The 3DSlicer open-source platform for segmentation, registration, quantitative imaging and 3D visualization of biomedical image data

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3DSlicer

A multi-platform, **free and open source** software package for
visualization and **medical image computing**

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About Slicer

▸ Introduction
▸ Acknowledgments
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Resources
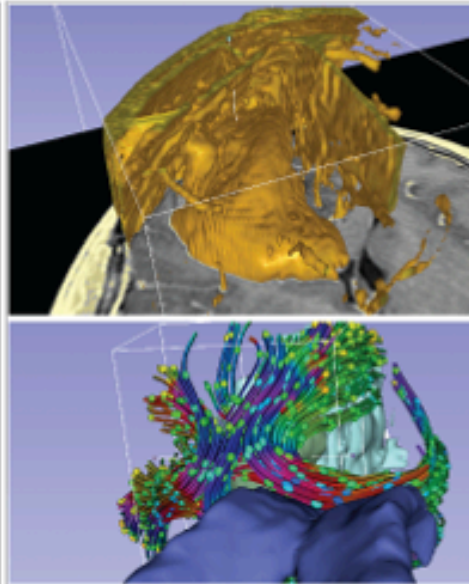
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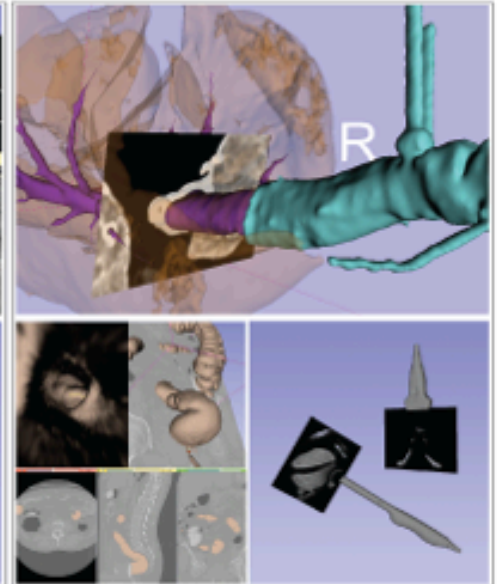▸ Source Code
▸ Licensing
▸ Mailing Lists
▸ Web Archive

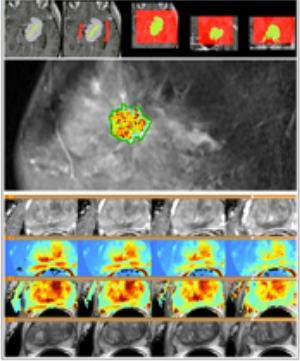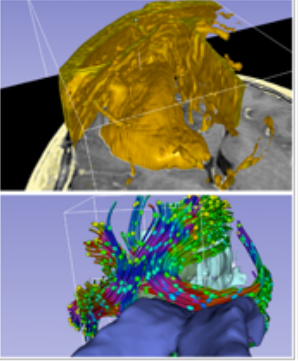Powerful processing.   Streamlined interface.   Extensible platform.
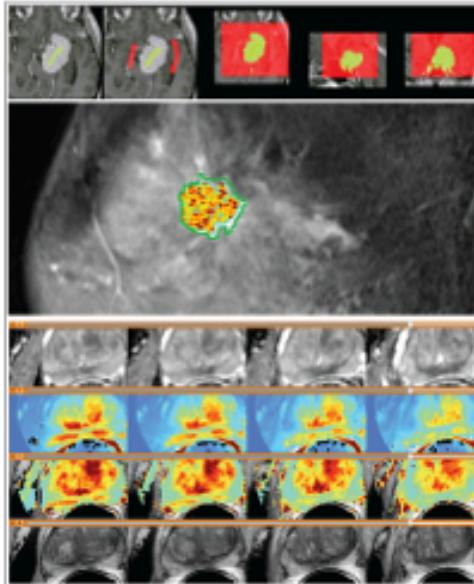
R

3D Slicer version 4
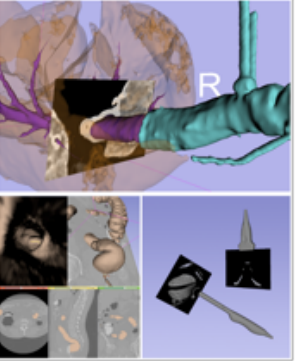
www.slicer.org

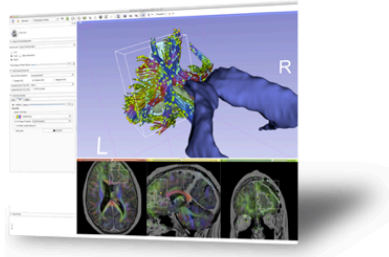The community of Slicer developers is proud to announce the release of Slicer 4.1. Find out more...

3DSlicer

- Slicer is a freely available open-source application for viewing, analyzing and interacting with biomedical imaging data

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- Slicer is a multi-platform software on Windows, Linux, and Mac

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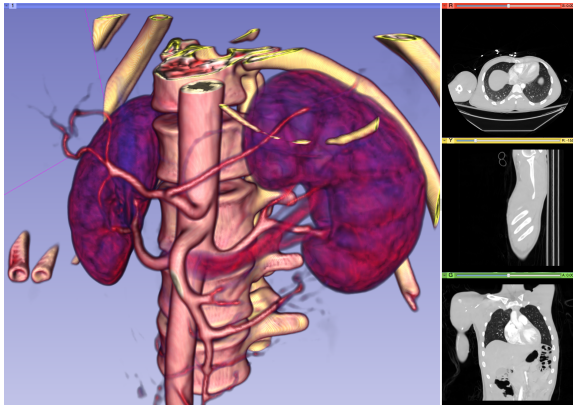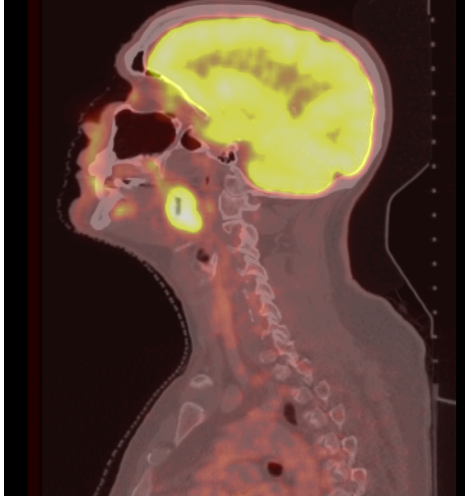
- Slicer is a freely available open-source application for viewing, analyzing and interacting with biomedical imaging data

- Slicer is a multi-platform software on Windows, Linux, and Mac

- Slicer is a multi-institutional effort mainly supported by the National Institute of Health
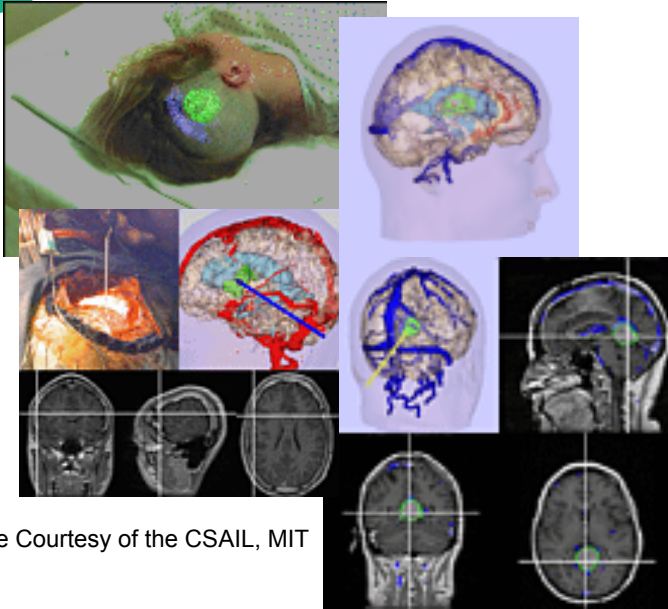
Slicer 16th year Anniversary

Image Courtesy of the CSAIL, MIT

- 1997: Slicer started as a Master's thesis between the Surgical Planning Lab (Harvard) and the Computer Science and Artificial Intelligence Laboratory (CSAIL) at MIT

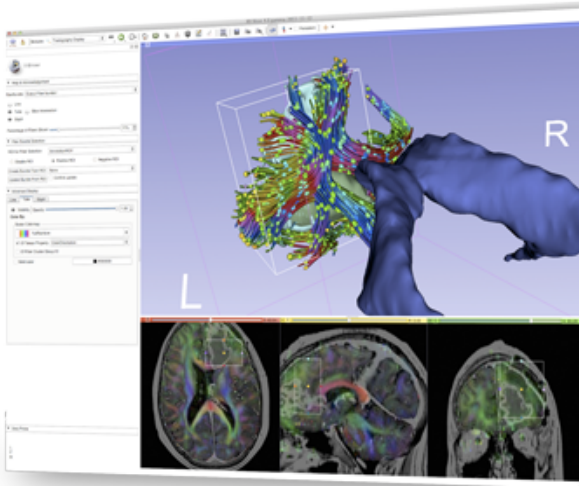- 2013: International open-source platform developed through a multi-institution effort

P.I. Prof. Ron Kikinis, BWH, Harvard

Slicer License

- Slicer is distributed under a BSD-style license agreement with no restriction on use

- Slicer is not FDA-approved nor CE-marked

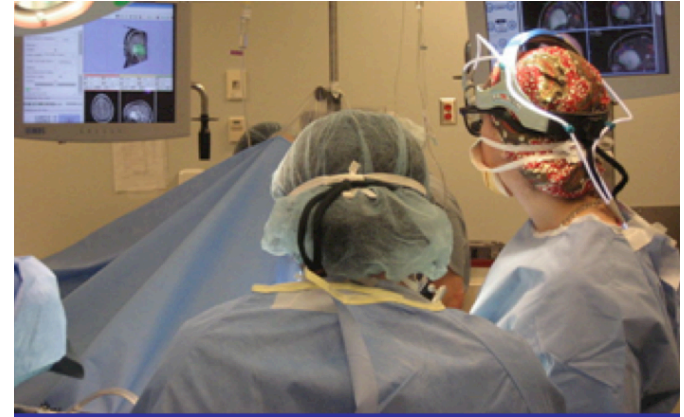- 3D Slicer bridges the "valley of death" for subject specific analysis

An interdisciplinary platform

An open-source environment for software developers

An end-user application for clinical investigators and scientists

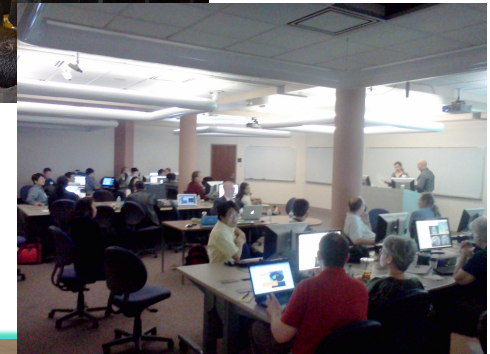A software platform that is both easy to use for clinical researchers and easy to extend for programmers

Slicer Is Open

• Open Science
=
Open Source
+
Open Data
+
Open Community

Madrid 2012

Iowa City, USA 2012

Courtesy R. Kikinis

Slicer Open Community
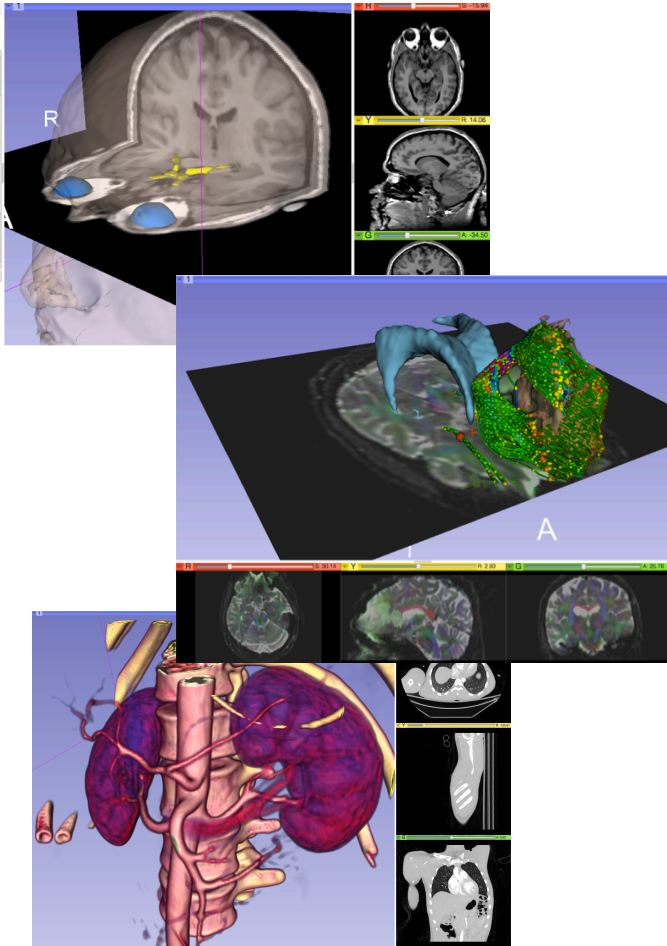
- 80 authorized developers contributing to the source code
- >700 subscribers on user and developer mailing list
- > 55,000 downloads of Slicer4 since November 2011

Nov.2011-March.2013 Download

Slicer 4 download statistics

Slicer4 downloads in Europe

Bridging the gap to accelerate translational research

Image courtesy of Arya Nabavi, MD

Algorithm Development

Problem solving

Bridging the communication gap requires a collaborative environment that fosters exchange of specialized knowledge and expertise between clinical researchers and scientists.

Slicer is 16 year old

- Every 4-5 year: Slicer versions: Major architectural, functional and GUI redesign

- Every 6 month: Within each version, updated release

- Every day!: Binary installation packages to access bleeding-edge functionality

Slicer is built every night

Slicer is under active development: built every night on every platform

Slicer Bug Tracker

Interoperability with software package and libraries

- Open-science and open-community philosophy

- File Format compatibility

- Complementary aspects of different open-source software on specialized functionalities

Slicer Extension Manager

Slicer is Extensible through plugins

Slicer Extension Catalog offers the possibility to the user to download additional Slicer modules

Core Functionalities
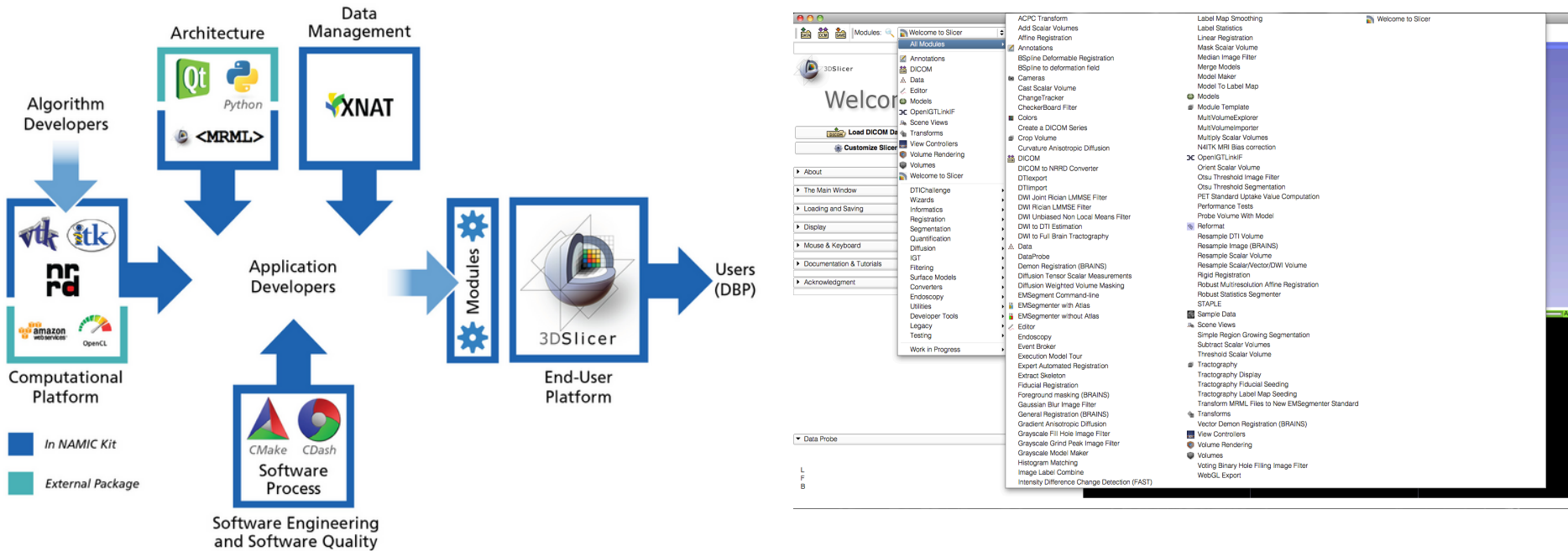
Slicer4 core functionalities include 108 modules, and represent 700,000 lines of code

Core Functionalities
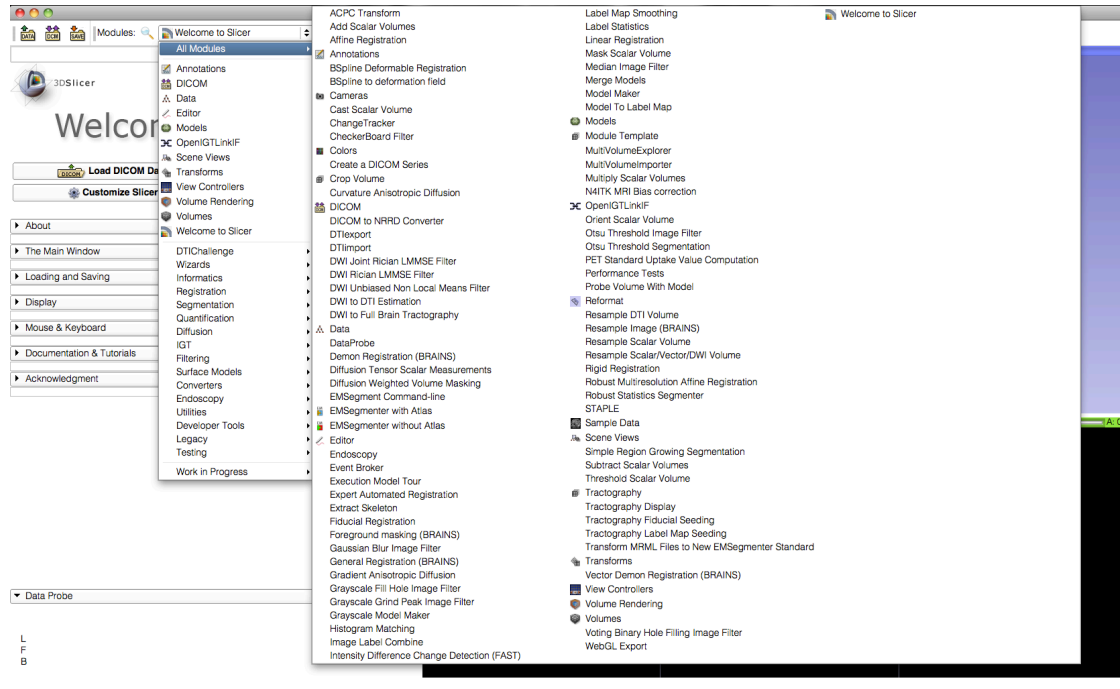
- Visualization
- Segmentation
- Registration
- Reconstruction
- Diffusion
- Image Guided Therapy
- Quantification
- Reporting

DICOM module

DICOM module

- Interface Between DICOM and Slicer
  - Core DICOM Parsing in DCMTK/CTK
  - Data Pre-Cached in Database
  - MRML Manipulation in Slicer Module Logic
- Patient/Study/Series Browser
  - Offers Slicer Interpretation of Selected Data
  - Multiple Interpretations where DICOM Data is Ambiguous

Slicer applications
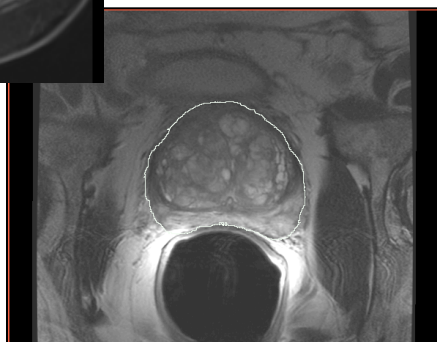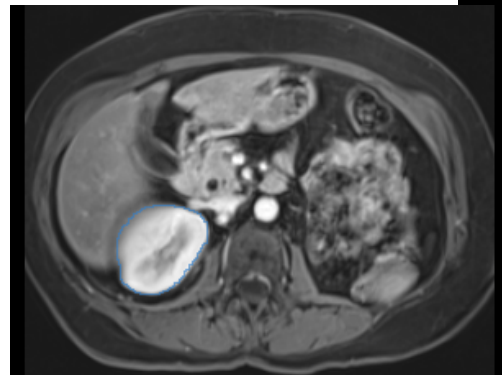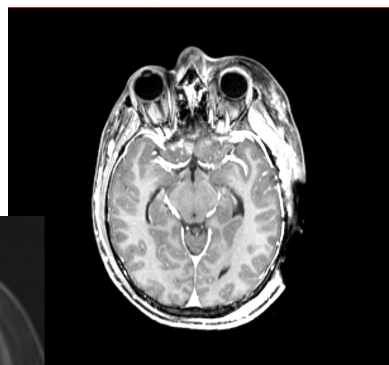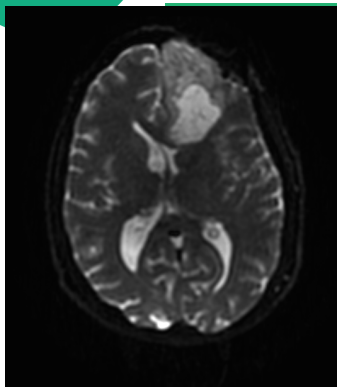
- Driving Biological Projects leading to the development of new tools

- Applied science oriented toward subject specific analysis in the presence of pathology

- Example: Image-guided therapy

Slicer use in clinical research environment

- AMIGO, BWH, Boston, USA (DTI)
- Slicer RT – Canada

(ECR 2013 IMAGINE Session, 'SlicerRT – 3D Slicer based open-source toolkit for radiation therapy research'. Pinter et al)

- Quantitative Image Network collaboration with German Cancer Research Institute (PET/CT)

Improving Patient Care with AMIGO
Advanced Multimodality Image Guided Operating Suite

Image-Guided Therapy
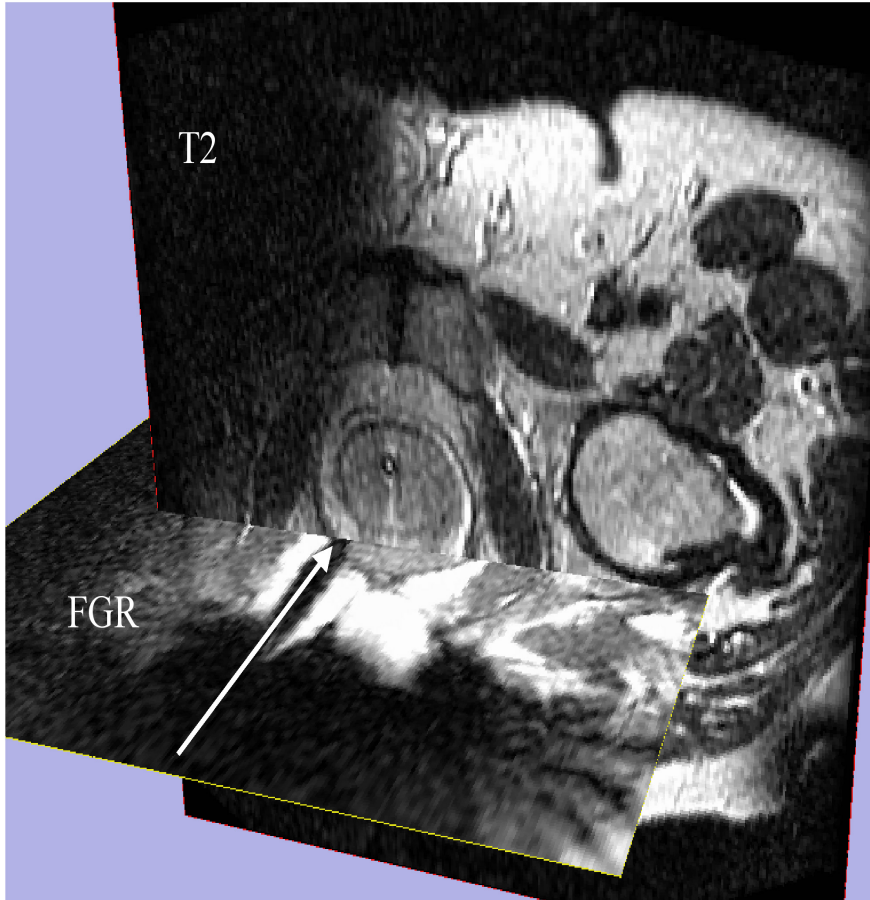
Image-guided therapy
for prostate interventions:
- Brachytherapy Planning
- Navigation for Biopsy

Haker SJ, Mulkern RV, Roebuck JR, Barnes AS, Dimaio S, Hata N, Tempany CM.: Magnetic resonance-guided prostate interventions. Top Magn Reson Imaging. 2005 Oct;16(5):355-68.

Image Courtesy of Steven Haker, PhD and Clare Tempany, MD

Neurosurgical planning
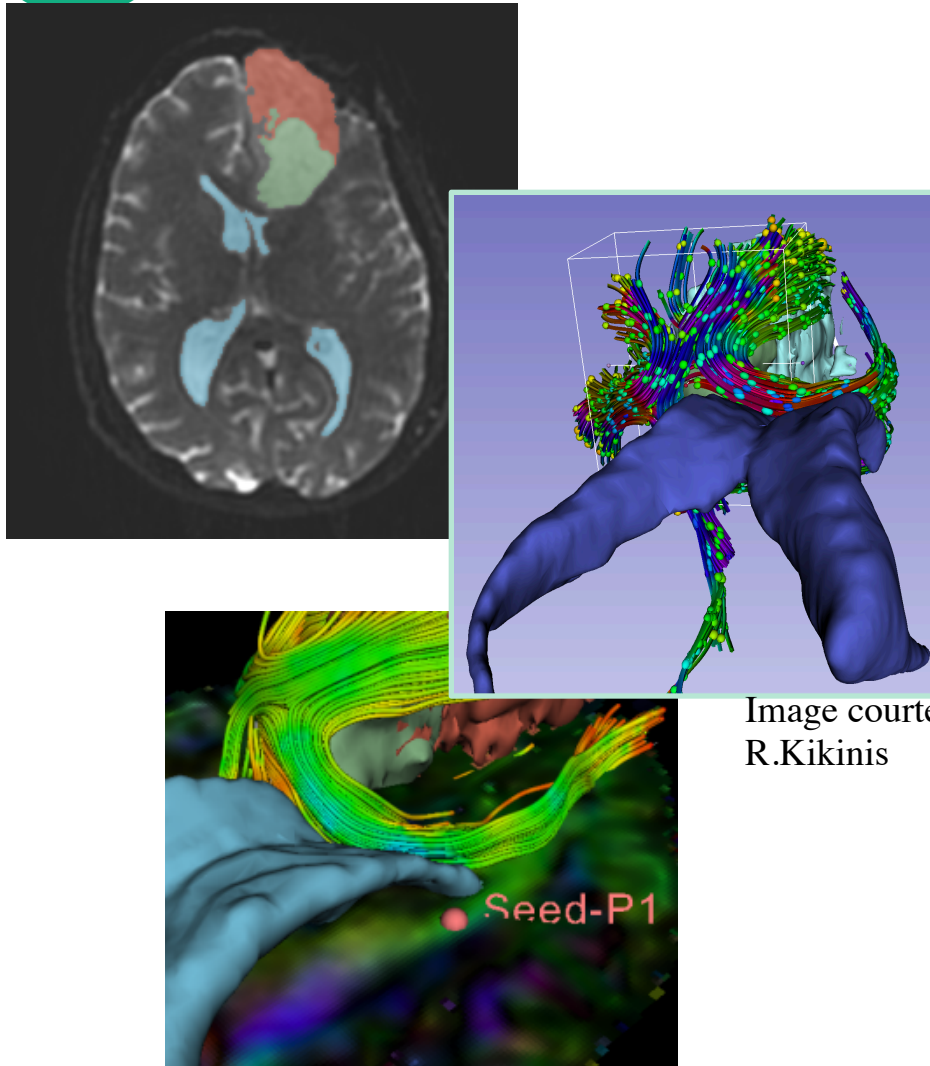
Image courtesy R.Kikinis

Slicer modules used for
- DWI denoising
- T1/T2/DTI Registration
- Tumor Segmentation
- Tractography with Labelmap Seeding
- Tractography with Fiducial Seeding

Fiducial Seeding
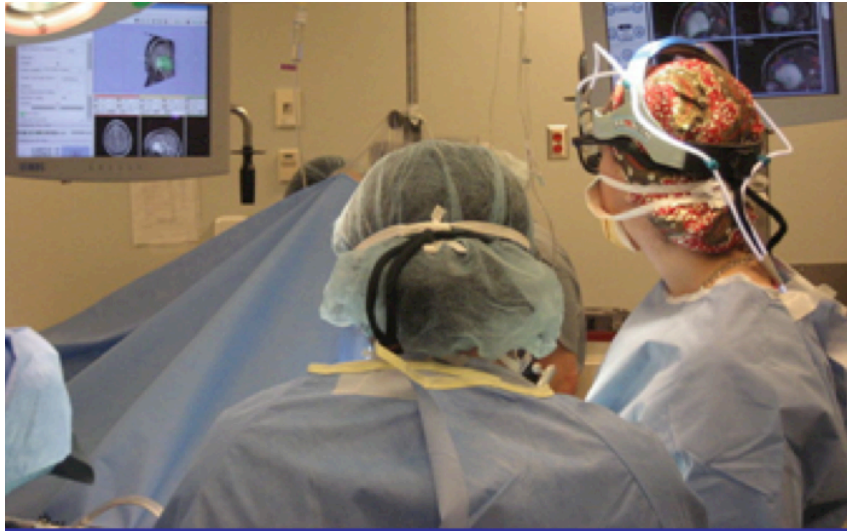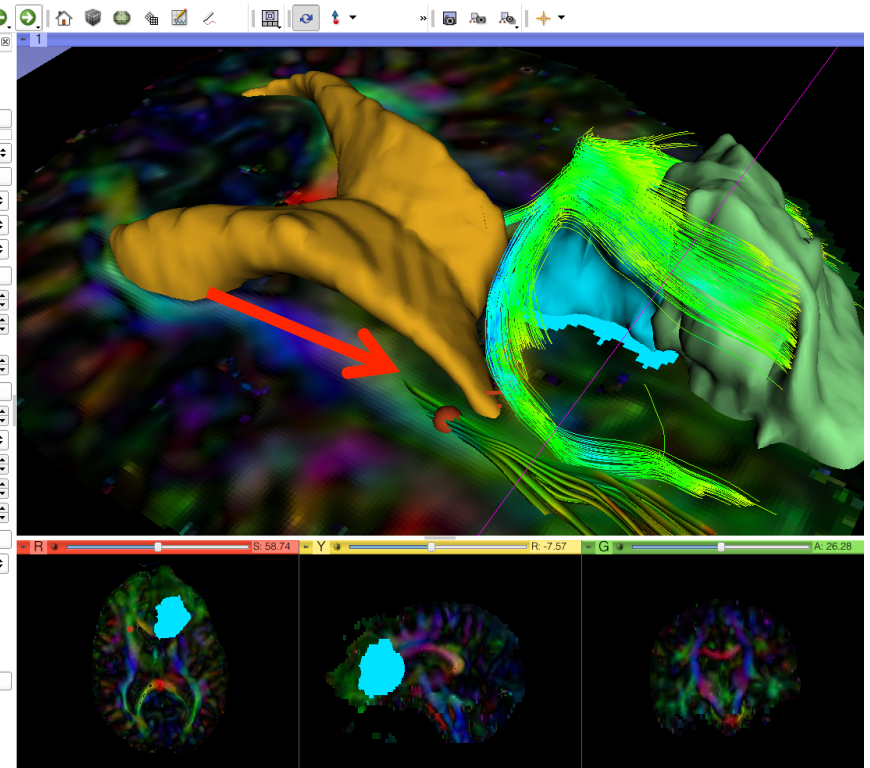
Example of on-the-fly exploration of white matter structures in the contralateral side of the tumor

Bridging the gap to accelerate translational research

GAP

Algorithm Development

Problem solving

Image courtesy of Arya Nabavi, MD

Slicer Training History: 2005-2013

- Training Core Component of two major NIH-funded consortia: the National Alliance for Medical Image Computing (NA-MIC) and the Neuroimage Analysis Center (NAC) (P.I. Ron Kikinis)

- Accelerating the translation of new technology into new skills of scientists and clinical investigators

Slicer Training Workshops
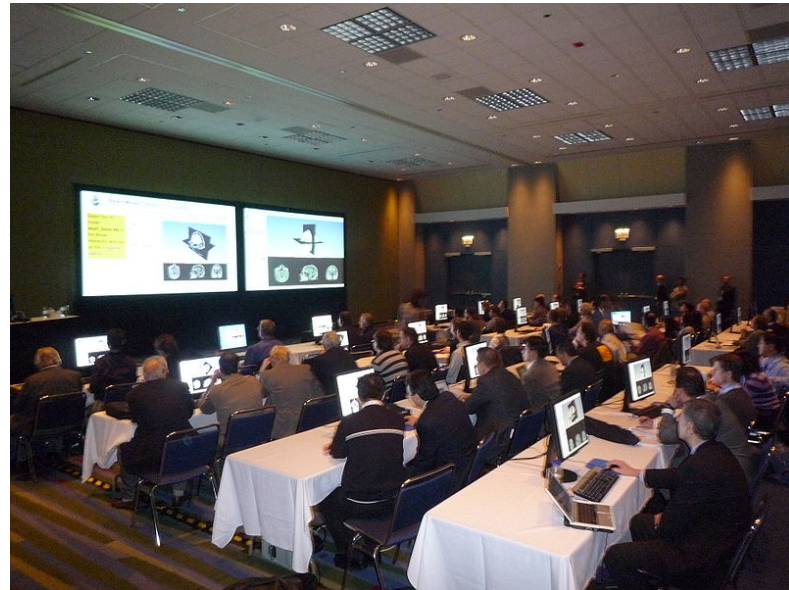
- 1-2 day hands-on events
- Thematic
  - DTI
  - Image-guided therapy
  - 3D Visualization for radiological applications
  - PETCT SUV Computation
- 15-25 all-level participants

Slicer Training Events

SfN, 2009

RSNA, 2009

RSNA, 2010

Hands-on courses at major international conferences

- **RSNA** 2008, 2009, 2010, 2011, 2012, 2013
- **MICCAI** 2008, 2009, 2010, 2011, 2012, 2013
- **SfN** 2009, 2011
- **SPIE** 2012, 2013
- **CAOS** 2010
- **CARS** 2010, 2012, 2013
- etc…

Slicer Training Events

Tokyo, 2010

Munich, 2008

Beijing, 2010

Invited workshops at international venues:

- – PLA General Hospital, Beijing, China,
- – Tokyo Women's Medical University, Japan
- – IHK Akademie Westerham, Munich, Germany
- – Rey Juan Carlos Universidad, Spain

Project Weeks

- Bi-annual week of hands-on programming
- Practical exchange of idea and experience
- 2010: 126 international attendees, 71 projects, 8 countries (Austria, England, France, Germany, Italy, Japan)
- 17 project weeks in the US since 2005

Conclusion

- Slicer is an open-source research platform for the rapid development of biomedical image analysis tools.

- Slicer community is open community with contributors from all over the world

- Slicer is a versatile platform for translational research and subject specific analysis of biomedical ima data

Acknowledgments

National Alliance for Medical Image Computing
NIH U54EB005149

Neuroimage Analysis Center
NIH P41RR013218