BrainSuite Lab Exercises

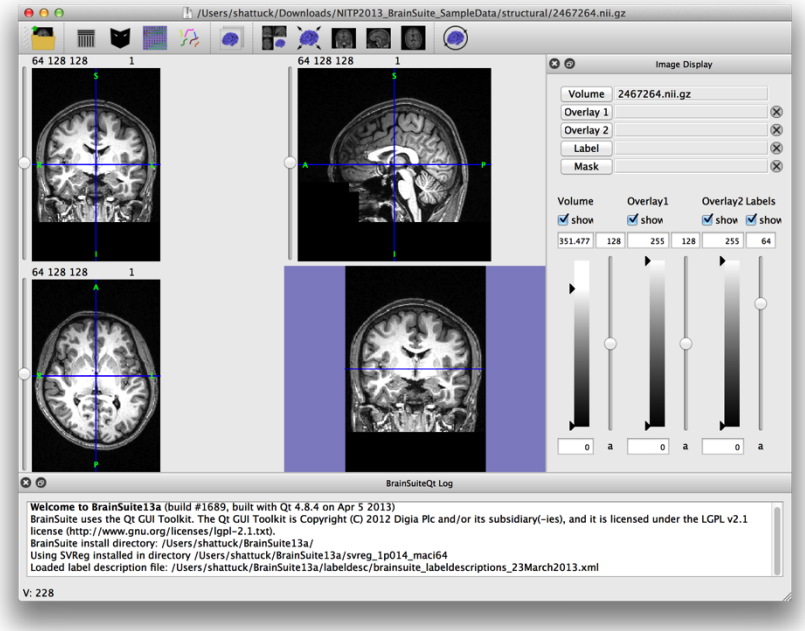
presented at the UCLA/NITP Advanced Neuroimaging Summer Program

29 July 2014

1. Opening and Displaying an MRI

- Start BrainSuite
- Drag and drop the T1 image from the native space folder onto the interface

  structural/2467264.nii.gz
- Navigation:
  - Scrolling the sliders or click in the image windows
  - Click and drag the mouse in the 3D view to rotate the display
  - Ctrl+click to zoom
- Press the 'I' key to open the Image Display Properties controller
  - Adjust the intensity ranges
  - Right-click to change colormaps



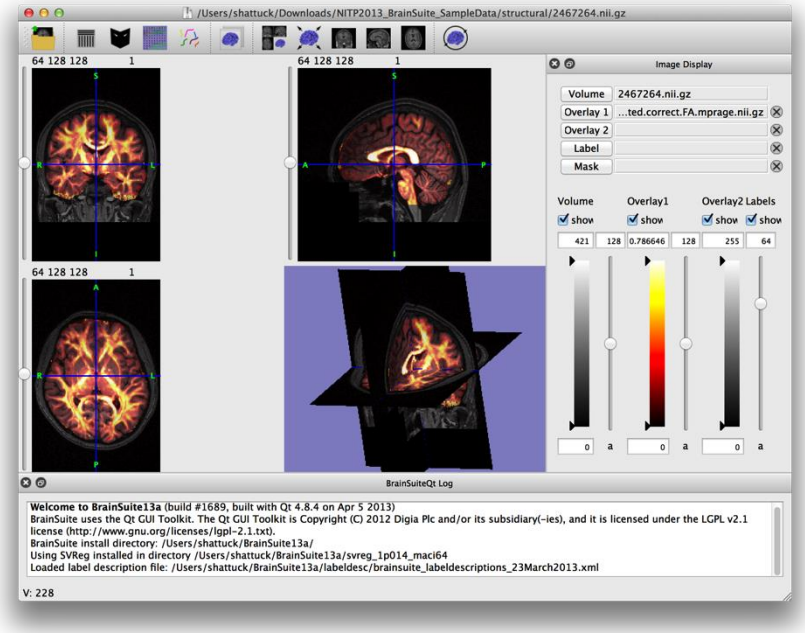
2. Opening an Overlay

Load an overlay image

- Press the Overlay1 button
- Select the FA file:

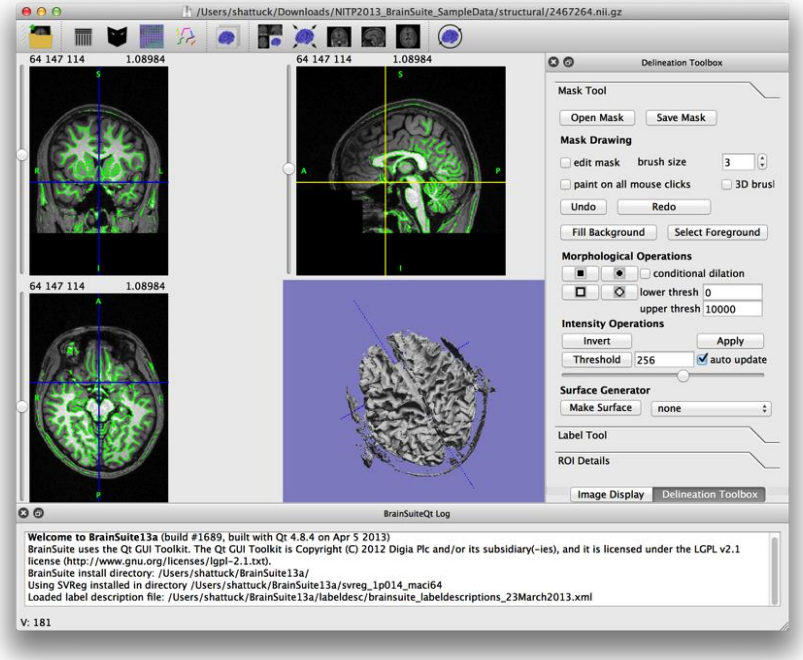
diffusion/DTI/2467264.dwi.RAS.correct.FA.T1_coord.nii.gz

- Adjust the first alpha slider to change the blending of the two images
- Change the colormap of the overlay



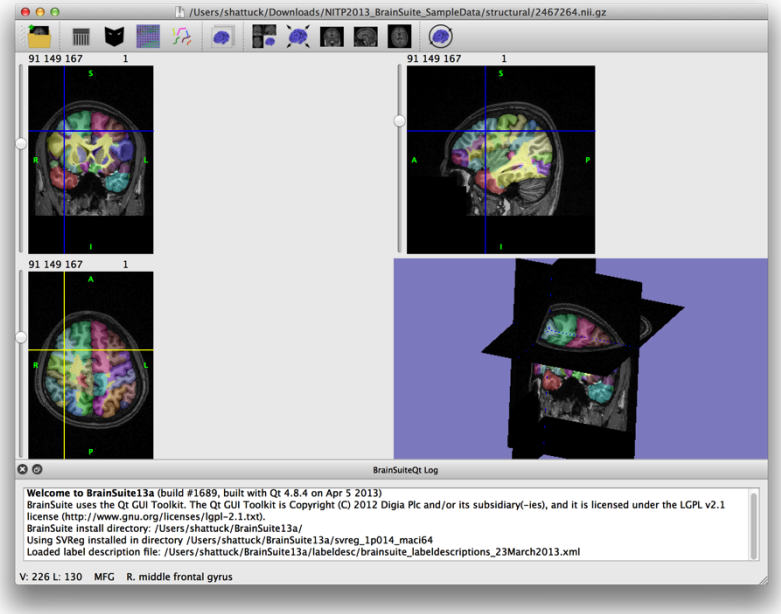
3. Mask and Surface Tools

- Open the T1 image as the primary volume
- Open the display properties and adjust the lower intensity range
- Press ‘M’ to open the mask tool
- Adjust the slider under Threshold, and see the mask boundary change.
- This will create a new mask as the slider moves.
- Set the value to 256.
- Press the ‘Make Surface’ button (you may need to enlarge the BrainSuite window to see this button)
- Press Ctrl-V to hide the slices in the 3D view



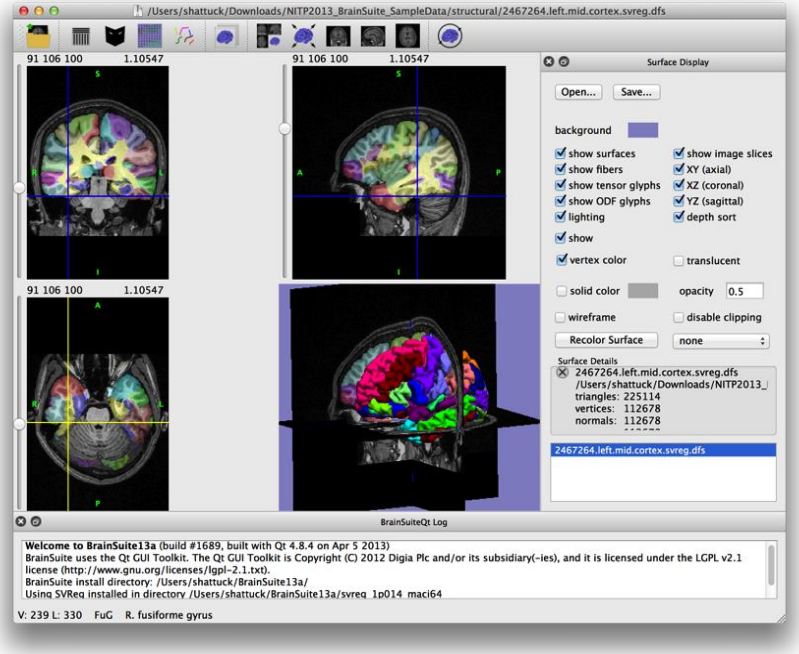
4. Working with Labels

- Load data from the structural directory
  - Load 2467264.nii.gz
  - Load 2467264.svreg.label.nii.gz as a Label image
- Each color corresponds to a different anatomical area as defined by BrainSuite
- Click the mouse on a labeled area, and the label is shown in the status bar.



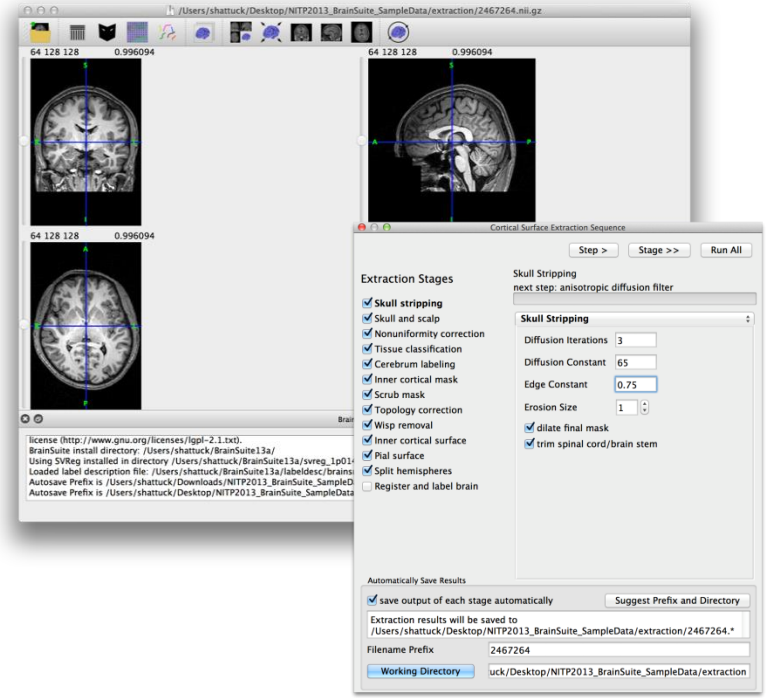
5. Working with Surfaces

- From the structural folder, drag and drop the file named 2467264.left.mid.cortex.svreg.dfs onto BrainSuite
- Properties of the different surfaces can be adjusted
  - Show or hide
  - Wireframe mode
  - Translucency
- Recolor based on different properties
  - Volumetric labeling
  - Curvature



6a. Extracting a Brain Surface

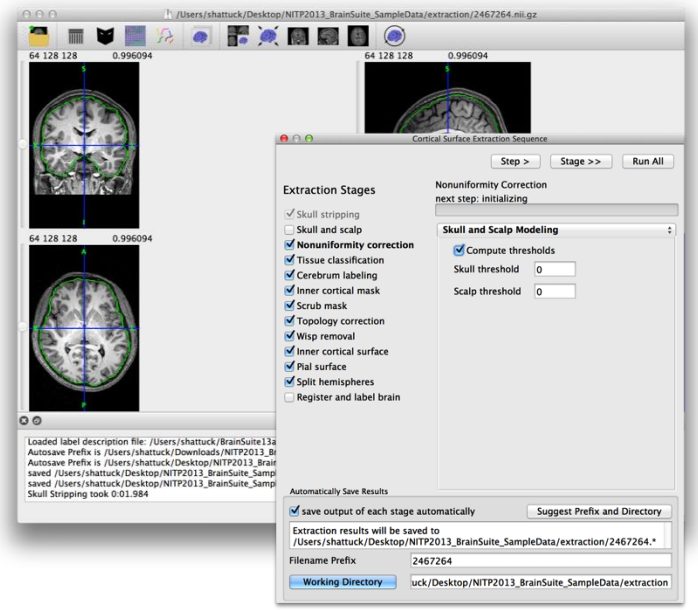
- Load the T1 image from the **extraction** folder*
- Open "Cortex -> Cortical Surface Extraction Sequence"
- Change the Skull Stripping parameters as follows:
  - Diffusion constant: 75
  - Edge constant: 0.75



* By default, BrainSuite's extraction dialog will write files to the same directory as the input image, so be sure to use the extraction folder rather than the structural folder, which contains pre-processed data.

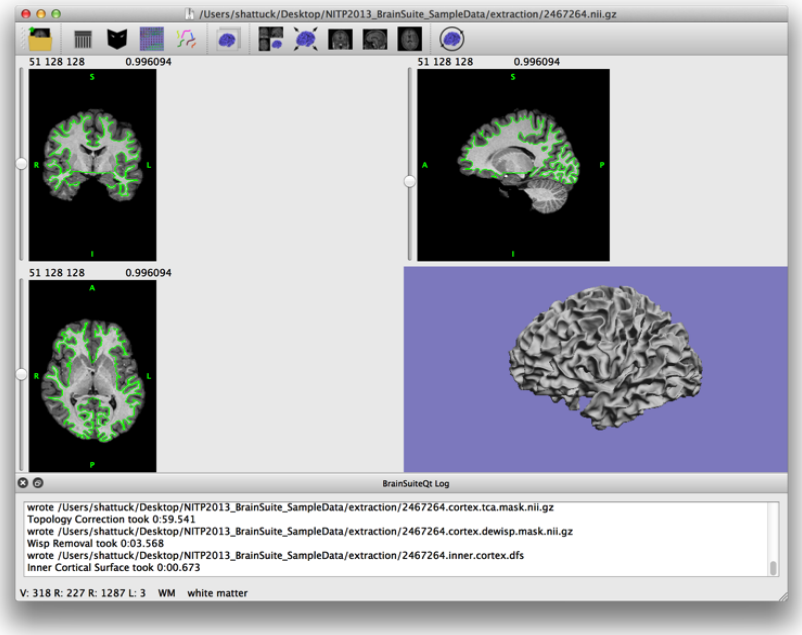
6b. Extracting a Brain Surface

- Step through the Skull Stripping Stage
- Uncheck “Skull and Scalp”
- Continue stepping through each stage, observing the outputs
- **Stop after you’ve finished producing the inner cortical surface**



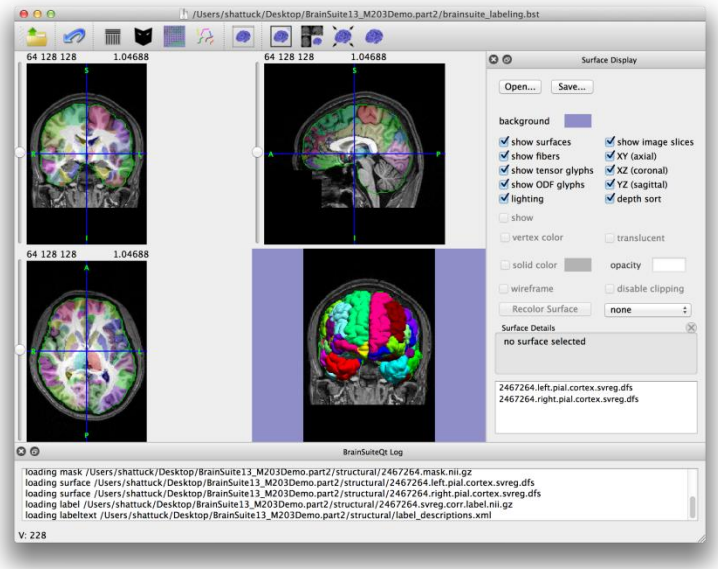
6c. Extracting a Brain Surface

- At this point, you have produced an inner cortical surface mesh.
- We won't perform the final step in class to produce the pial surface, as it takes several minutes.



7. Automated SVReg Labeling

- Drop brainsuite_labeling.bst onto BrainSuite
- Hide one of the surfaces
- Scroll to different positions in the volume and observe the boundaries of the labels
- Open the Label Painter tool (press ‘P’)
  - Can be used to edit the labels
  - Can calculate total volume of different labeled structures



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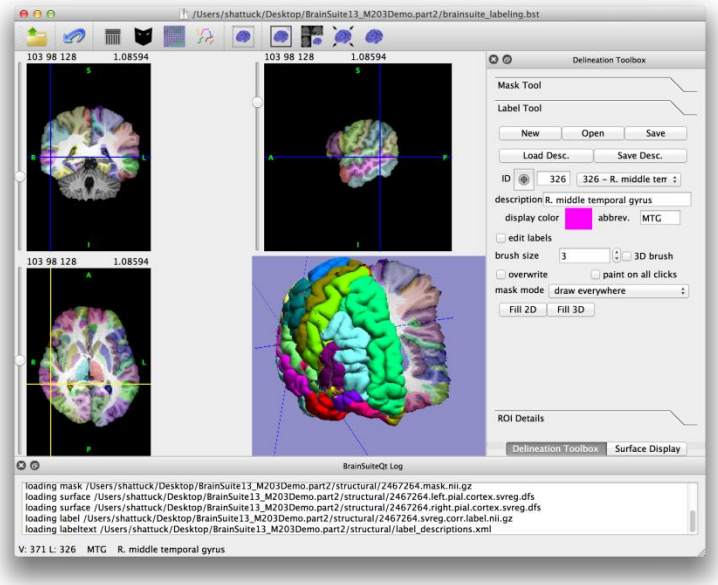
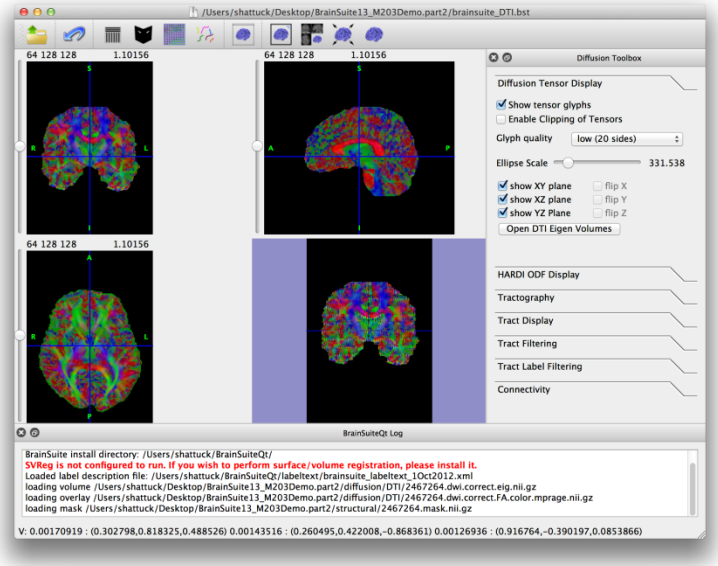


8. DTI Data

- Drop brainsuite_DTI.bst onto BrainSuite
- Adjust the image display parameters ('I'):
  - Show only the image overlay (DEC/FA)
  - Increase the brightness
- Scroll through the volume and observe some of the structure that is made visible by the DTI
  - Hide the volume slices (⌘-V)
  - Make the surface display full view
  - Zoom into the image
  - In the diffusion toolbox ('D'), adjust the size of the diffusion glyphs
- You can also load the structural scan as an overlay to observe the different modalities.



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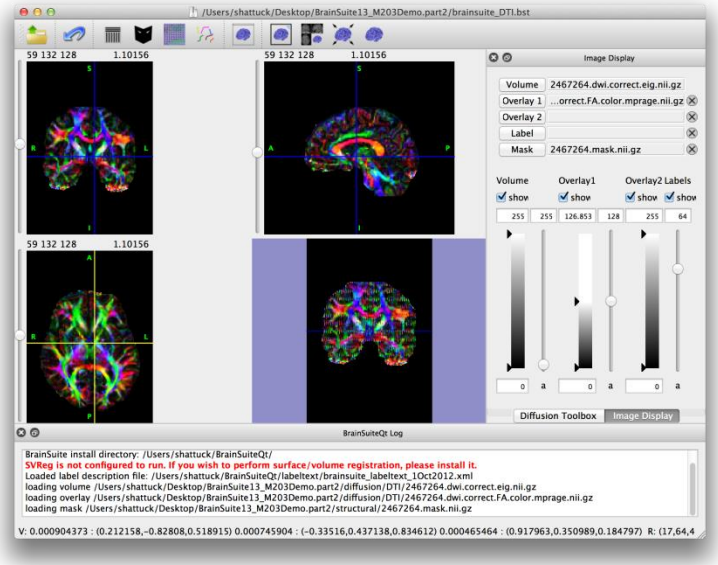

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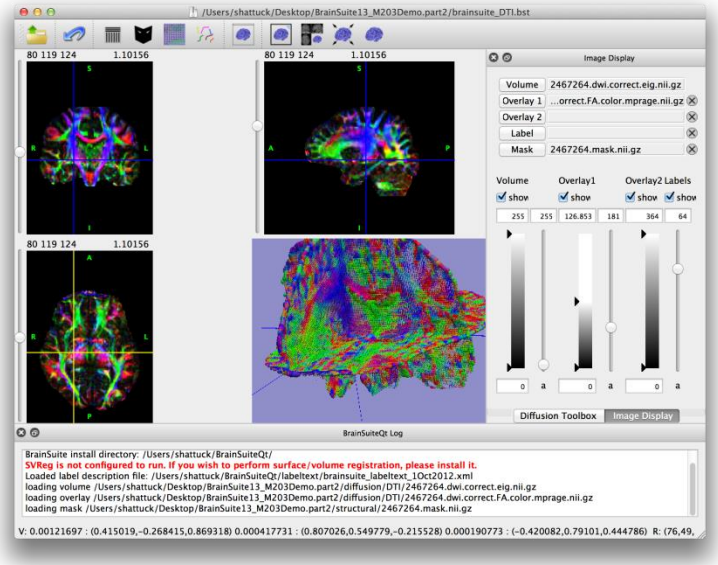

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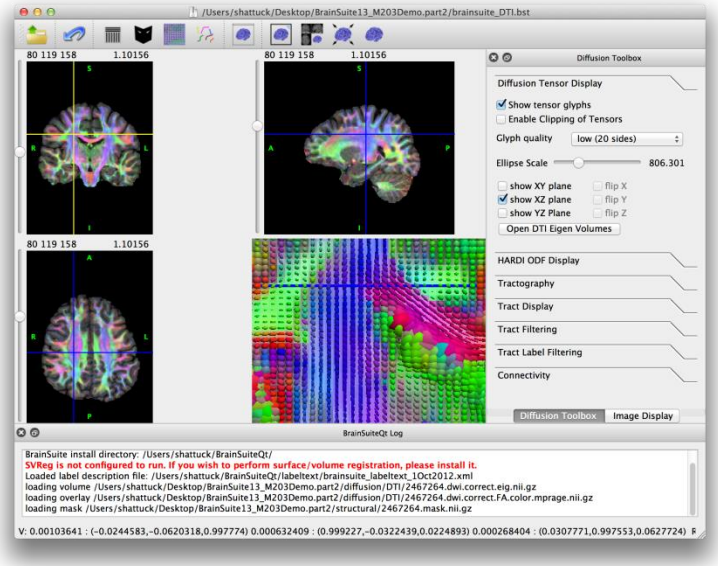
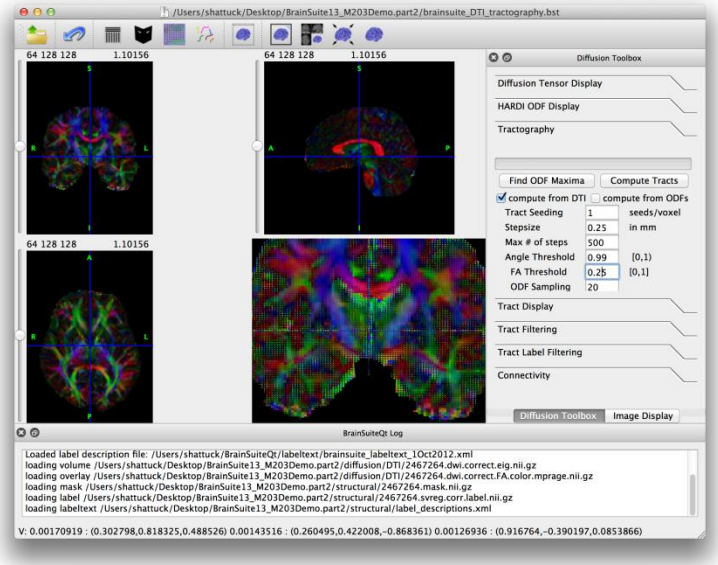


9. DTI Tractography

- Drop brainsuite_DTI_tractography.bst onto BrainSuite
- Adjust the display
  - Hide the labels (⌘-L)
  - Show only the image overlay (DEC/FA)
- Zoom in on the 3D view
- In the diffusion toolbox ('D'):
  - Open the tractography tab
  - Change FA threshold to 0.25
  - Change track seeding to 0.5
  - Press 'Compute Tracks'
- Explore the tracks using the interface
  - Cut planes (x/y/z keys)
  - Fibers on/off ('F')
  - Tensors glyphs on/off ('G')



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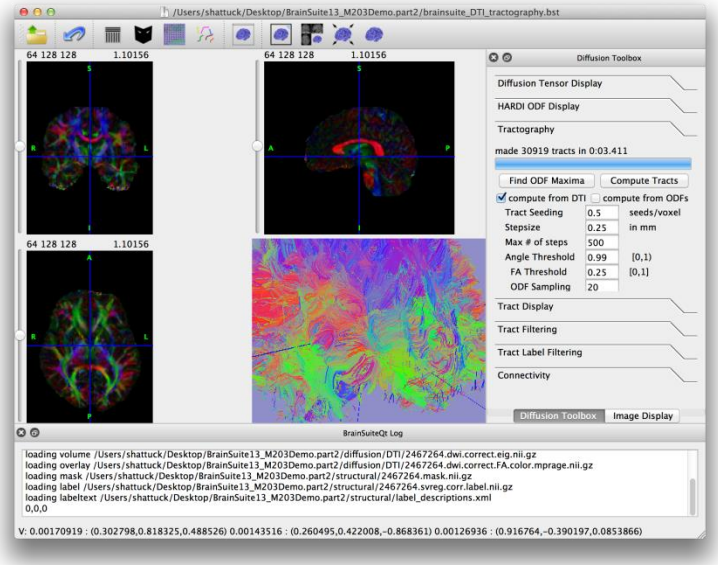

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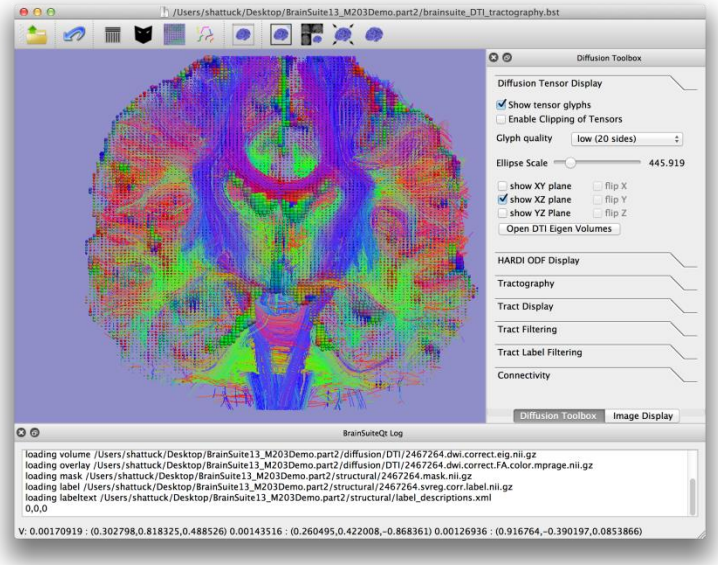
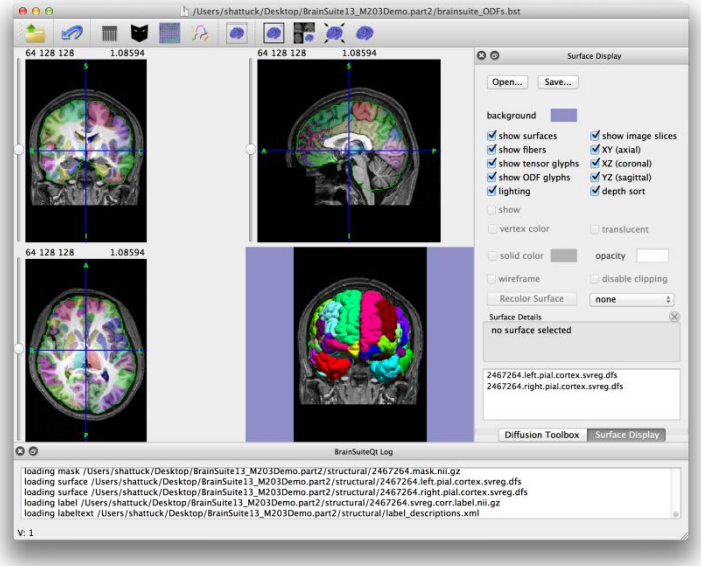


10. ODF Data

N.B.: This exercise requires a computer with a 64-bit operating system and at least 4GB of RAM

- Drop brainsuite_ODFs.bst onto BrainSuite
- Hide the surfaces (⌘-S)
- Zoom in on the 3D view
- In the diffusion toolbox ('D'):
  - Show only the X-Z plane
  - Increase the window size to cover more of the slice
  - Scroll through the image and observe the HARDI glyphs, particularly in the region of crossing fibers.



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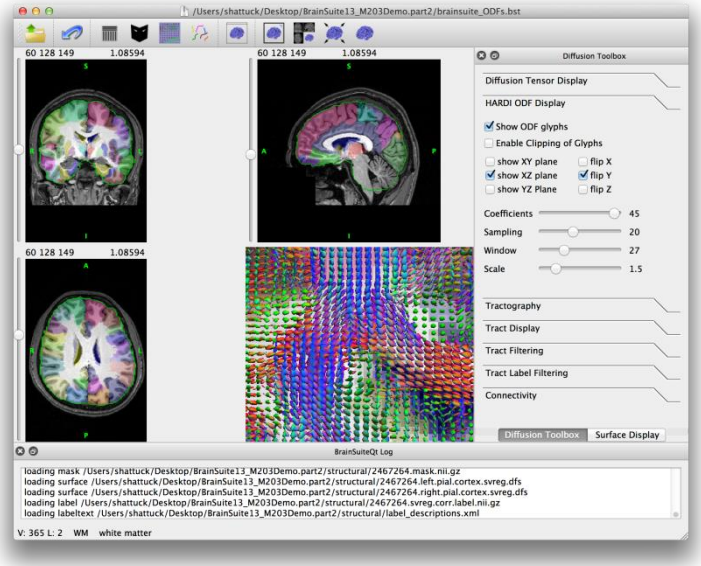

11. ODF Tracks

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- Drop brainsuite_ODF_tractography.bst onto BrainSuite
- Zoom in on the 3D view
- Hide the labels (⌘-L)
- Open the Mask Tool ('M'):
  - Change the threshold to 0.25
  - Press the threshold button
- Open Diffusion Toolbox ('D'):
  - Open the tractography tab
  - Change track seeding to 0.5
  - Press 'Compute Tracks'
- Explore the tracks using the interface
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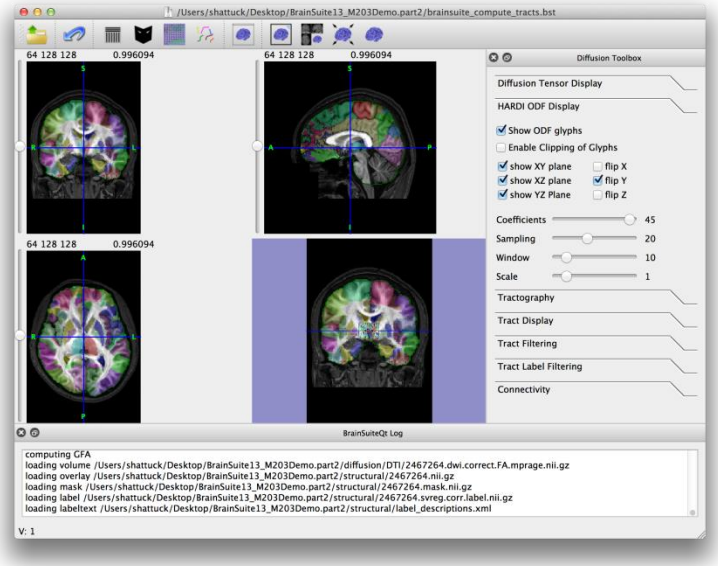
  - ODF glyphs on/off ('O')
  - Toggle the labels (⌘-L)



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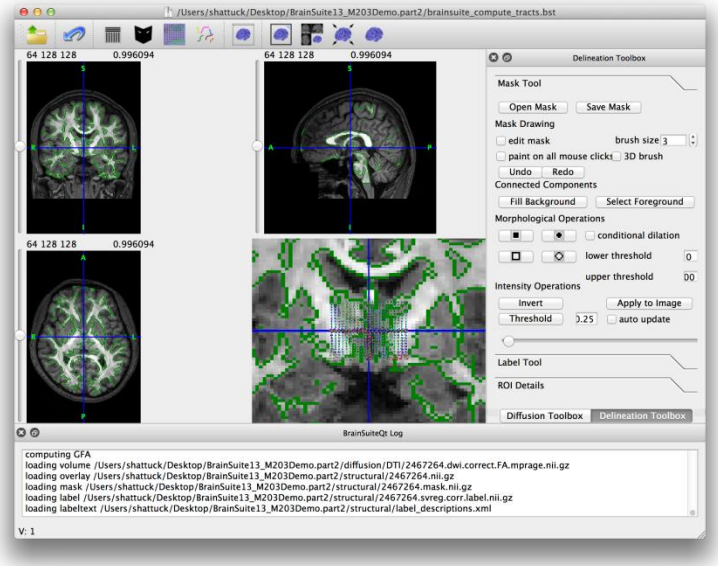

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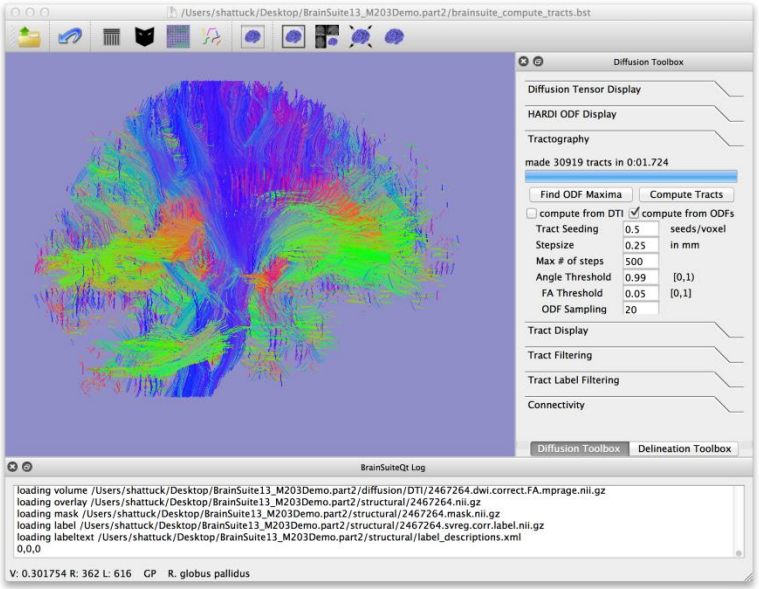

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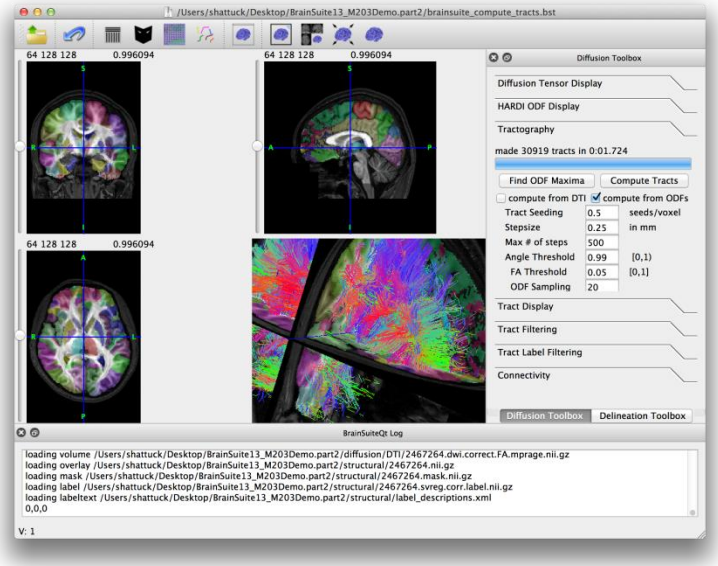
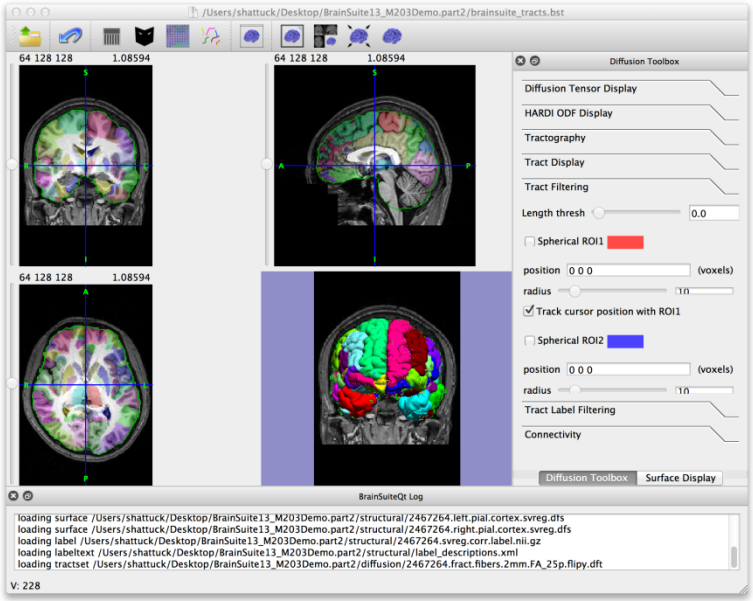


12a. Track Filtering

- Drop brainsuite_tracks.bst onto BrainSuite
- Adjust the display
  - Hide the surfaces (⌘-S)
  - Hide the slices (⌘-V)
  - Zoom in on the 3D view
- In the diffusion toolbox ('D'):
  - Open the Track Filtering tab
  - Adjust the length threshold to 10 and observe the spurious tracks disappear
- Explore the tracks using spherical ROIs
  - Press the ROI1 checkbox
  - Scroll through the image to see tracks connected to the sphere
  - Adjust the sphere radius to see larger regions
  - Adjust other parameters (e.g. wireframe)



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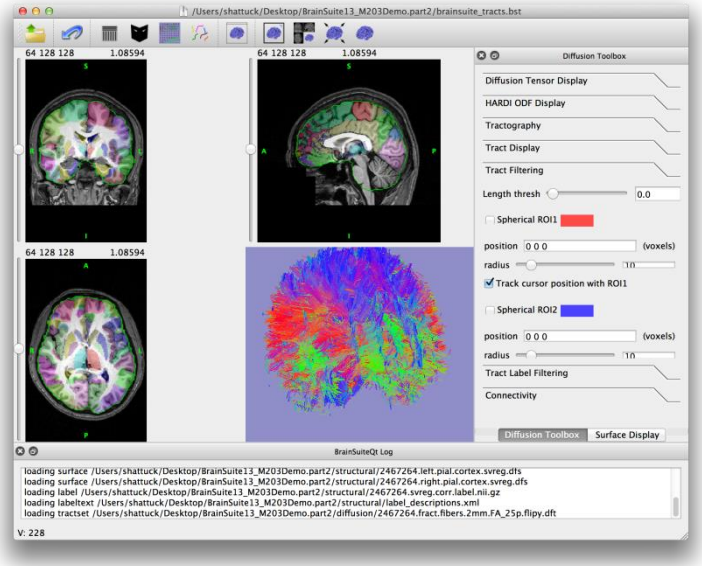

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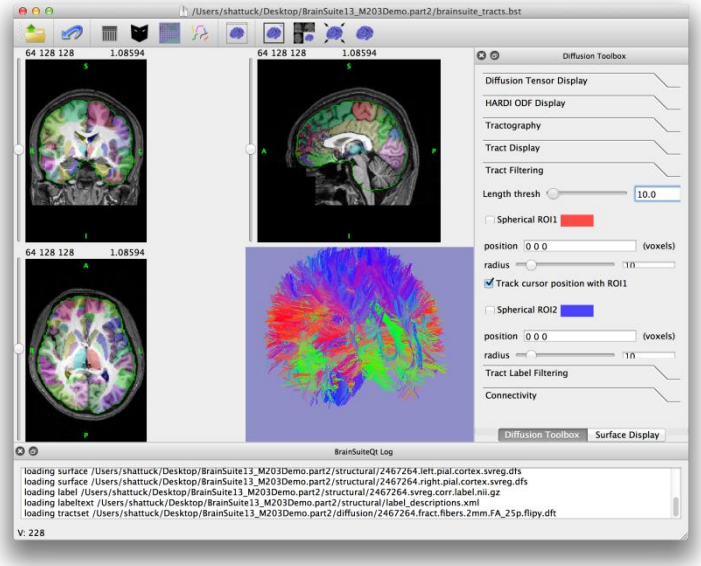

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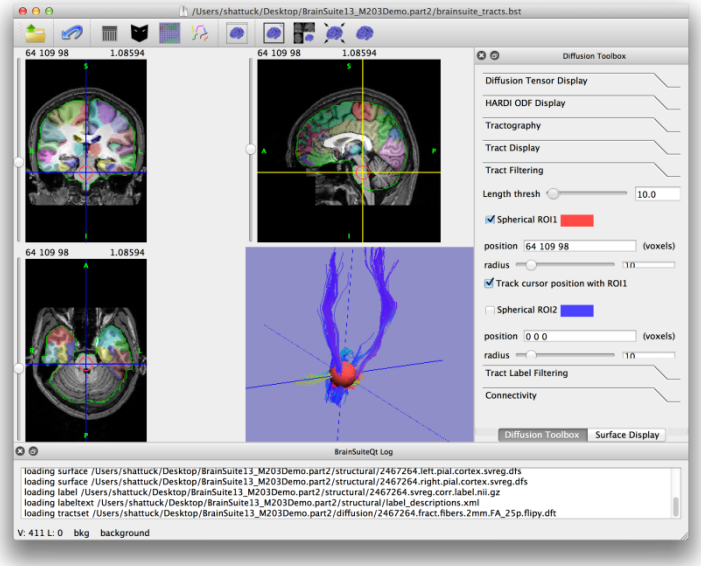

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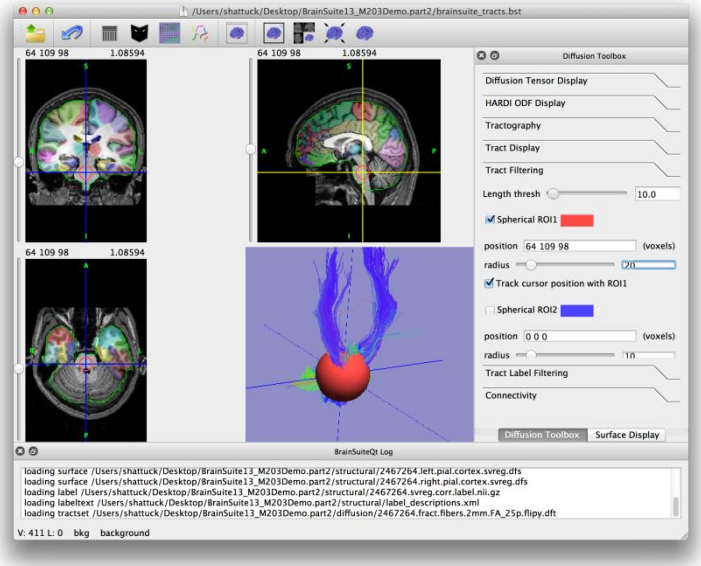

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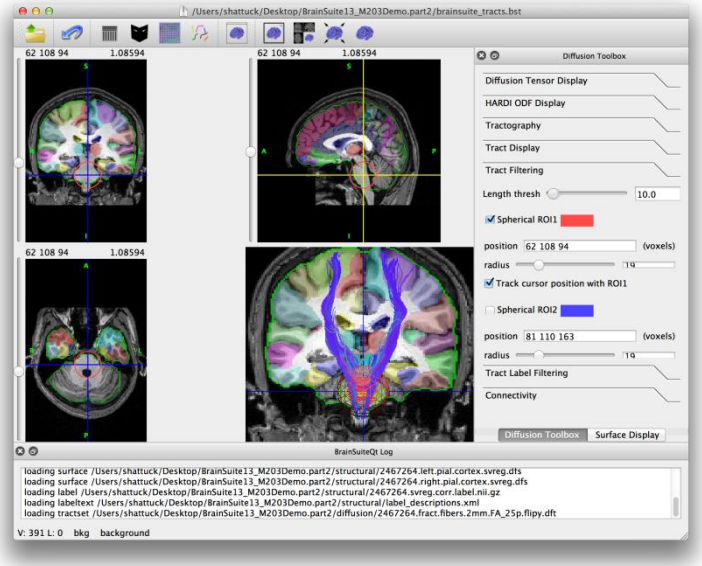
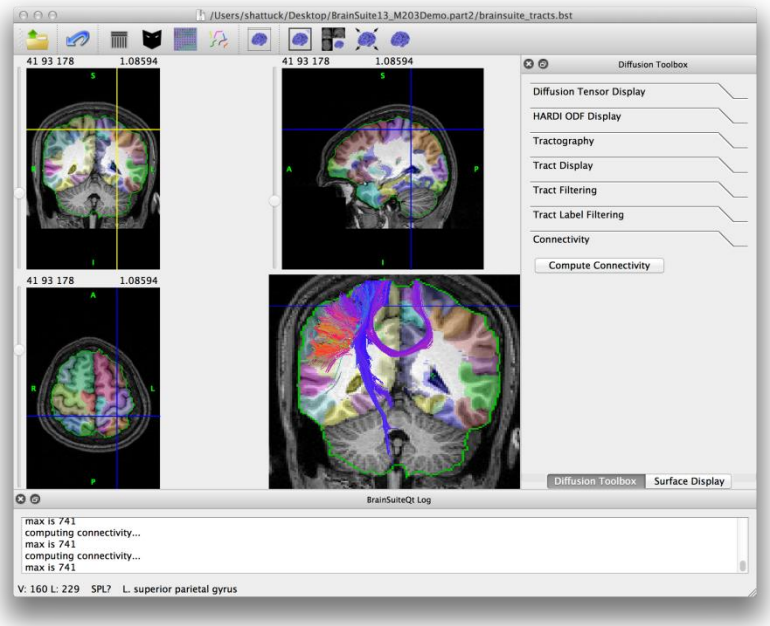
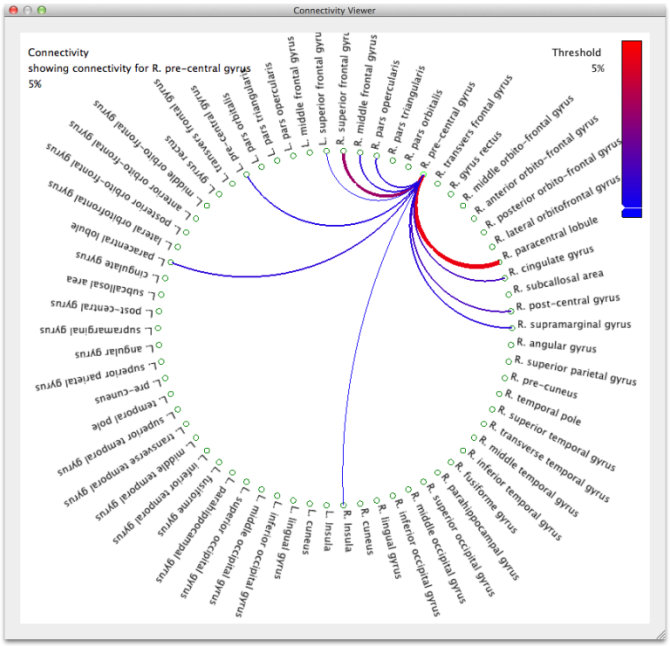


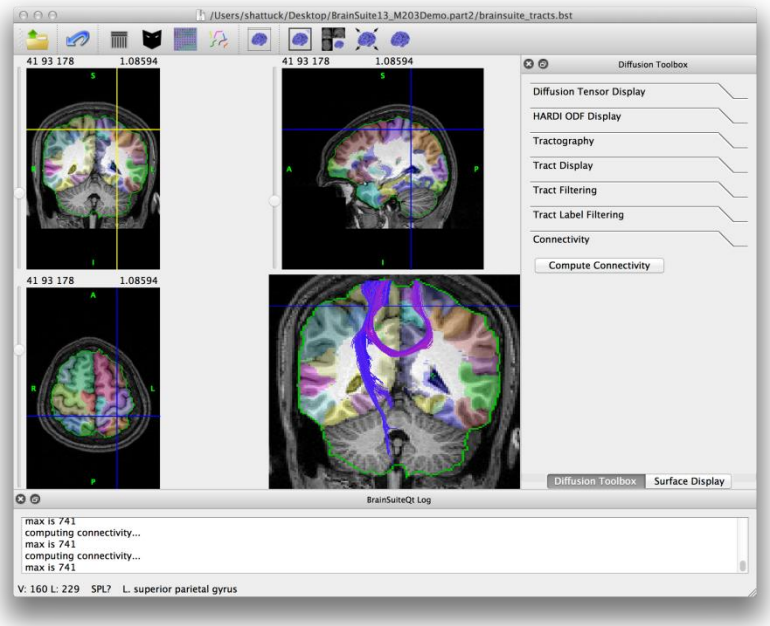
12b. Connectivity

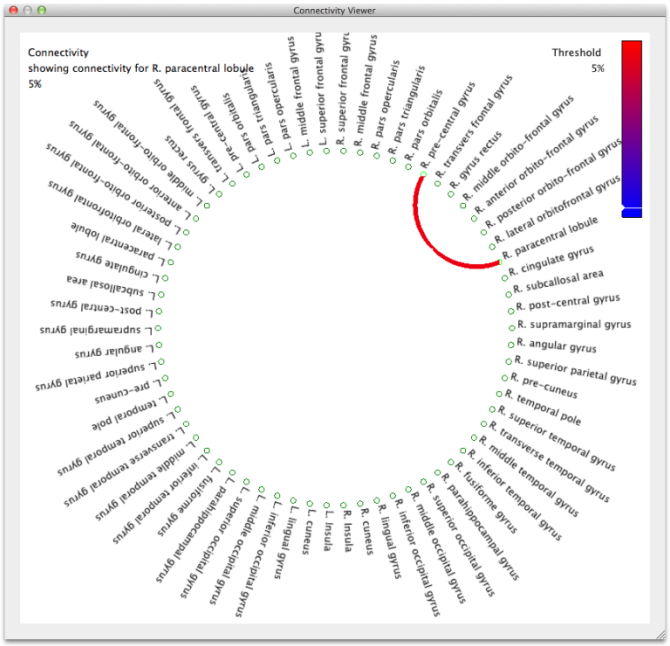




- Continue using brainsuite_tracks.bst
- In the diffusion toolbox (‘D’):
  - Open the Connectivity tab
  - Press the ‘Compute Connectivity’ button
- The Connectivity Viewer allows you to explore connections between different ROIs
  - Select nodes along the wheel
  - Ctrl-select to view connections between only 2 ROIs
  - Shift-select to view multiple connections
  - Press 1,2,3,4 to observe different subsets (e.g., lobes)

12b. Connectivity





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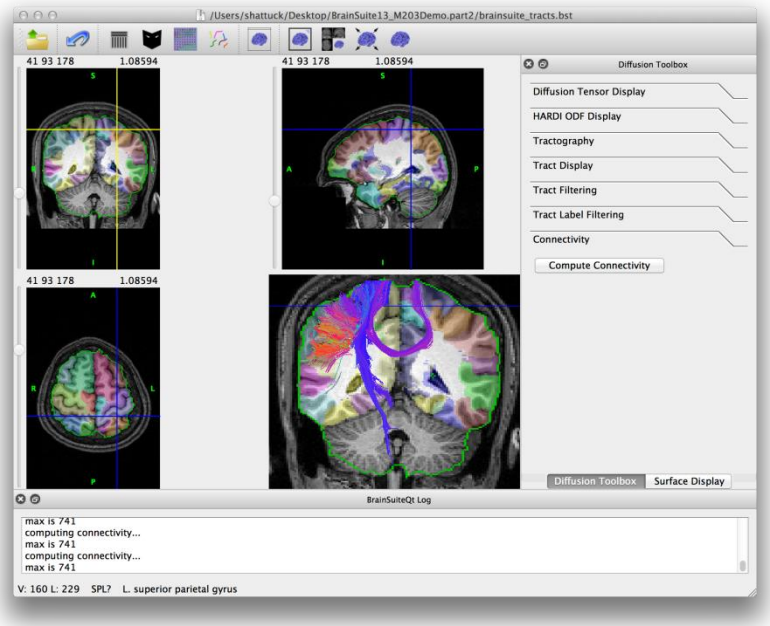
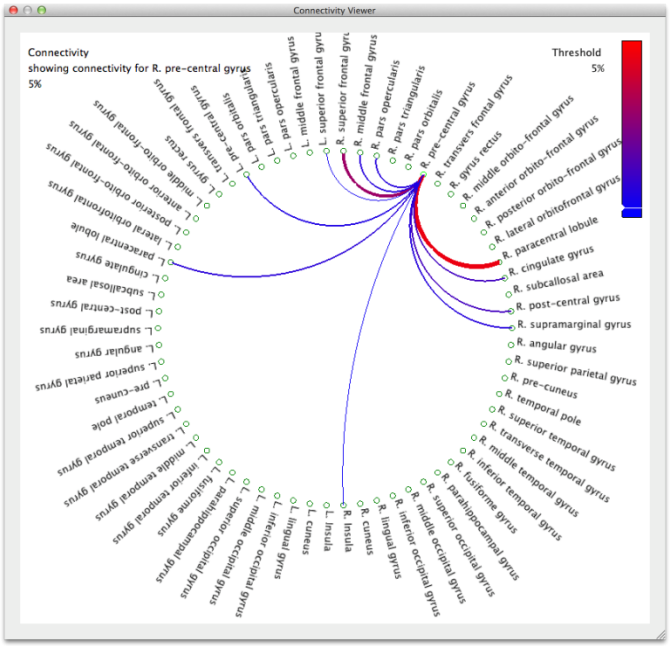
12b. Connectivity





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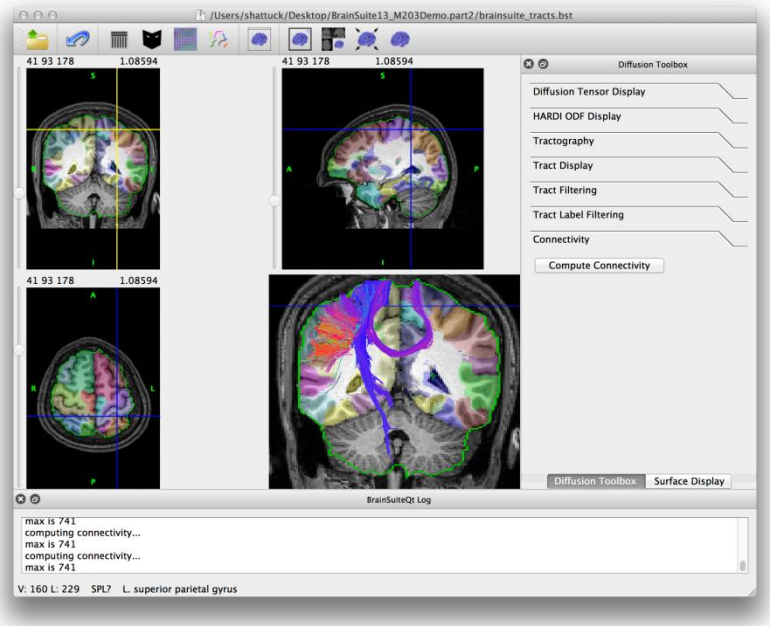
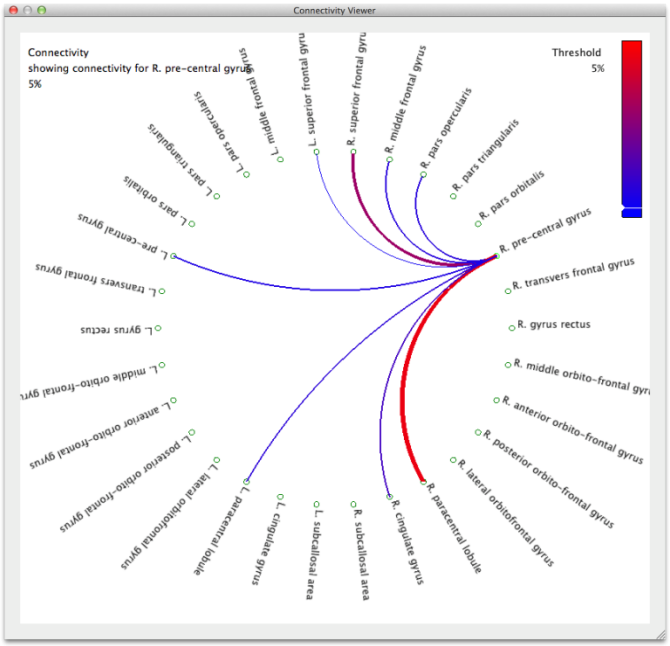
12b. Connectivity





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