DTI Atlas Registration via 3D Slicer and DTI-Reg

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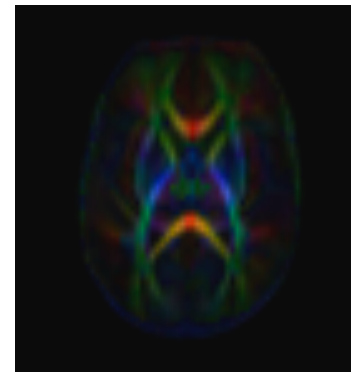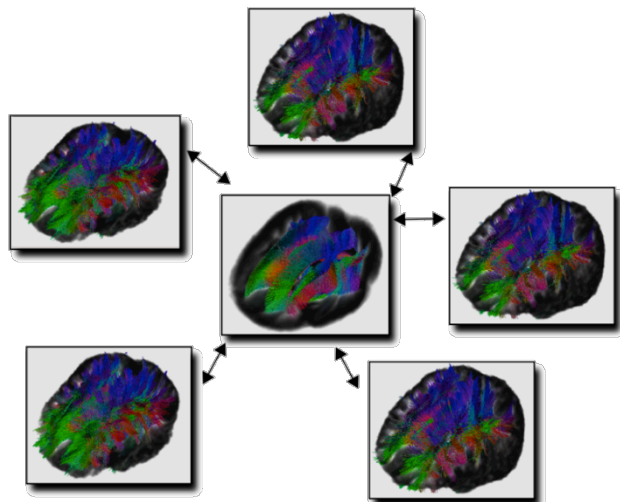
Clement Vachet, UNC

DTI Registration

- This tutorial teaches you how
  - Load DTI datasets & masks
  - Perform a pair-wise registration to a prior atlas via DTI-Reg
    - Affine transform and deformable transform
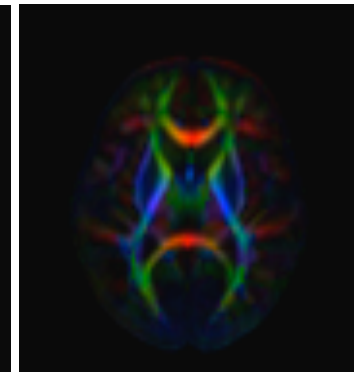 - Save the transformed images and the deformable transform
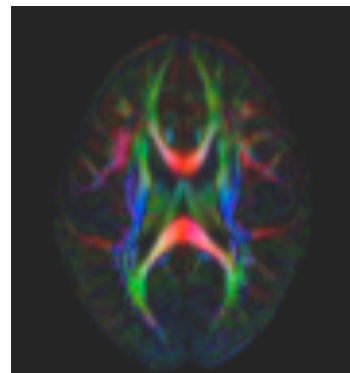
DTI Population Atlases

- Definition of standard space
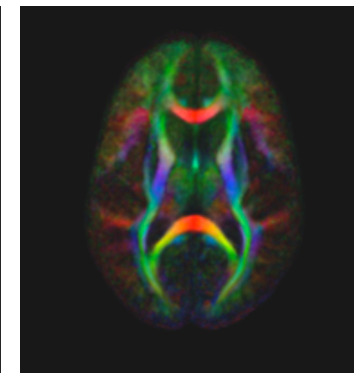- SNR increase
- Better tractography

Neonate
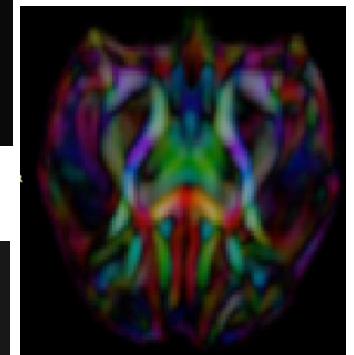
1 year

2 year

Adult

Rhesus (15mo)

Dataset

For this tutorial you will need some DTI data files that can be found on this link :
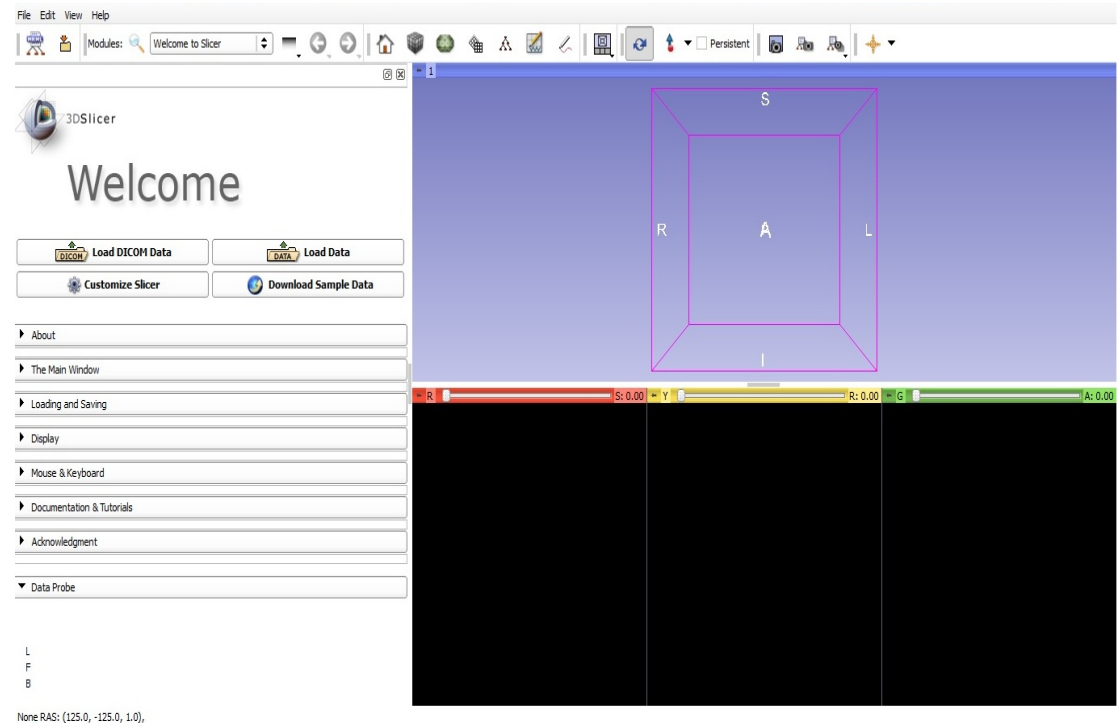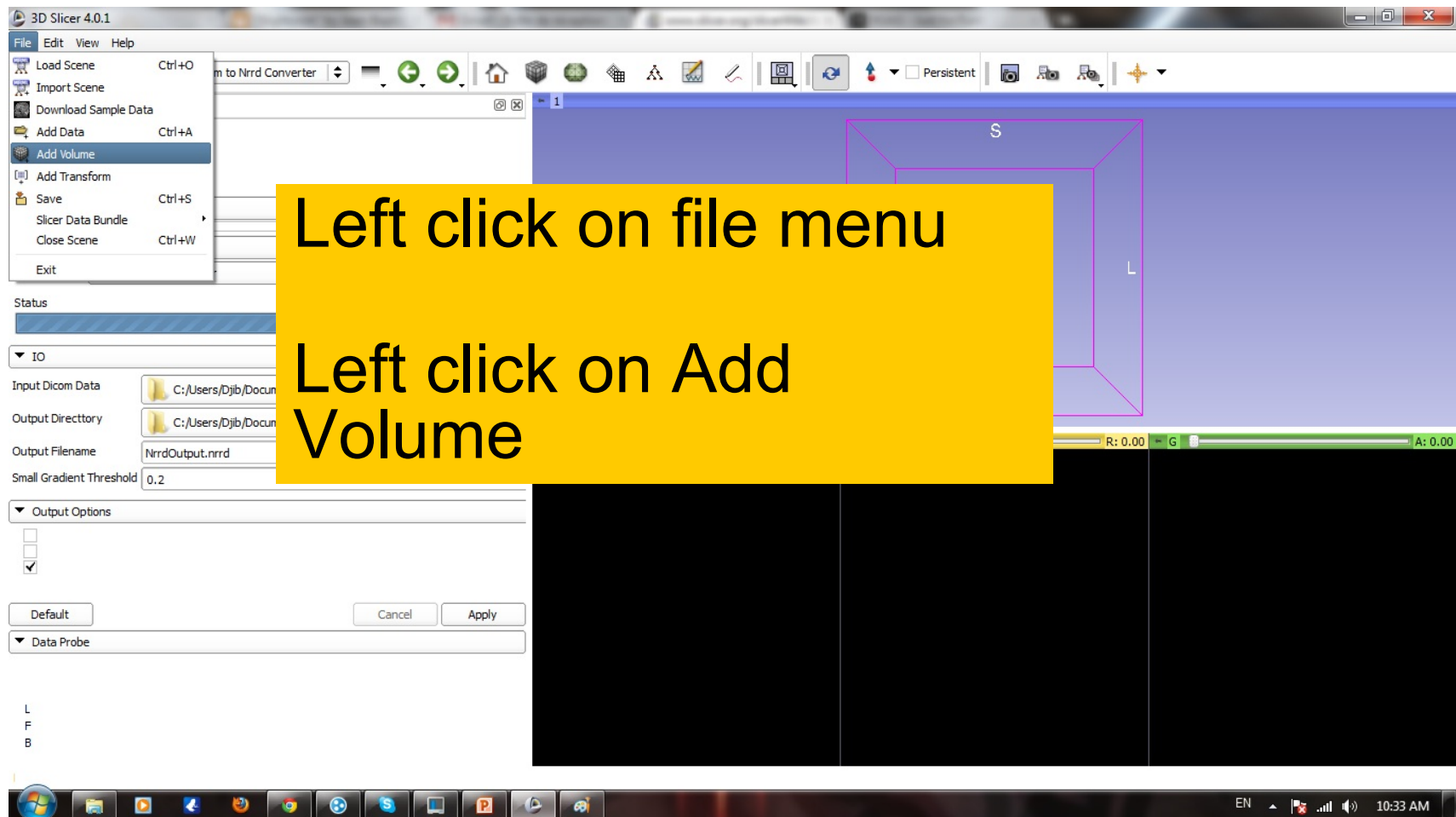http://hdl.handle.net/1926/1759

Start Slicer 4

Linux/Mac users :
Launch the Slicer executable located in the Slicer4 directory

Windows users :
Select Start→All Programs→Slicer4.0.1→Slicer

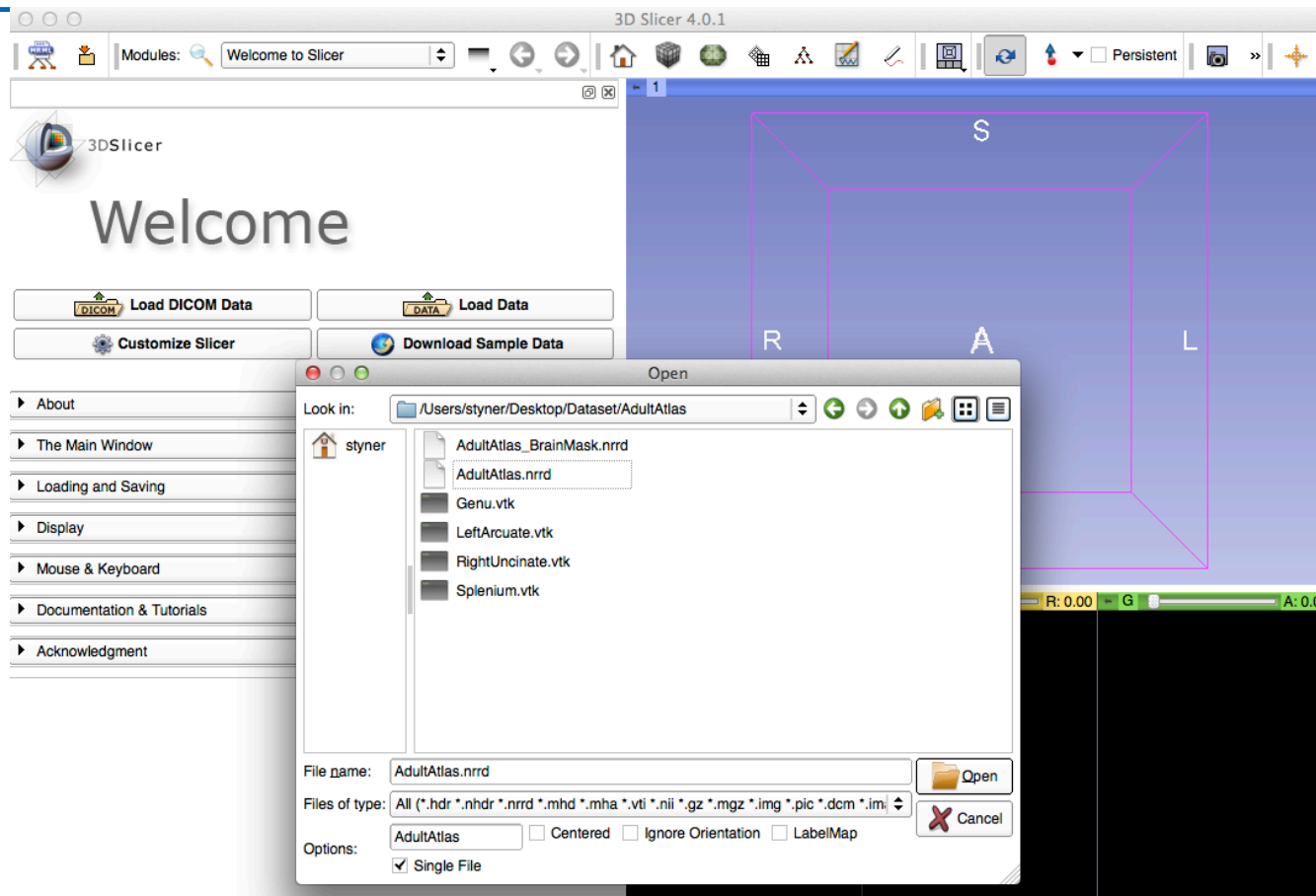Or launch the Slicer executable from Slicer4 directory

National Alliance for Medical Image Computing   *http://na-mic.org*

Loading DTI Atlas
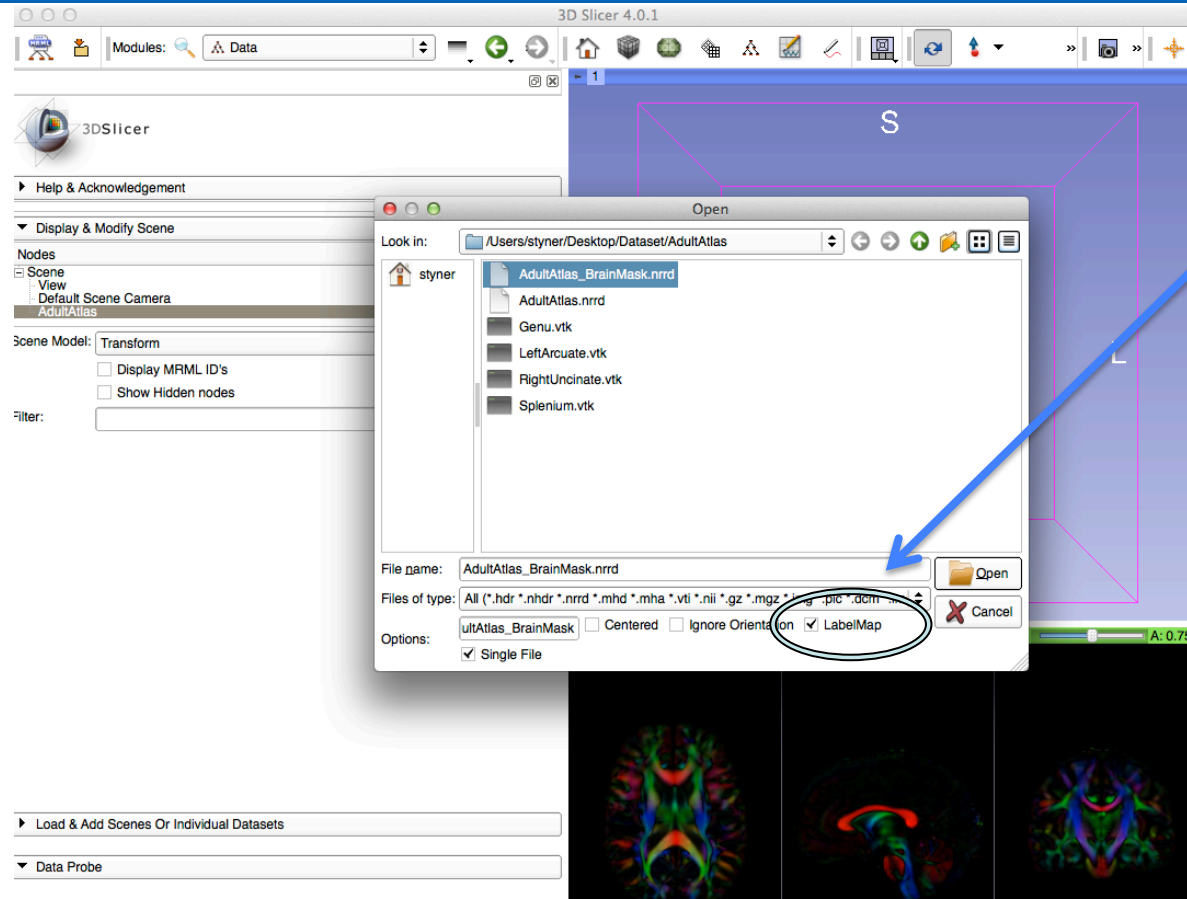

Left click on file menu

Left click on Add Volume

Loading DTI Atlas

Select the AdultAtlas.nrrd volume

Loading DTI Atlas Mask

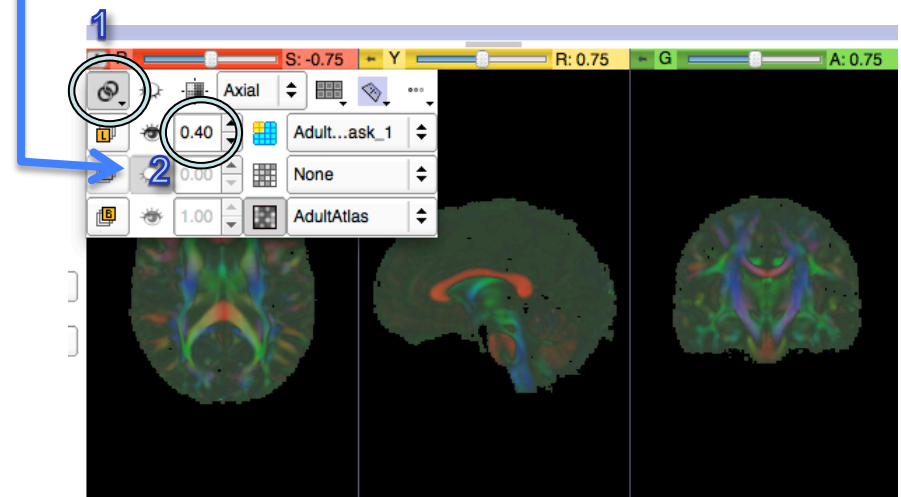Load AdultAtlas_BrainMask.nrrd label map

Adjust View

- Adjust view to see both mask and atlas
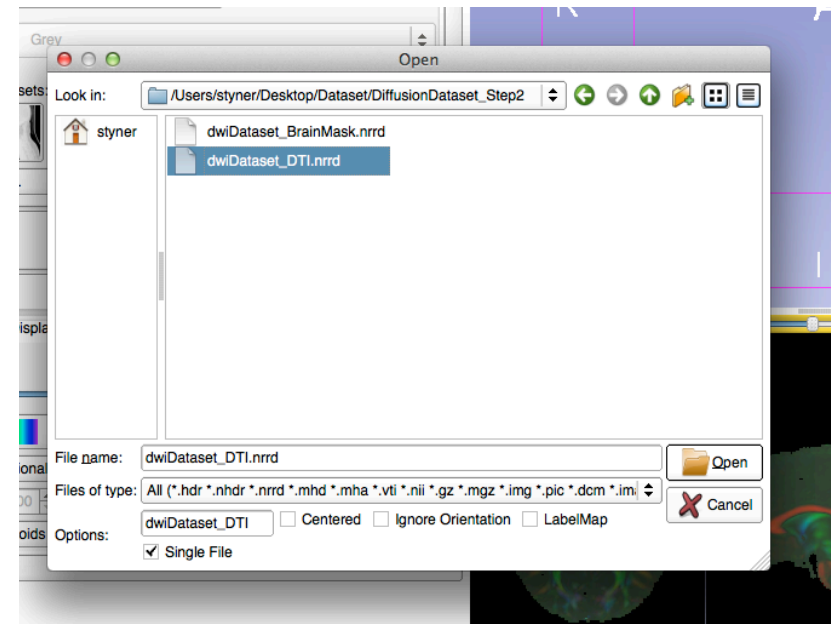1. Link all 3 viewers
2. Opacity change

Loading DTI dataset

- File Menu =>Add Volume (or use from previous tutorial)
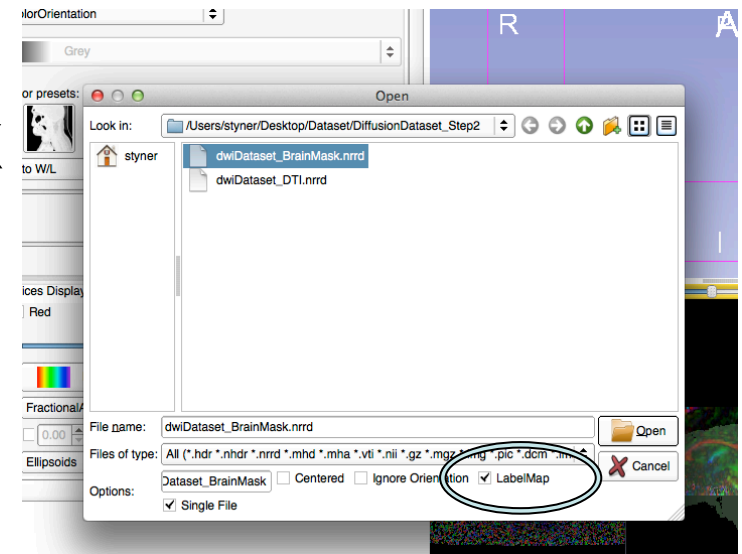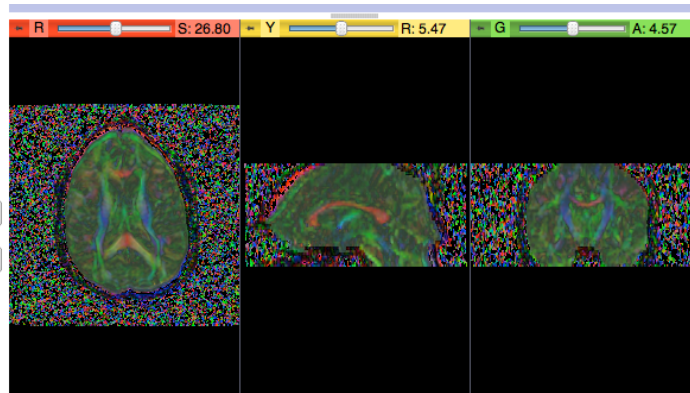
- DiffusionDataset_Step2

- Load DTI NRRD

Loading DTI dataset mask

- File Menu =>Add Volume (or use from previous tutorial)

- DiffusionDataset_Step2
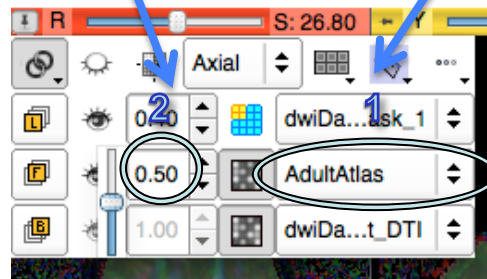
- Load BrainMask

- "LabelMap" checkbox
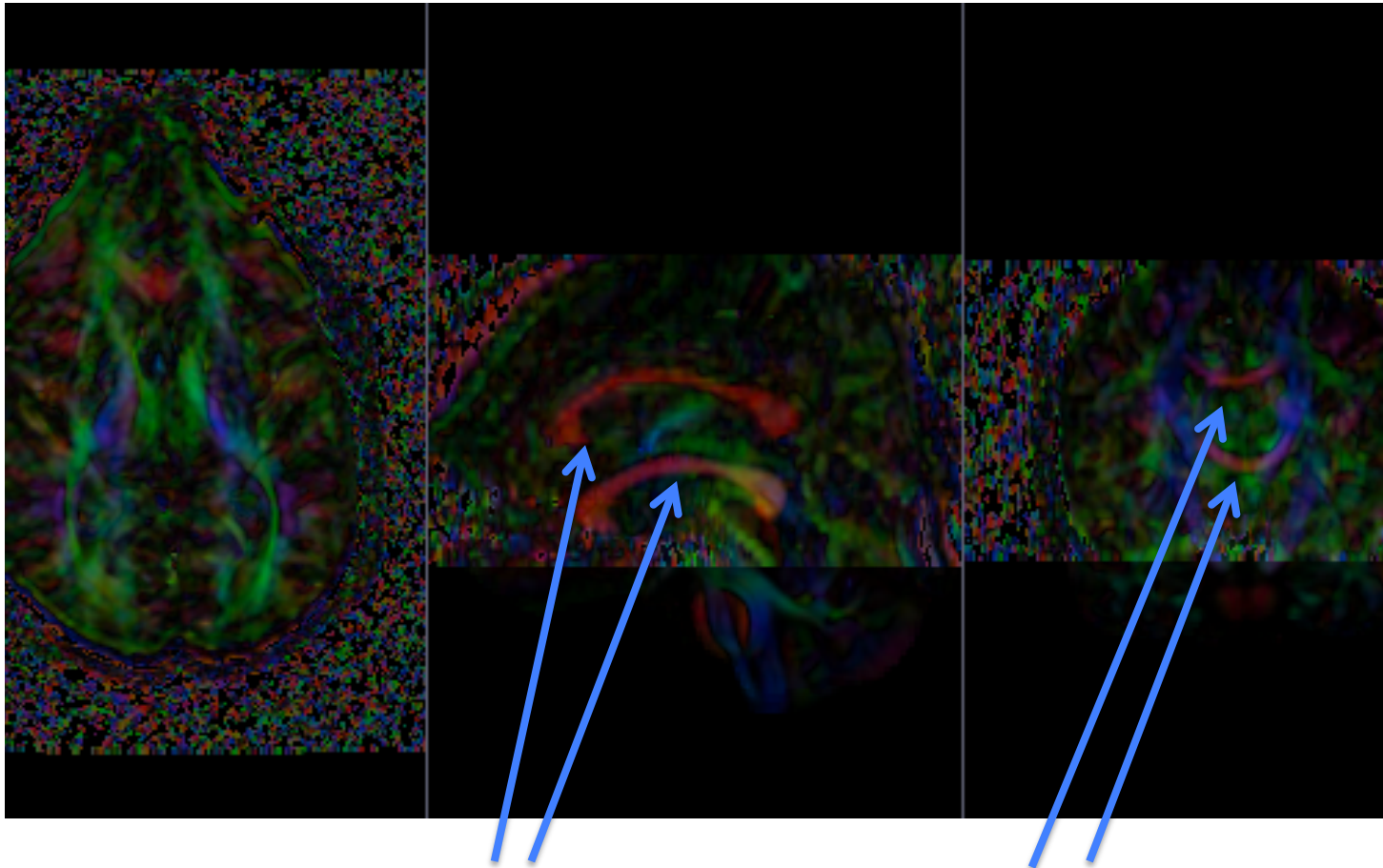
Overlay DTI datasets

- How can we check alignment?

- Overlay the DTI images!

1. Select AdultAtlas for Foreground
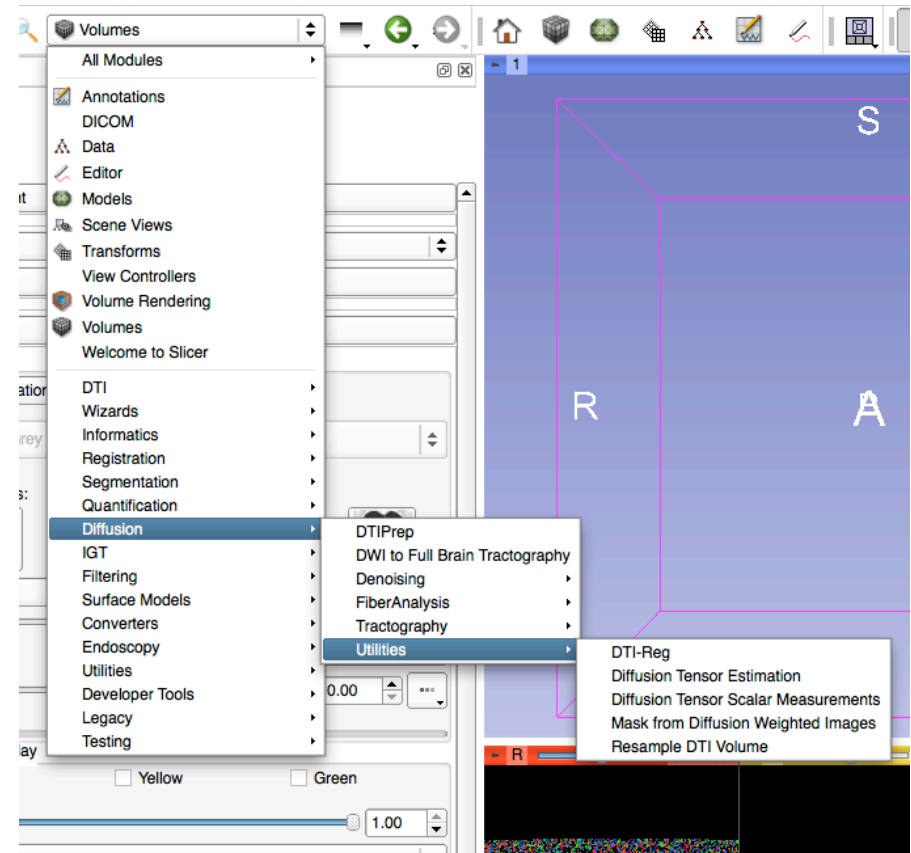2. Set Opacity to 0.5

Overlay

Bad alignment: 2 separate corpus callosum

Select DTI-Reg Module

- Slicer modules
  1. Diffusion
  2. Utilities
  3. DTI-Reg
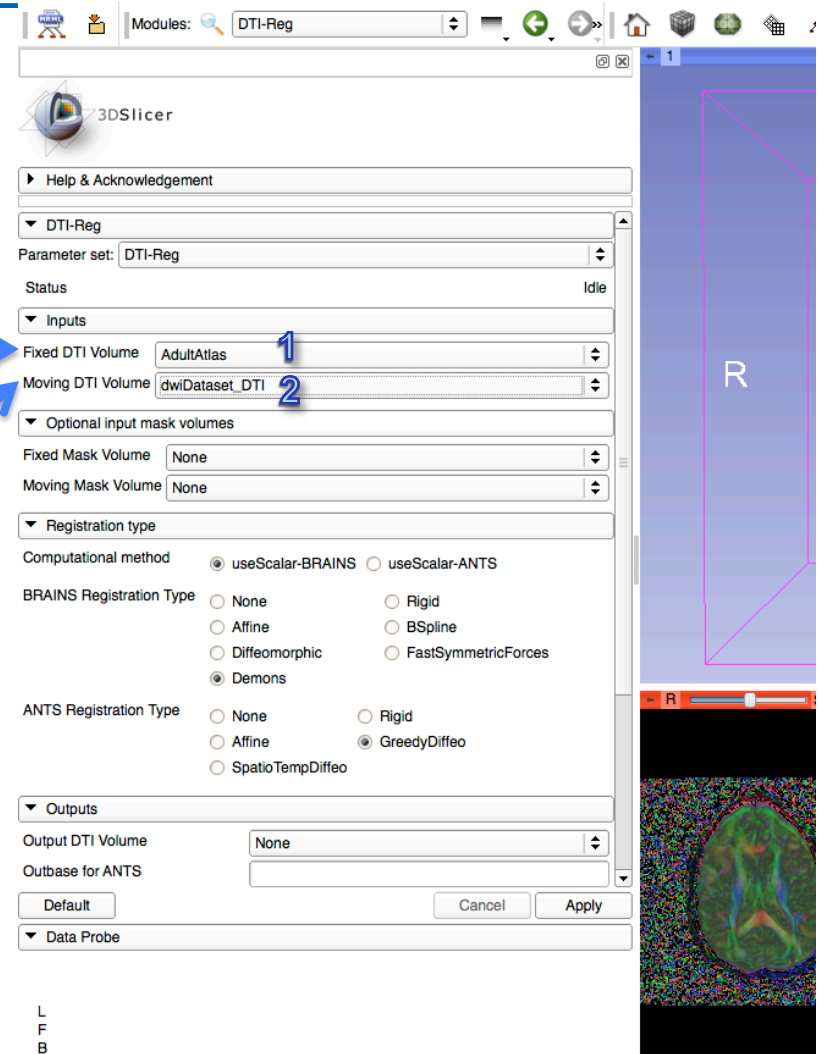- Pairwise DTI registration module

Volumes for Registration

1. Fixed Volume = Target of registration = Atlas DTI

2. Moving Volume = DTI dataset

Set Masks for Registration

1. Set Fixed Mask to Atlas Mask

2. Set Moving Mask to dwiDataset Mask

Set Transform to Affine

- Set registration transform to Affine

- Registration is performed in 2 steps

- Future versions: all in 1 step

- If you have ANTS pre-installed => select it!

Select Outputs

- Create & rename volumes for output

1. Affinely registered DTI dataset

2. Affine transform

- Apply to run & wait
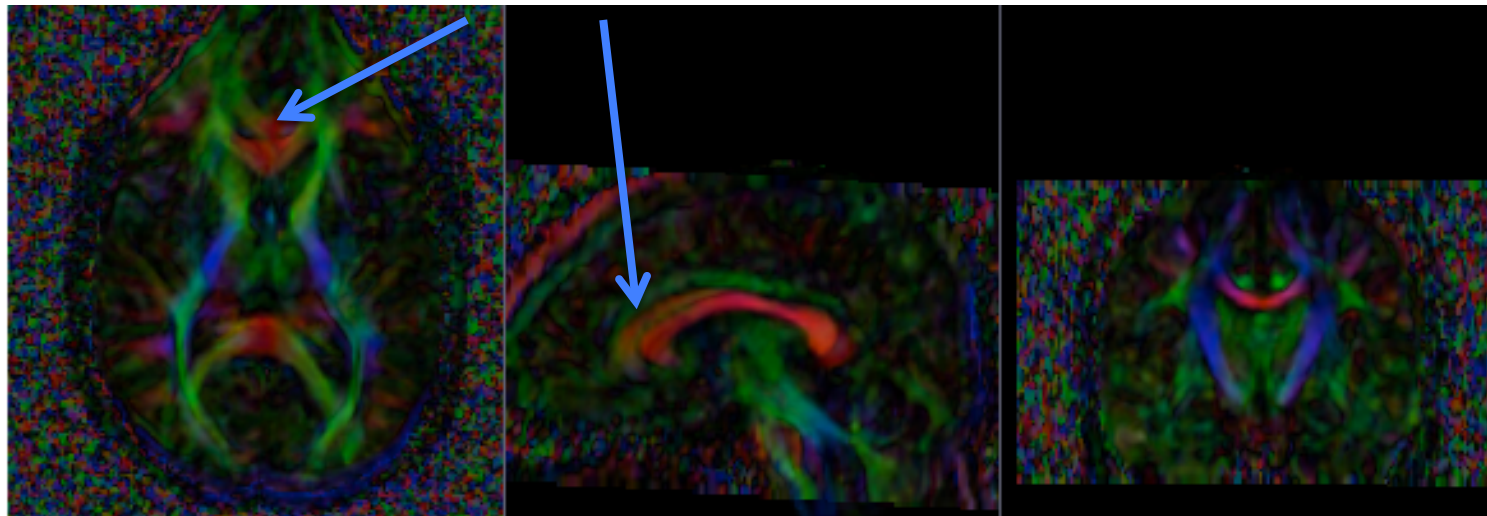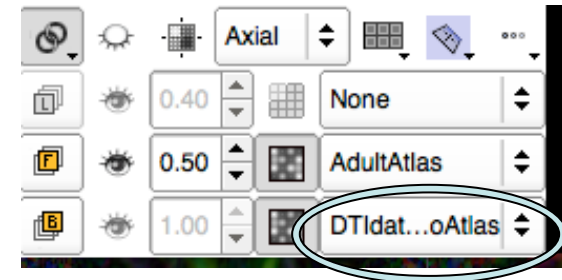
Registration

- Many pairwise methods exist

- DTI-Reg supports several registration methods based on calibrated FA image

    - Affine, B-spline, Demons-variants from within Slicer

    - ANTS as external call (necessitates ANTS installation)

- Future versions will also support DTI-TK

    – Registration based on full tensor

Affine Results

- Select DTI-Reg result as background

- Result: single corpus callosum, but fuzzy, insufficient registration

Deformable Registration

1. Change moving volume to affinely registered data

2. Change moving mask to atlas mask

3. Change registration to Diffeomorphic (Demons)

4. Add Deformation volume outputs

Deformable Results

- Select DTI-Reg deformable result as background

- Result: No longer fuzzy, great registration
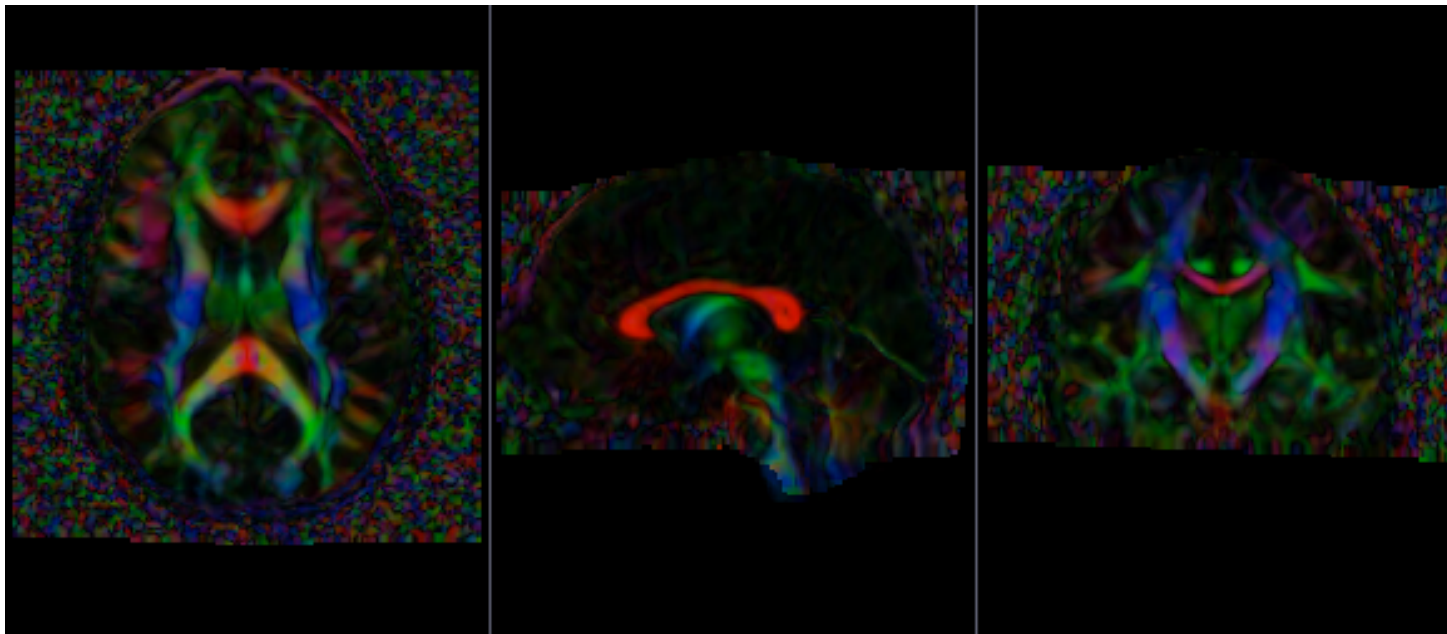
Save Outputs and Done

- Save all volumes and transform
  - Need: Affinely registered volume & Deformation field

Conclusions

- DTI registration is available in Slicer

- 2-step process currently, to be improved soon

- Brainmasks are needed (unless data is skull stripped already)

- This tutorial taught you how to register to an atlas

  – Next step: how to use the atlas for fiber base analysis

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