

Improvements in SlicerRT, the radiation therapy research toolkit for 3D Slicer

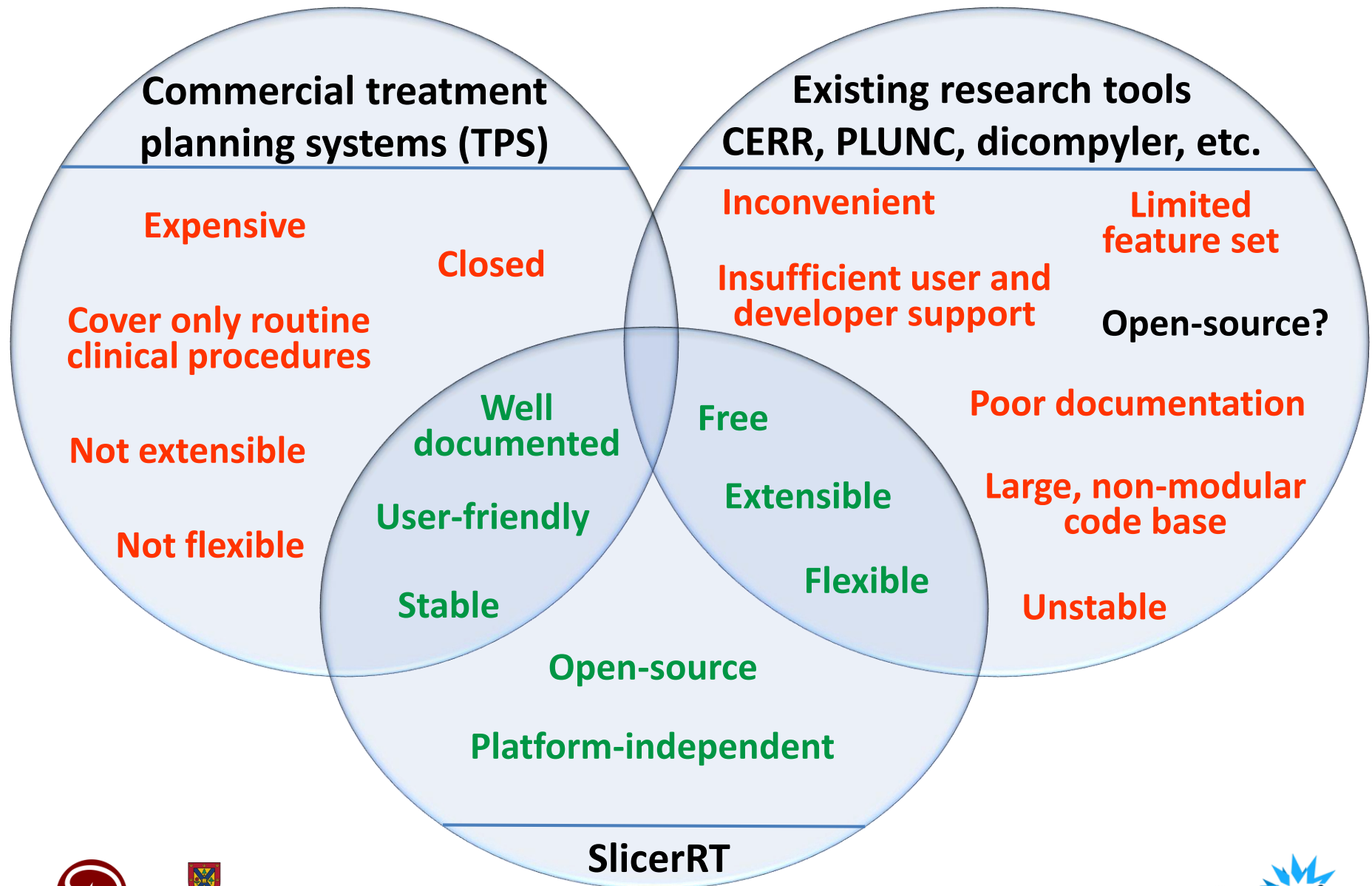
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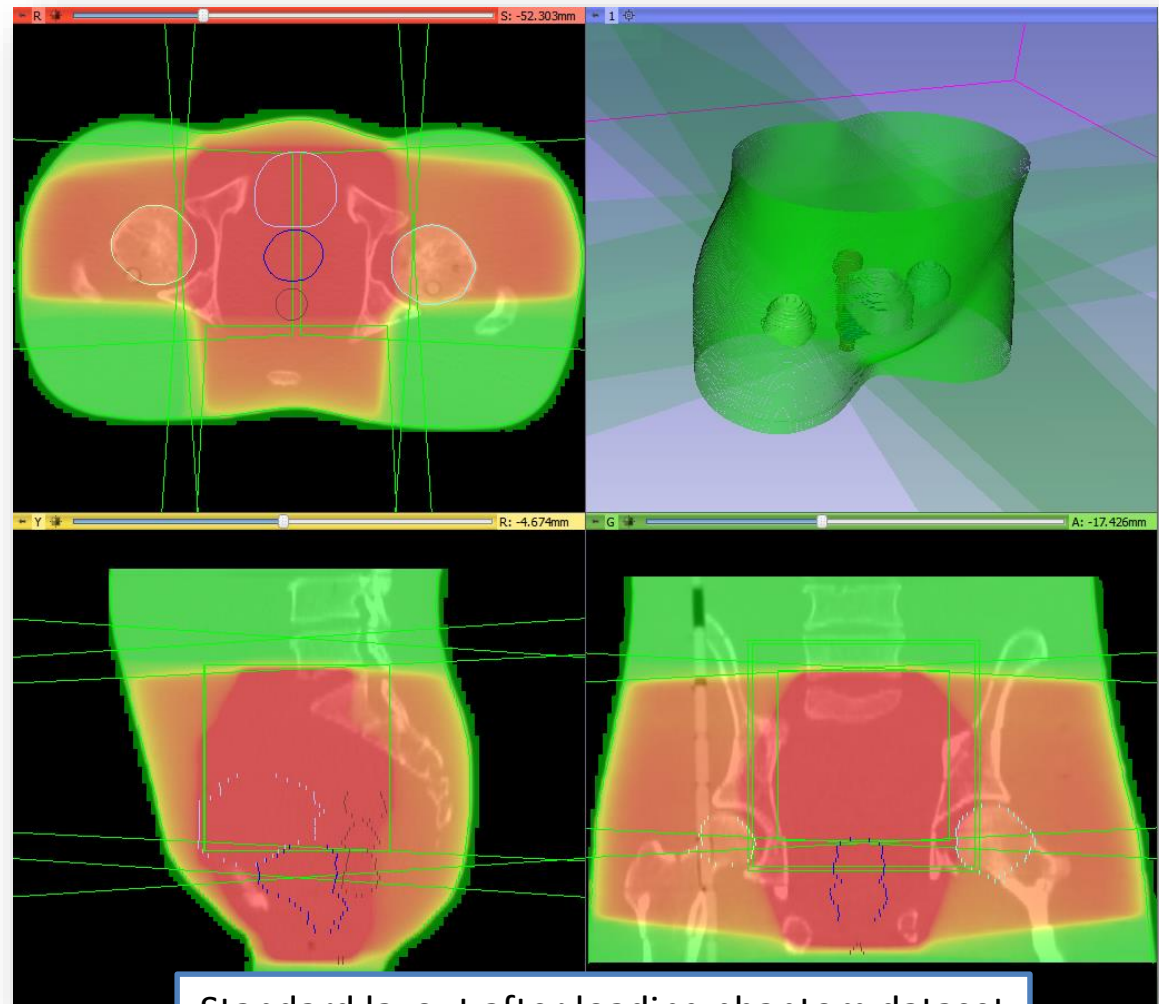


Motivation behind SlicerRT



DICOM-RT import/export

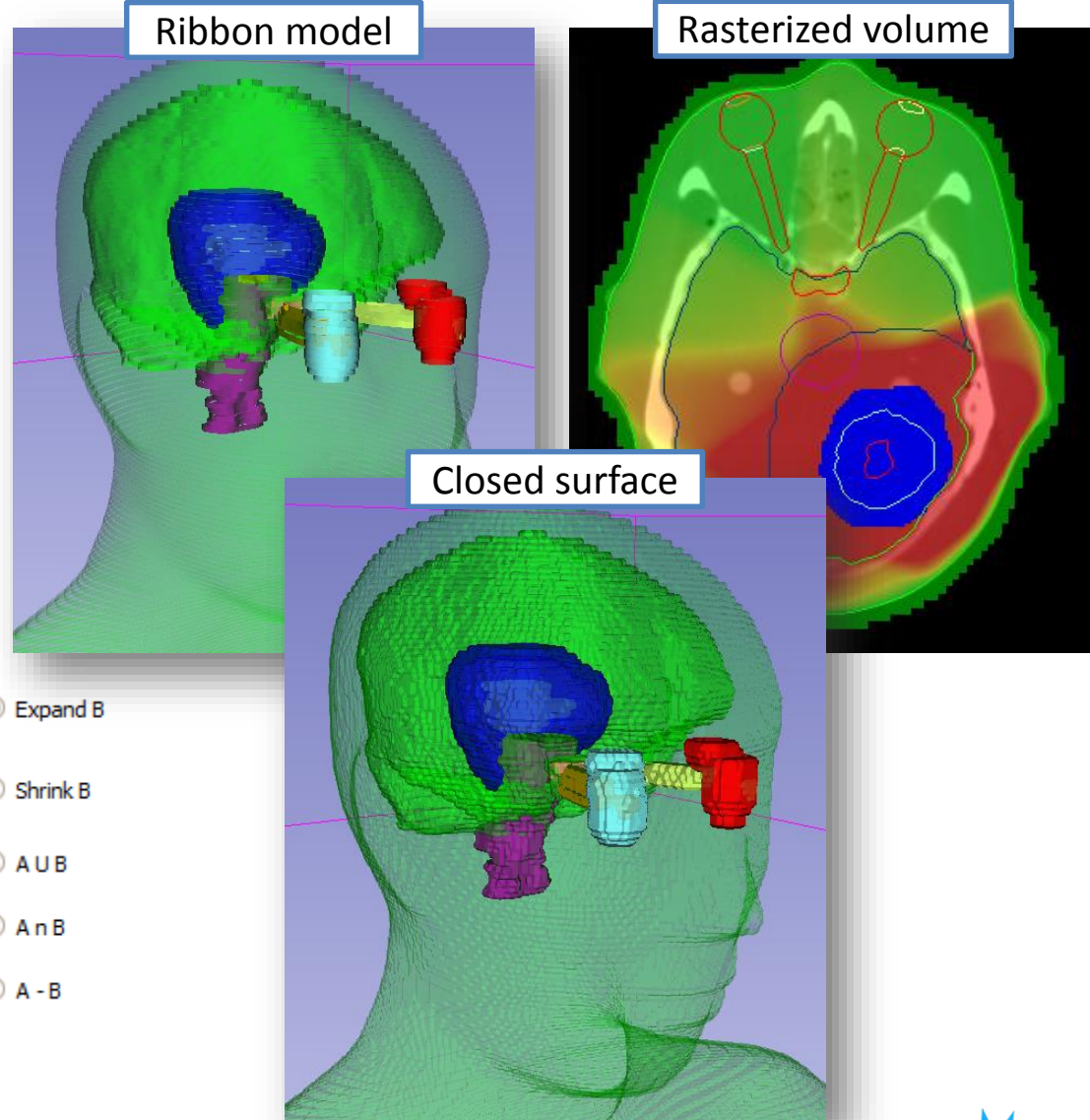
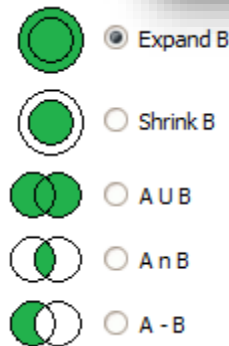
- Import integrated into core DICOM import plugin mechanism
- Supported data types:
 - RT structure sets
 - Contours
 - Fiducial point
 - RT dose map
 - RT image
 - RT plan
 - isocenter, beams
 - Planning CT, MR, etc.
- Basic DICOM-RT export is implemented



Standard layout after loading phantom dataset

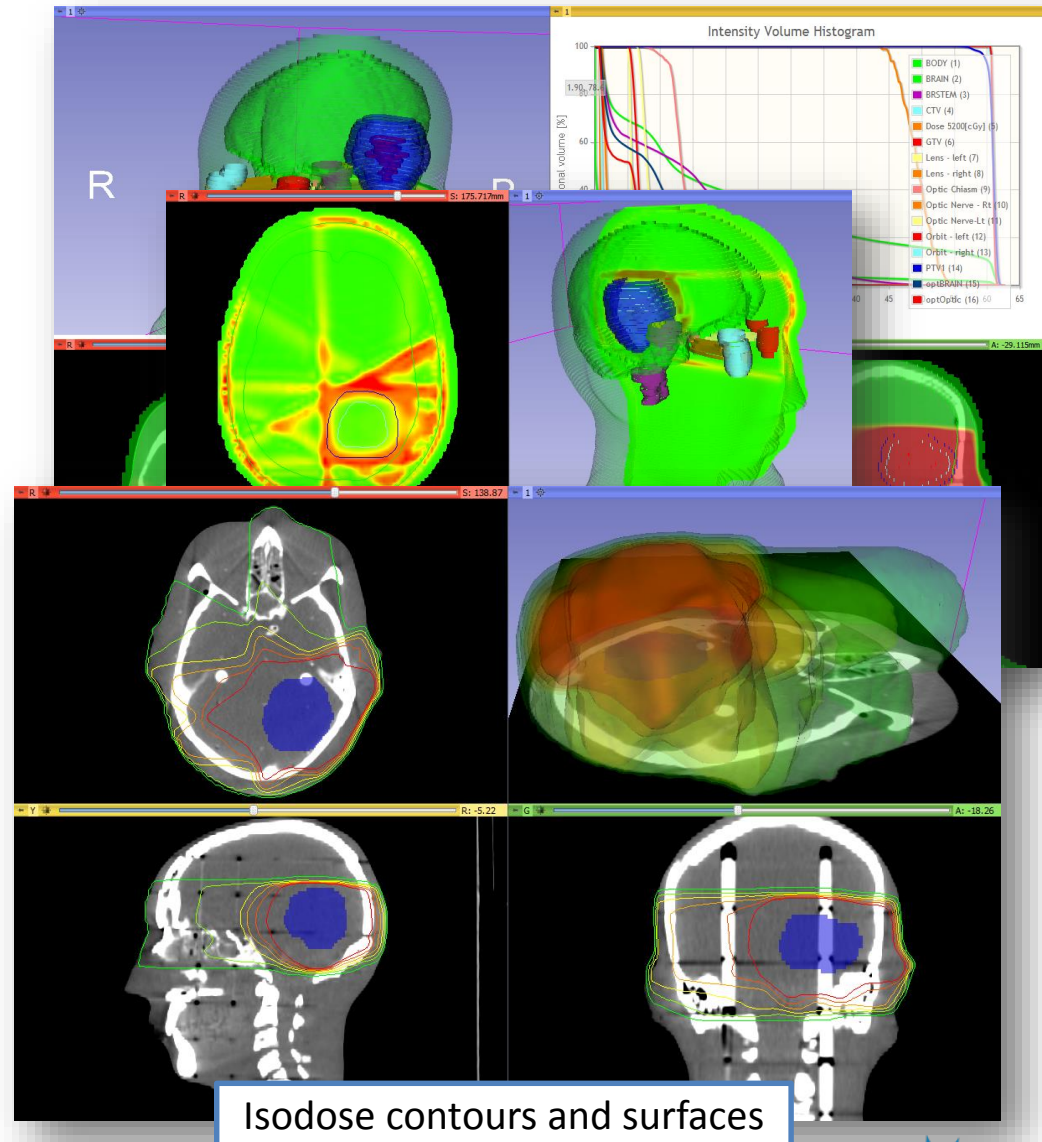
Contour analysis

- Multiple representations (automatic conversion)
 - Ribbon model
 - Rasterized volume
 - Closed surface model
- Contour comparison
 - Dice coefficient
 - Hausdorff distance
- Contour morphology
 - Expand, shrink
 - Combine using logical operators



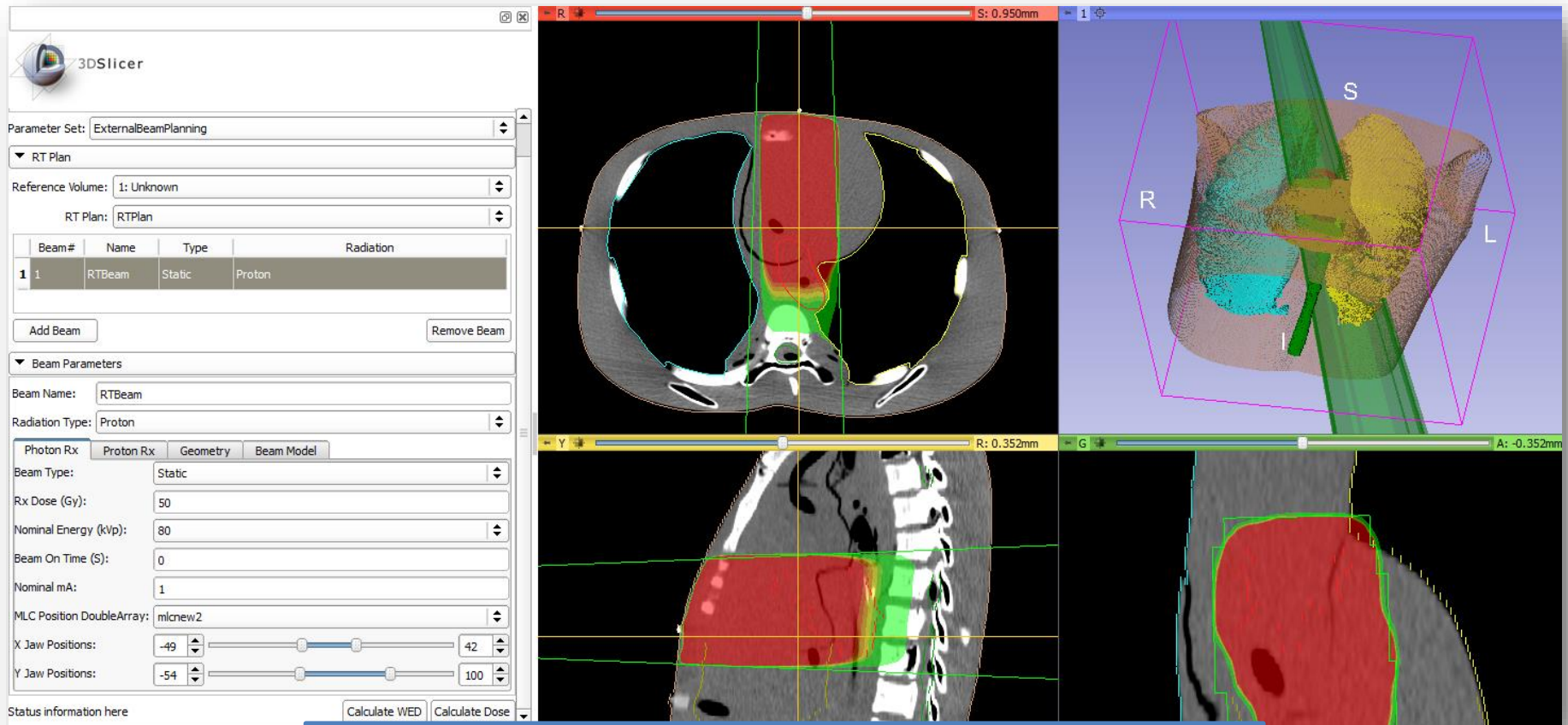
Dose analysis

- Dose volume histogram (plot visualization + metrics)
- Dose accumulation
- Dose comparison (gamma)
- Isodose contours / surfaces
- External beam planning (photon, proton)
- Registration
 - BSpline registration
 - Landwarp registration



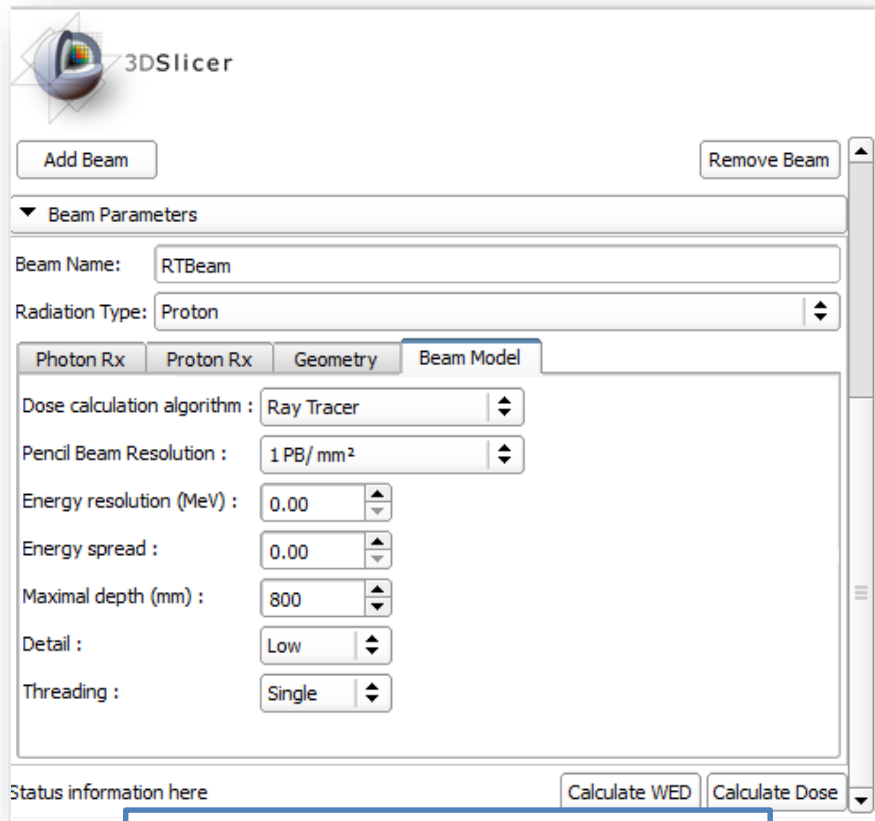
External beam planning

This module provide basic framework for RT planning and dose calculation for photon and proton

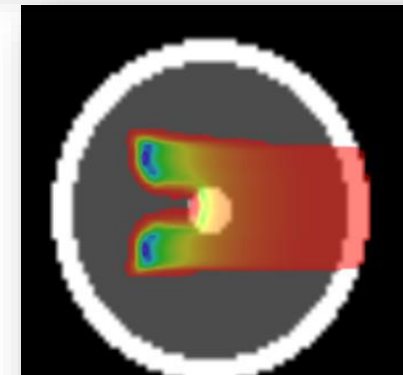
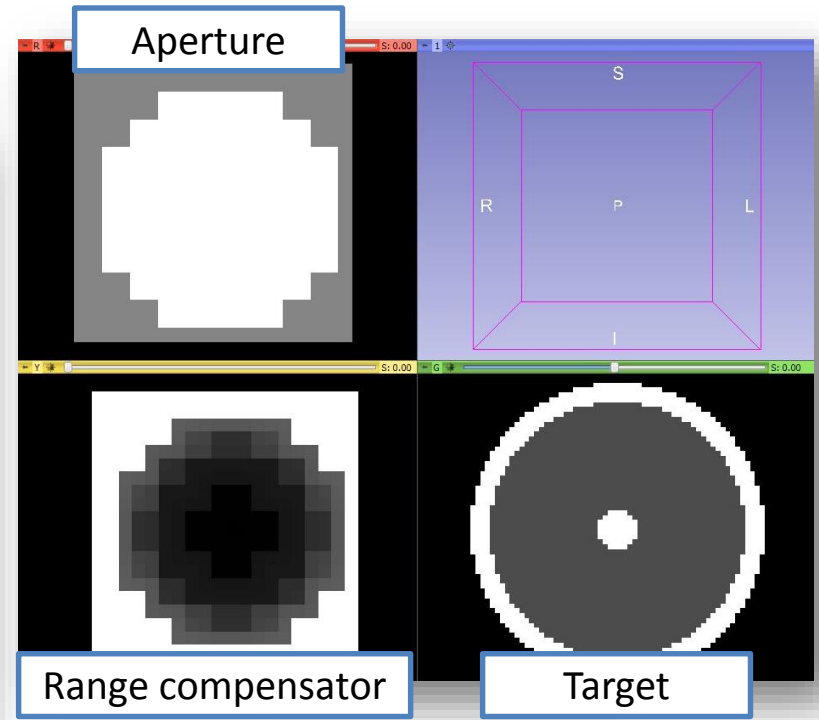


Photon MLC beam created in external beam planning module

External beam planning - proton



External beam planning module UI

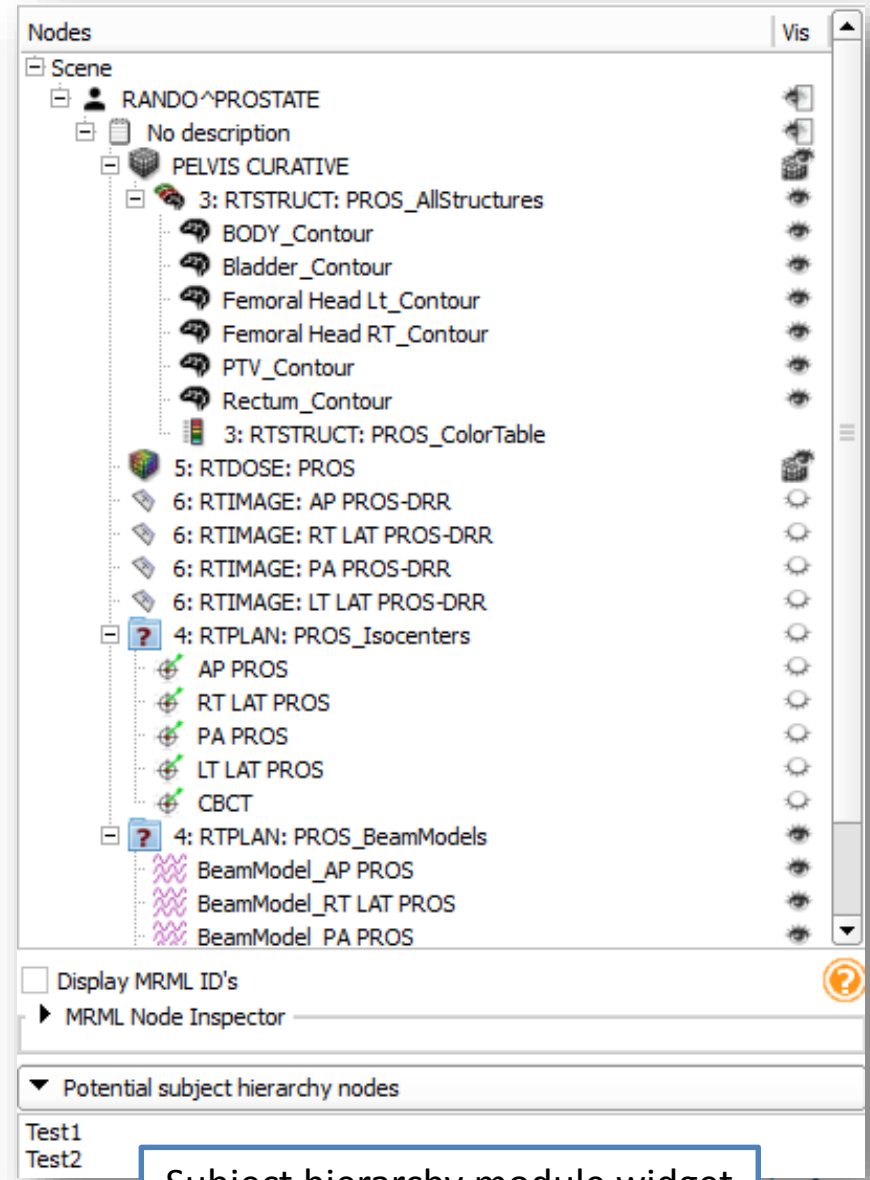


Beam dose distribution

Subject hierarchy

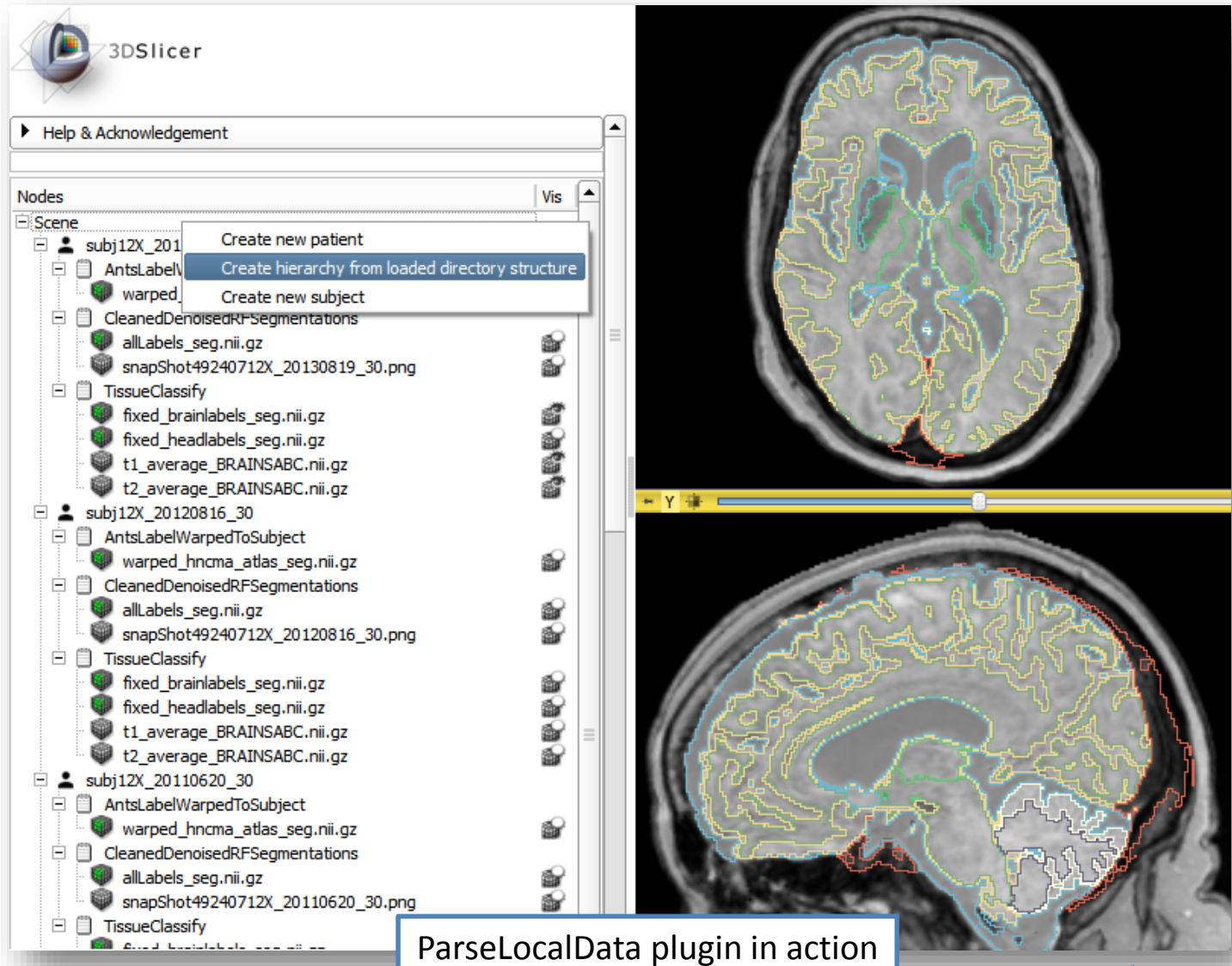
New concept for organizing data

- Nice and intuitive way of organizing and handling data
Bring basic features in a data-centered tree view, such as
 - Show/hide
 - Transform branch
- Extendable through plugins
Broad API allowing many customizations, such as
 - DICOM export
 - Registration



Subject hierarchy - plugins

- Default
- DICOM
- Volumes
- Registration
- Parse local data
- Contours
- RT objects
- Many more to come ...

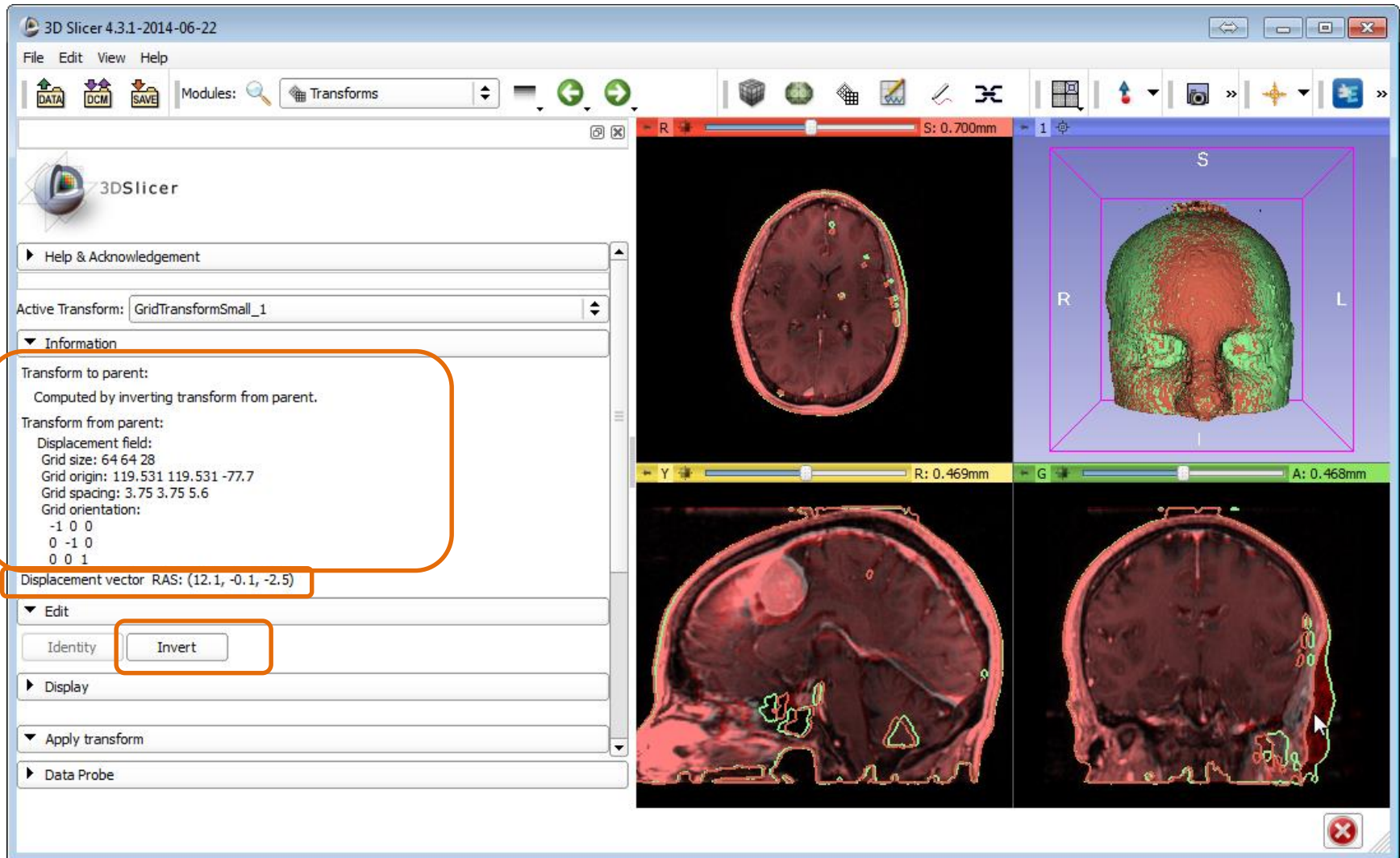


Non-linear transform support

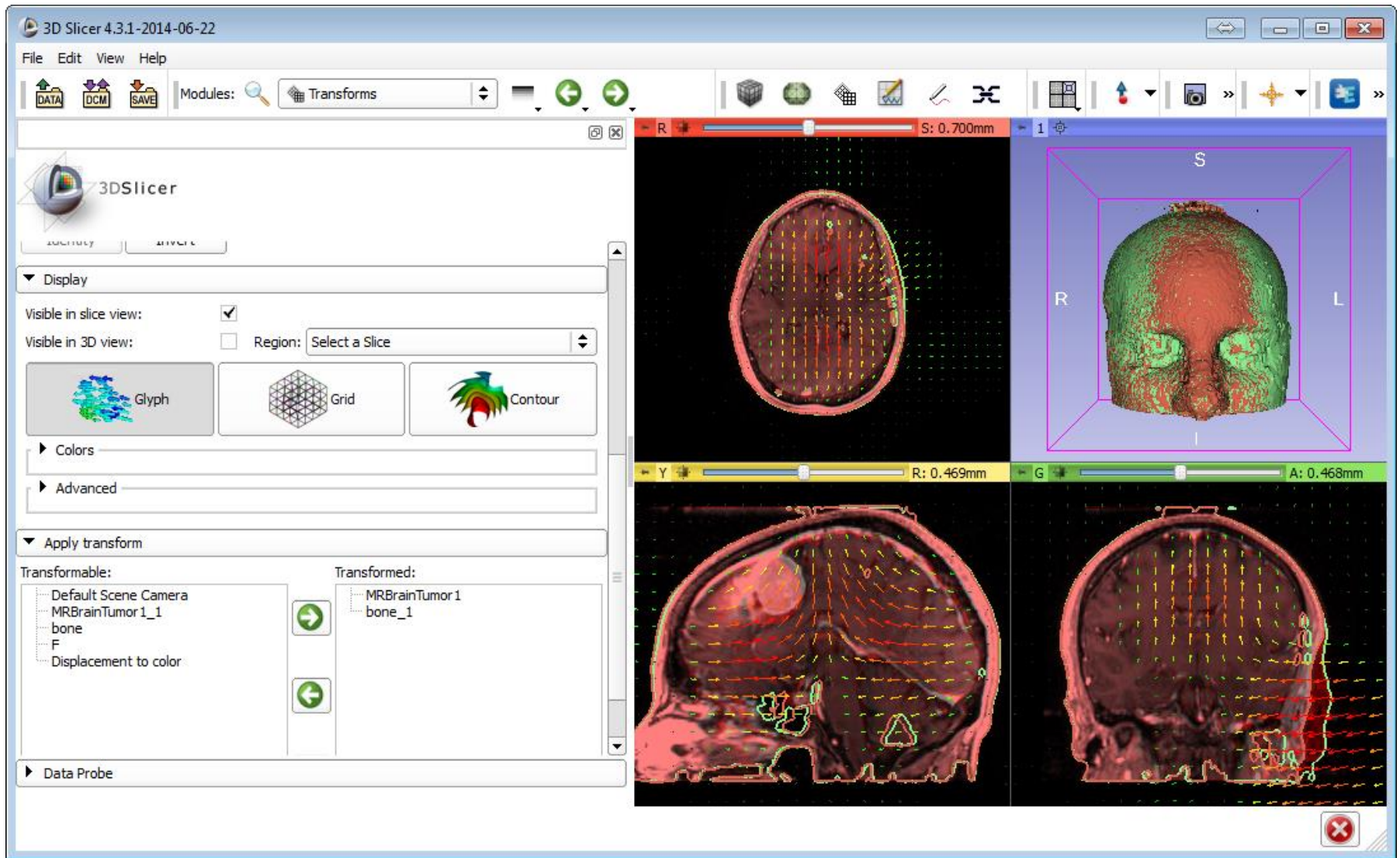
- Transforms are applicable in “real-time” to
 - Volumes (slice views, slice view in 3D)
 - Models (3D view, slice intersection)
 - Markup points, ruler
- Transform types
 - Linear
 - B-spline: arbitrary grid orientation, optional bulk transform
 - Grid (displacement field): arbitrary grid orientation
- Operations
 - Display
 - Invert
 - Combine
- Limitations
 - Volume rendering, processing in CLI modules: not real-time, need to harden transform
 - Composite transform cannot be saved
 - Annotation ROI transform is limited
 - Not possible to define a “reference” volume when hardening a transform



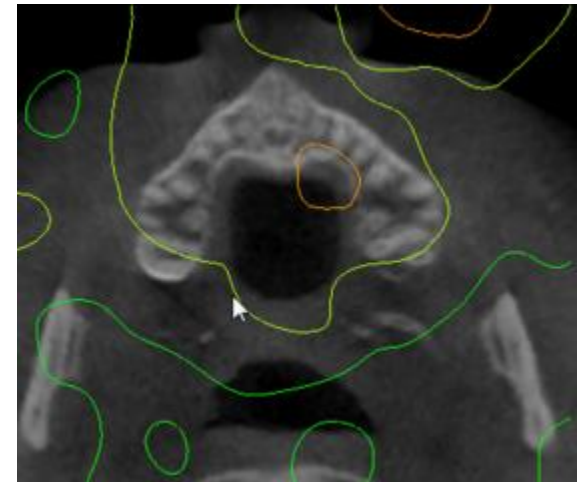
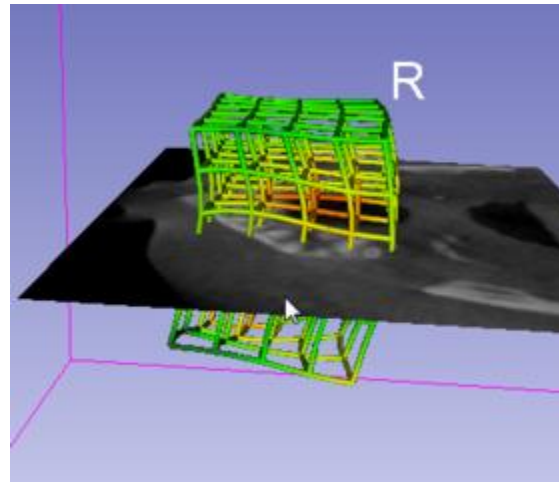
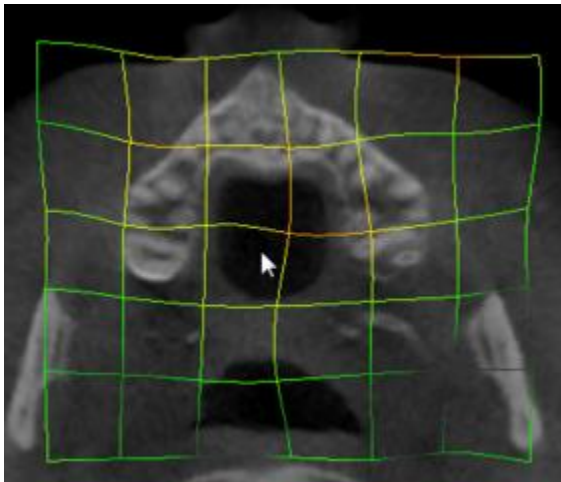
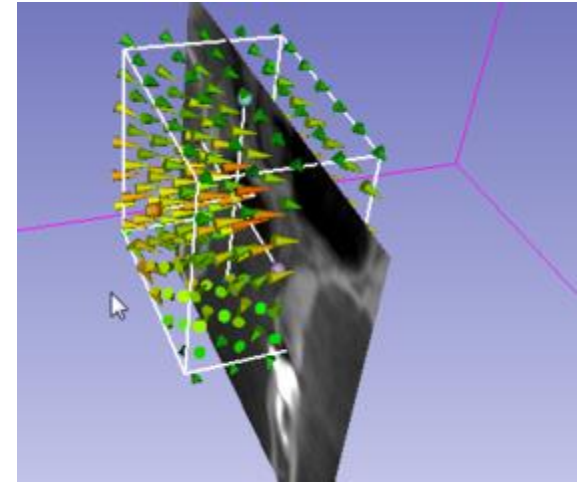
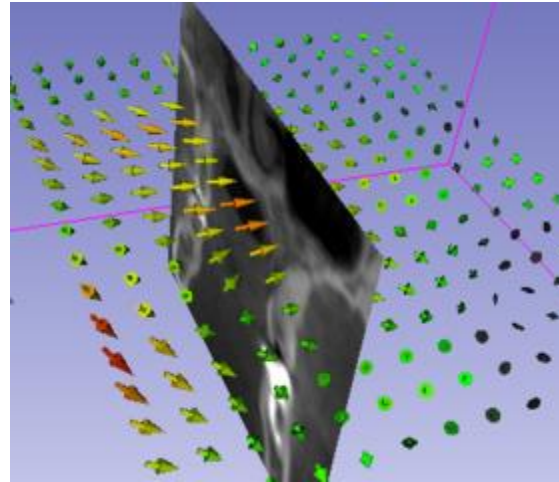
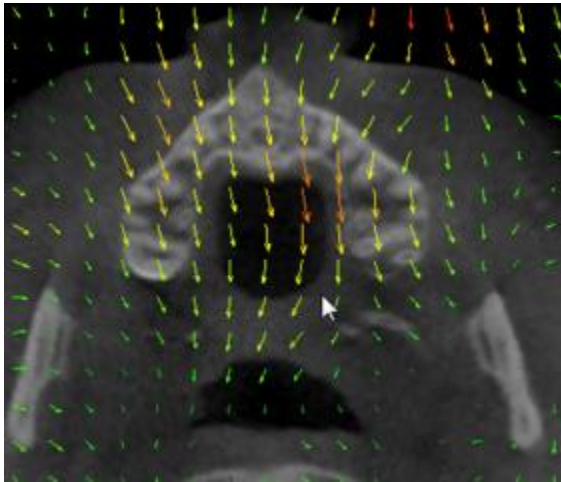
Transform info



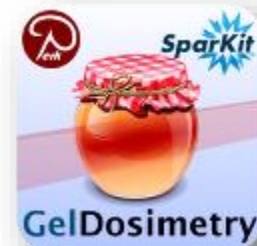
Transform display



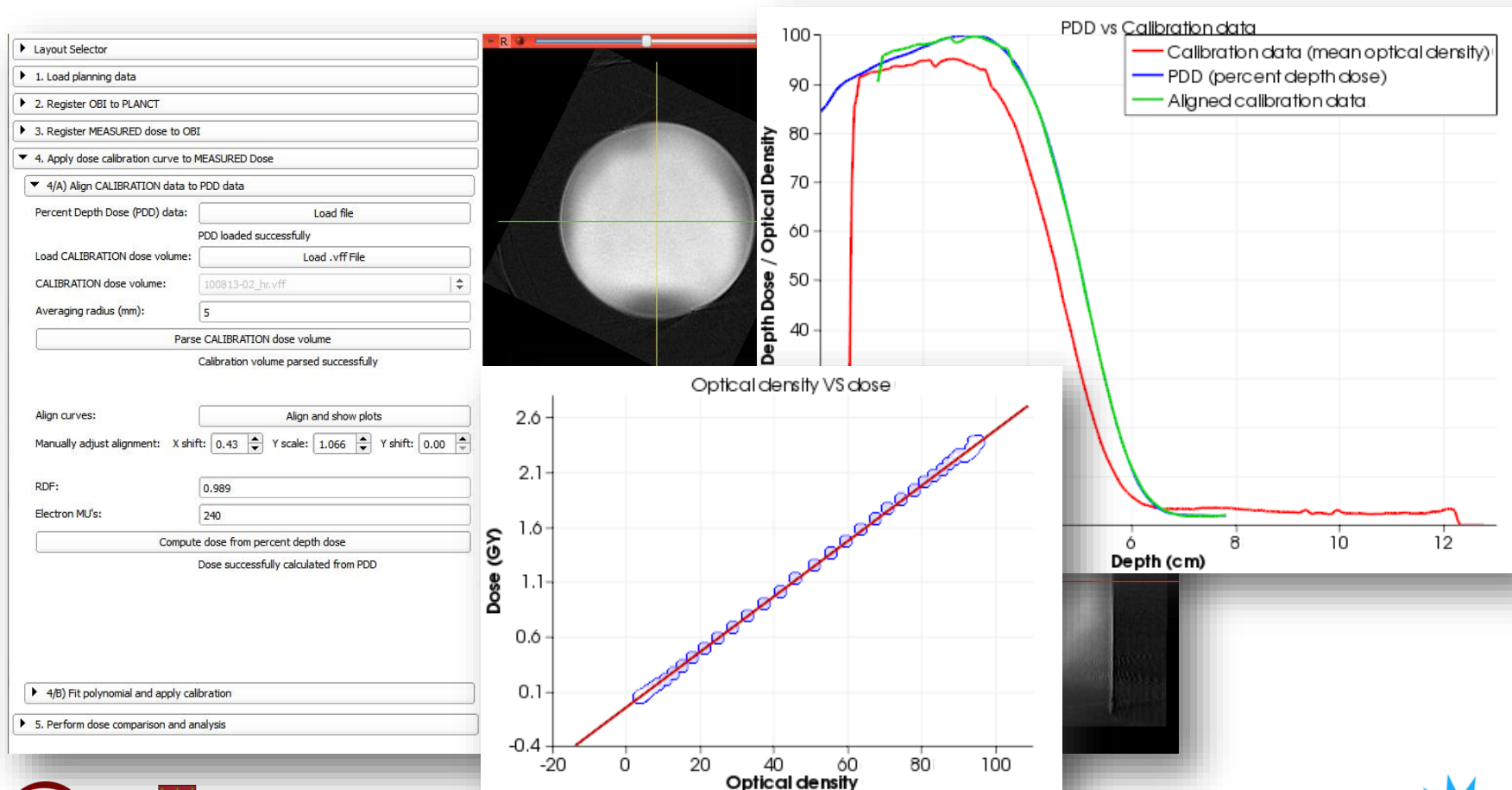
Transform display



Gel dosimetry analysis

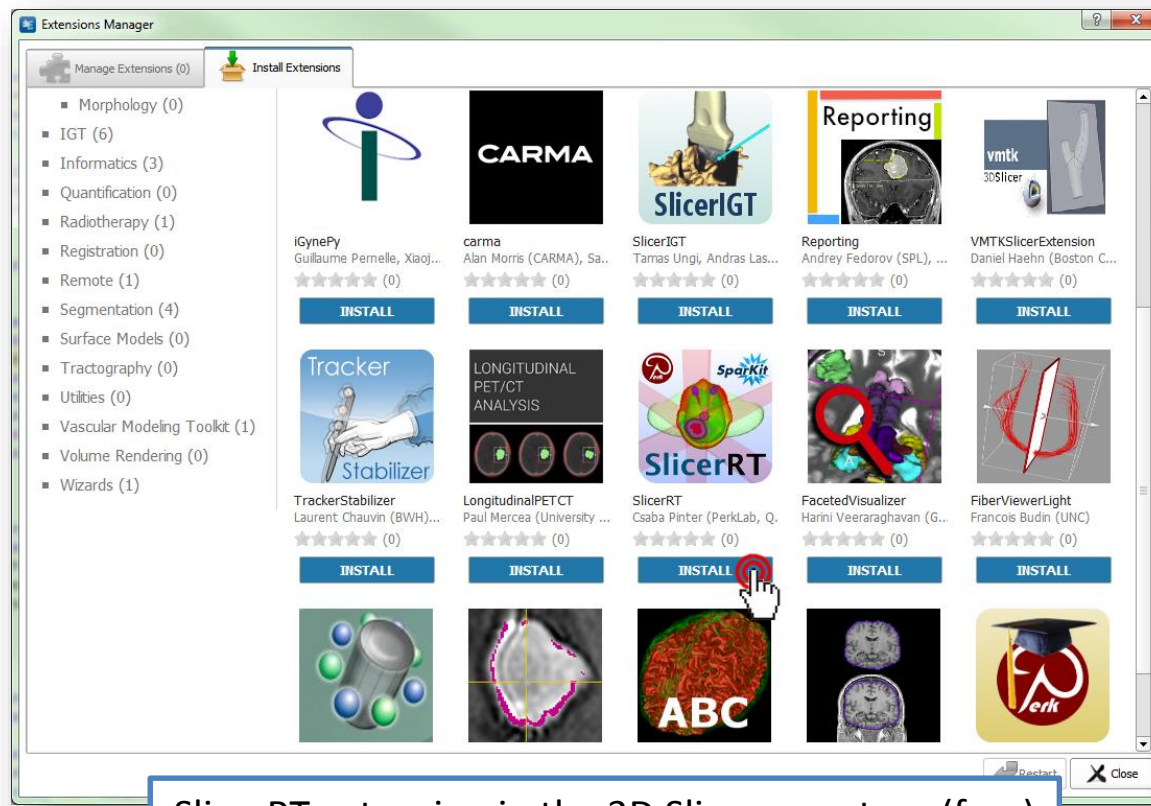


- “Slicelet” for gel dosimetry analysis workflow
- Wizard-like simplified user interface



SlicerRT extension for 3D Slicer

- Collection of RT-specific modules, includes *Plaslimatch*
- Distributed as a 3D Slicer extension: can be downloaded, installed, upgraded using the extension manager in Slicer



SlicerRT extension in the 3D Slicer app store (free)

Next steps

Planned for the next 6 months:

- DICOM-RT export
- External beam planning
- Contour mechanism – integration to 3D Slicer core
- Digitally reconstructed radiograph (DRR)
- Rasterization evaluation and improvements
- Scripting examples
- More testing and validation

More information: <http://SlicerRT.org>



Thank you for your attention!

