.9, 86.0), Lb: Slice not shown, Bg: Slice not shown.



# Adding a third structure

Click on **Add Structure** and select the label #15 'Structure\_2'

Per-Structure Volumes

| Number | Color | Name        | LabelName     |
|--------|-------|-------------|---------------|
| 14     |       | Structure_1 | grayscale-Stu |
| 6      |       | Ventricles  | grayscale-Ve  |

Add Structure | Split Merge Volume

Delete Structures Merge All Merge And Build

Edit Selected Label Map

Label 6

Active Tool: LevelTracing

Paint Over:

Threshold Painting:

Threshold: 1

Cancel Check Points

Manipulate Slice Views

Manipulate 3D View

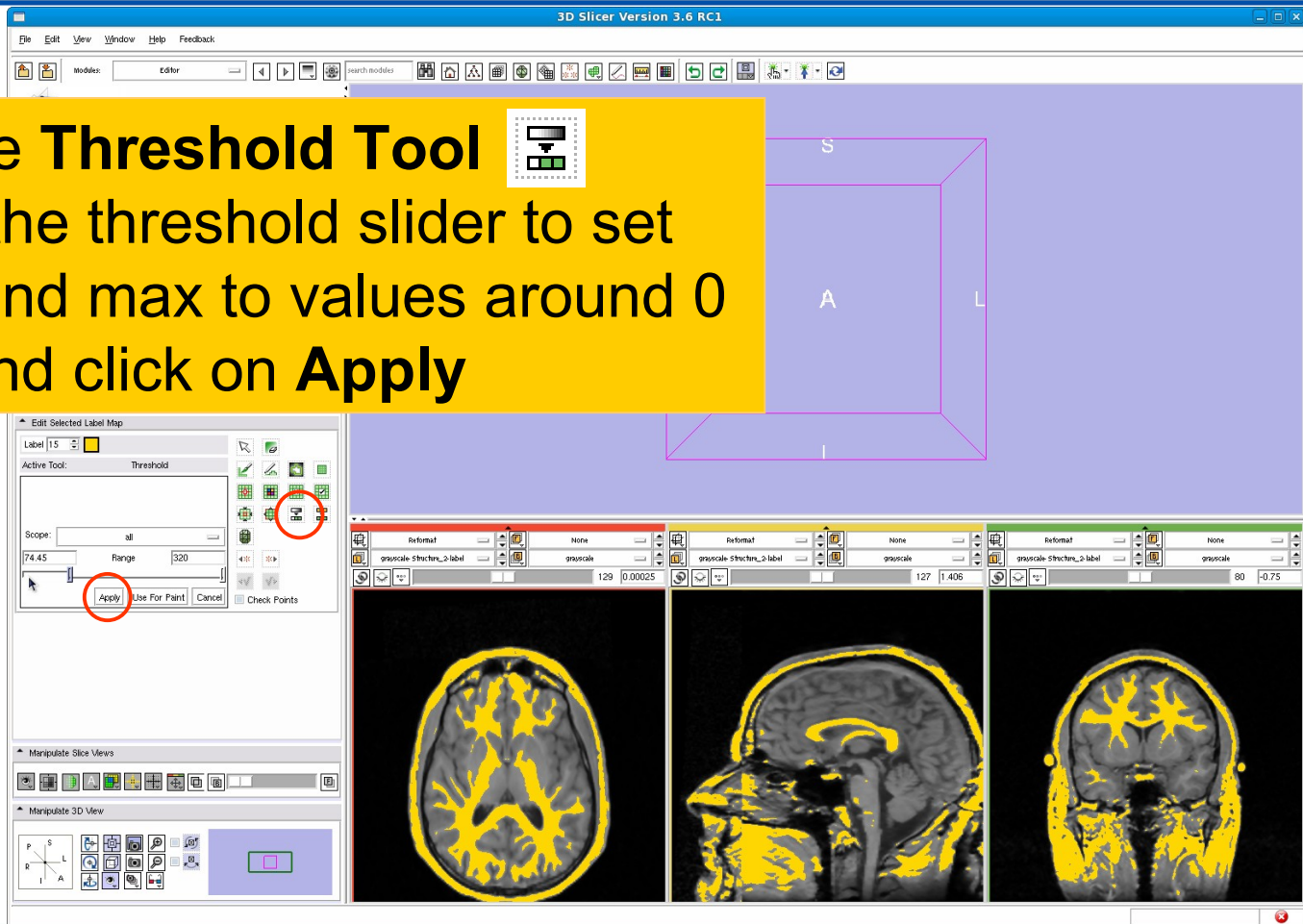
| Number | Color | Name         |
|--------|-------|--------------|
| 6      |       | Ventricles   |
| 7      |       | Arteries     |
| 8      |       | Veins        |
| 9      |       | Gray_matter  |
| 10     |       | White_matter |
| 11     |       | Tumor        |
| 12     |       | Edema        |
| 13     |       | Necrosis     |
| 14     |       | Structure_1  |
| 15     |       | Structure_2  |

grayscale RAS: (-1.4, 72.9, 86.0), Lb: Slice not shown, Bg: Slice not shown.



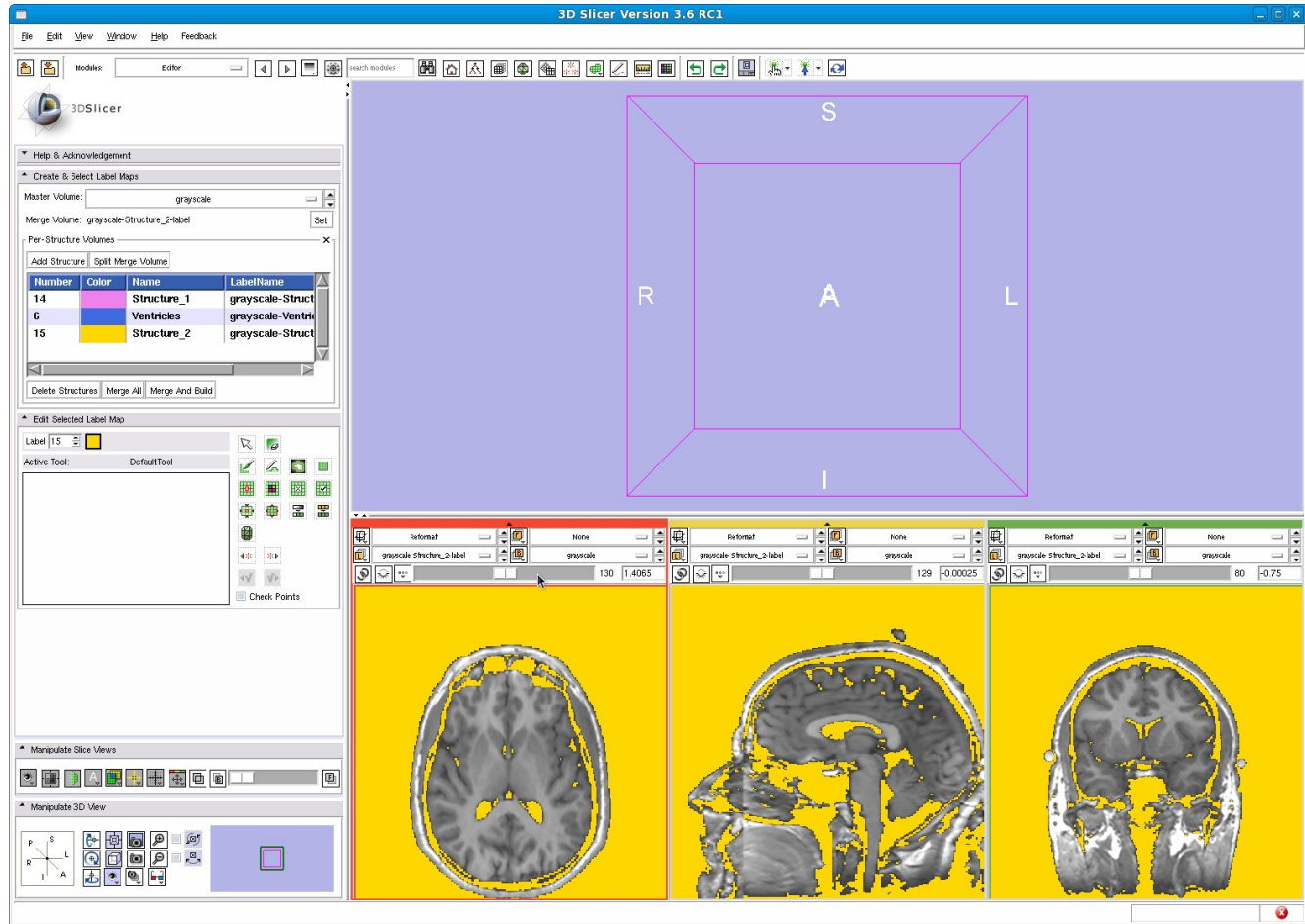
# Threshold tool

Select the **Threshold Tool** and use the threshold slider to set the min and max to values around 0 and 30 and click on **Apply**





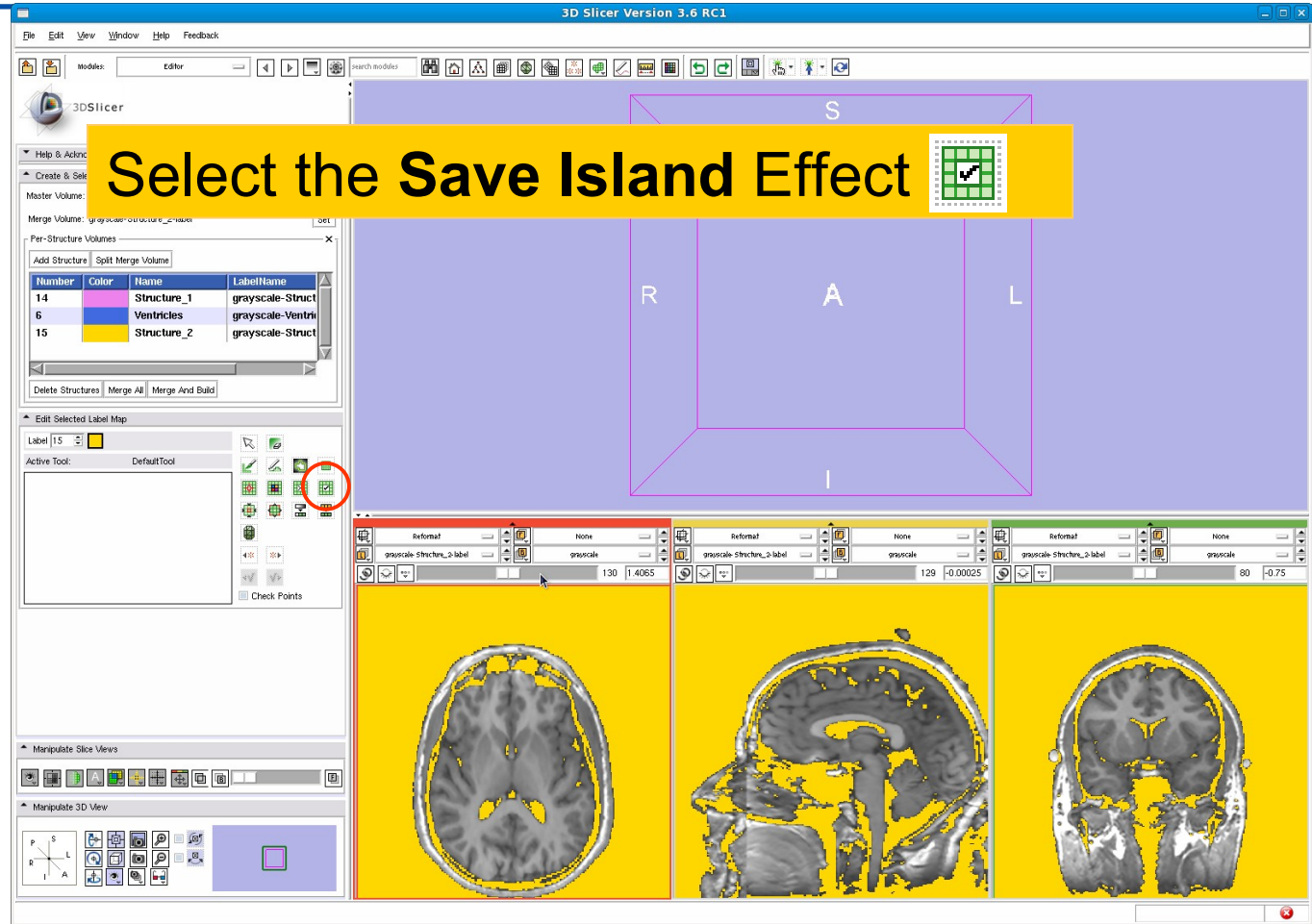
# Threshold tool







# Save Island





# Save Island

Click in the region of the right eyeball to isolate the structure

Structure Table:

| Number | Color  | Name        | LabelName     |
|--------|--------|-------------|---------------|
| 14     | Blue   | Structure_1 | grayscale-Stu |
| 6      | Purple | Ventricles  | grayscale-Ve  |
| 15     | Yellow | Structure_2 | grayscale-Stu |

3D Slicer Version 3.6

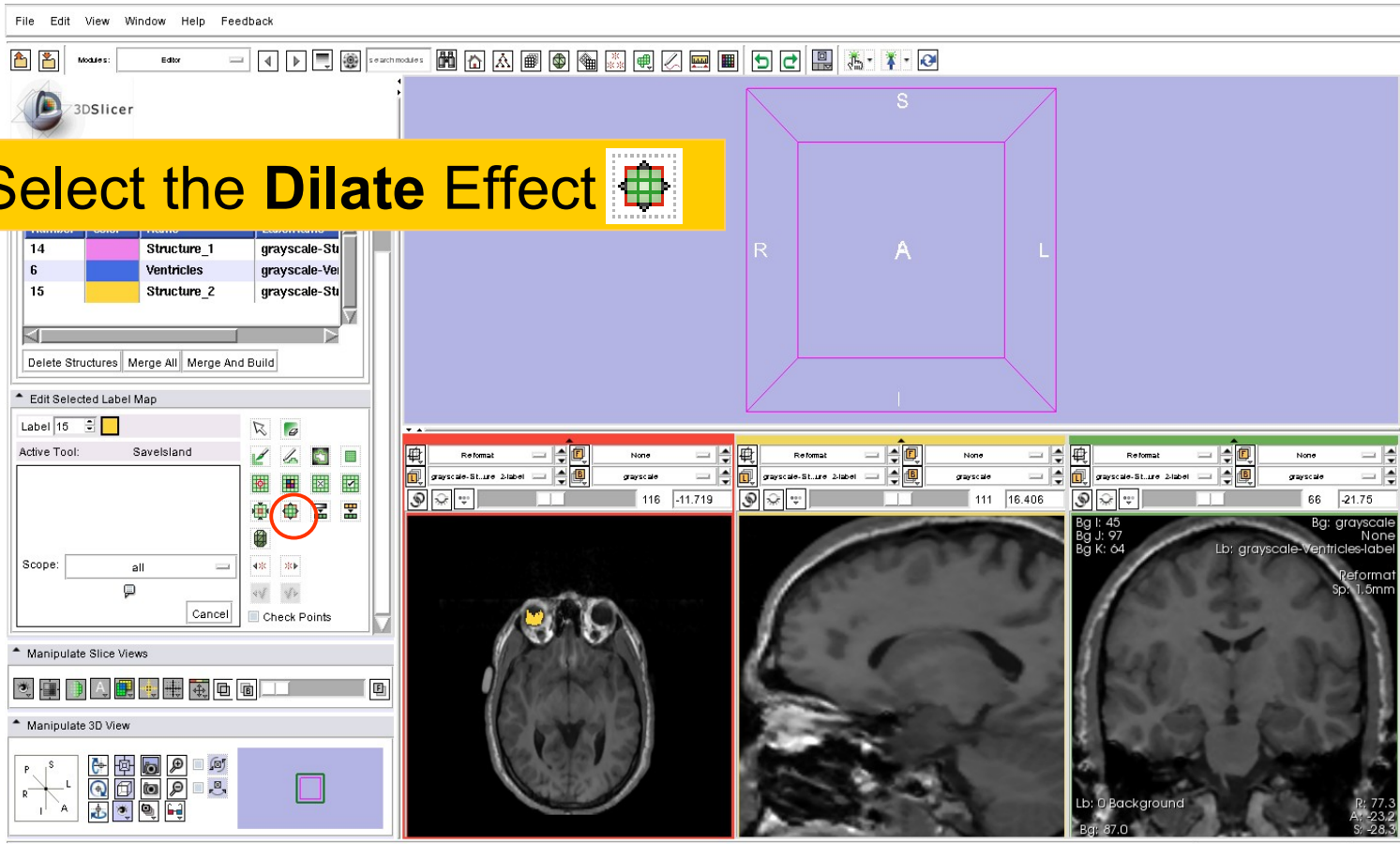
grayscale RAS: (146.9, 140.1, -13.6), Lb: Slice not shown, Bg: Slice not shown.





# Dilate Effect

Select the **Dilate** Effect 



The screenshot displays the 3DSlicer software interface. At the top, there is a menu bar (File, Edit, View, Window, Help, Feedback) and a toolbar. The main 3D view shows a purple wireframe box representing a dilated region. Below the 3D view, three slice views are visible: an axial slice (left), a sagittal slice (middle), and a coronal slice (right). The 'Edit Selected Label Map' panel is open, showing the 'Dilate' effect selected in the 'Effects' list. The 'Active Tool' is 'Savelsland'. The 'Scope' is set to 'all'. The 'Manipulate Slice Views' and 'Manipulate 3D View' panels are also visible.

| Label | Color  | Structure   | Grayscale     |
|-------|--------|-------------|---------------|
| 14    | Pink   | Structure_1 | grayscale-Stu |
| 6     | Blue   | Ventricles  | grayscale-Ve  |
| 15    | Yellow | Structure_2 | grayscale-Stu |

Effects: Reformat, None, grayscale-Stu-label, grayscale, grayscale-Stu-label, grayscale, grayscale-Stu-label, grayscale

Manipulate Slice Views: 116 -11.719, 111 16.406, 66 -21.75

Manipulate 3D View: P, S, L, R, I, A

Properties: Bg I: 45, Bg J: 97, Bg K: 04, Lb: grayscale-ventricles-label, Reformat Sp: 1.5mm, Lb: 0 Background, Bg: 87.0, P: 77.3, A: 23.2, S: 28.3



# Dilate Effect

Click on **Apply** to add a single layers of pixels to the eyeball structure

The screenshot shows the MICe software interface. A yellow text box at the top left contains the instruction: "Click on **Apply** to add a single layers of pixels to the eyeball structure". The interface includes a menu bar (File, Edit, View, Window, Help, Feedback), a toolbar, and several panels. The "Edit Selected Label Map" panel is active, showing "Label 15" and "Active Tool: Removelslands". The "Apply" button is circled in red. The main window displays a 3D view of a brain slice with a yellow region highlighted, and three 2D slice views (axial, sagittal, and coronal) below it. The interface also includes a "Manipulate Slice Views" panel and a "Manipulate 3D View" panel. The bottom of the interface shows a status bar with coordinates and other information.



# Dilate Effect

Browse through the axial slices of the segmented eyeball

Structure List:

| Number | Color | Name        | LabelName     |
|--------|-------|-------------|---------------|
| 14     |       | Structure_1 | grayscale-Stu |
| 6      |       | Ventricles  | grayscale-Ven |
| 15     |       | Structure_2 | grayscale-Stu |

Active Tool: Removelslands

Scope: visible

Manipulate Slice Views:

Manipulate 3D View:

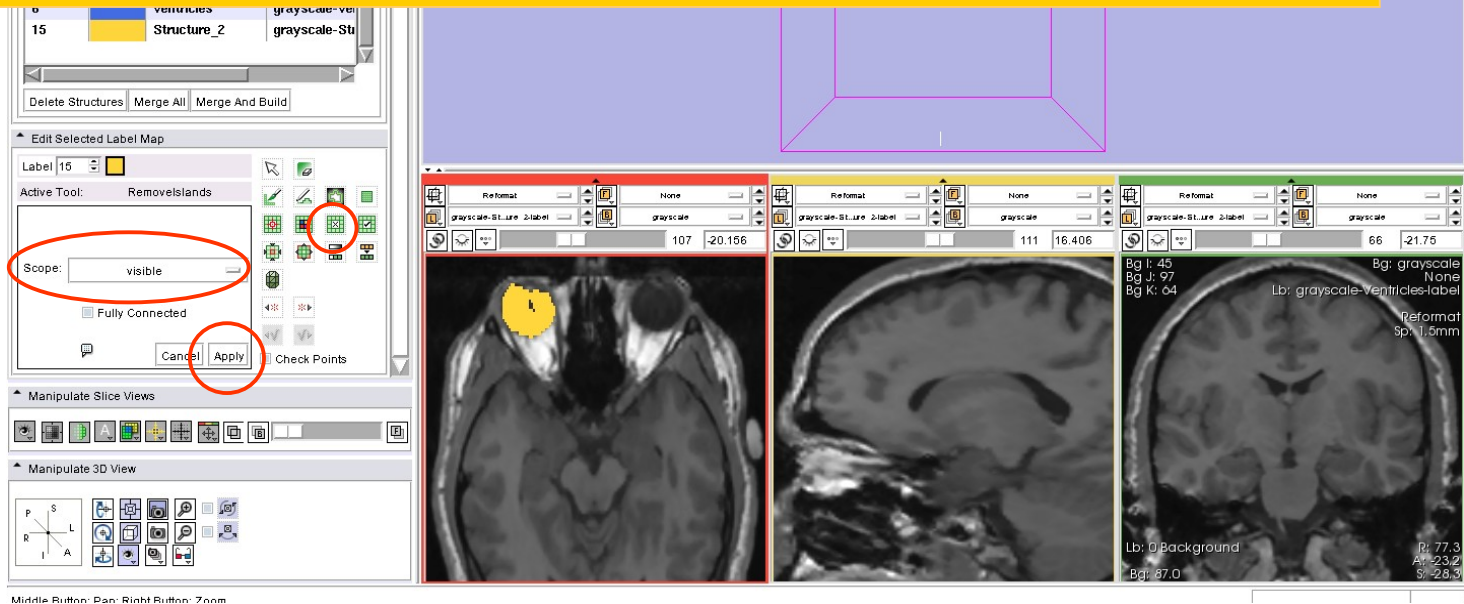
Middle Button: Pan; Right Button: Zoom



# Remove Island

Select the **Remove Island**  tool

Select **Scope: visible** and click on **Apply** to remove the isolated pixels inside the segmented structure





# Remove Island

Repeat the process in the slices that contain isolated pixels in the eyeball structure

**Per-Structure Volumes**

| Number | Color     | Name        | LabelName    |
|--------|-----------|-------------|--------------|
| 14     | grayscale | Structure_1 | grayscale-St |
| 6      | blue      | Ventricles  | grayscale-Ve |
| 15     | yellow    | Structure_2 | grayscale-St |

**Edit Selected Label Map**

Label: 16

Active Tool: RemoveIslands

Scope: visible

Fully Connected

Check Points

**Manipulate Slice Views**

**Manipulate 3D View**

Middle Button: Pan; Right Button: Zoom

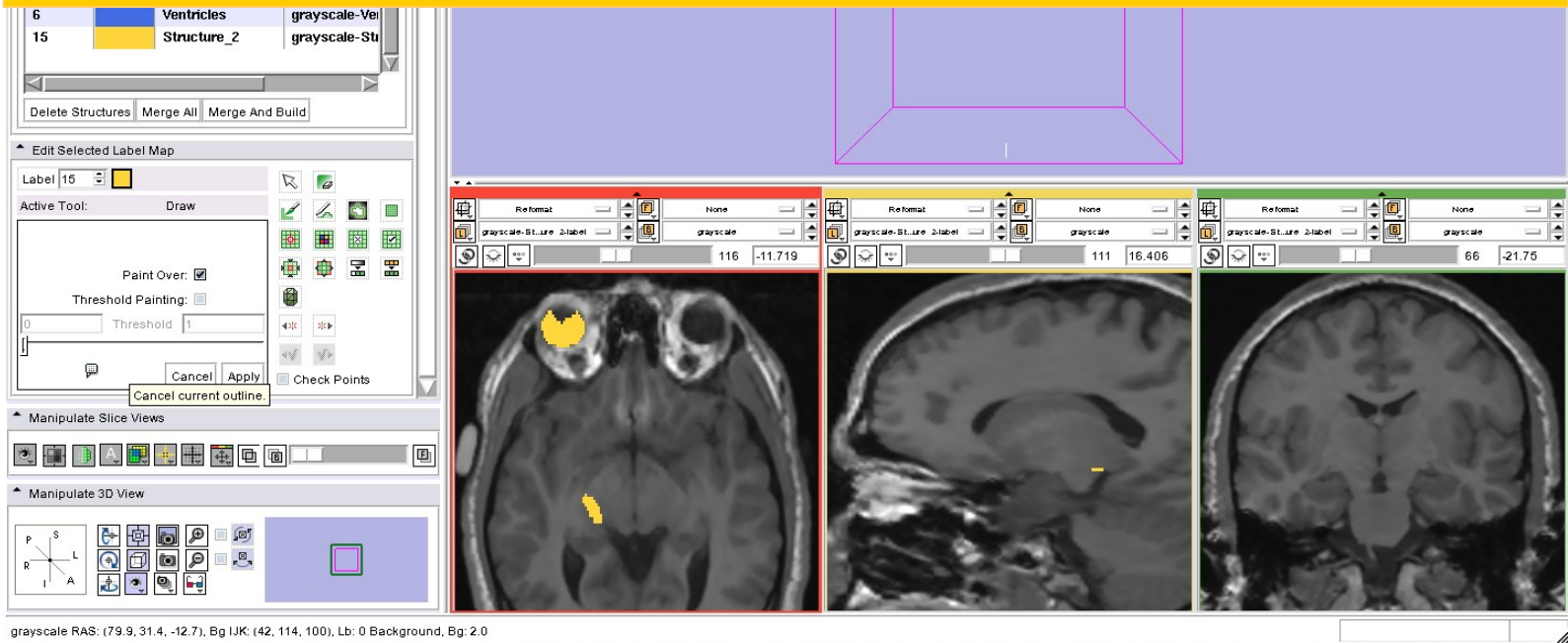
Three slice views are shown: axial, sagittal, and coronal. The axial view shows a yellow region in the eyeball. The sagittal and coronal views show the brain structure. The interface also includes a 'Reformat' panel with 'Reformat' and 'None' options, and a 'grayscale-ST\_Lure 2:label' dropdown menu.





# Adding more structures

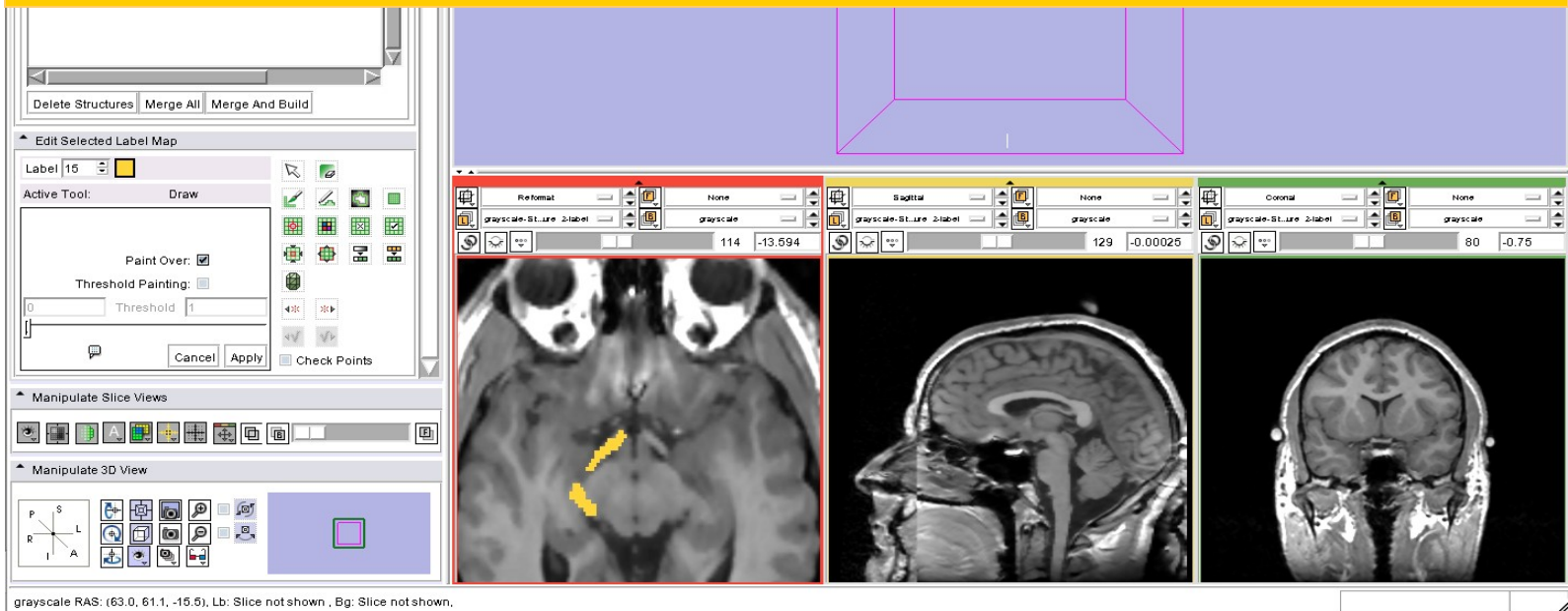
Zoom in using the right mouse button, and use the drawing tool to outline the contour of the right **lateral geniculate body** and **optic tract** in the axial view.





# Adding more structures

Repeat the process to outline the contour of the right lateral geniculate body and optic tract from slice 113 to slice 118





# Merge and Build

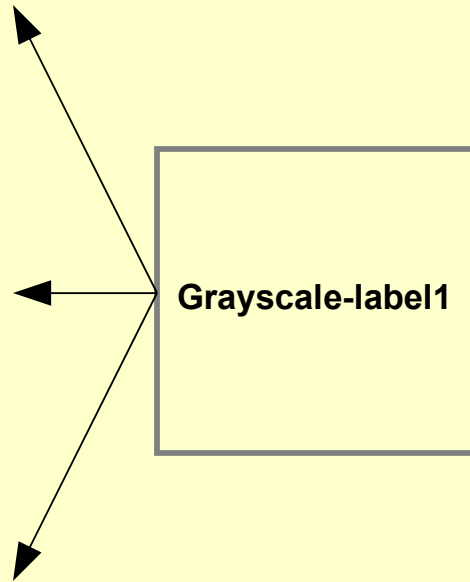
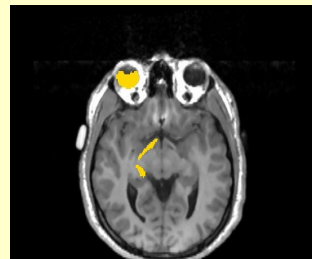
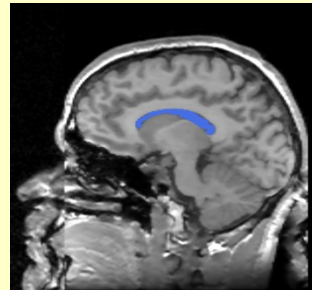
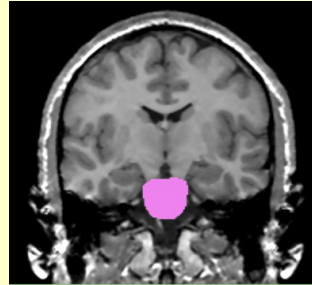
The three labels correspond to the three different label maps that we have edited for the pons (pink), the ventricles (blue) and the right eyeball, lateral geniculate body and optic tract (yellow).

| Number | Color  | Name        | LabelName        |
|--------|--------|-------------|------------------|
| 14     | Pink   | Structure_1 | grayscale-Struct |
| 6      | Blue   | Ventricles  | grayscale-Ventri |
| 15     | Yellow | Structure_2 | grayscale-Struct |





# Merging Label Maps



The Merge tool will merge the label maps of the anatomical structures that we have edited into a single label map



# Merge And Build

**Click on Merge And Build** button to put the different structures in the Merge volume and build the models from the segmented structures.

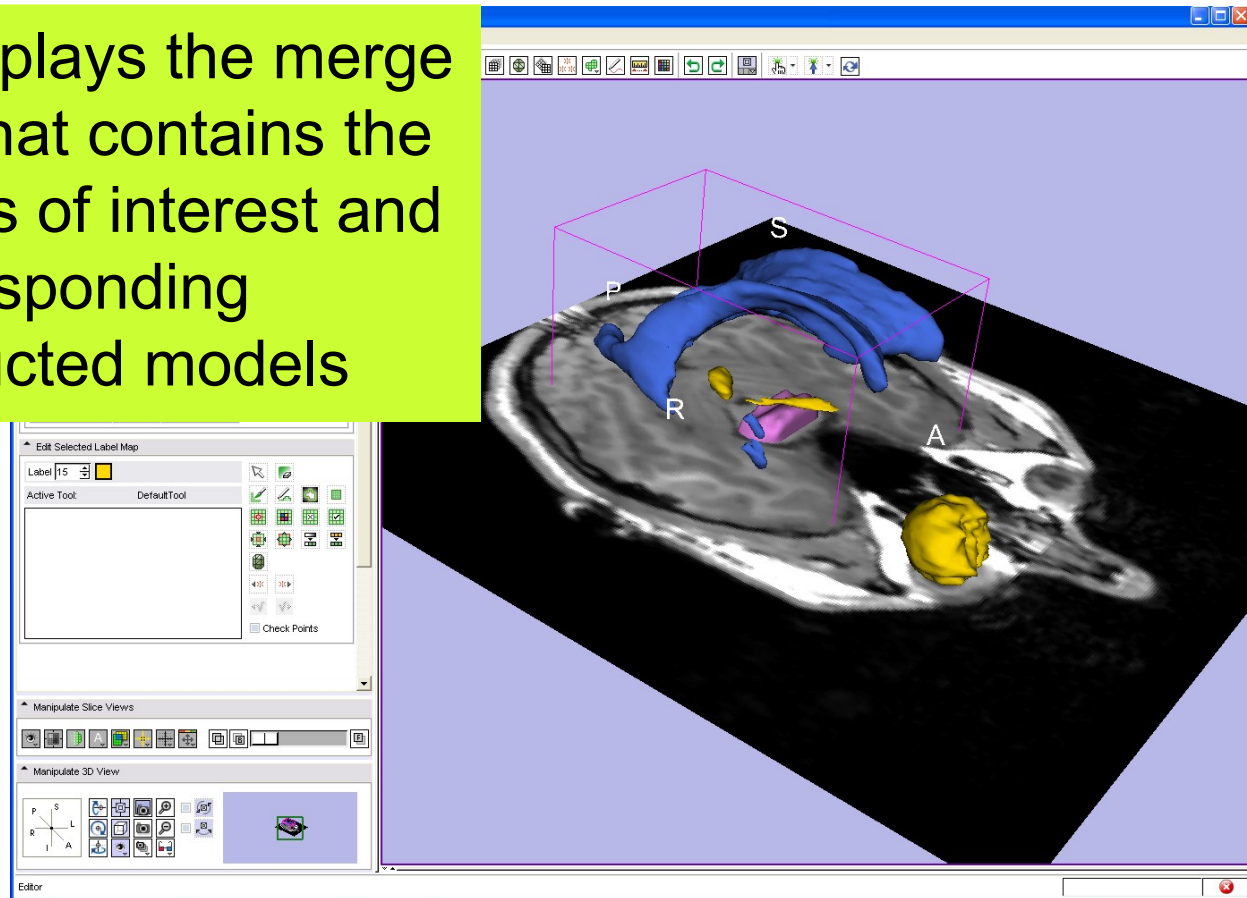
The three label maps will be merged in the order that they appear in the table.

| Number | Color  | Name        | LabelName        |
|--------|--------|-------------|------------------|
| 14     | Blue   | Structure_1 | grayscale-Struct |
| 6      | Purple | Ventricles  | grayscale-Ventri |
| 15     | Yellow | Structure_2 | grayscale-Struct |



# Merge And Build

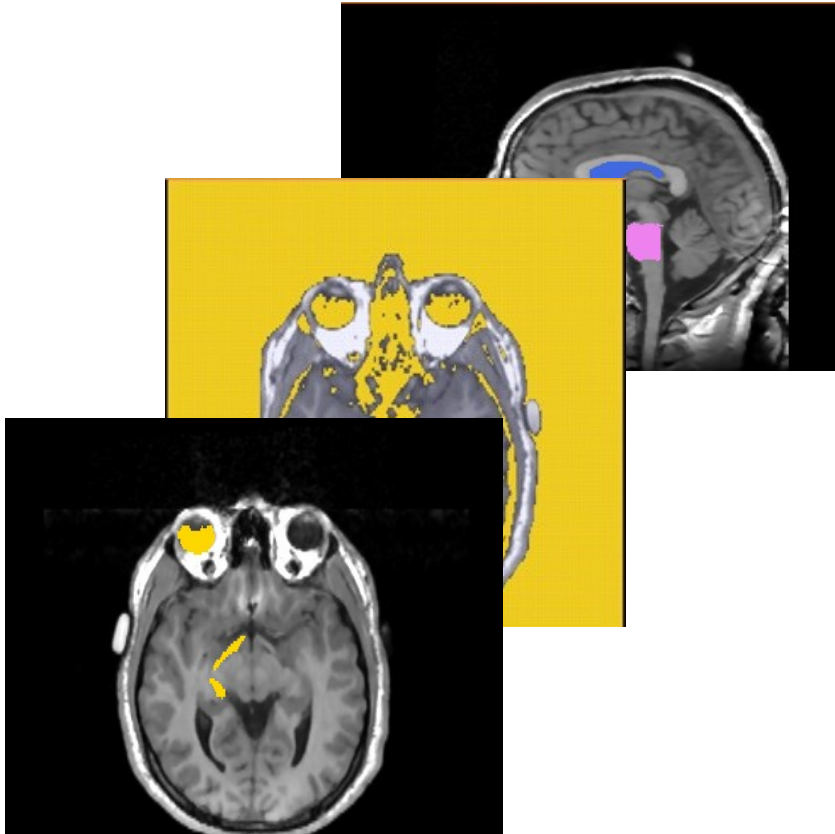
Slicer displays the merge volume that contains the structures of interest and the corresponding reconstructed models





# Conclusion

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This tutorial guided you through the tools for interactive editing of label maps created from scalar images using the **Interactive Editor** module of Slicer3.6.

[www.slicer.org](http://www.slicer.org)



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