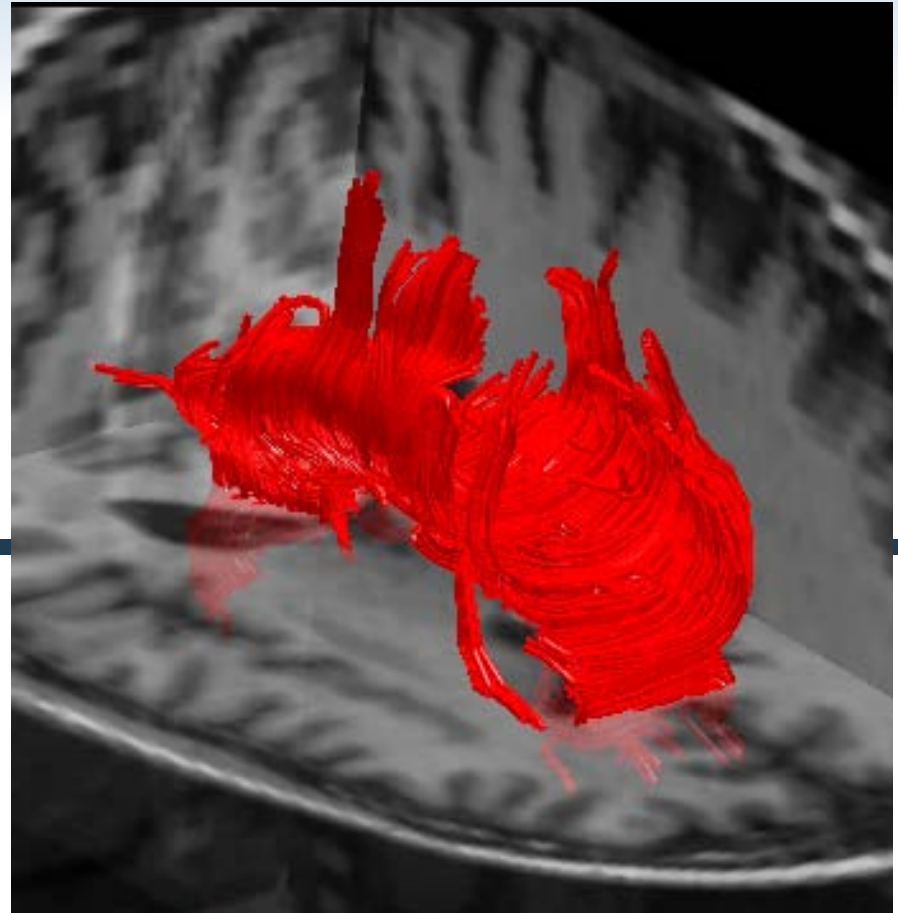


Analyze Webinar – November 17, 2011

DTI Analysis and Fiber Tractography with Analyze | 0.0

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Application Specialist
AnalyzeDirect



Webinar Agenda

- ◆ Estimated Duration: 30 minutes
- ◆ Webinar Agenda:
 - Diffusion Tensor Imaging and the DTI Add-On for Analyze 10.0
 - Demonstration of DTI analysis and fiber tractography with Analyze 10.0
 - Questions & Answers
- ◆ Webinar Objectives:
 - Provide information on how the DTI add-on module in Analyze works and the features it offers
 - Show how to use the DTI add-on module in Analyze 10.0

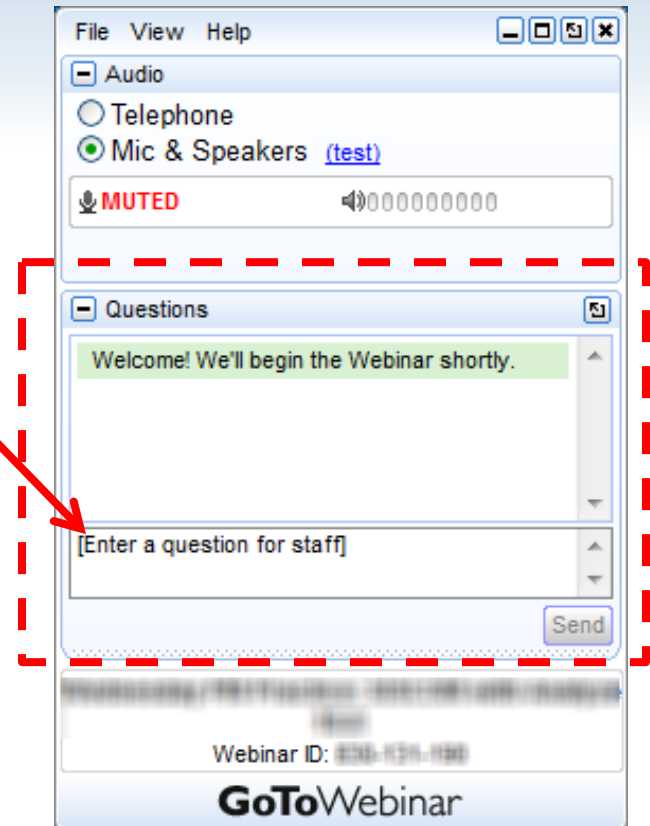
Webinar Notes

- ◆ Questions during the Webinar

- Use “Questions” pane of your GoToWebinar control panel

- ◆ After the Webinar

- Recording and presentation materials will be available online starting tomorrow
- Webinar registrants will receive email with link to recording
 - Recording also available on the AnalyzeDirect YouTube channel - <http://www.youtube.com/user/AnalyzeDirect>

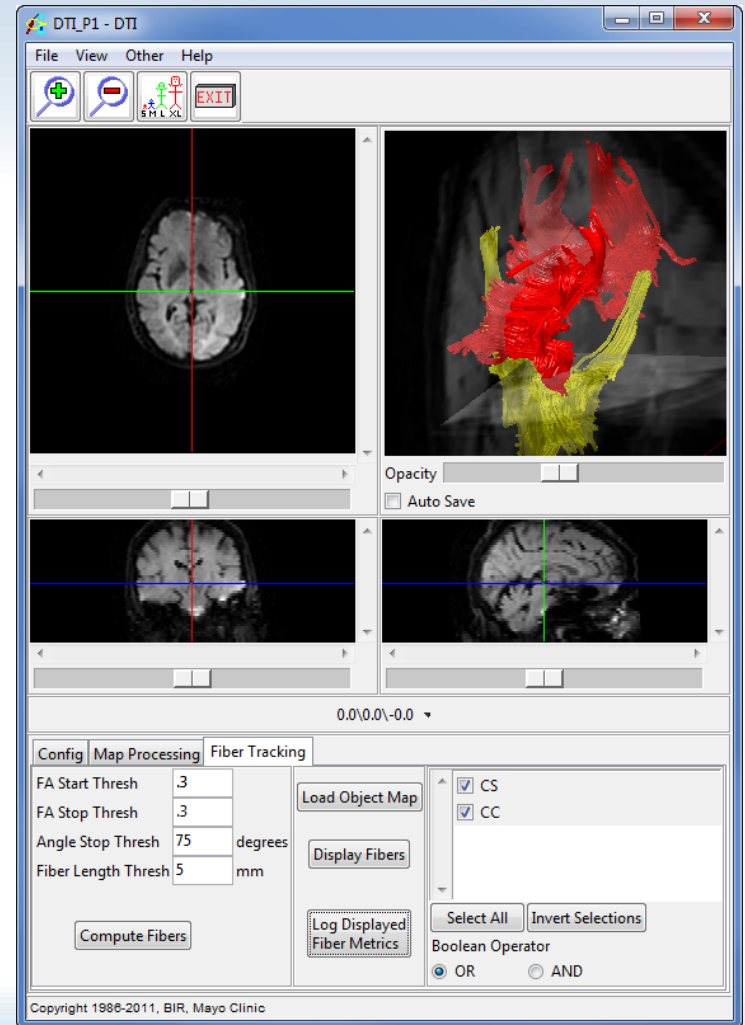


Diffusion Tensor Imaging (DTI)

- ◆ What is diffusion tensor imaging?
 - Series of diffusion weighted MR images (DWI)
 - At least six different magnetic field gradient pulses applied
 - Sensitive to the rate AND direction of diffusion
 - Provides information about tissue architecture
 - Diffusion tends to be “anisotropic” (in one direction) for ordered structures like white matter tracts and muscle fibers

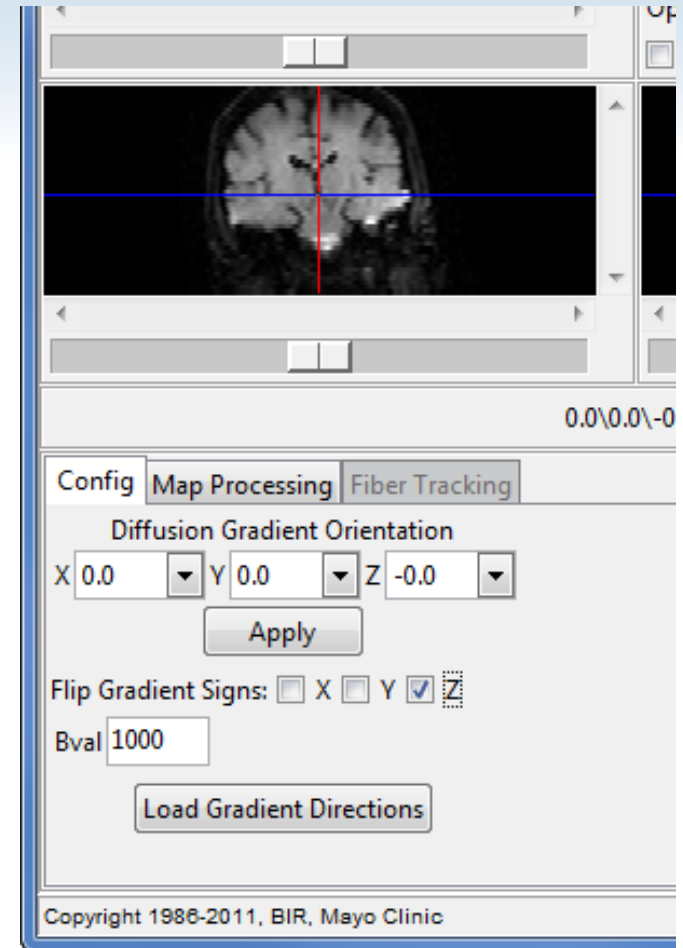
DTI Add-On for Analyze 10.0

- ◆ Apps menu > DTI
 - *Add-on module, only accessible with special license
- ◆ Features:
 - Supports unlimited number of diffusion gradients
 - Requires (1) b0 volume
 - At least (6) gradient-encoded volumes
 - Compute & export diffusion maps
 - Fiber tractography
 - Compute and display fiber tracts
 - Log fiber metrics
 - Export fiber tracts



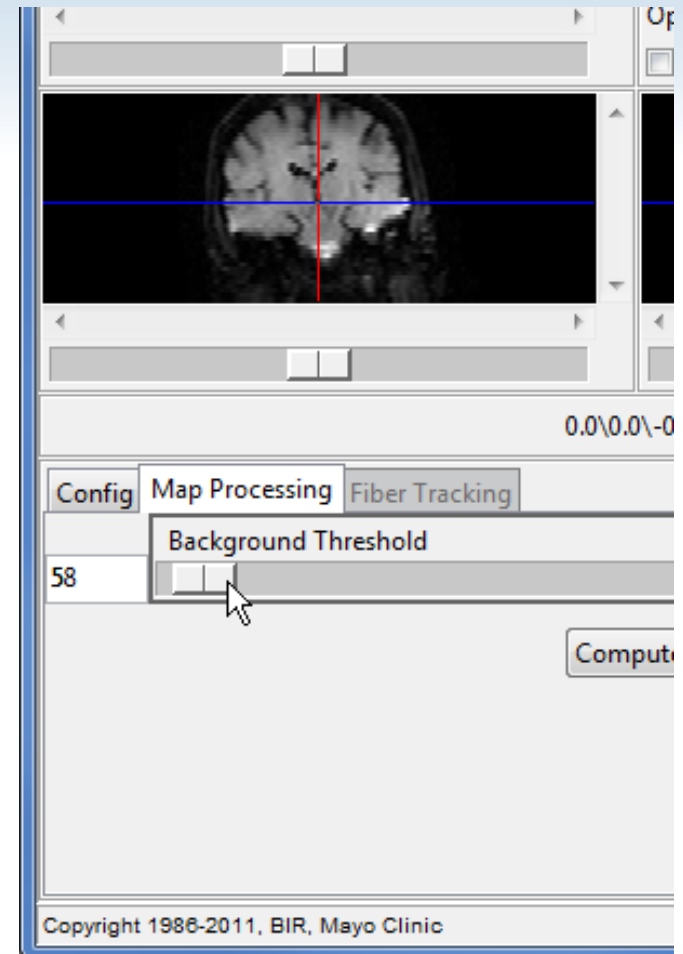
DTI Add-On for Analyze 10.0

- ◆ “Config” tab
 - Specify diffusion gradient directions
 - Manual entry
 - Load from text file
 - Flip gradient signs
 - Orient gradient directions in Analyze coordinate system
 - Left: Positive X
 - Anterior: Positive Y
 - Superior: Positive Z
 - Enter B value



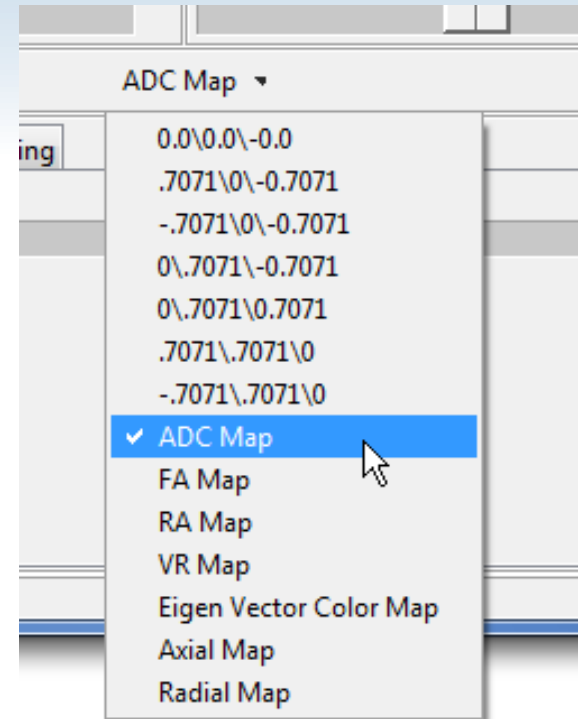
DTI Add-On for Analyze 10.0

- ◆ “Map Processing” tab
 - Background Threshold
 - Avoid computing tensor for background noise
 - Reduces processing time and memory usage
 - Compute DTI maps



DTI Add-On for Analyze 10.0

- ◆ Computed diffusion maps
 - Apparent Diffusion Coefficient (ADC) ¹
 - Fractional Anisotropy (FA) ¹
 - Relative Anisotropy (RA) ²
 - Volume Ratio (VR) ¹
 - Axial Diffusivity ³
 - Radial Diffusivity ³
 - Eigenvector colormap ¹



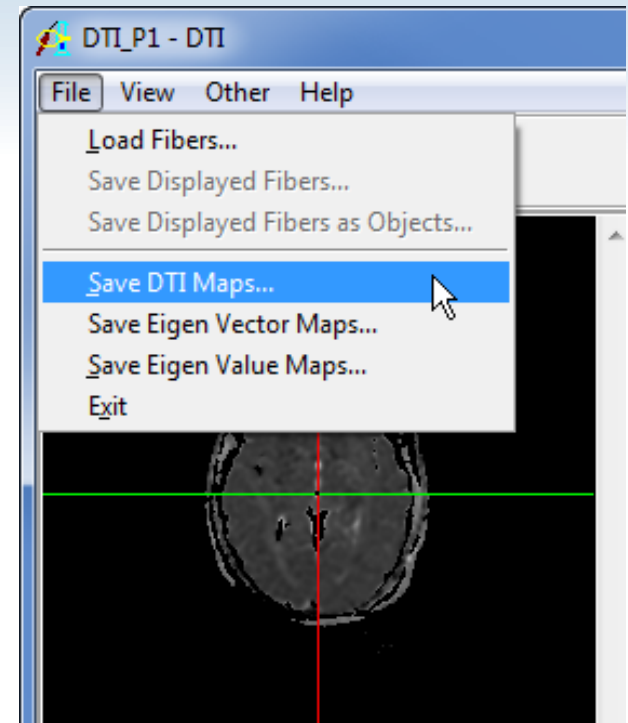
¹Jiang et. al., Computer Methods and Programs in Biomedicine 81 (2006) 106-116.

²Sun et. al., Magnetic Resonance in Medicine 50: 743-748 (2003)

³Pierpaoli and Basser., Magnetic Resonance in Medicine 36: 893-906 (1996)

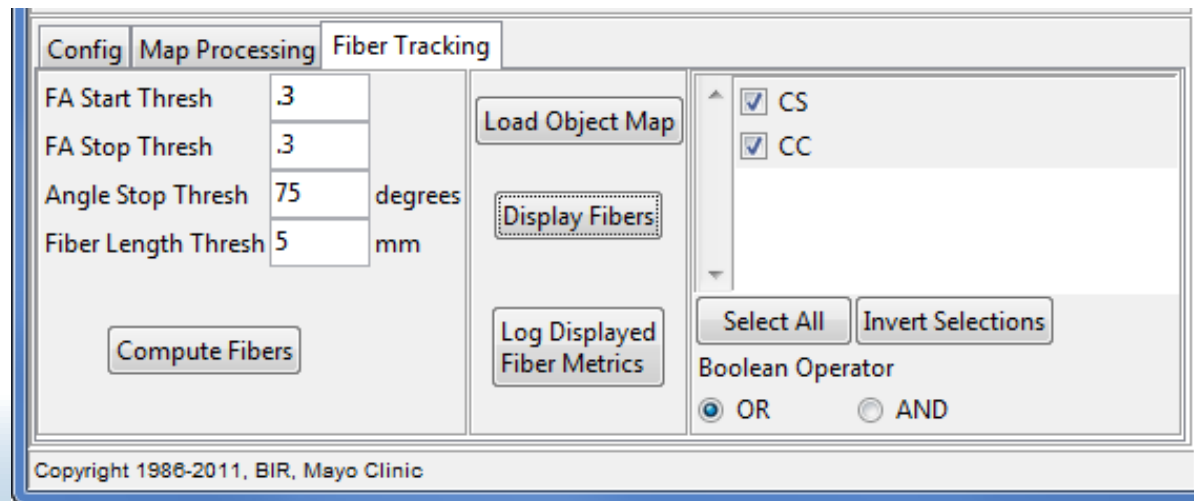
DTI Add-On for Analyze 10.0

- ◆ Export computed maps
 - File > Save DTI Maps
 - Output all computed diffusion maps
 - File > Save Eigenvector maps
 - X, Y, Z component of each eigenvalue
 - 9 volumes in total
 - File > Save Eigenvalue Maps
 - λ_1 , λ_2 , and λ_3
- ◆ Output to Disk or Workspace



DTI Add-On for Analyze 10.0

- ◆ “Fiber Tracking” tab
 - Fiber Assignment by Continuous Tracking (FACT) algorithm¹
 - All voxels used as seed points for computing tracks
 - All tracks passing through each voxel are determined
 - Tracks passing through defined ROIs are displayed



¹Jiang et. al., Computer Methods and Programs in Biomedicine 81 (2006) 106-116.

DTI Add-On for Analyze 10.0

◆ Computing Fibers

– FA Start Thresh

- All voxels with an FA greater than this value will serve as a seed point for a track

– FA Stop Thresh

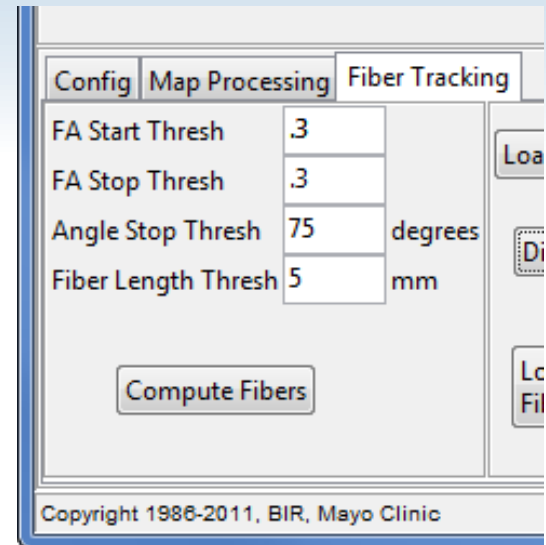
- A track will end upon encountering a voxel with an FA value less than this

– Angle Stop Thresh

- If a track turns more than this within a voxel, then the track will end

– Fiber Length Thresh

- Tracks less than this are removed



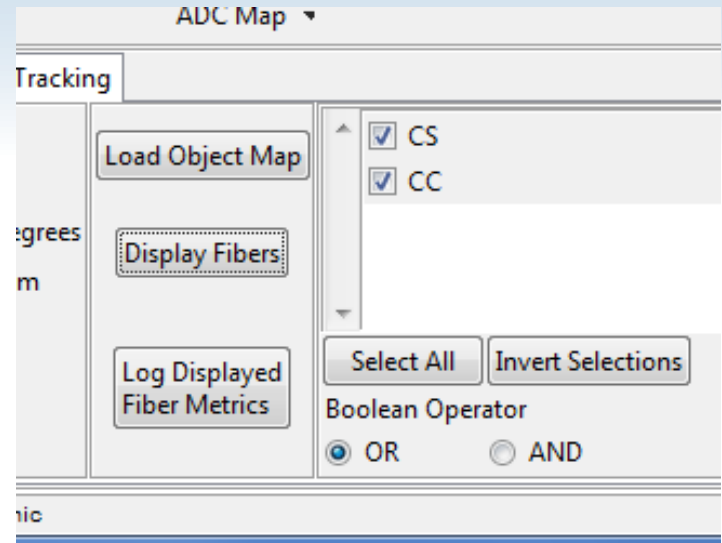
DTI Add-On for Analyze 10.0

- ◆ Load Object Map

- Define ROIs for fiber tractography with an Object Map file (*.obj)
- Create Object Map using Region of Interest or other Analyze modules

- ◆ Display Fibers

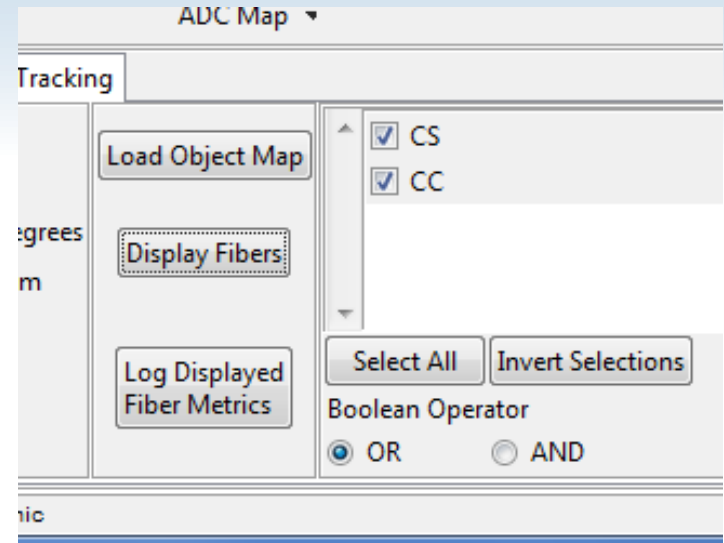
- Fiber display controlled by object list and OR/AND Boolean Operator
- Boolean Operator
 - **OR:** Fibers passing through any of the selected objects will be displayed
 - **AND:** Only fibers that pass through all selected objects will be displayed



DTI Add-On for Analyze 10.0

◆ Log Displayed Fiber Metrics

- Number of Fibers
- Maximum Fiber Length
- Minimum Fiber Length
- Mean Fiber Length
- FA Mean
- FA Standard Deviation



Fiber Metrics Log - DTI

```
# Thu Nov 17 10:44:30 CST 2011
# Volume=DTI_P1
#
#
#
#
#
```

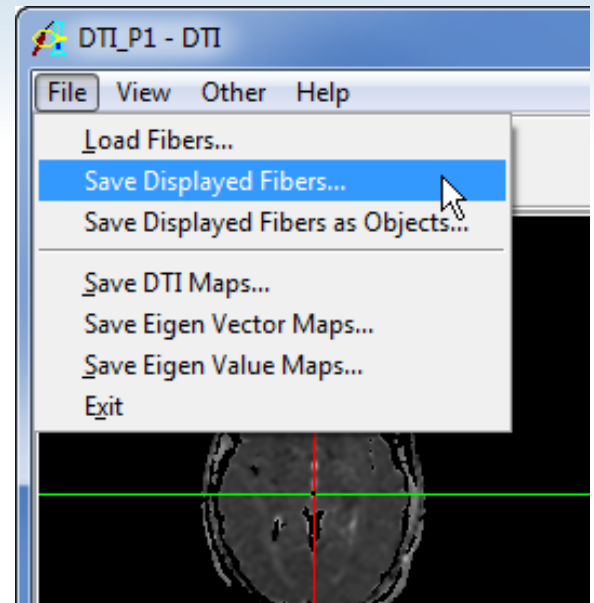
Name	Number	Max Length	Min Length	Mean Length	FA Mean	FA St. Dev.
CS	1554	107.025732	5.110354	33.134824	0.572519	0.161665
CC	2973	87.310265	5.006139	35.303857	0.617324	0.173792

Save Done

DTI Add-On for Analyze 10.0

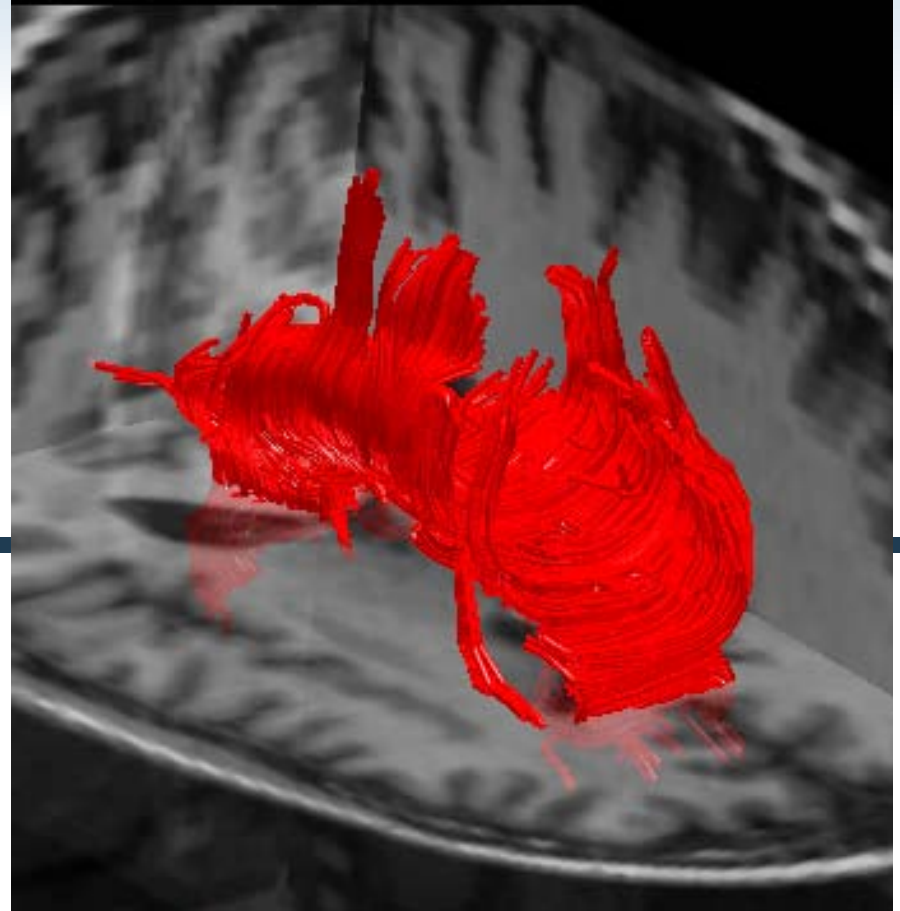
◆ Output Displayed Fibers

- File > Save Displayed Fibers
 - Text file (*.txt)
- File > Save Displayed Fibers as Objects
 - Outputs fiber bundles as objects in an Object Map file (*.obj)
 - Could then be used to sample diffusion maps



DTI Analysis and Fiber Tractography

with Analyze 10.0



Questions?

In Conclusion

- ◆ Watch for an email from Analyze Webinars tomorrow
- ◆ Other helpful documents and protocols - www.analyzedirect.com/support/resourcecenter.asp
- ◆ Evaluate Analyze 10.0 and/or the DTI add-on free for 30 days - www.analyzedirect.com/evaluate
- ◆ Suggest topics for future Webinars - webinars@analyzedirect.com
- ◆ Contact me: **Beth Adams**
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