

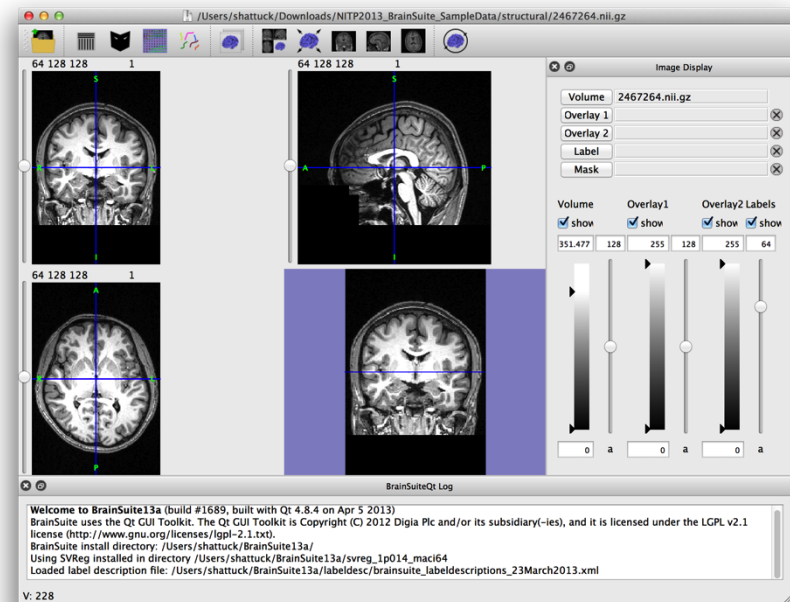
BrainSuite Workshop Exercises

presented at Children's Hospital Los Angeles

19 August 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



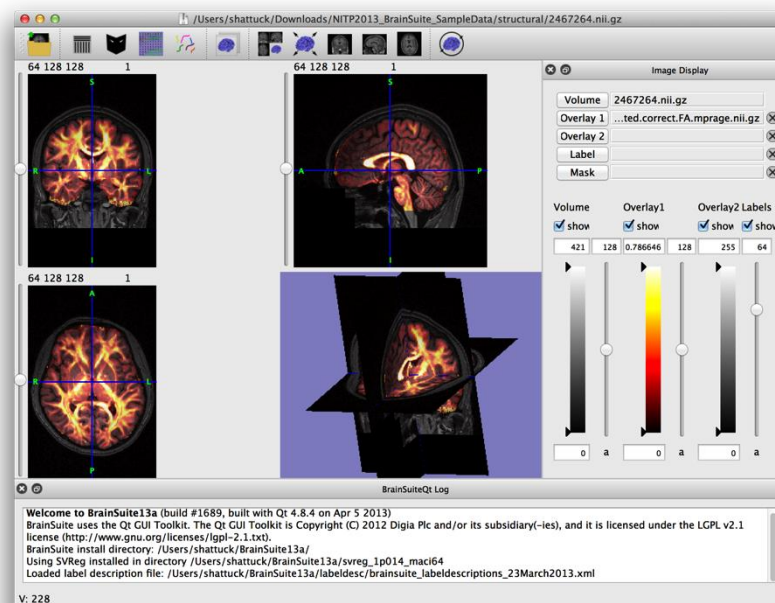
2. Opening an Overlay

Load an overlay image

- Press the Overlay1 button
- Select the FA file:

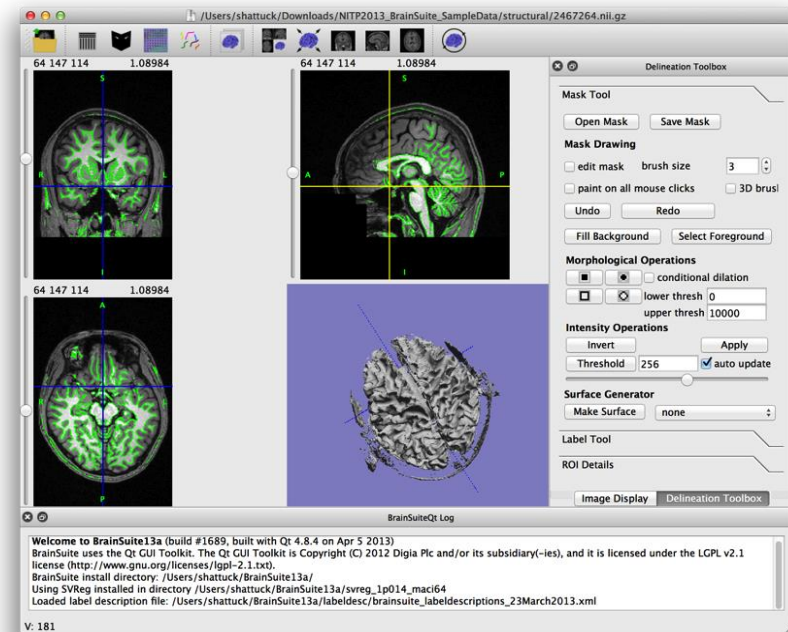
diffusion/DTI/2467264.dwi.RAS.correct.FA.T1_coord.nii.gz

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



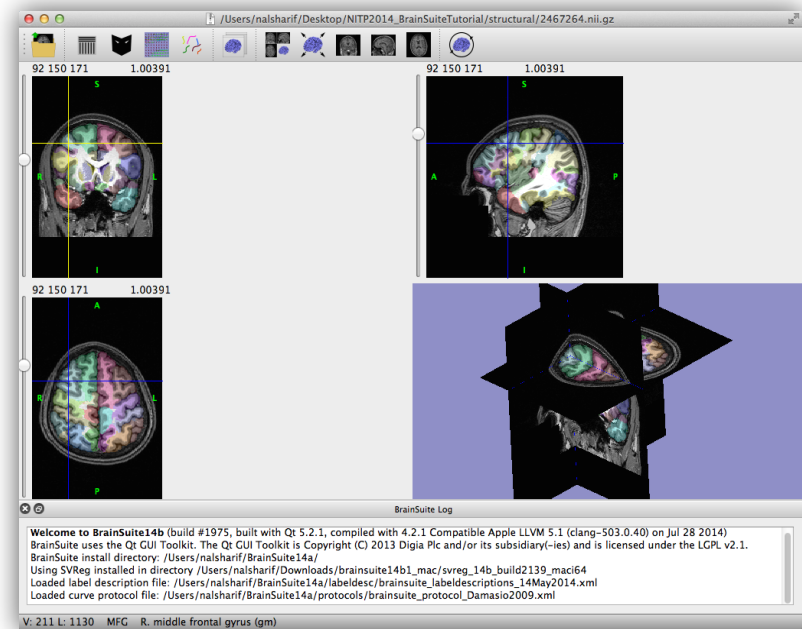
3. Mask and Surface Tools

- 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



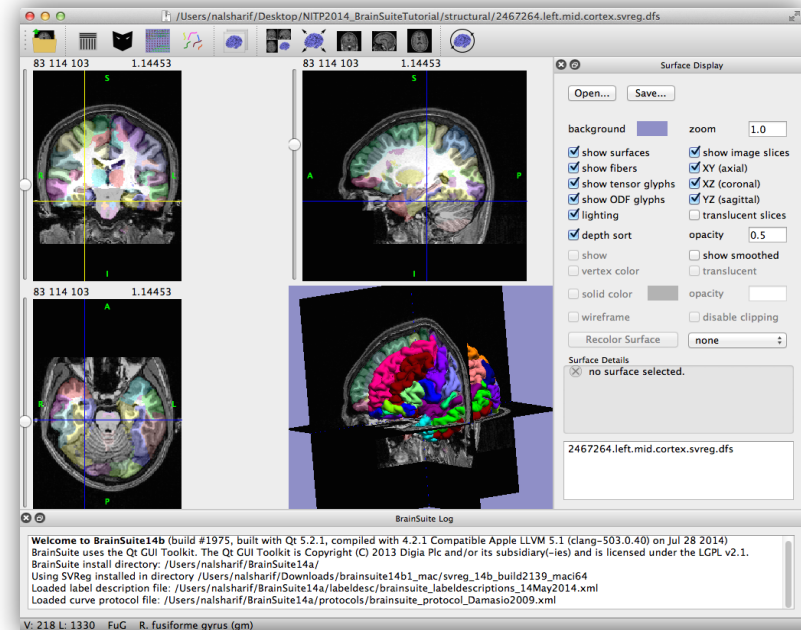
4. Working with Labels

- 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.



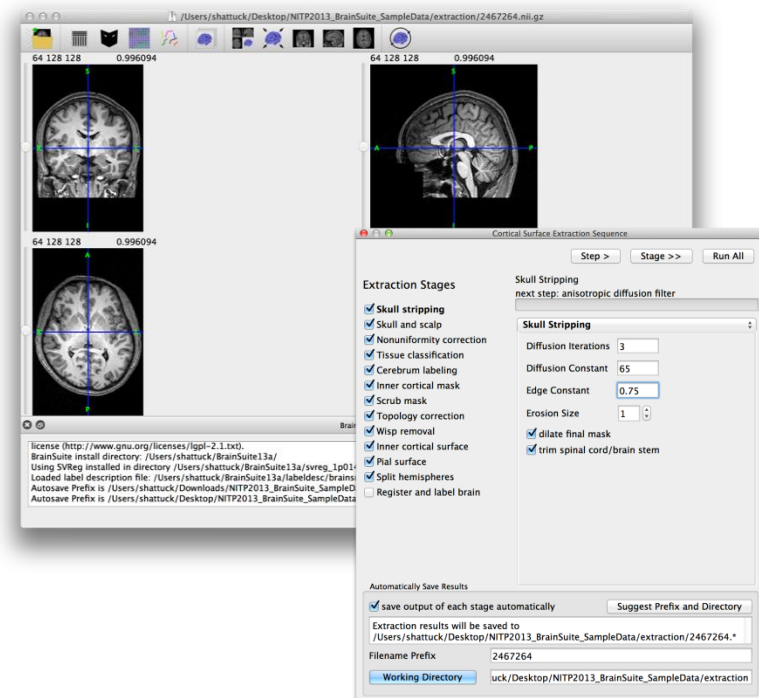
5. Working with Surfaces

- 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

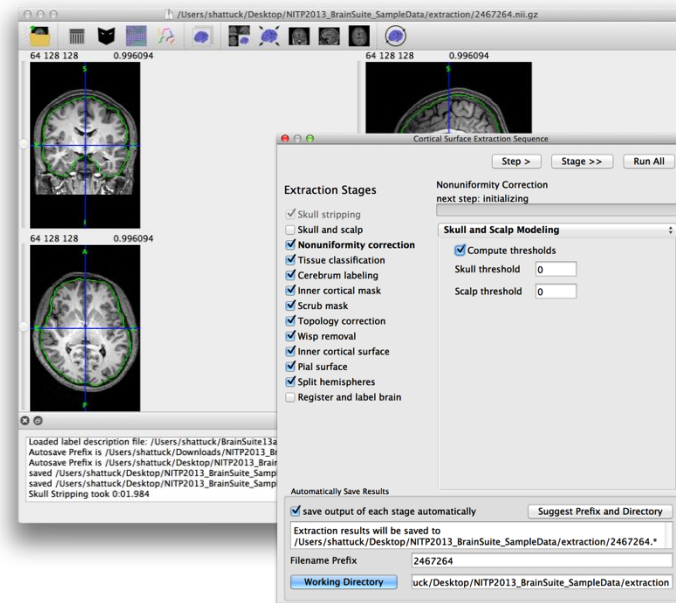
- Load the T1 image from the **extraction** folder*
- Open “Cortex -> Cortical Surface Extraction Sequence”
- Change the Skull Stripping parameters as follows:
 - Diffusion constant: 75
 - Edge constant: 0.75



* 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.

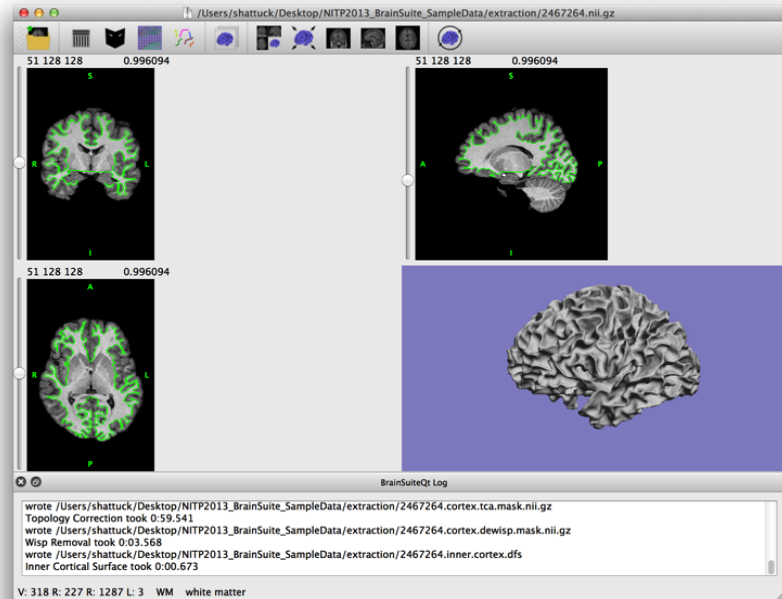
6b. Extracting a Brain Surface

- 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**



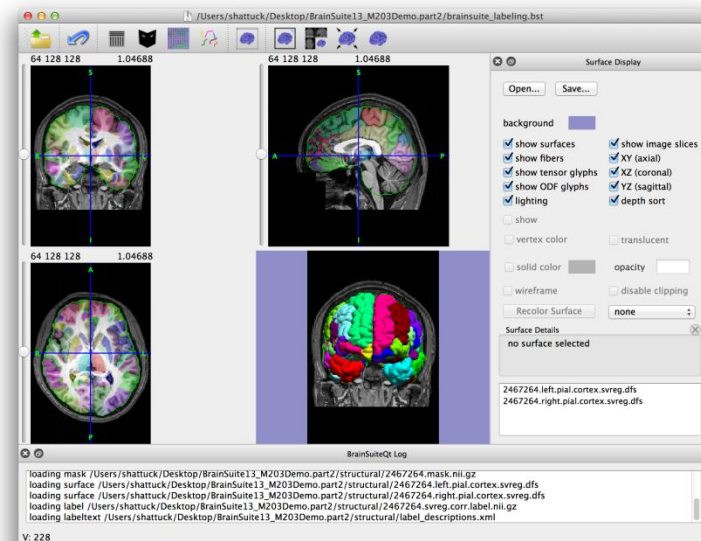
6c. Extracting a Brain Surface

- 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.



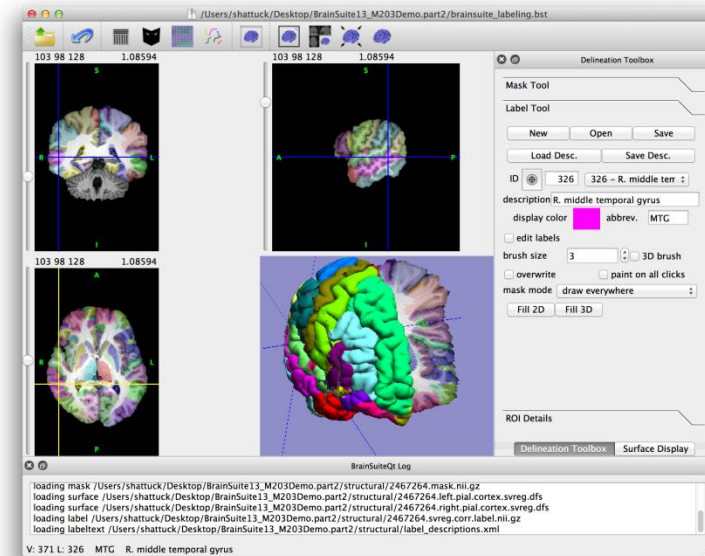
7. Automated SVReg Labeling

- 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



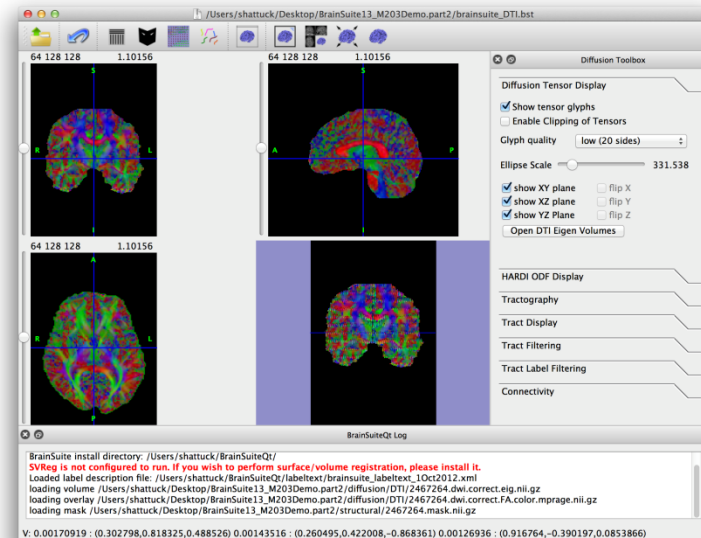
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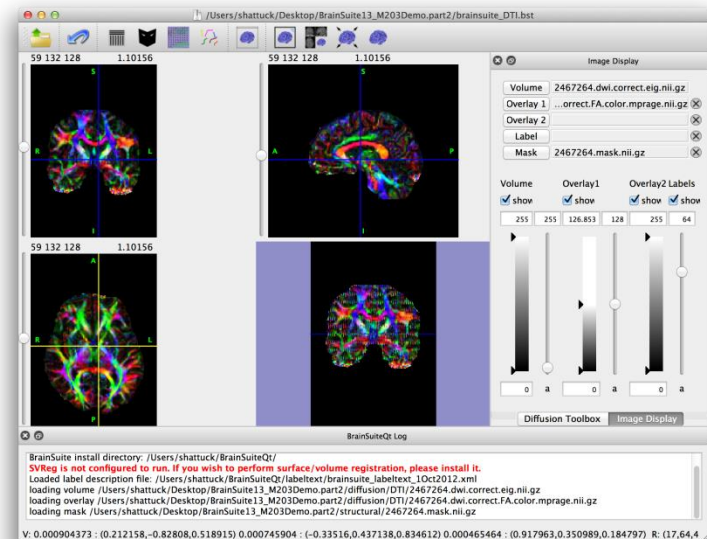
8. DTI Data

- 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.



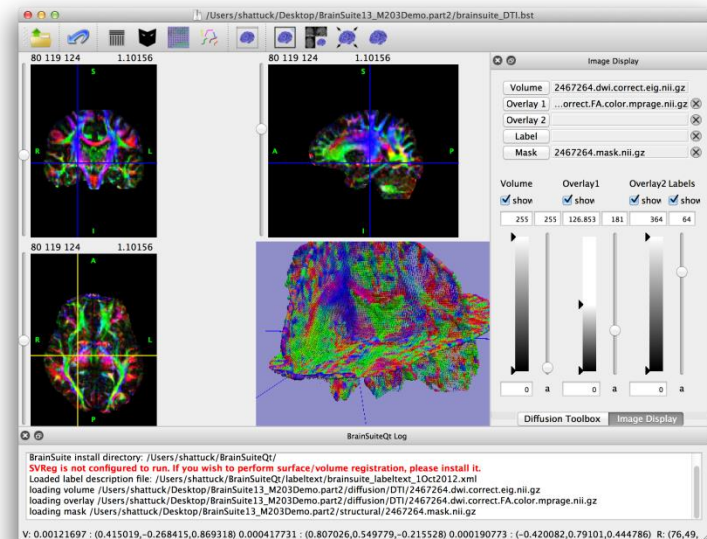
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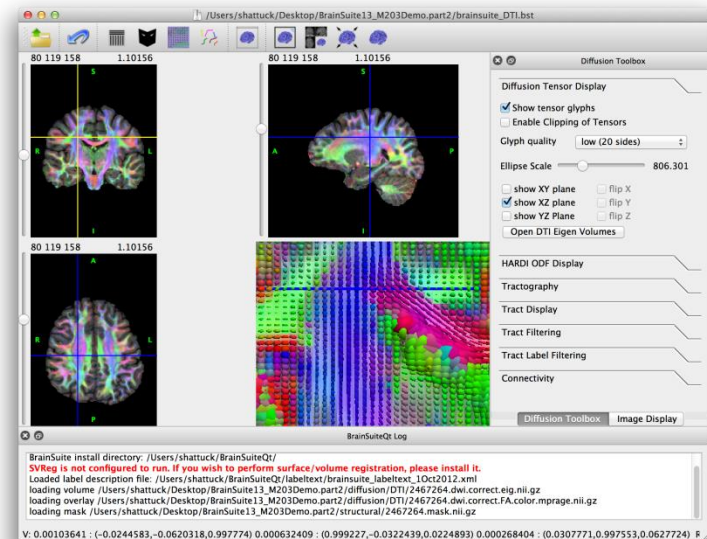
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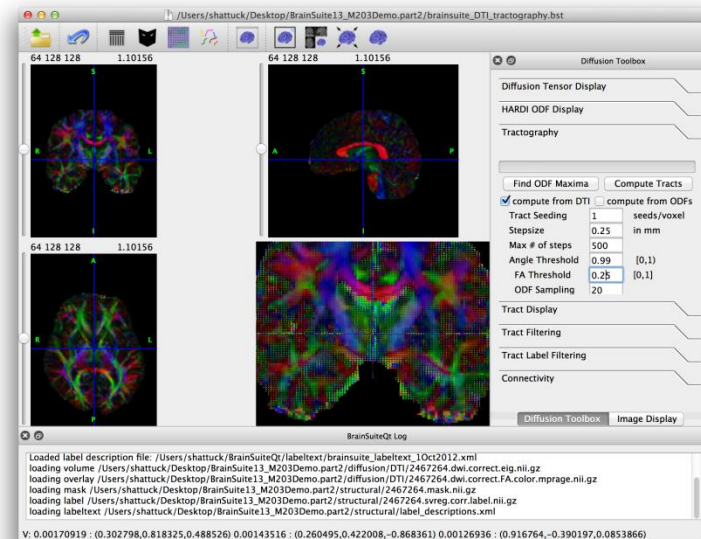
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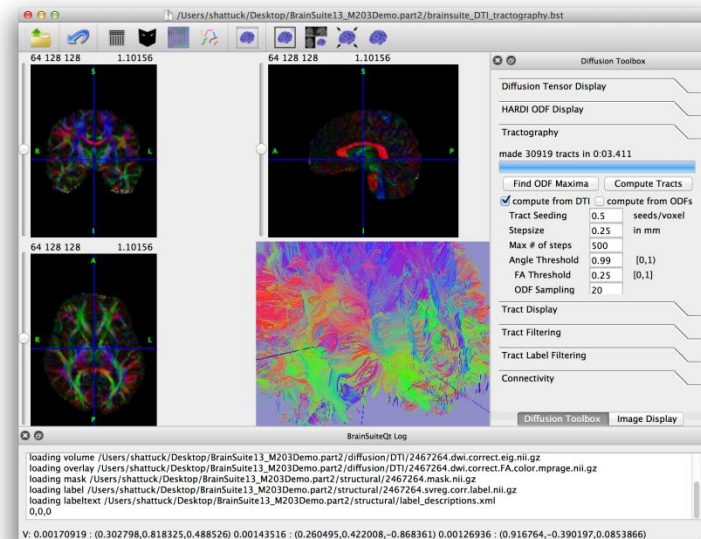
9. DTI Tractography

- 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')



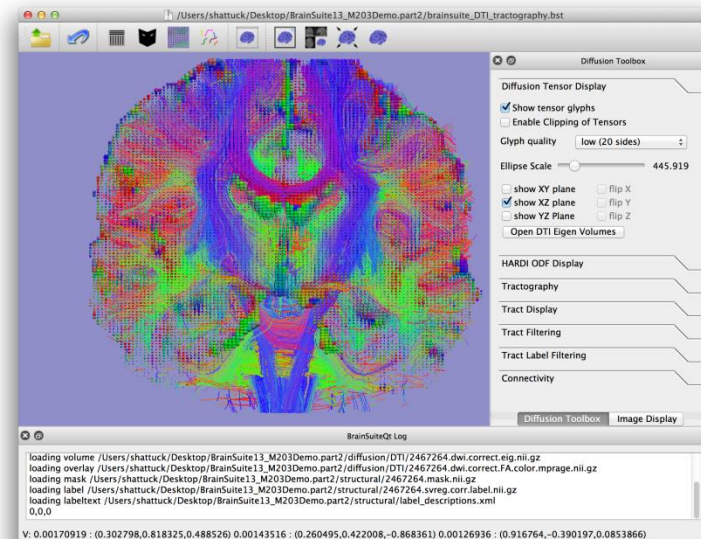
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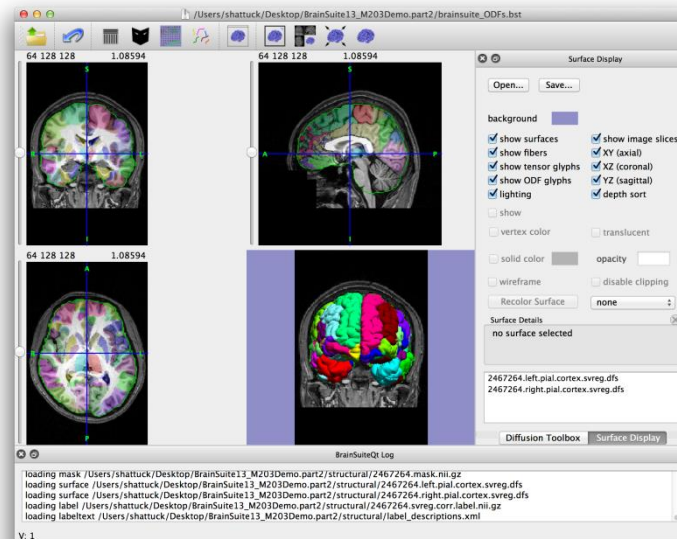
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10. ODF Data

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

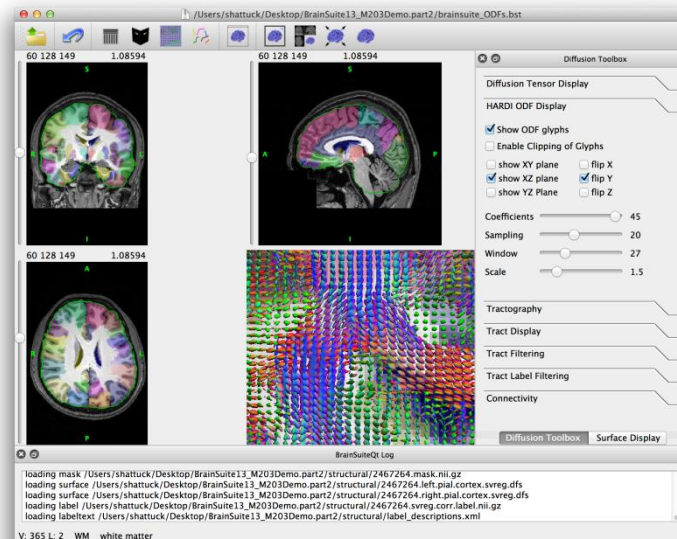
- Drop brainsuite_ODFs.bst onto BrainSuite
- Hide the surfaces (⌘-S)
- Zoom in on the 3D view
- In the diffusion toolbox ('D'):
 - Show only the X-Z plane
 - Increase the window size to cover more of the slice
 - Scroll through the image and observe the ODF glyphs, particularly in the region of crossing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



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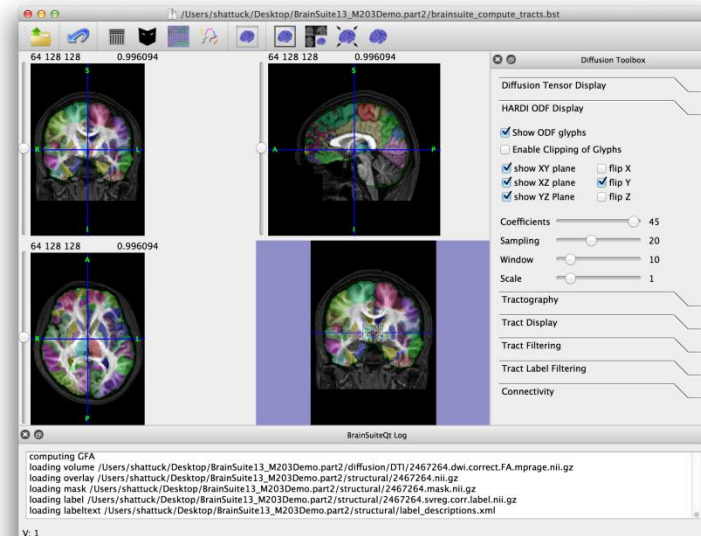
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11. ODF Tracks

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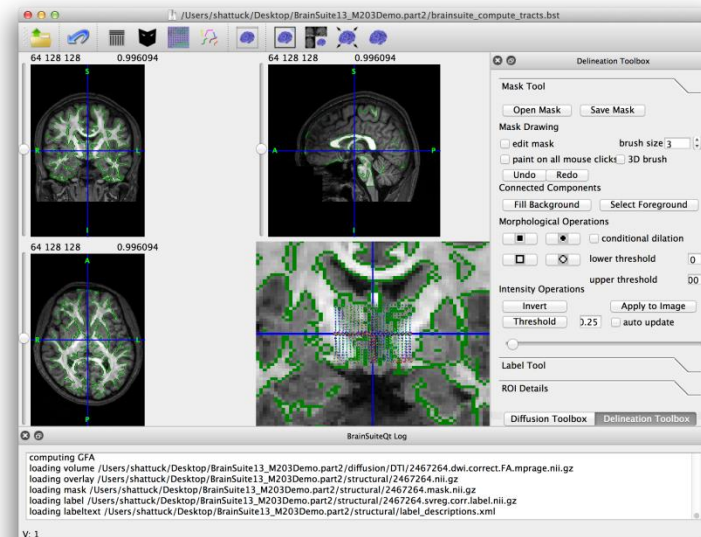
- Drop brainsuite_ODF_tractography.bst onto BrainSuite
- Zoom in on the 3D view
- Hide the labels (⌘-L)
- Open the Mask Tool ('M'):
 - Change the threshold to 0.25
 - Press the threshold button
- Open Diffusion Toolbox ('D'):
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 - Press 'Compute Tracks'
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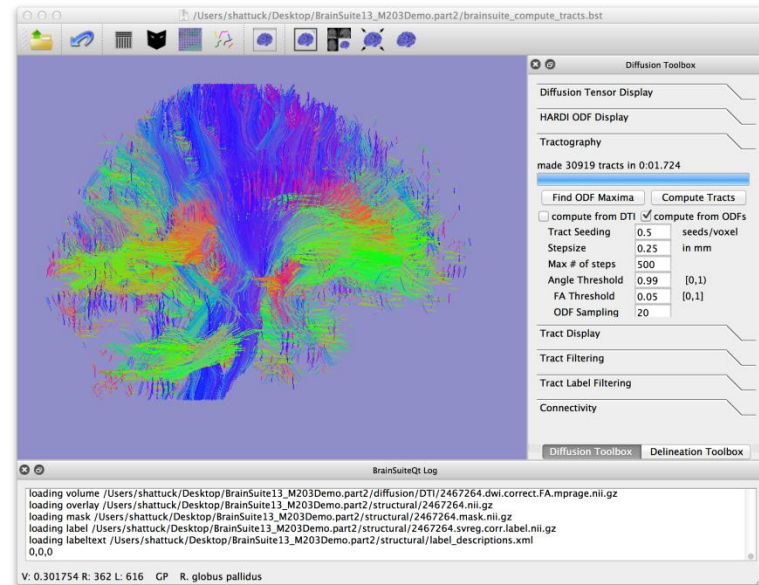
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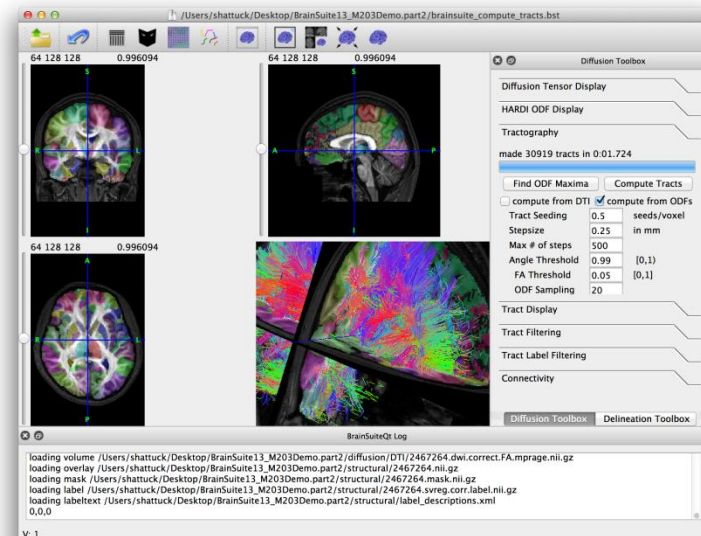
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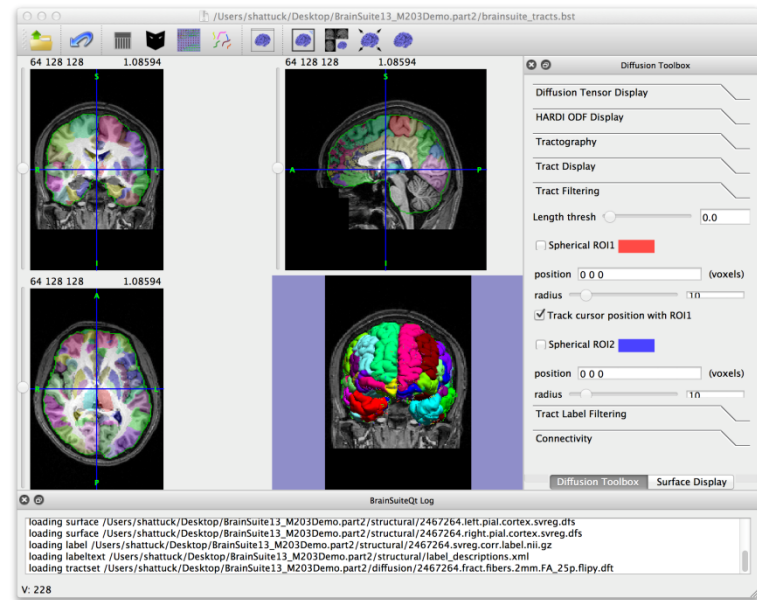
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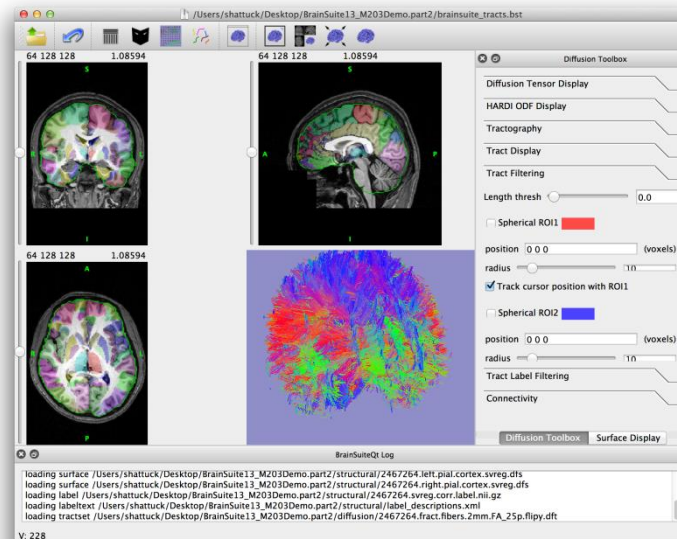
12a. Track Filtering

- 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)



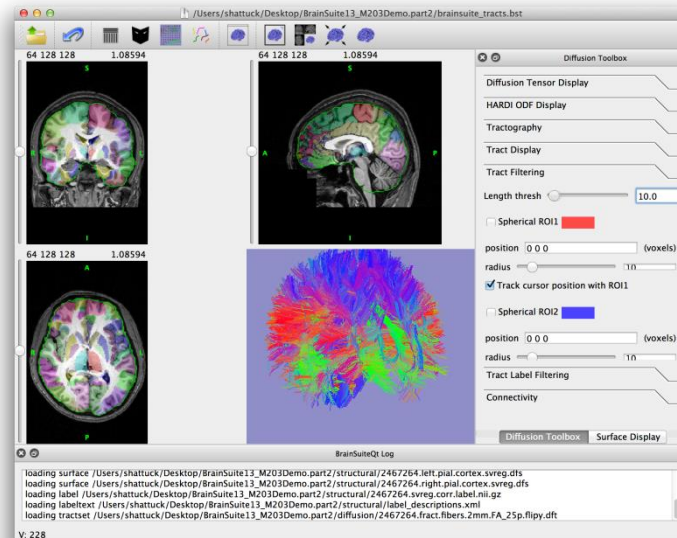
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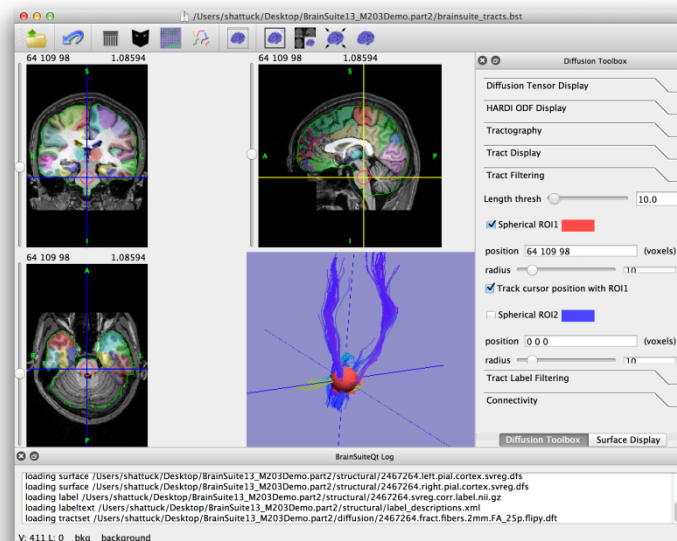
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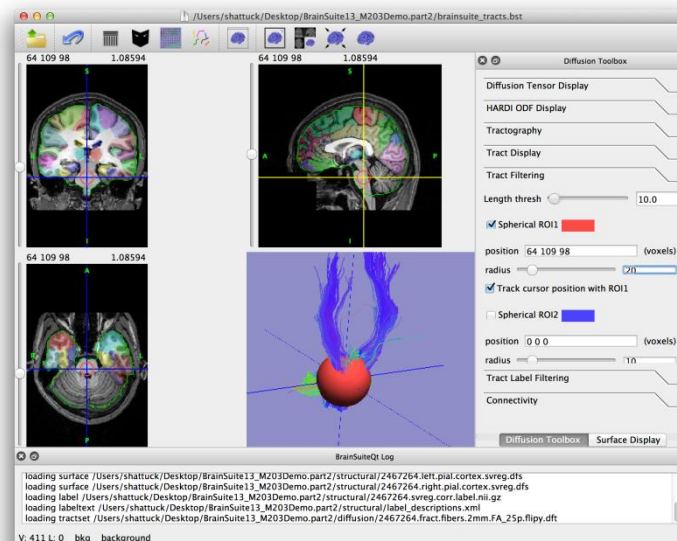
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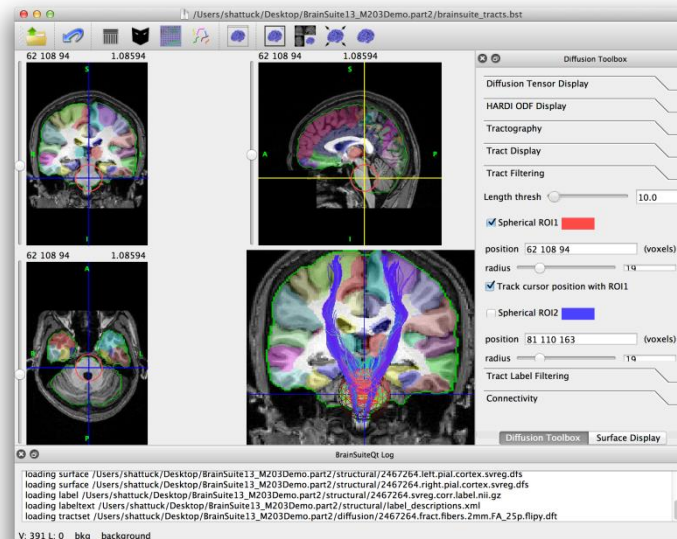
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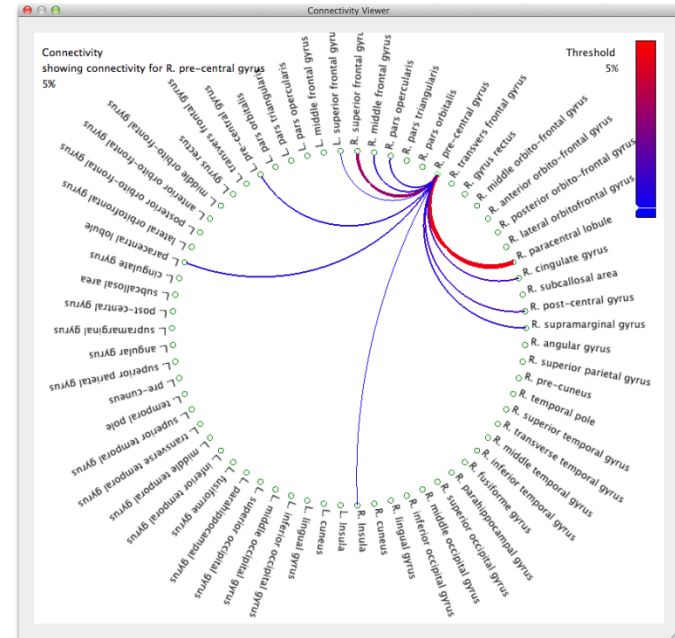
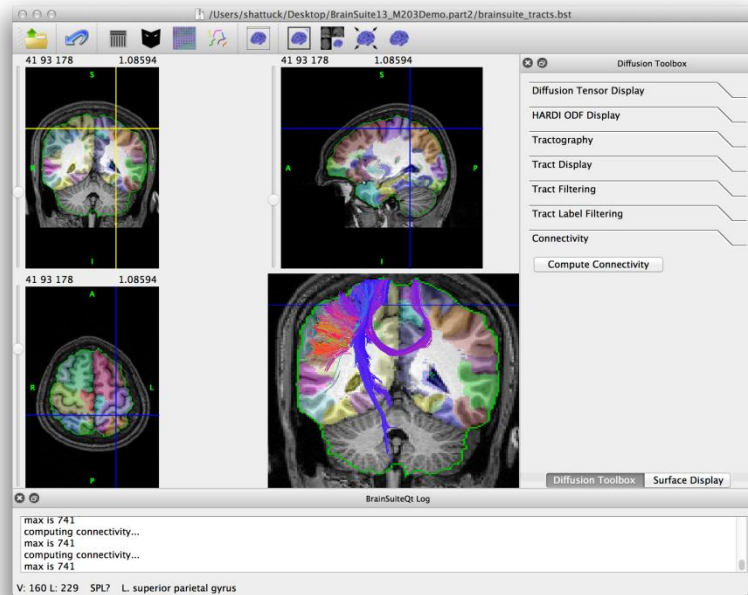


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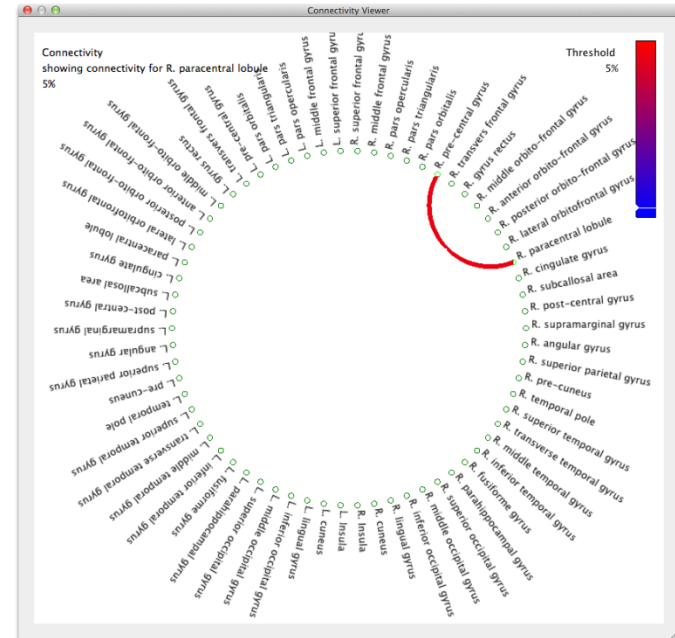
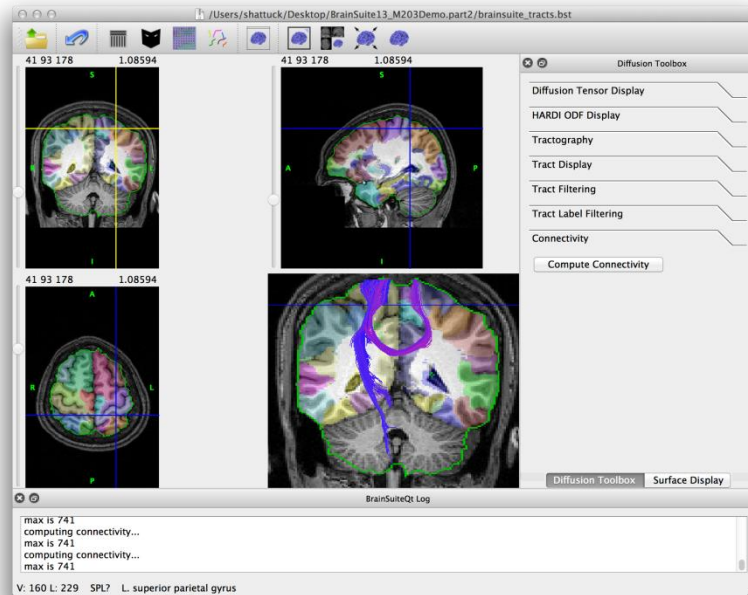


12b. Connectivity



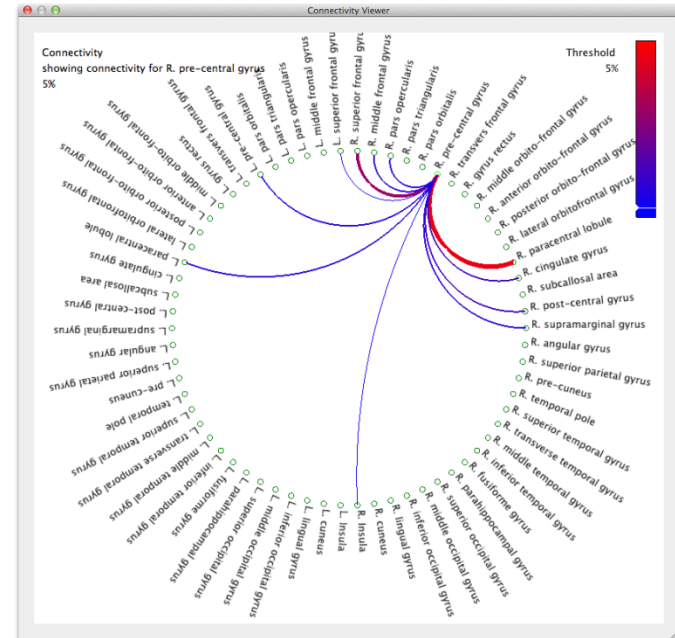
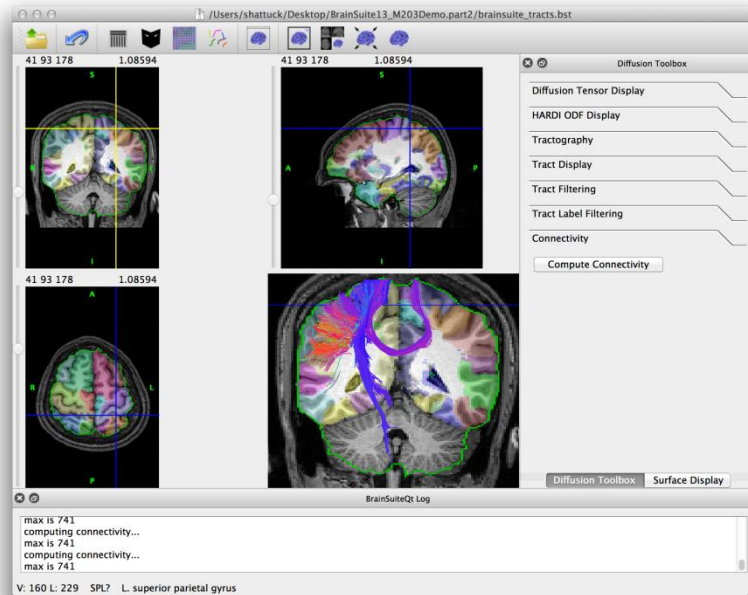
- Continue using brainsuite_tracks.bst
- In the diffusion toolbox ('D'):
 - Open the Connectivity tab
 - Press the 'Compute Connectivity' button
- The Connectivity Viewer allows you to explore connections between different ROIs
 - Select nodes along the wheel
 - Ctrl-select to view connections between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

12b. Connectivity



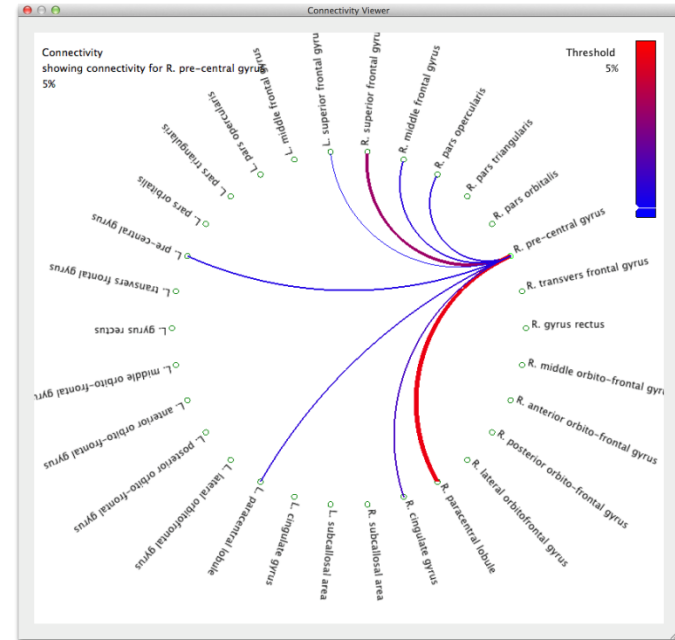
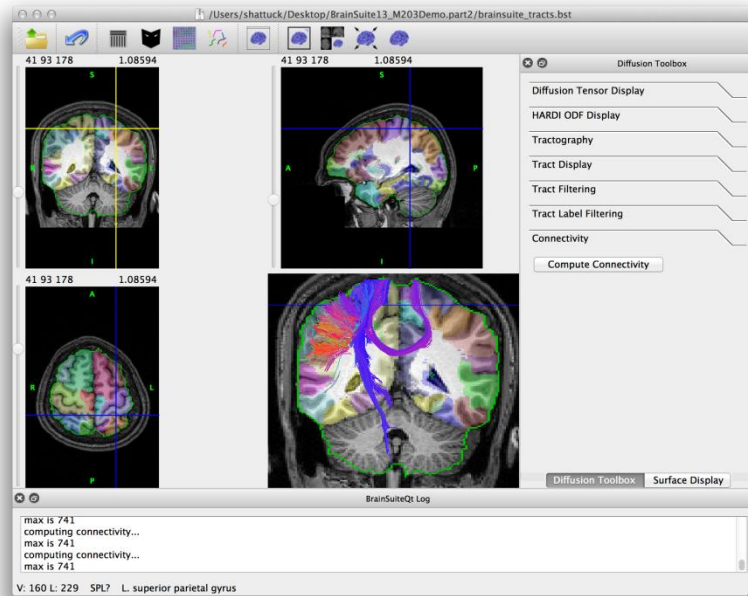
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