



NA-MIC

National Alliance for Medical Image Computing

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Interactive Editor tutorial

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Harvard Medical School

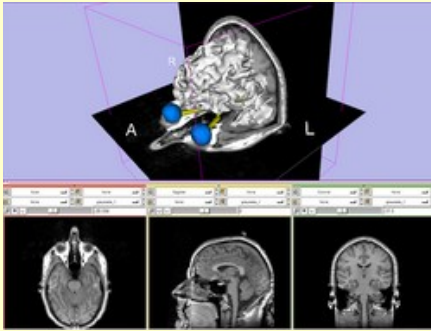


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Pre-requisite

- This course supposes that you have taken the following tutorial:



'Slicer3 Data Loading and Visualization'
Sonia Pujol, PhD

http://www.slicer.org/slicerWiki/index.php/Slicer3.6:Training#Software_tutorials



Material

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>

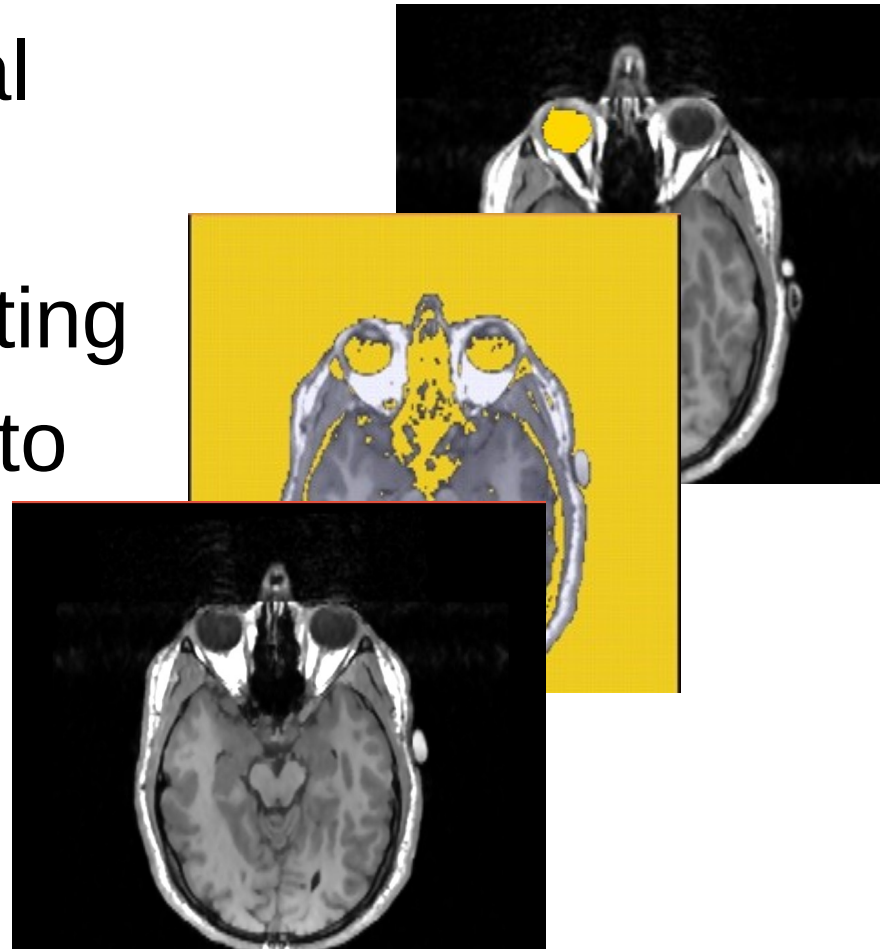
Disclaimer

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.





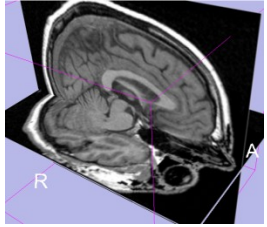
Label map



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



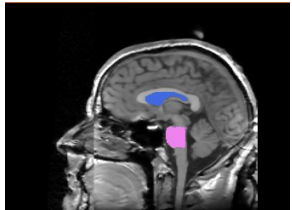
Overview



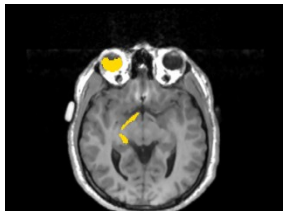
Part 1: Creating a single label map

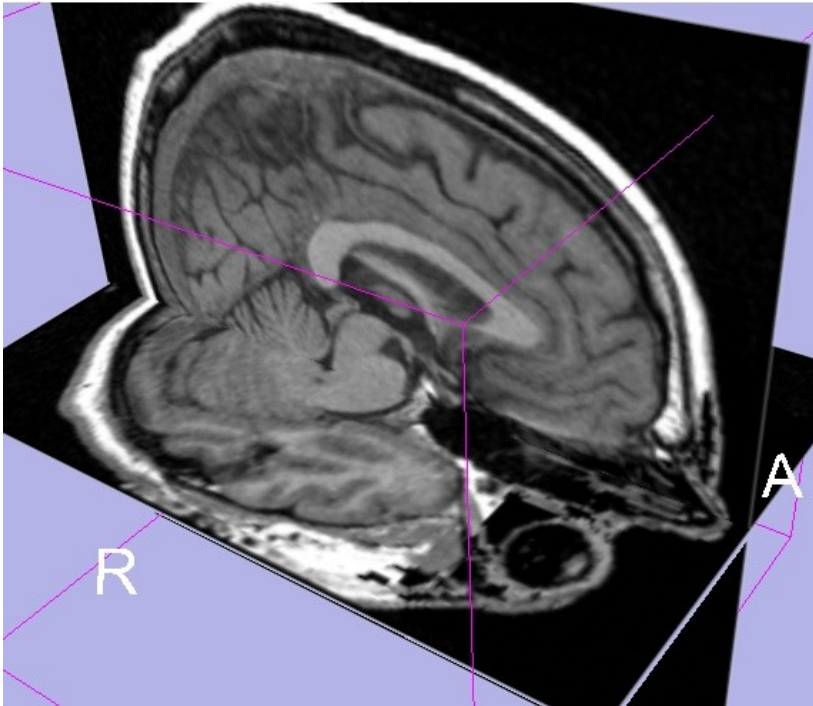


Part 2: Editing a single label map



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

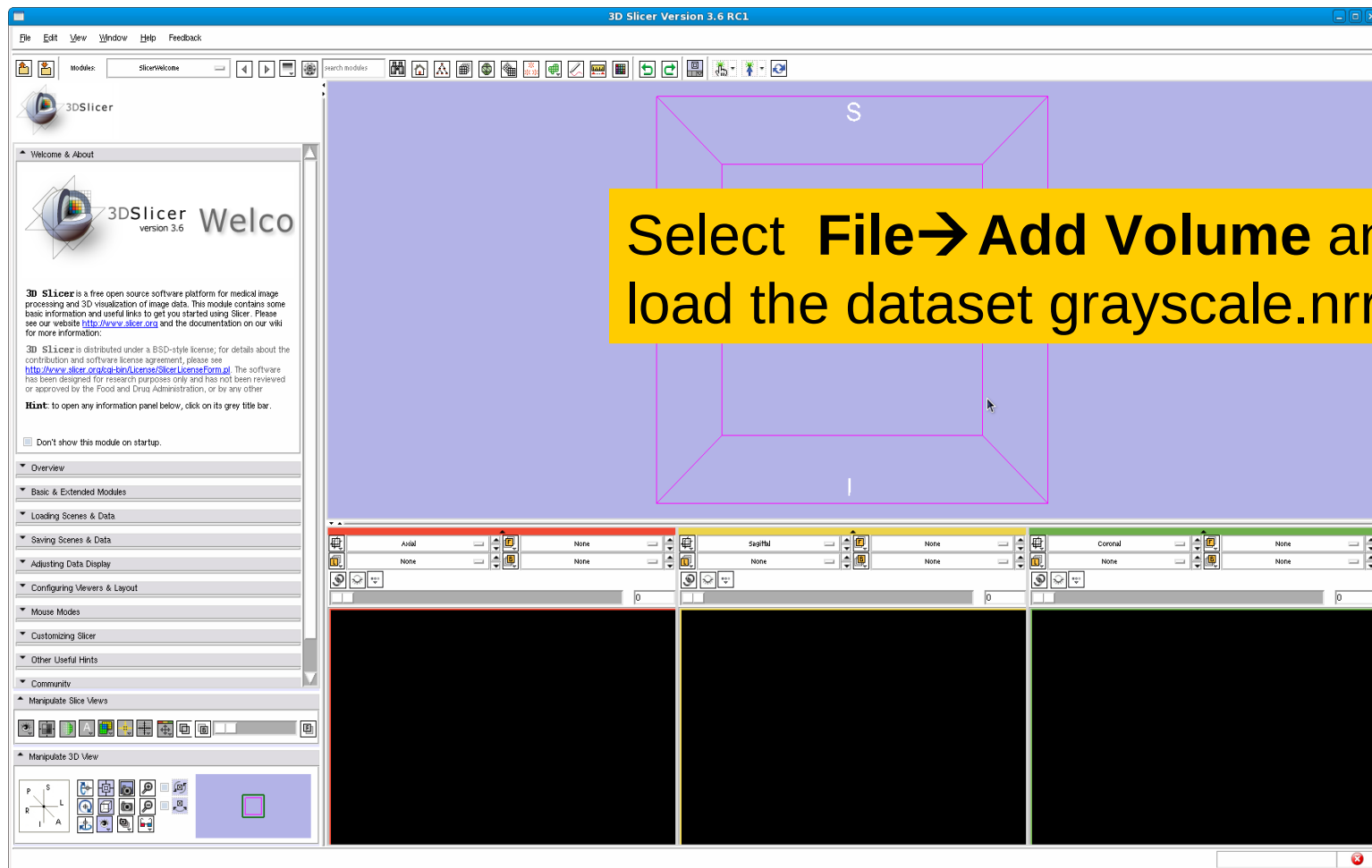




Part 1: Creating a single label map

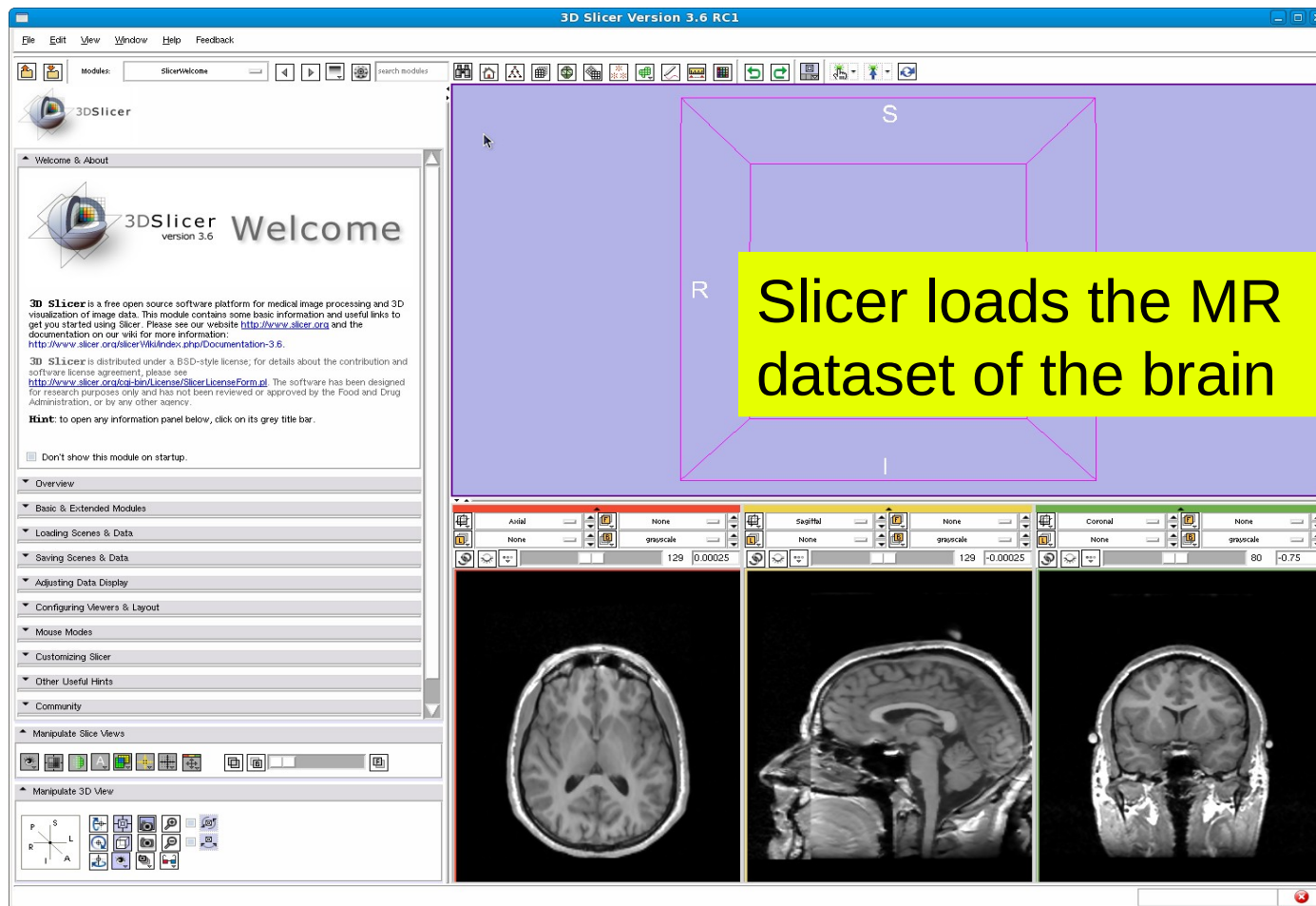


Data Loading



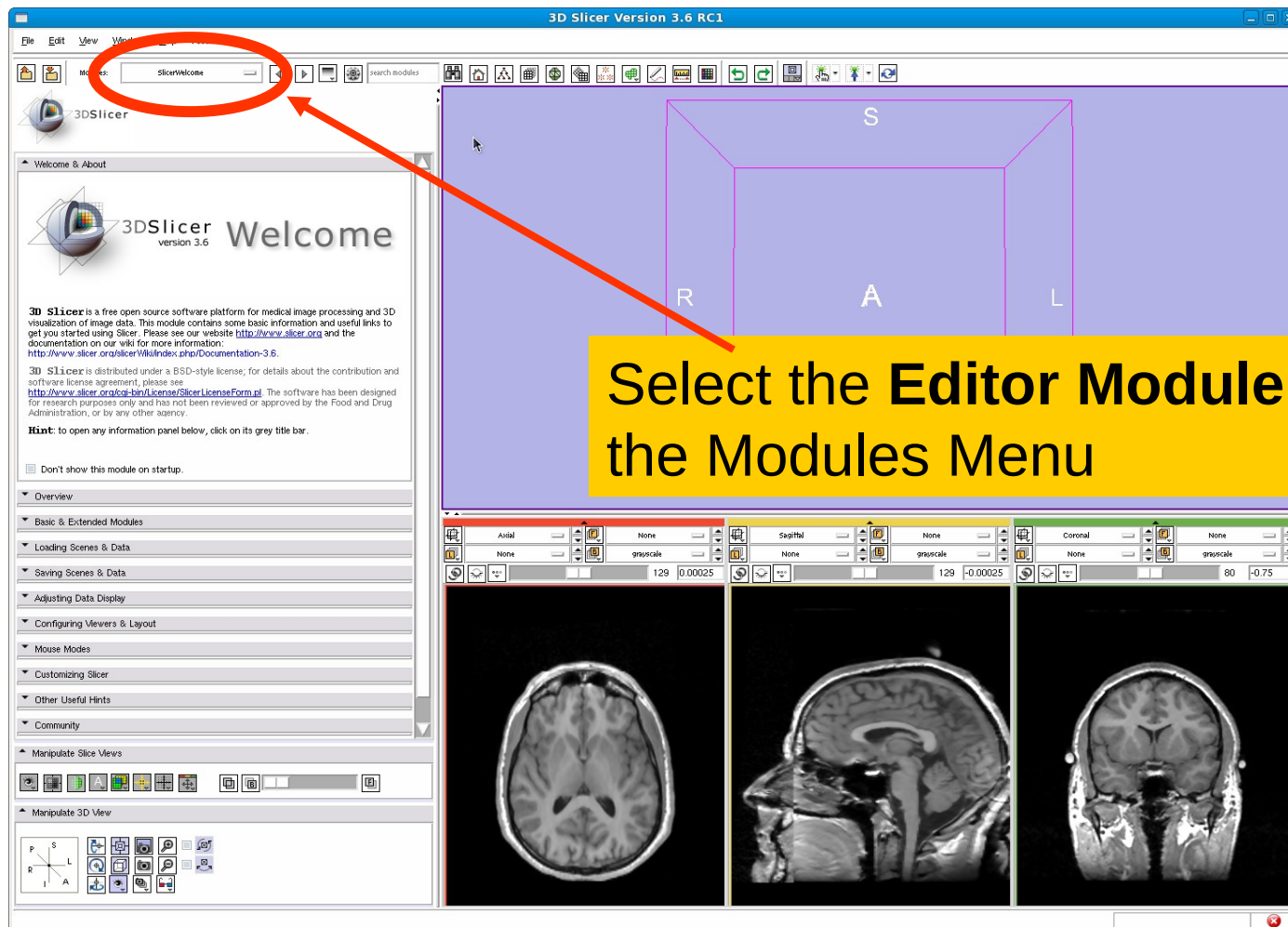


Data Loading



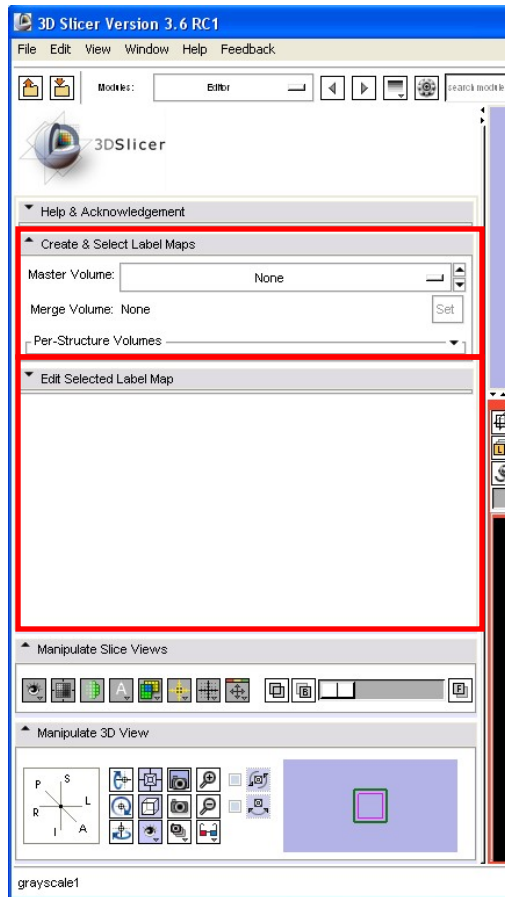


Data Loading





Editor Module

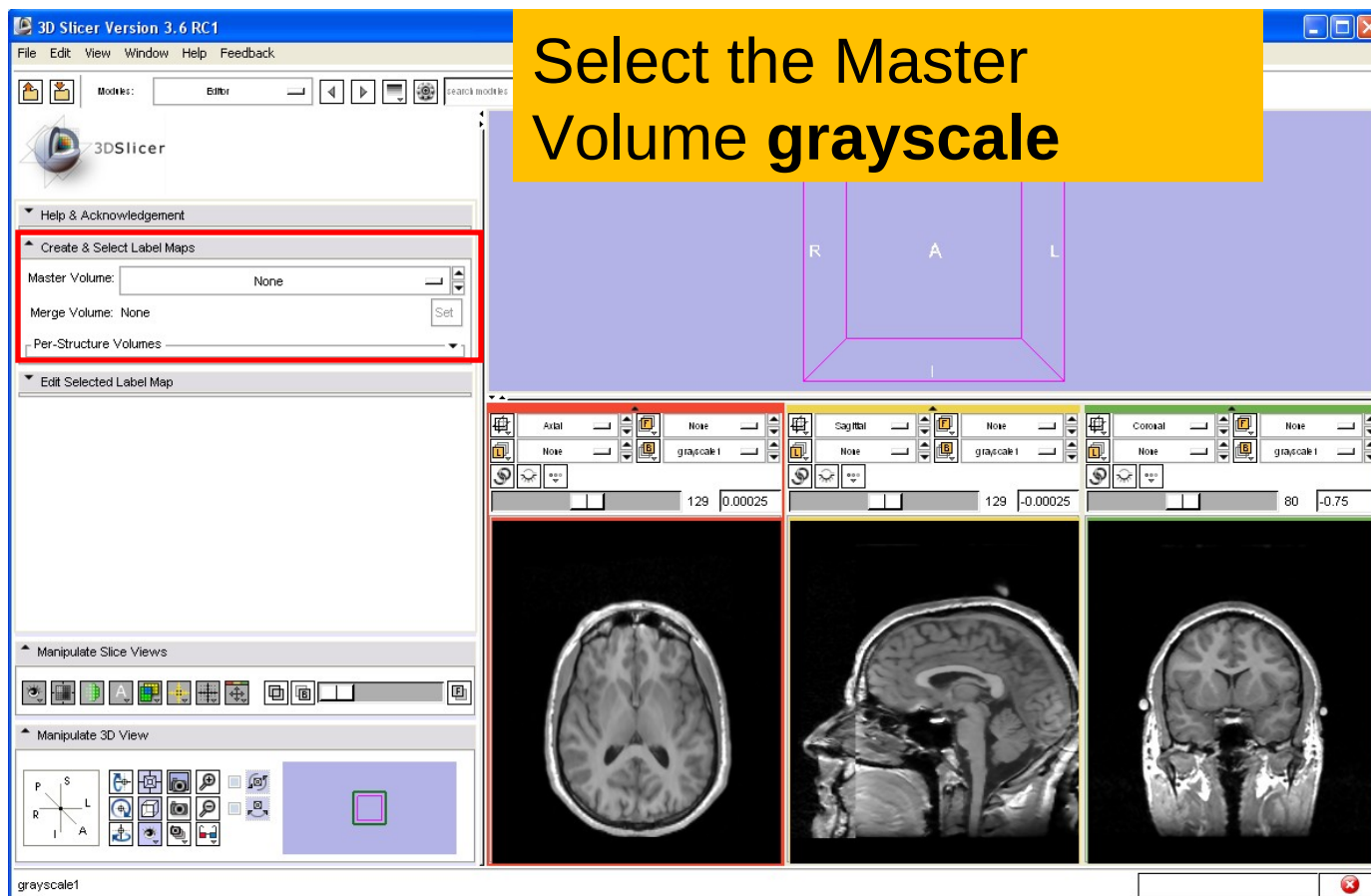


The Editor module GUI is composed of two parts:

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

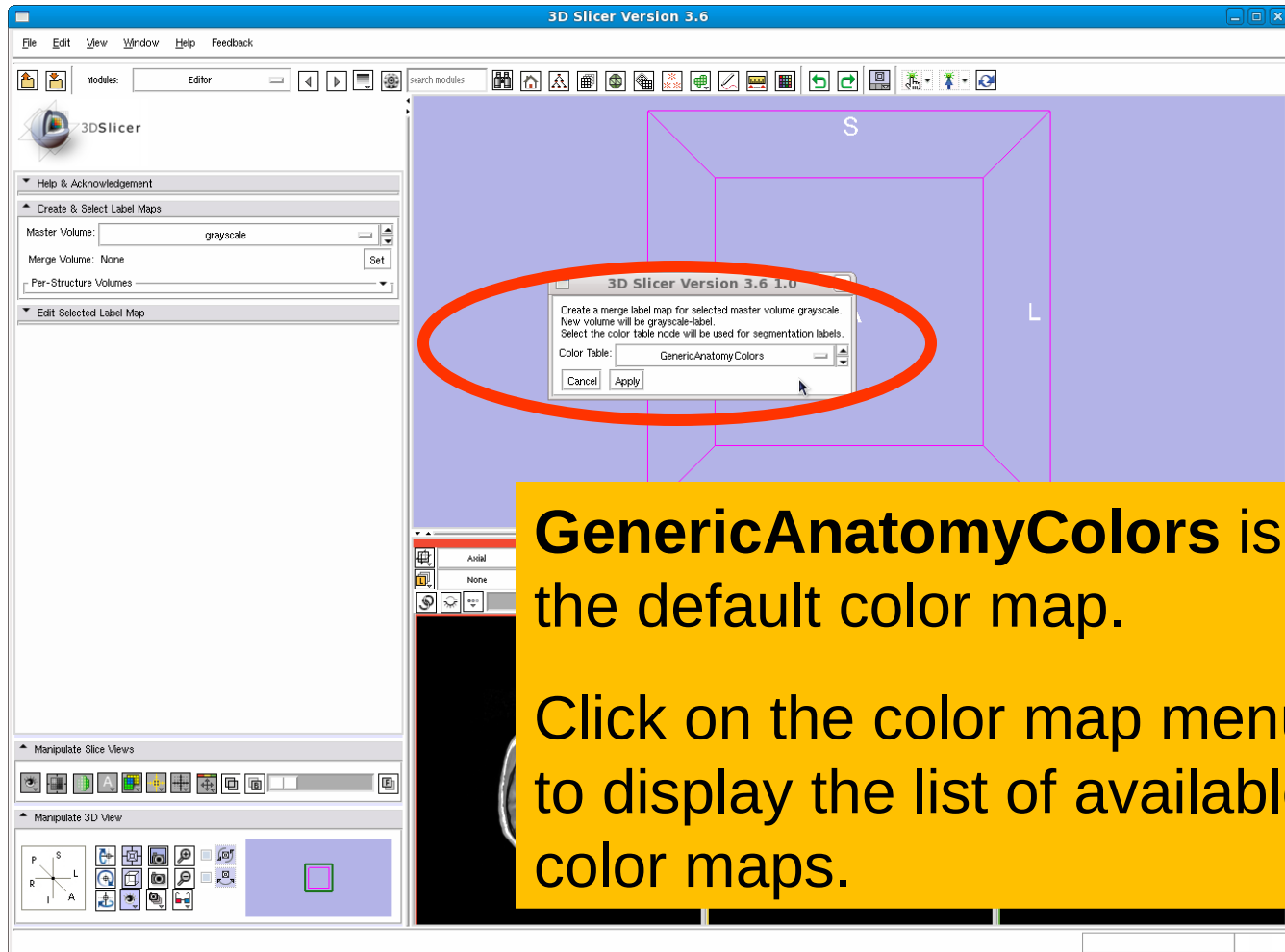


Label Map Creation



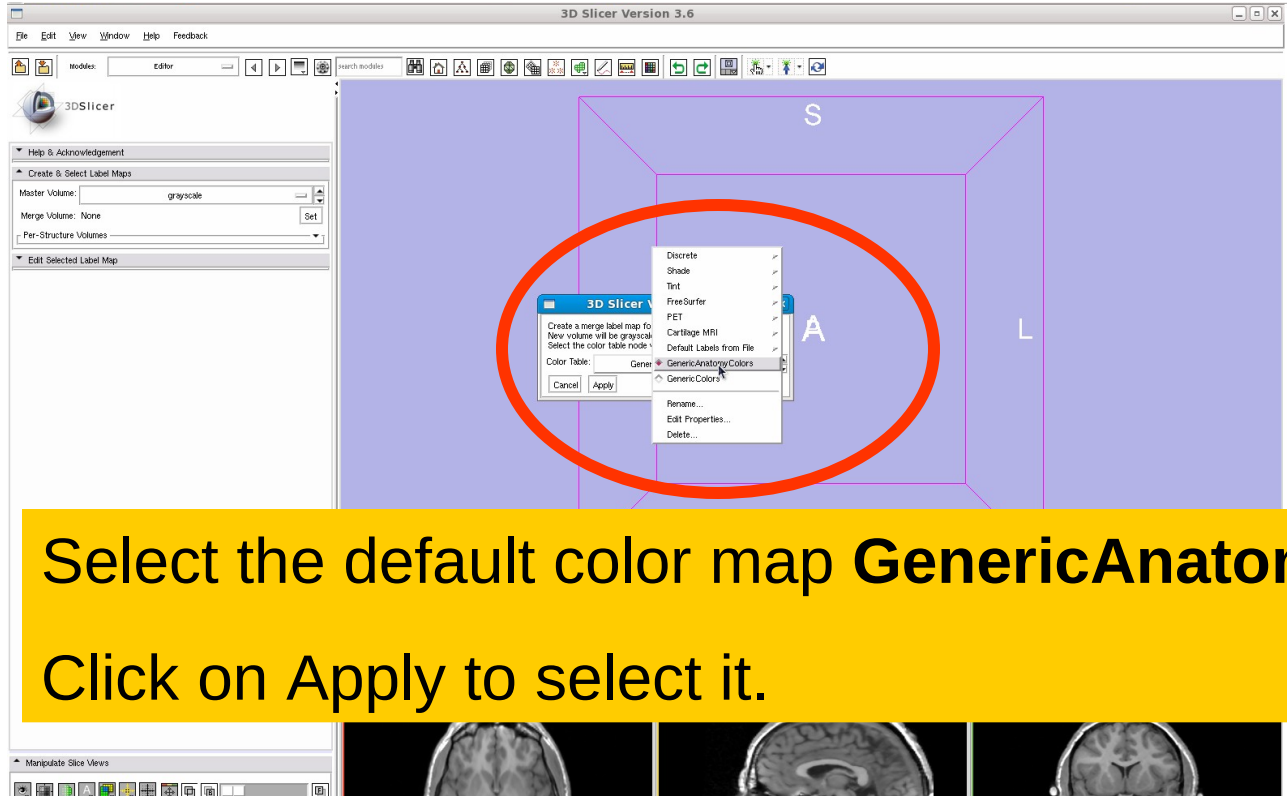


Label Map Creation





Label Map Creation

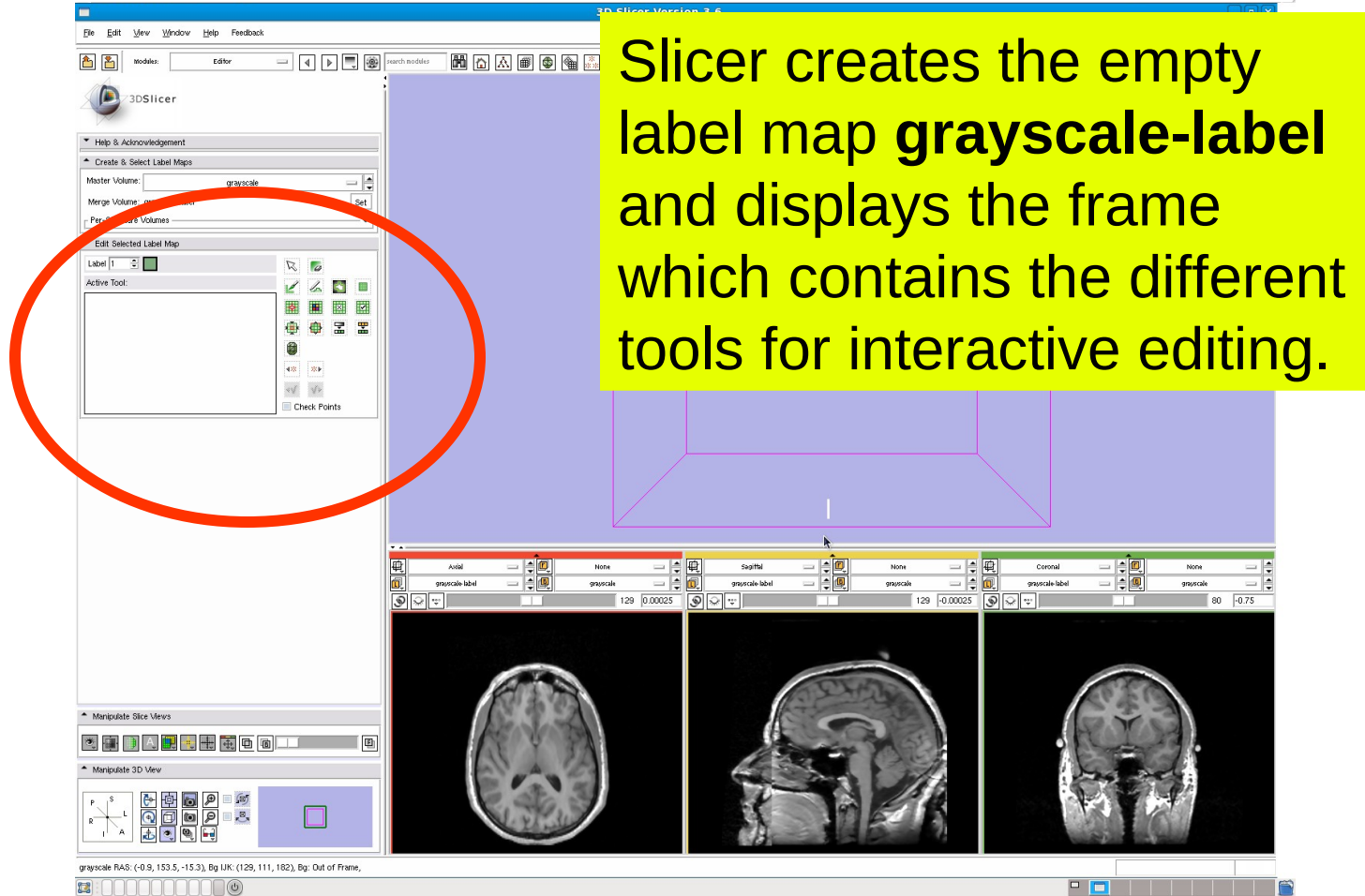


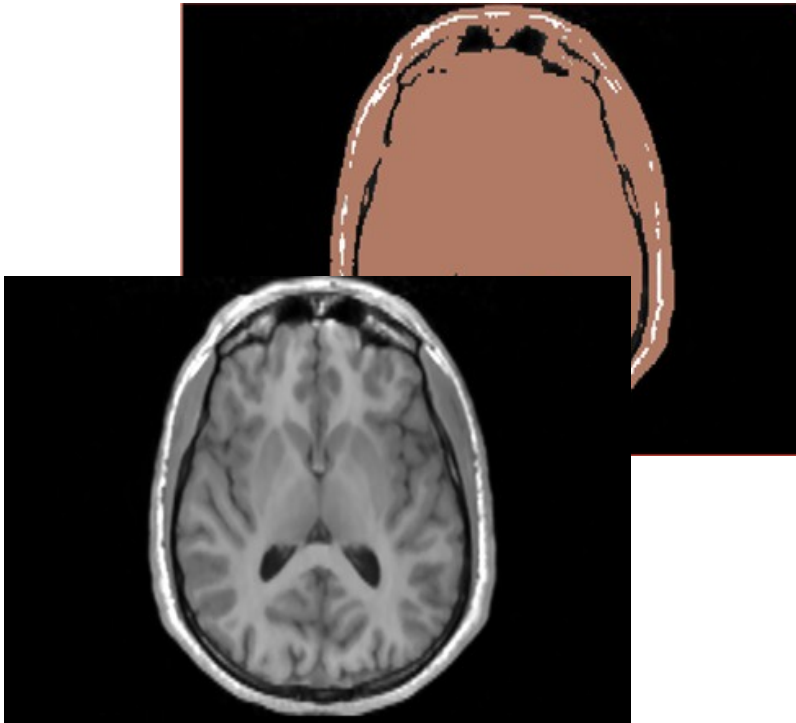
Select the default color map **GenericAnatomyColors**
Click on Apply to select it.

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



Label Map Creation

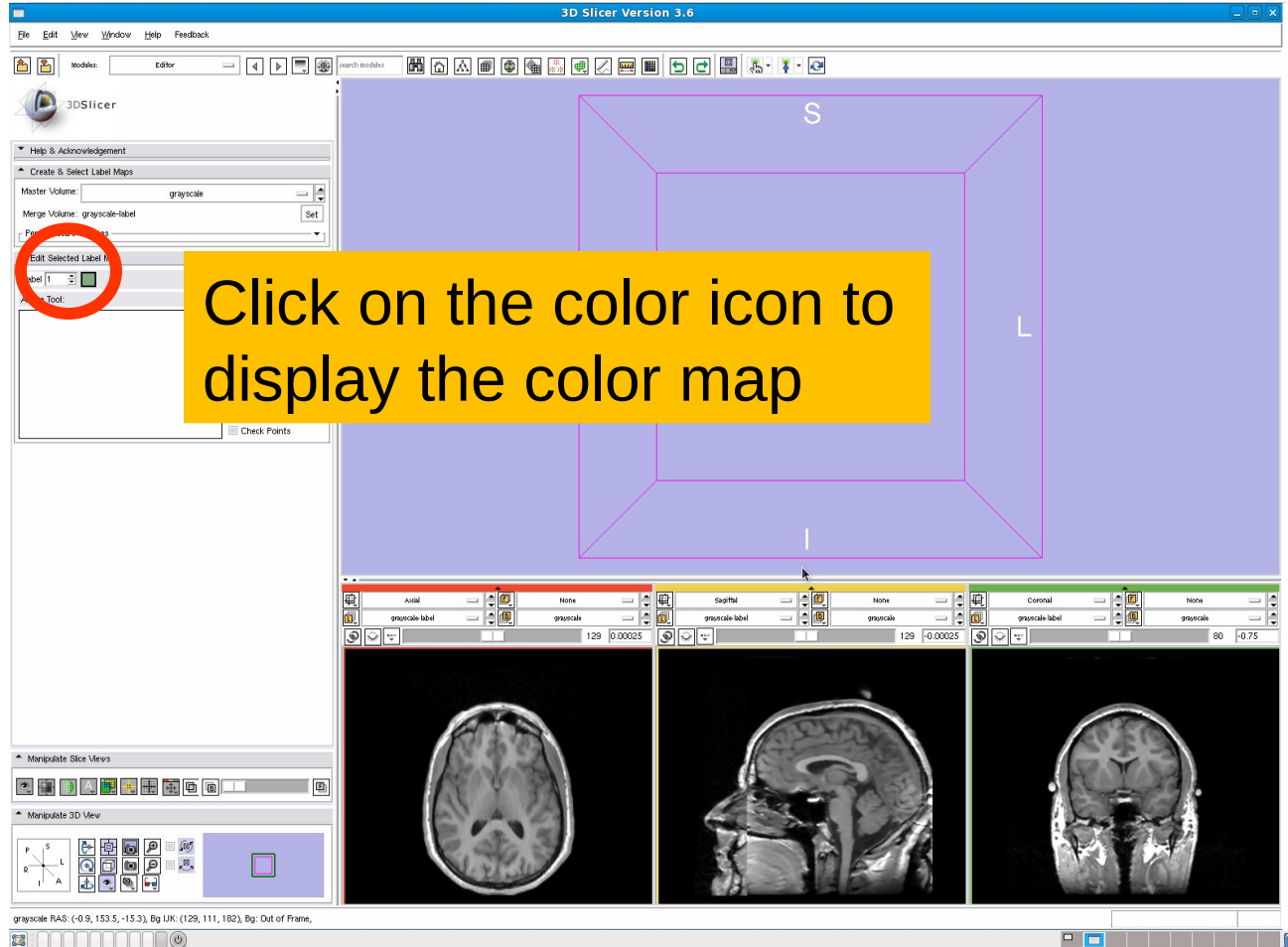




Part 2: Editing a single label map

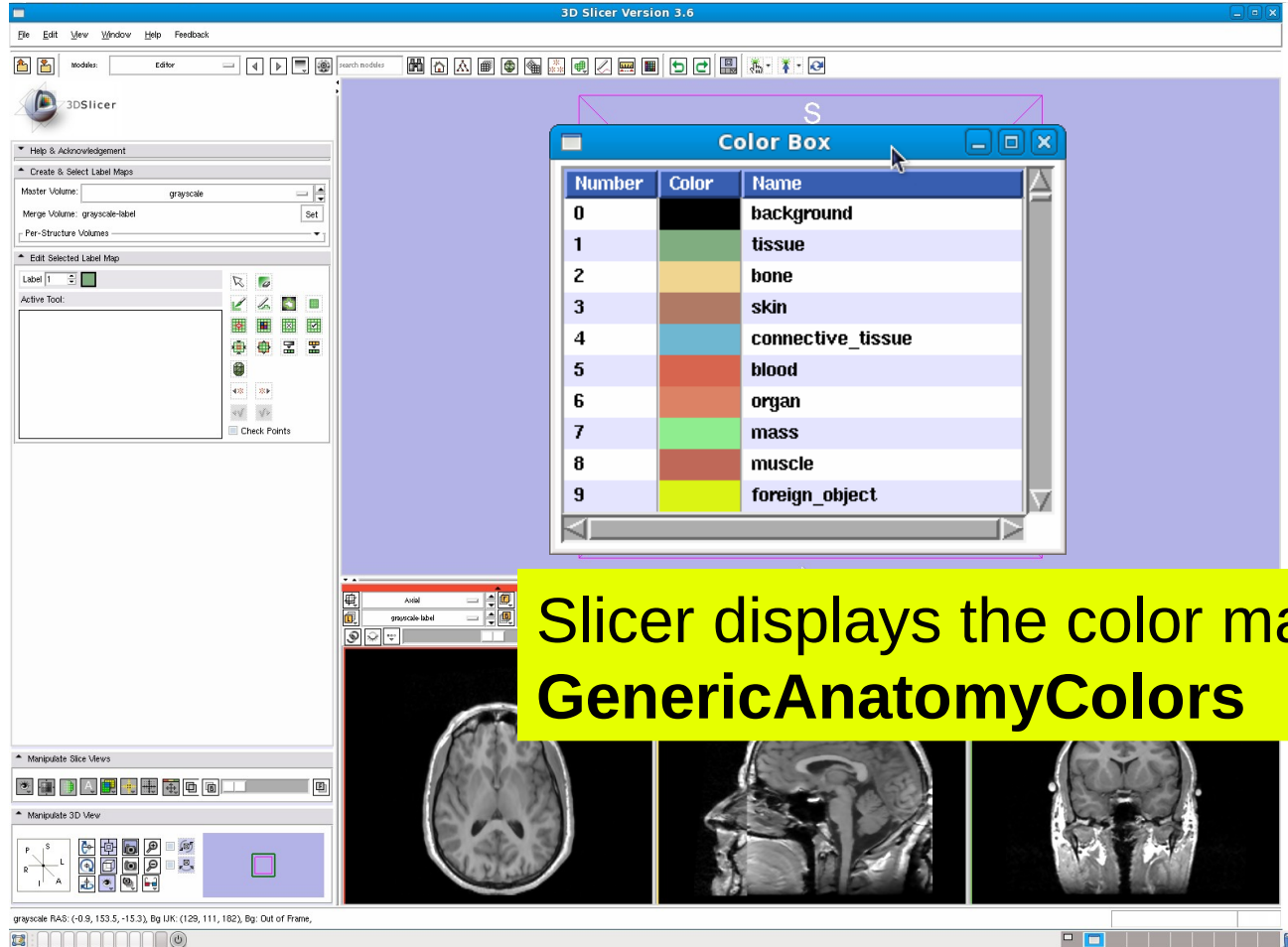


Label Map Editing





Label Map Editing





Label Map Editing

The screenshot shows the 3D Slicer software interface. On the left, the 'Color Box' panel is open, displaying a list of 307 labels with their corresponding colors. The labels are organized into a table with columns for 'Number', 'Color', and 'Name'. The 'Name' column lists various anatomical structures, including muscles, salivary glands, lips, nose, tongue, soft palate, and various bones of the head and neck. The 'Color' column shows a gradient of colors from light blue to dark blue. The 'Number' column shows the label ID. The 3D view on the right shows a sagittal slice of a brain scan with a yellow box highlighting the 'Skin' label (#3).

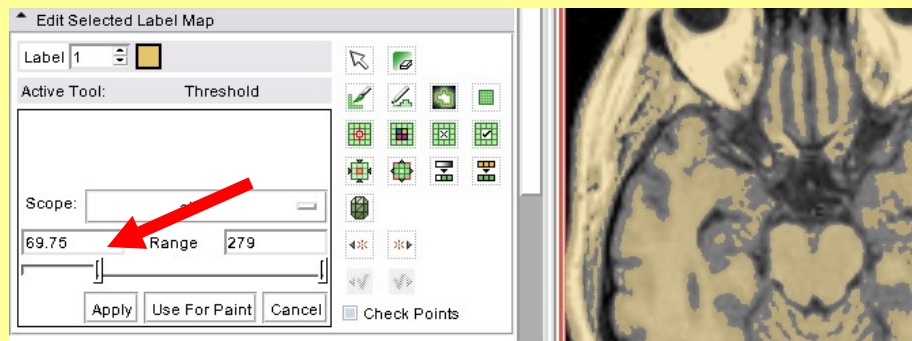
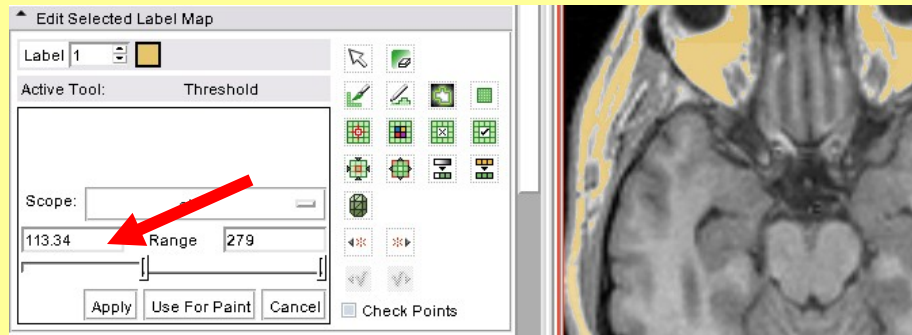
Number	Color	Name
125		pia_mater
126		muscles_of_head
127		salivary_glands
128		lips
129		nose
130		tongue
131		soft_palate
132		right_inner_ear
133		left_inner_ear
134		right_external_ear
135		left_external_ear
136		right_middle_ear
137		left_middle_ear
138		right_eyeball
139		left_eyeball
140		skull
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

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

Select the label #3 'Skin'



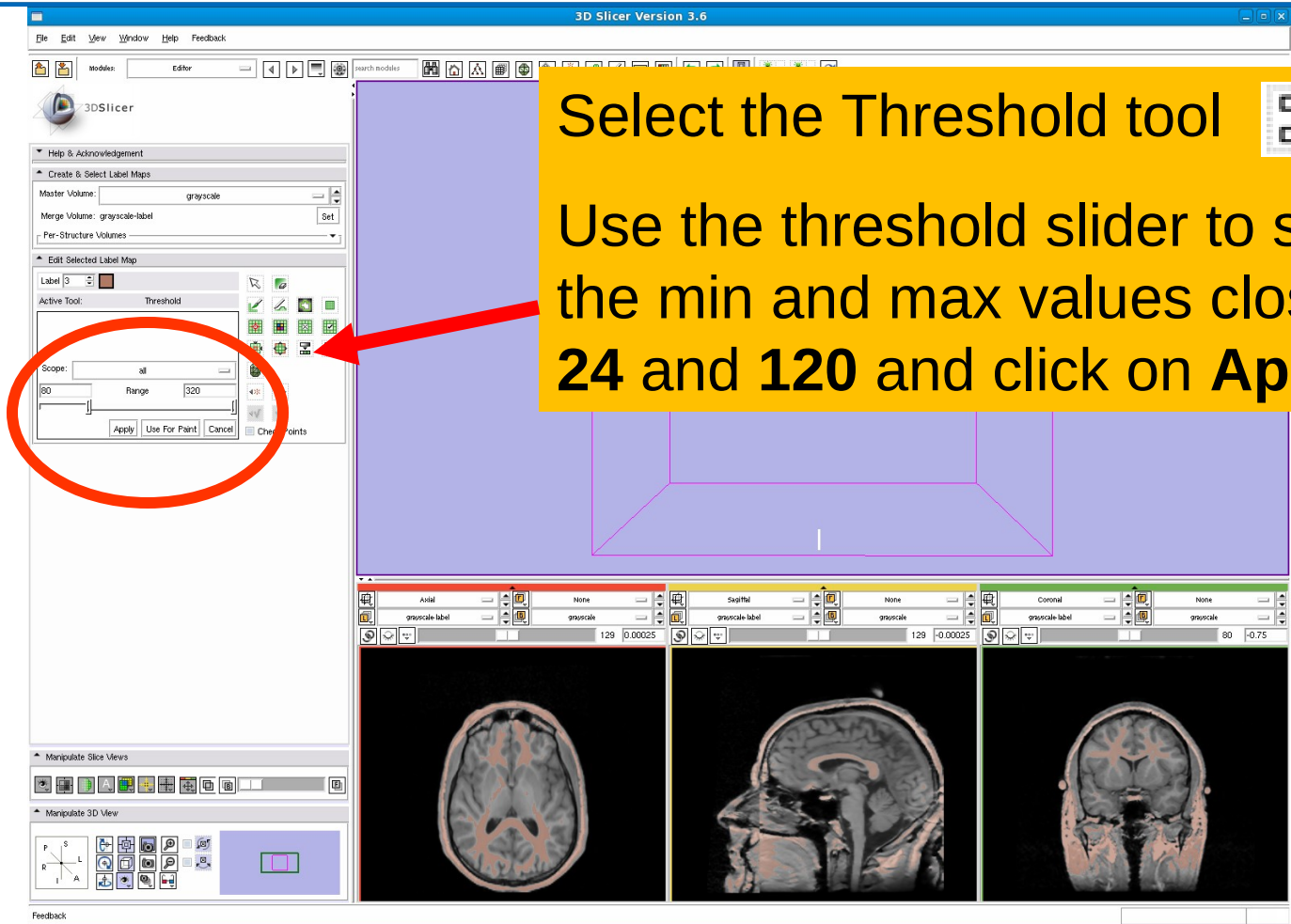
Threshold



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.



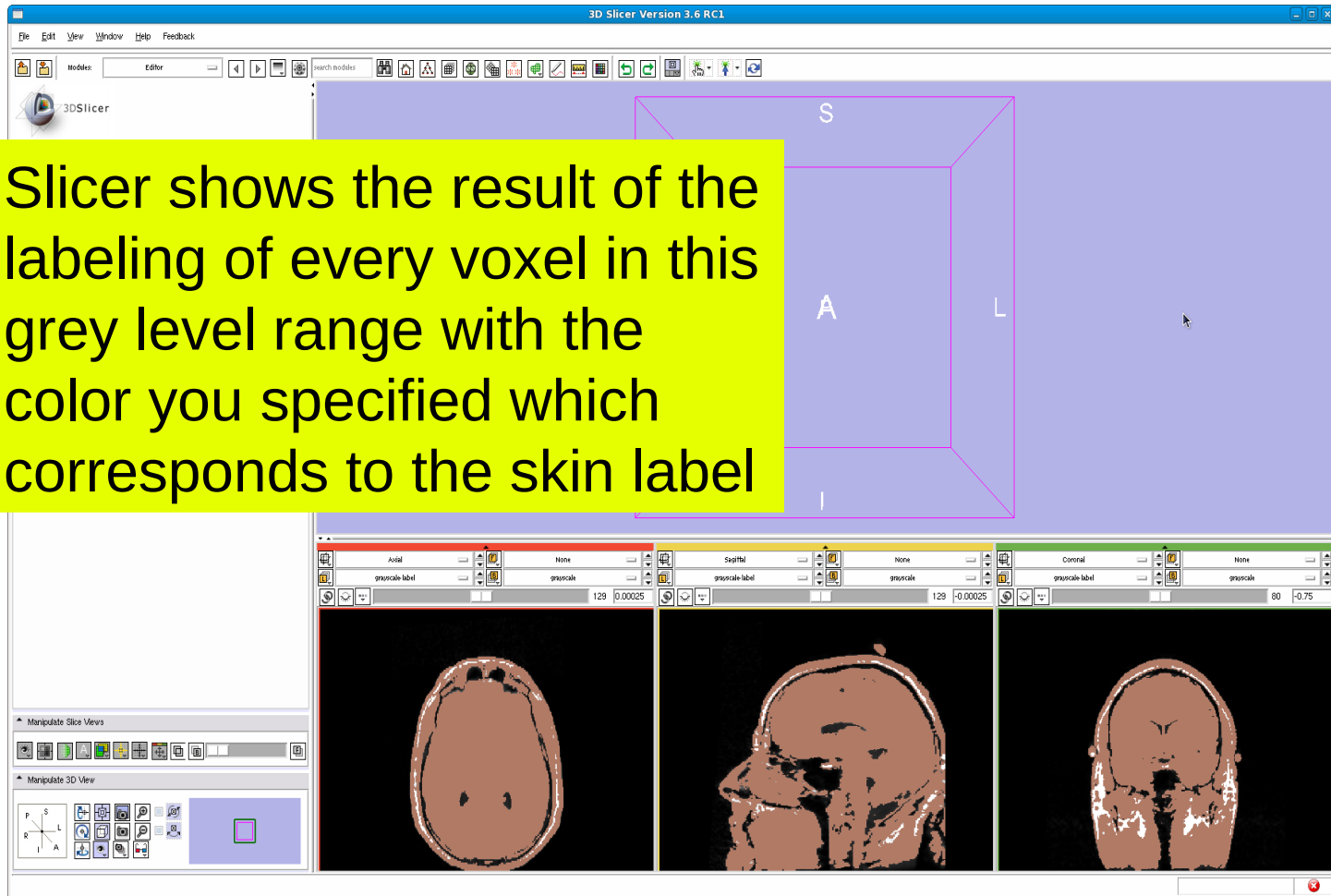
Threshold Effect





Threshold Effect

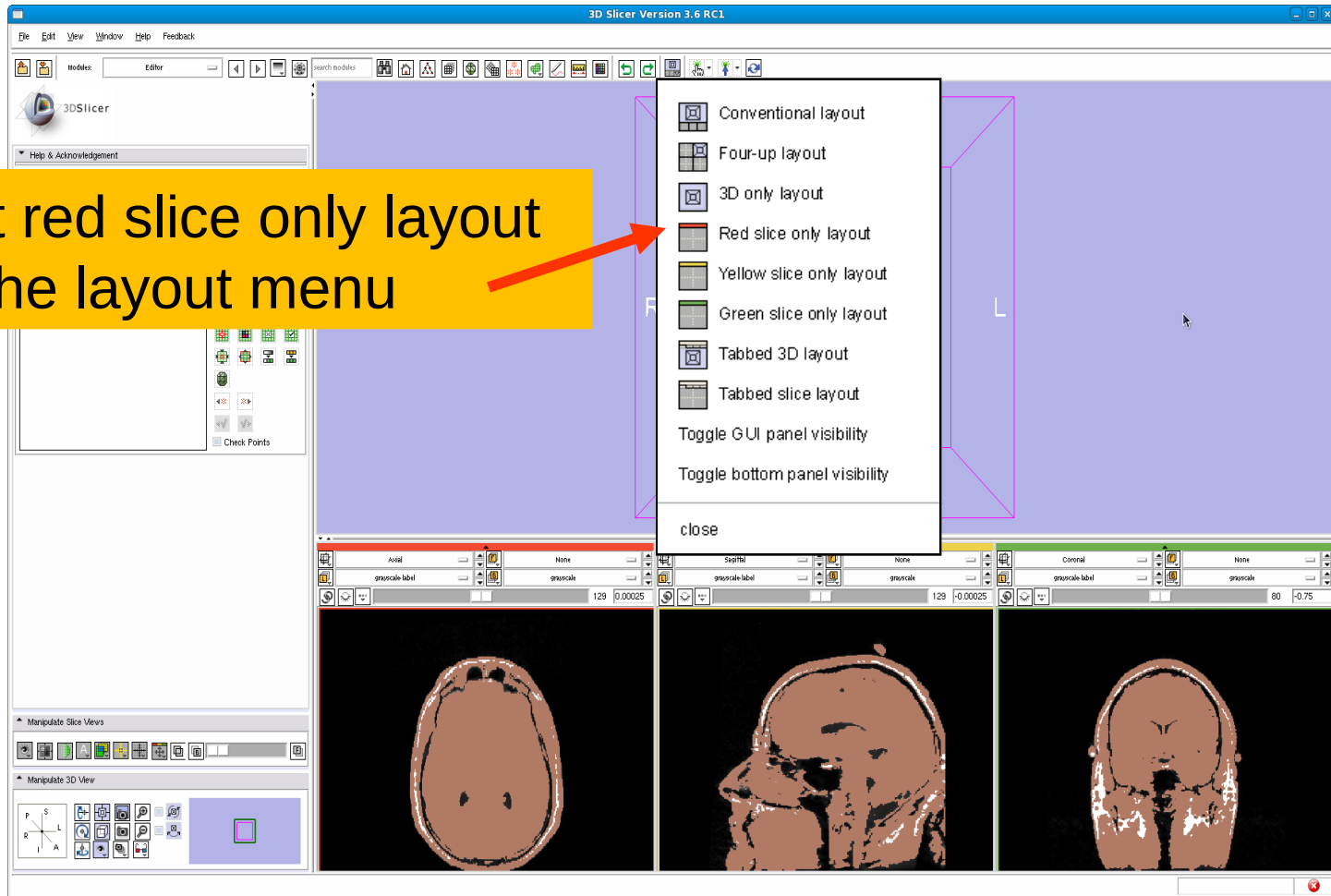
Slicer shows the result of the labeling of every voxel in this grey level range with the color you specified which corresponds to the skin label





Threshold Effect

Select red slice only layout
from the layout menu





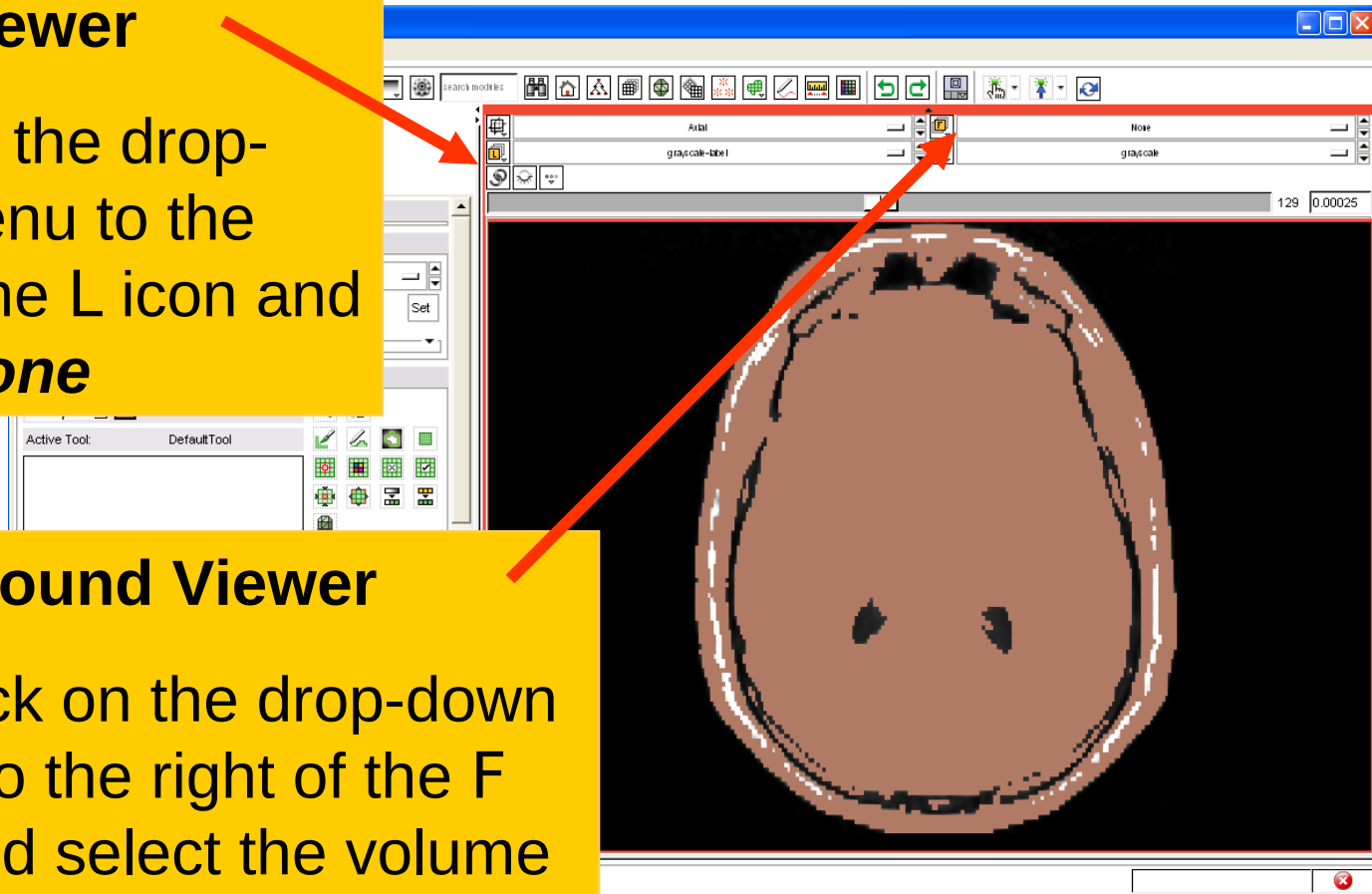
Threshold Effect

Label Viewer

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

Foreground Viewer

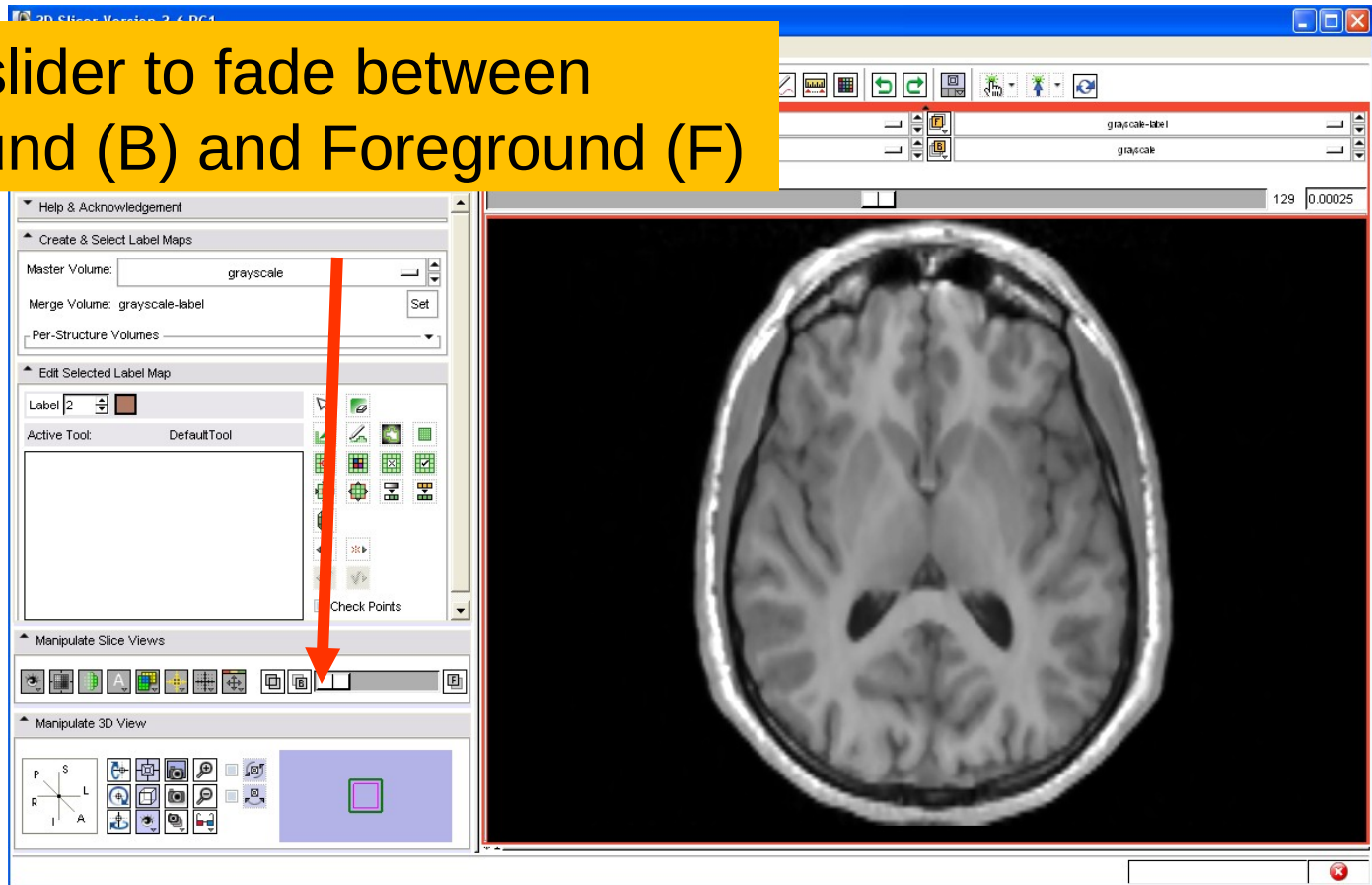
Left click on the drop-down menu to the right of the F icon and select the volume ***grayscale-label***





Threshold Effect

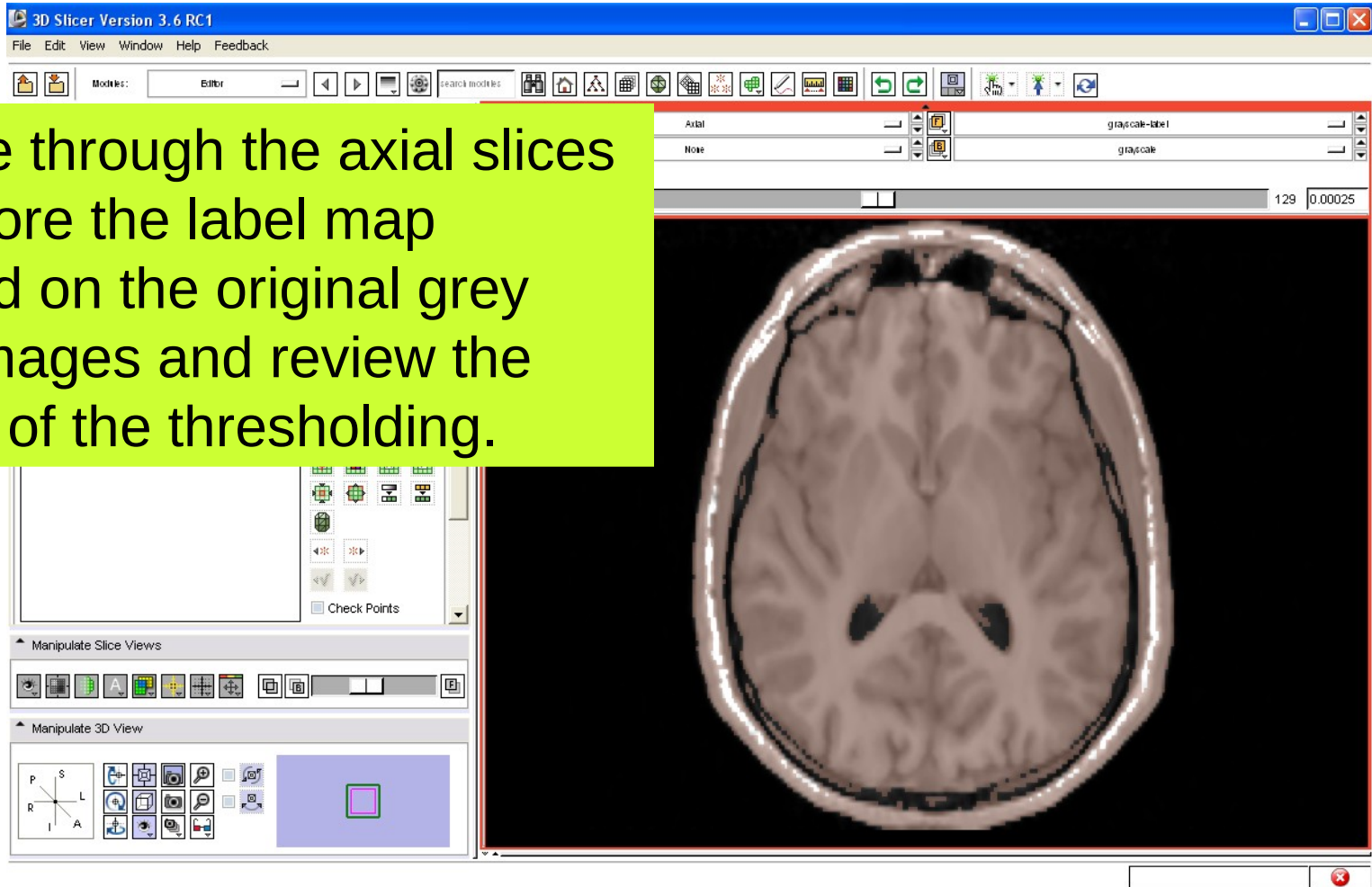
Use the slider to fade between Background (B) and Foreground (F)





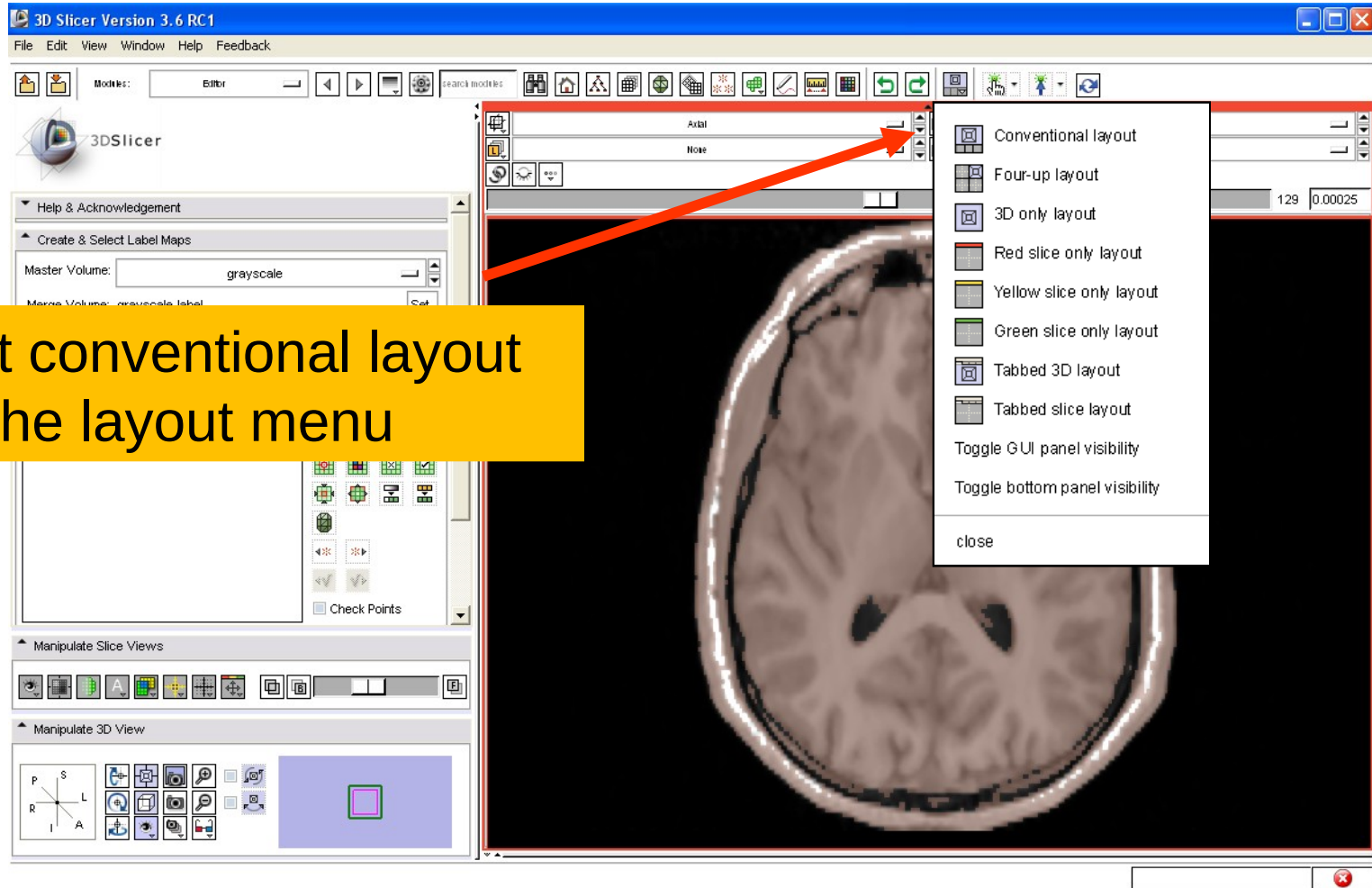
Exploring the result

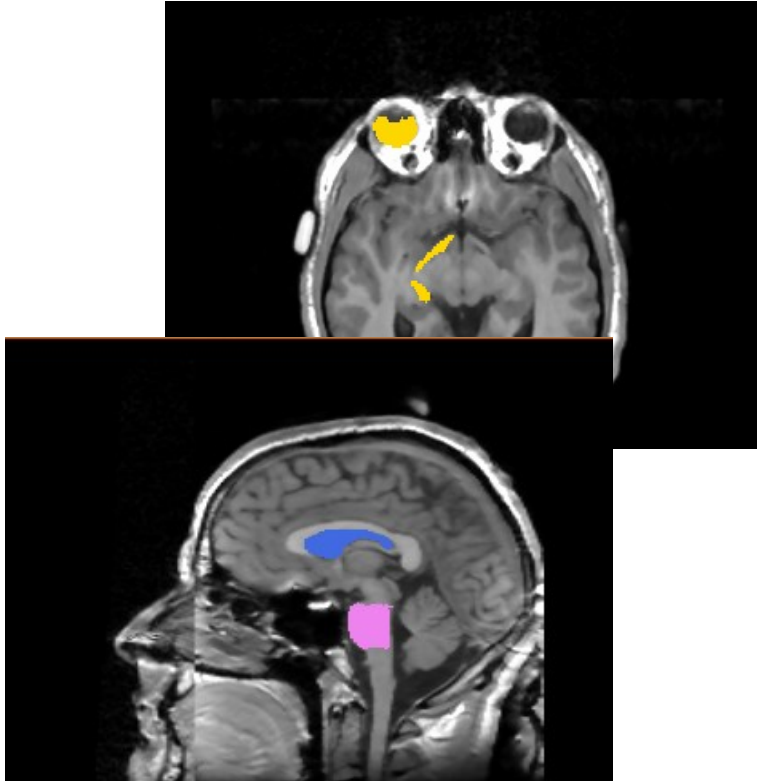
Browse through the axial slices to explore the label map overlaid on the original grey level images and review the results of the thresholding.





Threshold Effect

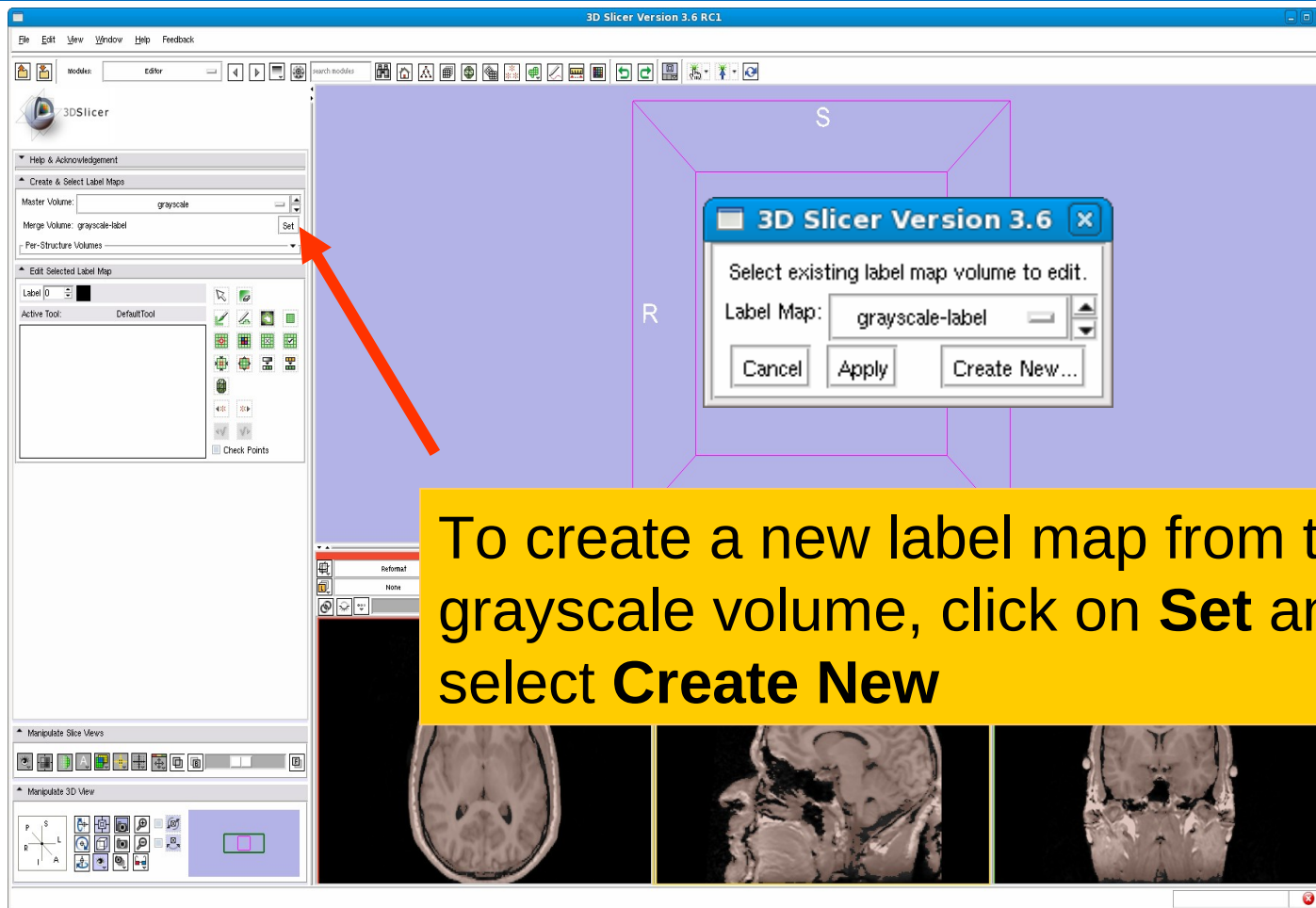




Part 3: Creating and editing a label map with multiple labels



Creating a map with multiple labels

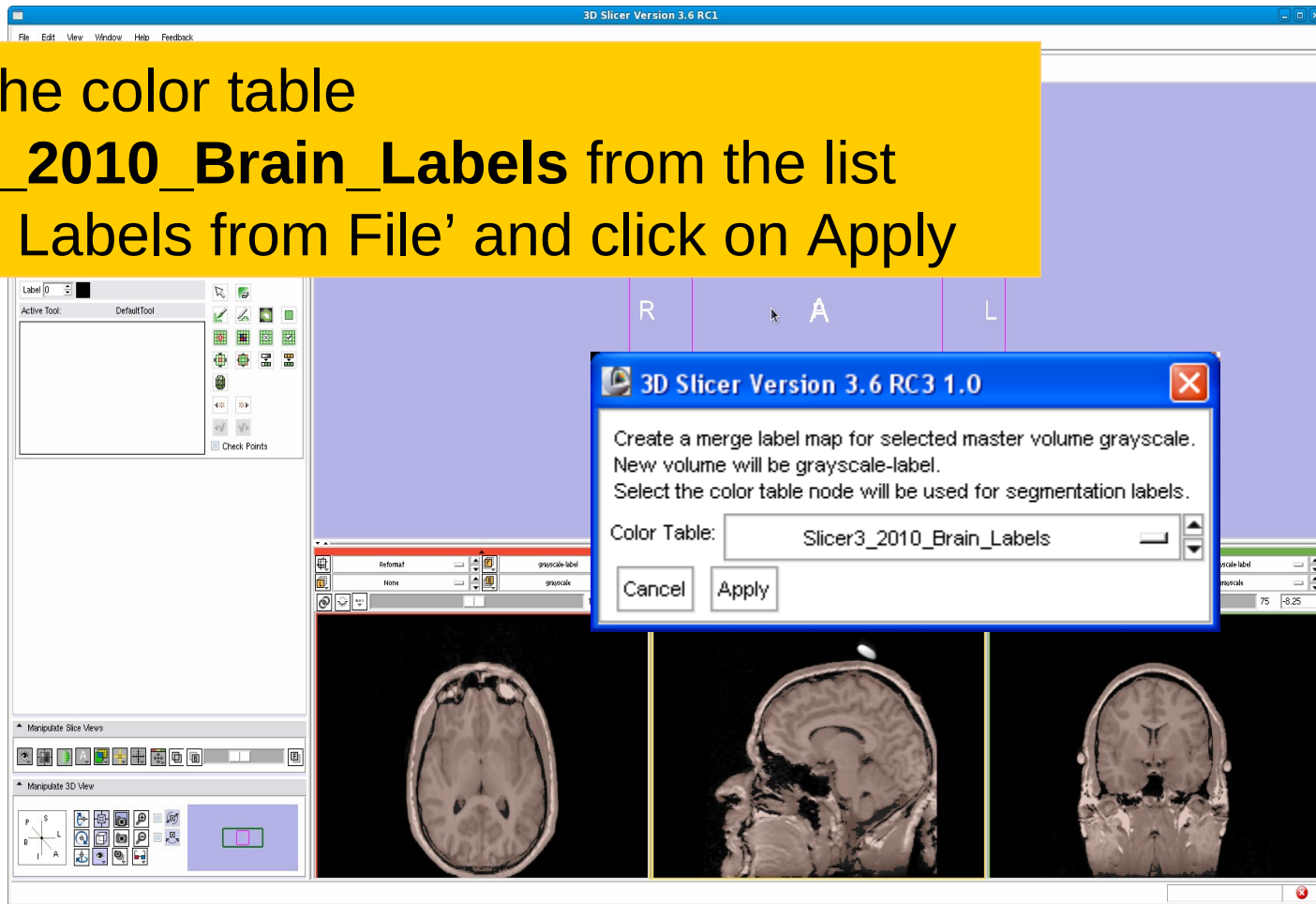




Creating a map with multiple labels

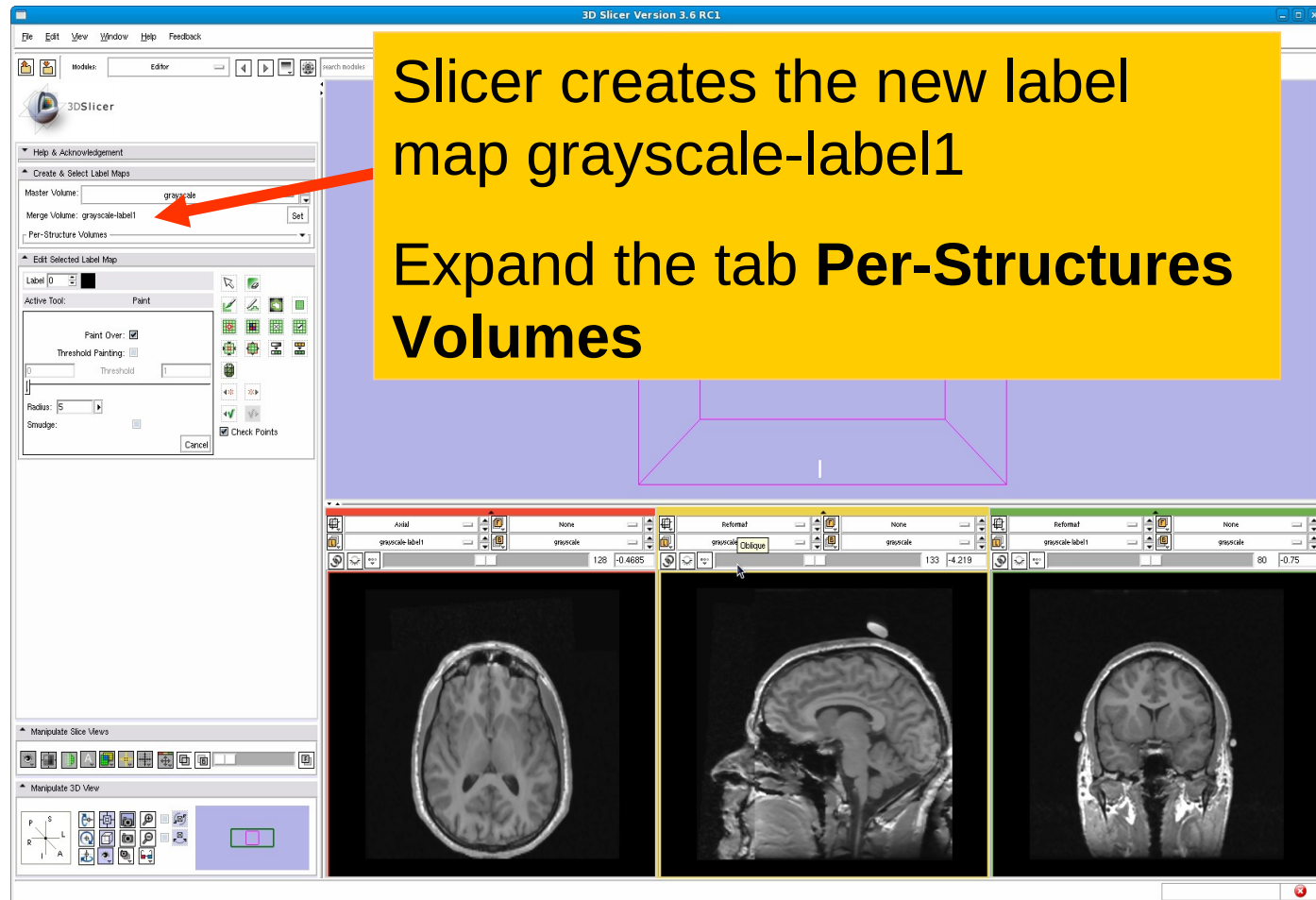
Select the color table

Slicer3_2010_Brain_Labels from the list
'Default Labels from File' and click on Apply





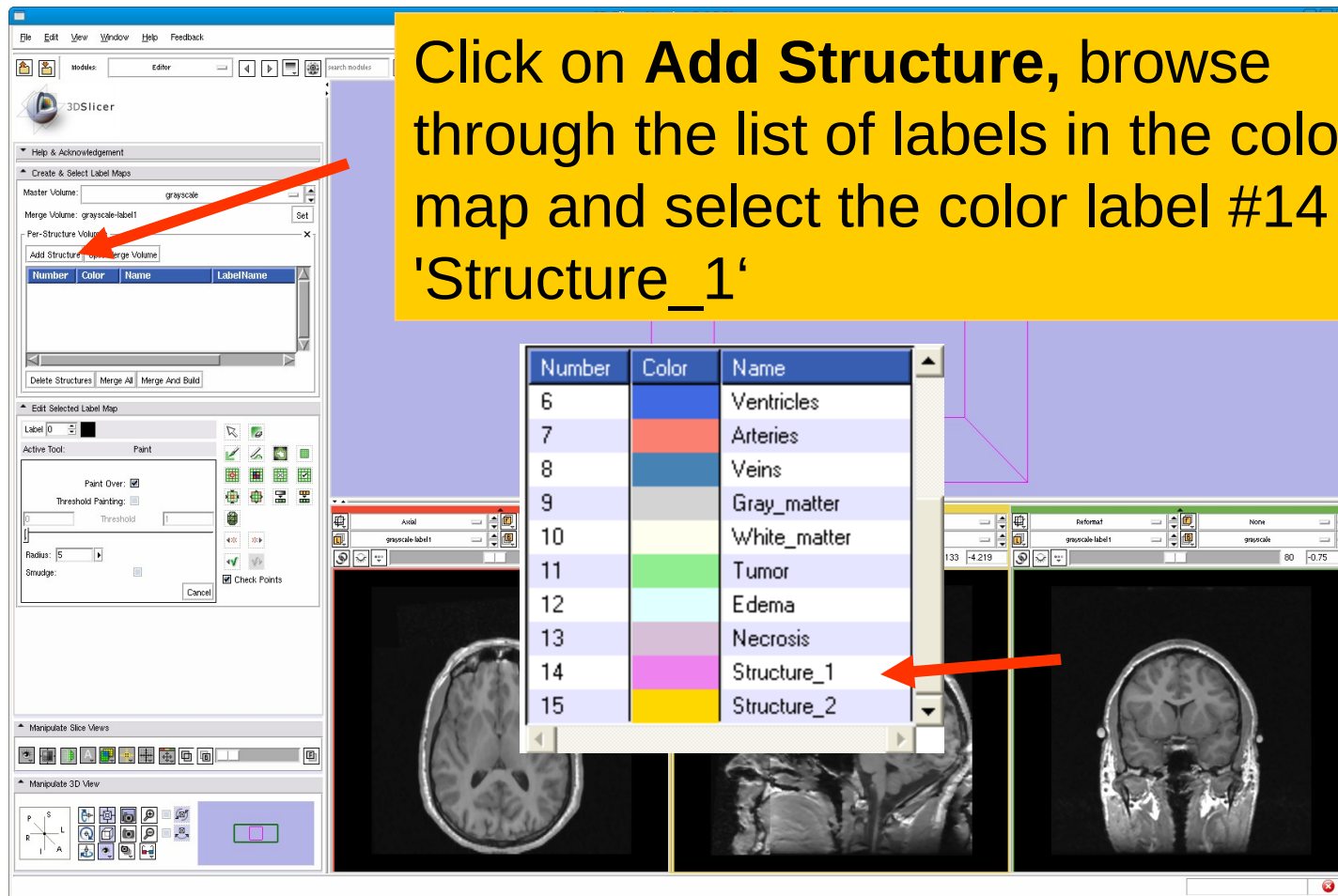
Creating a map with multiple labels





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'





Drawing

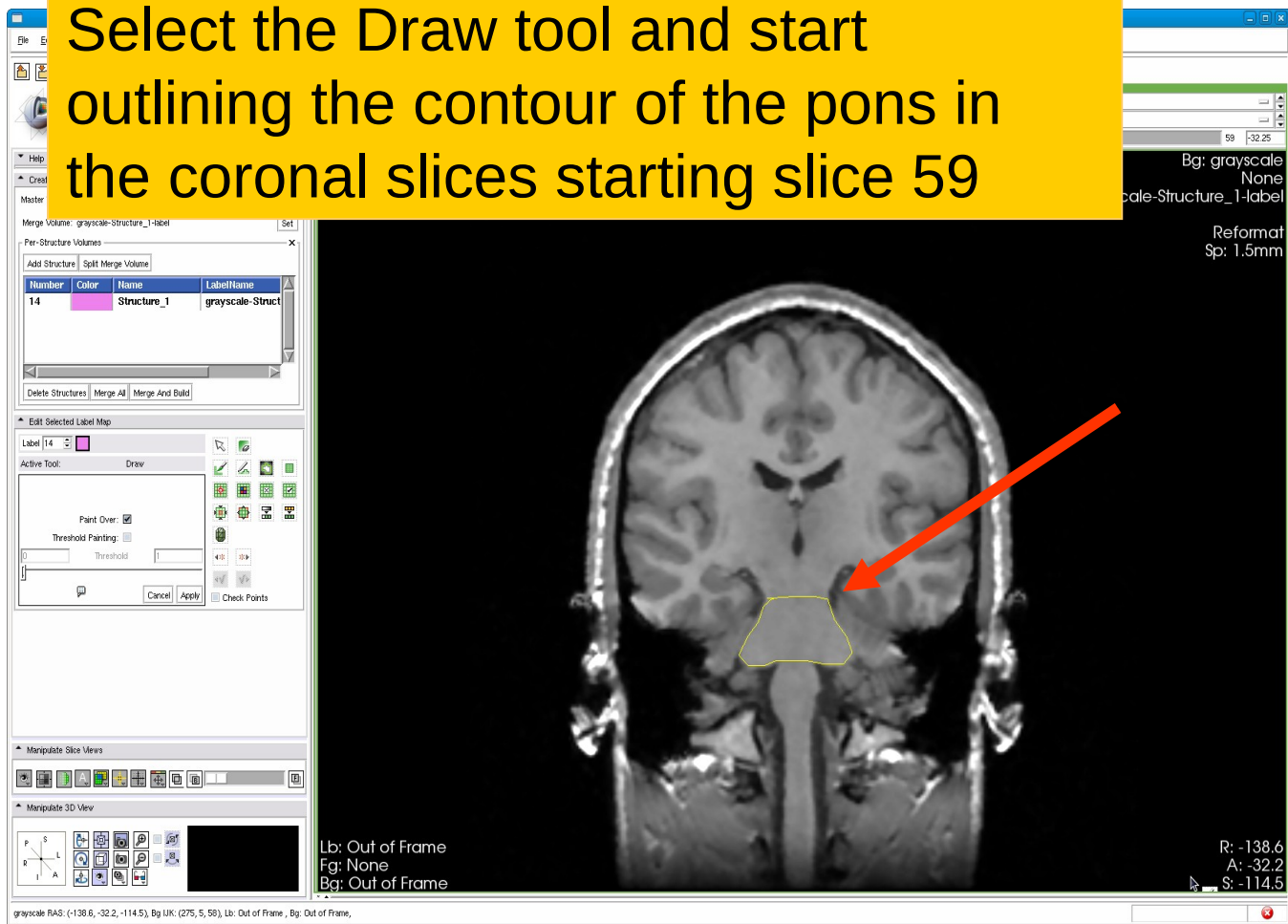


Description: The draw tool is an intuitive tool that can be used to manually outline structures in the grey level images.



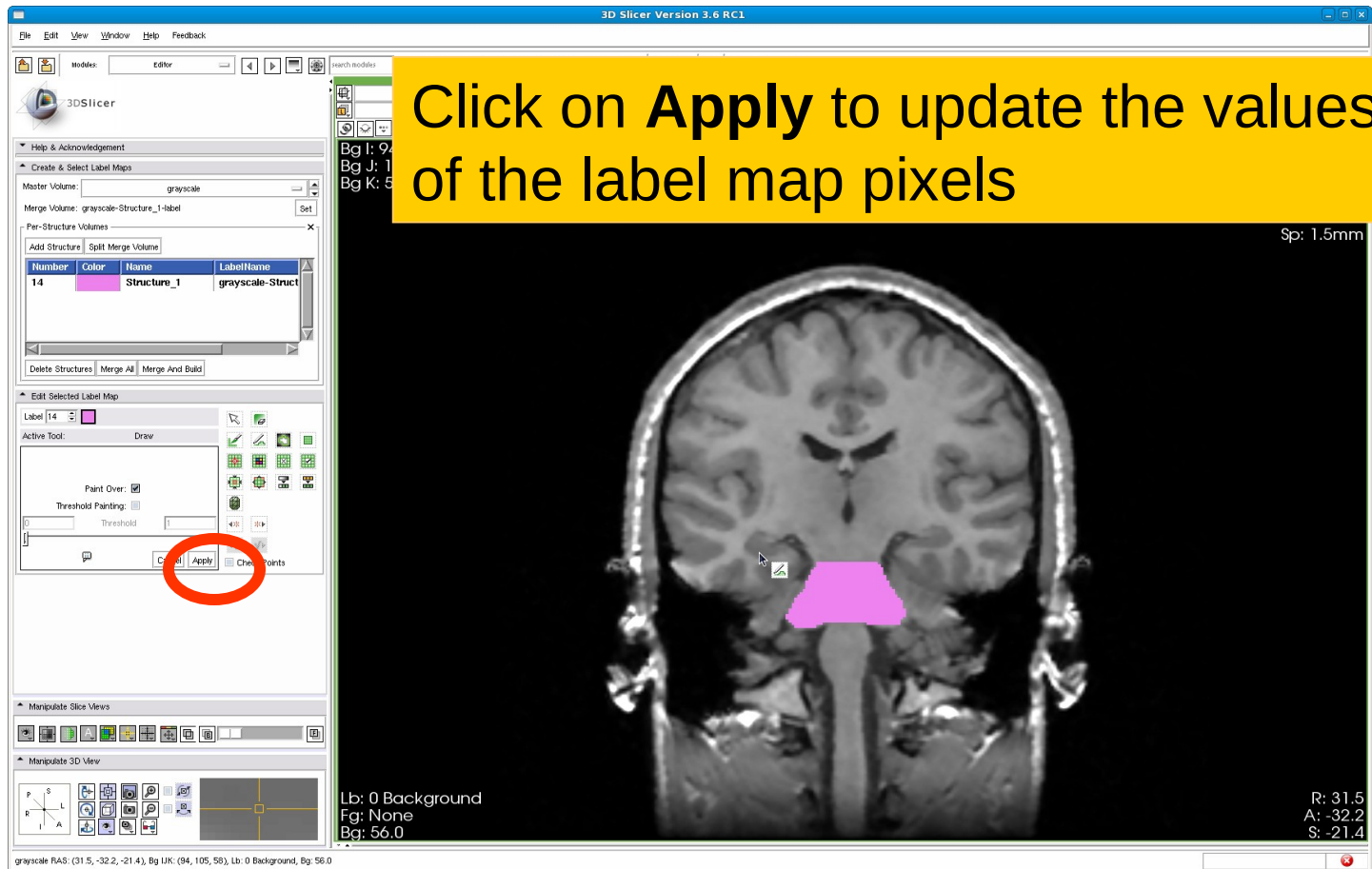
Draw Tool

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



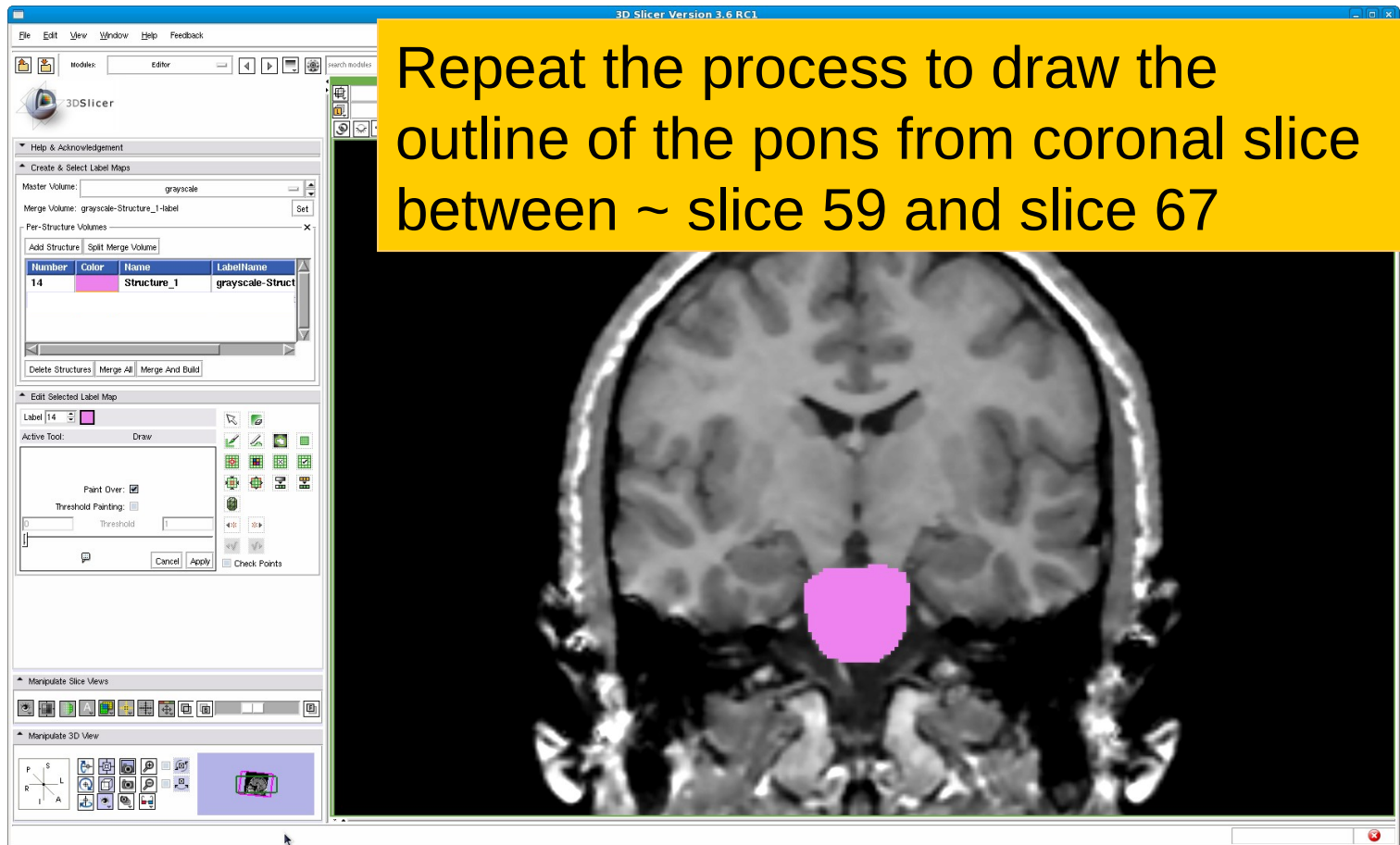


Draw Tool





Draw Tool





Adding a second structure

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

Number	Color	Name
0	Black	Background
1	Yellow	Bone
2	Brown	Skin
3	Red	Muscles
4	Yellow	Fat
5	Cyan	CSF
6	Blue	Ventricles
7	Red	Arteries
8	Blue	Veins
9	Gray	Gray_matter

3D Slicer Version 3.6 RC1

Reformat Sp: 1.5mm

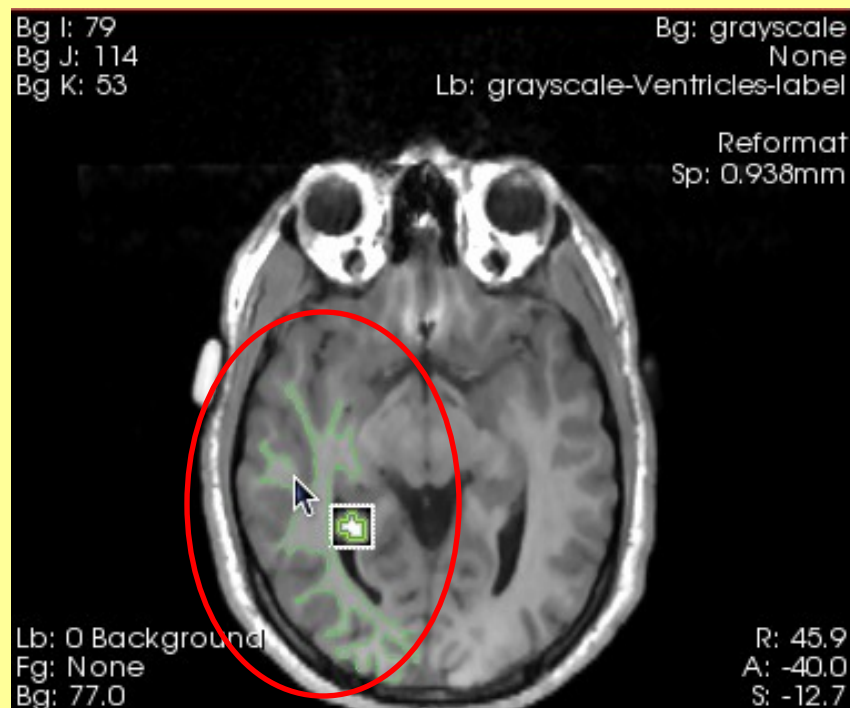
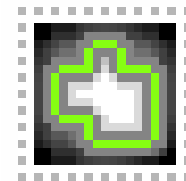
Lb: 0 Background
Fg: None
Bg: 81.0

R: -37.7
A: -30.8
S: 29.2

grayscale RAS: (-37.7, -30.8, 29.2), Bg LK: (168, 159, 59), Lb: 0 Background, Bg: 81.0



Level Tracing

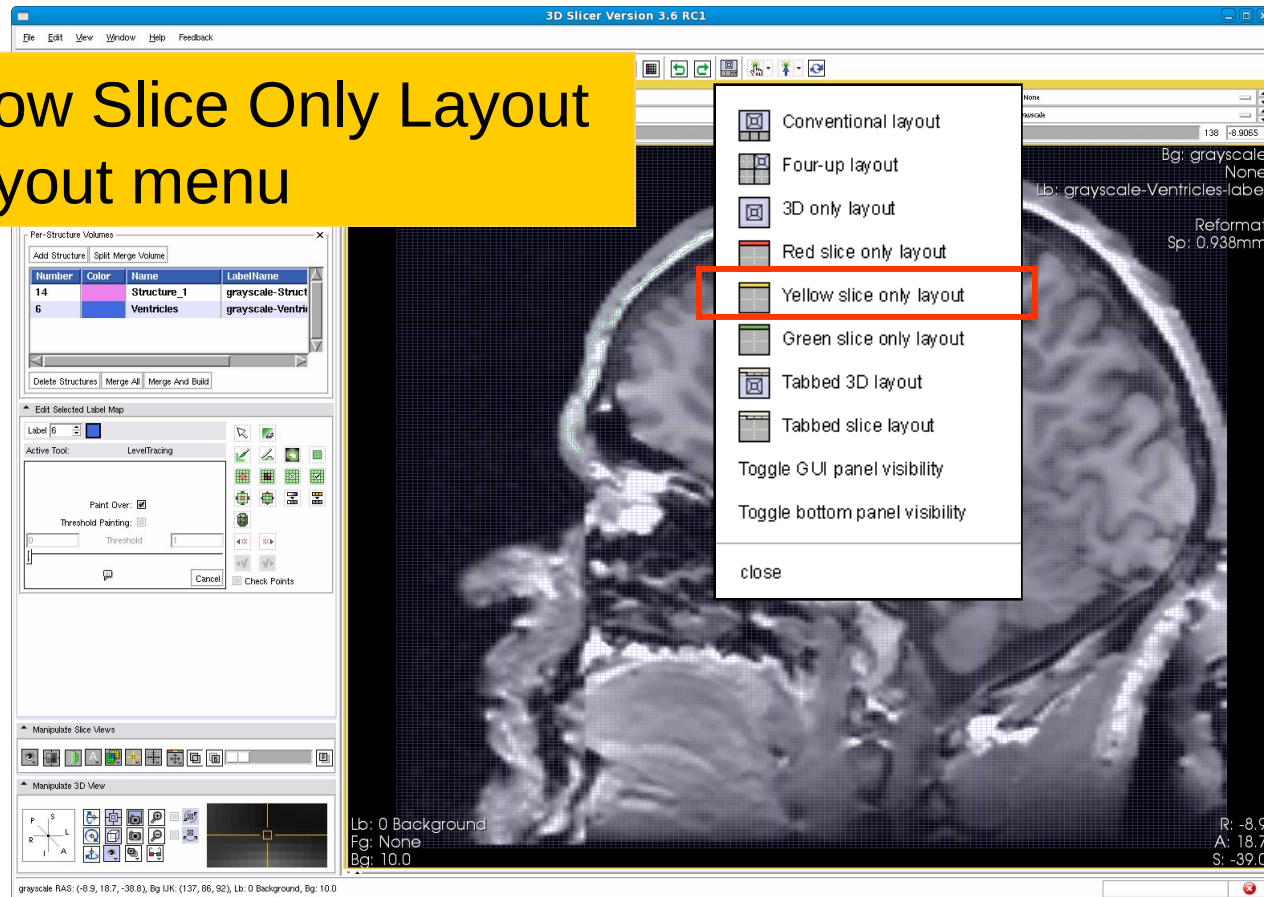


Description: By moving the mouse in the grey level images, you'll define in the label map volume an outline where the pixels all have the same value as the current background pixel.



Level Tracing

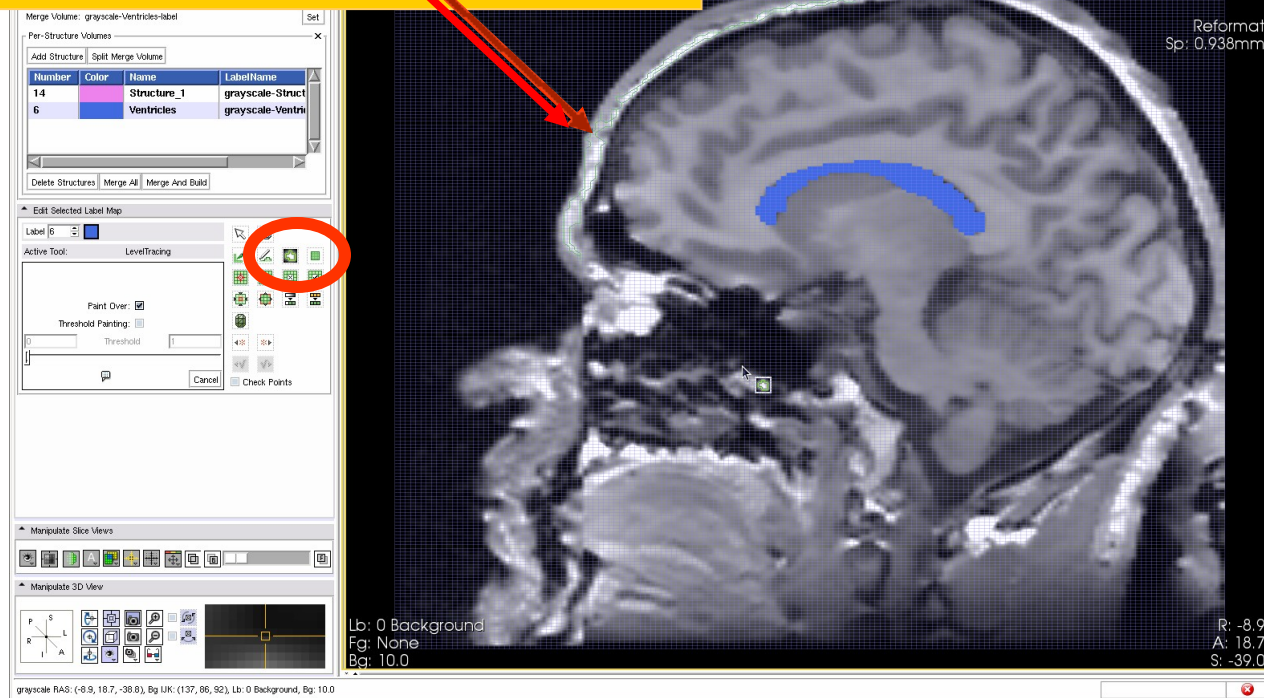
Select Yellow Slice Only Layout
from the layout menu





Level Tracing

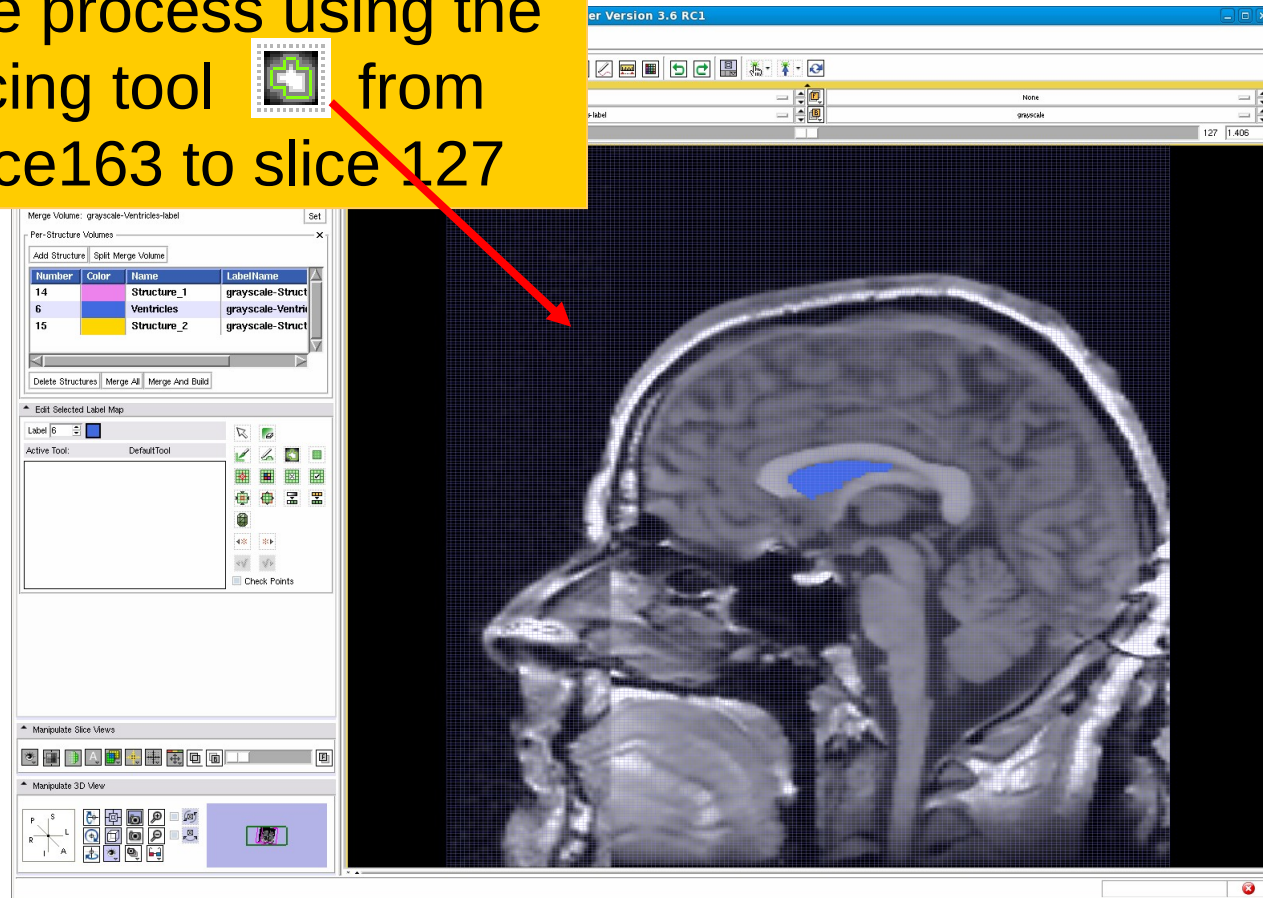
Use the **Level Tracing** tool to trace the outline of the left lateral ventricle on slice 138





Level Tracing

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

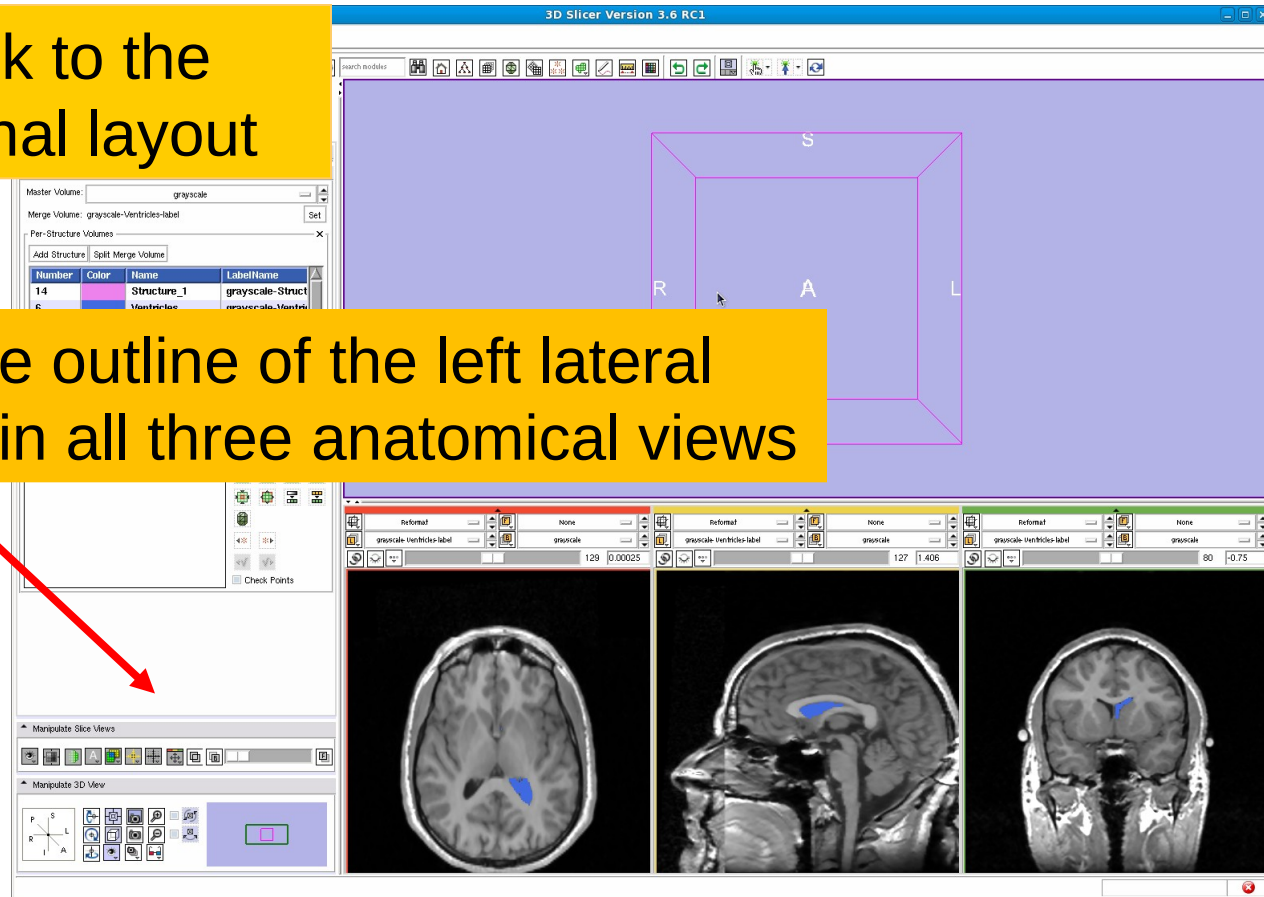




Level Tracing

Come back to the conventional layout

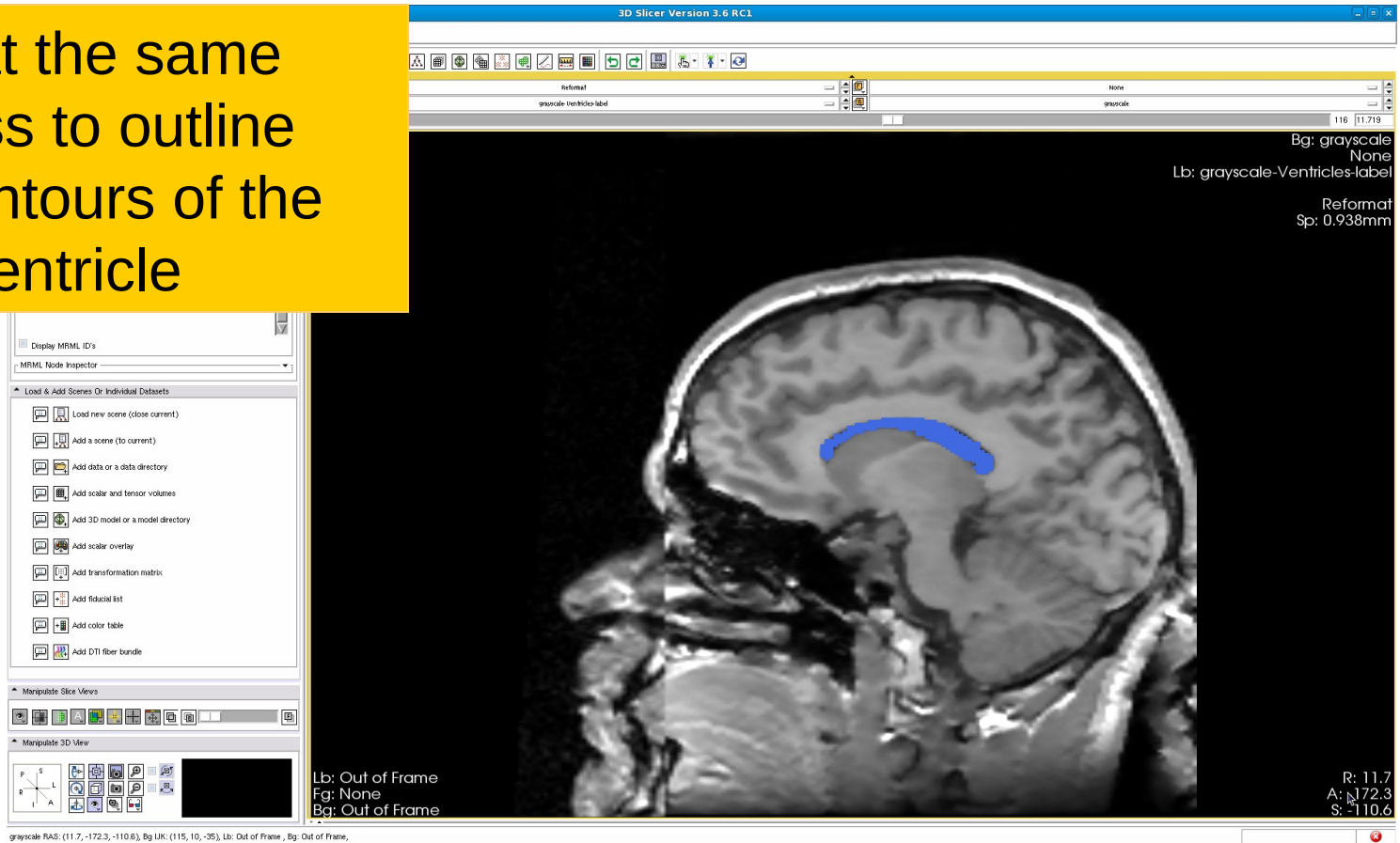
Explore the outline of the left lateral ventricles in all three anatomical views





Level Tracing

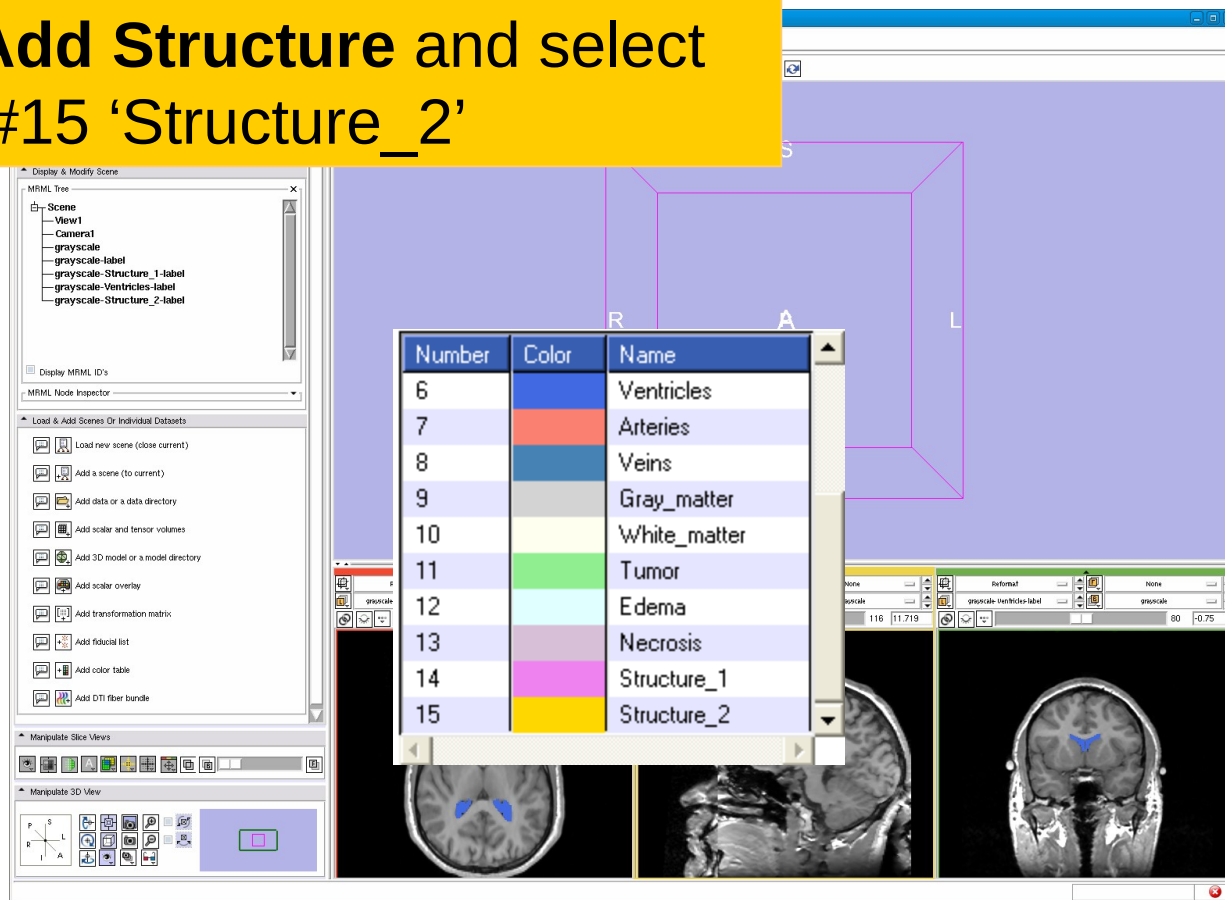
Repeat the same process to outline the contours of the right ventricle





Adding a third structure

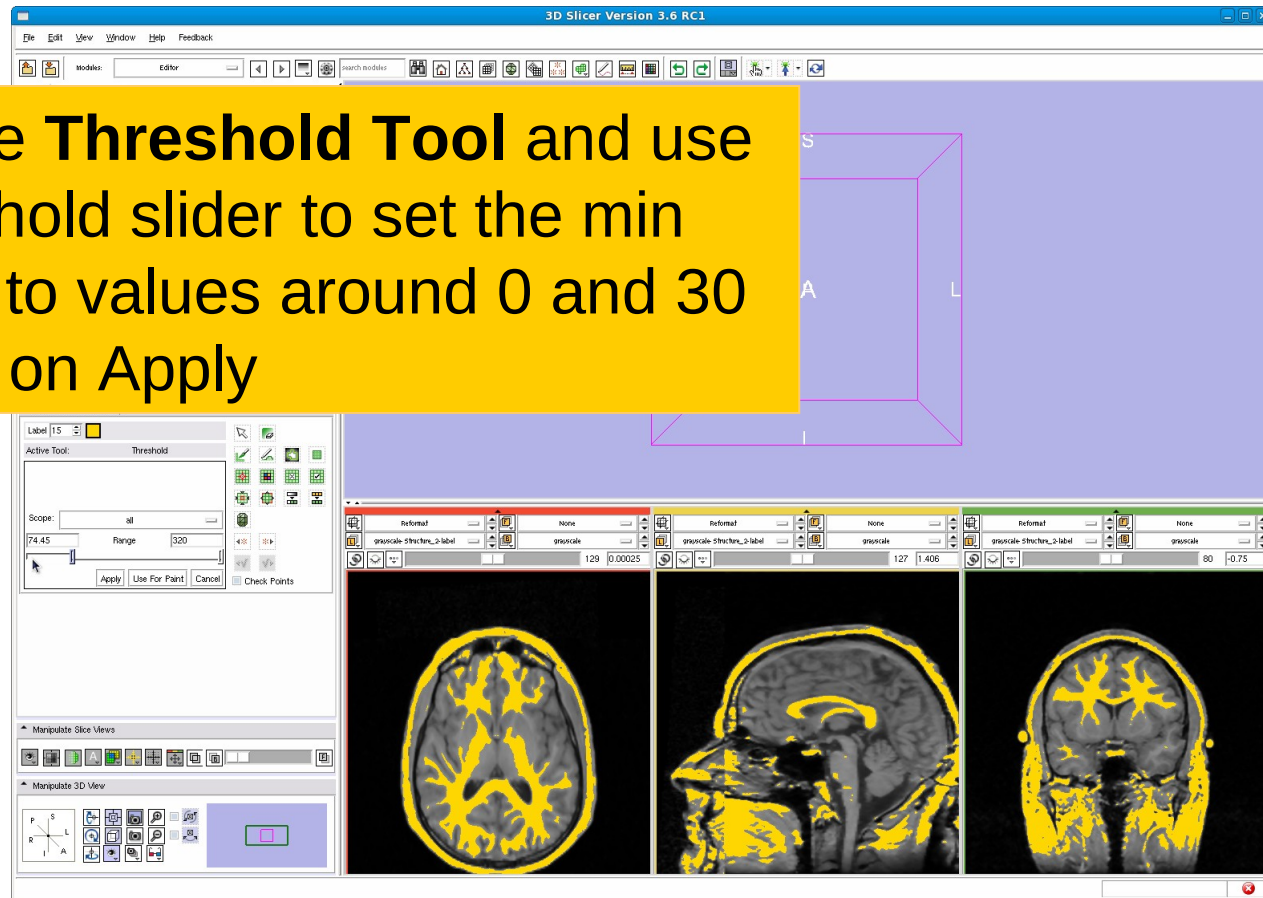
Click on **Add Structure** and select the label #15 'Structure_2'





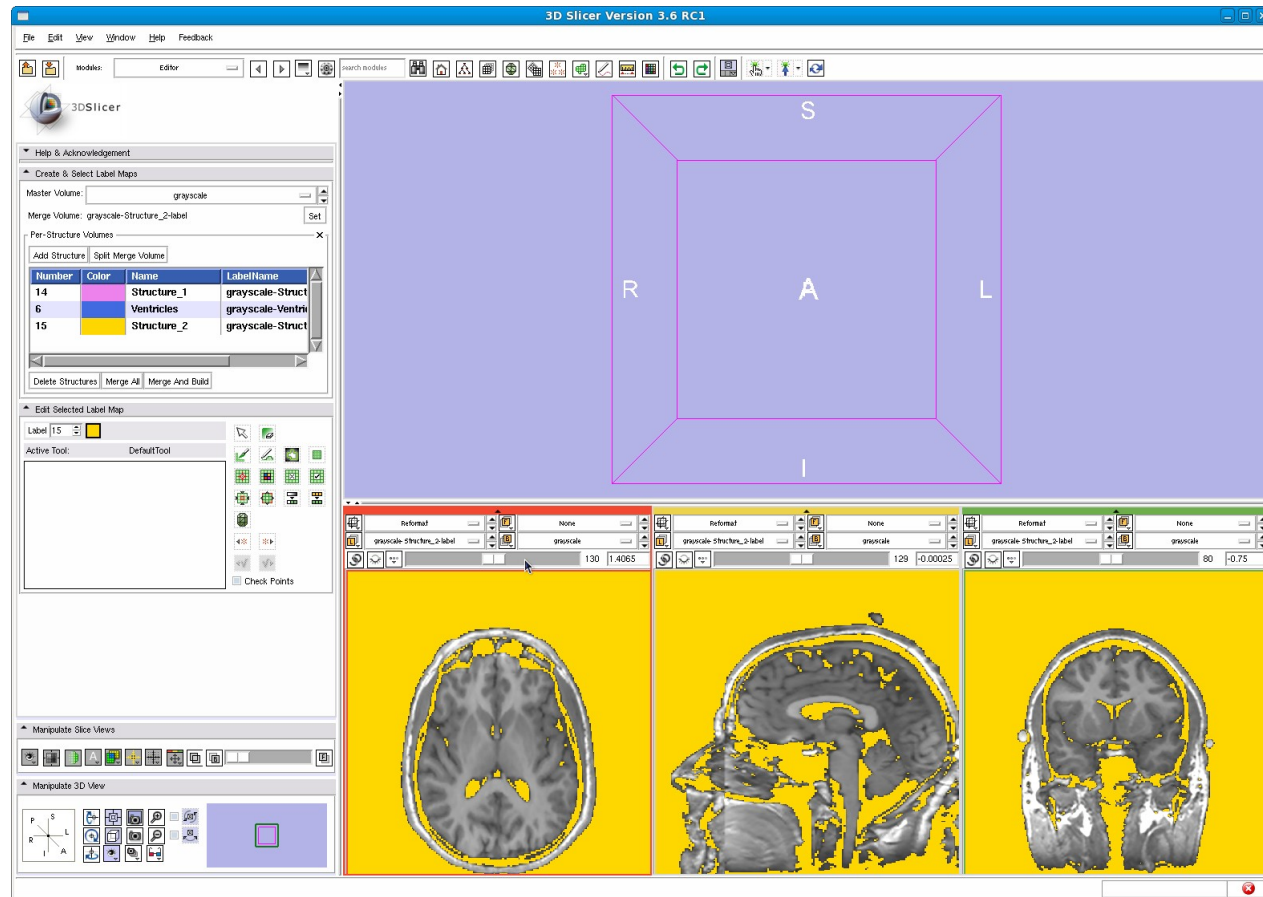
Threshold tool

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





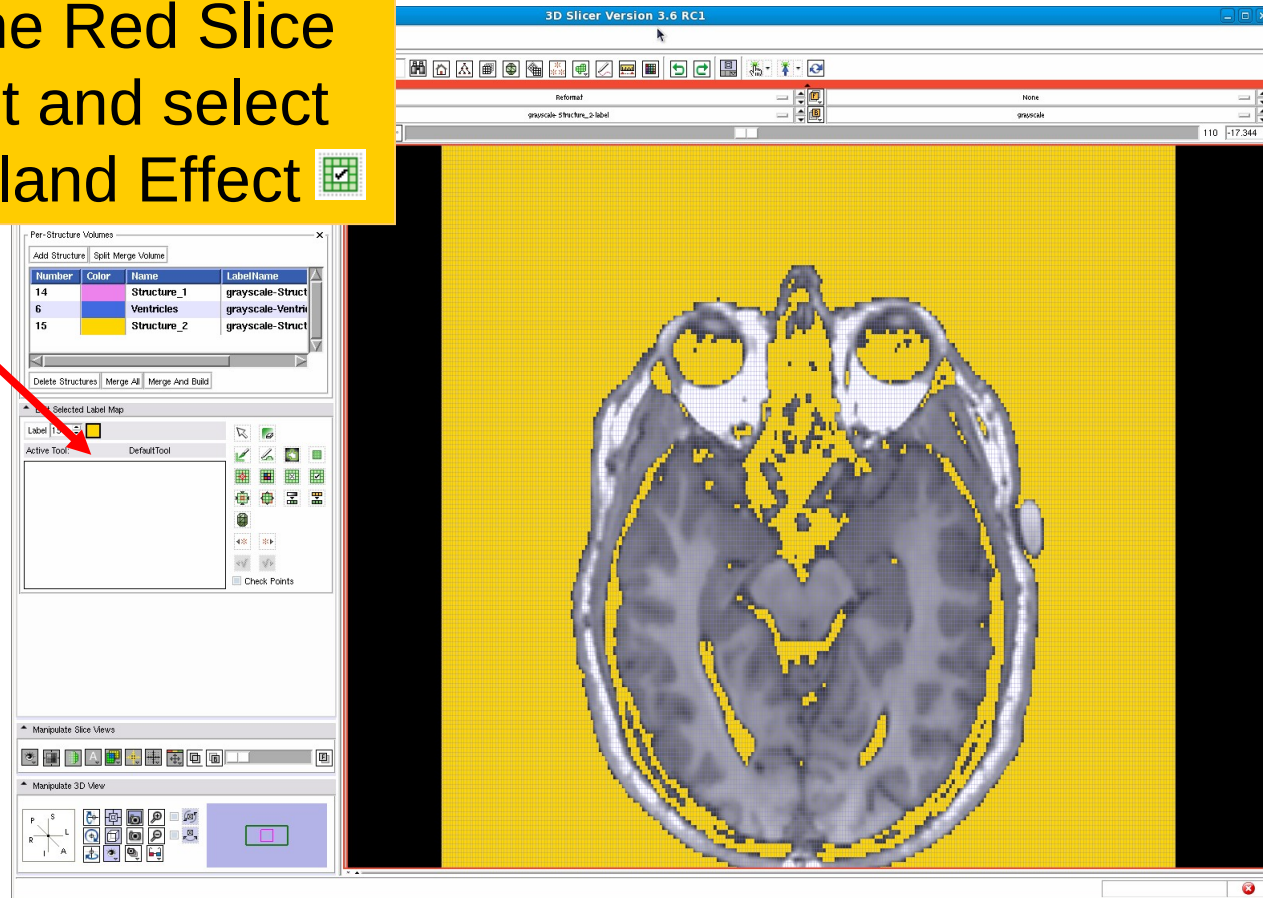
Threshold tool





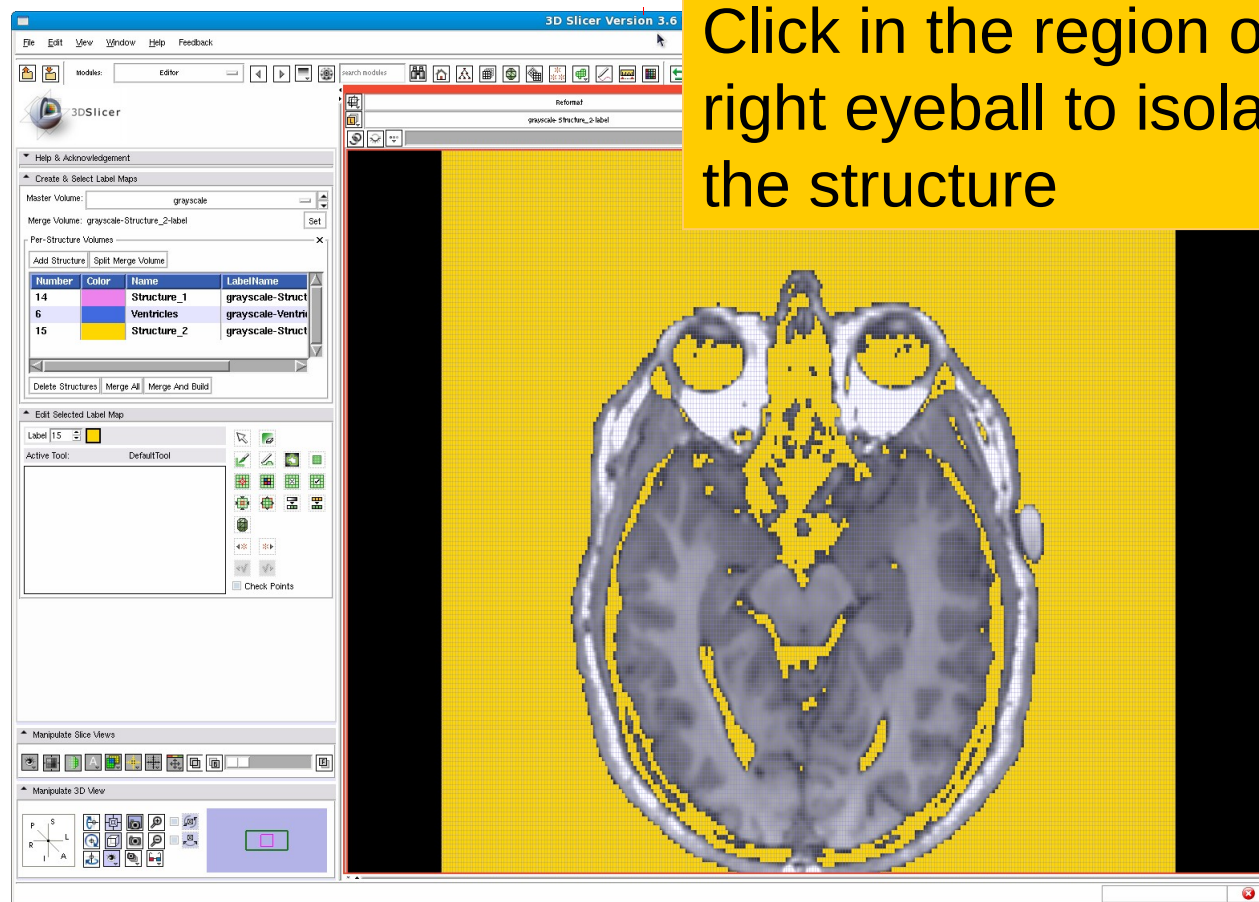
Save Island

Switch to the Red Slice Only Layout and select the Save Island Effect 





Save Island

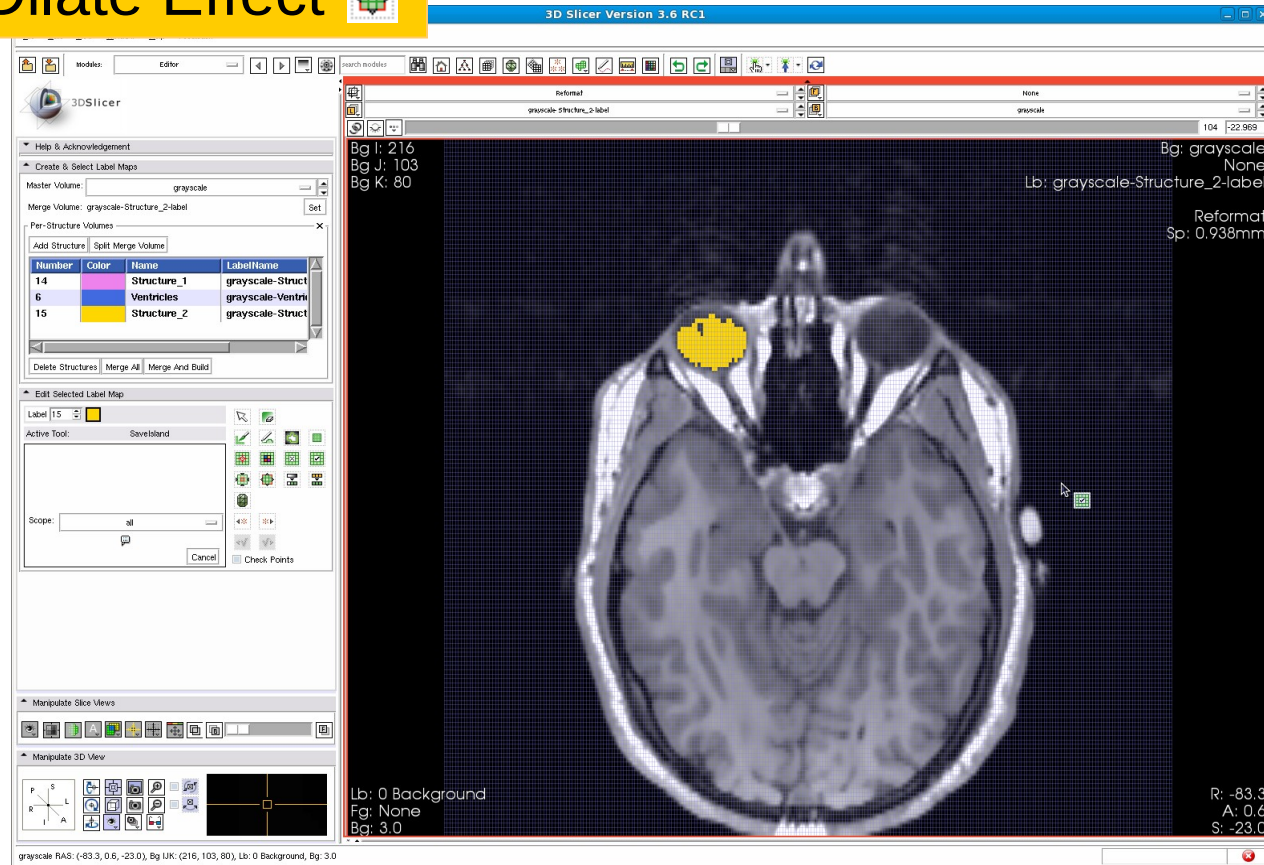


Click in the region of the right eyeball to isolate the structure



Dilate Effect

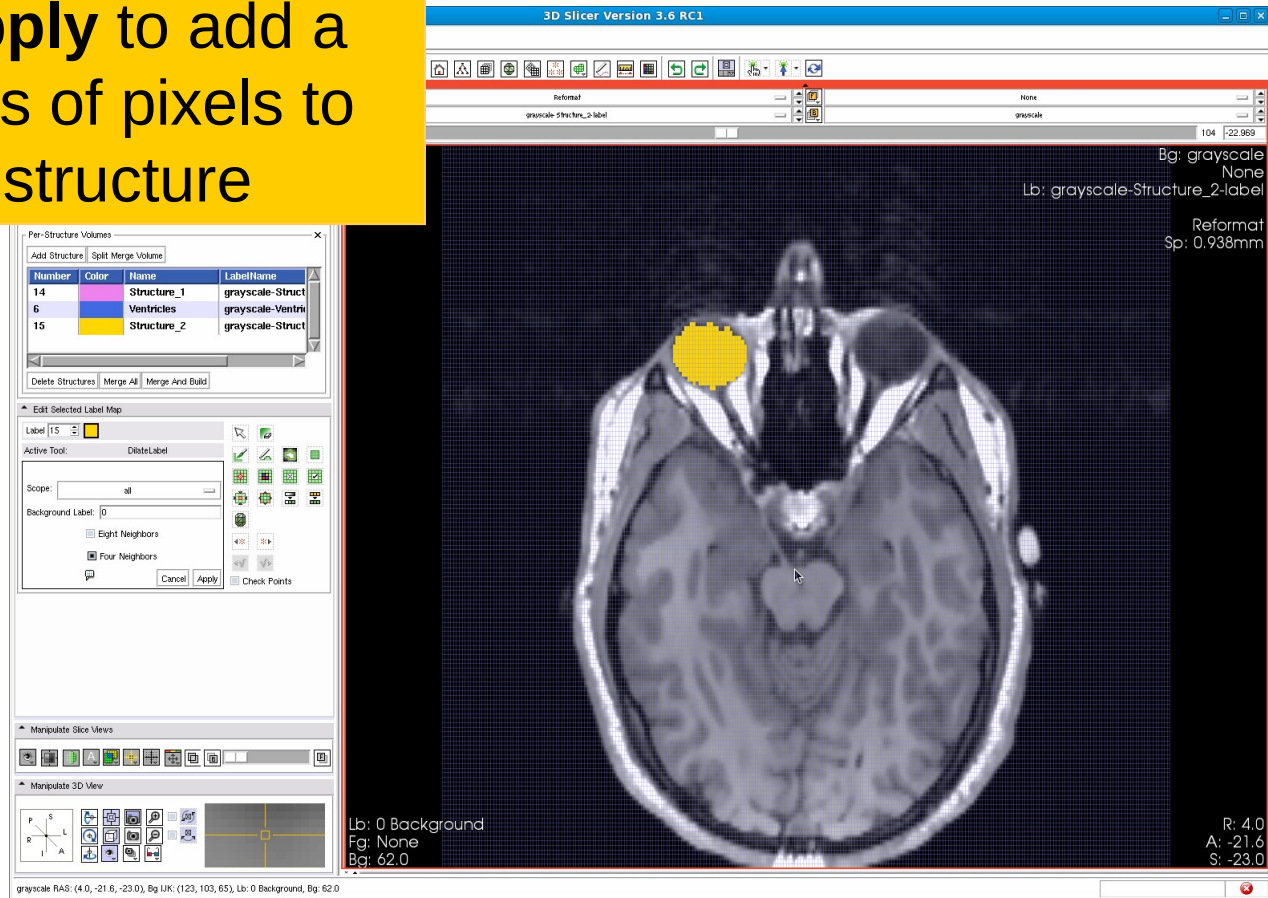
Select the Dilate Effect





Dilate Effect

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





Dilate Effect

Browse through the axial slices of the segmented eyeball

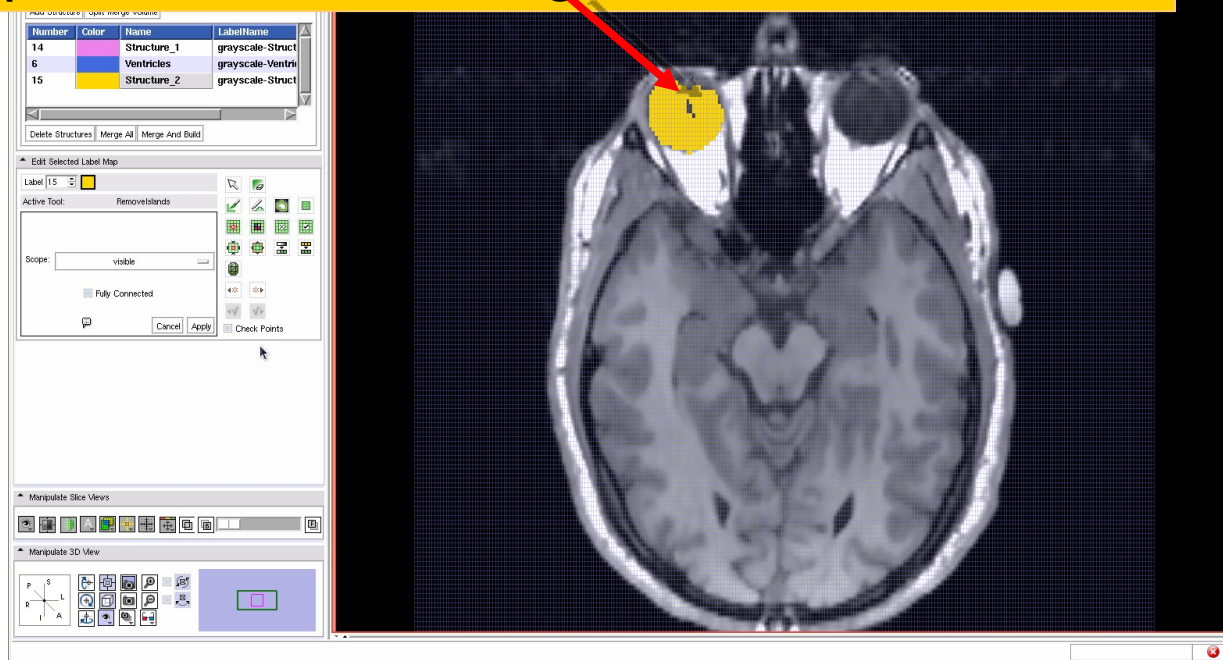




Remove Island

Select the **Remove Island**  tool

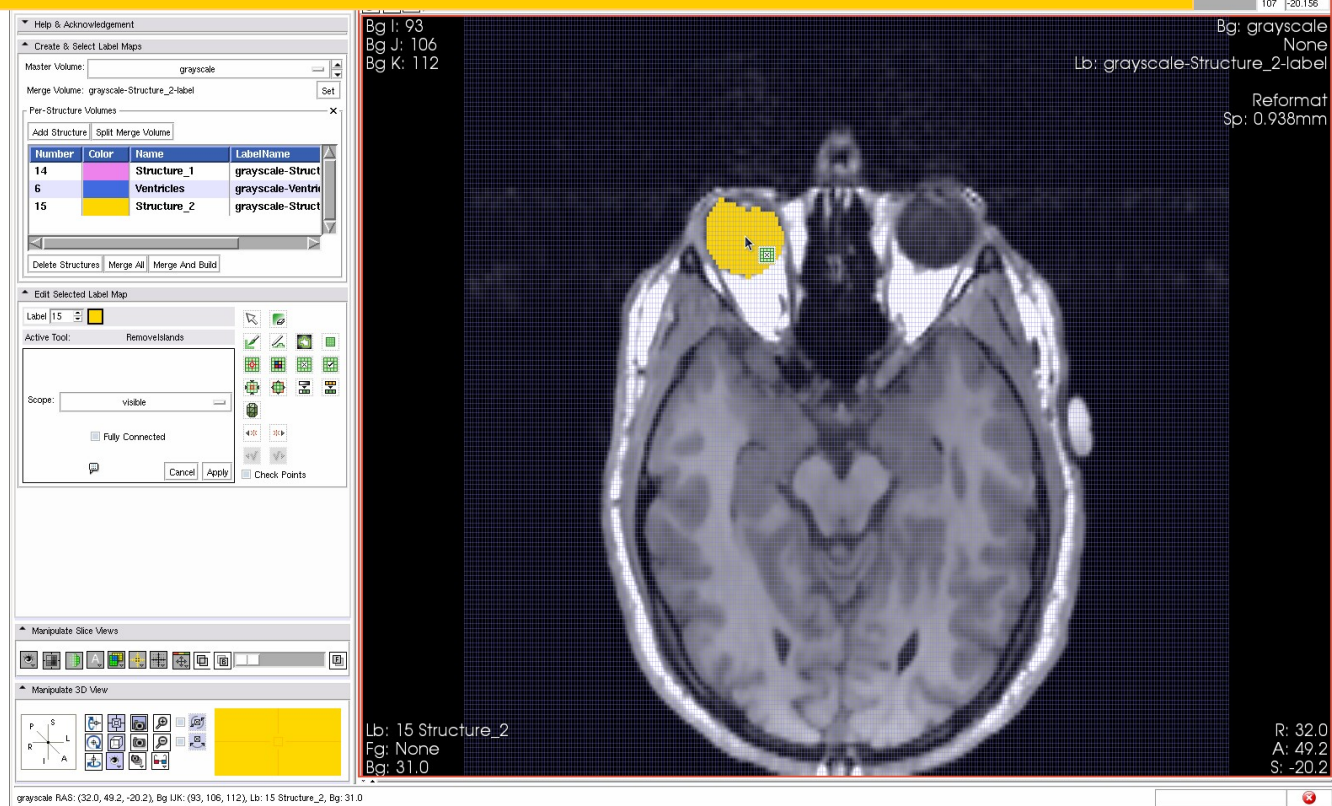
Select **Scope: visible** and click on **Apply** to remove the isolated pixels inside the segmented structure





Remove Island

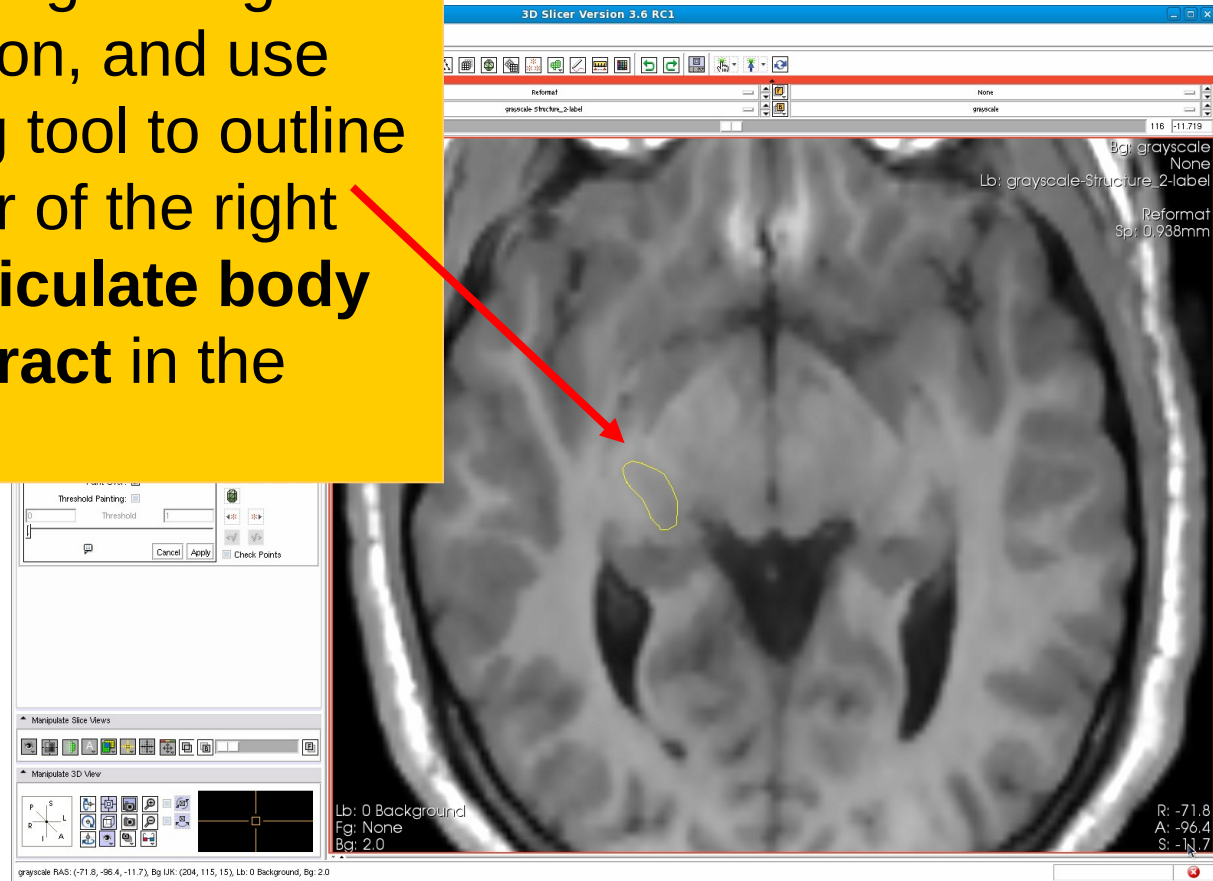
Repeat the process in the slices that contain isolated pixels in the eyeball structure





Adding more structures

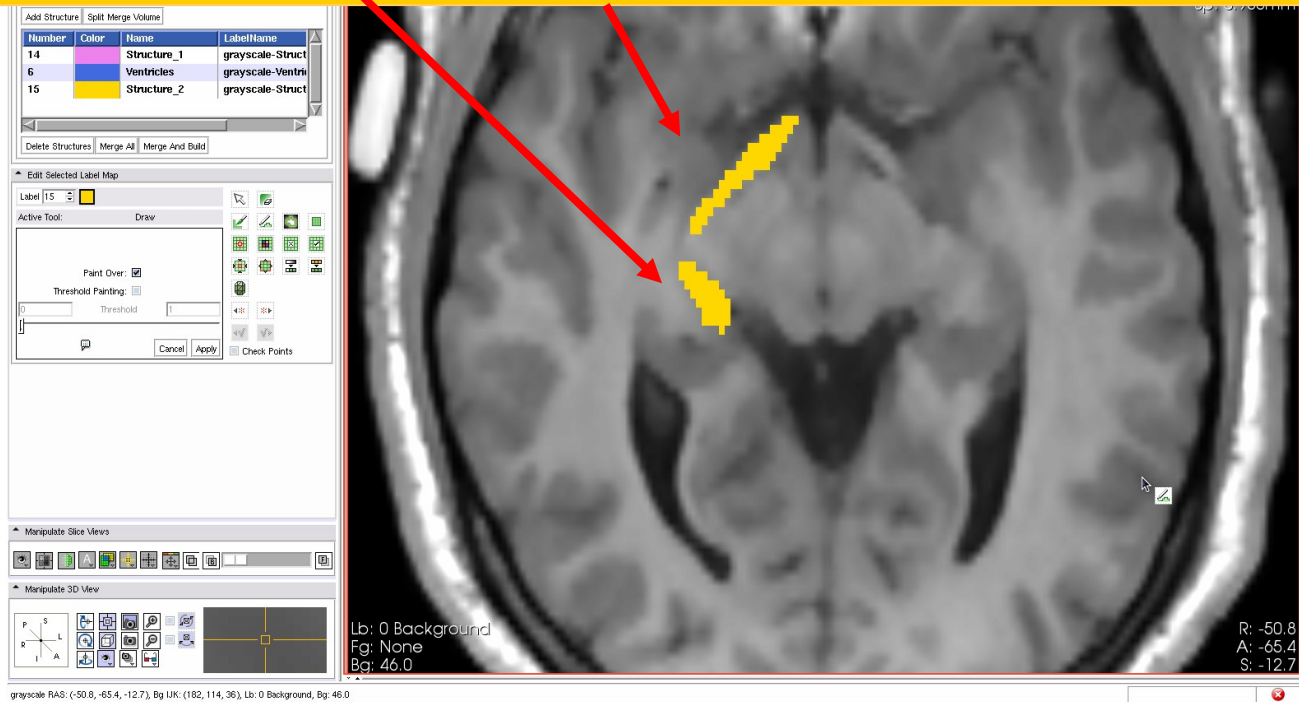
Zoom in using the right mouse button, and use the drawing tool to outline the contour of the right **lateral geniculate body** and **optic tract** in the axial view.





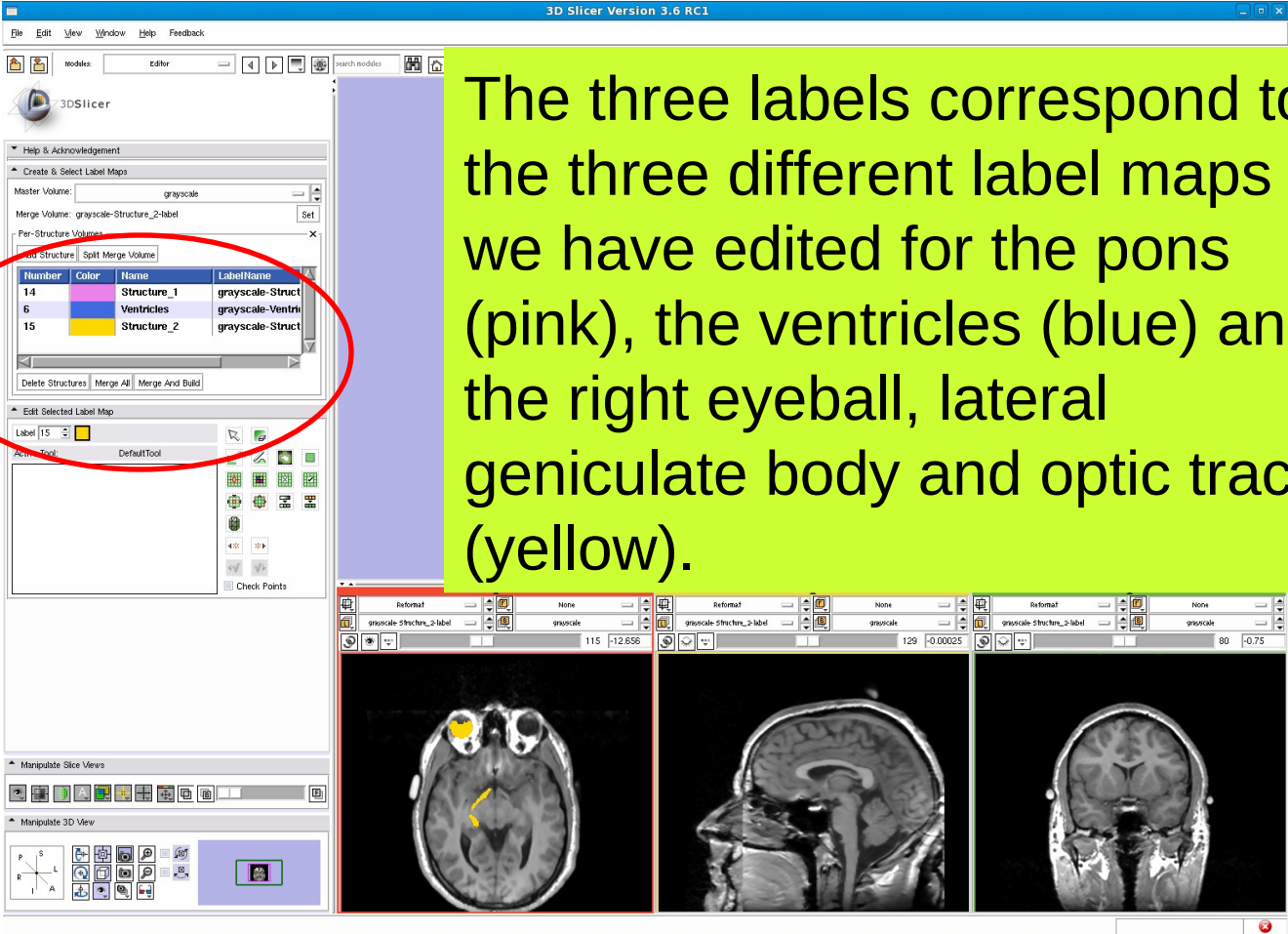
Adding more structures

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

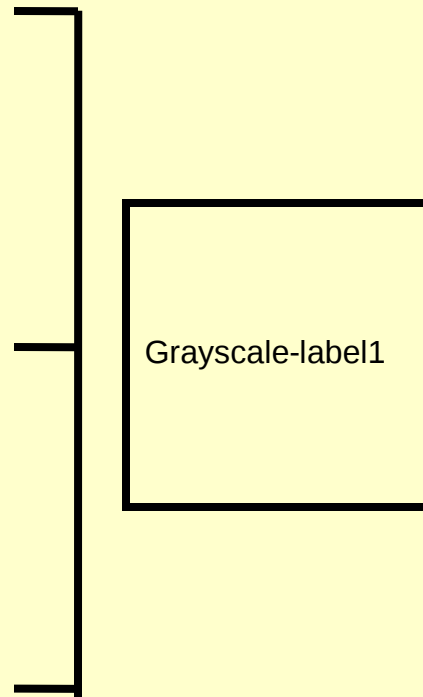
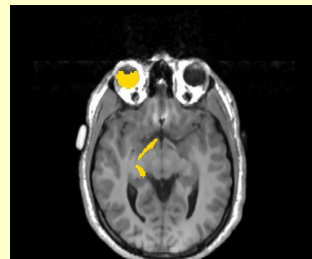
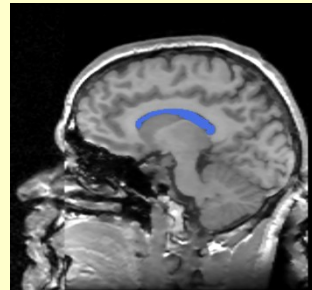
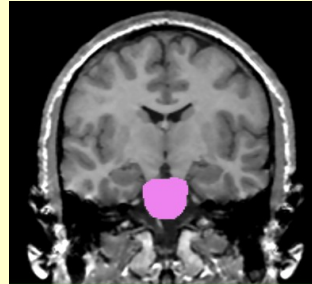


The three labels correspond to the three different label maps that we have edited for the pons (pink), the ventricles (blue) and the right eyeball, lateral geniculate body and optic tract (yellow).

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



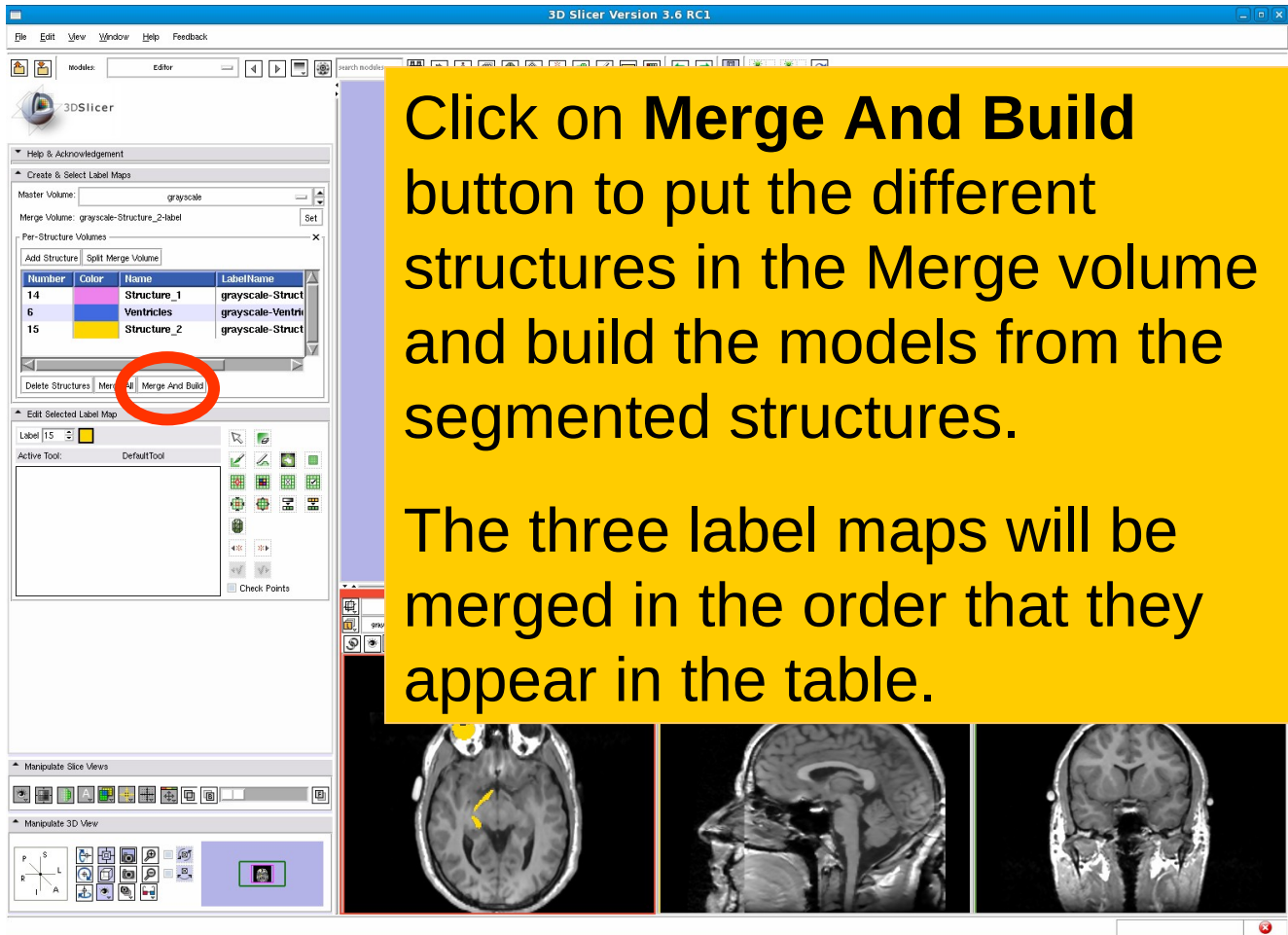
Merging label maps



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



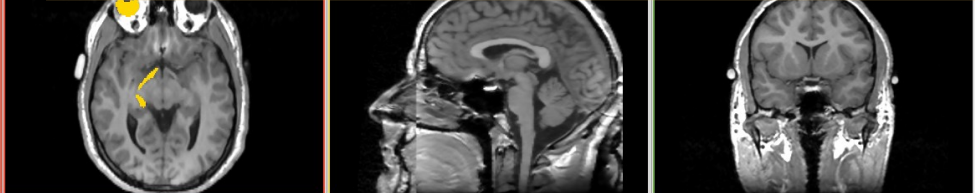
Merge And Build



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.

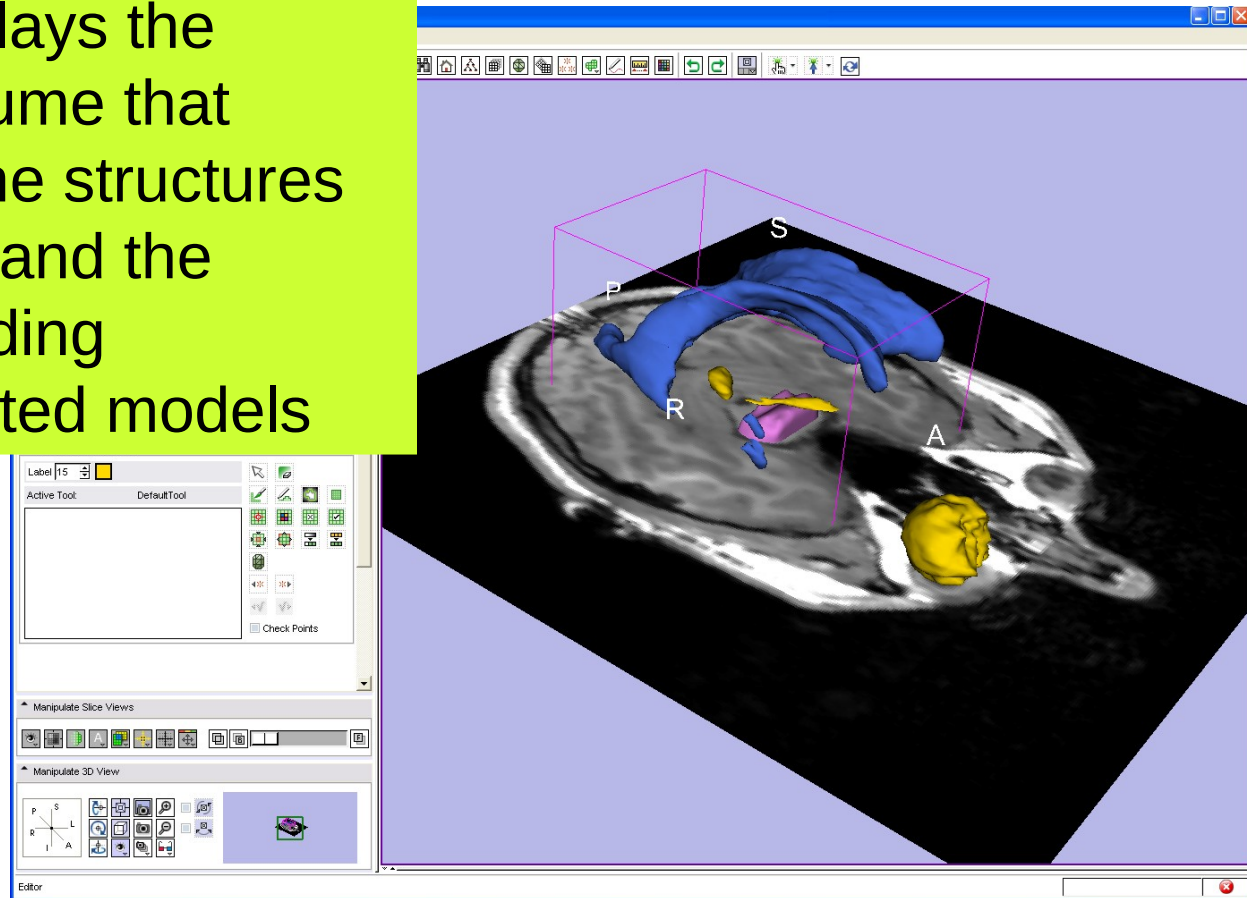
Number	Color	Name	LabelName
14	Blue	Structure_1	grayscale-Struct
6	Green	Ventricles	grayscale-Ventri
15	Yellow	Structure_2	grayscale-Struct





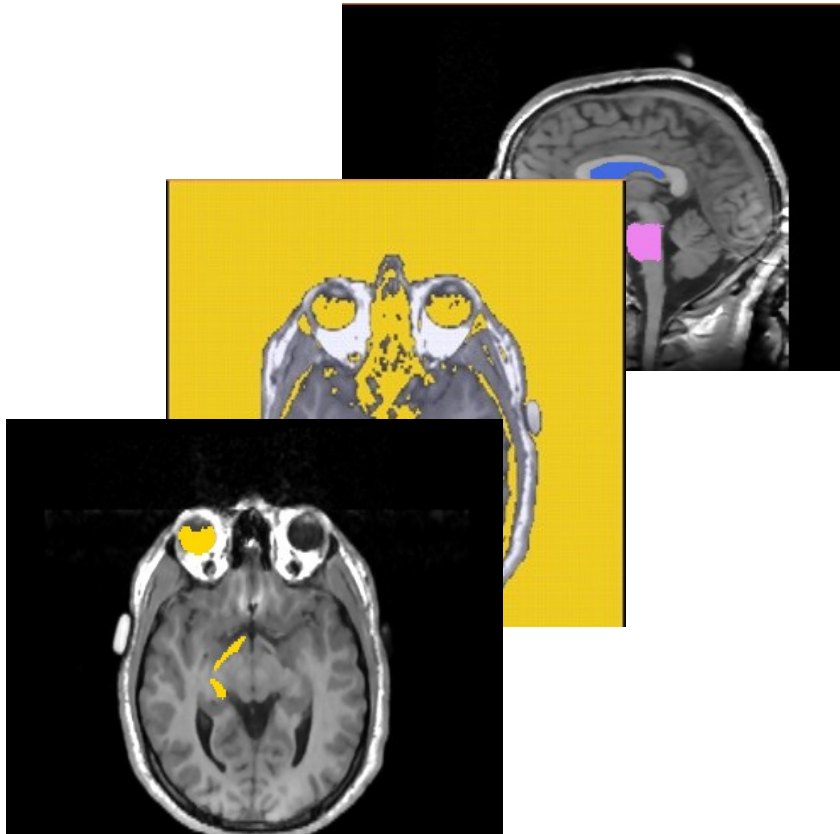
Merge And Build

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





Conclusion



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

www.slicer.org



Acknowledgments



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NIH U54EB005149



Neuroimage Analysis Center

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Ron Kikinis, Steve Pieper, Sota Oguro, Randy Gollub