



NA-MIC

National Alliance for Medical Image Computing

<http://www.na-mic.org>

Automatic LA Scar Detection

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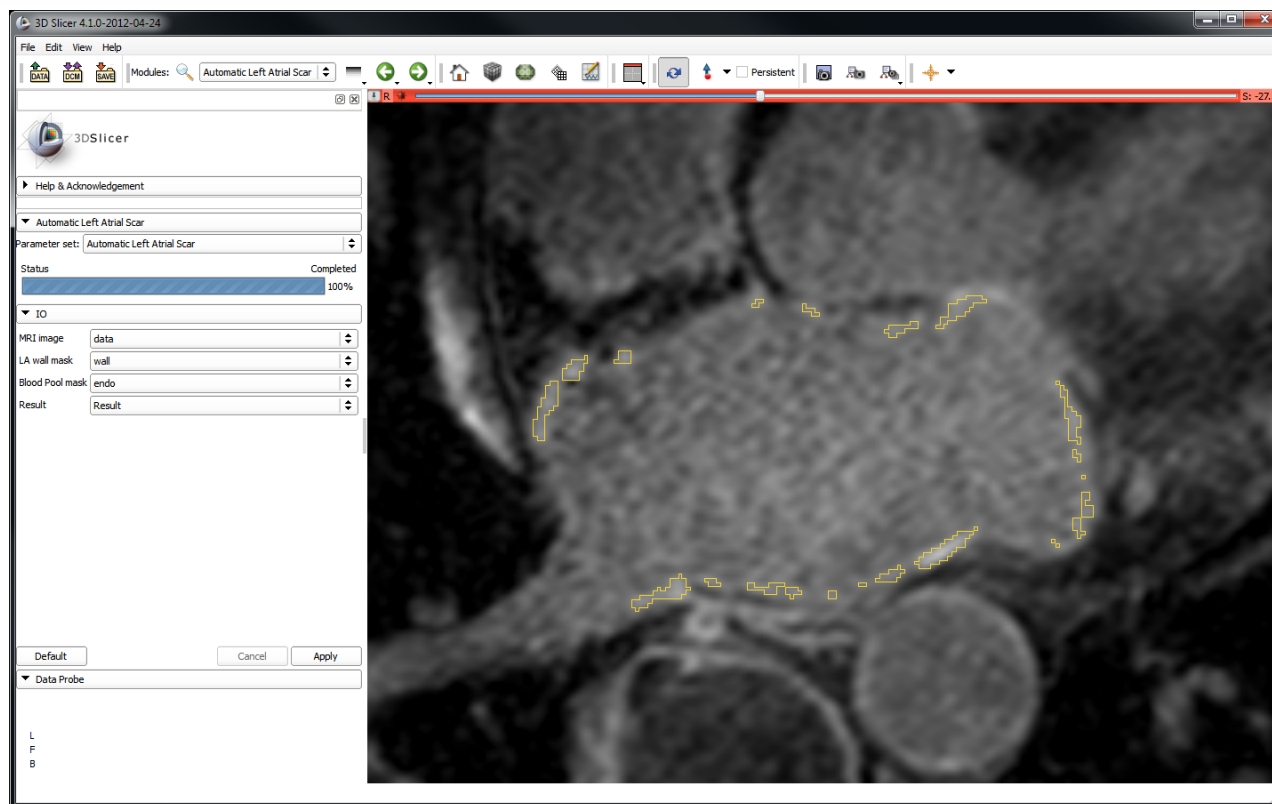
NA-MIC Tutorial Contest: Summer 2012



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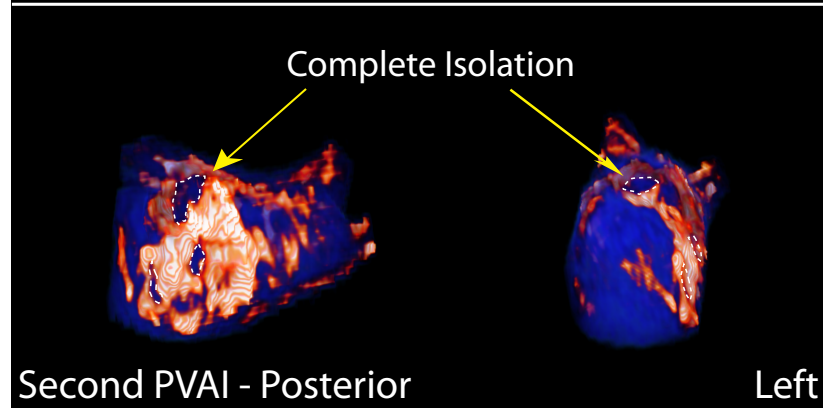
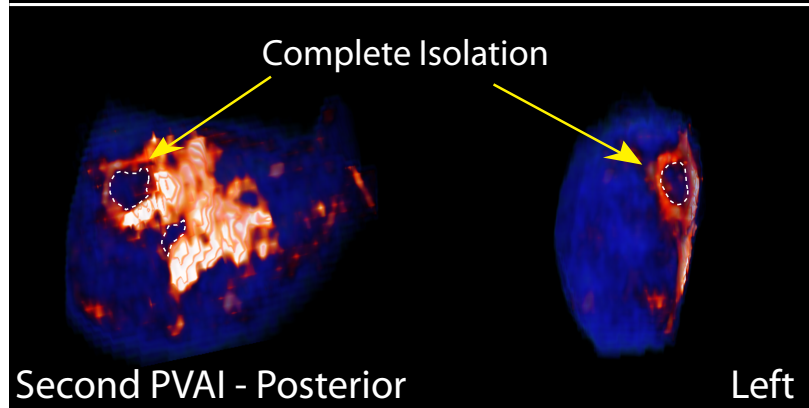
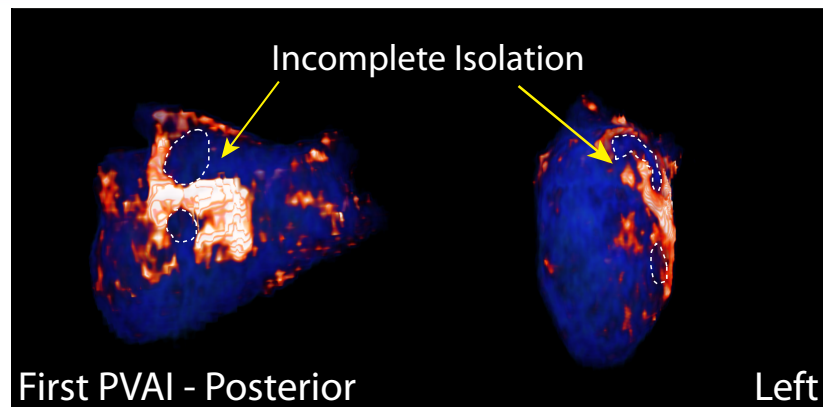
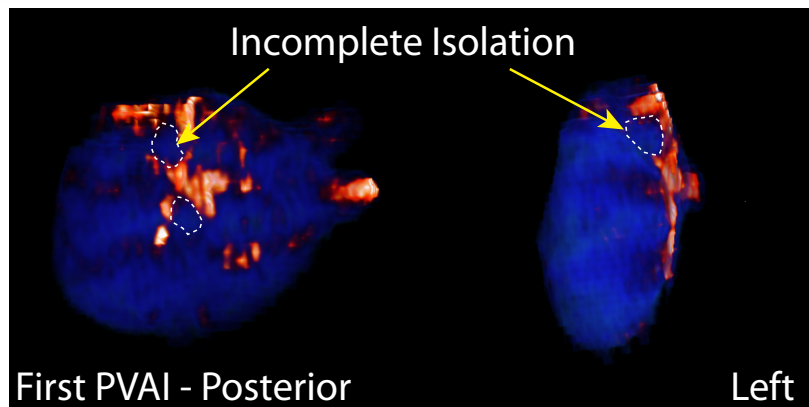
Learning Objective



Automatic left atrial (LA) scar detection in Slicer



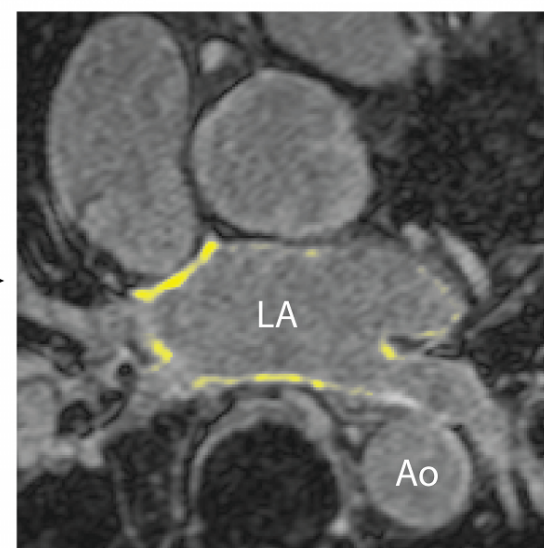
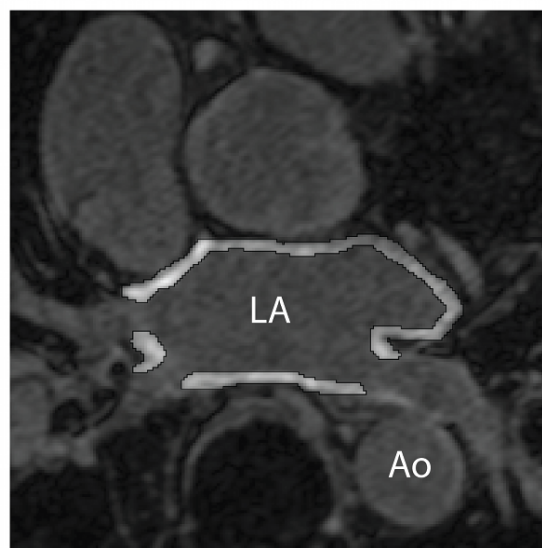
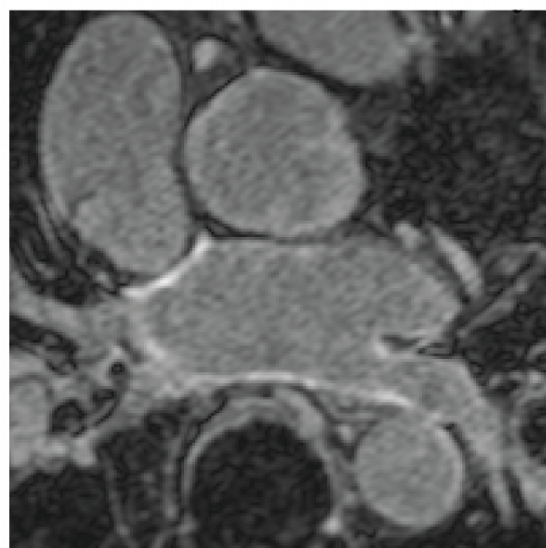
Background



McGann et al. JACC,52(15): 1263-1272, 2008



Current Workflow



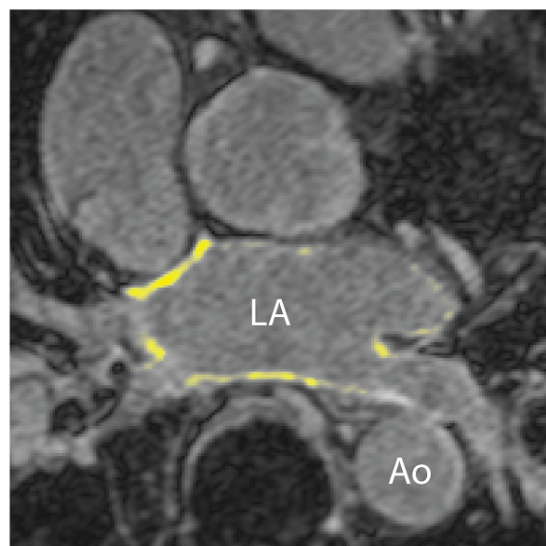
Acquire
LGE-MRI

Manually segment
LA wall

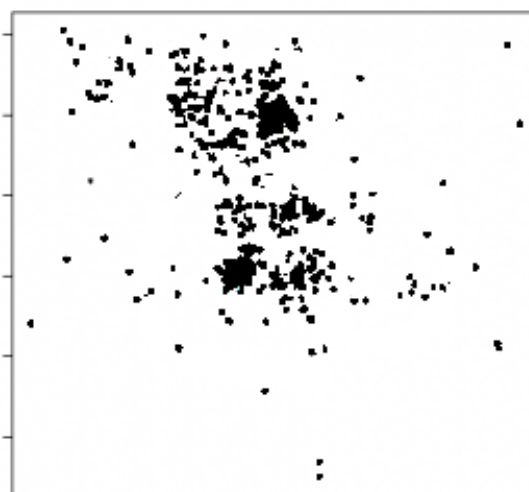
Manually
segment scar



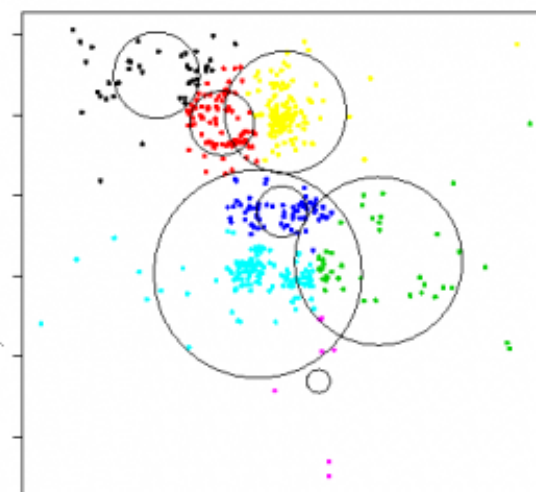
Current Workflow



Manually
segment scar



Raw Data



Clustered Data

Automatically
segment scar

Perry et al. SPIE, Feb. 2012



Required Materials

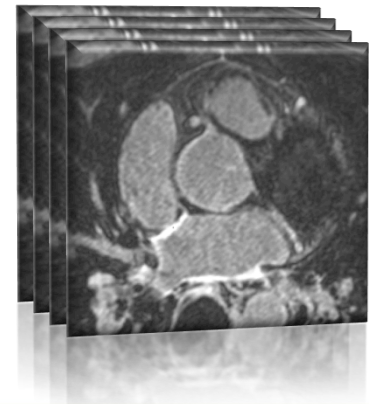
- **Slicer:** Release 4.1

<http://www.slicer.org/pages/Downloads/>



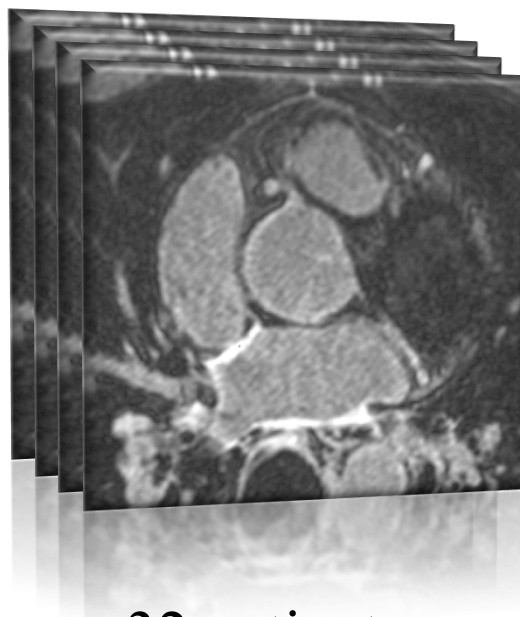
- **Data:** CARMA Left Atrial Scar

http://wiki.na-mic.org/Wiki/index.php/File:CARMA-LA-Scar_TutorialContestSummer2012.zip





Additional Sample Data



32 patients



<http://www.insight-journal.org/midas/collection/view/197>



Pre-requisite Tutorial



Surgical Planning Laboratory
Brigham and Women's Hospital
Boston, Massachusetts USA

a teaching affiliate of
Harvard Medical School

Data Loading and 3D Visualization

Sonia Pujol, Ph.D., Harvard Medical School
Director of Training, National Alliance for Medical Image Computing

<http://www.slicer.org/slicerWiki/index.php/Documentation/4.0/Training>



Platforms

Developed

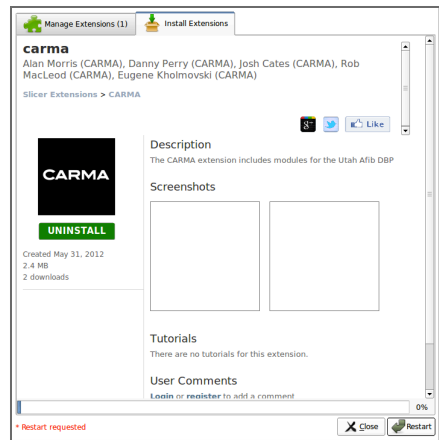


Tested

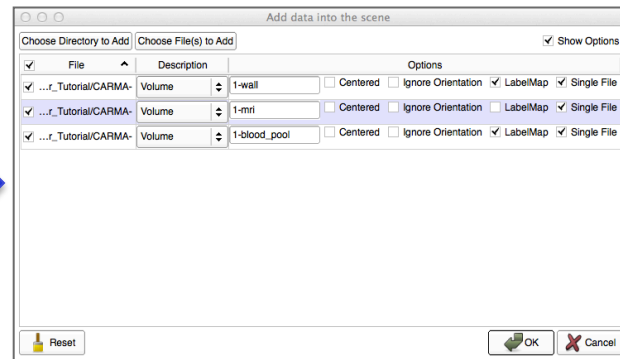




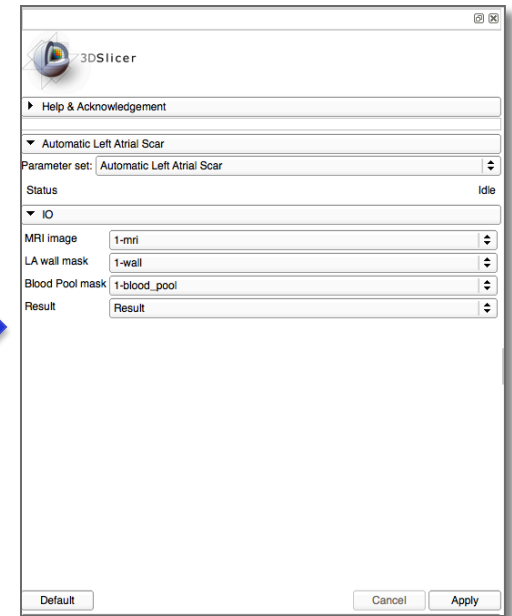
Overview



Load the
module



Load the
dataset



Automatic scar
detection



Loading the Module

Select View>Extension Manager in the menu bar (or push ⌘4)

If the Extension Manager isn't revealed, see the next 2 slides; otherwise, skip them

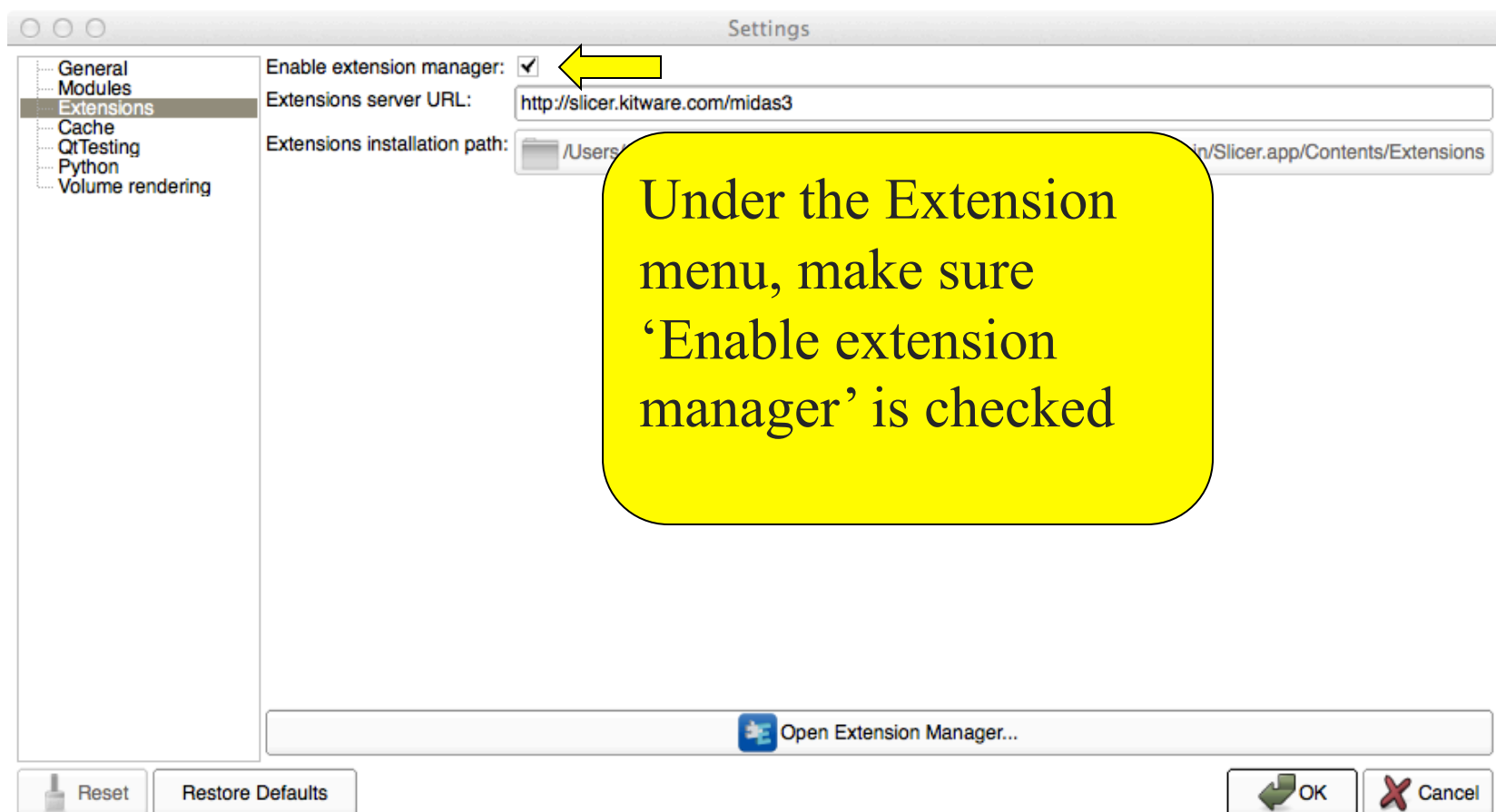


Loading the Module

To load the Extension Manager, Select
Edit>Application
Settings in the menu bar
(or push ⌘2)

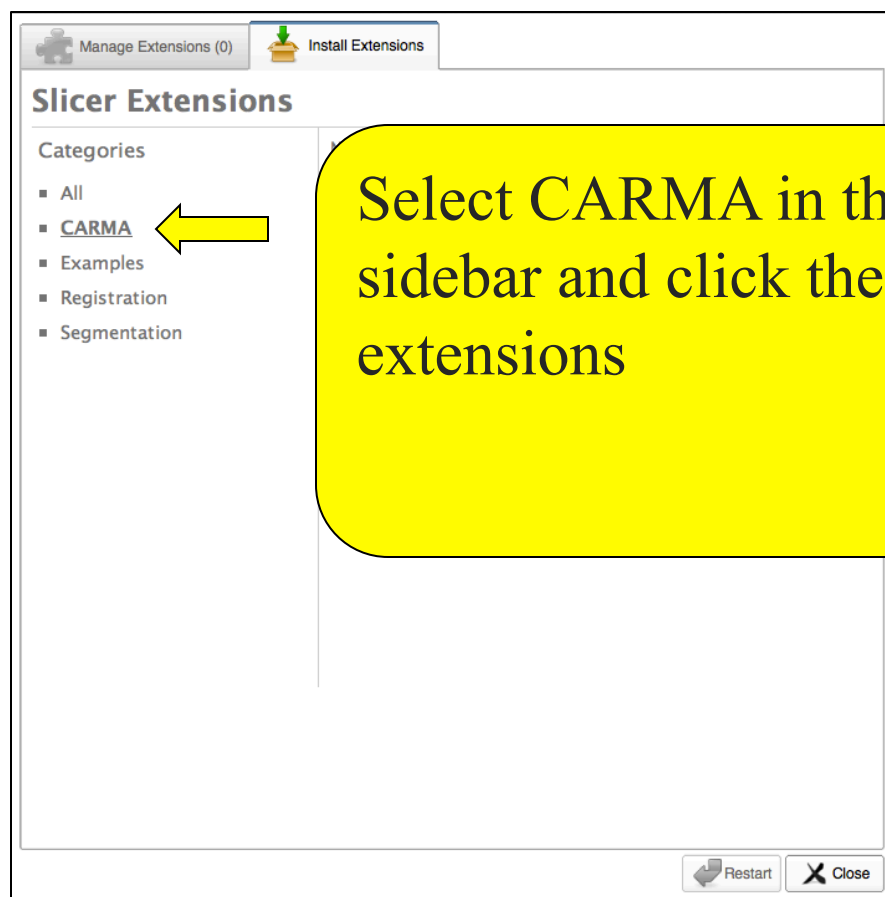


Loading the Module





Loading the Module



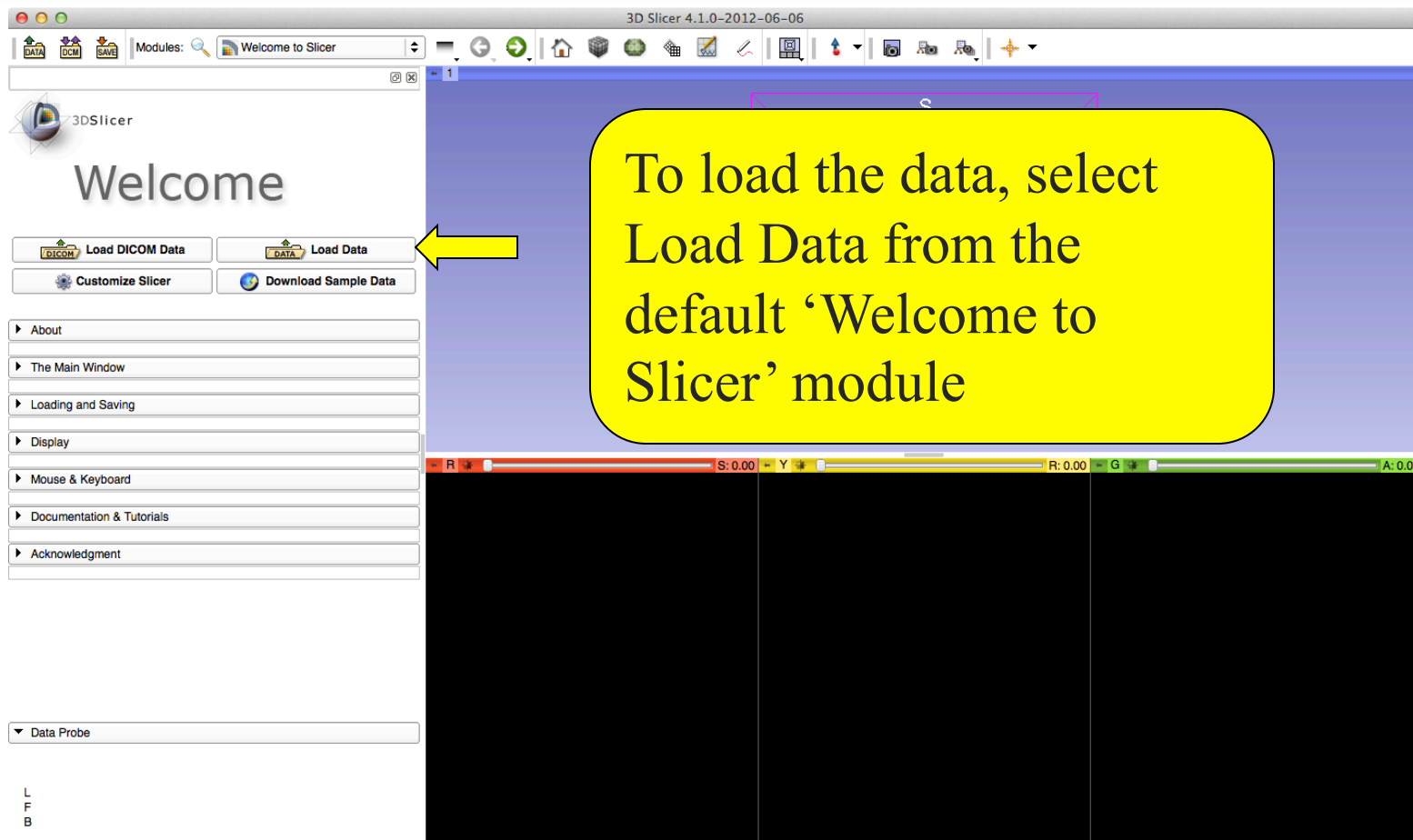


Loading the Module

The screenshot shows the Slicer Extensions interface for the 'carma' extension. The window title is 'Manage Extensions (1) Install Extensions'. The extension name is 'carma', developed by Alan Morris (CARMA), Danny Perry (CARMA), Josh Cates (CARMA), Rob MacLeod (CARMA), and Eugene Kholmovski (CARMA). The description states: 'The CARMA extension includes modules for the Utah Afib DBP'. A yellow callout box with the text 'Restart to install the extension' is overlaid on the page. A yellow arrow points to the 'Restart' button at the bottom right of the window. The 'Restart' button is located next to a 'Close' button. A red asterisk and the text '* Restart requested' are visible at the bottom left of the window.

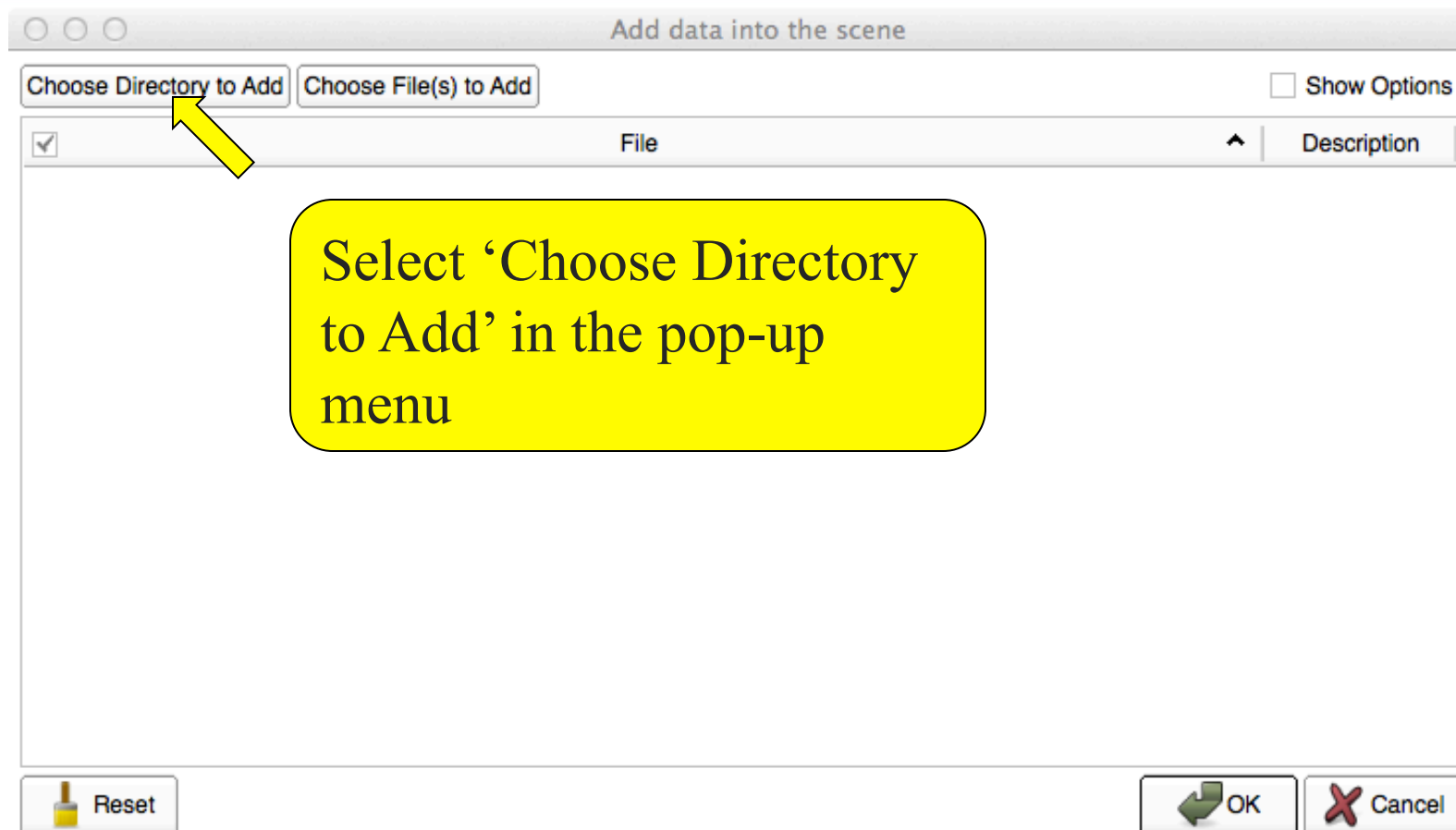


Loading the Data



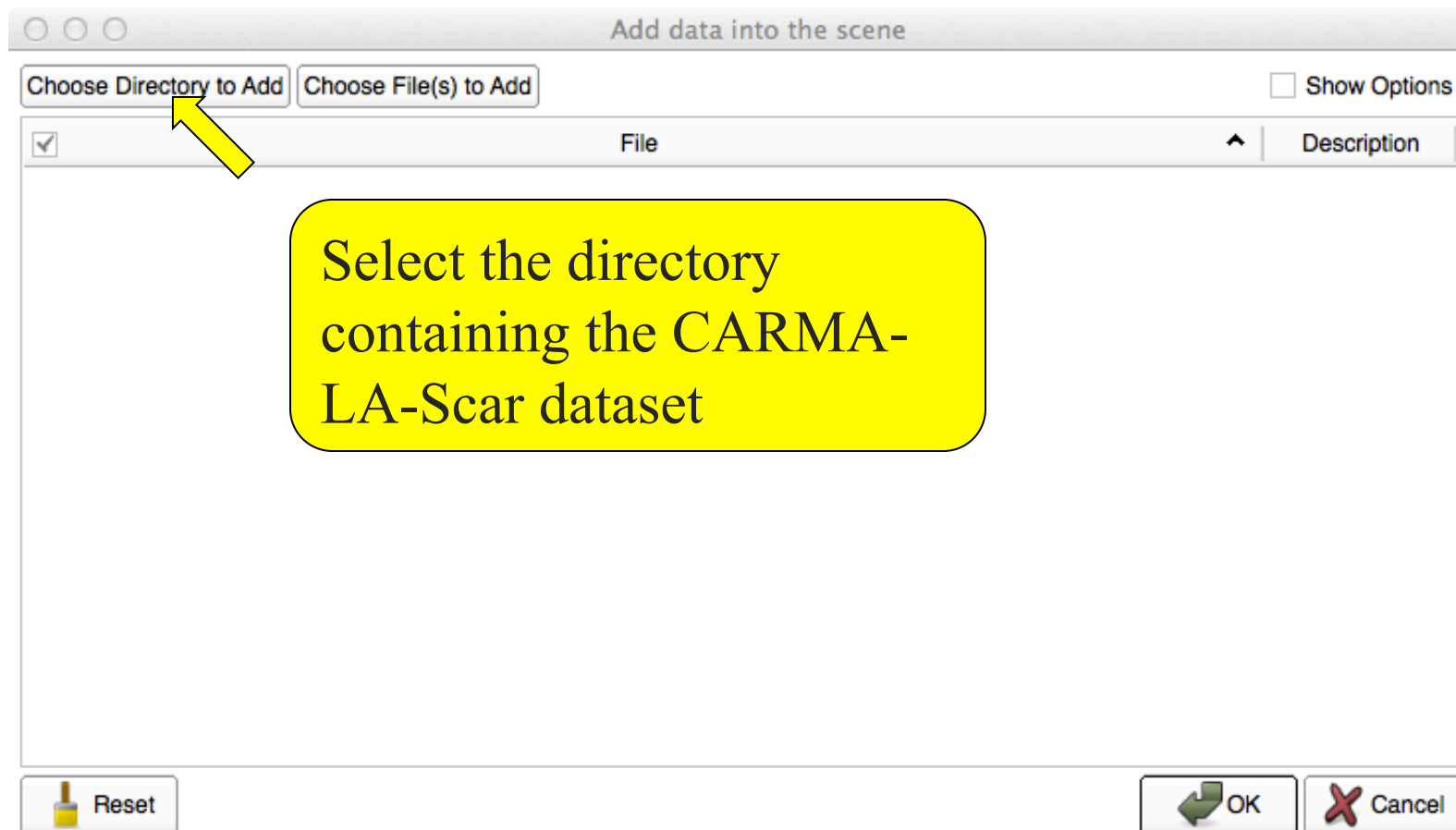


Loading the Data





Loading the Data





Loading the Data

Add data into the scene

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

<input checked="" type="checkbox"/>	File	Description
<input checked="" type="checkbox"/>	/Users/Greg/Desktop/Scar_Tutorial/CARMA-LA-Scar_TutorialContestSummer2012 2/1/1-wall.nrrd	Volume
<input checked="" type="checkbox"/>	/Users/Greg/Desktop/Scar_Tutorial/CARMA-LA-Scar_TutorialContestSummer2012 2/1/1-mri.nrrd	Volume
<input checked="" type="checkbox"/>	/Users/Greg/Desktop/Scar_Tutorial/CARMA-LA-Scar_TutorialContestSummer2012 2/1/1-blood_pool.nrrd	Volume

Make sure all 3 volumes are selected and click 'Show Options'

Reset OK Cancel



Loading the Data

Add data into the scene

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

<input checked="" type="checkbox"/>	File	Description		Options
<input checked="" type="checkbox"/>	...r_Tutorial/CARMA-	Volume	1-wall	<input type="checkbox"/> Centered <input type="checkbox"/> Ignore Orientation <input checked="" type="checkbox"/> LabelMap <input checked="" type="checkbox"/> Single File
<input checked="" type="checkbox"/>	...r_Tutorial/CARMA-	Volume	1-mri	<input type="checkbox"/> Centered <input type="checkbox"/> Ignore Orientation <input type="checkbox"/> LabelMap <input checked="" type="checkbox"/> Single File
<input checked="" type="checkbox"/>	...r_Tutorial/CARMA-	Volume	1-blood_pool	<input type="checkbox"/> Centered <input type="checkbox"/> Ignore Orientation <input checked="" type="checkbox"/> LabelMap <input checked="" type="checkbox"/> Single File

Designate the wall and blood pool volumes as label masks, then push 'OK'

Reset



Adjusting the Viewer

Expose the viewer options, and select the button to link the viewers

File->Load Scene:
This load command selected from Slicer's File Menu will close the current scene, pop up a File Browser, and load data from the MRML scene file you select.

File->Import Scene:
This load command selected from Slicer's File Menu will pop up a File Browser, and add all data referenced in the MRML scene file you select into the current scene.

File->Add Volume:
This command allows the loading of individual volumes or use of Slicer's DICOM browser.

File->Download Sample Data:
This command provides an option to download a variety of anonymized datasets for learning and testing in Slicer. Because the datasets are hosted in a remote repository, a network connection is required to access them.

L
F
B



Adjusting the Viewer

3D Slicer 4.1.0-2012-06-06

Welcome to Slicer

3DSlicer

Welcome

Load DICOM Data Load Data

Customize Slicer Download Sample Data

About

The Main Window

Loading and Saving


MRML: The Medical Reality Markup Language (MRML) scene file is an XML-based text file that references all data loaded into Slicer, and records its display and processing parameterization. Loading a MRML scene file will also load its referenced data and display it in the manner it was saved.

Loading Scene

Data Probe

L
F
B

S: 0.00 Y R: 0.00 G A: 0.00

Click the  icon and select 'Red slice only' from the drop-down menu

- Conventional
- Conventional Widescreen
- Conventional Quantitative
- Four-Up
- Four-Up Quantitative
- Dual 3D
- Triple 3D
- 3D Only
- Red slice only**
- Yellow slice only
- Green slice only
- Tabbed 3D
- Tabbed slice
- Compare
- Compare Widescreen
- Compare Grid
- Three over three
- Four over four
- Two over Two

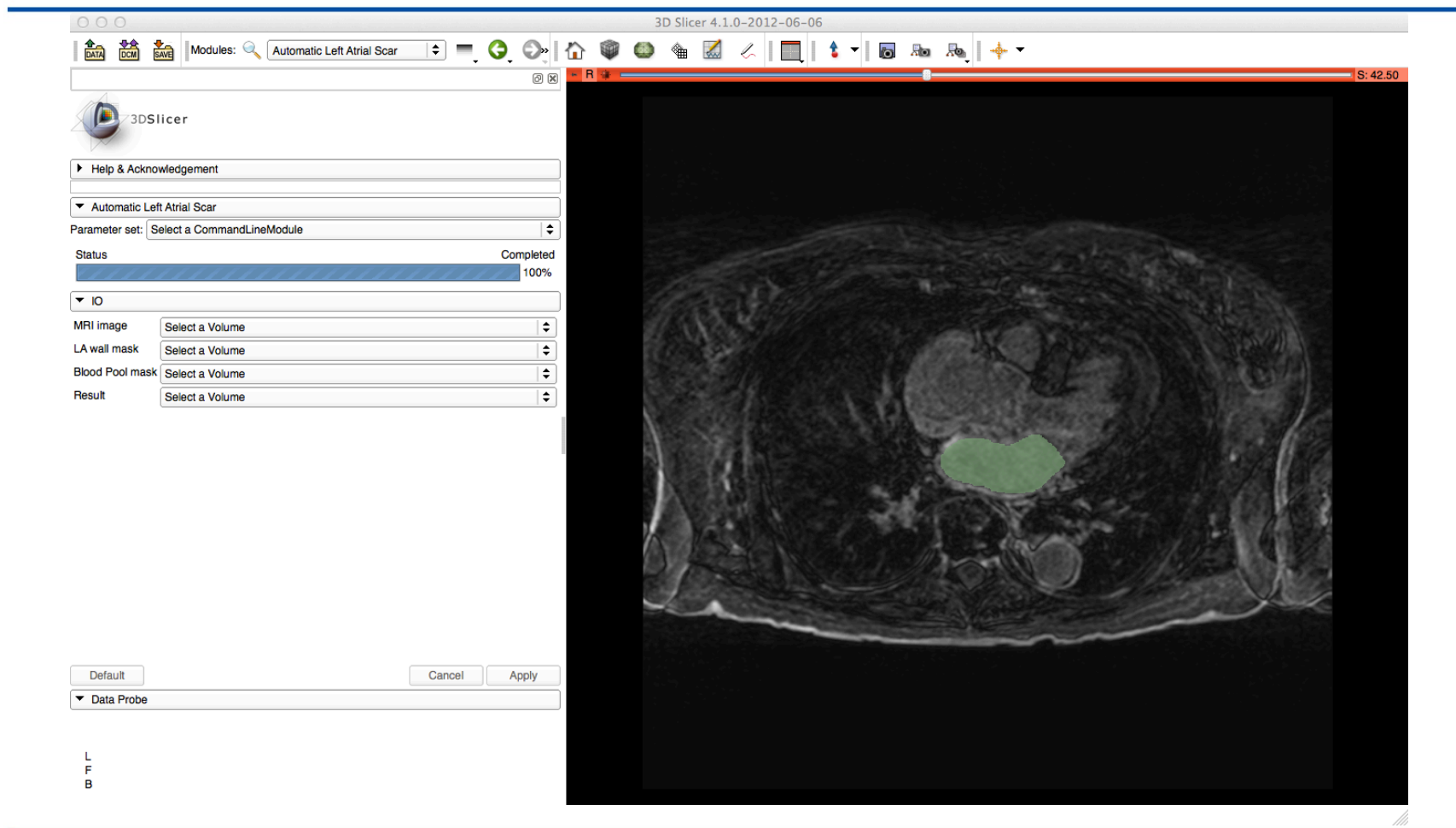


Automatic Scar Detection

Under the modules menu, select CARMA>Automatic Left Atrial Scar



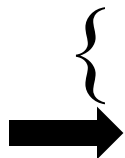
Automatic Scar Detection





Automatic Scar Detection

Input volumes
Output volume



3DSlicer

▶ Help & Acknowledgement

▼ Automatic Left Atrial Scar

Parameter set: Automatic Left Atrial Scar

Status Idle

▼ IO

MRI image 1-mri

LA wall mask 1-wall

Blood Pool mask 1-blood_pool

Result Result

Default Cancel Apply

← Parameter Sets



Automatic Scar Detection

3D Slicer 4.1.0-2012-06-06

Modules: Automatic Left Atrial Scar

3DSlicer

Help & Acknowledgement

Automatic Left Atrial Scar

Parameter set: Select a CommandLineModule

Status Completed 100%

IO

MRI image 1-wall

LA wall mask 1-mri

Blood Pool mask 1-blood_pool

Result Rename current Volume
Delete current Volume

Default Cancel Apply

Data Probe

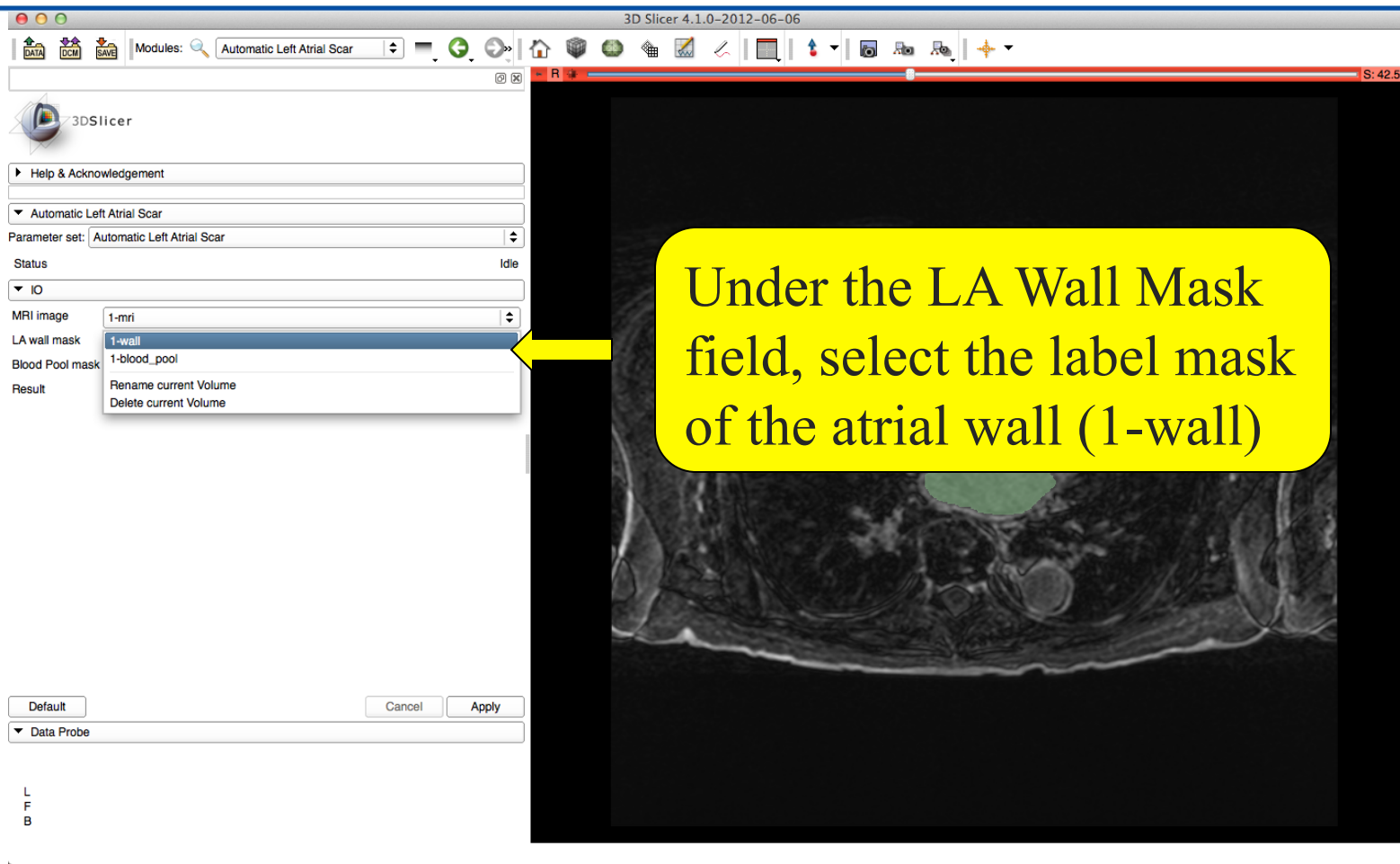
L
F
B

S: 42.50

Under the MRI Image field, select the MRI image stack (1-mri)

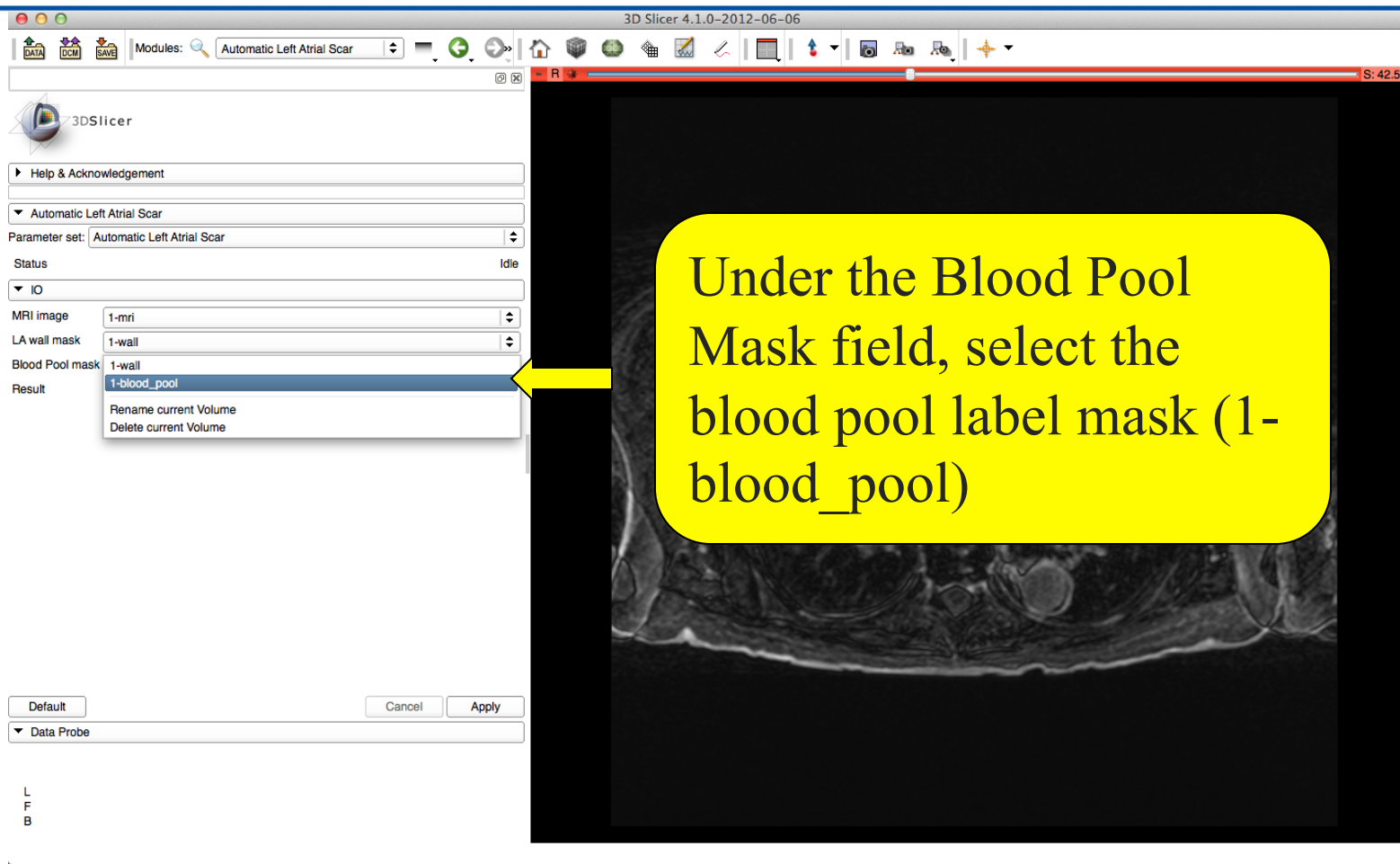


Automatic Scar Detection





Automatic Scar Detection





Automatic Scar Detection

3D Slicer 4.1.0-2012-06-06

Modules: Automatic Left Atrial Scar

3DSlicer

Help & Acknowledgement

Automatic Left Atrial Scar

Parameter set: Automatic Left Atrial Scar

Status: Idle

IO

MRI image: 1-mri

LA wall mask: 1-wall

Blood Pool mask: 1-blood_pool

Result: 1-wall, 1-blood_pool

Rename current Volume

Create new Volume

Create and rename new Volume

Delete current Volume

Default Cancel Apply

Data Probe

L
F
B

S: 42.50

Under the Result field, select 'Create New Volume,' which will be named Result



Automatic Scar Detection

3D Slicer 4.1.0-2012-06-06

Modules: Automatic Left Atrial Scar

3DSlicer

- Help & Acknowledgement
- Automatic Left Atrial Scar
 - Parameter set: Automatic Left Atrial Scar
 - Status: Idle
 - IO
 - MRI image: 1-mri
 - LA wall mask: 1-wall
 - Blood Pool mask: 1-blood_pool
 - Result: Result

Default Cancel Apply

Data Probe

L
F
B

S: 42.50

Lastly, apply the settings



Automatic Scar Detection

3D Slicer 4.1.0-2012-06-06

Modules: Automatic Left Atrial Scar

3DSlicer

Help & Acknowledgement

Automatic Left Atrial Scar

Parameter set: Automatic Left Atrial Scar

Status Running

IO

MRI image: 1-mri

LA wall mask: 1-wall

Blood Pool mask: 1-blood_pool

Result: Result

Default Cancel Apply

Data Probe

L
F
B

S: 42.50

Wait bar indicates the process in running



Automatic Scar Detection

3D Slicer 4.1.0-2012-06-06

Modules: Automatic Left Atrial Scar

3DSlicer

Help & Acknowledgement

Automatic Left Atrial Scar

Parameter set: Automatic Left Atrial Scar

Status Completed 100%

IO

MRI image 1-mri

LA wall mask 1-wall

Blood Pool mask 1-blood_pool

Result Result

Default Cancel Apply

Data Probe

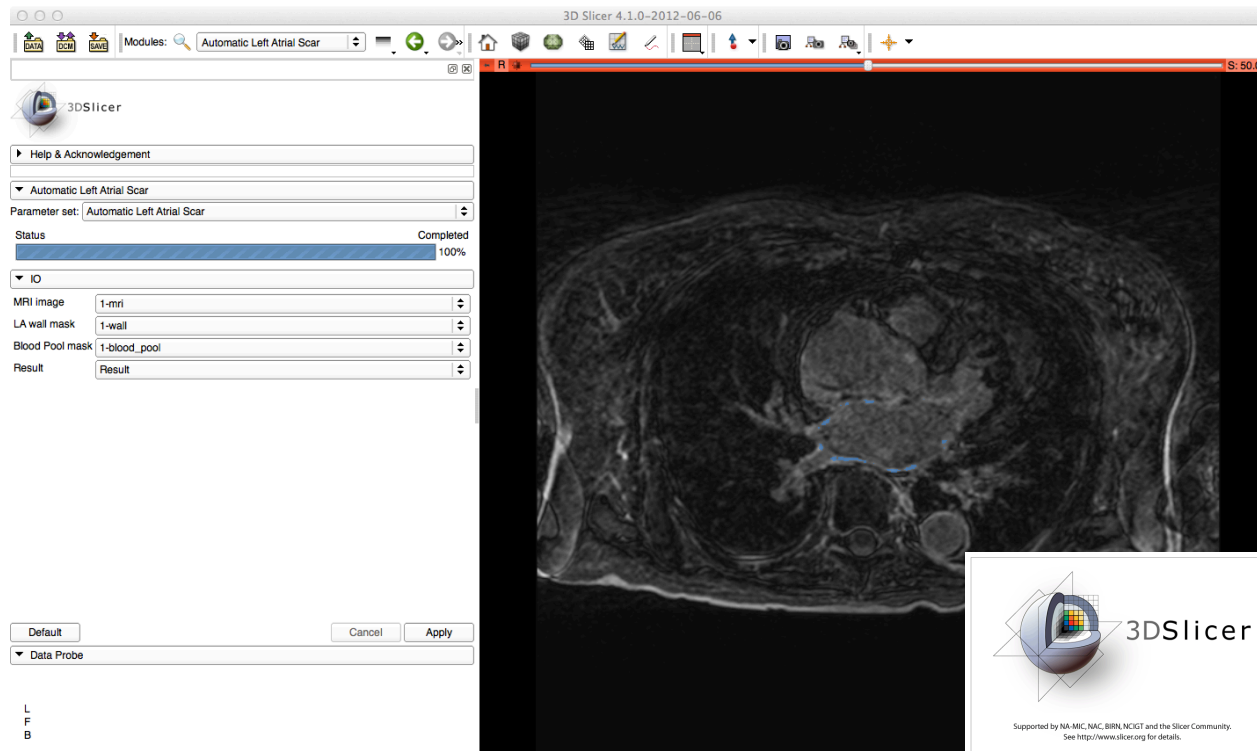
L
F
B

S: 50.00

Viewer automatically updates to show the resulting label mask



Conclusion



Student can use the module to automatically detect LA scar in Slicer 4.1



Acknowledgments



National Alliance for Medical Image Computing
NIH U54EB005149

