

# 3D Slicer

## An Open Source Platform for Registration, Segmentation, Quantitative Analysis, and Visualization of Biomedical Image Data

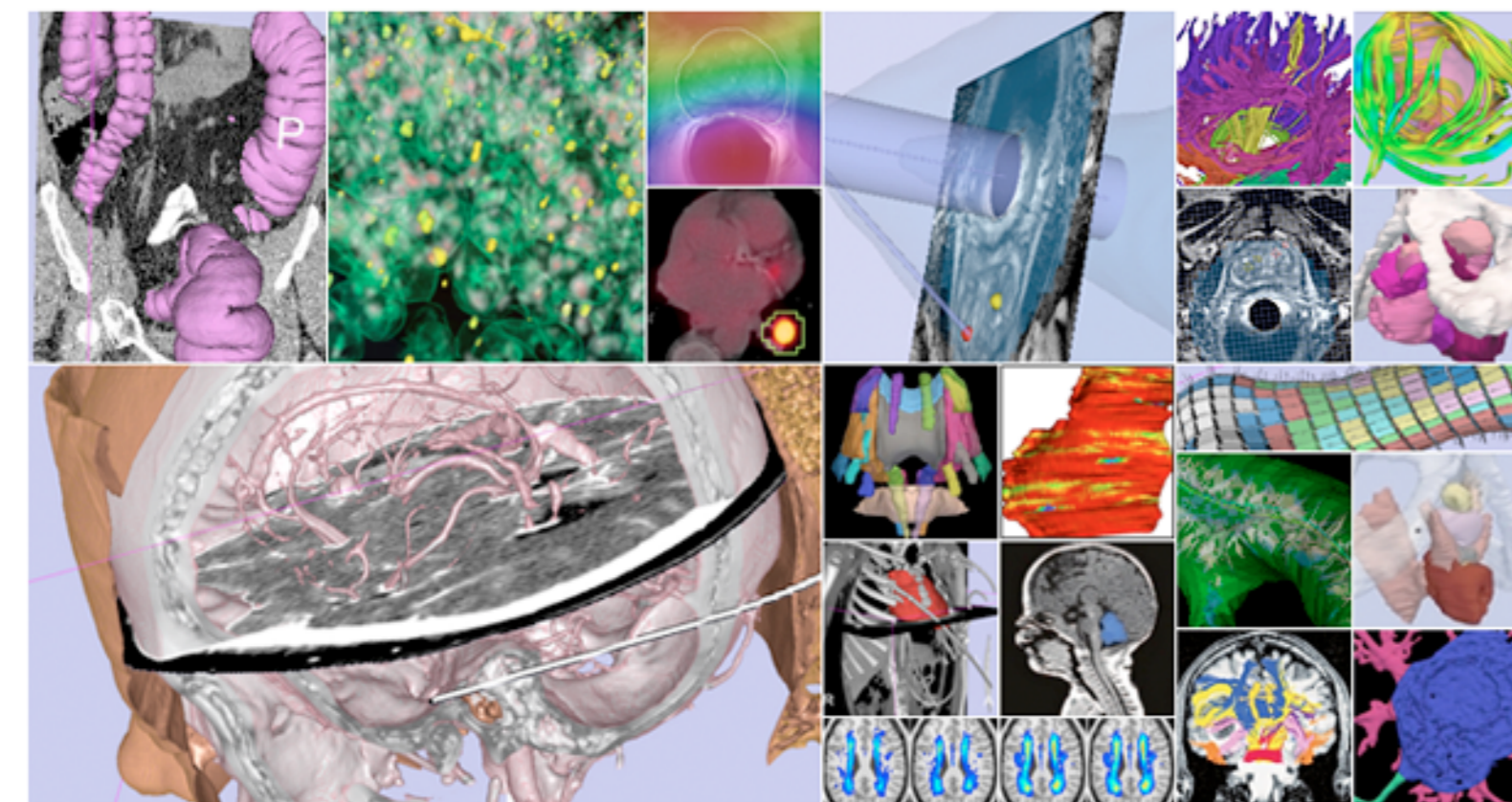


### About 3D Slicer

**3D Slicer is a multi-platform, free and open source software package for visualization and medical image computing.**

The software platform is **community created** for the purpose of subject specific medical image analysis and visualization. Slicer includes support for:

- Multi-modality imaging including, MRI, CT, US, nuclear medicine, and microscopy
- Multi organ from head to toe
- Bidirectional interface for devices
- Expandable and interfaced to multiple toolkits

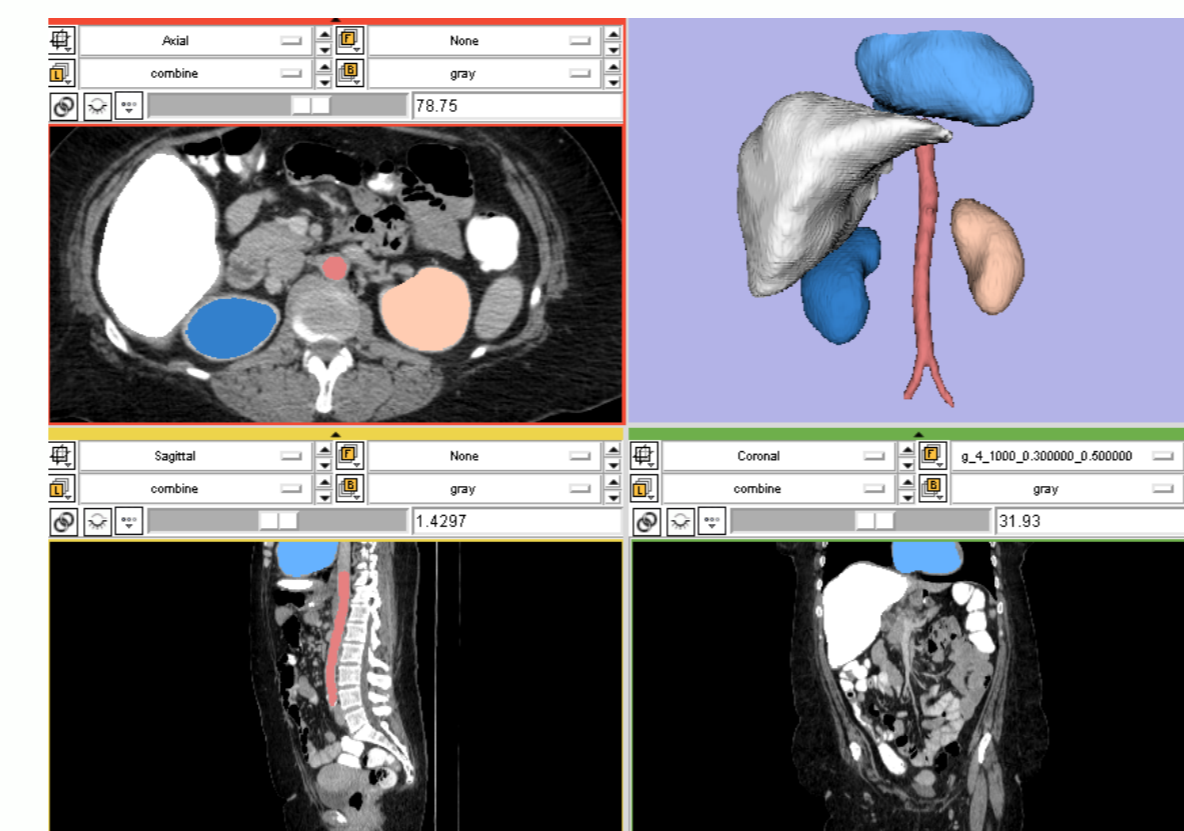


**History:** Slicer was initiated as a masters thesis project between the Surgical Planning Laboratory at the Brigham and Women's Hospital and the MIT Artificial Intelligence Laboratory in 1998. Slicer has been downloaded many thousand times. A variety of publications were enabled by the Slicer software. A new, completely re-architected version of Slicer was developed and released in 2007. Subsequently, version 3.2 was released in May of 2008, version 3.4 was released in May of 2009 and the newest version 3.6 of Slicer has been released in November of 2010.

**License:** Slicer executables and source code are available under a BSD-style, free open source licensing agreement under which there are no reciprocity requirements, **no restrictions** on use, and no guarantees of performance. Slicer leverages a variety of toolkits and software methodologies that have been labeled the NA-MIC kit. Please see <http://wiki.na-mic.org/Wiki/index.php/NA-MIC-Kit> for more information.

### Segmentation & Registration

**Segmentation** is required for defining features of interest in imaging data for quantification and analysis.



3D Slicer has a variety of interactive and automated segmentation methods:

- support for manual contouring and editing
- region growing and level sets
- graph cuts with gesture support
- skull stripping and hierarchical brain segmentation for morphological studies

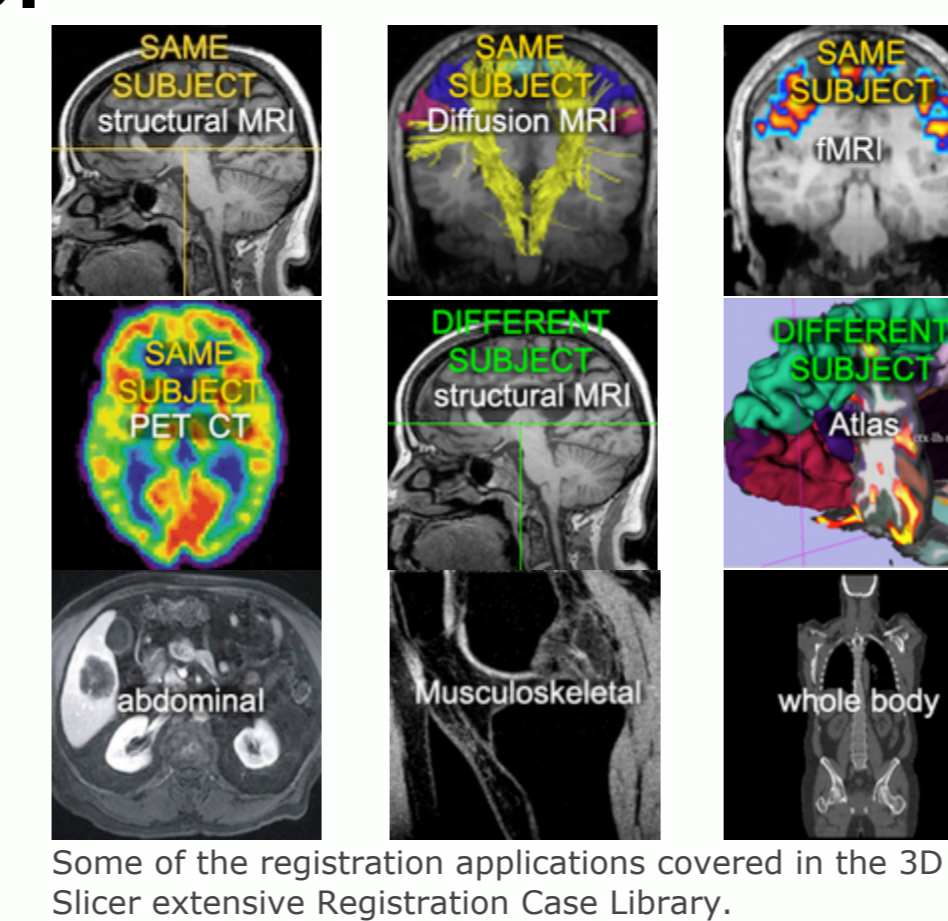
The desktop application provides interactive visualization of the results and an intuitive GUI.

Timeseries analysis and multi-subject analysis require good **registration** of imaging data acquired at different times, on different scanners, and across modalities.

Slicer also provides a variety of registration **methods** and **resources** to support versatile applications:

- Deformation models: rigid, affine, non-rigid, fluid
- Algorithm types: fiducial-, surface-, intensity-based
- Image types: scalar, vector, tensor

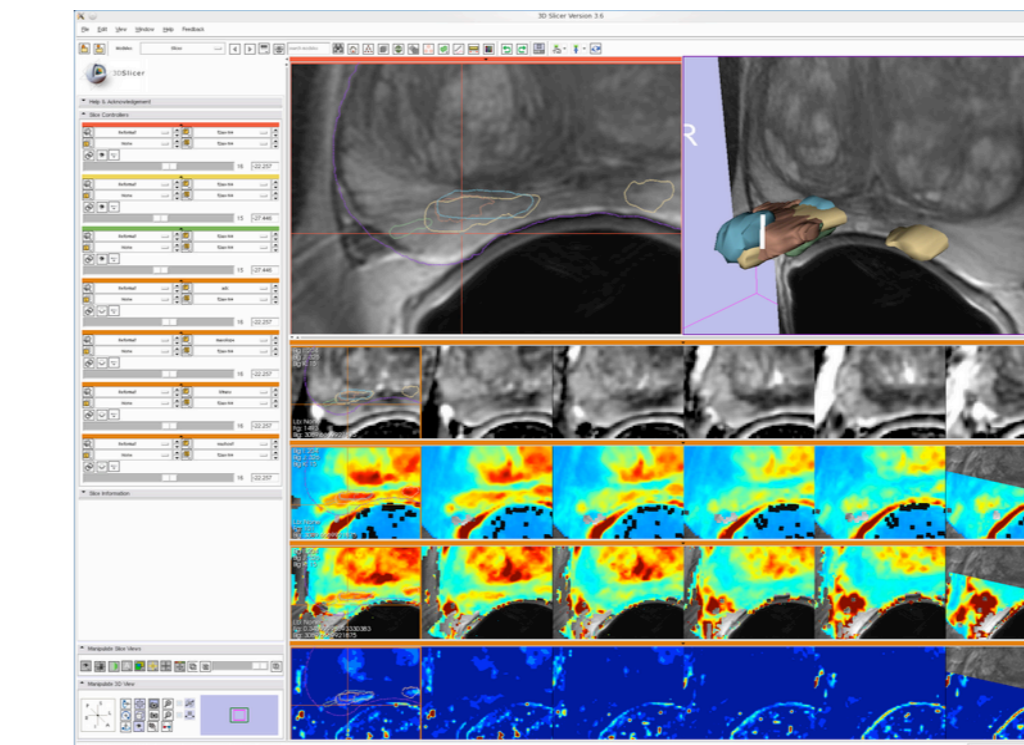
Google "na-mic registration documentation" for the extensive collection of Slicer registration cases and recipes



Some of the registration applications covered in the 3D Slicer extensive Registration Case Library.

### Multi-modality Visualization

A combined **visualization** of multiple imaging modalities and derived data can provide clinician scientists with an integrated understanding of anatomy and pathology.

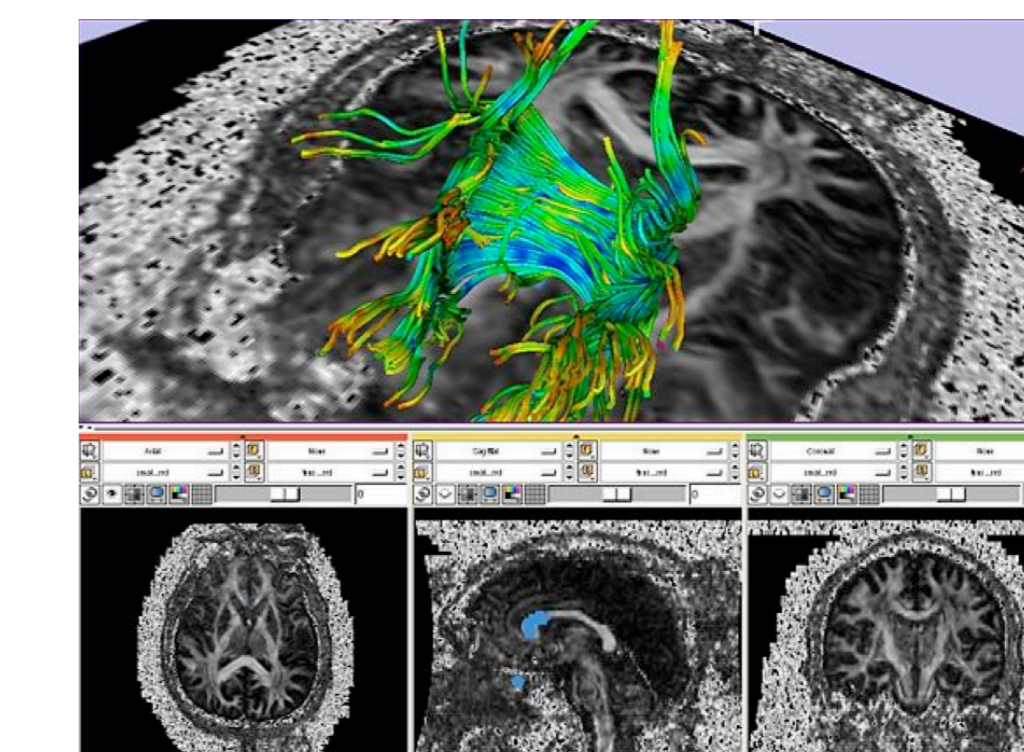


Slicer's CompareView layout is used to facilitate visualization of multimodal MRI of the prostate

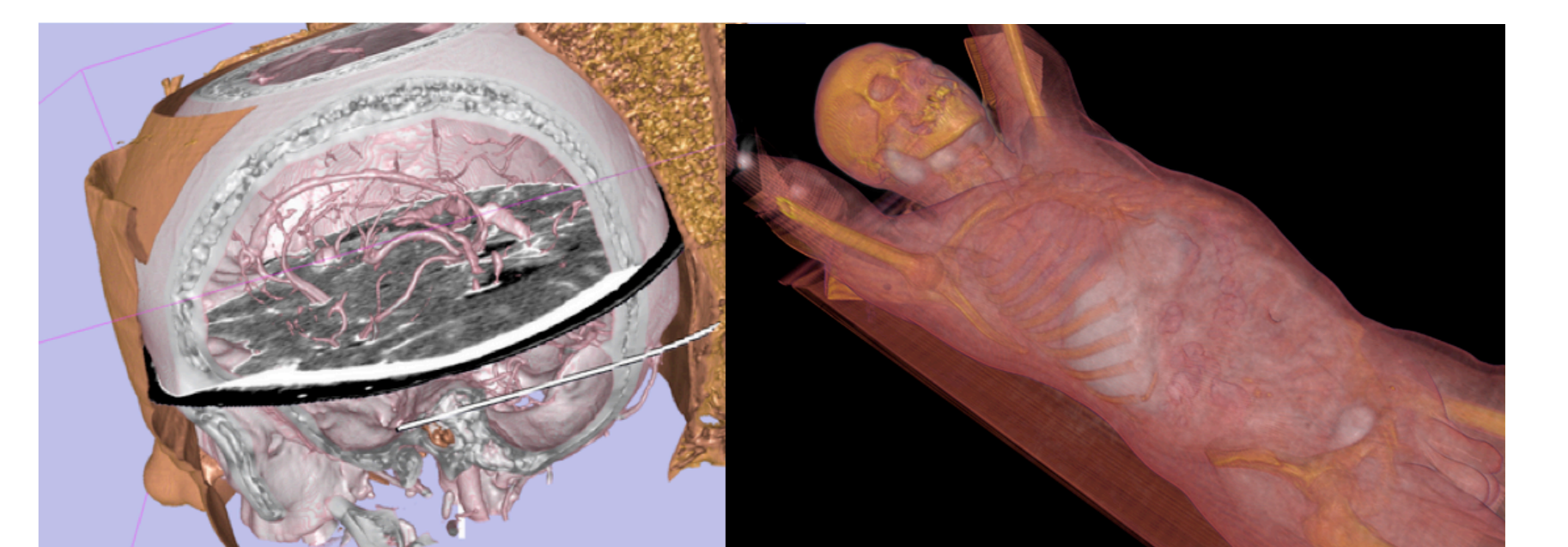
3D Slicer offers a **suite of layouts** and the ability to visualize many types of data including:

- greyscale volumetric data
- parameter maps and VOIs
- surface models & glyphs
- measurement tools & annotations
- tracking devices

Fast new hardware accelerated **volume rendering** is available in 3D Slicer version 3.6



Deterministic tractography result produced with the Label Seeding or Fiducial Seeding modules.



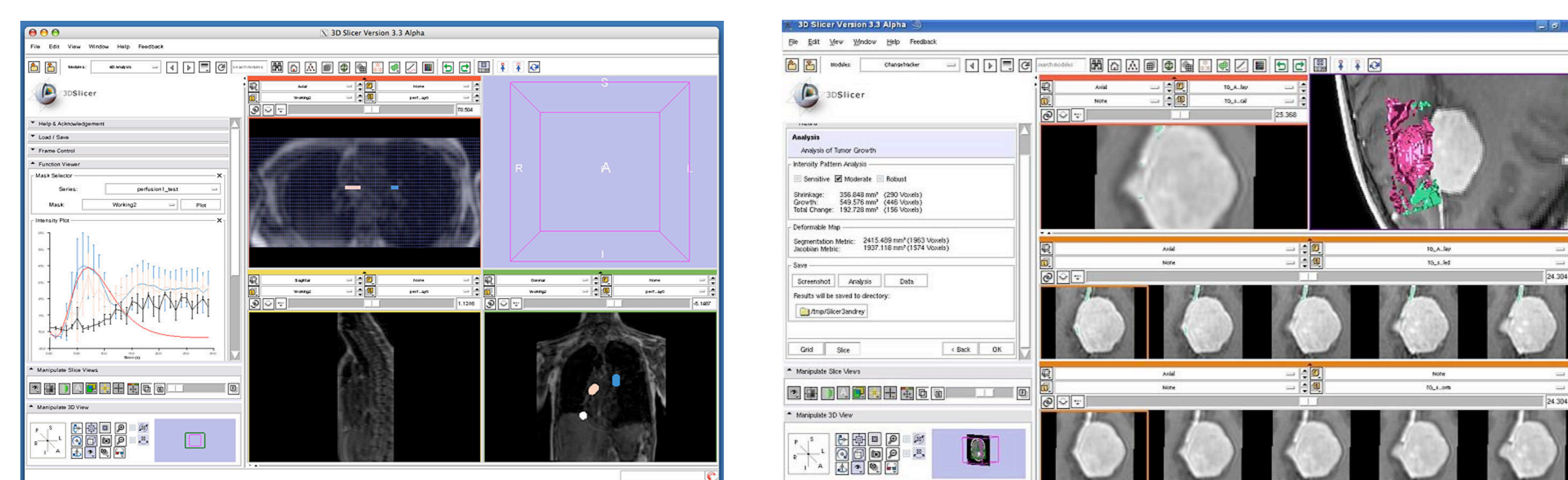
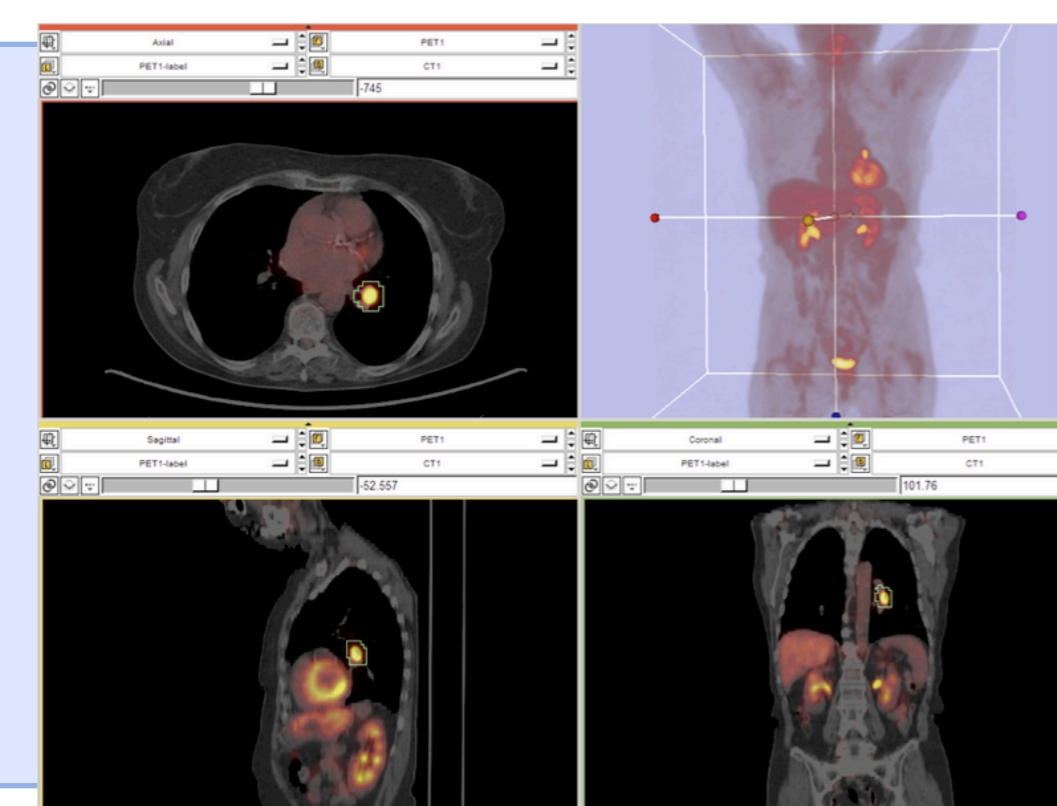
With VTK version 5.6, fast new hardware accelerated volume rendering is available in 3D Slicer Version 3.6. (Hardware accelerated volume rendering requires nVidia drivers, and is available on Windows and Linux only.)

### Quantitative Analysis

Many hundreds of **imaging biomarkers** are used in clinical practice, drug discovery and development. A free and open source platform can improve access to standard methods of image quantification and rapidly translate experimental methods into the clinical research setting for validation and refinement.

3D Slicer includes tools to quantify:

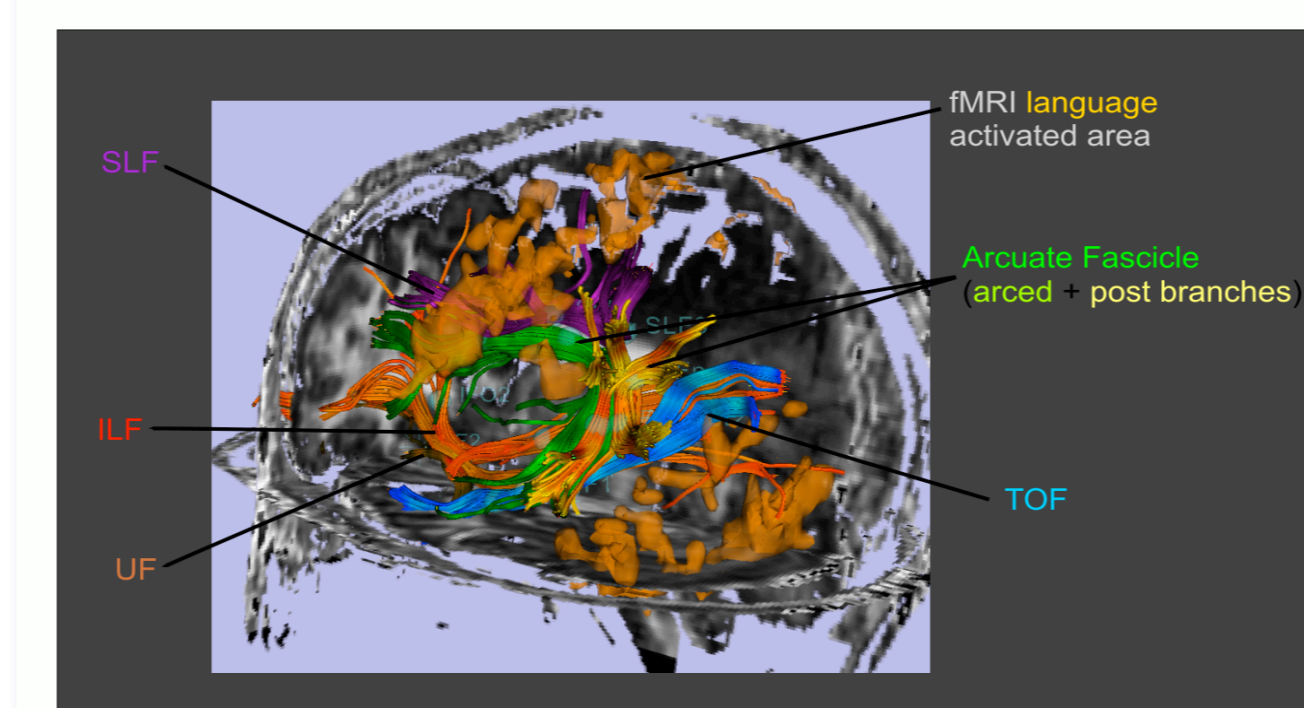
- PET/CT studies (SUV body weight)
- Tumor growth (experimental)
- Tumor response to treatment (measurements for RECIST)
- DCE-MRI (pharmacokinetics)



### IGT and Other Success Stories

3D Slicer has been used in clinical research, with IRB clinical protocols appropriately created and managed. In **image-guided therapy** (IGT) research, Slicer is frequently used to construct and visualize collections of MRI data that are available pre- and intra-operatively, and to display the tracked spatial position of surgical instruments.

Image-Guided Neurosurgery



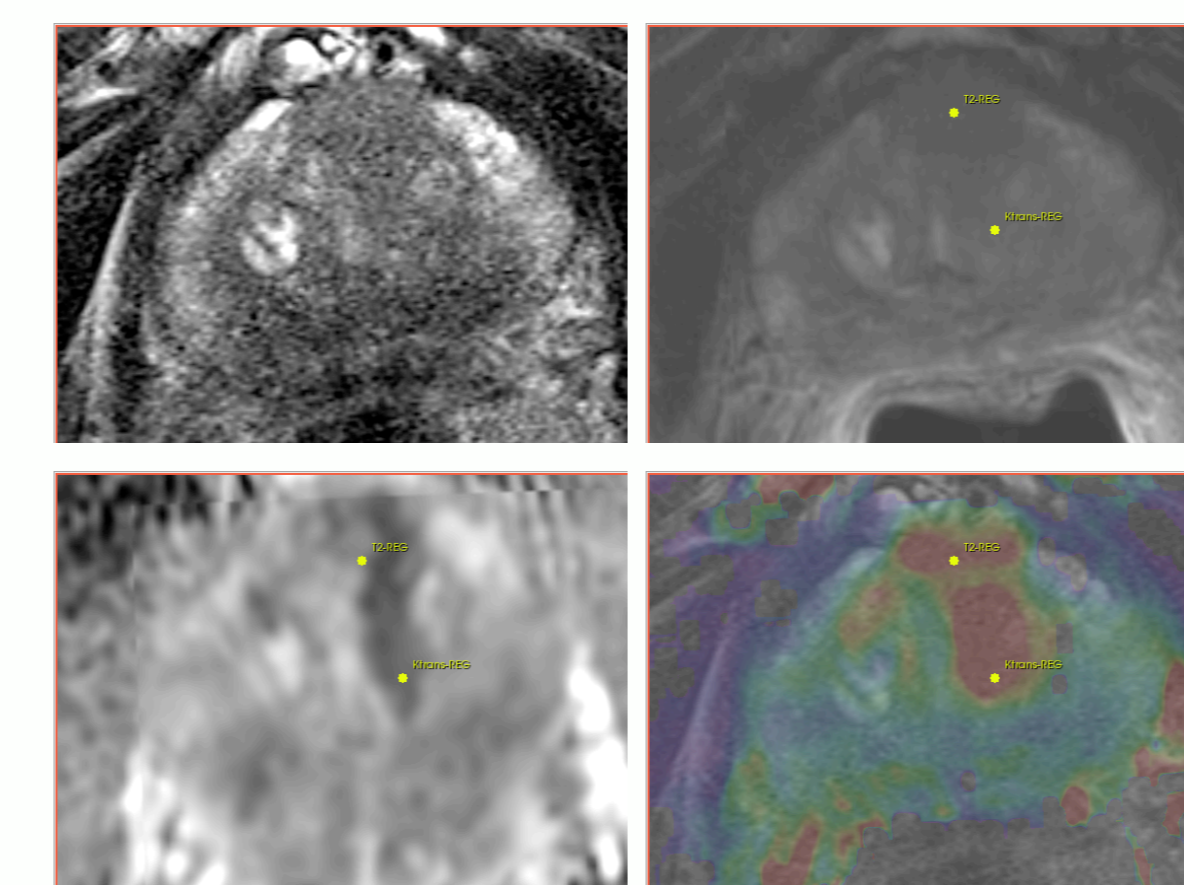
3D Slicer has been used extensively for brain tumor resection planning and guidance during the surgery.

Integration of 3D Slicer with the surgical navigation BrainLab system allows to track surgical instruments in real-time, and transfer the position to 3D Slicer. This enables intra-operative context-dependent visualization of the critical structures in the proximity of the surgical tool.

This project is a joint collaboration between BWH, Yale University and BrainLab.



MRI-Guided Prostate Cancer Biopsy



Targeted MRI guided prostate cancer biopsy attempts to improve the biopsy precision while reducing the number of tissue samples that need to be collected. This is achieved by first using diagnostic multi-parametric MRI to highlight the suspicious areas. The biopsy procedure takes place in the MR bore. Deformable registration is used to fuse the diagnostic image data to the intra-procedural configuration of the gland.

3D Slicer is used for MRI visualization and fusion, target planning, deformable registration, and needle trajectory planning (ProstateNav module).

Shown are intra-procedural T2 MRI (A), and pre-procedural T2, ADC and a pharmacokinetic map (B,C,D) registered to intra-procedural image, with the biopsy targets selected.

### Learning & Support

To support user and developer communities and the effective translation of tools into the clinical research setting, the 3D Slicer Project provides many **outreach materials and activities** including:

- Slicer Training Events
- Slicer Tutorial Materials & datasets
- Slicer Reference Style Documentation
- Slicer mailing lists
- Project week events for Developers

**Learning objectives**

**DTI tutorial**

**Learning Objective**

Category	Tutorial	Sample Data	Image
Diff	Brain Tumor Segmentation	The BrainLab dataset contains an MRI scan of the brain with 3D reconstruction of the anatomy.	
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A sampling of some of the self-guided tutorials available at: [http://www.slicer.org/slicerWiki/index.php/Slicer\\_3.6:Training](http://www.slicer.org/slicerWiki/index.php/Slicer_3.6:Training)

