



NA-MIC

National Alliance for Medical Image Computing

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

Hello CLI: contributing an algorithm into Slicer 4

Nadya Shusharina, Greg Sharp
Massachusetts General Hospital
nshusharina@partners.org

NA-MIC Tutorial Contest: Summer 2013



Learning Objective

This step by step tutorial leads you through developing command line interface (CLI) for Slicer 4 (<http://www.slicer.org>)

- Getting ready
- Building a template module
- Building module for image thresholding



Pre-requisite

- Slicer is an open-source software for segmentation, registration and visualization of medical imaging data
- The platform is developed through a multi-institution effort of several NIH funded large-scale consortia
- Slicer is for medical research only, and is not FDA approved
- For the general information and “How to” tutorials please visit <http://www.slicer.org/slicerWiki/index.php/Documentation/Nightly/Training>

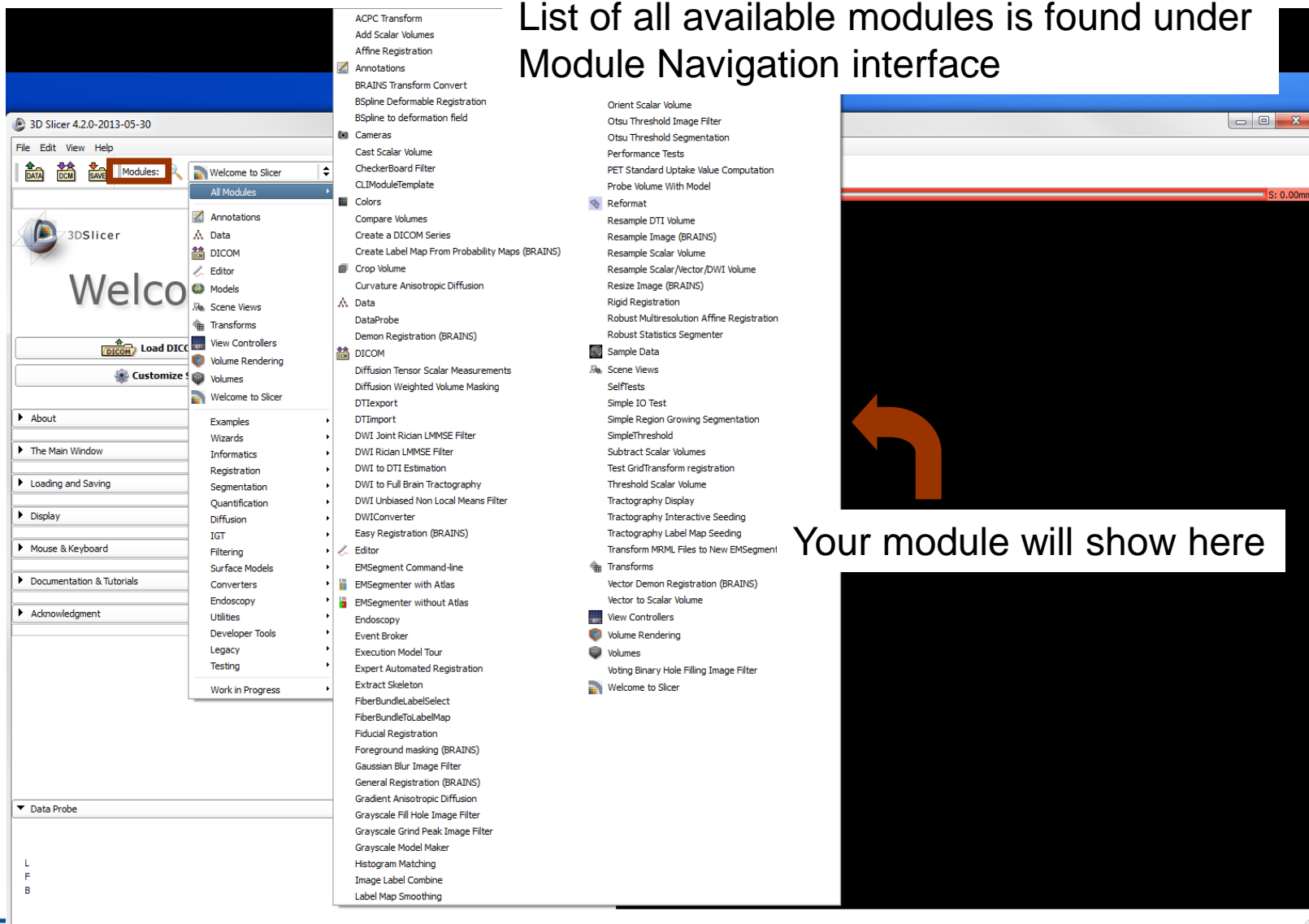


Material

- We recommend to build Slicer 4 from source
- Refer to the following page:
http://www.slicer.org/slicerWiki/index.php/Documentation/Nightly/Developers/Build_Instructions
- Read prerequisites and platform specific instructions and install all required tools
- Checkout Slicer source
- Configure and build
- Become Slicer community member:
<http://www.slicer.org/slicerWiki/index.php/Documentation/Nightly/Developers/StartHere>

Run Slicer: *path-to-SlicerSuperbuild/Slicer-build/Slicer.exe*

List of all available modules is found under Module Navigation interface



The screenshot shows the 3D Slicer 4.2.0-2013-05-30 interface. The 'Modules' menu is open, displaying a list of available modules. The list includes:

- ACPC Transform
- Add Scalar Volumes
- Affine Registration
- Annotations
- BRAINS Transform Convert
- BSpline Deformable Registration
- BSpline to deformation field
- Cameras
- Cast Scalar Volume
- CheckerBoard Filter
- CLIModuleTemplate
- Colors
- Compare Volumes
- Create a DICOM Series
- Create Label Map From Probability Maps (BRAINS)
- Crop Volume
- Curvature Anisotropic Diffusion
- Data
- DataProbe
- Demon Registration (BRAINS)
- DICOM
- Diffusion Tensor Scalar Measurements
- Diffusion Weighted Volume Masking
- DTIexport
- DTIimport
- DWI Joint Rician LMMSE Filter
- DWI Rician LMMSE Filter
- DWI to DTI Estimation
- DWI to Full Brain Tractography
- DWI Unbiased Non Local Means Filter
- DWIConverter
- Easy Registration (BRAINS)
- Editor
- EMSegment Command-line
- EMSegmenter with Atlas
- EMSegmenter without Atlas
- Endoscopy
- Event Broker
- Execution Model Tour
- Expert Automated Registration
- Extract Skeleton
- FiberBundleLabelSelect
- FiberBundleToLabelMap
- Fiducial Registration
- Foreground masking (BRAINS)
- Gaussian Blur Image Filter
- General Registration (BRAINS)
- Gradient Anisotropic Diffusion
- Grayscale Fill Hole Image Filter
- Grayscale Grind Peak Image Filter
- Grayscale Model Maker
- Histogram Matching
- Image Label Combine
- Label Map Smoothing
- Otsu Threshold Image Filter
- Otsu Threshold Segmentation
- Performance Tests
- PET Standard Uptake Value Computation
- Probe Volume With Model
- Reformat
- Resample DTI Volume
- Resample Image (BRAINS)
- Resample Scalar Volume
- Resample Scalar/Vector/DWI Volume
- Resize Image (BRAINS)
- Rigid Registration
- Robust Multiresolution Affine Registration
- Robust Statistics Segmenter
- Sample Data
- Scene Views
- SelfTests
- Simple IO Test
- Simple Region Growing Segmentation
- SimpleThreshold
- Subtract Scalar Volumes
- Test Grid/Transform registration
- Threshold Scalar Volume
- Tractography Display
- Tractography Interactive Seeding
- Tractography Label Map Seeding
- Transform MRML Files to New EMSegment
- Transforms
- Vector Demon Registration (BRAINS)
- Vector to Scalar Volume
- View Controllers
- Volume Rendering
- Volumes
- Voting Binary Hole Filling Image Filter
- Welcome to Slicer

Your module will show here



CLI module

- Standalone executables, shared libraries or scripts
- Introduced via plugin mechanism
- XML description produces UI
- Command line parsing code
- Link: http://www.na-mic.org/Wiki/index.php/File:Slicer4_CLI.ppt



Creating module: Step 1

- Make sure that any version of Python is installed on your computer
- From Slicer source directory run the command:
`./Utilities/Scripts/ModuleWizard.py --template
./Extensions/Testing/CLIExtensionTemplate --target
../My_Module My_Module`
- This command created a new directory “My_Module” parallel to Slicer source directory



Build extension: Windows

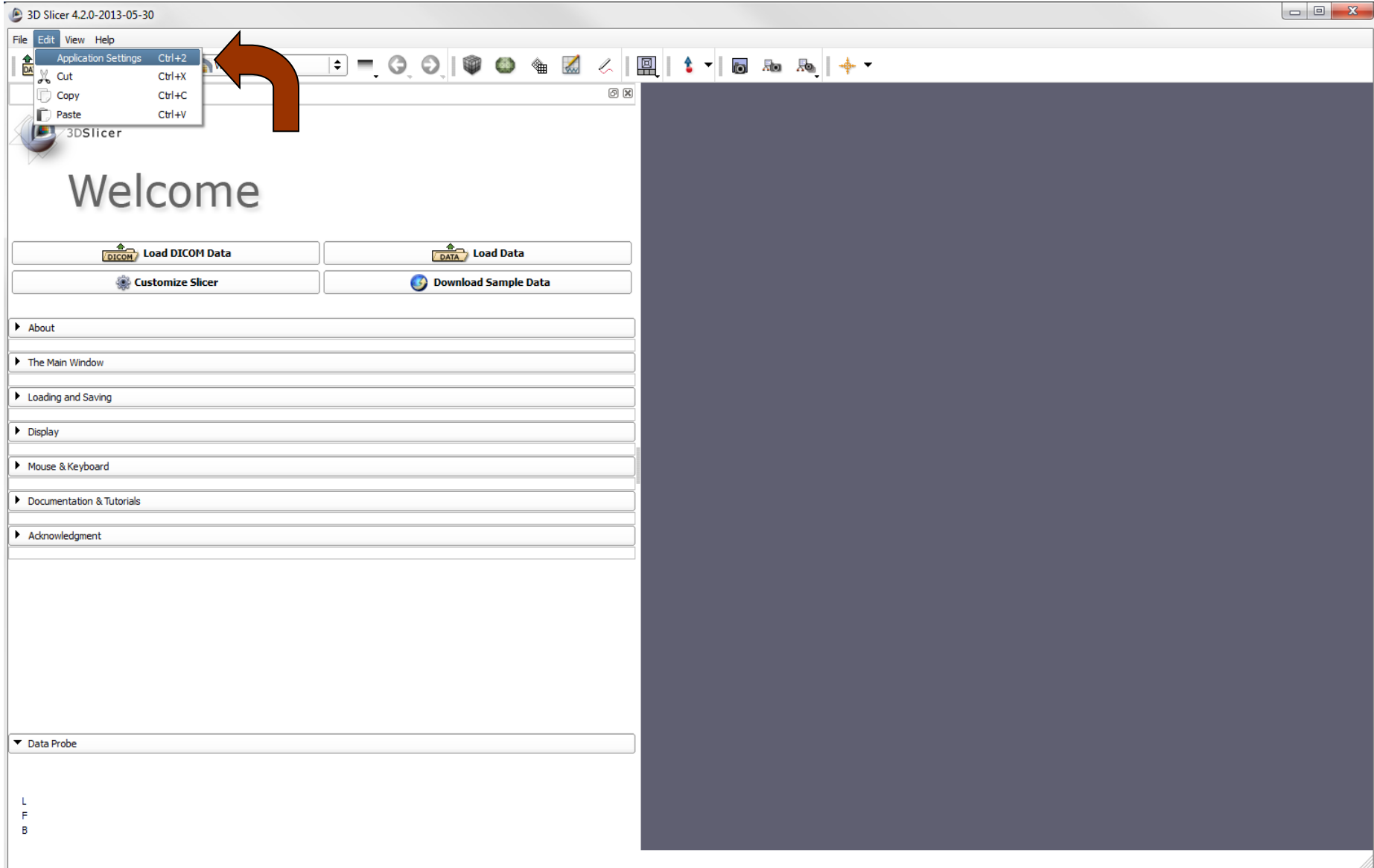
- Run cmake
- Set Slicer_DIR to path-to-Slicer-Superbuid/Slicer-build
- Set *../My_Module* as a source directory
- Choose a build directory
- Use default settings
- Compile using VC

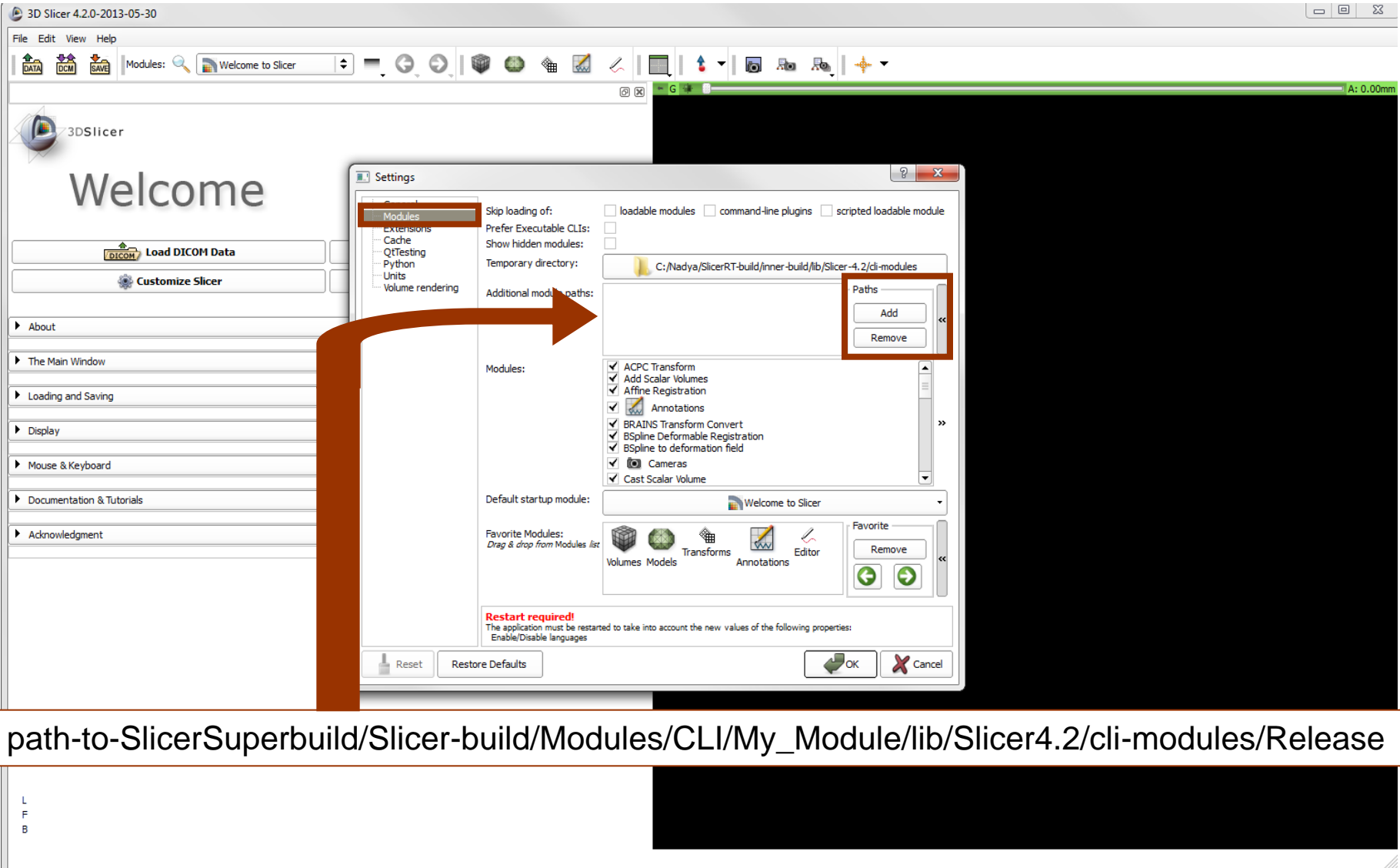


Build extension: Linux

- `$ mkdir My_Module-build`
- `$ cd MyModule-build`
- `$ cmake -DSlicer_DIR:PATH=/path-to-Slicer-Superbuild/Slicer-build ../My_Module`
- `$ make`

Set the path to My_Module in the Application Settings

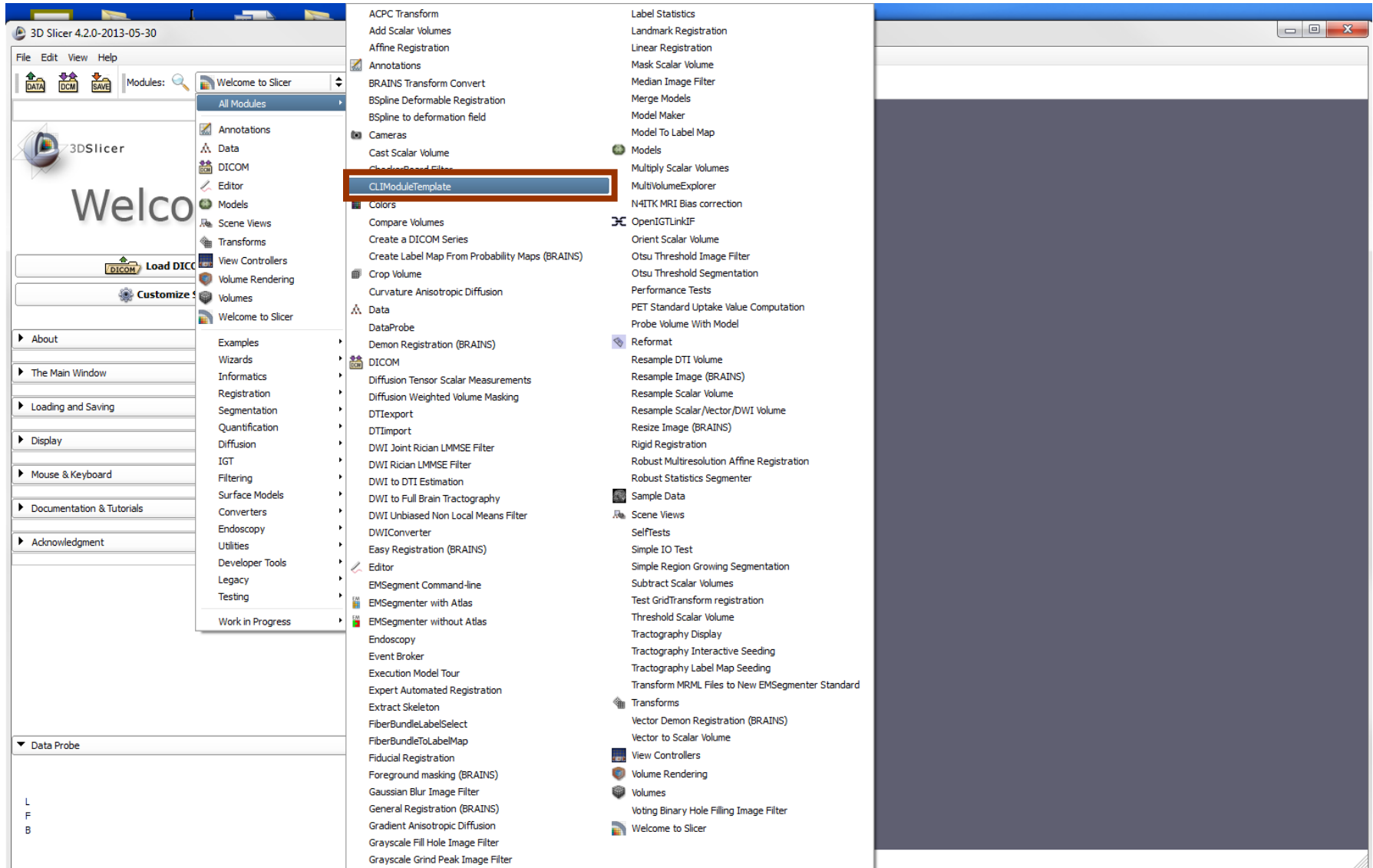




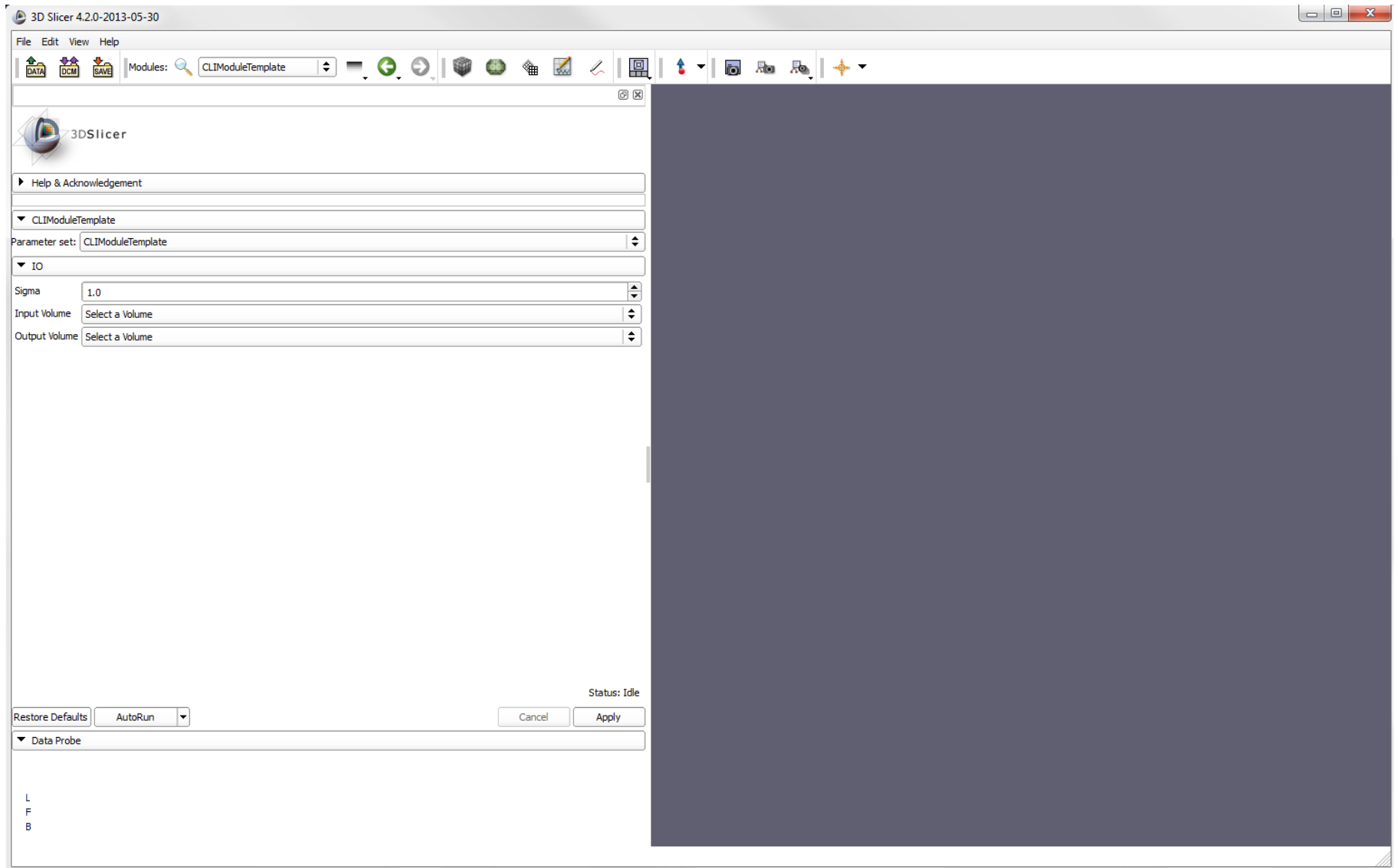
path-to-SlicerSuperbuild/Slicer-build/Modules/CLI/My_Module/lib/Slicer4.2/cli-modules/Release

Restart Slicer!

Find the module CLIModuleTemplate in the Module Navigation interface



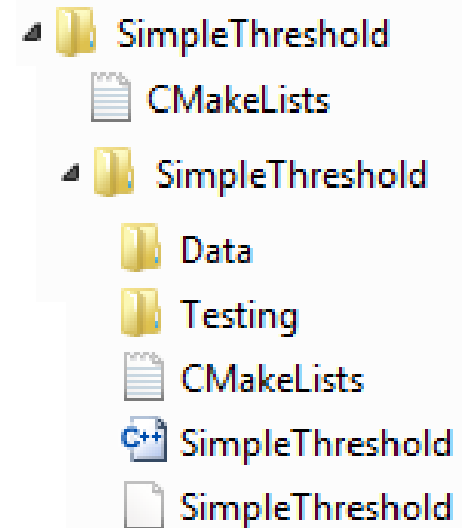
Open the module. Congratulations!





Creating module: Step 2

- Download sample data:
https://forge.abcd.harvard.edu/gf/download/frsrelease/85/2851/hello_cli.zip
- The name of directory is the name of the Module as it appears in the list of modules

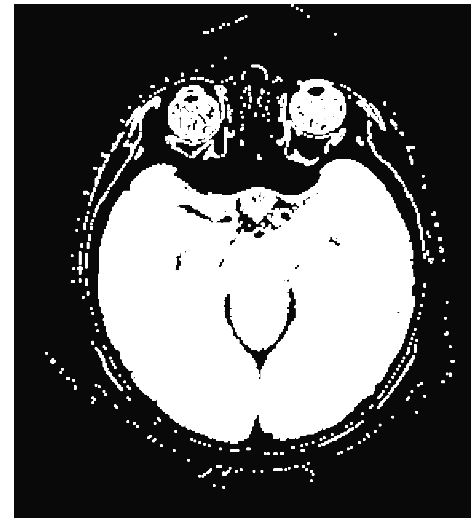
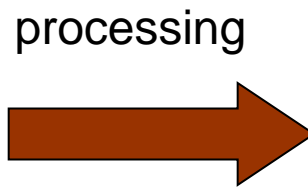




Module function



Input image



Output image



Module description

GUI

▼ IO

Input Volume	Select a Volume
Output Volume	Select a Volume

▼ ThresholdParameters

Lower Threshold	10
Upper Threshold	50

XML

```
<image>
  <name>inputVolume</name>
  <label>Input Volume</label>
  <channel>input</channel>
  <index>0</index>
  <description><![CDATA[Inputvolume]]></decription>
</image>
```



```
<integer>
  <name>lowerThreshold</name>
  <longflag>--lowerThreshold</longflag>
  <description><![CDATA[The lower threshold]]></description>
  <label>Lower Threshold</label>
  <default>10</default>
</integer>
<integer>
```




Module coding

```
typedef itk::ImageFileReader<InputImageType> ReaderType;  
typedef itk::ImageFileWriter<OutputImageType> WriterType;  
typename ReaderType::Pointer reader = ReaderType::New();  
reader->SetFileName( inputVolume.c_str() );  
itk::GetImageType(inputVolume, pixelType, componentType);
```

```
typedef itk::BinaryThresholdImageFilter<  
    InputImageType, OutputImageType> FilterType;  
typename FilterType::Pointer filter = FilterType::New();  
filter->SetLowerThreshold(lowerThreshold);
```



Compile the module

- From Slicer source directory run the command:
`./Utilities/Scripts/ModuleWizard.py --template
../SimpleThreshold --target ../SimpleThreshold
SimpleThreshold`
- Build extension (pp 9,10)
- Start Slicer
- Set the path to SimpleThreshold in the Application Settings (pp 11,12)
- Restart Slicer



Loading data

3D Slicer 4.2.0-2013-05-30

File Edit View Help

Modules: SimpleThreshold

3DSlicer

Help & Acknowledgement

SimpleThreshold

Parameter set: SimpleThreshold

IO

Input Volume: Select a Volume

Output Volume: Select a Volume

ThresholdParameters

Lower Threshold: 10

Upper Threshold: 50

Reset

OK Cancel

Click OK

Navigate to the location of ct_head.mha

3D Slicer 4.2.0-2013-05-30

File Edit View Help

Modules: SimpleThreshold

3DSlicer

Choose ct_head.mha in Input Volume and
"Create new Volume" in Output Volume

Input Volume: ct_head

Output Volume: Output Volume

ThresholdParameters

Lower Threshold: 10

Upper Threshold: 50

Click Apply

Restore Defaults AutoRun

Status: Idle

Cancel Apply

Data Probe

L
F
B



Saving data

In "Save" menu choose volume and format to save

Click Save

File Name	File Format	Directory
<input checked="" type="checkbox"/> 2013-06-11-Scene.mrml	MRML Scene (.mrml)	C:/cygwin/home/Nadya
<input type="checkbox"/> ct_head.mha	MetaImage (.mha)	F:/Work/CT_for_noise
<input checked="" type="checkbox"/> Output Volume.nrrd	NRRD (.nrrd)	C:/cygwin/home/Nadya



Contact information

If you have questions please contact Greg Sharp at

E-mail: gsharp@partners.org

Tel: (617) 724 3866



Acknowledgments



National Alliance for Medical Image Computing

NIH U54EB005149



National Institutes of Health

NIH / NCI 6-PO1 CA 21239

Federal share of program income earned by MGH on C06CA059267



Progetto Rocca Foundation

A collaboration between MIT and Politecnico di Milano