NA-MIC
National Alliance for Medical Image Computing
http://na-mic.org

A Tutorial for RSS in Slicer

Yi Gao[1], Allen Tannenbaum[1], Ron Kikinis[2]
[1]Georgia Tech, [2]BWH

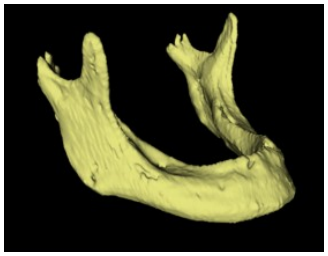
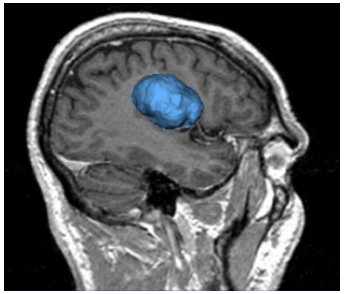
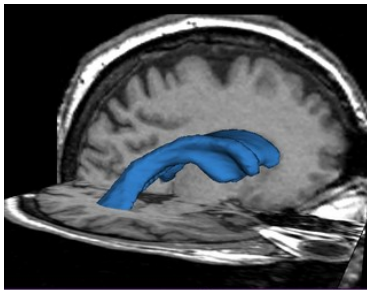
Contact: yi.gao@gatech.edu

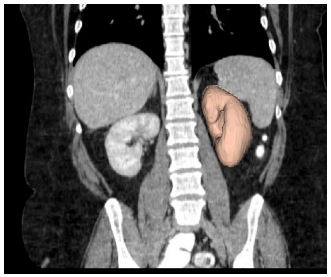
NA-MIC Tutorial Contest: Summer 2010

Learning Objective

- How to use:

RSS (Robust Statistics Segmenter) in Slicer 3.6



Pre-requisite tutorials:

- Slicer3Minute Tutorial
  - by Sonia Pujol
  - at http://www.slicer.org/slicerWiki/images/e/e2/Slicer3.6MinuteTutorial_SoniaPujol.pdf
- Slicer3Visualization Tutorial
  - by Sonia Pujol
  - at http://www.slicer.org/slicerWiki/images/c/c9/3DDataLoadingAndVisualization_Slicer3.6_SoniaPujol.pdf

Material

- This tutorial requires the installation of the **Slicer3.6 release** and the tutorial dataset. They are available at the following locations:

- **Slicer3.6** download page
  http://www.slicer.org/pages/Downloads/

- **Tutorial dataset**:http://wiki.na-mic.org/Wiki/images/2/20/RSSData_TutorialContestSummer2010.zip

Disclaimer: *It is the responsibility of the user of Slicer to comply with both the terms of the license and with the applicable laws, regulations, and rules.*

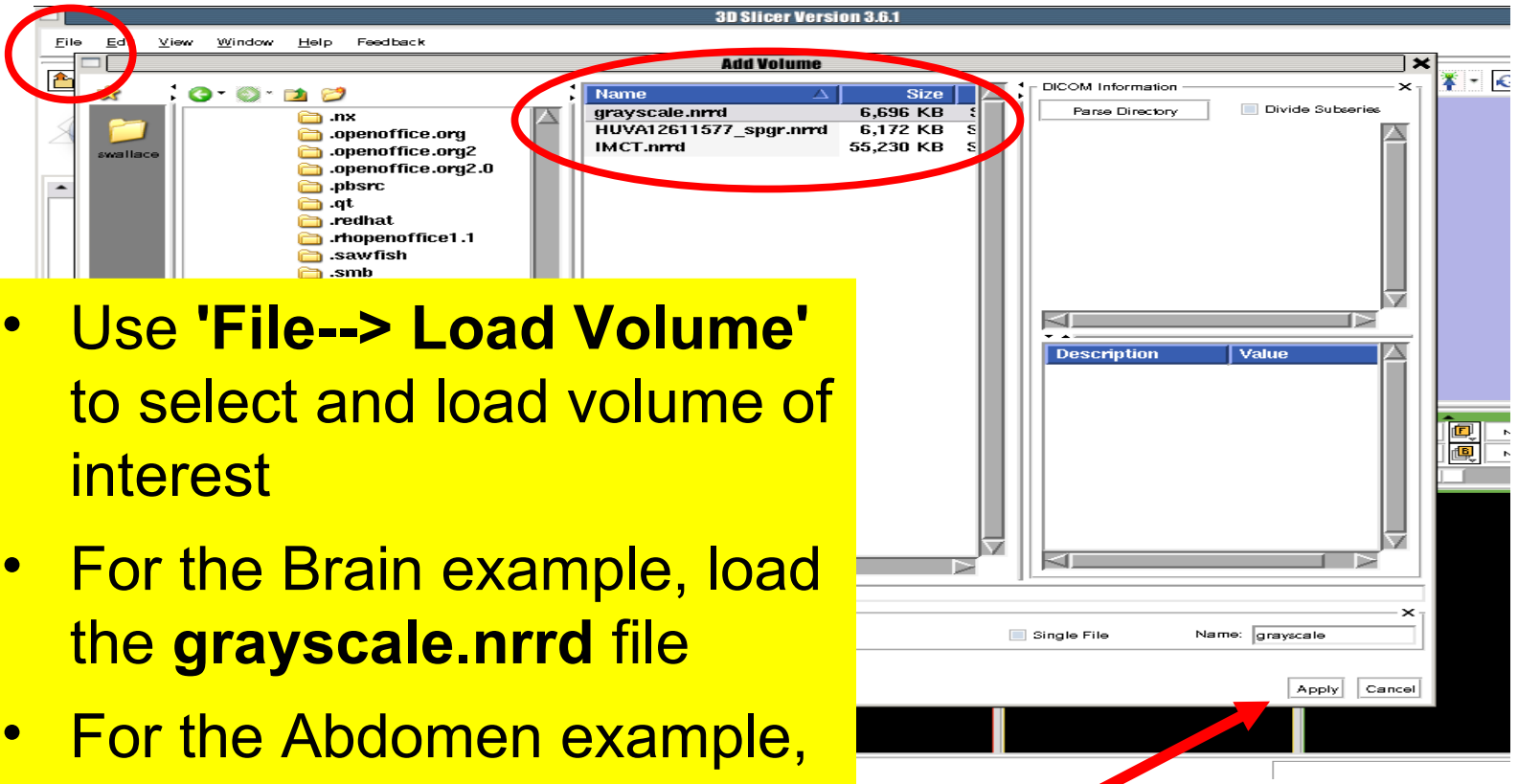
Platform

- Developed on Linux 64
- Tested on
  - Linux 64/32
  - Mac
  - Windows XP 32 (I don't have Win64 ...)

Overview

- Basic using steps
  - First try
- How to tune it
  - What if not satisfying
- Examples
- What's not for
  - Cases may need other tools

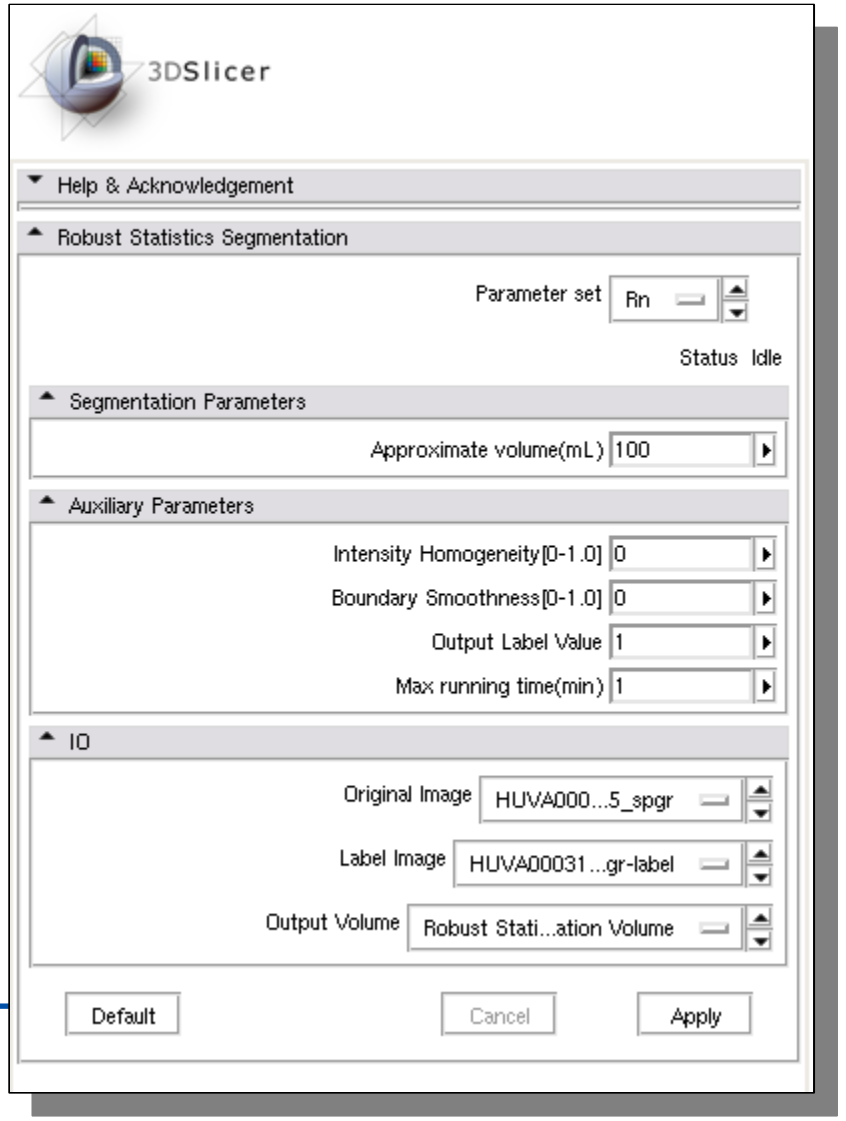
Add Volume



- Use **'File--> Load Volume'** to select and load volume of interest
- For the Brain example, load the **grayscale.nrrd** file
- For the Abdomen example, load **IMCT.nrrd**
- Click **'Apply'**

Basic usage, 1/4

- Slicer 3.6
- Module
  - Segmentation
    - Robust Statistics Segmentation
- Module panel

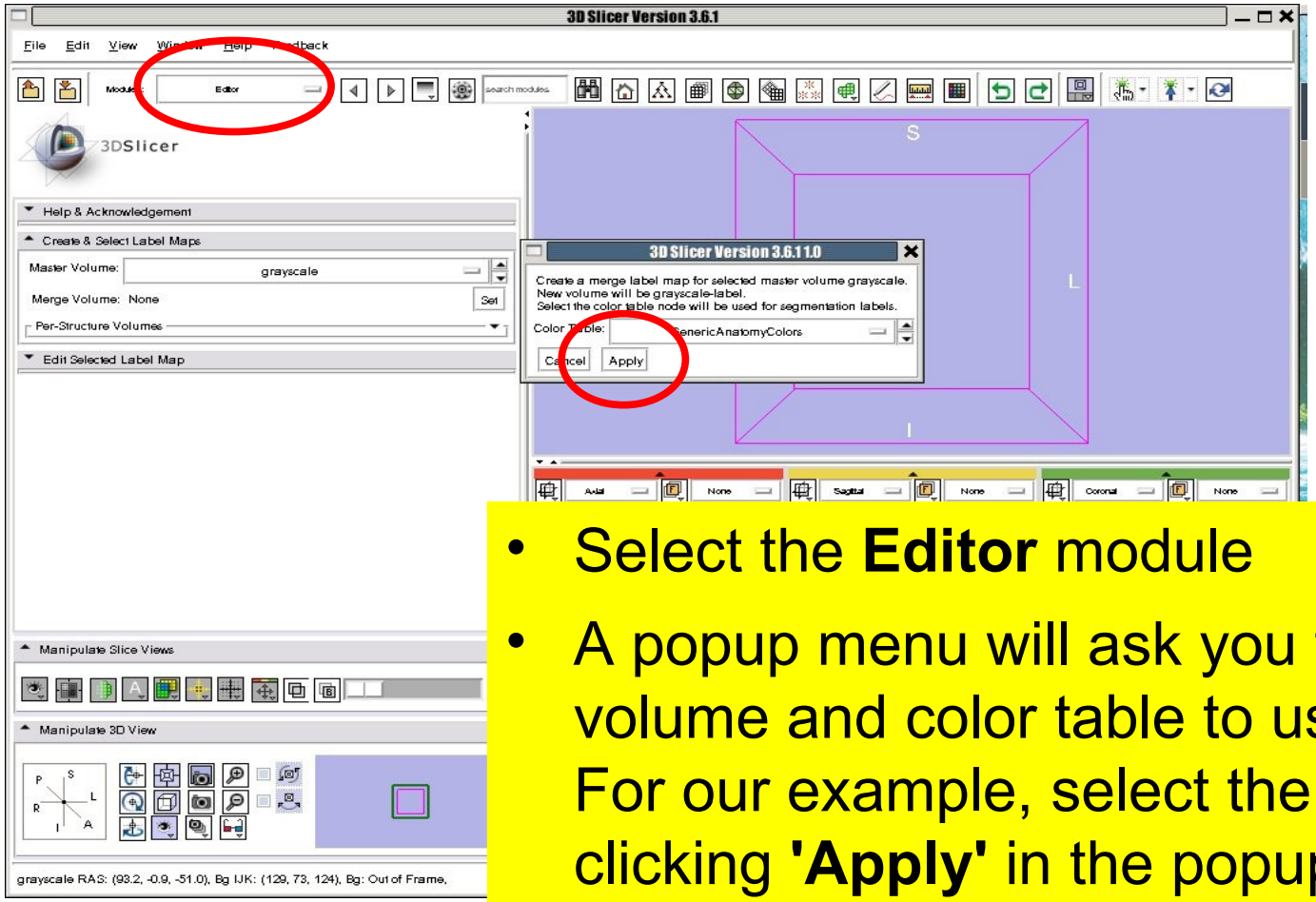


Basic usage, 2/4

- Load in target image
  - Slicer3/Applications/CLI/RobustStatisticsSegmenter/grayscale.nrrd
  - http://www.spl.harvard.edu/publications/item/view/1180
    - Tumorbase.zip at page bottom, case 3
- Label map in Editor module

- In the editor, draw in the object

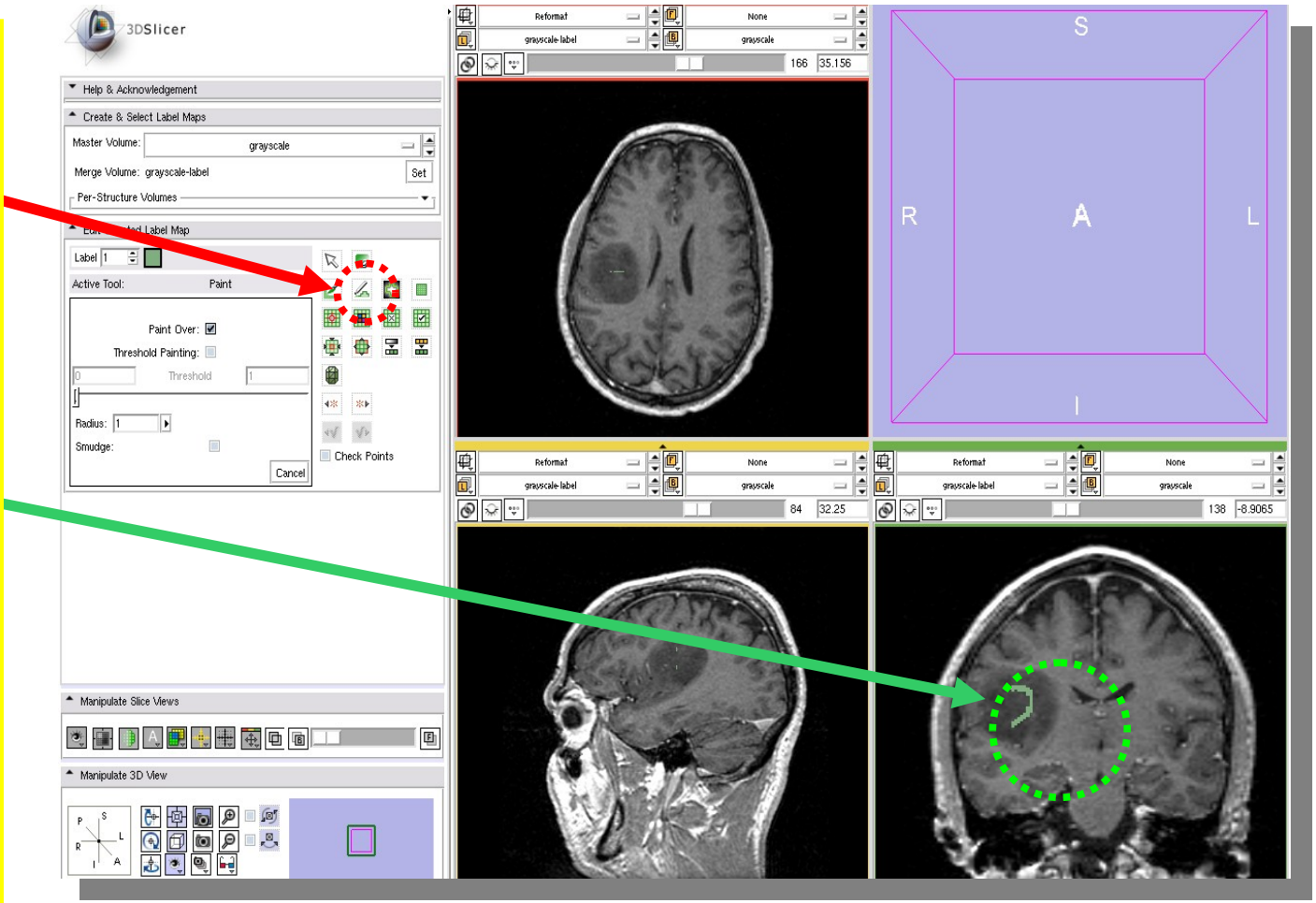
Interactive Editor and Labelmap



- Select the **Editor** module
- A popup menu will ask you to select a volume and color table to use for editing. For our example, select the defaults by clicking **'Apply'** in the popup menu

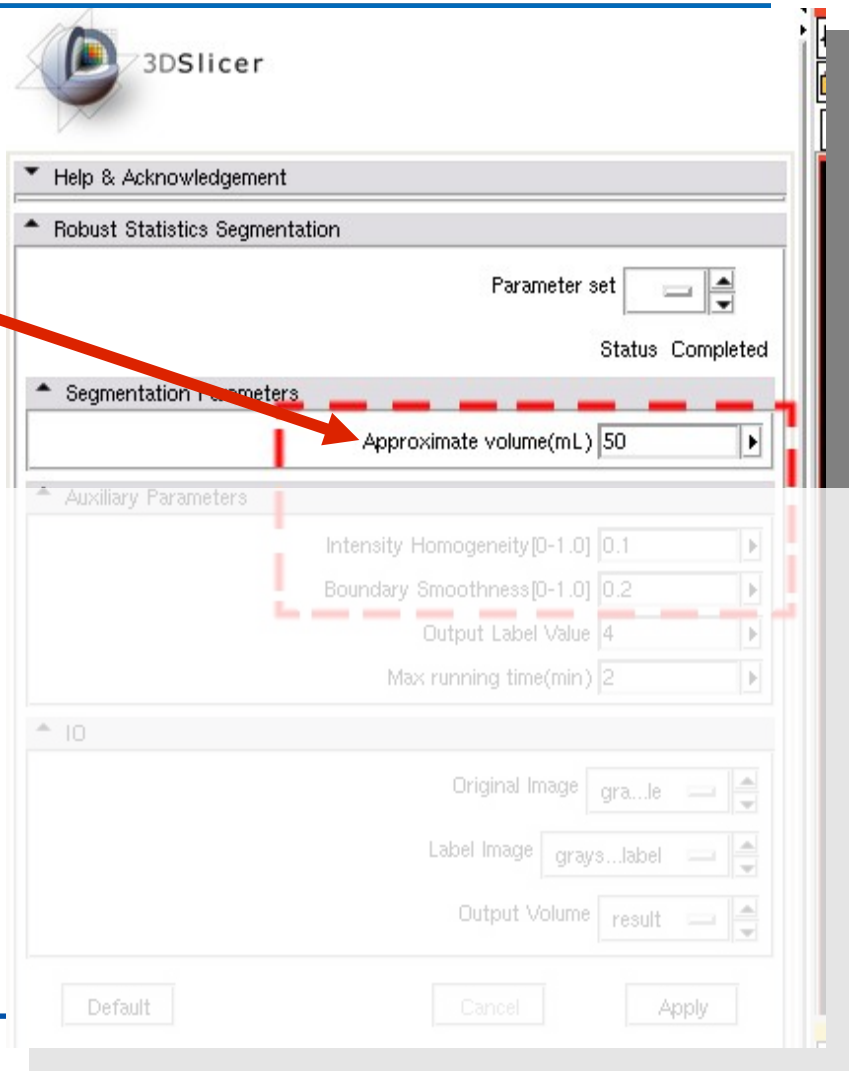
Basic usage, 3/4

- Use the draw button to draw in an area within our ROI (here, a brain tumor)



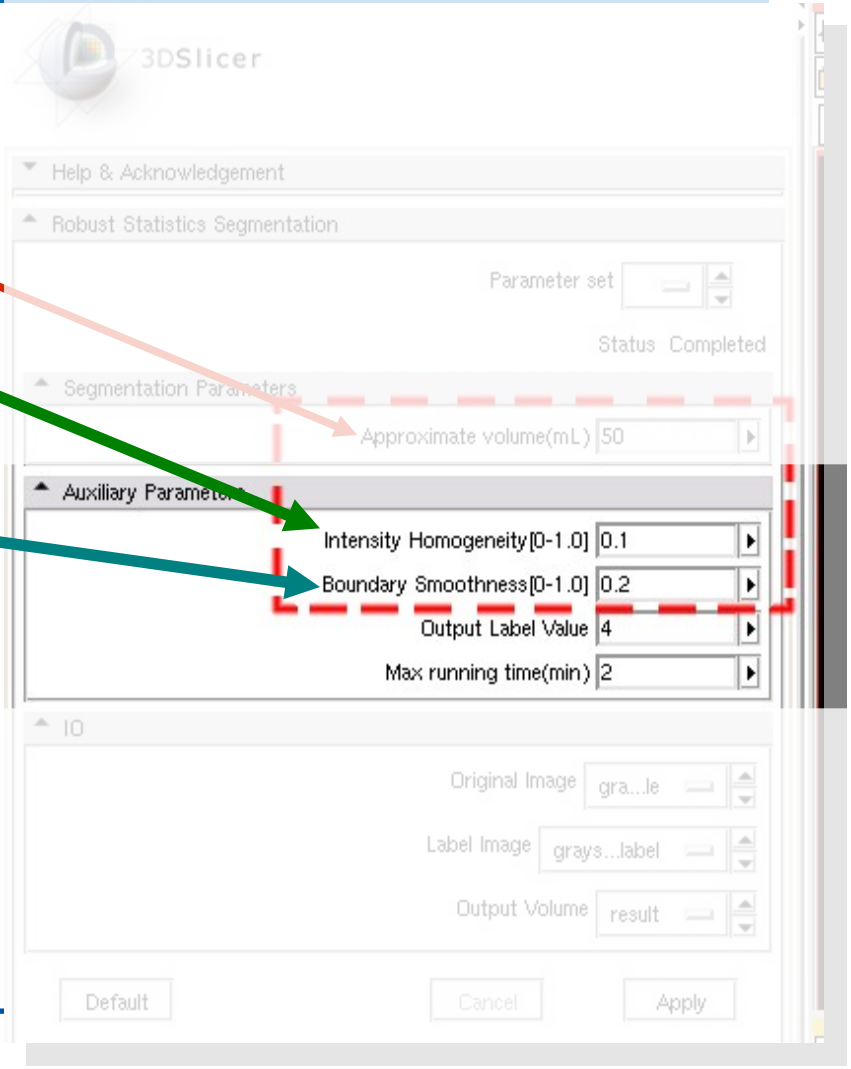
Basic usage, 4/4

- Set your volume limit; this will vary by the size of your structure of interest
- Intensity homogeneity
- Smoothness
- Target image
- Label image
- “Create new volume”



Basic usage, 4/4

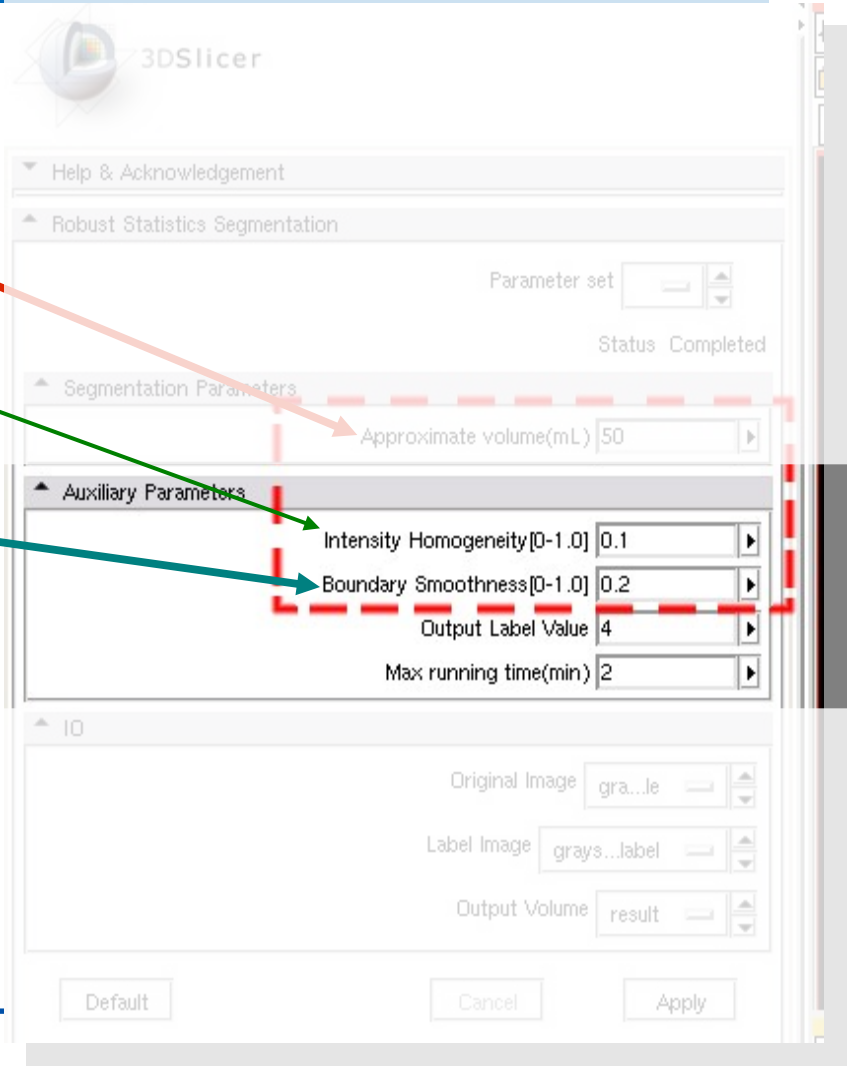
- Volume limit
- Intensity homogeneity
- Smoothness
- Target image
- Label image
- “Create new volume”



Basic usage, 4/4

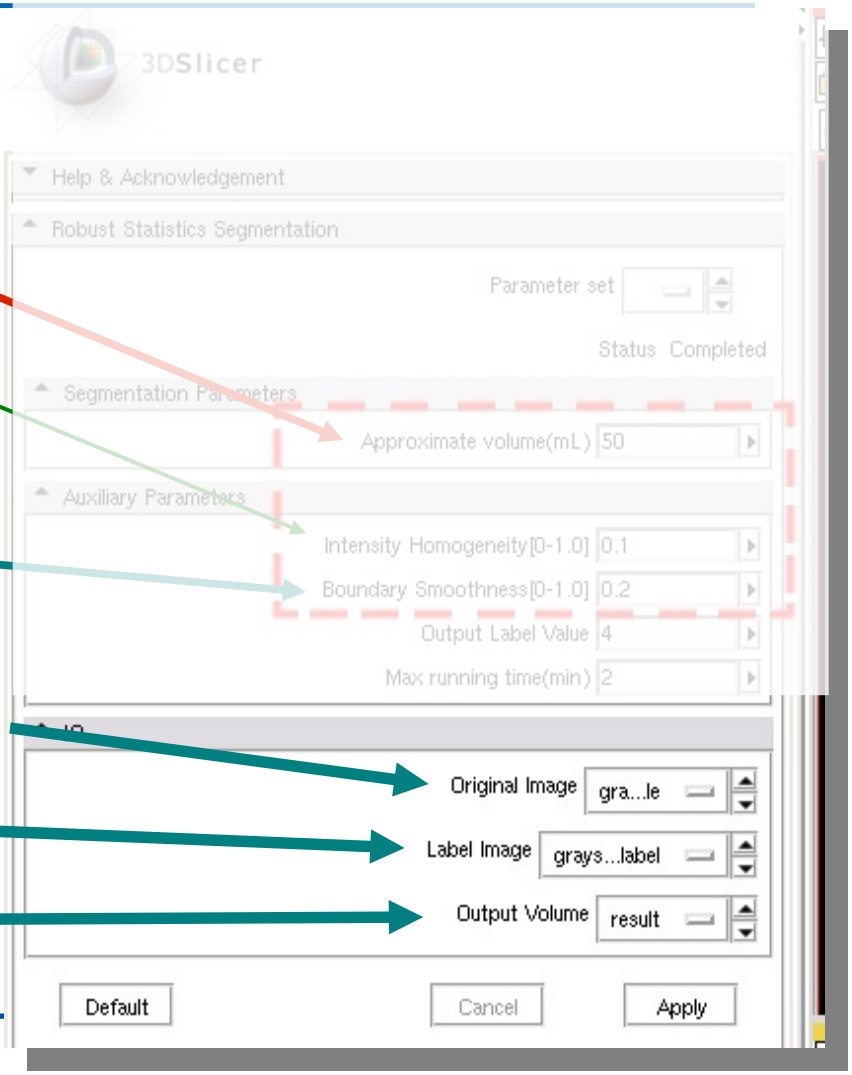
- Volume limit
- Intensity homogeneity
- Smoothness

If not sure, use default values (both set to 0). Let it run and adjust later.

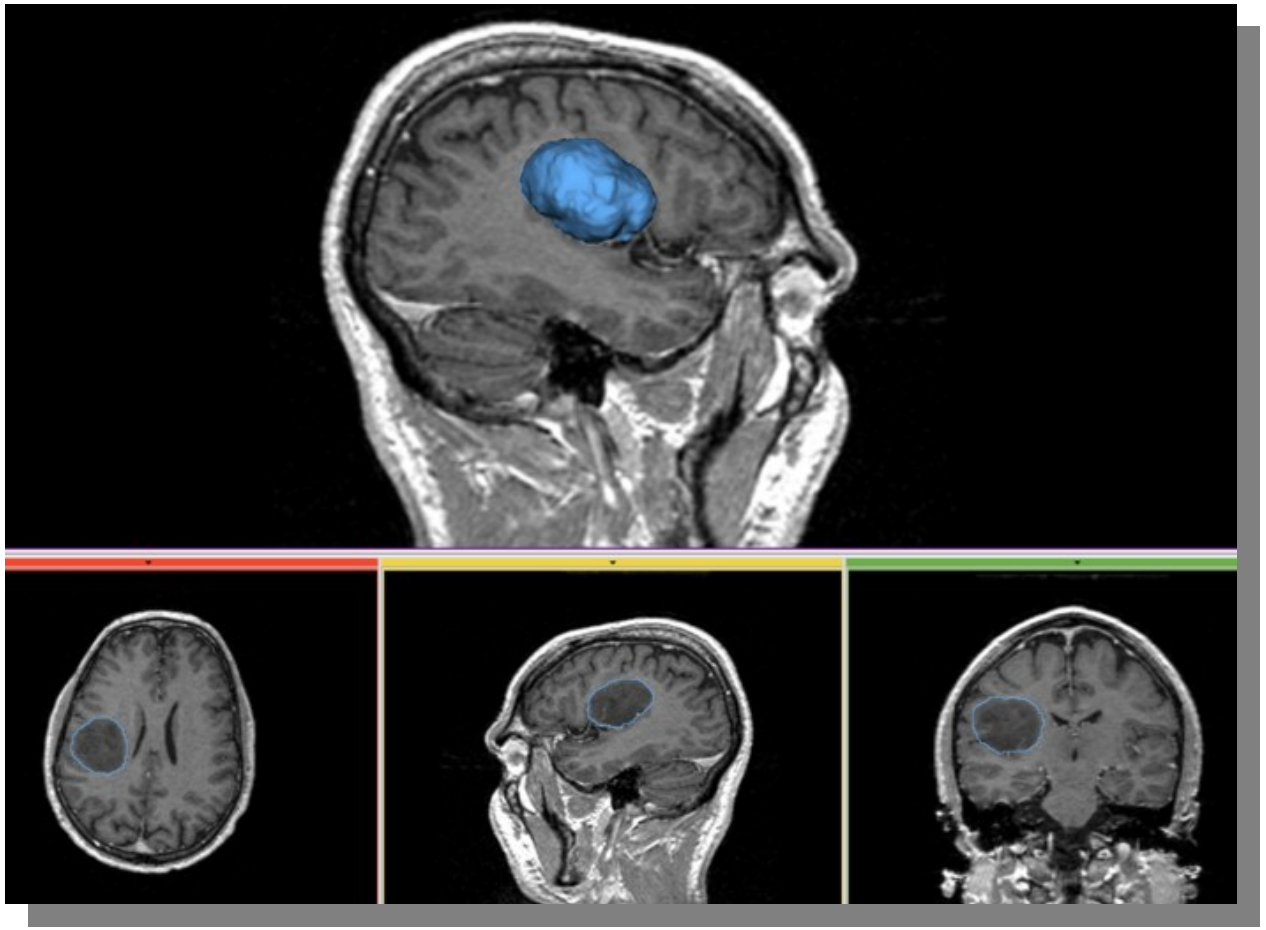


Basic usage, 4/4

- Volume limit
- Intensity homogeneity
- Smoothness
- Target image = original image
- Label image =labelmap
- “Create new volume”

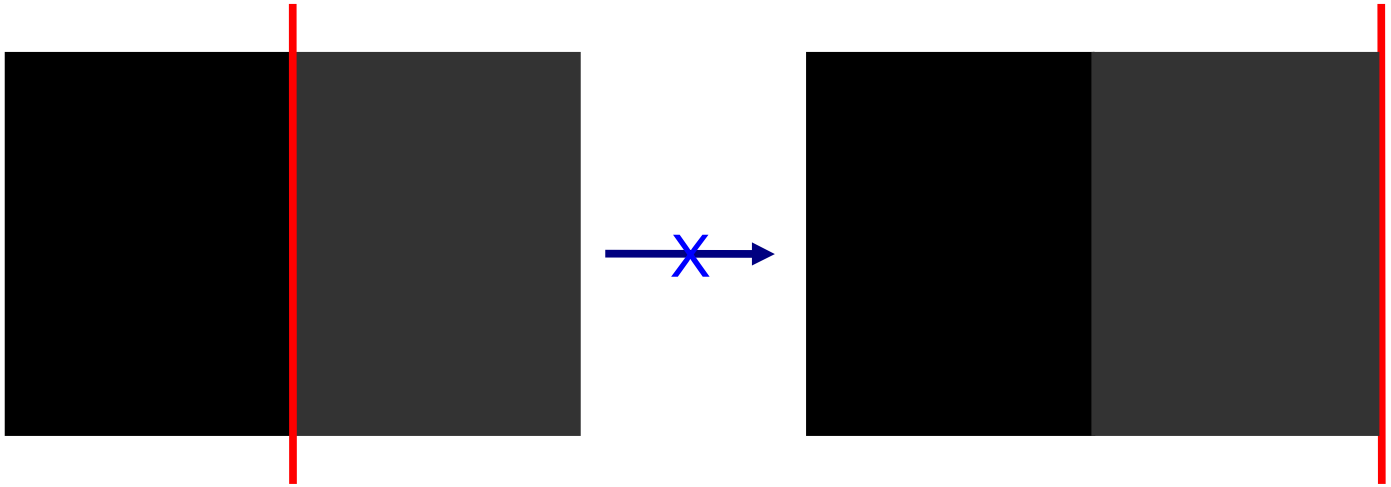


Wait 2.5 seconds...



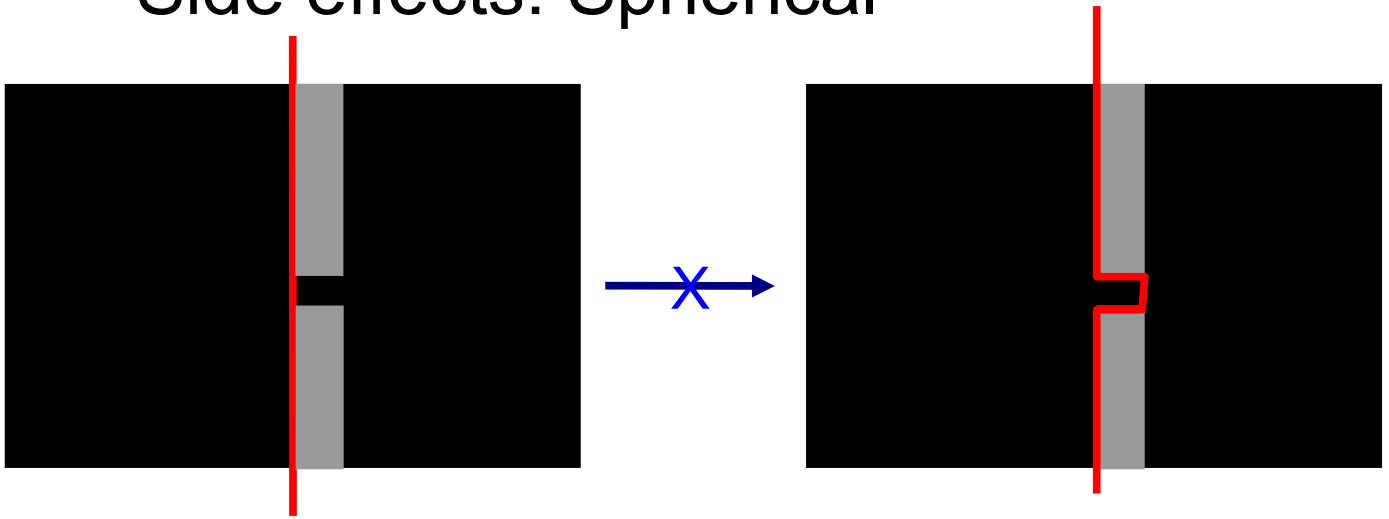
Fine tune, 1/2

- **Intensity homogeneity** ~1 means:
  - Homogeneous intensity in the target
  - Prevent leakage to *similar intensity region*
  - Be strict



Fine tune, 2/2

- **Boundary smoothness** ~1 means:
  - Boundary is smooth
  - Prevent leakage *through a thin gap*
  - Side effects: Spherical

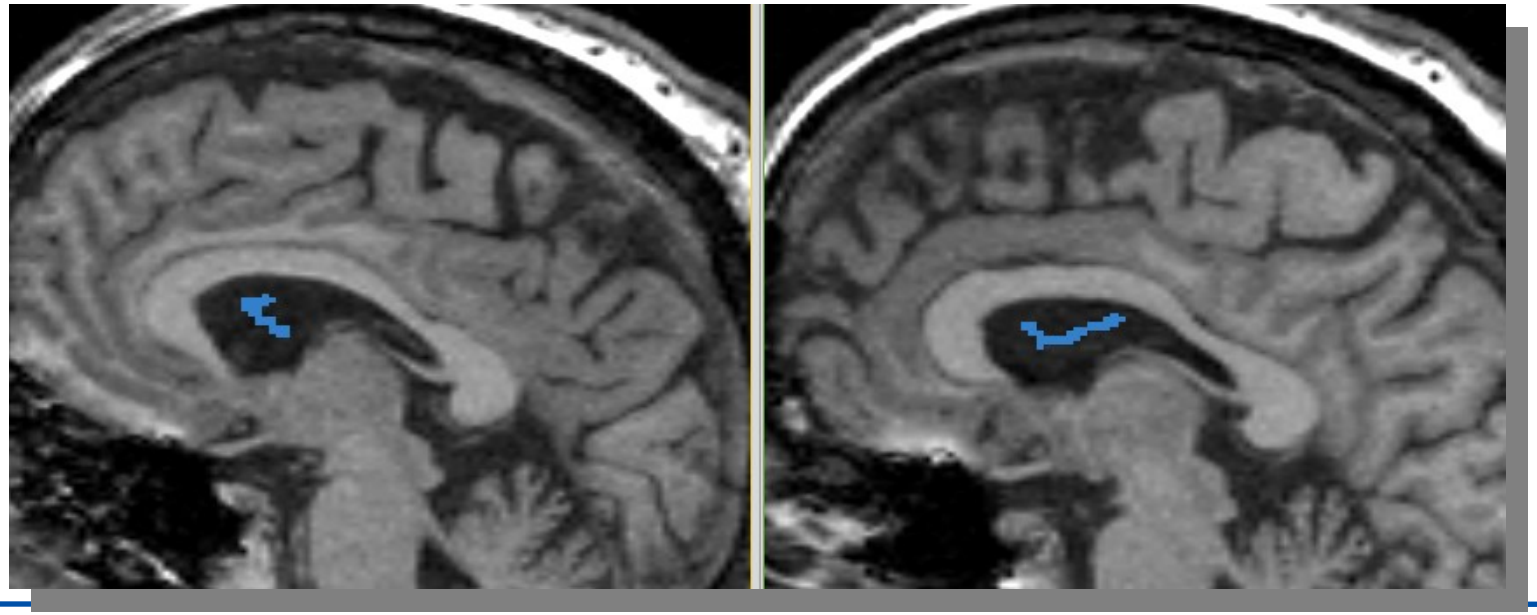


Fine tune, summery

- **Small** (~0)
  - IH, BS: encourage growth
- **Large** (~1)
  - IH, BS: discourage growth
  - BS: spherical shape
    - In the following examples, set BS to 0 because the objects (ventricle, aorta, mandible) are not spherical.

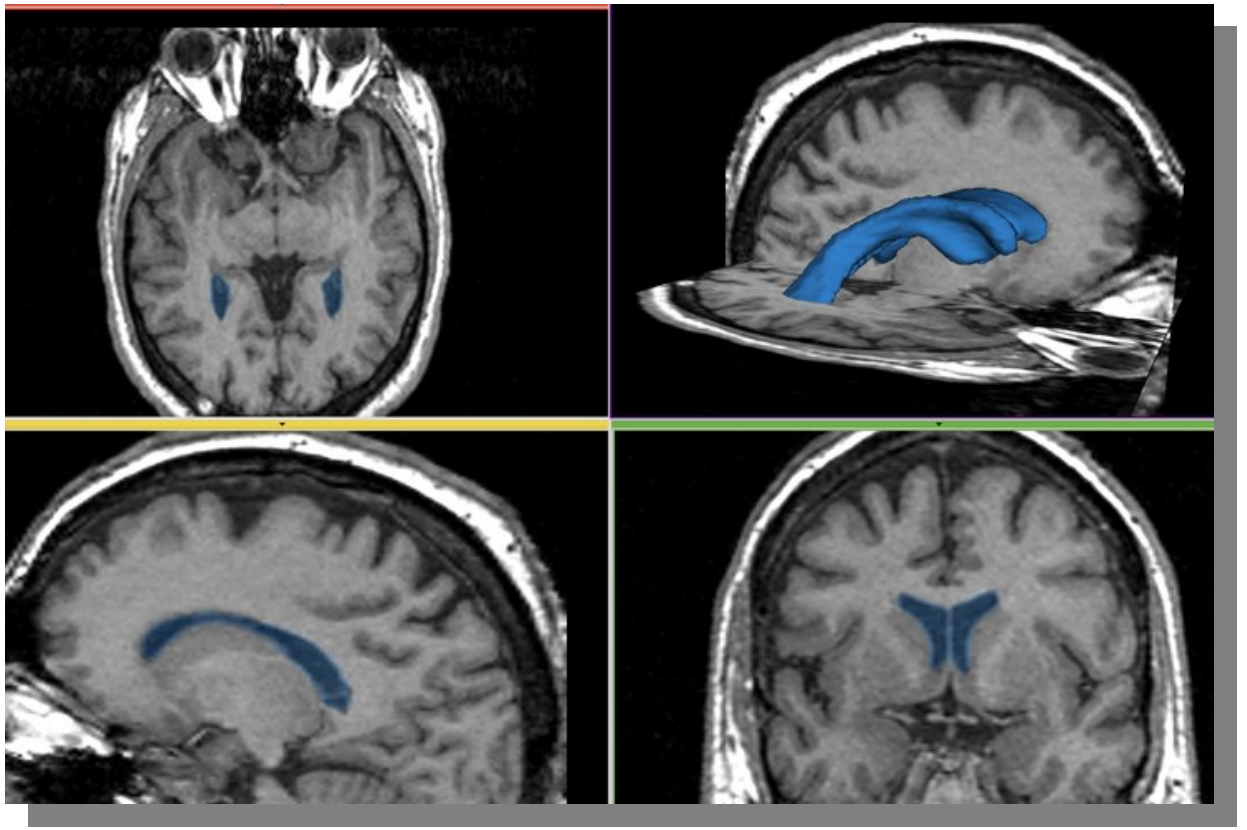
More examples, ventricle

- MRI
  - HUVA12611577_spgr.nrrd
  - Labels: in two sagittal slices



More examples, ventricle

- Parameters
  - Vol: 30ml
  - IH: 0.02
  - BS: 0
- 2.5 sec

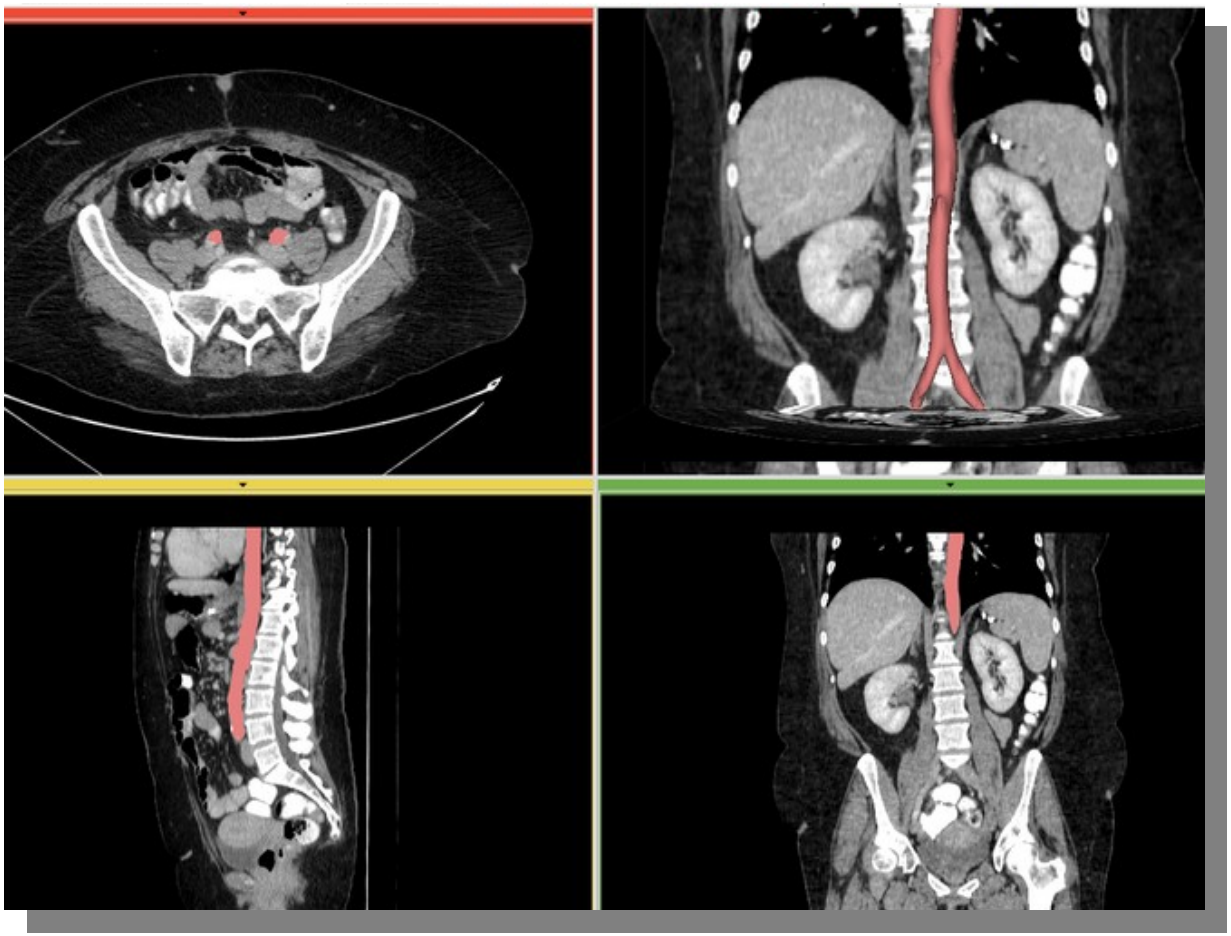


More example, aorta

- CT
  - IMCT.nrrd
- Label
  - 1 sagittal slice
  - Along center line

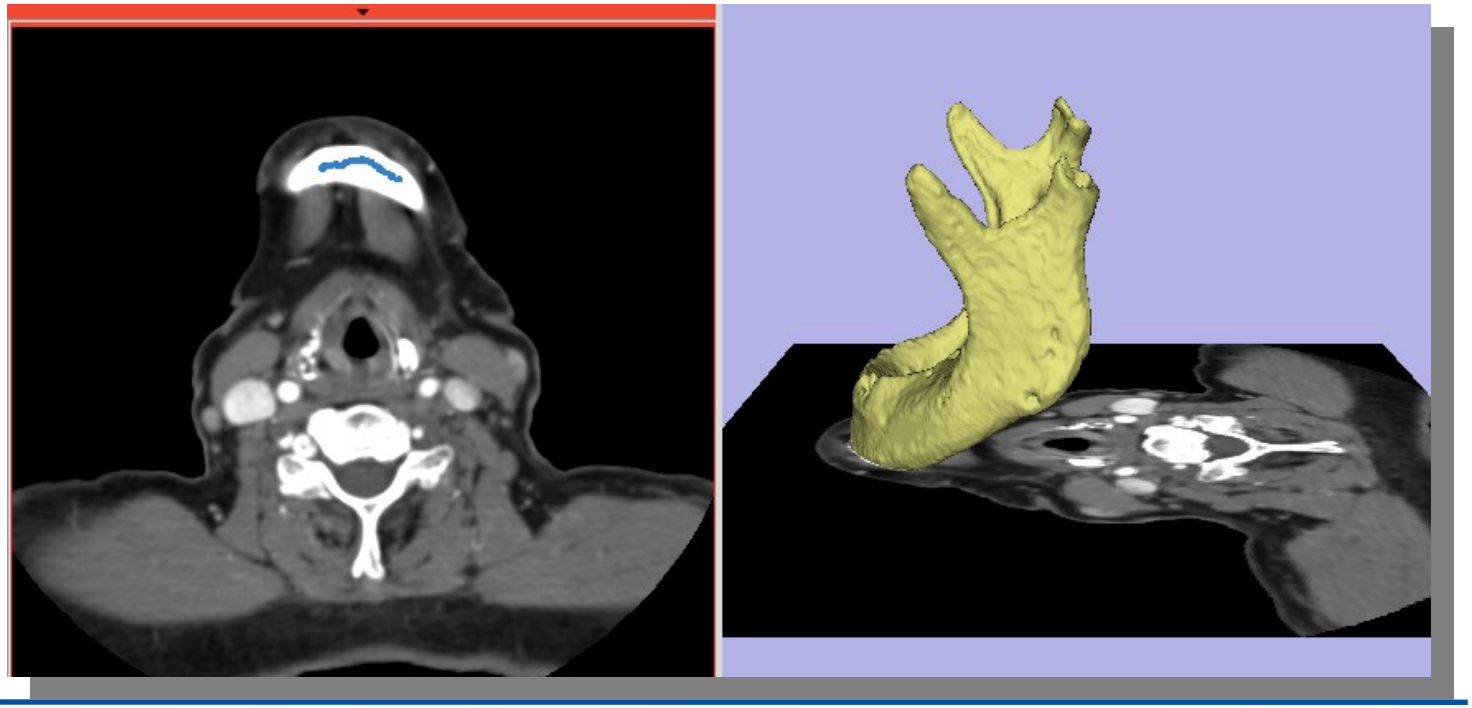
More example, aorta

- Parameters
  - Vol: 60ml
  - IH: 1.0
  - BS: 0
- 12 sec



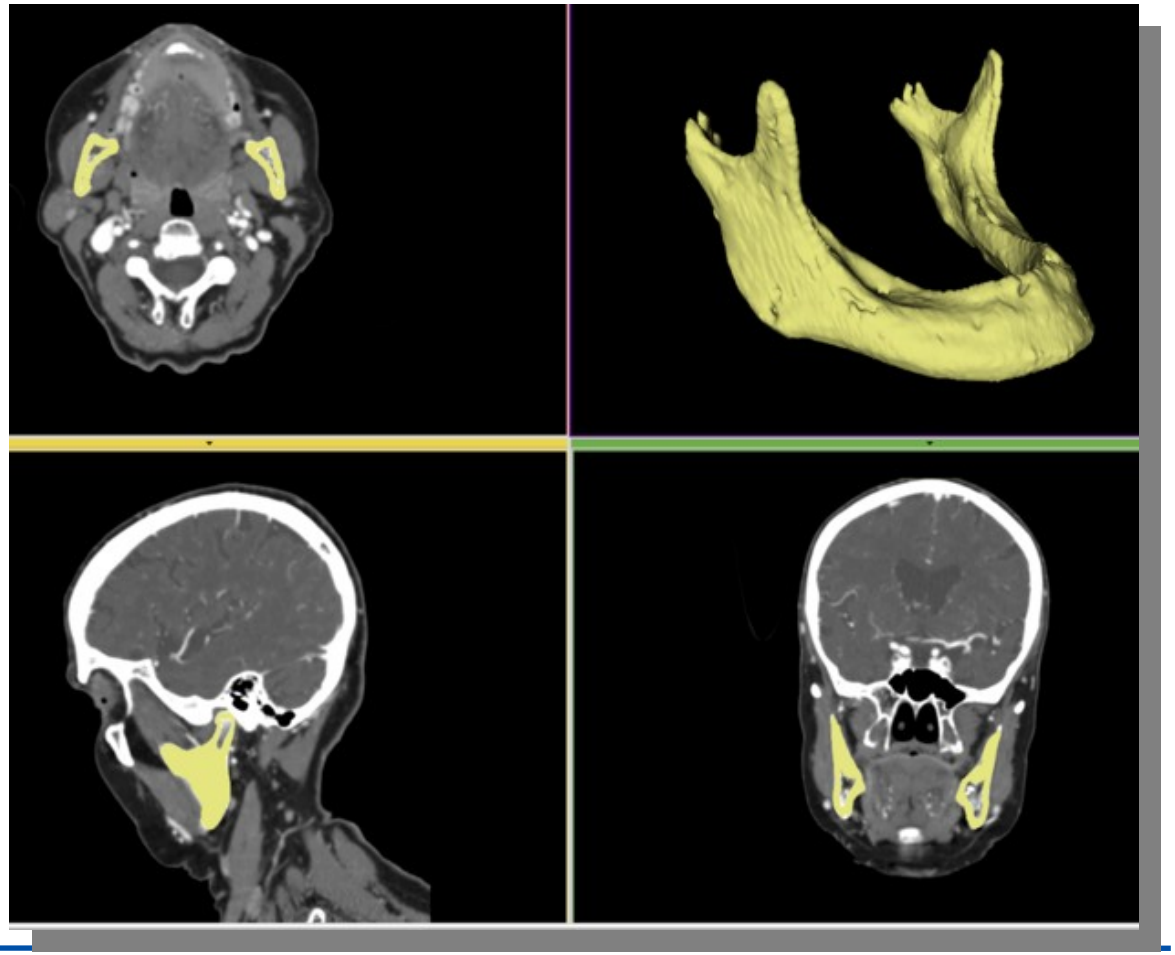
More example, mandible

- CT http://pubimage.hcuge.ch:8080/ MANIX data set
- Label: 1 axial slice



More example, mandible

- Parameters:
  - Vol: 100ml
  - IH: 0.5
  - BS: 0.0
- 160 sec

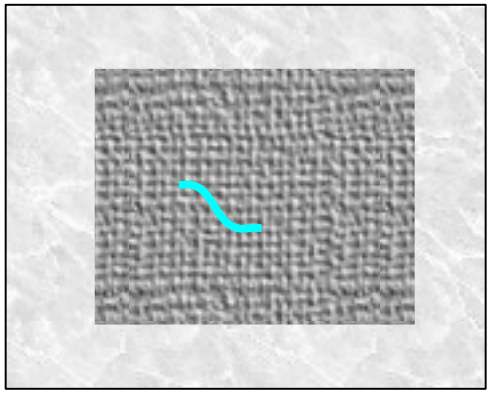


Example summery

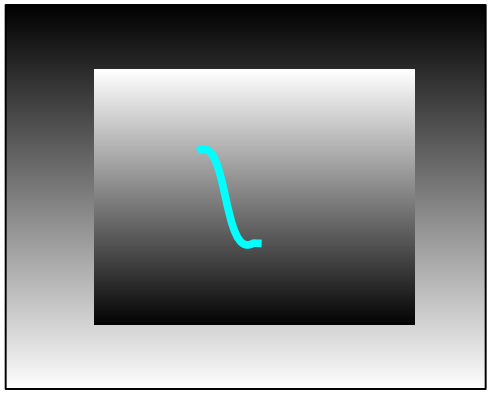
	volume limit	homogeneity	smoothness	running time
	50 ml	0.1	0.2	2.5 sec
	30 ml	0.02	0	2.5 sec
[redacted]	60 ml	1.0	0	12 sec
	100 ml	0.5	0	160

What's not for

- Texture images
  - Seeds cover many intensity levels, also appearing in background



- Intensity range similar to background
  - Similar reason as above



Conclusion

- A new module, RSS, in Slicer3.6
- It's basic usage & How to tune it
- Examples
- Cases RSS won't work well

Acknowledgments

National Alliance for Medical Image Computing

NIH U54EB005149

- Thank the creator of this template file, who makes tutorial preparation much easier.

