



MASSACHUSETTS
GENERAL HOSPITAL

RADIATION ONCOLOGY



*National
Alliance for
Medical Image
Computing*

3D Slicer for Medical Physics Research

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Massachusetts General Hospital

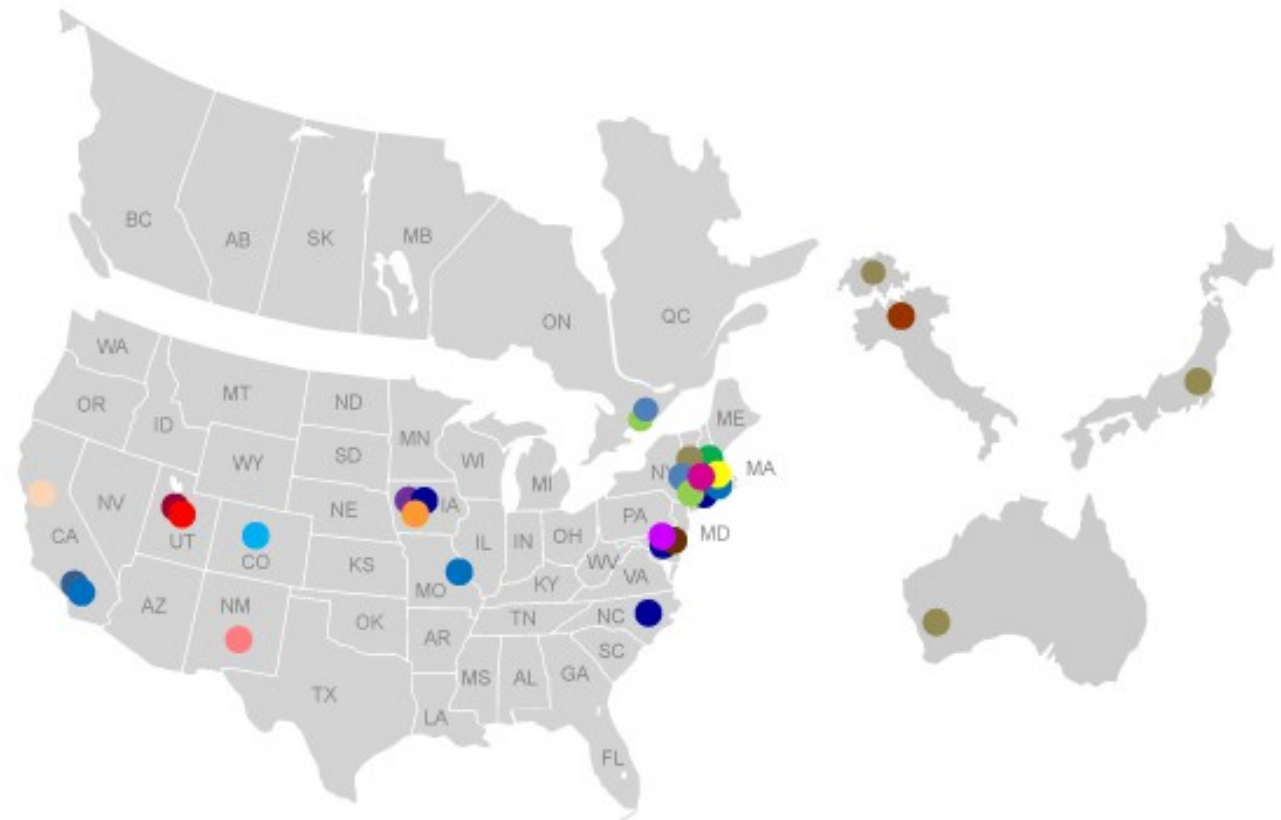
AAPM/COMP Annual Meeting 2011

Thanks to NIH: 2-U54EB005149

Acknowledgments



- Autism
- Brain Cancer
- Depression
- Head and Neck Cancer
- Huntington's Disease
- Lupus
- Schizophrenia
- Traumatic Brain Injury
- VCFS
- Neuroimage Analysis
- Lung Disease
- Atrial Fibrillation
- Cardiovascular Disease
- Liver Cancer
- Colon Cancer
- Prostate Cancer
- Orthopedic Injury
- Neuromuscular Dynamics
- Image Informatics



Active

- | | | | | | | | |
|--------------------------------|----------------------|-------------------|---------------|---------------|---------------|---------------|--------------------|
| ● R01MH084795 | ● U41RR019703 | ● NSF CCF-0916526 | ● R01EB008171 | ● U01HL089897 | ● R01CA124377 | ● R01CA131718 | ● R01CA11128 |
| ● R01EB005973 | ● U54EB005149-05S2 | ● U54GM072970 | ● P41RR013218 | ● R01EB006733 | ● R01NS050568 | ● R21EB009900 | ● U54EB005149-05S3 |
| ● UL1RR025758 | ● U54LM008748 | ● U24RR025736 | ● U24RR021992 | ● U24RR021382 | ● U24RR026057 | ● AIST, Japan | ● UWA, Australia |
| ● Mario Negri Institute, Italy | ● CO-ME, Switzerland | ● OCAIRO, Canada | | | | | |

Completed

- U54EB005149-04S1

Disclaimer

“The Software has been designed for research purposes only and has not been reviewed or approved by the Food and Drug Administration or by any other agency”

Open Community Process

Open development

- Mailing lists
- Documentation
- Source code control
- Bug reporting



Open working meetings called *project weeks*

January in Salt Lake City, June in Boston

Open Source Software

BSD-style license

No protected IP

Software can move with scientists

Coexist with proprietary software

Cross-platform: Windows, Linux, OSX

Basic visualization

Window/level

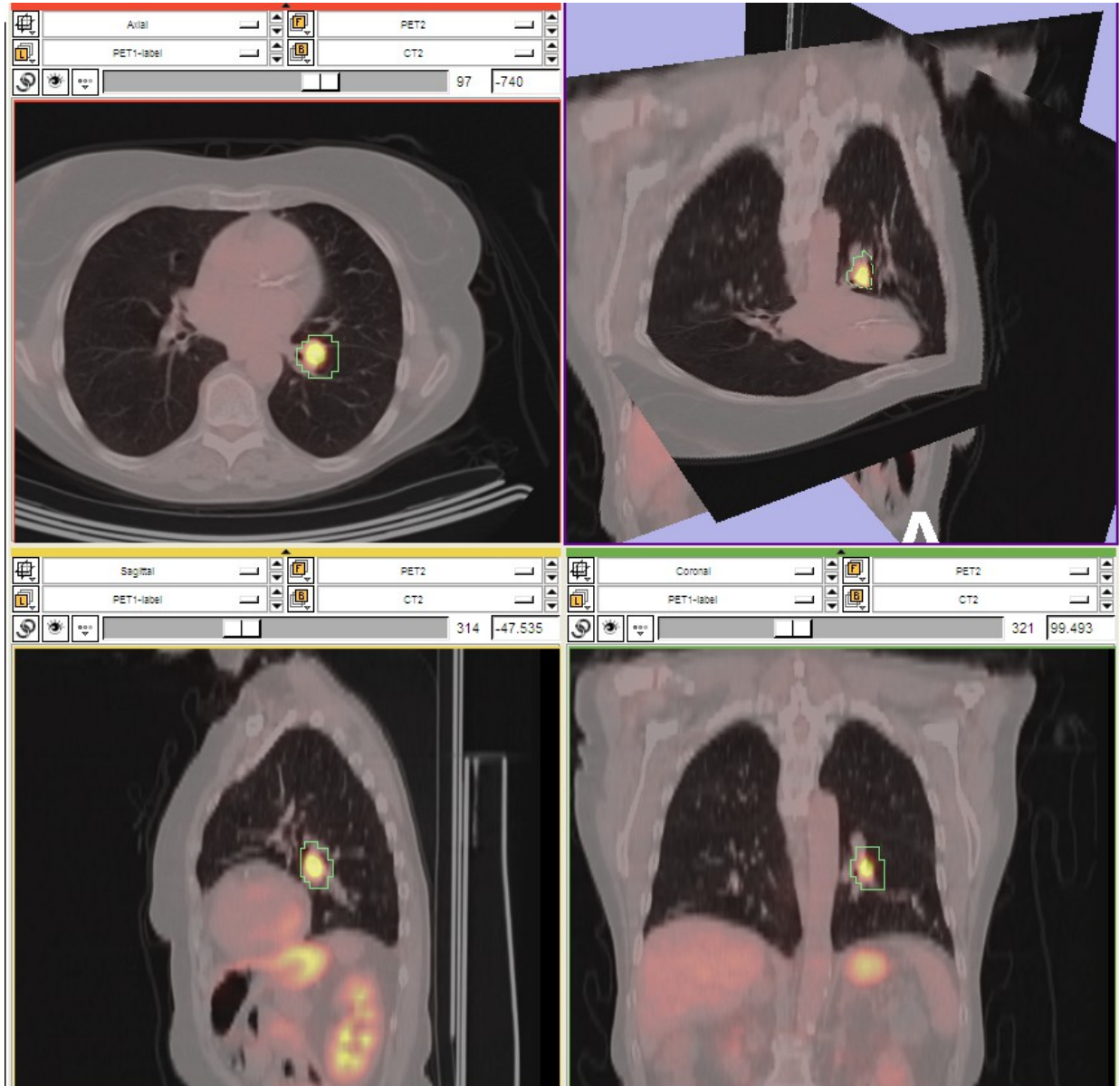
Pseudo-color

Mosaic

Multi-modal fusion

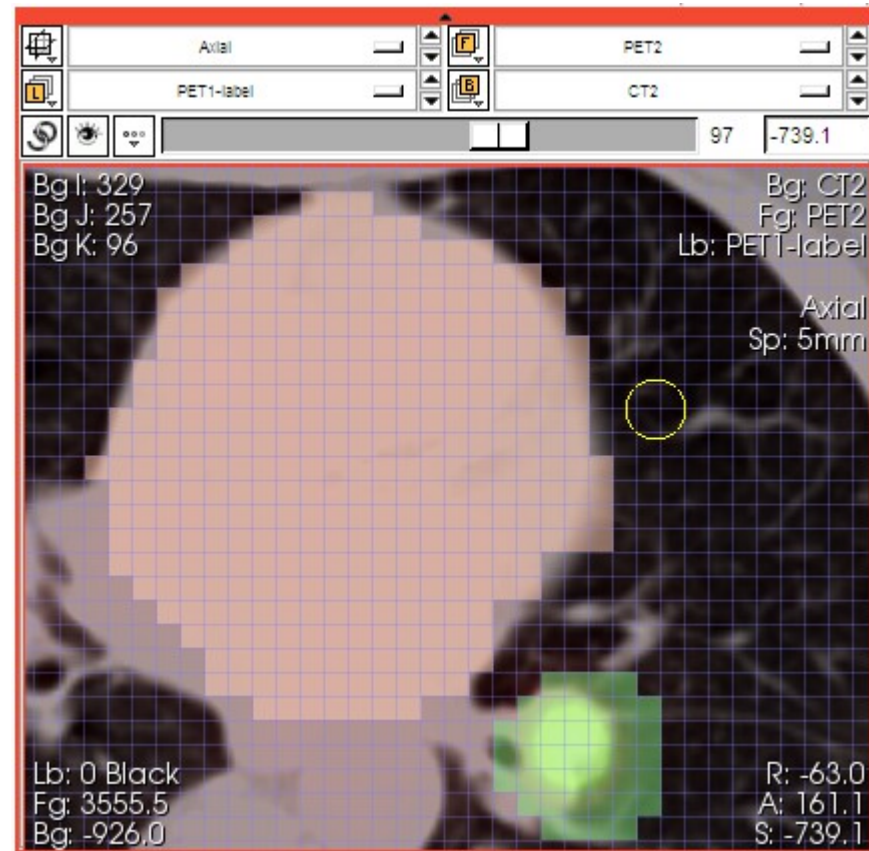
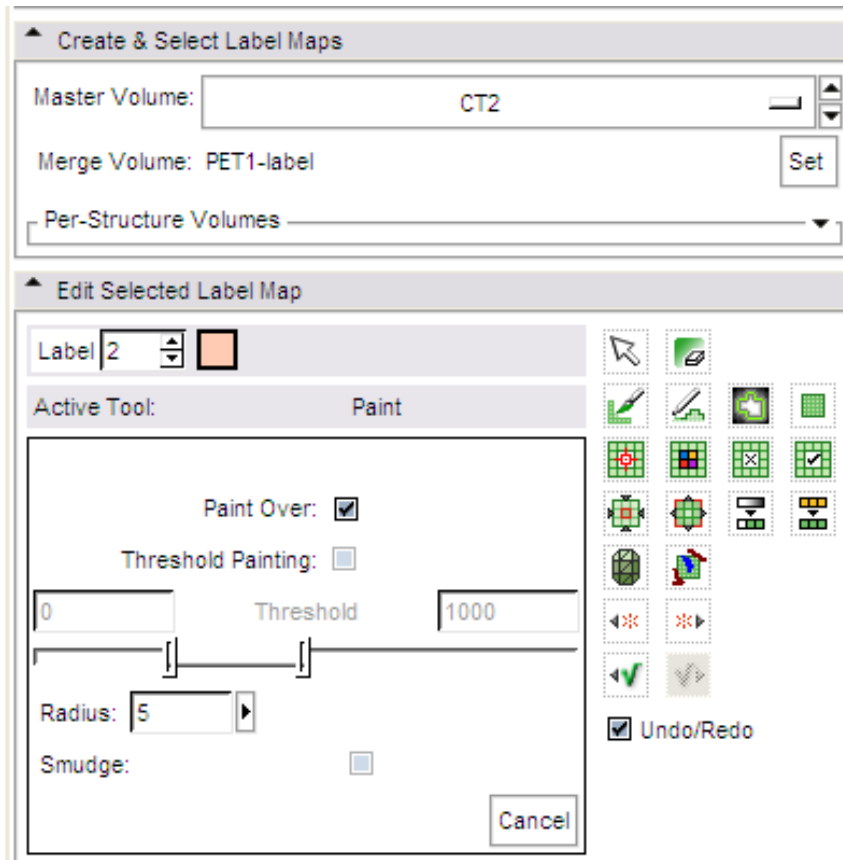
2 images

+ 1 labelmap



Interactive editor

Paint, draw, threshold, morphological operations, ...



3D visualization

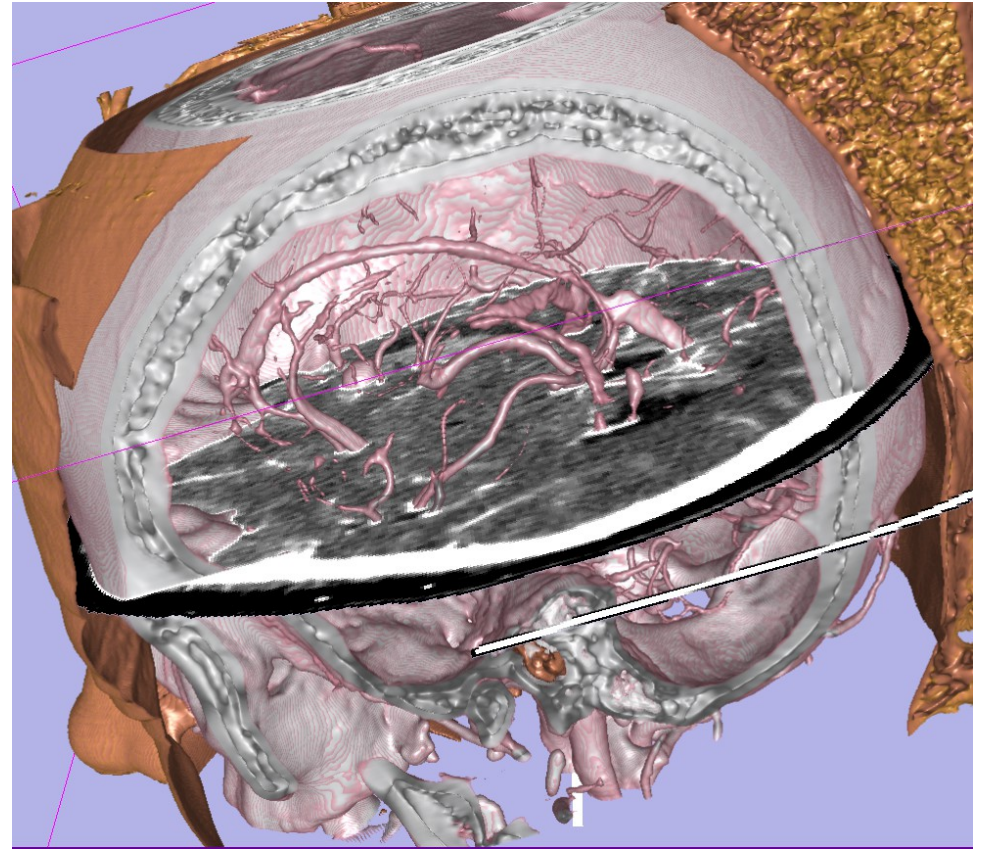
Ray casting

- Color and opacity transfer functions
- Composite displays

Shaded surfaces

- Pseudo-color
- Shaded lighting

Maximum intensity projection



Interactive registration

Transform Node: vtkMRMLLinearTransformNode4

1.000000	0.000000	0.000000	8.400000
0.000000	1.000000	0.000000	-19.600000
0.000000	0.000000	1.000000	-342.800000
0.000000	0.000000	0.000000	1.000000

Translation

LR

PA

IS

Min Translation Limit

Max Translation Limit

Rotation

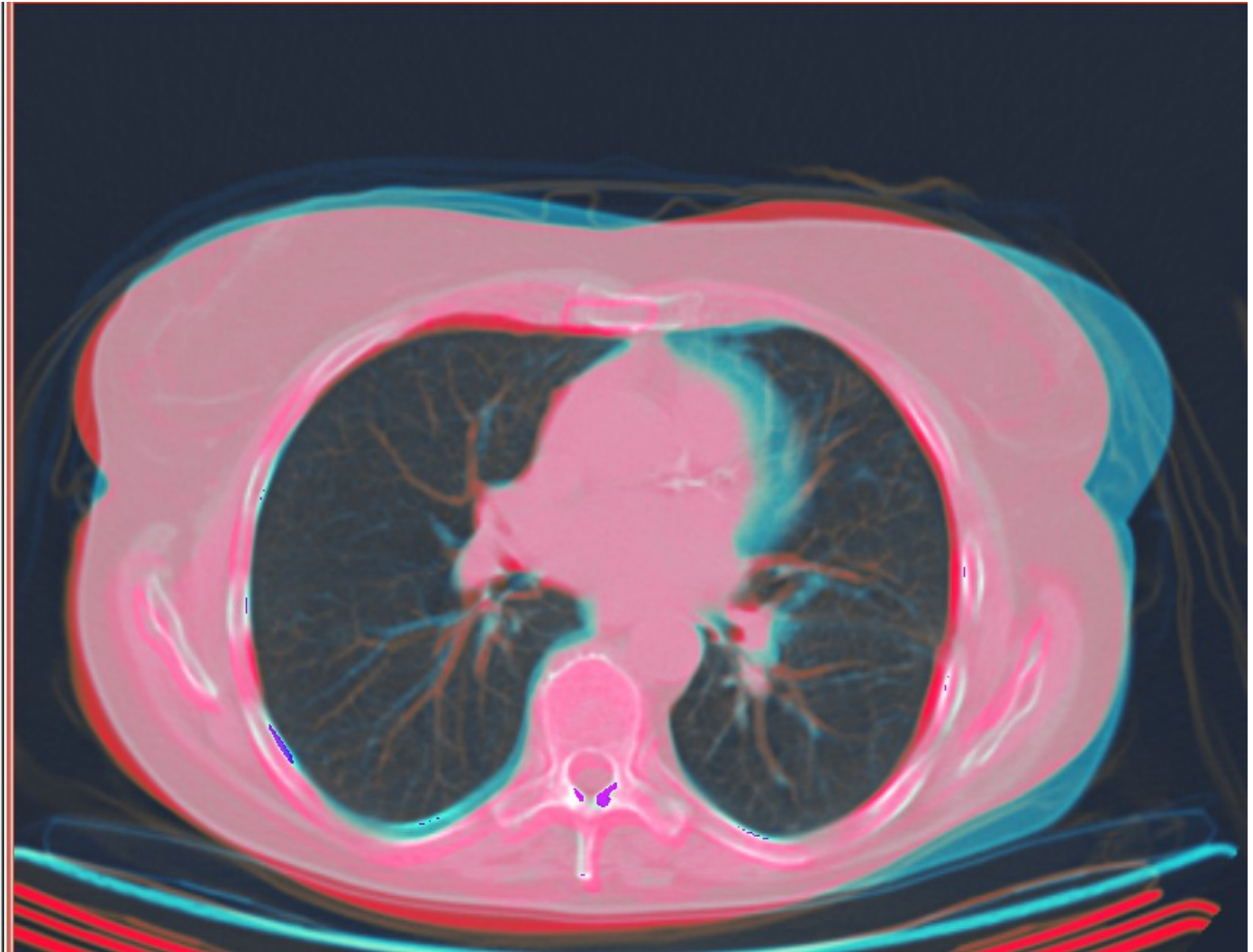
LR

PA

IS

Coordinate Reference

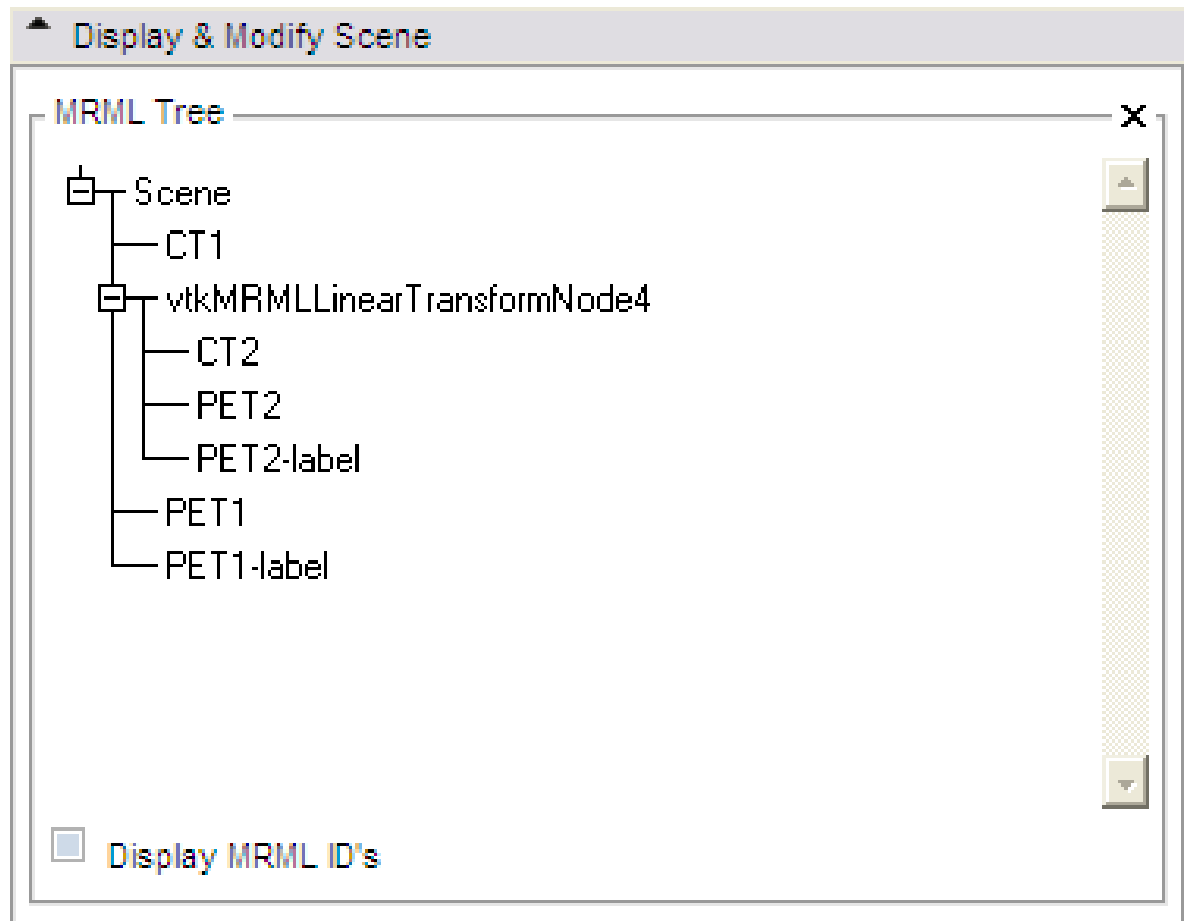
Manipulate Slice Views



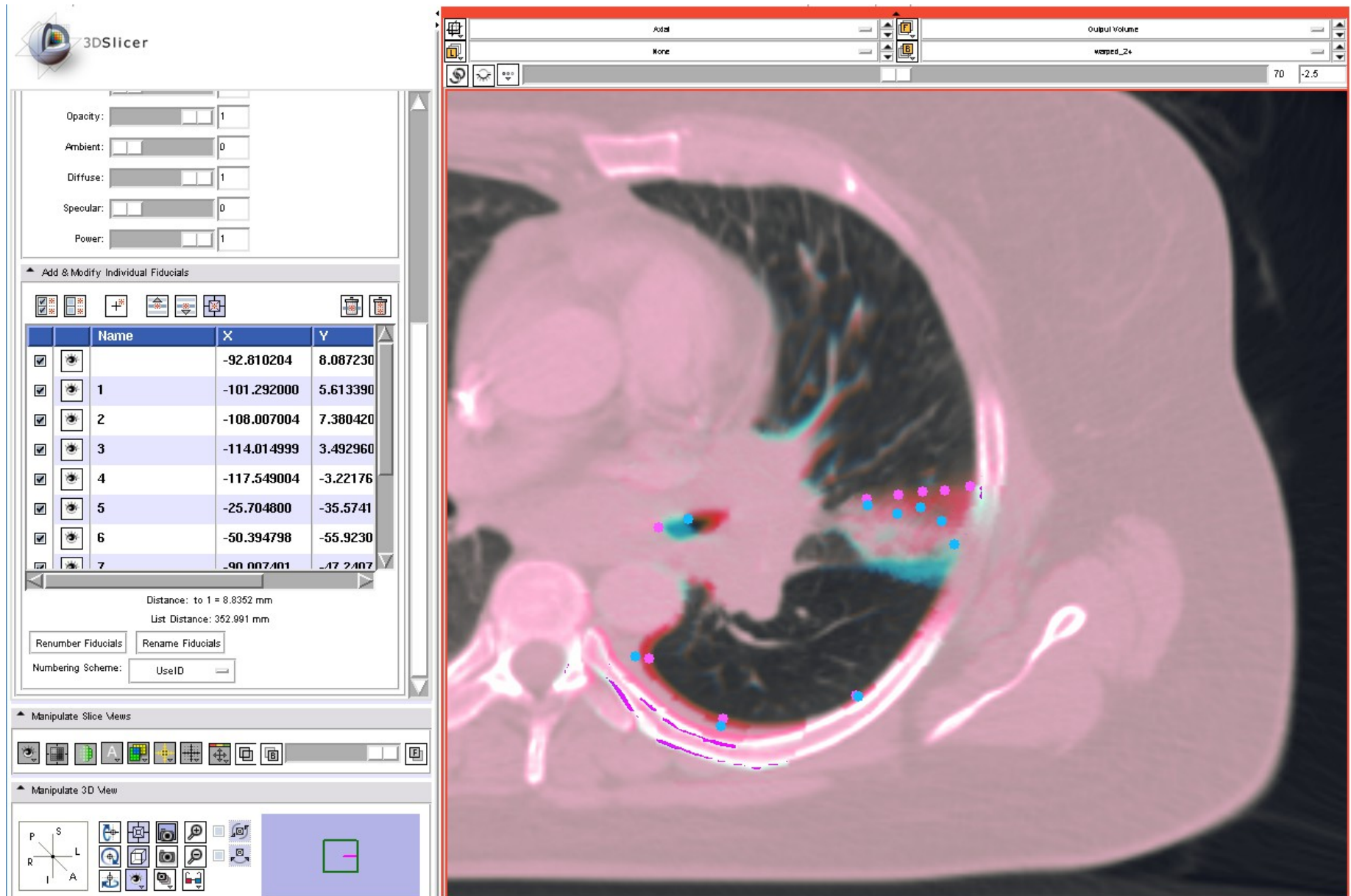
MRML tree

Data items are stored in the MRML tree

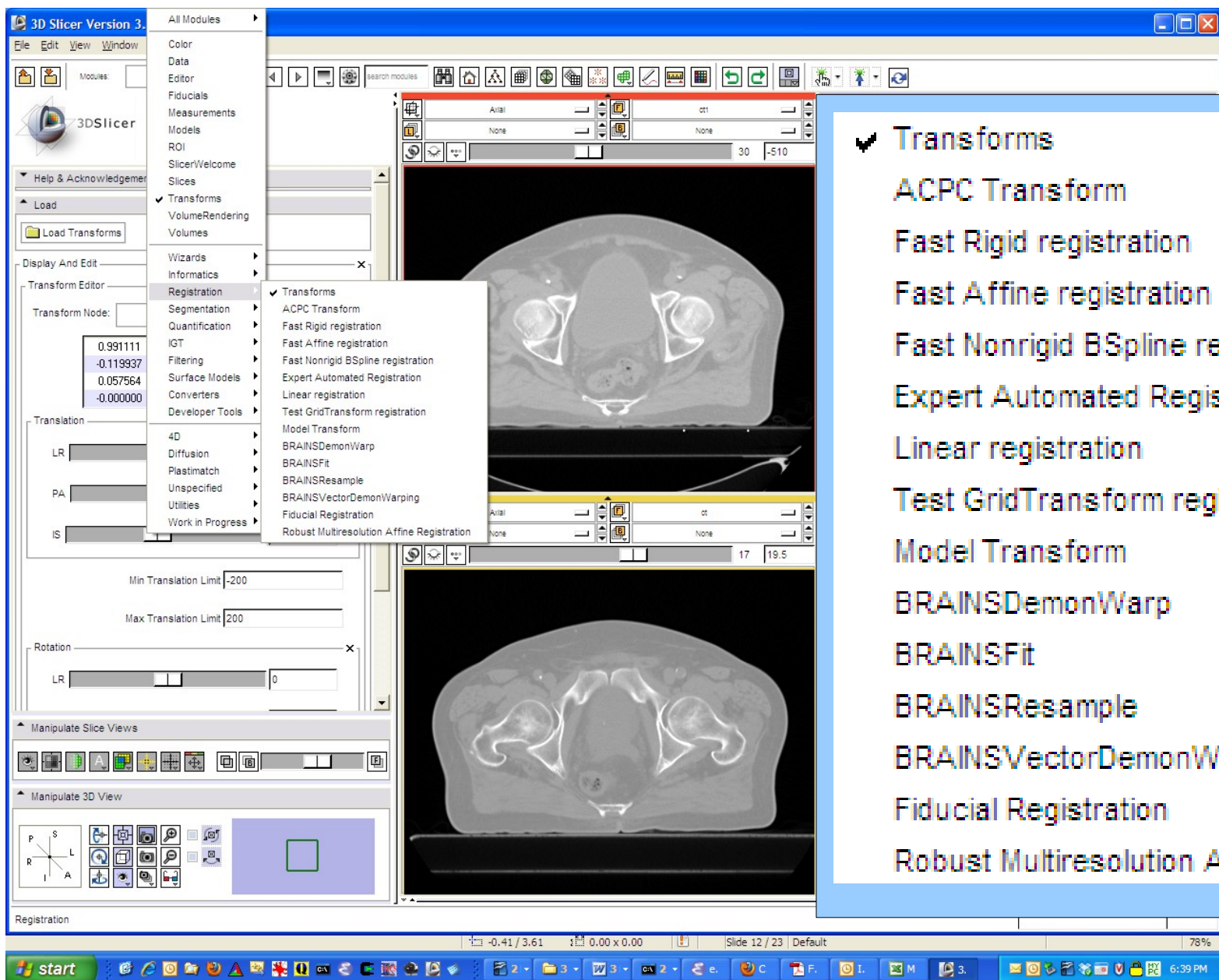
- Images
- Transforms
- Models



Interactive deformable registration



Automatic registration



✓ Transforms

ACPC Transform

Fast Rigid registration

Fast Affine registration

Fast Nonrigid BSpline registration

Expert Automated Registration

Linear registration

Test GridTransform registration

Model Transform

BRAINSDemonWarp

BRAINSFit

BRAINSResample

BRAINSVectorDemonWarping

Fiducial Registration

Robust Multiresolution Affine Registration

Automatic registration

	How to get?	Algorithm	Metric
“Expert Automated”	Included	B-spline	SSD, NCC, MI
BRAINS	Included	B-spline, demons	MI, demons
Plastimatch	Extension	B-spline	SSD, MI
Hammer	Extension	Feature-based	Block matching
CMTK	Separate download	B-spline	SSD, MI, others

Slicer extensions

3D Slicer Version 3.6.3 1.0

Extension Management Wizard

Select extensions, then click uninstall to remove them from your version of 3D Slicer, or click download to retrieve them.

Select	Status	Name	Category	Description	HomePage	Binary URL
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ABC				http://ext.slicer.org/ext/Slicer-3-6/16156-win32/ABC-svn58-2011-06-07-win32.zi
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ARCTIC	Cortical Thickness	ARCTIC is an e		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/ARCTIC-svn42-2011-06-07-win3
<input type="checkbox"/>	<input checked="" type="checkbox"/>	EMFiberClusteringModule	Tractography	An EM approa		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/EMFiberClusteringModule-svn11
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ExampleCommandLine				http://ext.slicer.org/ext/Slicer-3-6/16156-win32/ExampleCommandLine-svn36-20
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ExampleLoadableGuiLessModule	Examples	An example of		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/ExampleLoadableGuiLessModul
<input type="checkbox"/>	<input checked="" type="checkbox"/>	ExampleLoadableModule	Examples	An example of		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/ExampleLoadableModule-svn36
<input type="checkbox"/>	<input checked="" type="checkbox"/>	HammerRegistration	Work in Progress	HammerRegist		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/HammerRegistration-svn183-201
<input type="checkbox"/>	<input checked="" type="checkbox"/>	LabelDiameterEstimation	Statistics			http://ext.slicer.org/ext/Slicer-3-6/16156-win32/LabelDiameterEstimation-svn754
<input type="checkbox"/>	<input checked="" type="checkbox"/>	plastimatch-slicer				http://ext.slicer.org/ext/Slicer-3-6/16156-win32/plastimatch-slicer-svn2423-2011
<input type="checkbox"/>	<input checked="" type="checkbox"/>	PythonSampleScriptedModule	Developer Tools	This is an exa		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/PythonSampleScriptedModule-s
<input type="checkbox"/>	<input checked="" type="checkbox"/>	TclSampleScriptedModule	Developer Tools	This is an exa		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/TclSampleScriptedModule-svn31
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VMTKBranchSplitting	Segmentation	Vascular bran		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VMTKBranchSplitting-svn137-20
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VMTKCenterlines	Segmentation	Centerline cor		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VMTKCenterlines-svn137-2011-4
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VMTKEasyLevelSetSegmentation	Segmentation	Easier interfac		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VMTKEasyLevelSetSegmentatic
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VMTKNetworkExtraction	Segmentation	Vascular netw		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VMTKNetworkExtraction-svn137
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VmtkSlicerModule	Library	The Vascular		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VmtkSlicerModule-svn137-2011-
<input type="checkbox"/>	<input checked="" type="checkbox"/>	VMTKVesselEnhancement	Filtering	Vessel Enhanc		http://ext.slicer.org/ext/Slicer-3-6/16156-win32/VMTKVesselEnhancement-svn1

Download and install selected extensions...

< Back Next > Finish Cancel

Registration portal

Slicer3:Registration - SlicerWiki - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.slicer.org/slicerWiki/index.php/Slicer3:Registration

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Engineering... Documentat... Slicer 3.6:Tr... slicer yuhan... Slicer3:Visu... Modules:Re... Modules:Gr... NITRC: Com... +ants defor... hammer regi... File:Dose w... Slicer... Log in

page discussion view source history

Slicer3:Registration

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- 1 Registration in 3D Slicer
- 2 Find Registration Method by Category: looking for....
- 3 Default Registration Modules
- 4 Alternative Registration Modules
- 5 Modules for Special Case Registration
- 6 Auxiliary Modules for Registration
- 7 Registration Examples / Use-Cases
- 8 Further Registration Links & Work in Progress

Registration in 3D Slicer

An extensive set of tools is available within 3D Slicer to support your registration or image fusion task. The right module will depend on your input data and the underlying question asked. Below is an overview of the main and auxiliary modules related to image registration. The spectrum ranges from fully automated to fiducial to fully interactive manual alignment, and from rigid to fully elastic image warping. Most modules are generic and can handle any image content, but a few are designed specifically for brain images. They have a brain contour in the icon.

There are also many auxiliary/support modules that perform important functions you may need to successfully complete your registration, such as the ROI or Interactive Editor modules to obtain masks, or the Resample modules to properly apply your result transform to the image.

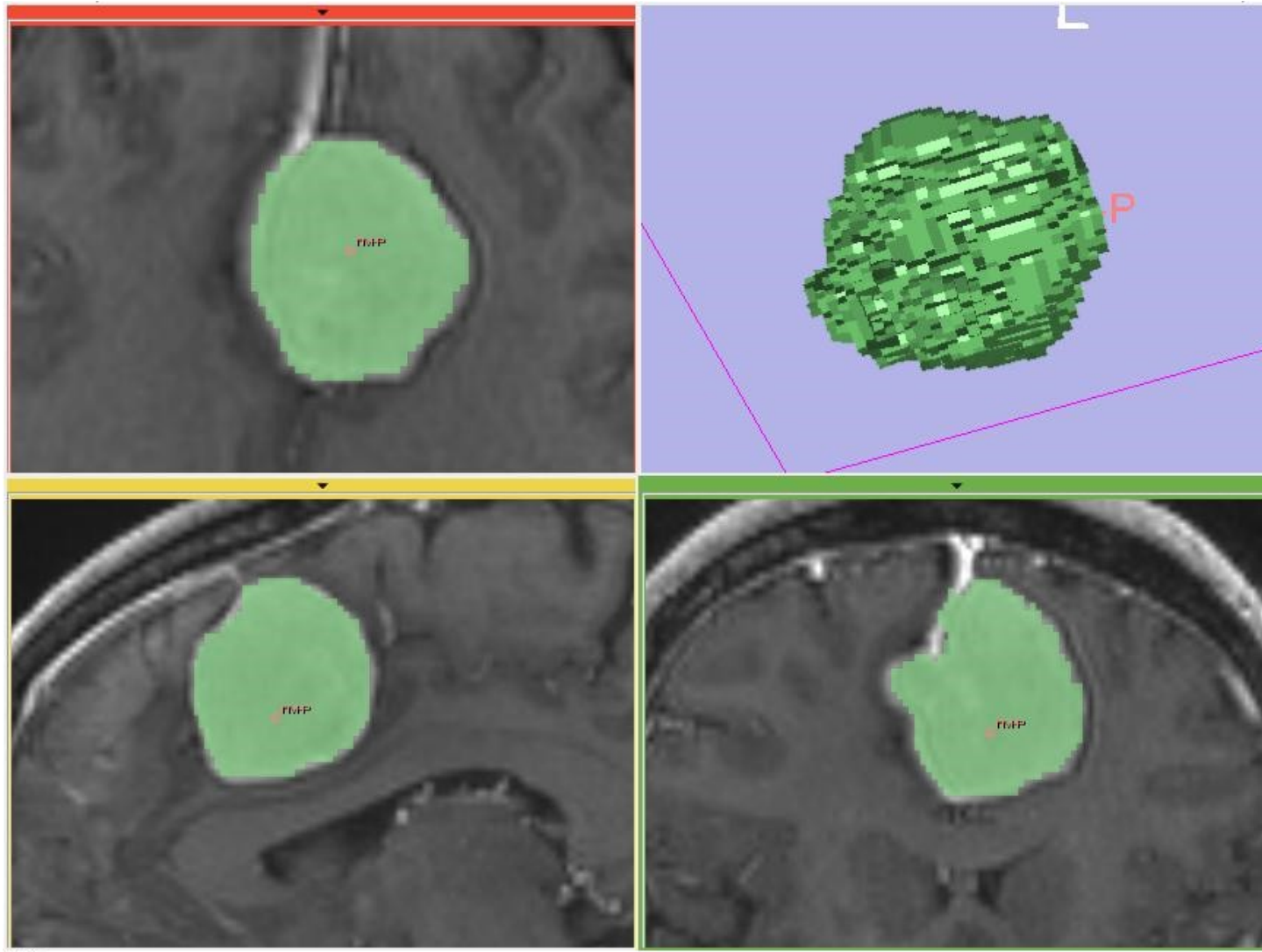
This page is organized by methods. Alternatively the [Slicer Registration Case Library](#) is organized by data type, i.e. it provides example cases, complete with tutorials, for a variety of registration problems collected in the "real world". You may find a good starting point and helpful discussion in those examples. If you find something amiss, please let us know so we can amend (meier at bwh.harvard.edu).

3DSlicer
REGISTRATION
ONLINE CASE SUPPORT
2010-2011

Consider adding your case to the library: We can (for 2010-2011) offer you direct consulting on your image registration problem: If we can add your (anonymized) case to the Library, we will try to register it for you, build a step-by-step tutorial and send you the registration strategy and solution parameters. See here for details

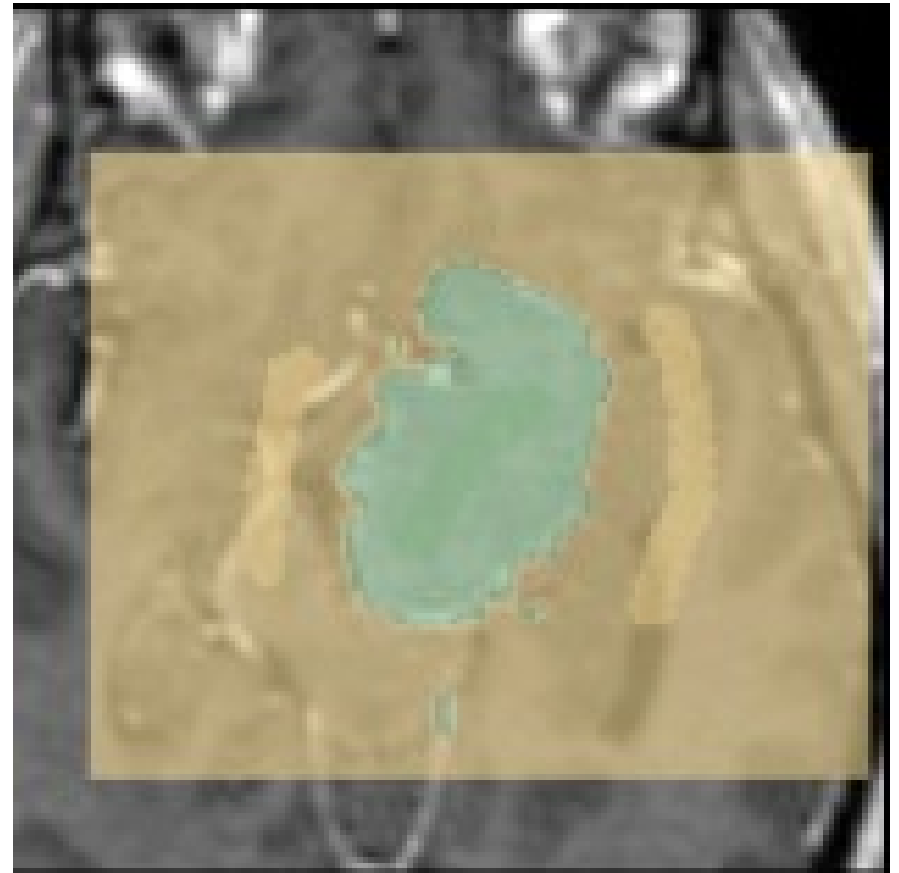
What links here
Related changes
Special pages
Printable version
Permanent link

Segmentation



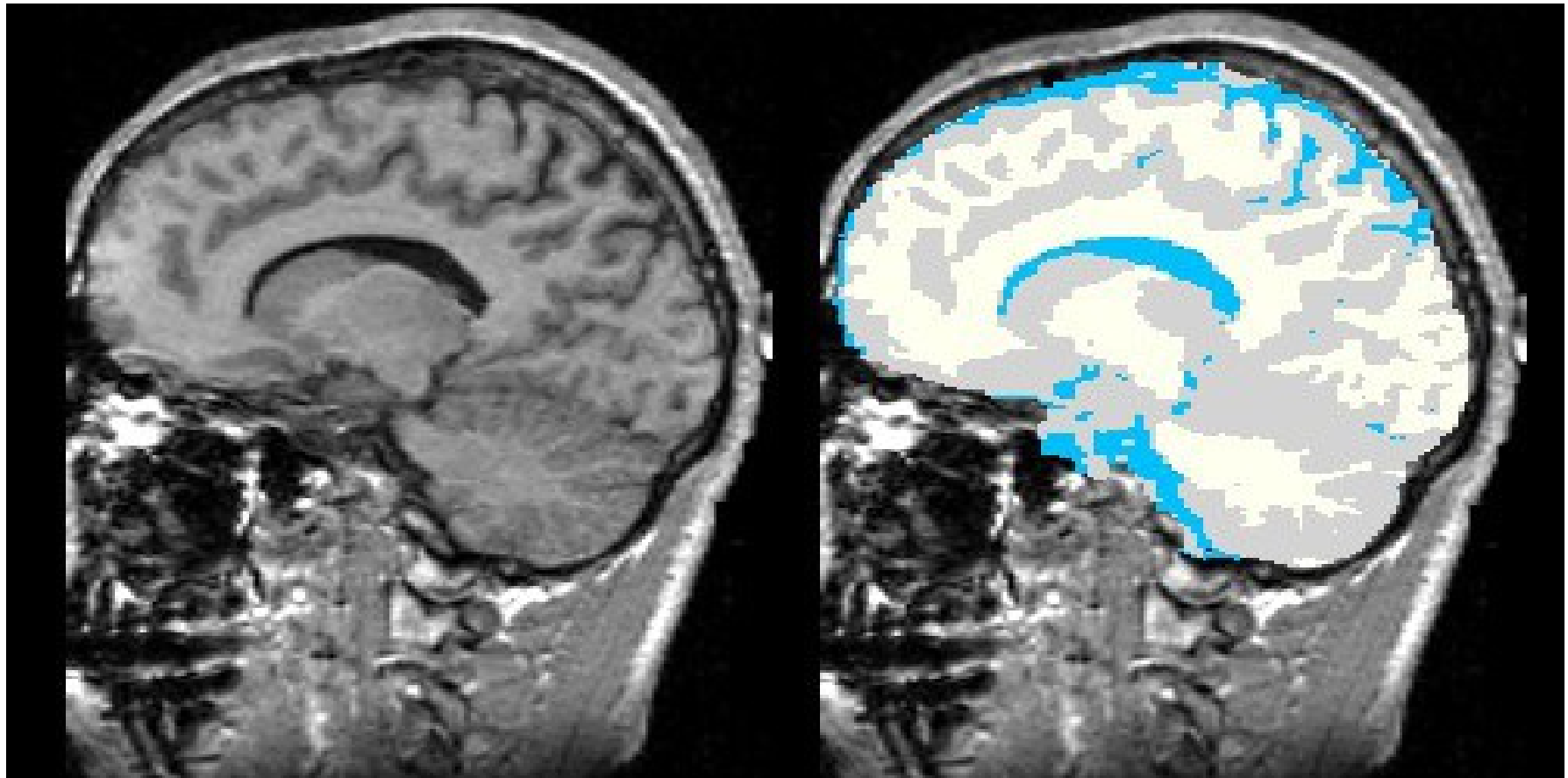
Fast marching segmentation

Segmentation



Grow-cut segmentation

Segmentation



EM segmentation

Other capabilities

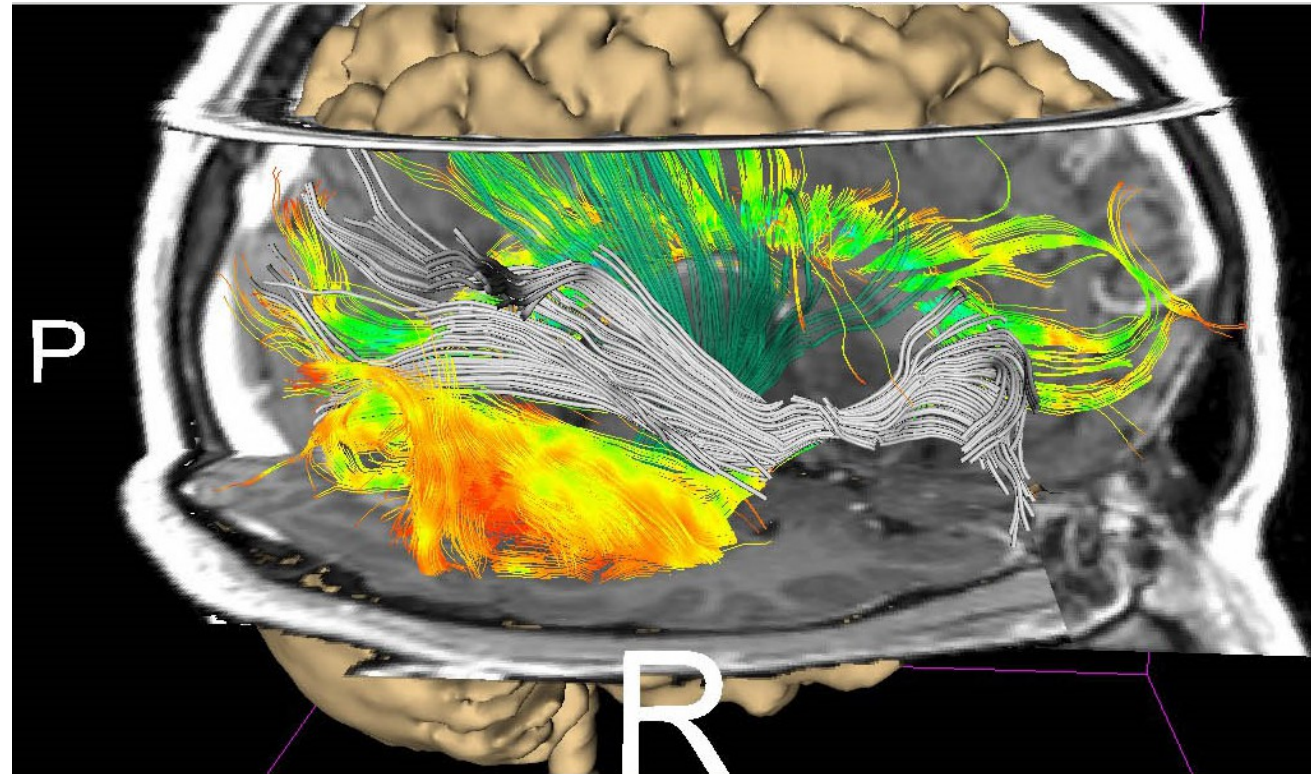
Meshing and model generation

Image-guided therapy

Vascular modeling

SUV computation

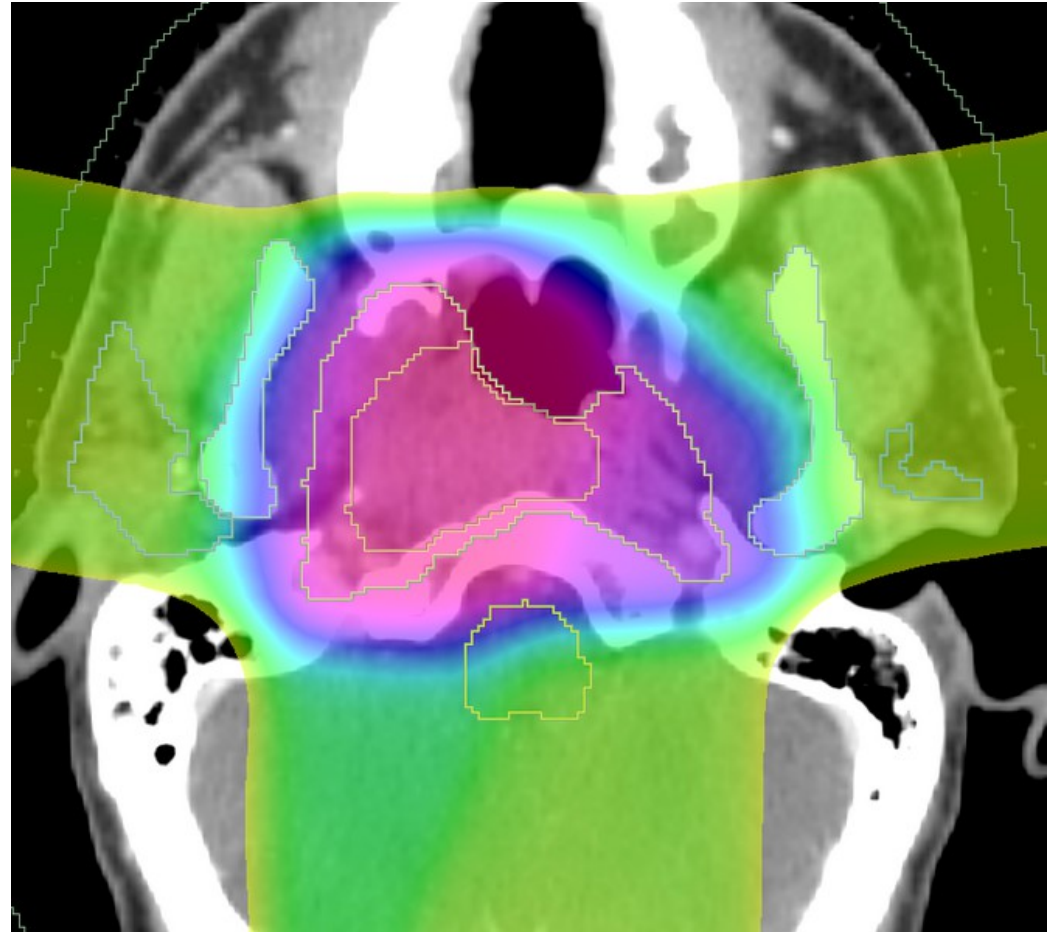
Tractography



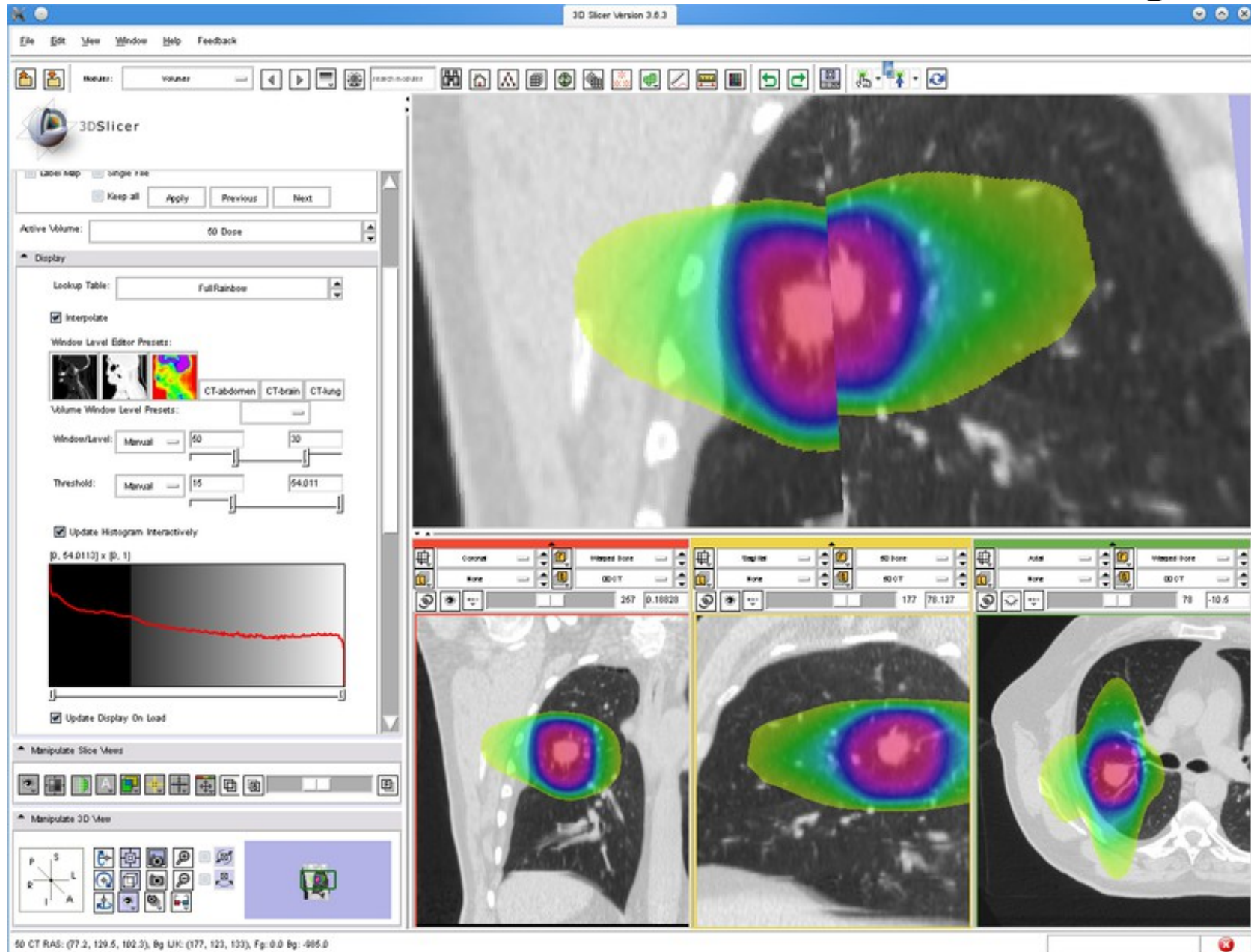
DICOM-RT Interchange

- RT Dose
 - Import / Export
- RT Structure Sets *
 - Import / Export

* with caveats



Structure and Dose Warping



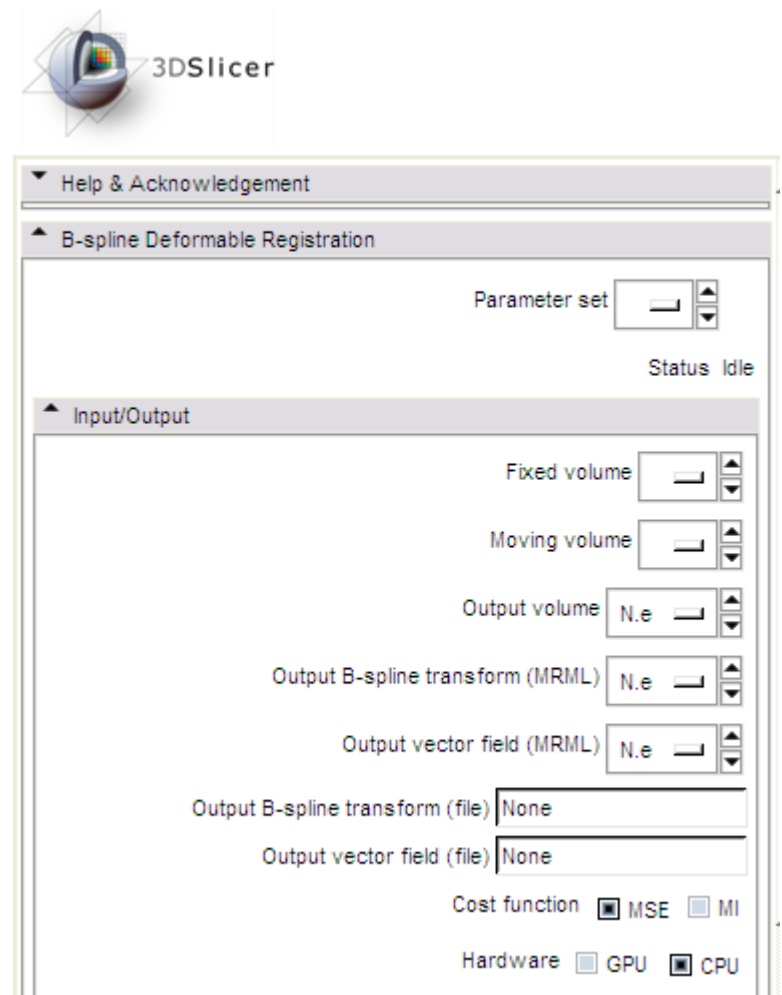
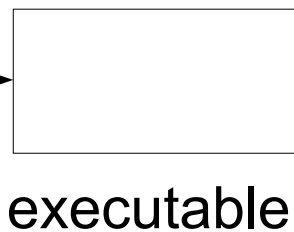
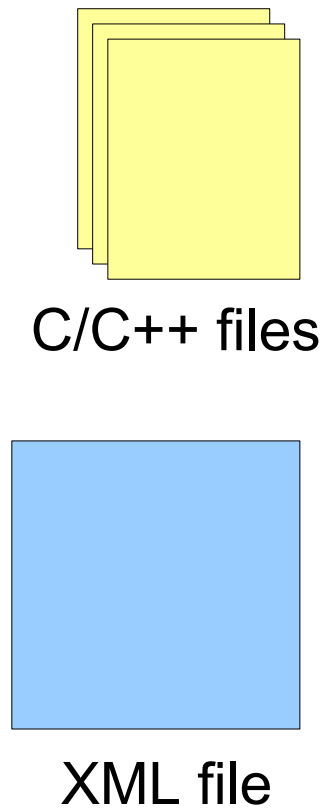
Developing slicer modules

Three kinds of modules:

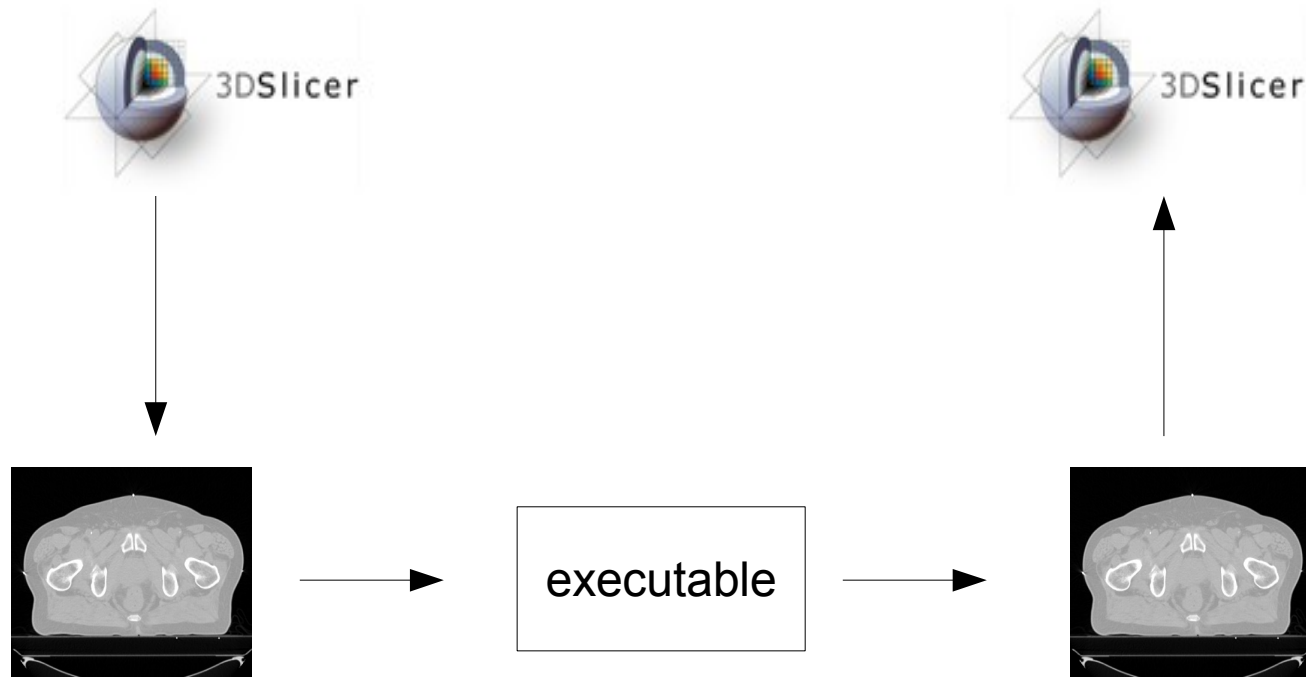
- Command line module
- Scripted module
- Loadable module

Command line module

User interface is generated by slicer



Command line module



(1) Slicer writes your input files,
then launches your executable

(2) Your executable runs,
and it writes output files

(3) Slicer loads your
output files

More information

Slicer email lists

- slicer-users@bwh.harvard.edu
- slicer-devel@bwh.harvard.edu

Documentation & tutorials

- <http://www.slicer.org/slicerWiki/index.php/Documentation-3.6>
- http://www.slicer.org/slicerWiki/index.php/Slicer_3.6:Training
- <http://www.slicer.org/slicerWiki/index.php/Slicer3:Registration>

Contact Greg:

- gcsharp@partners.org