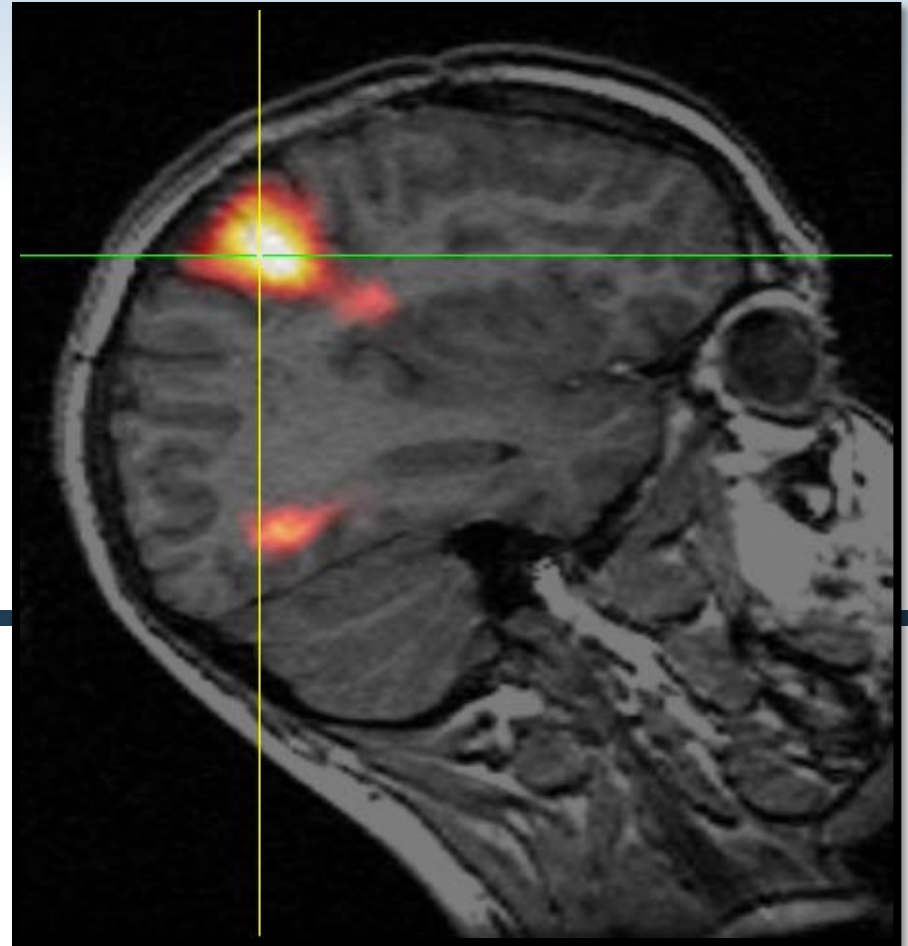


Analyze Webinar – June 23, 2011

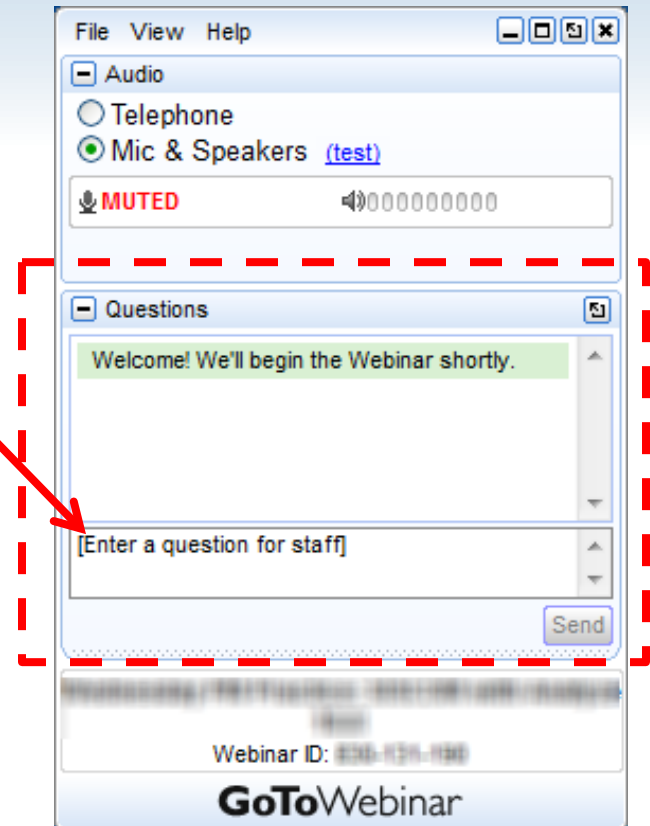
# SISCOM with Analyze 10.0

Beth Farrell  
Application Specialist  
AnalyzeDirect



# SISCOM with Analyze 10.0 Webinar

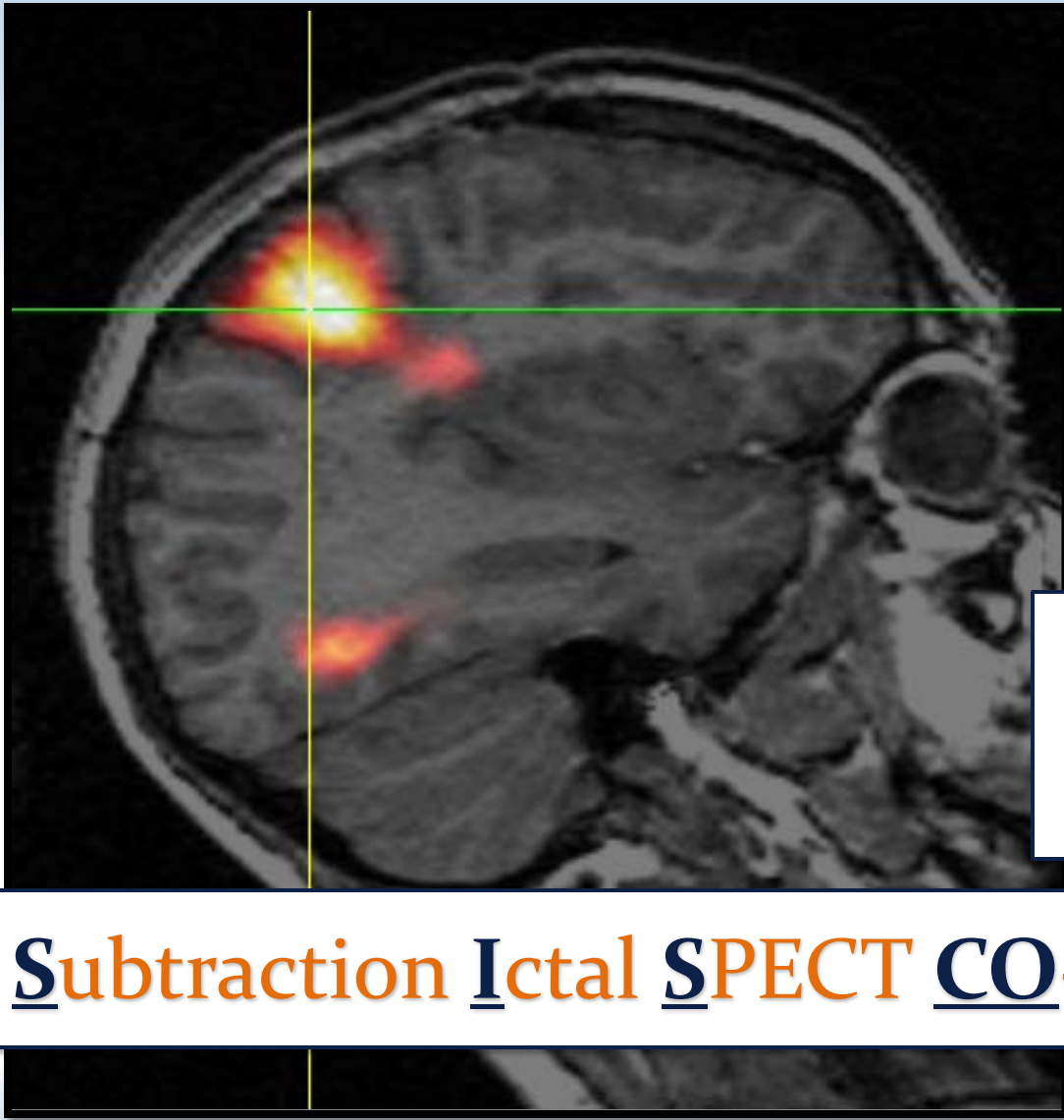
- ◆ Questions during the Webinar
  - Use “Questions” pane of your GoToWebinar control panel
- ◆ After the Webinar
  - Recording and presentation materials will be available online starting tomorrow
  - Webinar registrants will receive link to website location via e-mail



# SISCOM with Analyze 10.0 Webinar

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- ◆ Webinar Agenda:
  - Introduction to SISCOM
  - Using the SISCOM module in Analyze 10.0
  - Other relevant applications for Analyze 10.0
  - Questions & Answers
- ◆ Estimated Duration: 40 minutes
- ◆ Webinar Objectives:
  - To familiarize you with the SISCOM process
  - To teach you the basics of using the SISCOM module
  - To provide you with “tips and tricks” that can help you work more effectively in Analyze



**SISCOM**

**Subtraction Ictal SPECT CO-registered to MRI**

# What is SISCOM?

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- ◆ Epilepsy-oriented application
- ◆ Uses a combination of SPECT and MR imaging
- ◆ Identifies the areas of increased activation in the brain during seizure (the “seizure focus”)
- ◆ Fuses functional information with structural anatomy

# SISCOM Inputs

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- ◆ Ictal SPECT
  - Radiotracer injected during seizure activity
    - Early injection is important
    - $^{99m}\text{Tc}$ -HMPAO or  $^{99m}\text{Tc}$ -ECD
  - Provides a “snap shot” of the cerebral blood flow patterns during seizure
- ◆ Interictal SPECT
  - Radiotracer injected between seizures
  - Shows areas of hypoperfusion in the region of seizure focus
- ◆ MRI
  - 3D T<sub>1</sub>-weighted SPGR or MPRAGE
  - Isotropic spatial resolutions around 1mm
  - Spans the entire extent of the brain

# Why use SISCOM?

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- ◆ Improves localization of the seizure focus
  - Improves sensitivity and specificity of SPECT
- ◆ Side-by-side visual analysis of ictal and interictal SPECT images does not take into account differences in:
  - Injected dose
  - Radiotracer uptake and decay
  - Patient head position
  - Image slice location
- ◆ O'Brien *et al.* (Neurology 1998)
  - SISCOM images were localizing in 88.2% of patients, compared with 39.2% for side-by-side visual inspection of ictal and interictal images
  - Concordance of seizure localization with more established tests was also better for SISCOM (84.3% vs. 41.2%)

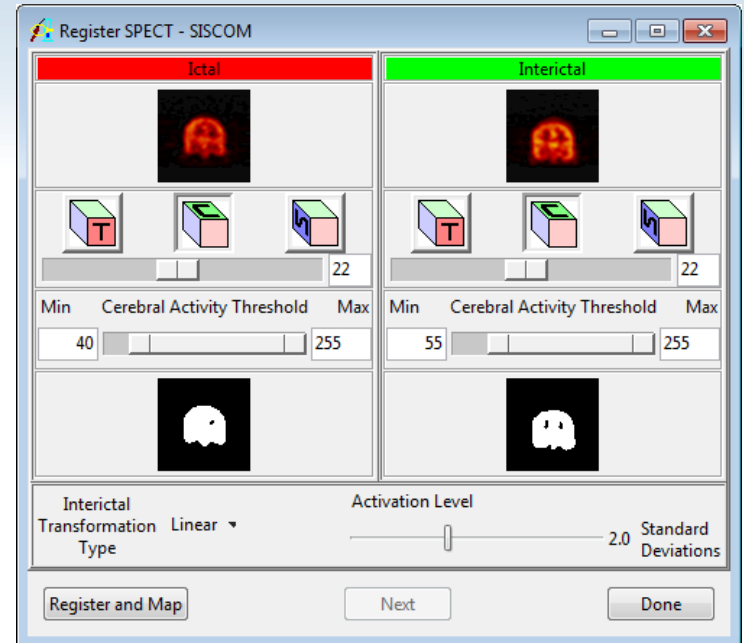
# The SISCOM Process

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1. Register the ictal to the interictal SPECT volume
2. Normalize the SPECT volumes to a common mean value based on global mean activity levels
3. Subtract the normalized interictal images from the normalized ictal images
4. Determine the statistical regions of activation from the subtraction SPECT image
5. Register the SPECT to the MRI volume and create a fused representation of regions of focal activation with the structural information of the MRI

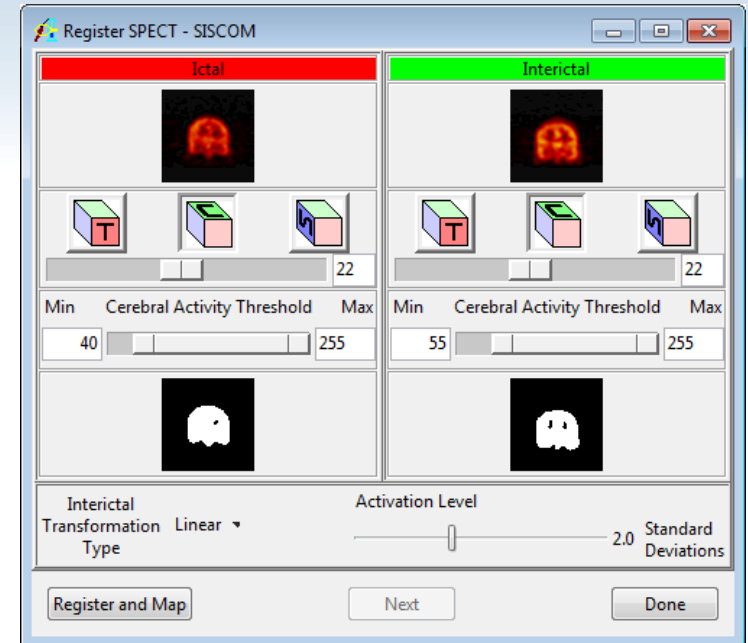
# SISCOM: SPECT Processing

- ◆ **SPECT registration:**
  - Segment cerebral voxels
    - Cerebral Activity Thresholds
    - Binary thresholding
  - Registration
    - Normalized mutual information-based registration (i.e. 3D Voxel Registration)



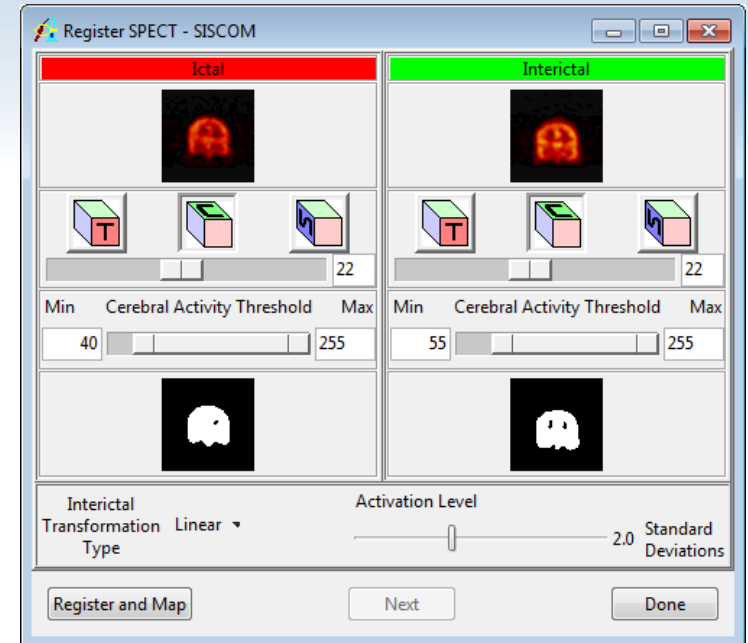
# SISCOM: SPECT Processing

- ◆ **SPECT normalization:**
  - Scans are scaled to a common mean value
  - Assumes global mean activity level in the independent scans represents comparable function



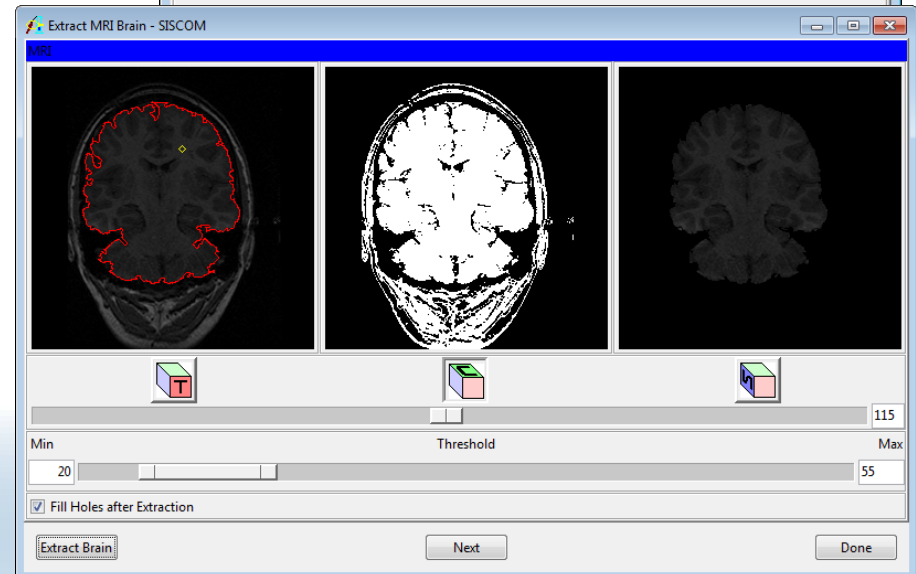
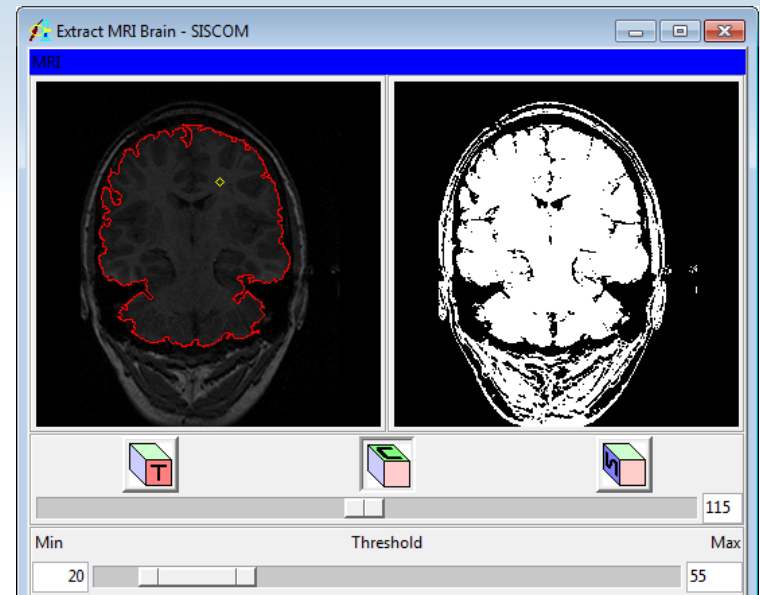
# SISCOM: SPECT Processing

- ◆ **SPECT subtraction:**
  - Normalized interictal images subtracted from normalized ictal images
- ◆ **Activation map calculation:**
  - Only contains those voxels whose intensity value was more than the given number of standard deviations above the mean



# SISCOM: MRI Processing

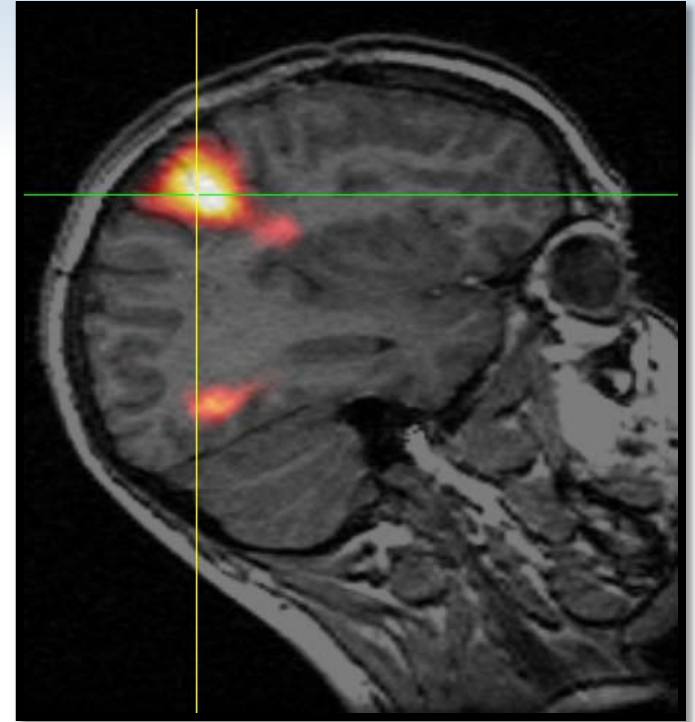
- ◆ Brain must be extracted from MRI in order for SPECT to be co-registered
- ◆ Brain segmentation achieved with:
  - Seeded region growing
  - Morphology



# SISCOM: Fuse SPECT & MRI

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- ◆ **Registration of SPECT to MRI**
  - Surface-based registration
- ◆ **Automatic fusion of activation map with MRI**



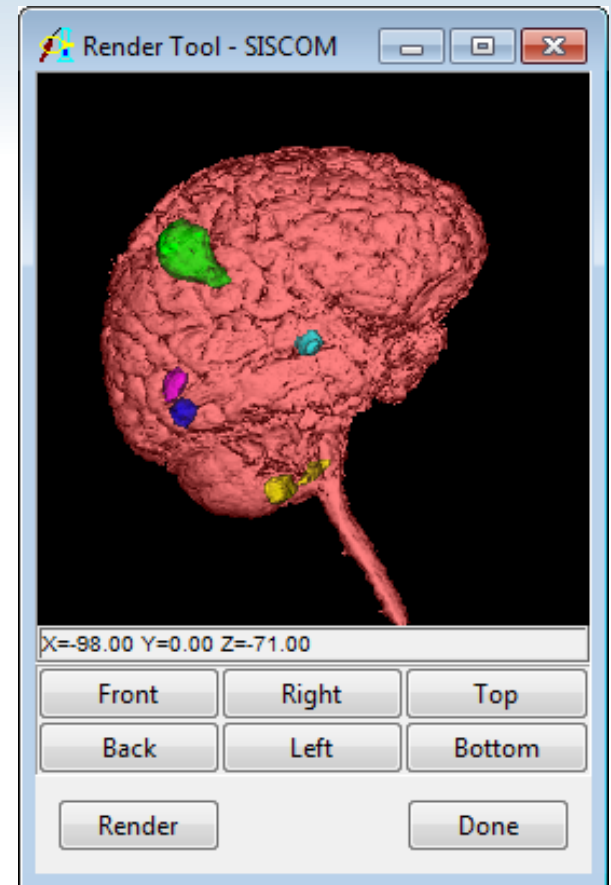
# SISCOM: Additional Options

## ◆ Volume comparison

- Compare SPECT-SPECT registration, as well as SPECT-MRI registration
- Useful for verifying SISCOM results

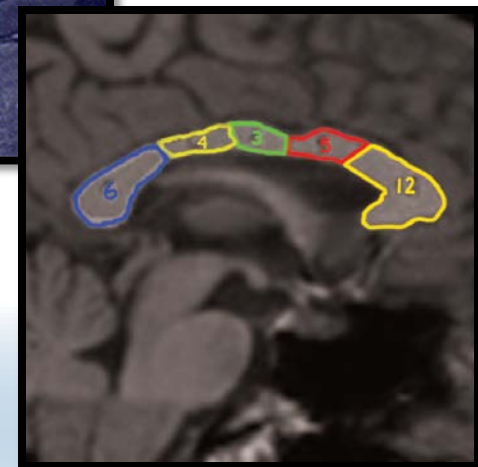
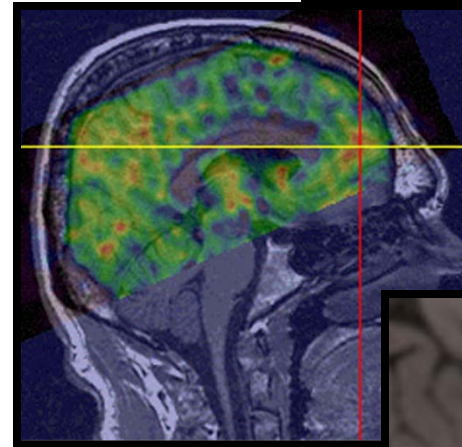
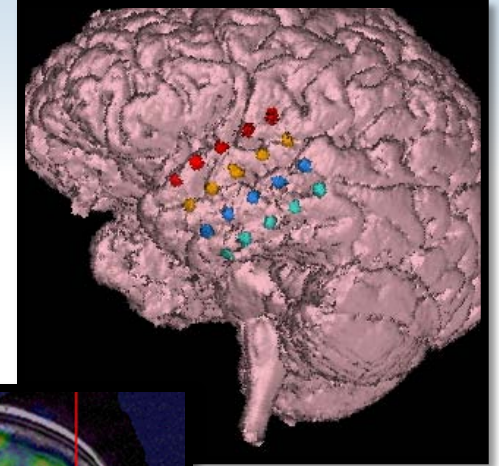
## ◆ Object Map creation

- Create object map for extracted brain and specified activation regions
- View rendering



# Other Analyze Applications

- ◆ **Electrode grid visualization**
  - Pre-operative MRI
  - Post-operative CT with electrodes
- ◆ **Multi-modality image fusion**
  - PET-MR coregistration
  - CT-MR coregistration
- ◆ **Region measurement**
  - Brain structure volume assessment
  - 4D PET analysis

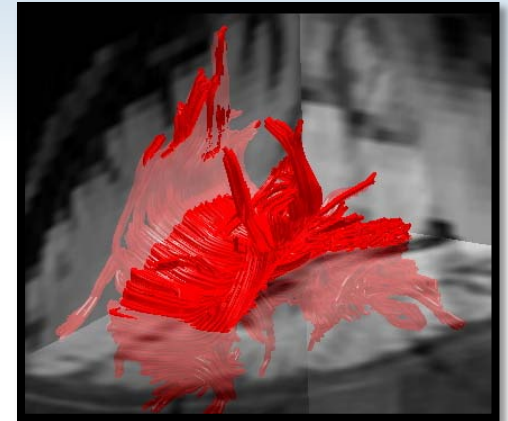


# Other Analyze Applications

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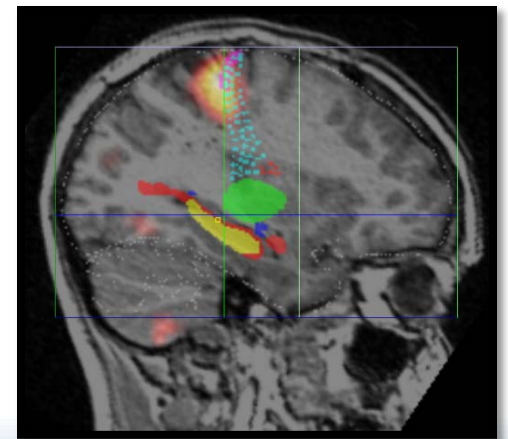
- ◆ DTI

- Fiber tractography
- Compute: ADC, FA, RA, VR, Axial and Radial Diffusivity, Eigen Vector Colormap



- ◆ Mayo 3D Brain Atlas

- Talairach-Tournoux based 3D labeling of activation regions
- Output atlas-derived regions for further analysis



**Questions?**

# Conclusion

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- ◆ Watch for a link to the AnalyzeDirect website tomorrow
- ◆ Other helpful documents and protocols -  
[www.analyzedirect.com/support/resourcecenter.asp](http://www.analyzedirect.com/support/resourcecenter.asp)
- ◆ Evaluate Analyze 10.0 free for 30 days -  
[www.analyzedirect.com/evaluate](http://www.analyzedirect.com/evaluate)
- ◆ Contact me: **Beth Farrell**  
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1 (913) 653-8306