



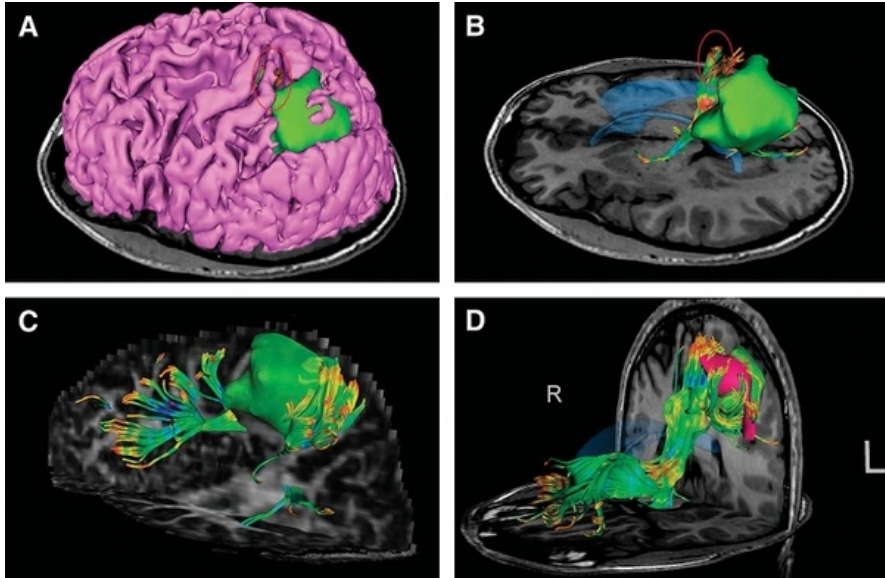
Exploring Peritumoral White Matter Fibers for Neurosurgical Planning

Sonia Pujol, Ph.D.

Ron Kikinis, M.D.

Surgical Planning Laboratory
Harvard University

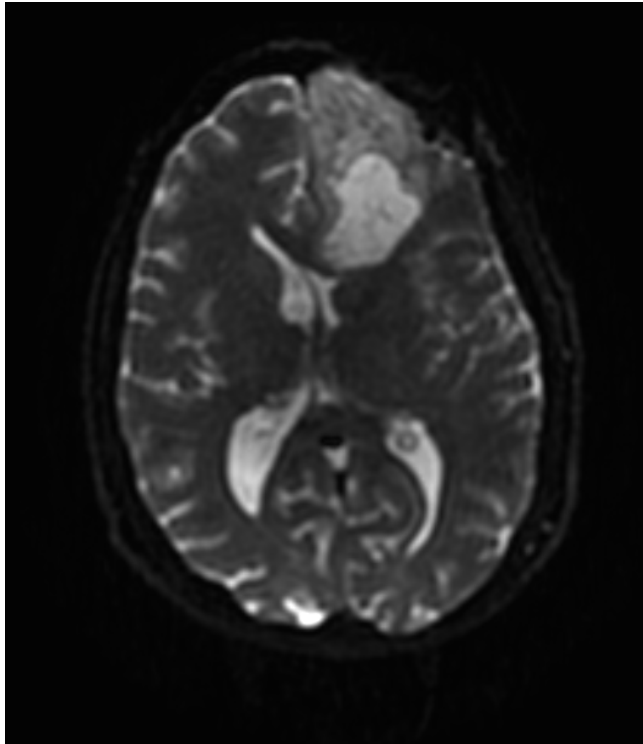
Clinical Goal



Diffusion Tensor Imaging (DTI) Tractography has the potential to bring valuable spatial information on tumor infiltration and tract displacement for neurosurgical planning of tumor resection.

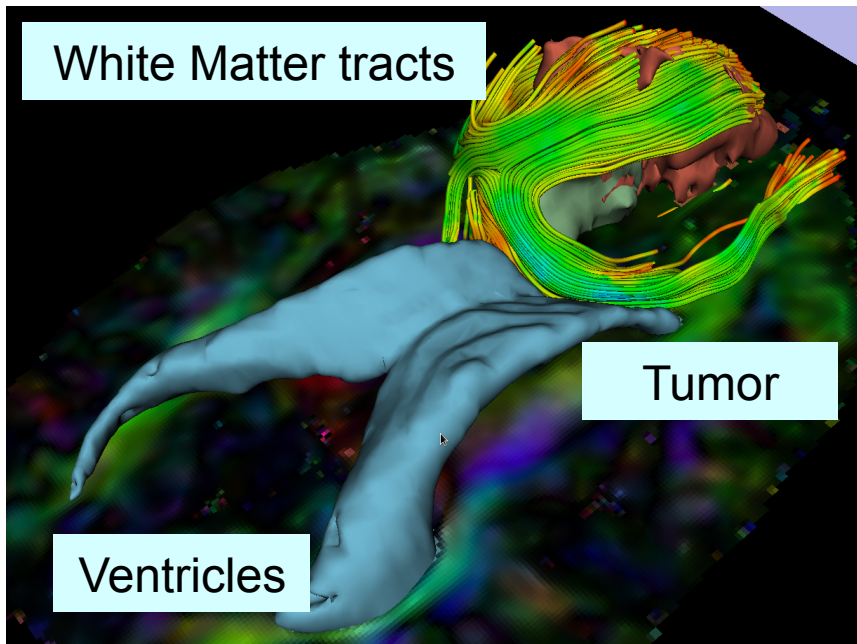
Image Courtesy of Dr. Alexandra Golby, Brigham and Women's Hospital, Boston, MA..

Clinical Case



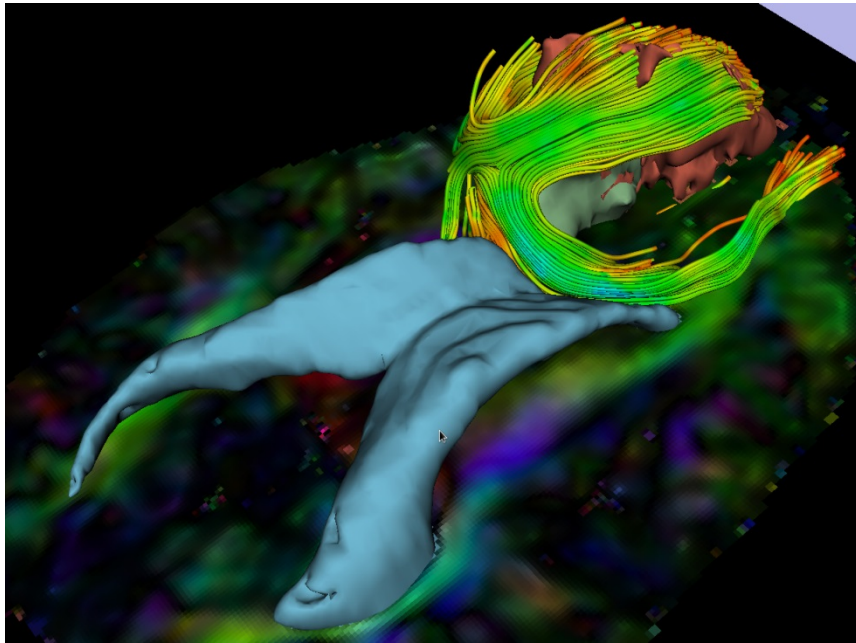
- 35 year-old male diagnosed with Glioblastoma multiforme (GBM)
- Diffusion Weighted Imaging (DWI) acquisition for neurosurgical planning

Clinical Goal



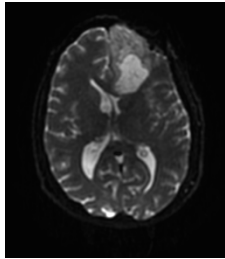
The goal of this tutorial is to explore white matter fibers surrounding a tumor using Diffusion Tensor Imaging (DTI) Tractography.

Image Analysis Pipeline

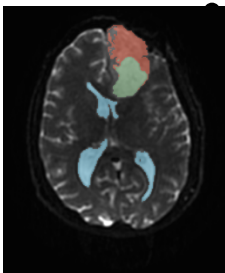


The image analysis pipeline described in this tutorial uses three different algorithms: the “Grow Cut” algorithm for segmentation of the tumor parts, the Marching Cube algorithm for surface modeling, and the single tensor streamline tractography algorithm for tract generation.

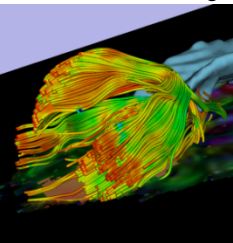
Overview of the analysis pipeline



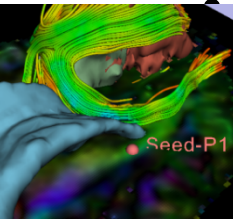
Part 1: Loading & Visualization of Diffusion Data



Part 2: Segmentation of the ventricles, and solid and cystic parts of the tumor

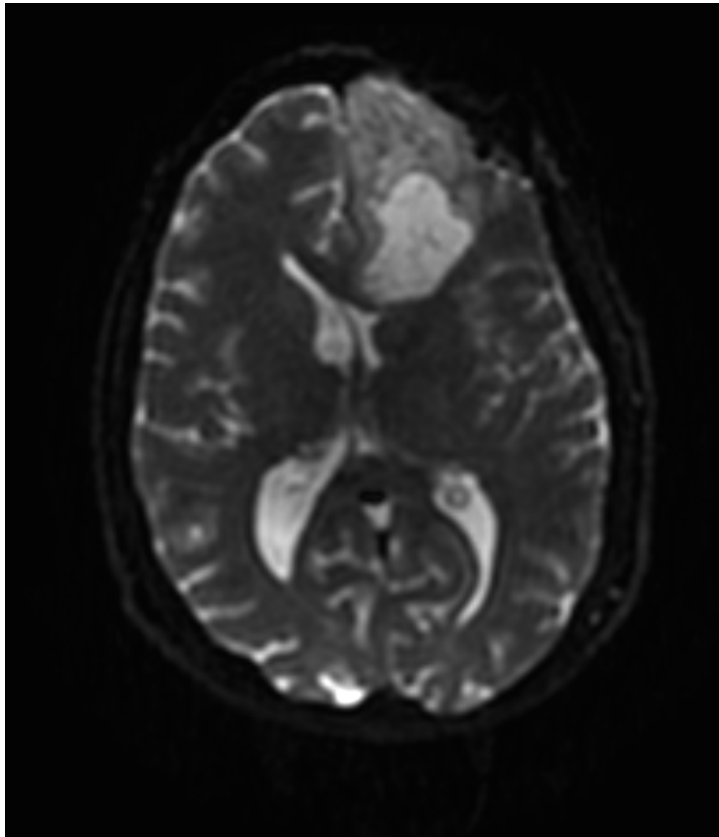


Part 3: Tractography reconstruction of the white matter fibers in the peri-tumoral volume

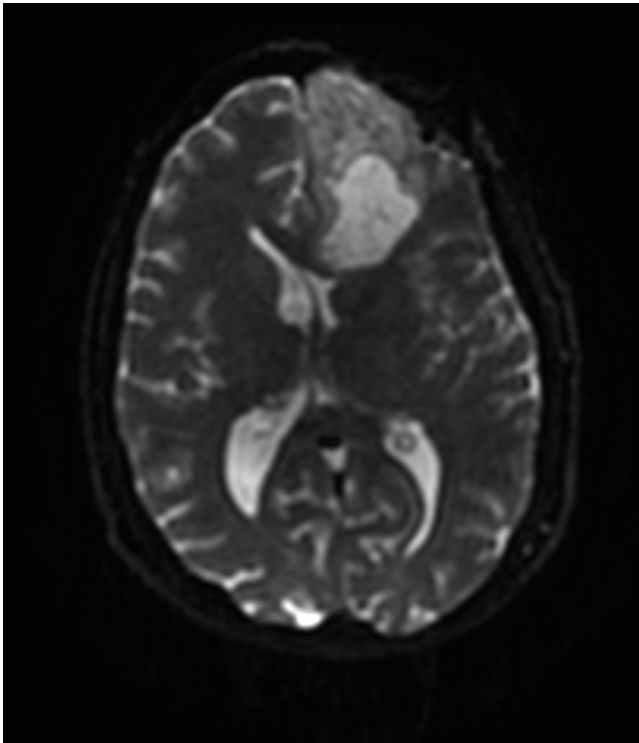


Part 4: Tractography exploration of the ipsilateral and contralateral side

Part 1: Loading and Visualization of Diffusion Data



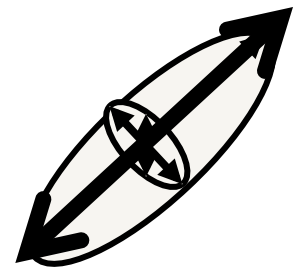
Diffusion Tensor Imaging



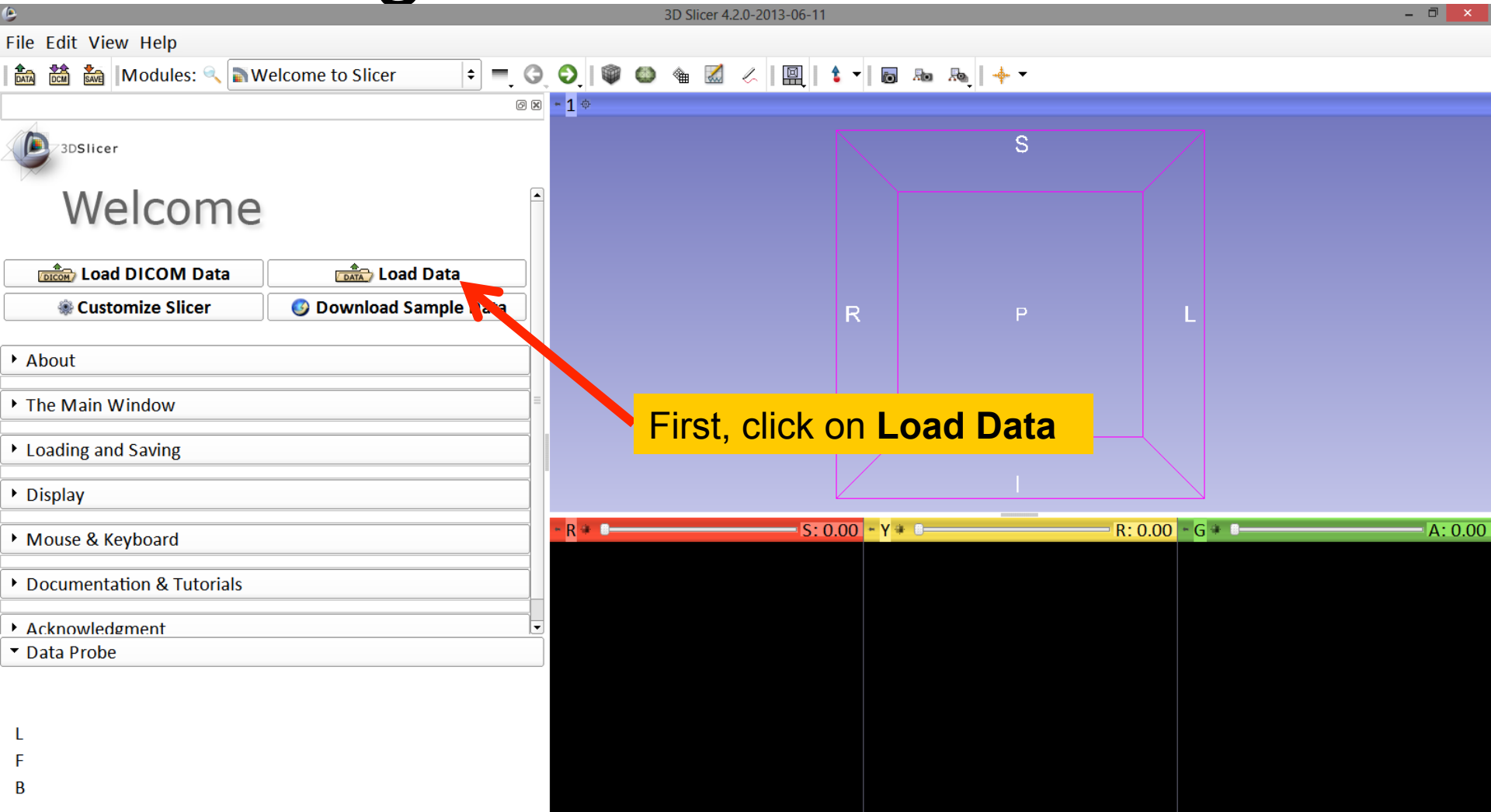
$$S_i = S_0 e^{-b \hat{g}_i^T \underline{D} \hat{g}_i}$$

(Stejskal and Tanner 1965, Basser 1994)

$$\underline{D} = \begin{bmatrix} D_{xx} & D_{xy} & D_{xz} \\ D_{yx} & D_{yy} & D_{yz} \\ D_{zx} & D_{zy} & D_{zz} \end{bmatrix}$$



Loading DTI and Baseline Data



Loading DTI and Baseline Data

The screenshot shows the 3D Slicer interface with the 'Add data into the scene' dialog box open. The dialog has two tabs: 'Choose Directory to Add' and 'Choose File(s) to Add'. The 'Choose Directory to Add' tab is active, showing a table with columns for 'File' and 'Description'. A red arrow points to the 'Choose Directory to Add' button. A yellow callout box contains the text: 'The "Add data into the scene" window appears. Click **Choose Directory to Add**'.

3D Slicer 4.2.0-2013-07-08

File Edit View Help

Modules: Welcome to Slicer

3DSlicer

Welcome

Load DICOM Data Load

Customize Slicer Download Sa

- About
- The Main Window
- Loading and Saving
- Display
- Mouse & Keyboard
- Documentation & Tutorials
- Acknowledgment
- Data Probe

Reset OK Cancel

The "Add data into the scene" window appears. Click **Choose Directory to Add**

Loading DTI and Baseline Data

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Welcome to Slicer

3DSlicer

Welcome

Load DICOM Data Load D Load D

Customize Slicer Download San

About

The Main Window

Loading and Saving

Display

Mouse & Keyboard

Documentation & Tutorials

Acknowledgment

Data Probe

L
F
B

Look in: C:\Users\flynnm3\Desktop

flynn Slicer4minute
WhiteMatterExplorationData

Directory: WhiteMatterExplorationData

Files of type: Directories

Choose Cancel

Locate and select the file **WhiteMatterExplorationData** and click **Choose**

Loading DTI and Baseline Data

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Welcome to Slicer

3DSlicer

Welcome

Load DICOM Data Load Data

Customize Slicer Download Samples

About

The Main Window

Loading and Saving

Display

Mouse & Keyboard

Documentation & Tutorials

Acknowledgment

Data Probe

Add data into the scene

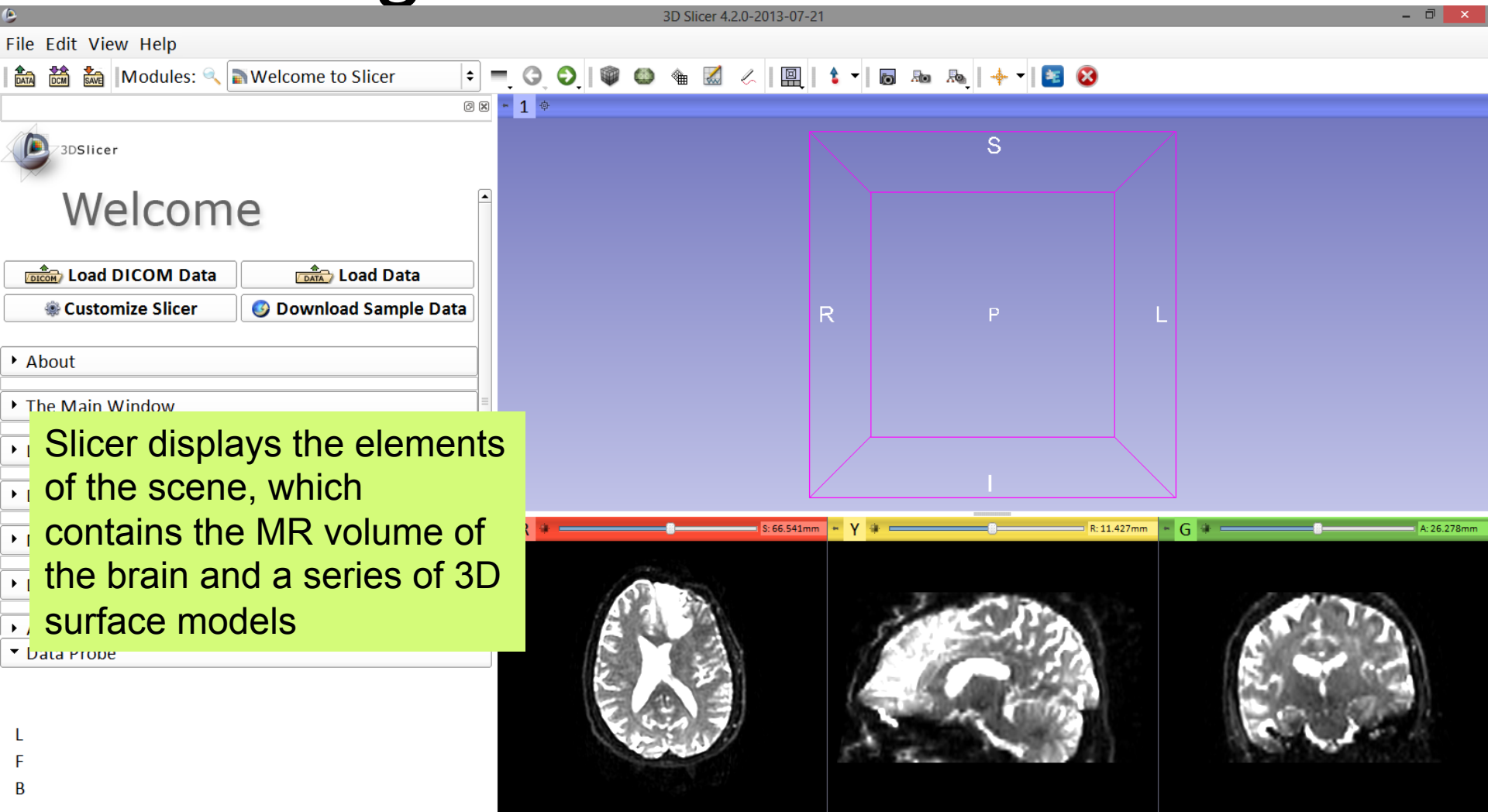
Choose Directory to Add Choose File(s) to Add Show Options

File	Description
<input checked="" type="checkbox"/> .../Desktop/WhiteMatterExplorationData/BaselineVolume.nrrd	Volume
<input checked="" type="checkbox"/> ...nm3/Desktop/WhiteMatterExplorationData/DTIVolume.nhdr	Volume
<input type="checkbox"/> ...3/Desktop/WhiteMatterExplorationData/DTIVolume.raw.gz	Volume

Reset OK Cancel

Check off the Volumes
BaselineVolume.nrrd and
DTIVolume.nhdr click **OK**

Loading DTI and Baseline Data



Loading DTI and Baseline Data

File Edit View Help

3D Slicer 4.2.0-2013-07-21

Modules: Welcome to Slicer

Click on the **pin icon** to display the slice menu, then click on the **link icon** to link the 3 anatomical viewers. Make sure that the background is set to **BaselineVolume**

R None R: 11.427mm G A: 26.278mm

Axial BaselineVolume DTIVolume BaselineVolume_1 DTIVolume_1 Rename current Volume

L
F
B

Loading DTI and Baseline Data

The image shows the 3D Slicer software interface. The 'Modules' menu is open, and the 'Volumes' option is highlighted with a blue background and a red arrow. A yellow callout box with black text says 'Select the **Volumes** module from the Modules menu'. The main 3D view shows a purple wireframe box with 'S' at the top and 'I' at the bottom. Below the 3D view are three 2D viewports: a coronal slice (labeled 'S'), a sagittal slice (labeled 'Y'), and an axial slice (labeled 'G'). The status bar at the bottom shows coordinates: S: 66.541mm, Y: 11.427mm, G: 26.278mm.

Loading DTI and Baseline Data

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Volumes

3DSlicer

Help & Acknowledgement

Active Volume: BaselineVolume

Volume Information

Display

Lookup Table: Grey

Interpolate:

Window Level editor presets:

W: 4848 Manual W/L L: 1680

Threshold: Off

-1820 20017

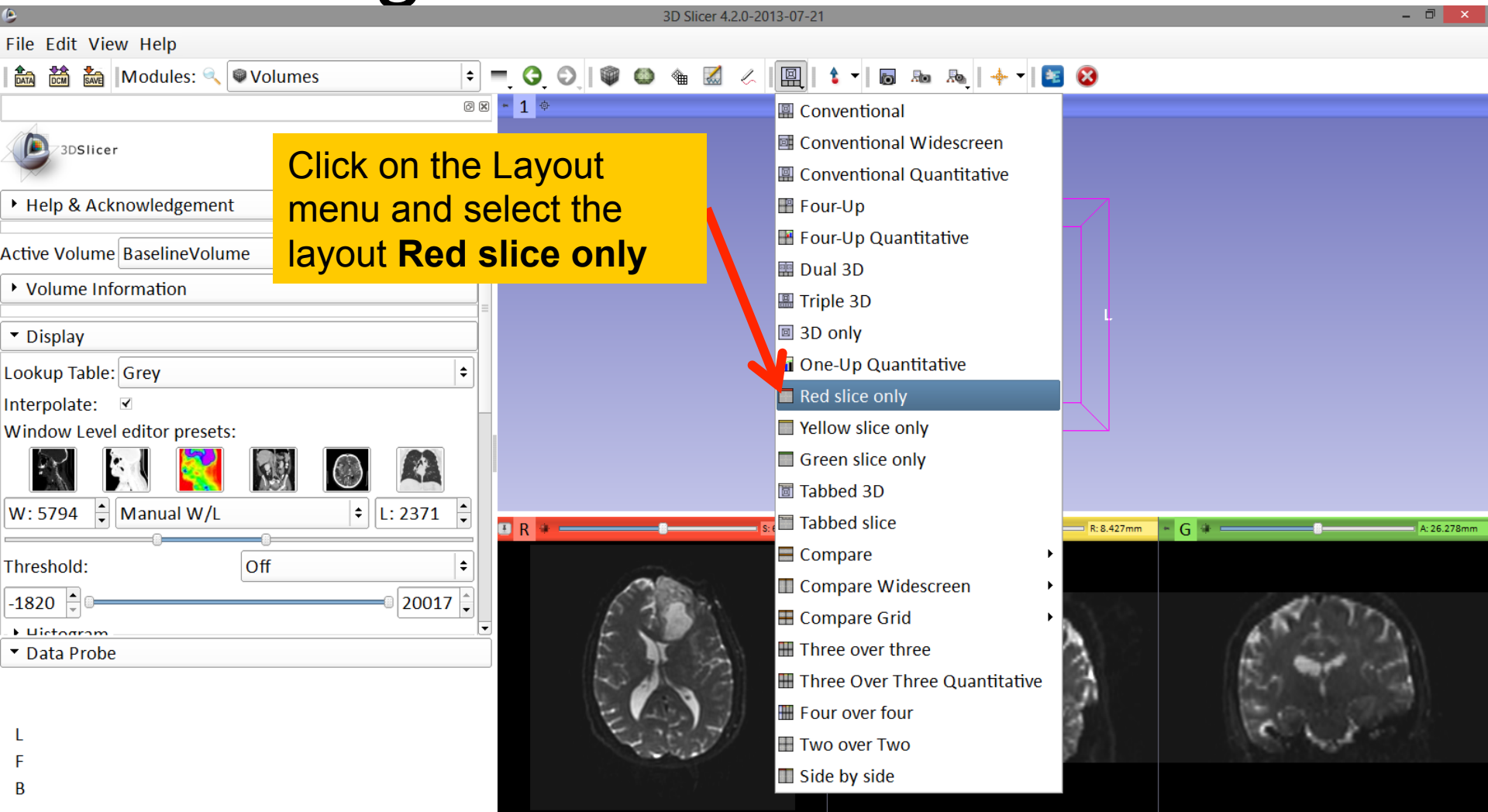
Data Probe

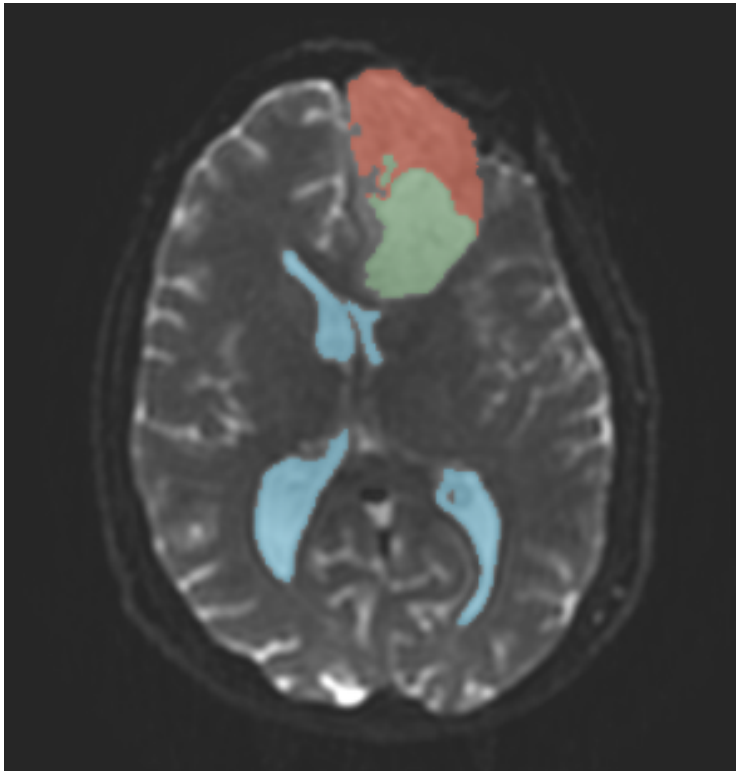
L
F
B

The user can manually adjust the **Window Level editor presets** with the **Volume** module menu

R: 61.341mm Y: 8.427mm G: 26.278mm

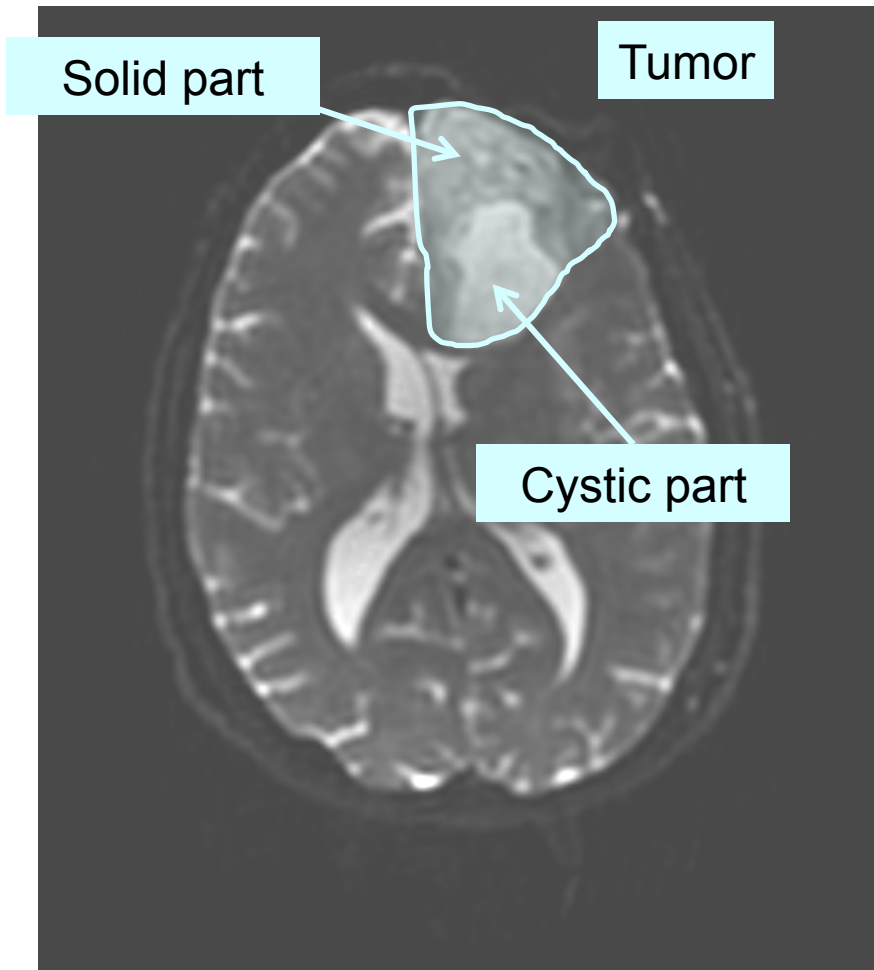
Loading DTI and Baseline Data





Part 1: Segmenting the tumor and ventricles

Tumor Segmentation



The tumor in this clinical case is composed of two parts: a solid part, and a cystic part.

In this section, we will segment the different parts of the tumor using a Grow Cut Segmentation algorithm.

Tumor Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Volumes

Active Volume: BaselineVolume

Volume Information

Disp

Lookup

Interpo

Window

W: 5794 Manual W/L L: 2371

Threshold: Off

-1820 20017

Histogram

Data Probe

Red RAS: (104.8, -58.6, 61.3) Axial Sp: 2.6

L None ()

F None ()

B **BaselineVolume** (26, 212, 26) 1

Slicer displays only the Axial anatomical slice in the Viewer

Axial BaselineVolume

S: 61.341mm

Tumor Segmentation

The image shows the 3D Slicer software interface. The 'Modules' menu is open, listing various tool categories. The 'Editor' module is highlighted in blue. A red arrow points from a yellow callout box to the 'Editor' option. The callout box contains the text: 'Click on the Modules menu and select the module **Editor**'. The background shows a brain MRI slice in the 'BaselineVolume' view.

- All Modules
- Testing
- Work in Progress
- Annotations
- Data
- DICOM
- Editor**
- Models
- Scene Views
- Transforms
- View Controllers
- Volume Rendering
- Volumes
- Welcome to Slicer
- Wizards
- Informatics
- Registration
- Segmentation
- Quantification
- Diffusion
- IGT
- Filtering
- Surface Models
- Converters
- Endoscopy
- Utilities
- Developer Tools
- Legacy

Tumor Segmentation

File Edit View Help

3D Slicer 4.2.0-2013-07-21

Modules: Editor

3DSlicer

Help & Acknowledgement

Create and Select Label Maps

Master Volume: BaselineVolume

Merge Volume: None

Per-Structure Volumes

Edit Selected Label Map

SlicerApp-real

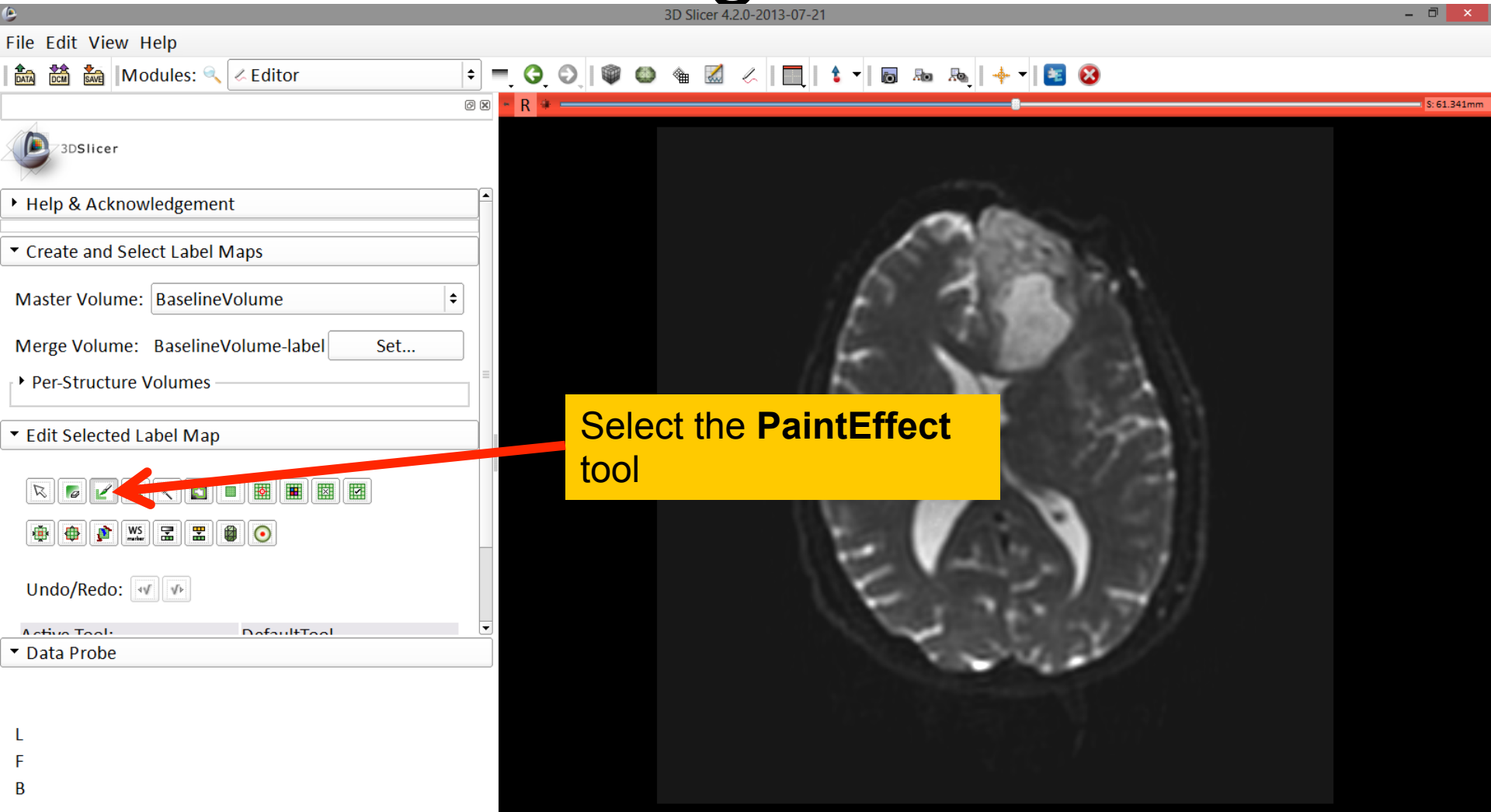
Create a merge label map for selected master volume BaselineVolume.
New volume will be BaselineVolume-label.
Select the color table node will be used for segmentation labels.

GenericAnatomyColors

Apply Cancel

The 'SlicerApp-real' window appears. Select the label map **GenericAnatomyColors** and click **Apply**

Tumor Segmentation



Tumor Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

Merge Volume: BaselineVolume-label Set...

Per-Structure Volumes

Edit Selected Label Map

Active Tool: PaintEffect

Label: region 1 293

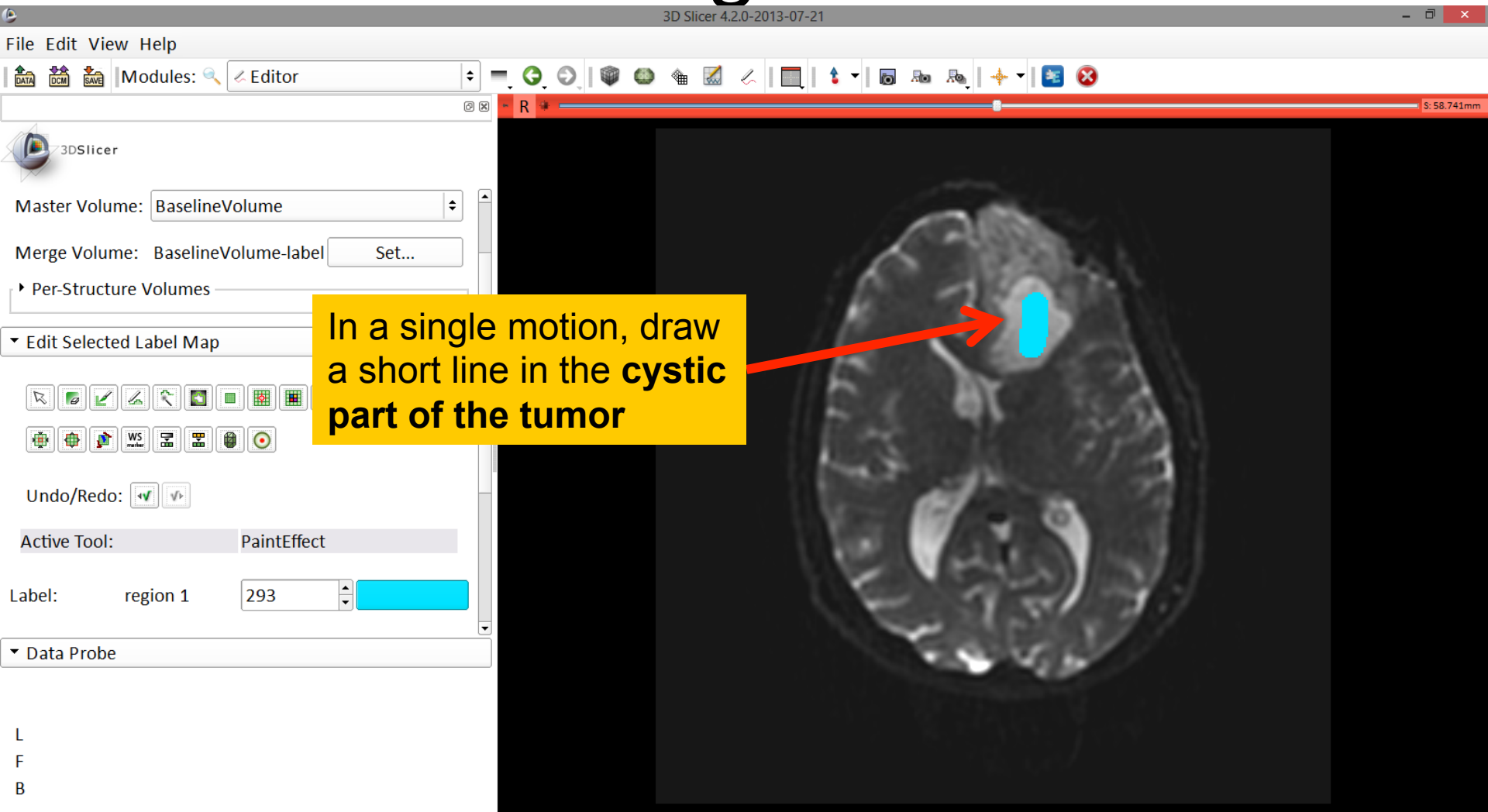
Paint Over

Threshold Paint

Data Probe

Choose color #293 for the region 1 label

Tumor Segmentation



Tumor Segmentation

Select **color #7** for the mass label and, again in a single motion, draw a short line in the **solid part of the tumor**

3D Slicer 4.2.0-2013-07-21

File Edit View Help

DATA DC

Merge

Per-

S: 58.741mm

▼ Edit Selected Label Map

Undo/Redo: [Undo] [Redo]

Active Tool: PaintEffect

Label: mass 7 [Color Swatch]

Paint Over

Threshold Paint

▼ Data Probe

L

F

B

Tumor Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

Merge Volume: BaselineV

Per-Structure Volumes

Edit Selected Label Map

Undo/Redo: [Undo] [Redo]

Active Tool: PaintEffect

Label: region 3 295 [Color Swatch]

Paint Over

Threshold Paint

Data Probe

L
F
B

Select color #295 for region 3 and draw a circle around the tumor

S: 58.741mm

Tumor Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

Merge Volume: BaselineVolume-label Set...

Per-Structure Volumes

Edit Selected Label Map

Active Tool: PaintEffect

Label: region 3 295

Paint Over

Threshold Paint

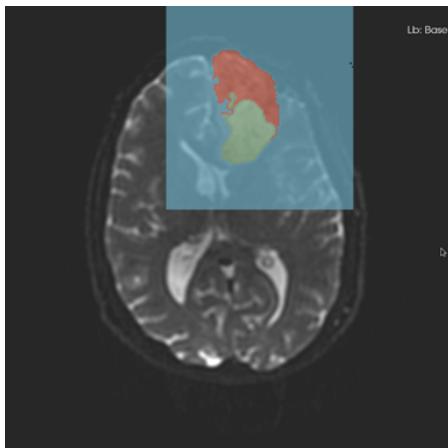
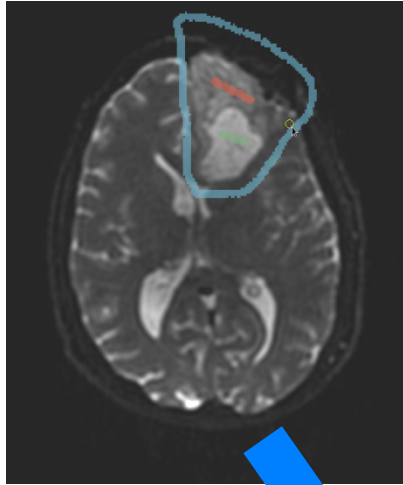
Data Probe

Select the GrowCutEffect tool

L
F
B

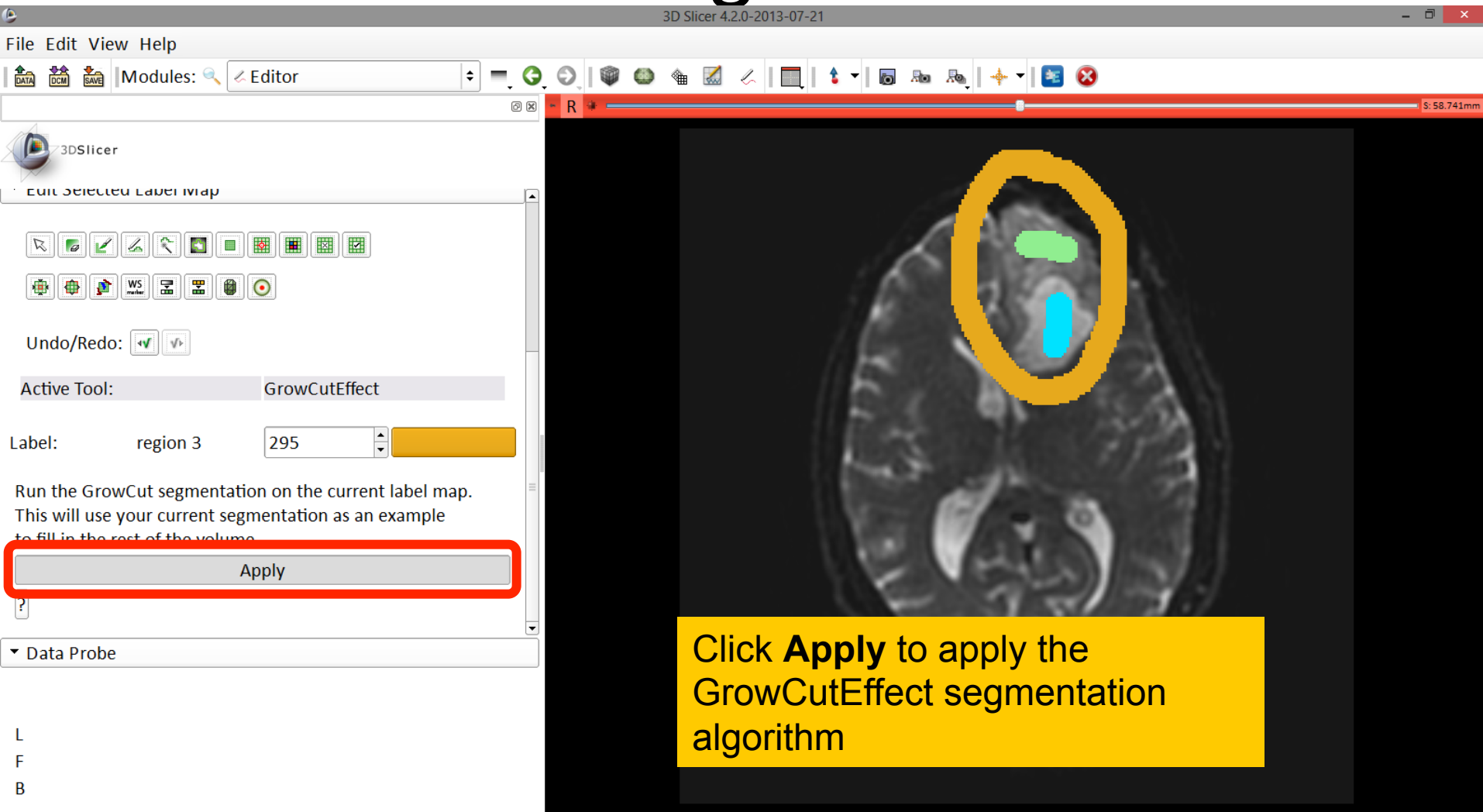
S: 58.741mm

Grow Cut Segmentation



- The **Grow Cut Segmentation** method is a competitive region growing algorithm using Cellular Automata.
- The algorithm performs multi-label image segmentation using a set of user input scribbles.
- V. Vezhnevets, V. Konouchine. "Grow-Cut" - Interactive Multi-Label N-D Image Segmentation". *Proc. Graphicon. 2005* . pp. 150–156.

Tumor Segmentation



The image shows a screenshot of the 3D Slicer software interface. The main window displays an axial MRI slice of a brain with a yellow oval highlighting a region of interest. Inside this region, there are two distinct areas: one colored green and another colored blue. The software's interface includes a menu bar (File, Edit, View, Help), a toolbar with various icons, and a left-hand panel with several tool icons and a 'GrowCutEffect' tool selected. The 'GrowCutEffect' tool settings show 'Label: region 3' and '295'. Below the settings, there is a red-bordered 'Apply' button. A yellow text box at the bottom of the main window reads: 'Click **Apply** to apply the GrowCutEffect segmentation algorithm'. The top of the window shows the title bar '3D Slicer 4.2.0-2013-07-21' and a status bar 'S: 58.741mm'.

Tumor Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

Exit Selected Label

Slicer displays the results from the segmentation

Undo/Redo: [undo] [redo]

Active Tool: GrowCutEffect

Label: region 3 295

Run the GrowCut segmentation on the current label map. This will use your current segmentation as an example to fill in the rest of the volume.

Apply

▼ Data Probe

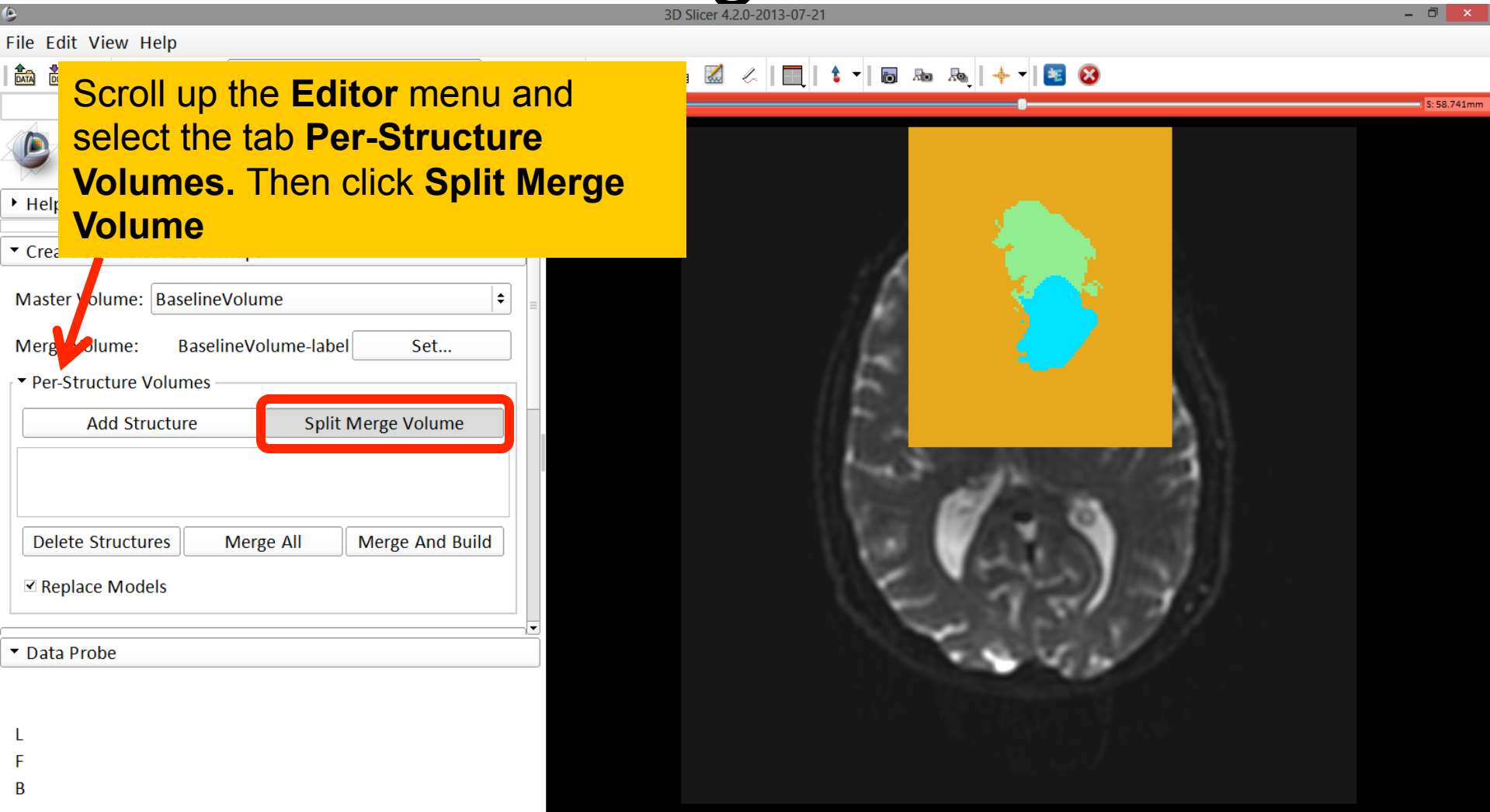
L
F
B

Solid part

Cystic part

S: 58.741mm

Tumor Segmentation



File Edit View Help

3D Slicer 4.2.0-2013-07-21

S: 58.741mm

Scroll up the **Editor** menu and select the tab **Per-Structure Volumes**. Then click **Split Merge Volume**

Master Volume: BaselineVolume

Merge Volume: BaselineVolume-label Set...

Per-Structure Volumes

Add Structure **Split Merge Volume**

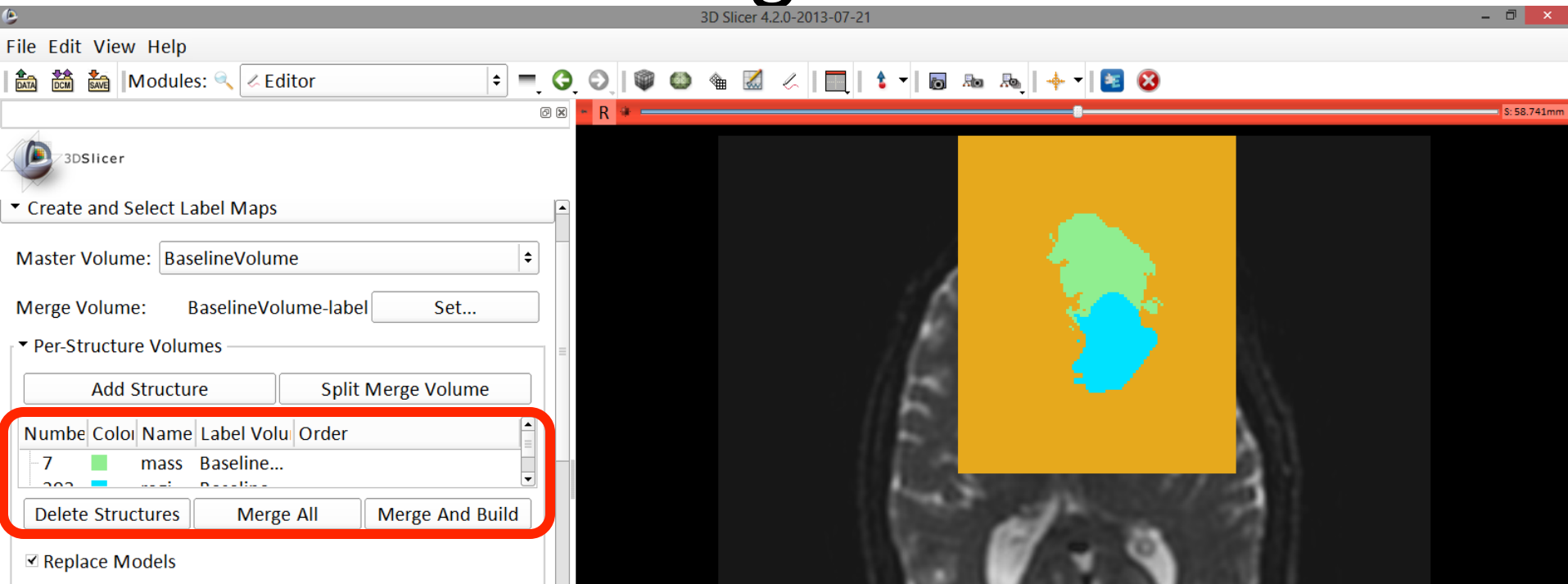
Delete Structures Merge All Merge And Build

Replace Models

Data Probe

L
F
B

Tumor Segmentation



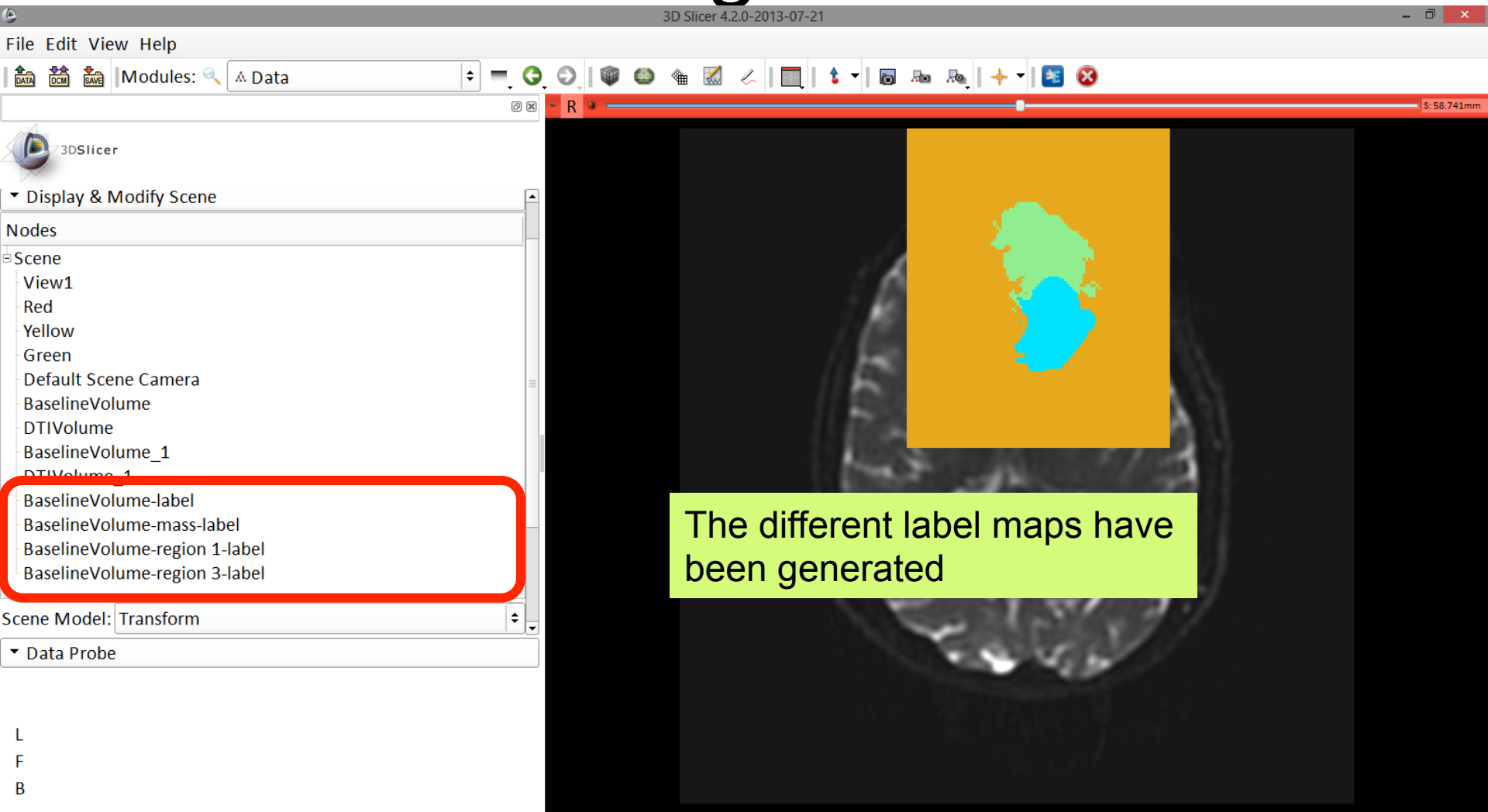
The label map **BaselineVolume-label** has been split into three volumes:

- BaselineVolume-mass-label**: solid part of the tumor
- BaselineVolume-region_1-label**: cystic part of the tumor
- BaselineVolume-region_3-label**: surrounding structures

Tumor Segmentation

The image shows the 3D Slicer 4.2.0-2013-07-21 interface. On the left, the 'Modules' menu is open, with 'Data' selected and highlighted in blue. A red arrow points from the 'Data' module to a yellow callout box that contains the text: 'Click on the Modules menu and select the Module Data'. The main window displays a brain MRI slice with a segmented tumor region highlighted in green and blue, set against a yellow background. The top toolbar and various control panels are visible.

Tumor Segmentation



Ventricles Segmentation

The image shows the 3D Slicer 4.2.0-2013-07-21 interface. The 'All Modules' menu is open, and the 'Editor' module is highlighted with a blue background and a red arrow pointing to it. A yellow callout box with the text 'Go back to the Editor module' is positioned over the main 3D view, with a red arrow pointing from the callout to the 'Editor' menu item. The main 3D view displays a brain MRI slice with segmented ventricles in green and blue. The 'Nodes' panel on the left shows the scene hierarchy, and the 'Scene Model' is set to 'Transform'.

Ventricles Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

Master Volume: baselinevolume

Merge Volume: BaselineVolume-label Set...

Per-Structure Volumes

Add Structure Split Merge Volume

Number	Color	Name	Label	Value	Order
295	■	regi...	Baseline...		

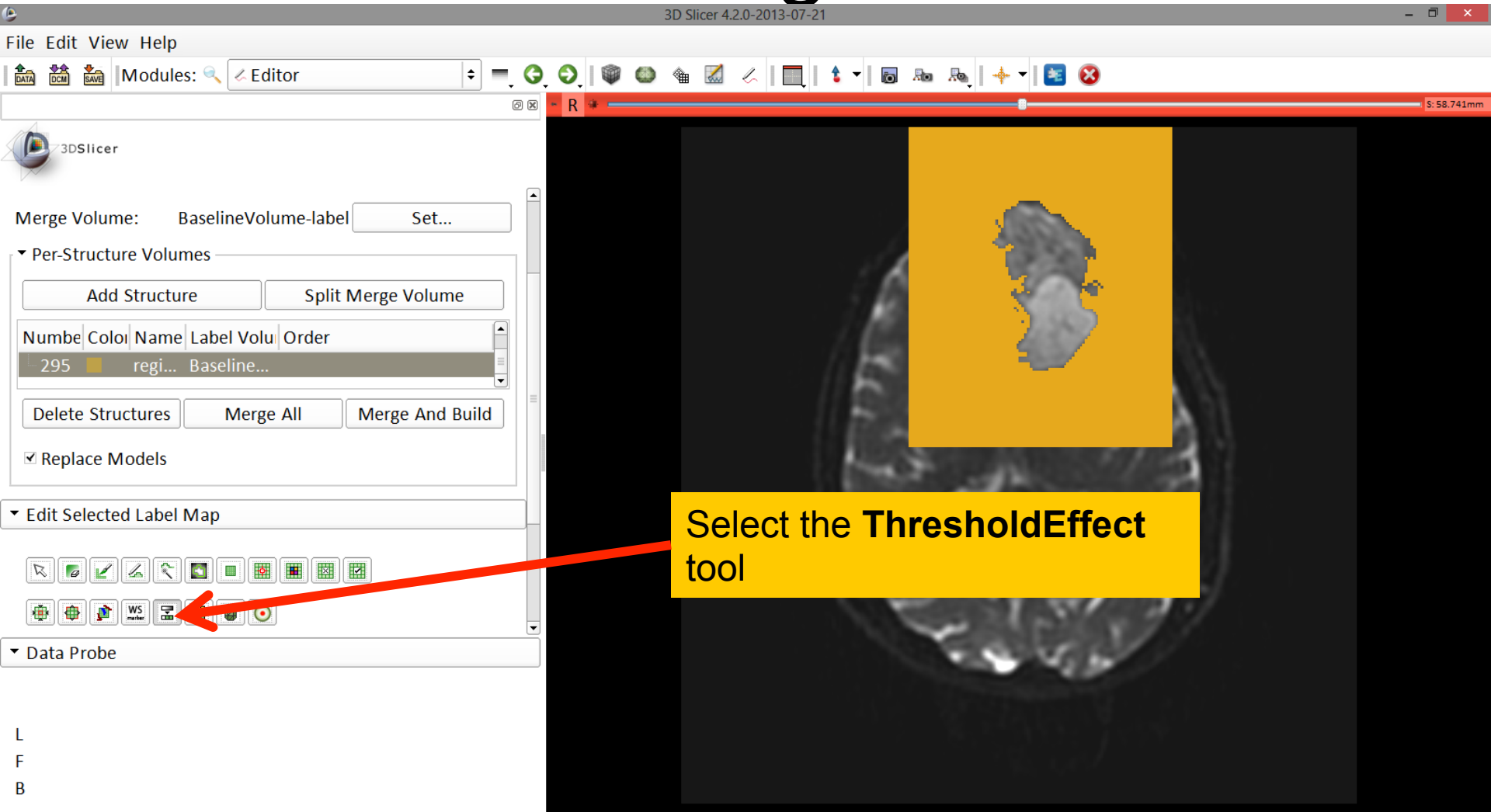
Delete Structures Merge All Merge And Build

Replace Models

Edit Selected Label Map

Select the volume **BaselineVolume-region_3-label** so that it is highlighted and that the yellow region is visible in the viewer

Ventricles Segmentation



Ventricles Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

Active Tool: ThresholdEffect

Label: region 3 295

Threshold Range: 1700.00 18197.00

Use For Paint

Apply

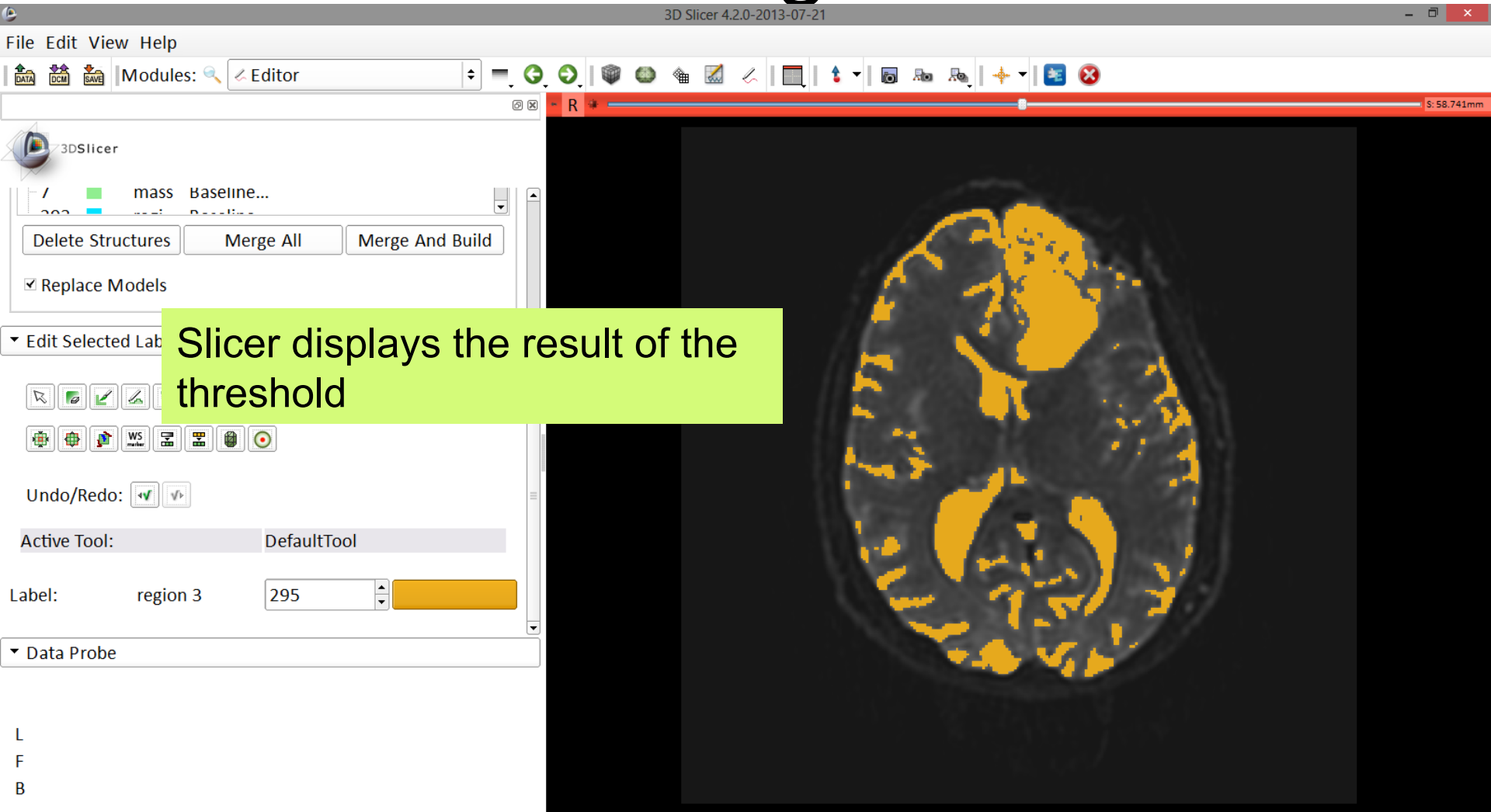
Data Probe

L
F
B

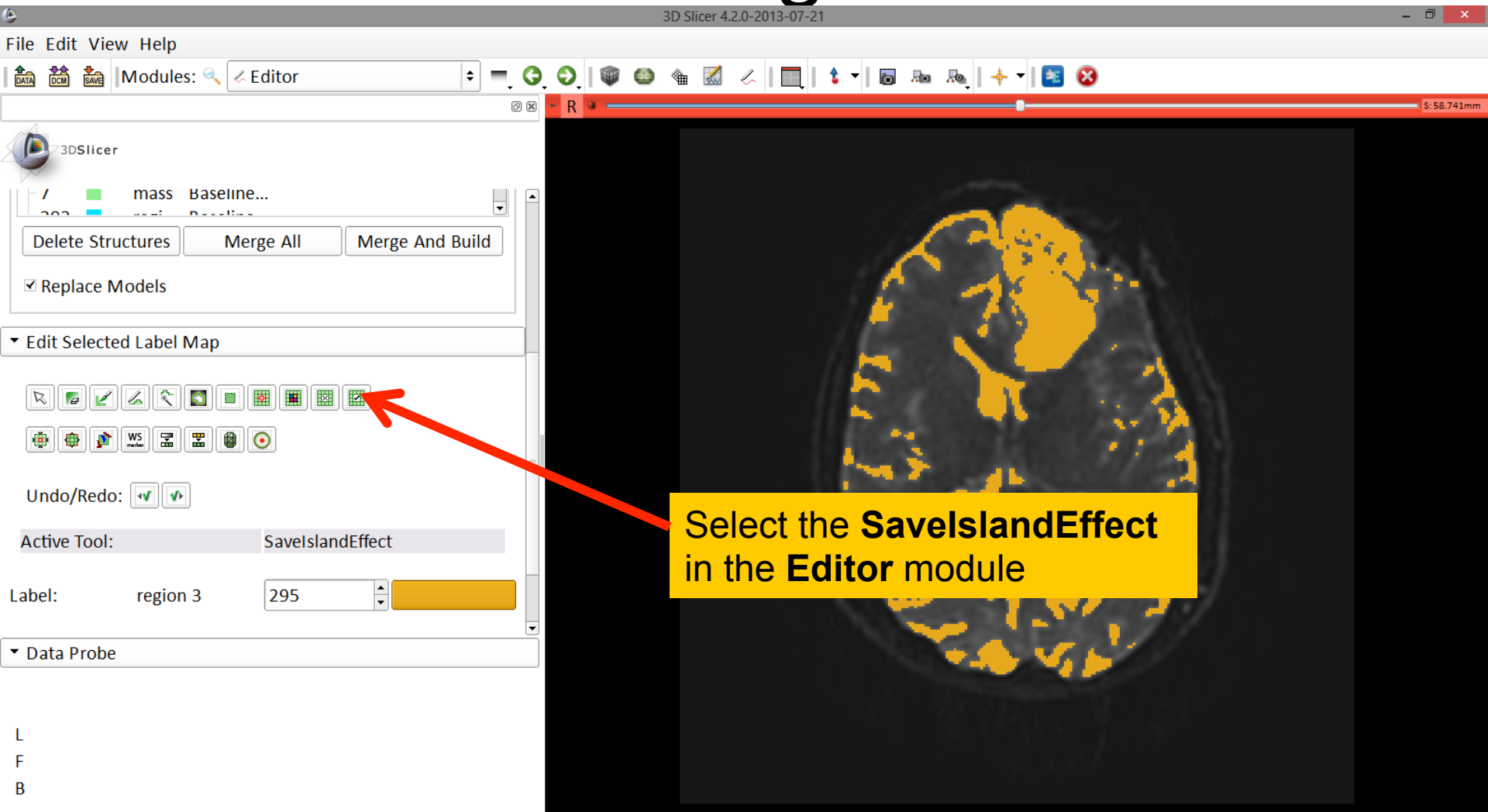
R S: 58.741mm

Scroll down the **Editor** module and set the lower **Threshold Range** to **1700** and click **Apply**

Ventricles Segmentation



Ventricles Segmentation



Ventricles Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

mass Baseline...
202 Baseline...

Delete Structures Merge All Merge And Build

Replace Models

▼ Edit Selected Label Map

Undo/Redo:

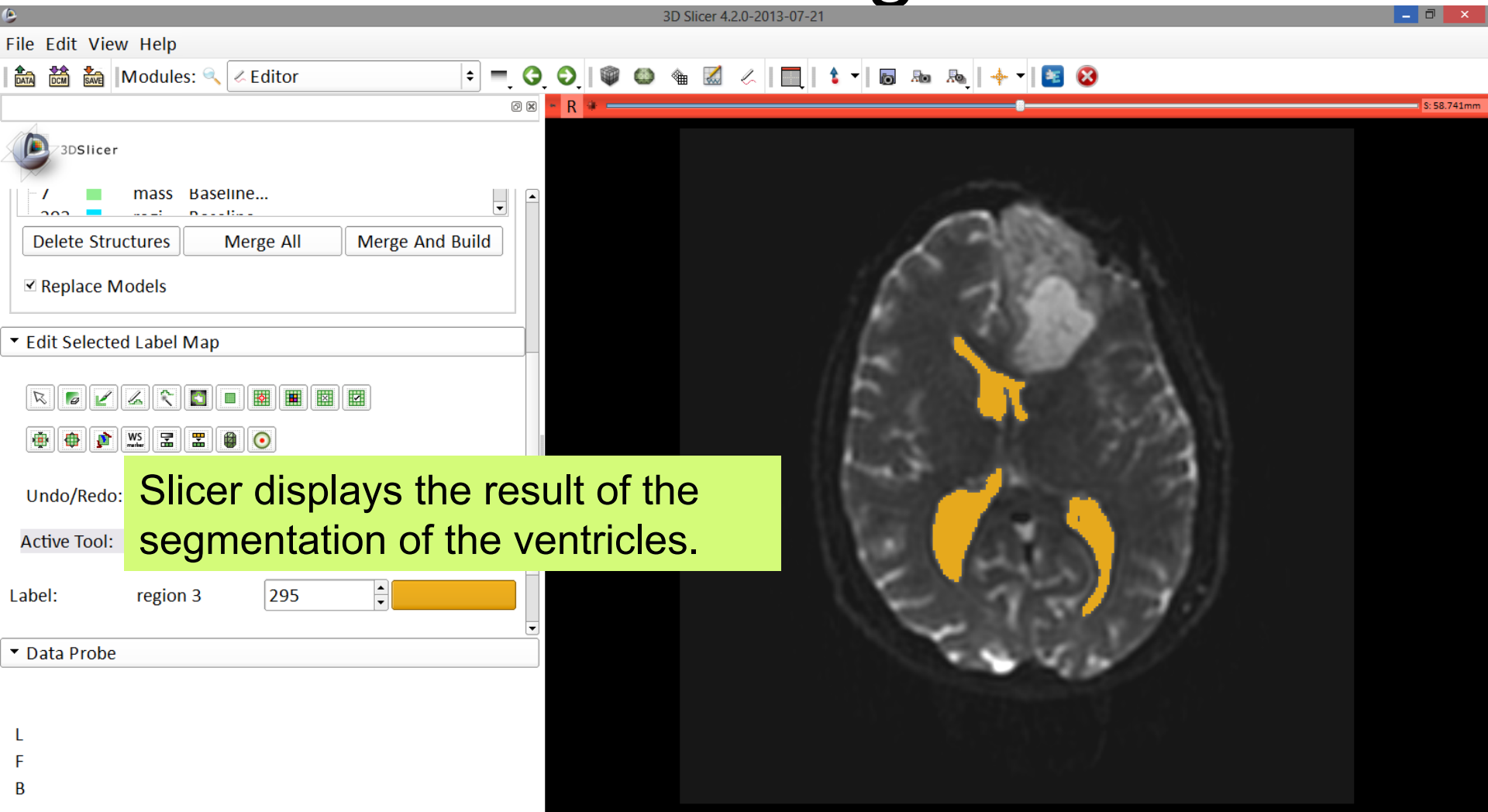
Active Tool: SaverIslandEffect

With the **SaverIslandEffect** tool equipped, click in the occipital horn of the ventricle

L BaselineVolum...n 3-label (105, 147, 25) region 3 (295)
F None ()
B BaselineVolume (105, 147, 25) 2780

S: 58.741mm

Final Result of Segmentation



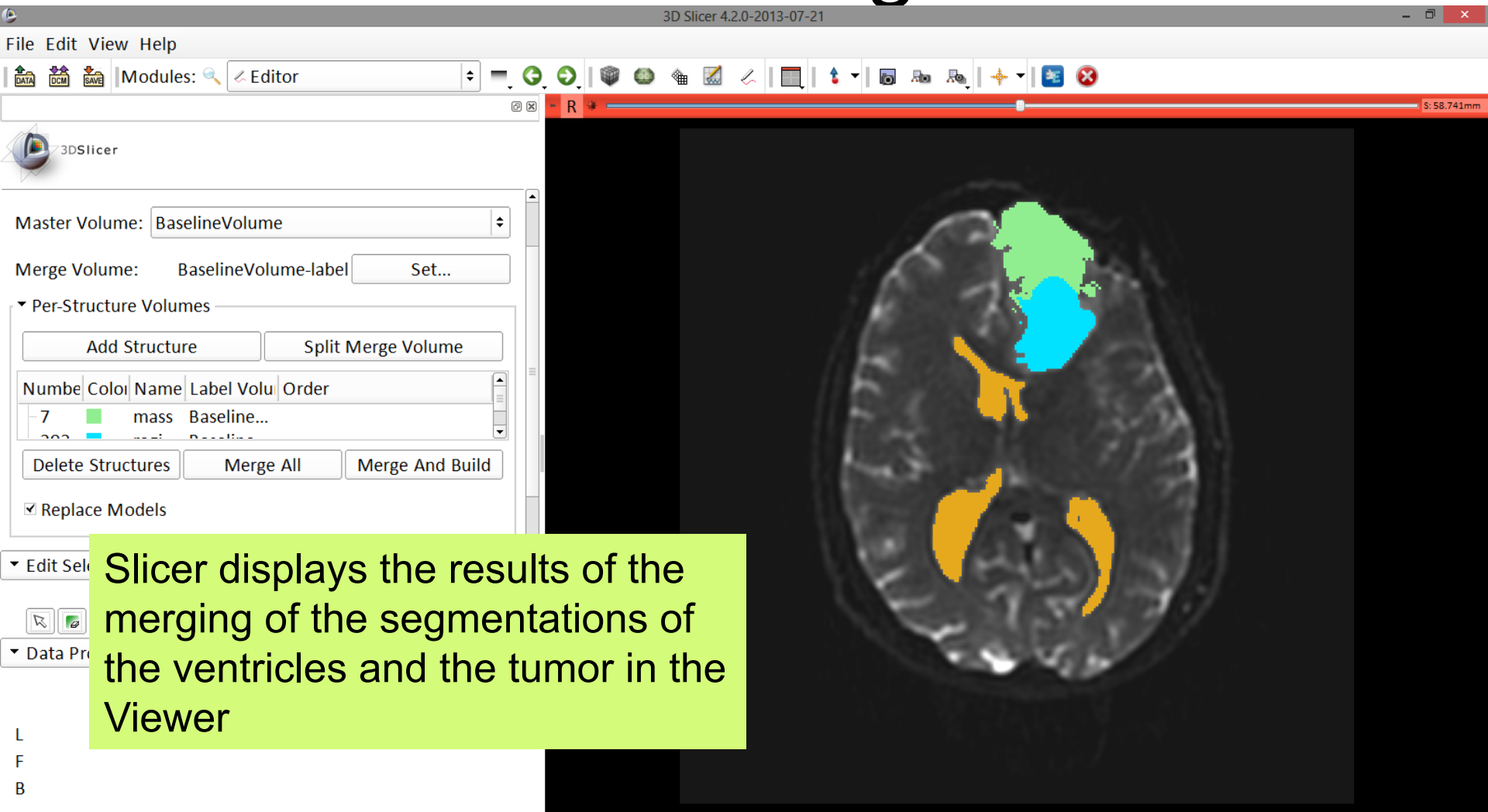
Final Result of Segmentation

The image shows the 3D Slicer software interface. On the left, the 'Per-Structure Volumes' panel is visible, containing a table of structures and buttons for 'Merge All' and 'Merge And Build'. A red arrow points to the 'Merge And Build' button. On the right, a brain MRI slice is displayed with two yellow segmented regions. A yellow text box with black text is overlaid on the MRI slice, providing instructions on how to use the 'Merge And Build' button.

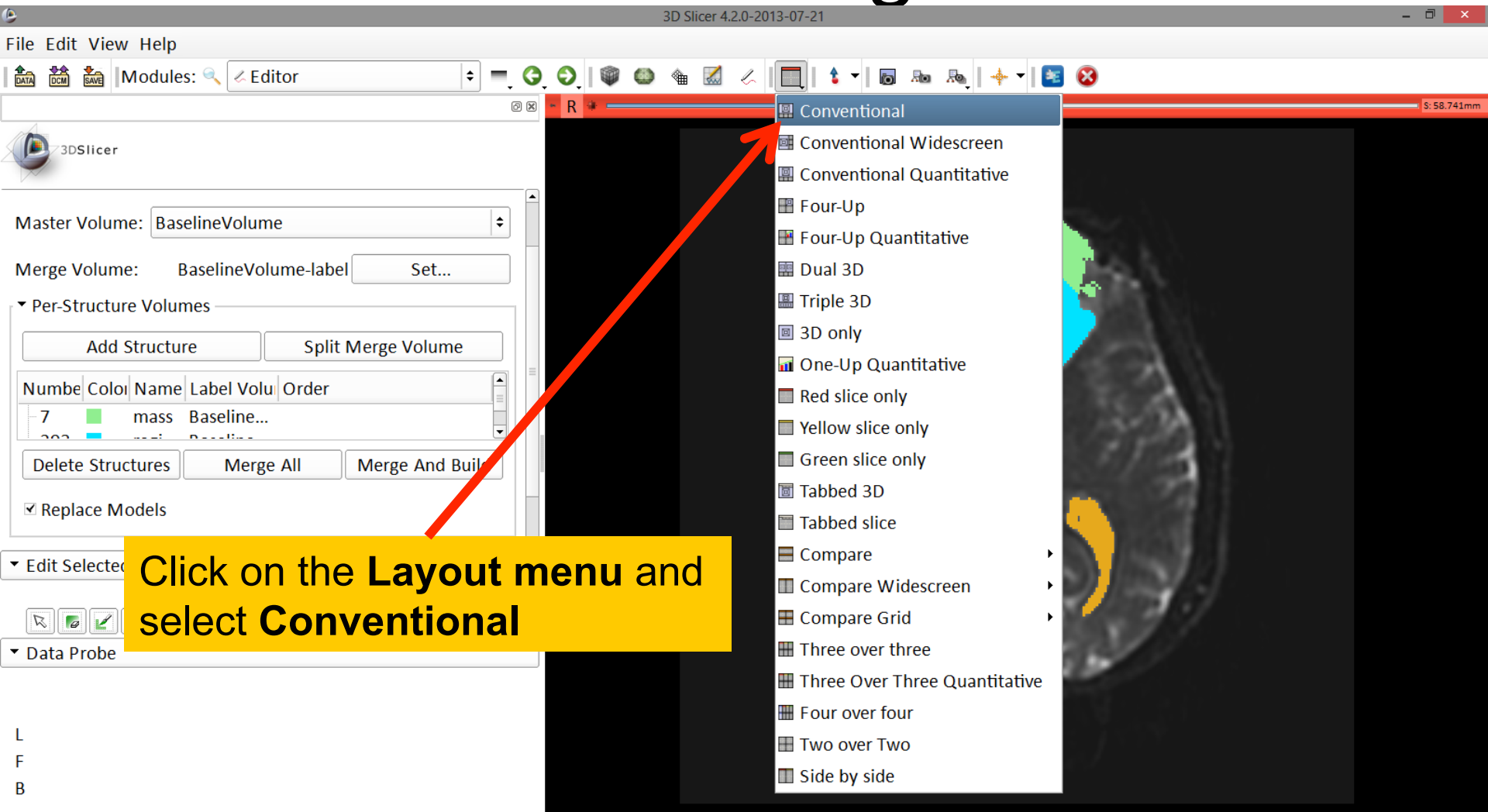
Click on **Merge and Build** to merge the different label maps, and generate the 3D models of the tumor and ventricles using a Marching Cubes algorithm

Number	Color	Name	Label Volu	Order
7	Green	mass	Baseline...	
202	Blue	ventr	Baseline...	

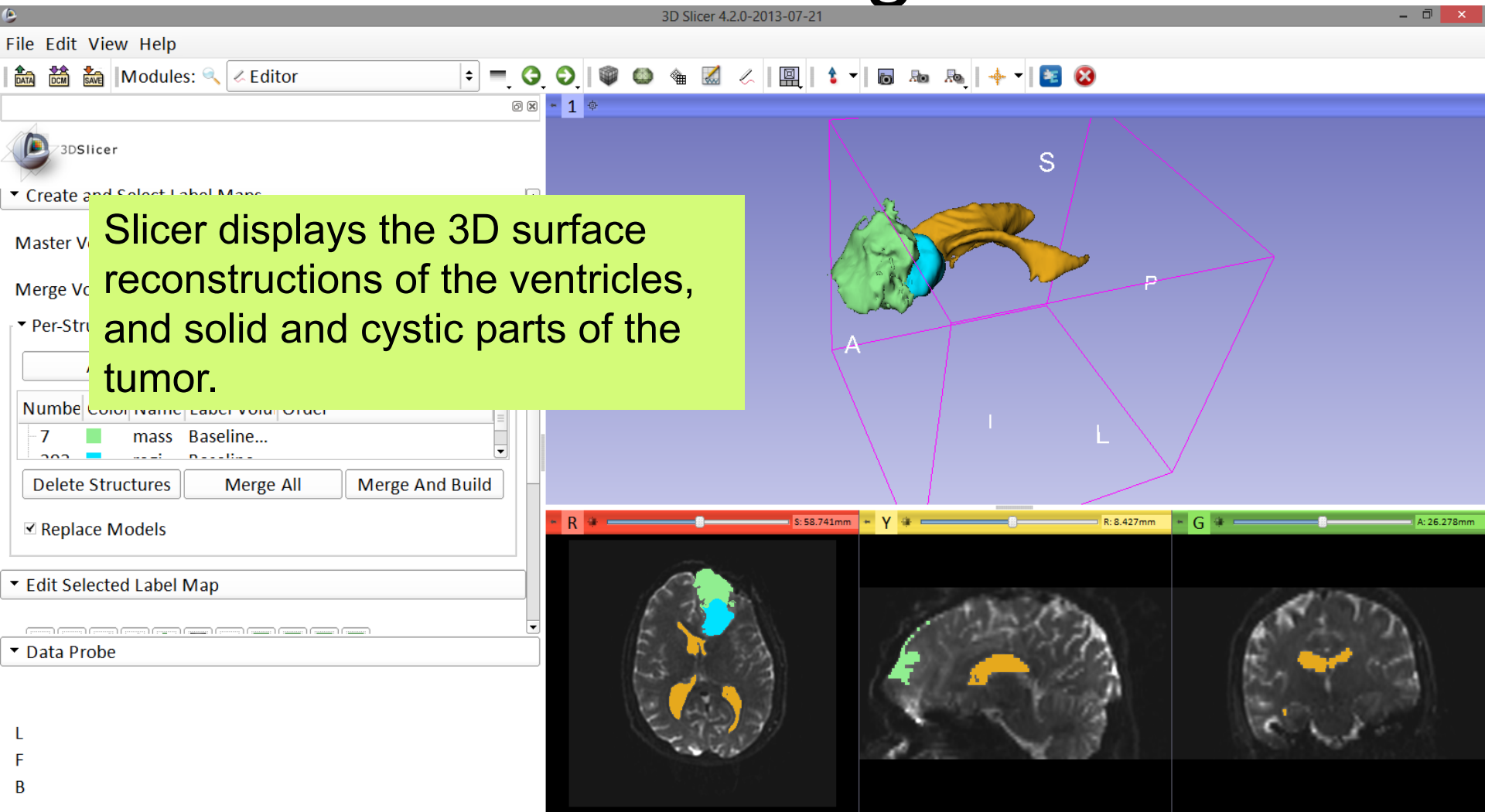
Final Result of Segmentation



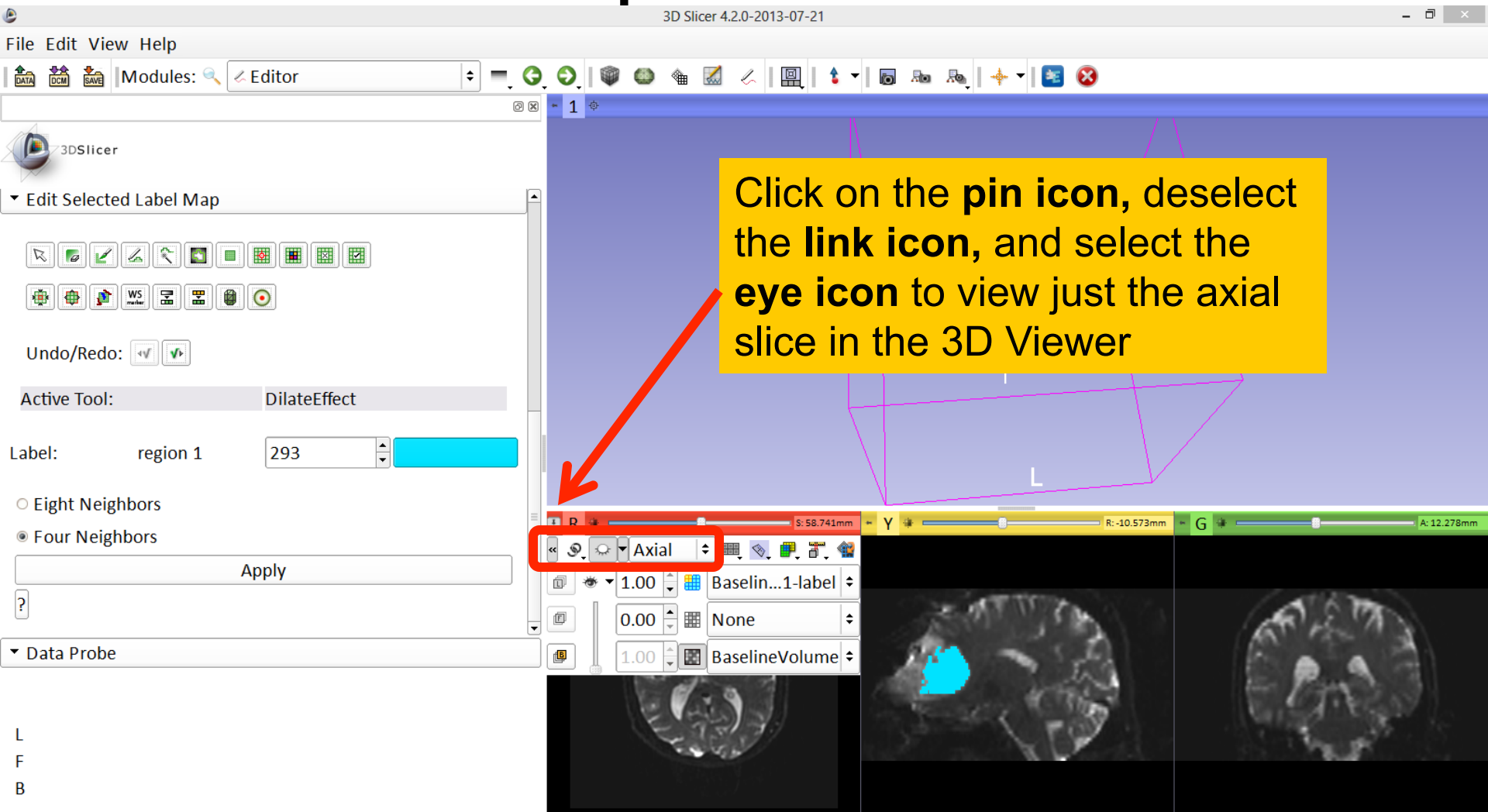
Final Result of Segmentation



Final Result of Segmentation



Definition of peri-tumoral volume



Definition of peri-tumoral volume

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Editor

3DSlicer

Per-Structure Volumes

Number	Color	Name	Label	Volume	Order
293	Blue	regi...	Baseline...		
295	Yellow	regi...	Baseline...		

Edit Selected Label Map

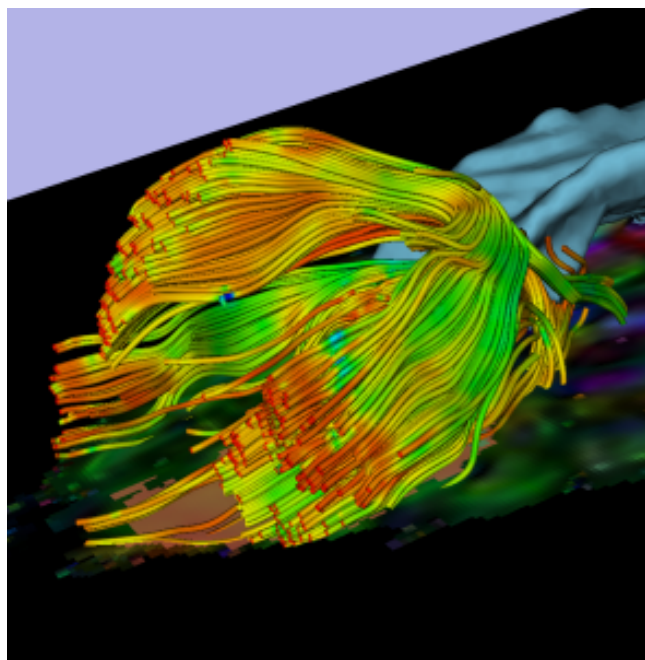
Undo/Redo

Data Probe

L
F
B

Select the label map **BaselineVolume-region_1-label** (blue) and select the **DilateEffect** tool

R S: 58.741mm Y R: 3.427mm G A: 26.278mm



Part 2: Tractography exploration of peri- tumoral white matter fibers

Definition of peri-tumoral volume

The screenshot displays the 3D Slicer software interface. At the top, the title bar reads "3D Slicer 4.2.0-2013-07-21". Below it is a menu bar with "File", "Edit", "View", and "Help". A toolbar contains various icons for file operations (Data, DCM, Save), editing (Editor), and navigation. The main 3D view shows a brain slice with a tumor segmented into green, yellow, and cyan regions. A red arrow points from a yellow text box to the cyan region in the 2D axial slice view. The 2D view also shows coordinate axes (R, Y, G) and a scale bar.

With the **DilateEffect** tool equipped, click on the cystic part of the tumor in the axial slice viewer once, then select **Apply** 3 times to generate the peritumoral volume

Label: region 1 293

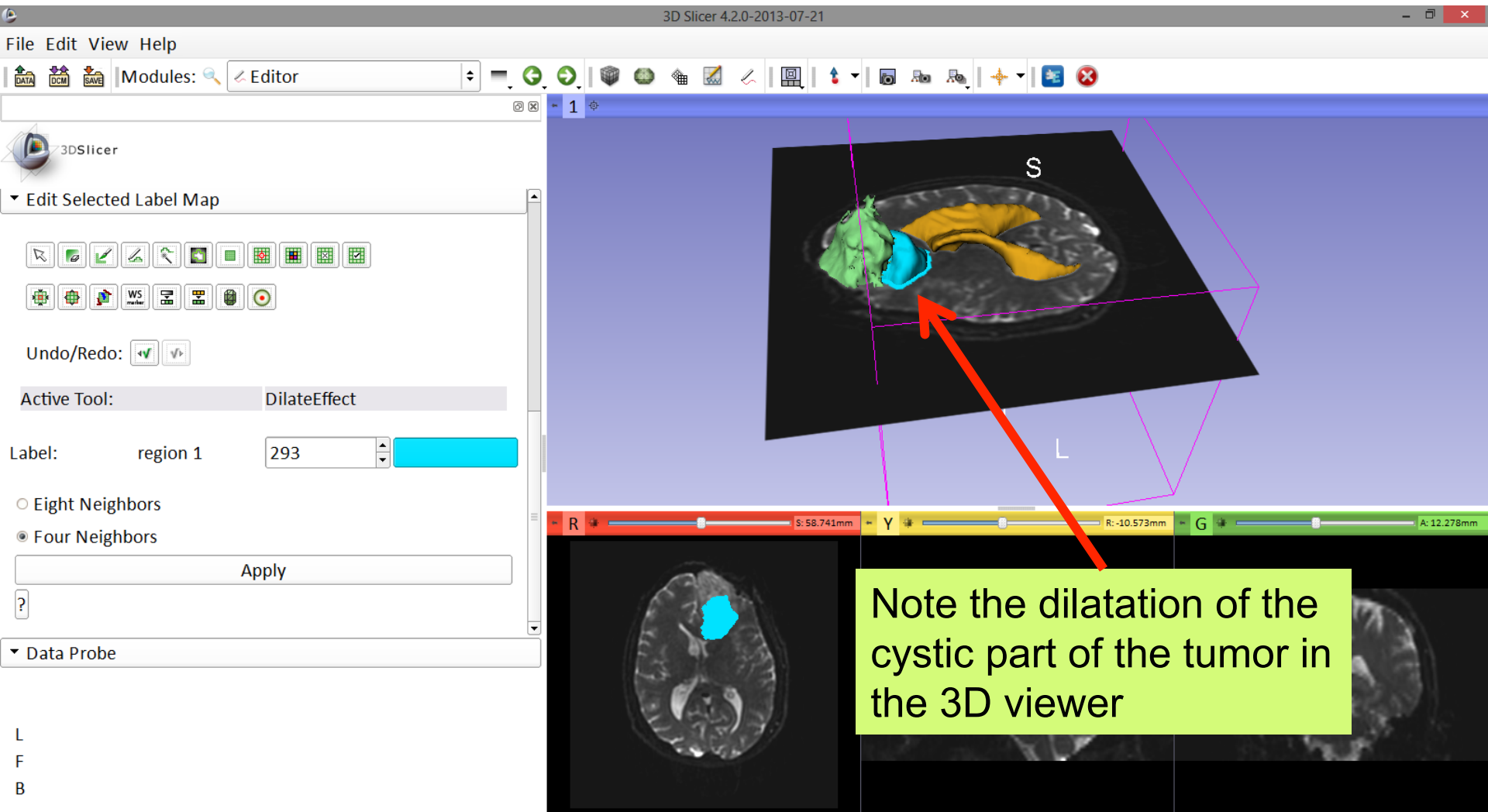
Eight Neighbors

Four Neighbors

▼ Data Probe

L
F
B

Definition of DTI volume



Final Result of Segmentation

File Edit View Help

3DSlicer

Help & Acknowledgement

Create and Select Label Maps

Master Volume: Baseline Volume

Merge Volume: BaselineVolume-label Set...

Per-Structure Volumes

Add Structure Split Merge Volume

Number	Color	Name	Label	Volu	Order
7	Green	mass	Baseline...		

Delete Structures Merge All Merge And Build

Click on the **Module search icon**, delete **Editor** and type in **Tractography Label Map Seeding**

R S: 58.741mm Y R: -10.573mm G A: 12.278mm

Final Result of Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Tractography Label Map Seeding

3DSlicer

Help & Acknowledgement

Tractography Label Map Seeding

Parameter set: Tractography Label Map Seeding

IO

Input DTI Volume: DTIVolume

Input Label Map: BaselineVolume-region 1-label

Output Fiber Bundle: newFiberBundle

Seed Placement Options

Tractography Seeding Parameters

Minimum Path Length: 20.00

Status: Idle

Restore Defaults AutoRun Cancel Apply

Data Probe

L
F
B

- I/O: Set the following input and output volume:
Input DTI Volume: DTIVolume
Input Label Map: BaselineVolume-region_1-label
Output Fiber Bundle: Create new Fiber Bundle

R S: 58.741mm Y R: -10.573mm G A: 12.278mm

Final Result of Segmentation

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Tractography Label Map Seeding

3DSlicer

Help & Acknowledgement

Seed Placement Options

Use Index Space

Seed Spacing 2.00

Random Grid

Linear Measure Start Threshold 0.3

Tractography Seeding Parameters

Minimum Path Length 20.00

Maximum Length 800.00

Stopping Criteria LinearMeasure FractionalAnisotropy

Stopping Value 0.15

Stopping Track Curvature 0.7

Integration Step Length(mm) 0.5

Label definition

Seeding label 293

Restore Defaults AutoRun

Cancel Apply

1

Scroll down and set the following values:

- **Seed Placement Options:**
Check **Use Index Space**
- **Stopping Value**
Set the FA threshold to 0.15
- **Label Definition:**
Enter Seeding Label **293**, and Click on **Apply**

Final Result of Segmentation

File Edit View Help
Modules: Tractography Label Map Seeding

3DSlicer

Help & Acknowledgement

Use Index Space

Seed Spacing

Random Grid

Linear Measure Start Threshold

Tractography Seeding Parameters

Minimum Path Length

Maximum Length

Stopping Criteria LinearMeasure FractionalAnisotropy

Stopping Value

Status: Completed

100%

Restore Defaults AutoRun Cancel Apply

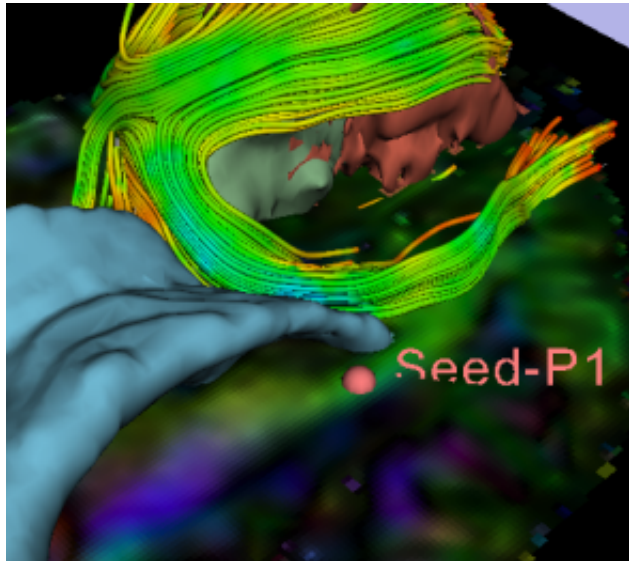
Data Probe

Slicer displays the white matter fibers surrounding the tumor

The fibers are colored according to the fractional anisotropy values (red = low ; blue, green = high)

R S: 58.741mm Y R: 3.427mm G A: 26.278mm

L F B



Part 4: Tractography exploration of the ipsilateral and contralateral side

Tractography on-the-fly

The screenshot shows the 3D Slicer interface. The 'Modules' menu is highlighted with a red box, and 'Tractography Interactive Seeding' is selected. The left sidebar shows the 'FiducialSeedingParameters' panel with 'DTIVolume' selected as the 'Input DTI Volume'. The main 3D view shows a brain model with fiber bundles in green and yellow. The bottom right shows a list of volumes with 'DTIVolume' selected, indicated by a red arrow.

File Edit View Help

3D Slicer 4.2.0-2013-07-21

Modules: Tractography Interactive Seeding

3DSlicer

Help & Acknowledgement

FiducialSeedingParameters

Parameter set

IO

Input DTI Volume: DTIVolume

Input Fiducials, Model or Label Map: Select a AnnotationHierarchyNode

Output Fiber Bundle: Select a FiberBundle

Enable Seeding Tracks:

Seed Placement Options

Click on the **Modules** menu and select the module **Tractography Interactive Seeding**, then switch the background of the 3 anatomical slice viewers to **DTIVolume**

None
BaselineVolume
DTIVolume
BaselineVolume-label
BaselineVolume-mass-label
BaselineVolume-region 1-label
BaselineVolume-region 3-label
Rename current Volume

Tractography on-the-fly

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Tractography Interactive Seeding

3DSlicer

Help & Acknowledgement

FiducialSeedingParameters

Parameter set

IO

Input DTI Volume: DTIVolume

Input Fiducials, Model or Label Map: Select a AnnotationHierarchyNode

Output Fiber Bundle: Select a FiberBundle

Enable Seeding Tracts:

Seed Placement Options

Fiducial Region Size: 2.50mm

Fiducial Seeding Step Size: 1.00mm

Seed Selected Fiducials:

Max Number of Seeds: 100

Data Probe

L
F
B

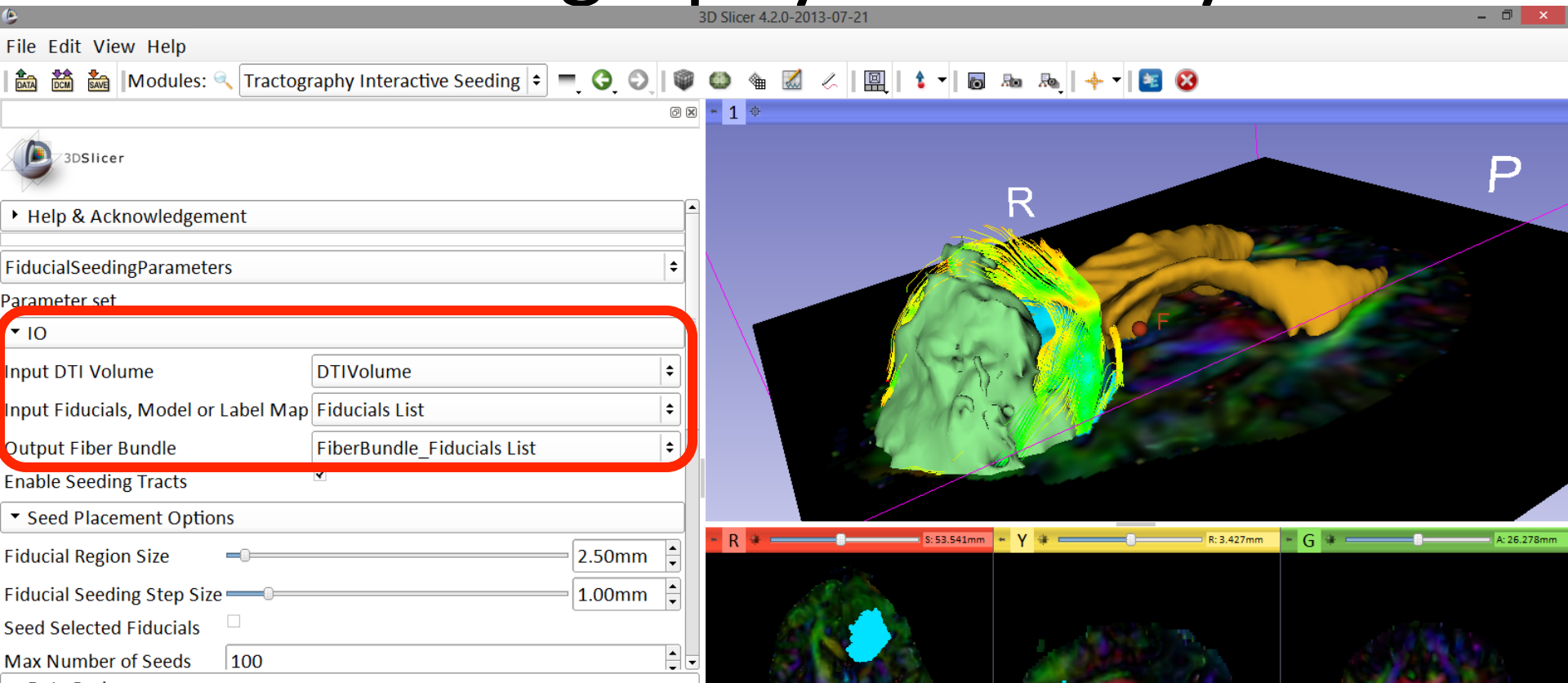
R P

F

S: 53.541mm Y R: 3.427mm G A: 26.278mm

Select the **Fudicial** icon, and position it next to the cystic part of the tumor by clicking near it in the 3D viewer

Tractography on-the-fly



Set Input DTI Volume to **DTIVolume**
Set Fiducial List or Model to **FiducialsList**
Set Output Fiber Bundle to **Create new Fiber Bundle**

Tractography on-the-fly

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Tractography Interactive Seeding

3DSlicer

Tractography Seeding Parameters

Minimum Path Length 10.000mm

Maximum Path Length 800.000mm

Stopping Criteria Fractional Anisotropy

Stopping Value 0.150

Stopping Track Curvature 0.700

Integration Step Length 0.500mm

Enabling Options

Create Tracts Initially As Tubes

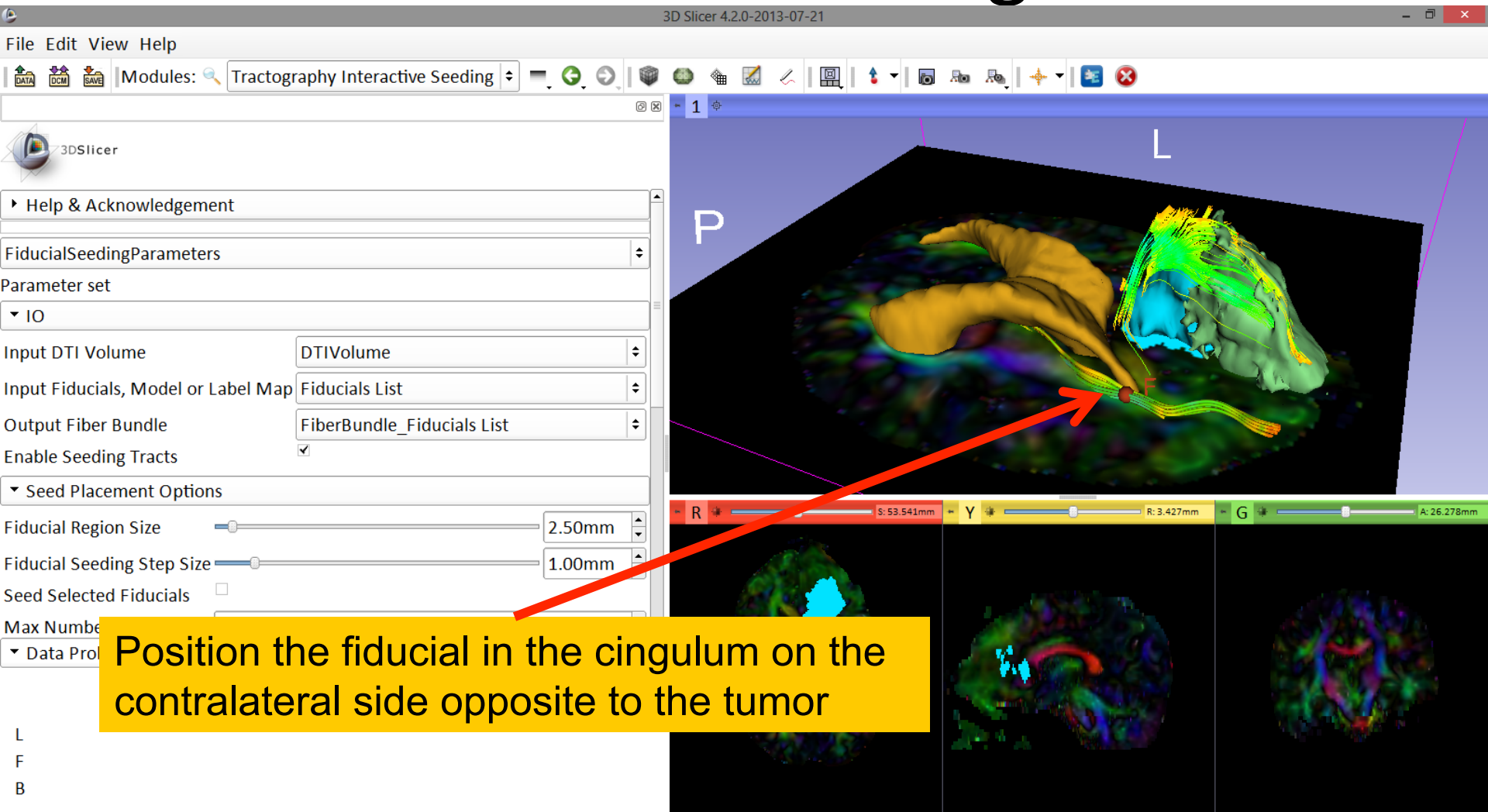
Data Probe

L
F
B

Set the **Minimum Path Length** to 10.0 mm and the **FA Stopping Value** at 0.15

R S: 53.541mm Y R: 3.427mm G A: 26.278mm

Fiducial Seeding



Tractography on-the-fly

3D Slicer 4.2.0-2013-07-21

File Edit View Help

Modules: Tractography Interactive Seeding

Explore the aspect of the cingulum in the contralateral and ipsilateral sides

FiducialSeedingParameters

Parameter set

IO

Input DTI Volume: DTIVolume

Input Fiducials, Model or Label Map: Fiducials List

Output Fiber Bundle: FiberBundle_Fiducials List

Enable Seeding Tracts:

Seed Placement Options

Fiducial Region Size: 2.50mm

Fiducial Seeding Step Size: 1.00mm

Seed Selected Fiducials:

Max Number of Seeds: 100

Data Probe

Image Courtesy of Dr. Alexandra Golby, Brigham and Women's Hospital, Boston, MA..

L

F

B

R: 53.541mm Y: 3.427mm G: 26.278mm

Conclusion

- Fully integrated pipeline for semi-automated tumor segmentation and white matter tract reconstruction
- 3D interactive exploration of the white matter tracts surrounding a tumor (peritumoral tracts) for neurosurgical planning

Acknowledgments



- National Alliance for Medical Image Computing (NA-MIC)
NIH U54EB005149



- Neuroimage Analysis Center (NAC)
NIH P41RR013218



- Parth Amin, WIT '16
- Matthew Flynn, WIT '16