Computational Radiology Laboratory
Harvard Medical School
www.crl.med.harvard.edu

Children's Hospital
Department of Radiology
Boston Massachusetts

Translation of neuroimaging technologies to advance clinical care

Simon K. Warfield, Ph.D.

Associate Professor of Radiology

Department of Radiology

Children's Hospital Boston

Children's Hospital Boston
The Hospital for Children

Outline

- Imaging of epilepsy patients
- Fetal MRI
- Image segmentation

Surgical Planning for Epilepsy

- Epilepsy
  - affects over 2.5 million Americans, approximately 1% of population across the world.
  - Annual health care cost of $12.5 billion per year in USA.
  - 75% of patients have their first seizure in childhood.
  - 20% of patients become candidates for surgery after a long period of partially effective medication that can have debilitating educational and sociological side effects.
  - Hetereogeneous causes and consequences of epilepsy in pediatric patients.

Pediatric Epilepsy Surgical Planning

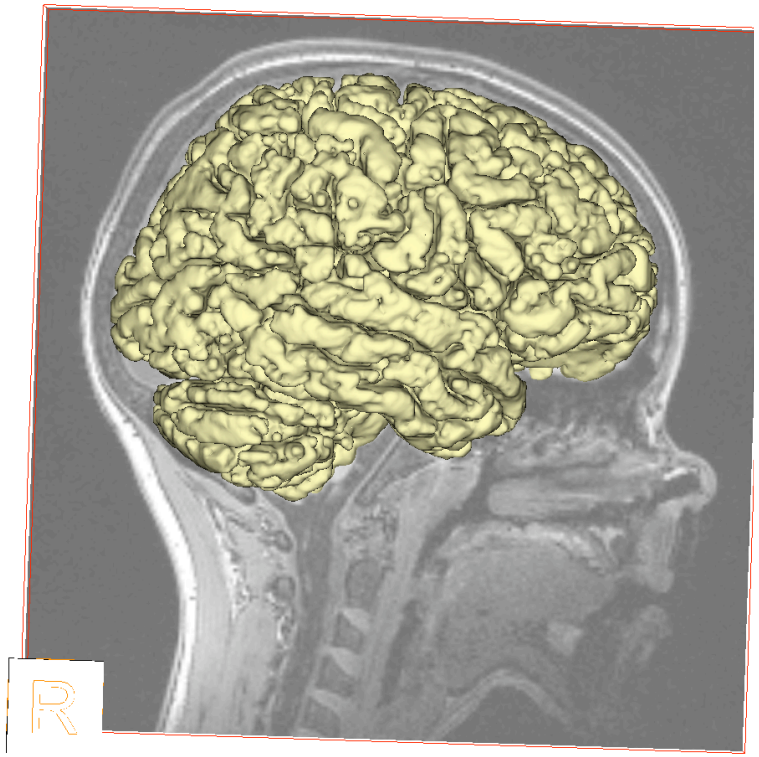
- Objective: Enable an early and effective surgical intervention by accurate identification and localization of seizure foci.

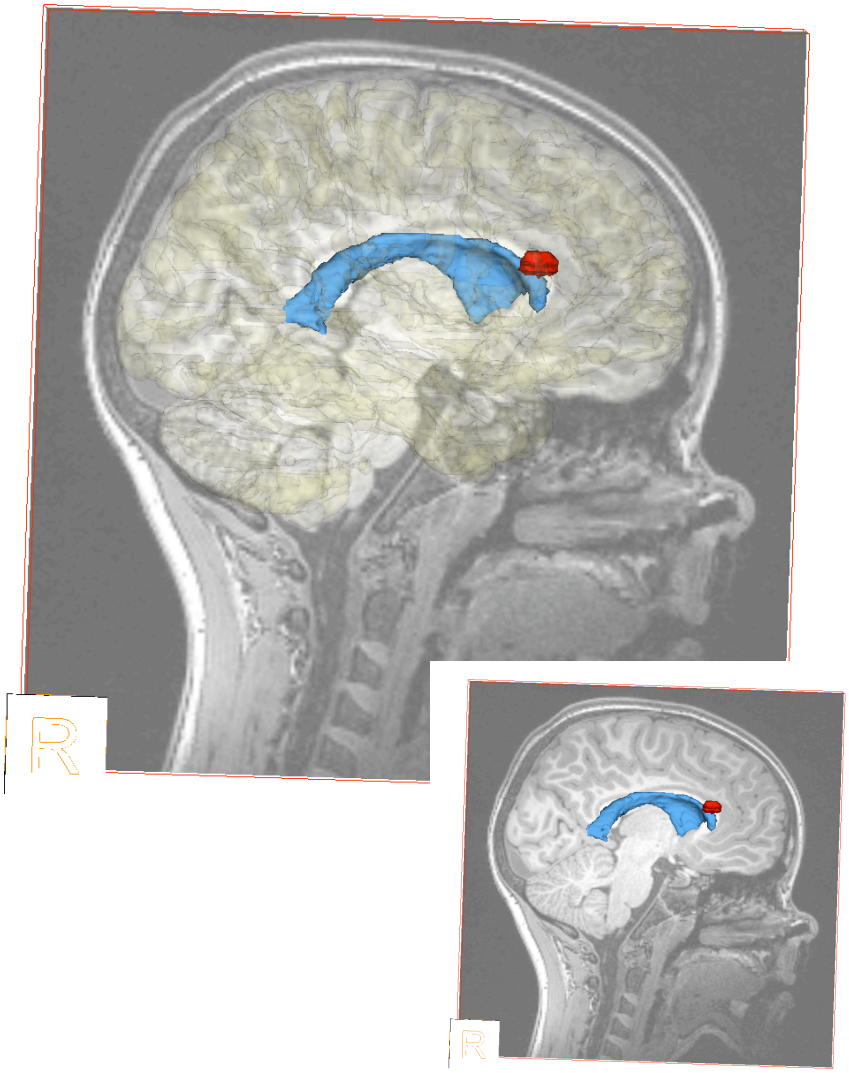
- Imaging of epilepsy:
  - Structural : MRI, DTMRI.
  - Metabolic/function: PET,SPECT,MRS,fMRI.
  - Electrical imaging key to seizure focus localization: EEG, MEG.

Preoperative visualization

- Teenage girl with refractory seizures
- Suspected cortical dysplasia
- Aim to detect and visualize:
  - Region of dysplasia (MRI)
  - Connected white matter (DT-MRI)

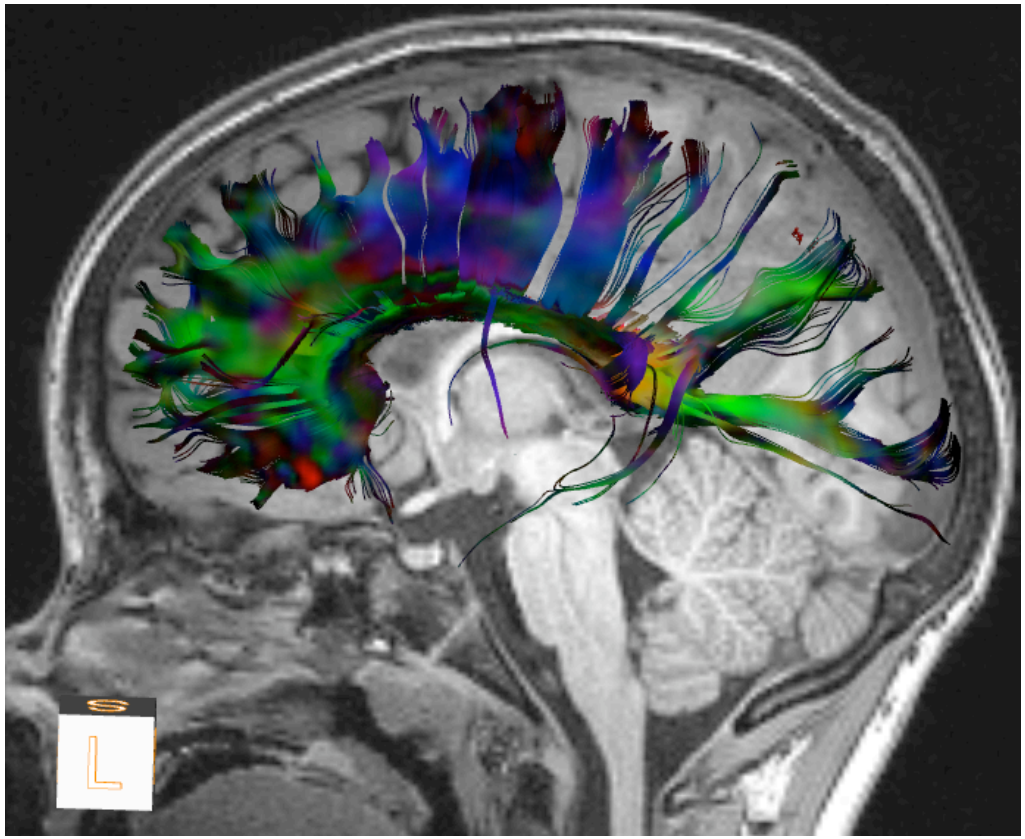
Preoperative visualization





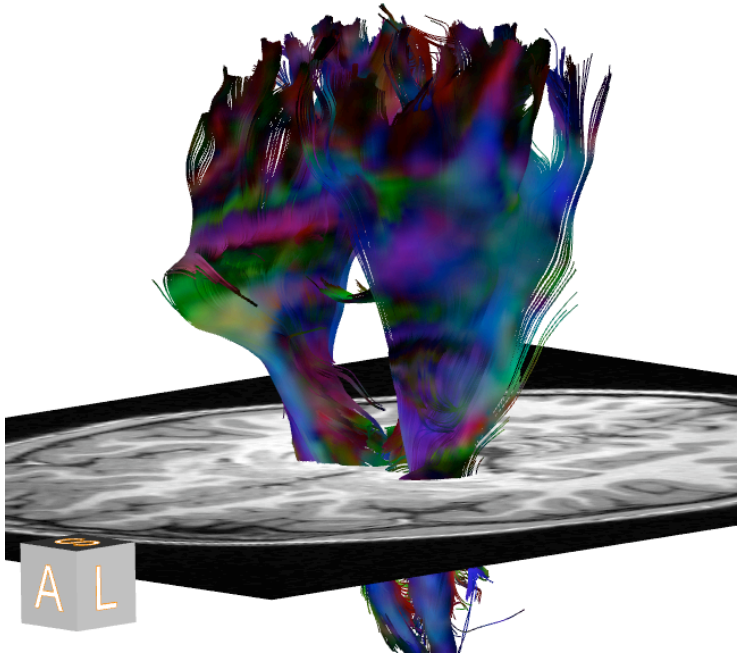
Automatic segmentation of the brain surface and ventricles. Focal dysplasia shown in red.

Preoperative visualization

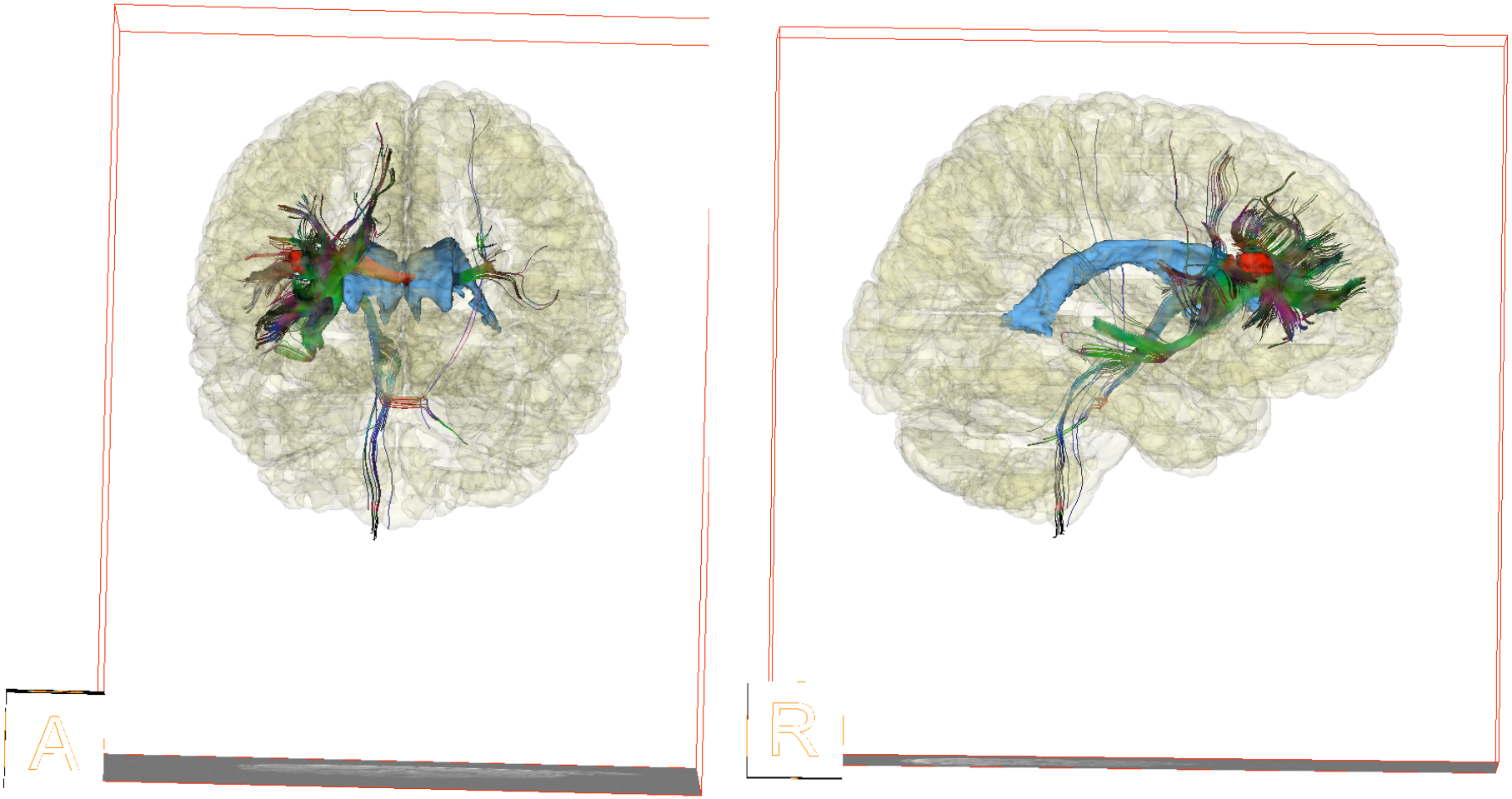


Projections through the corpus callosum.

Corticospinal tract

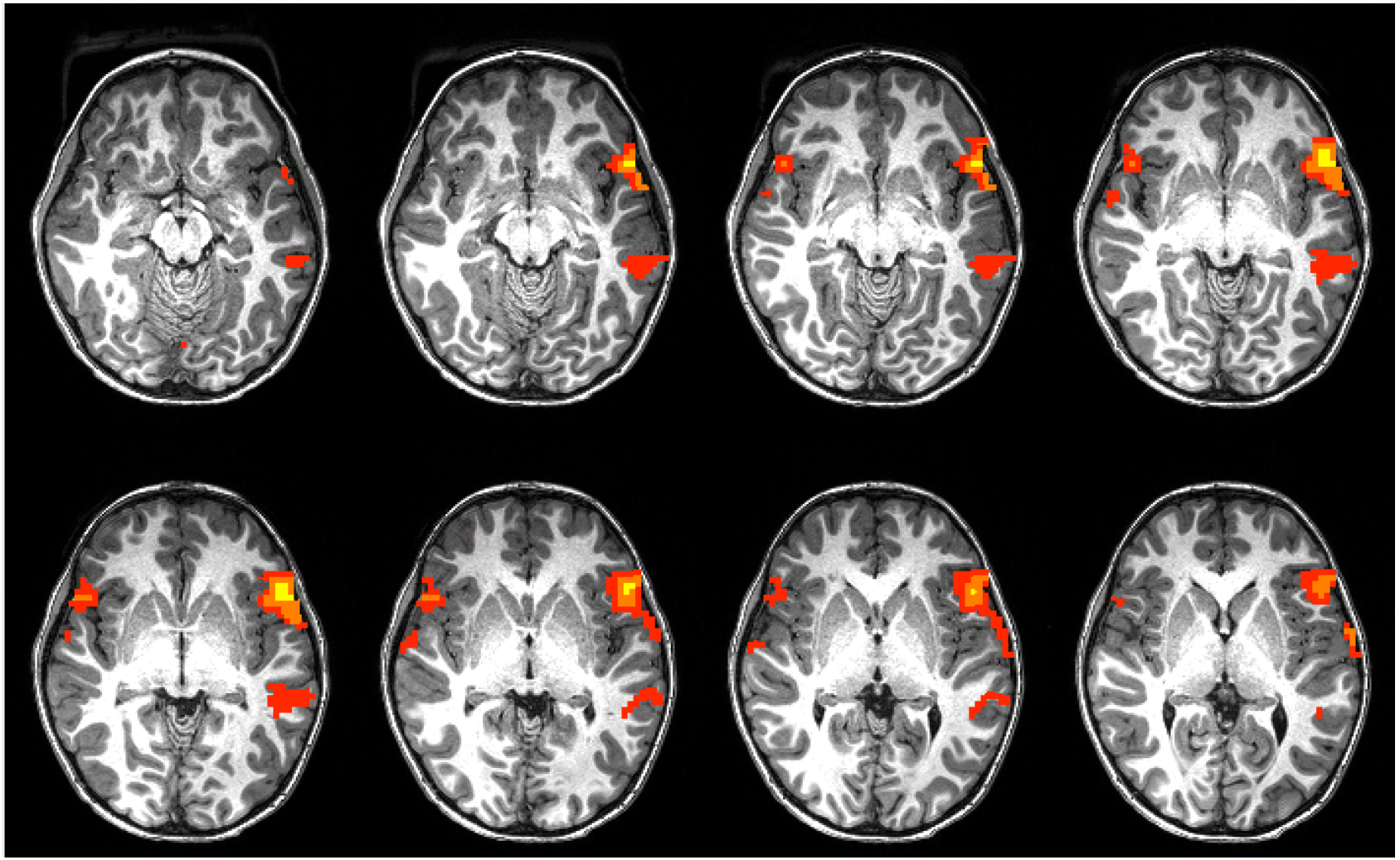


White matter near dysplasia

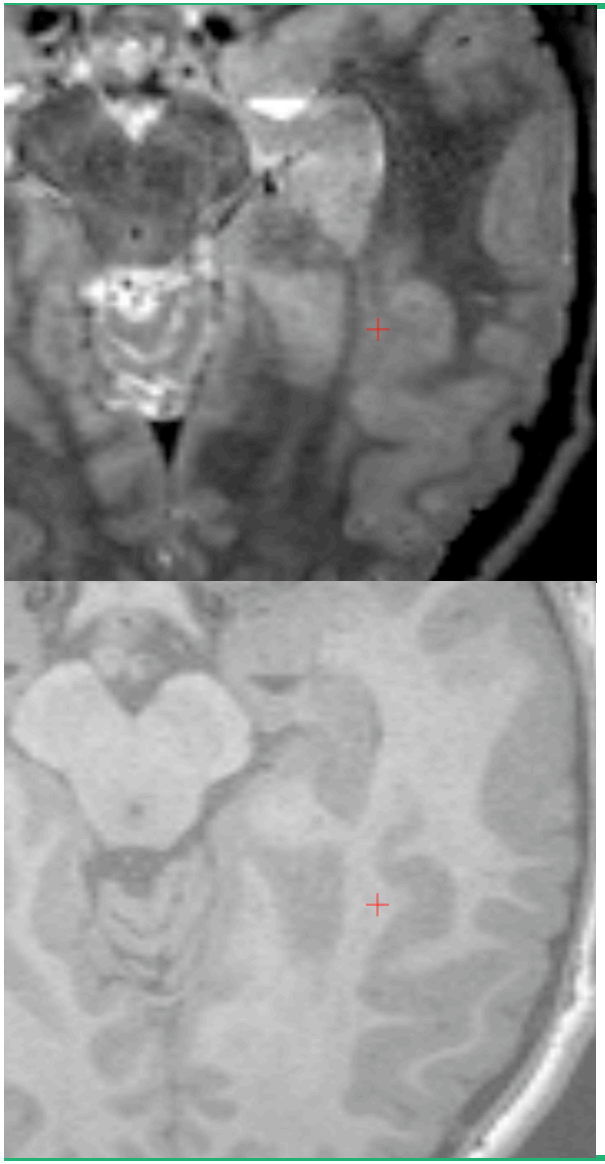


Preoperative visualization

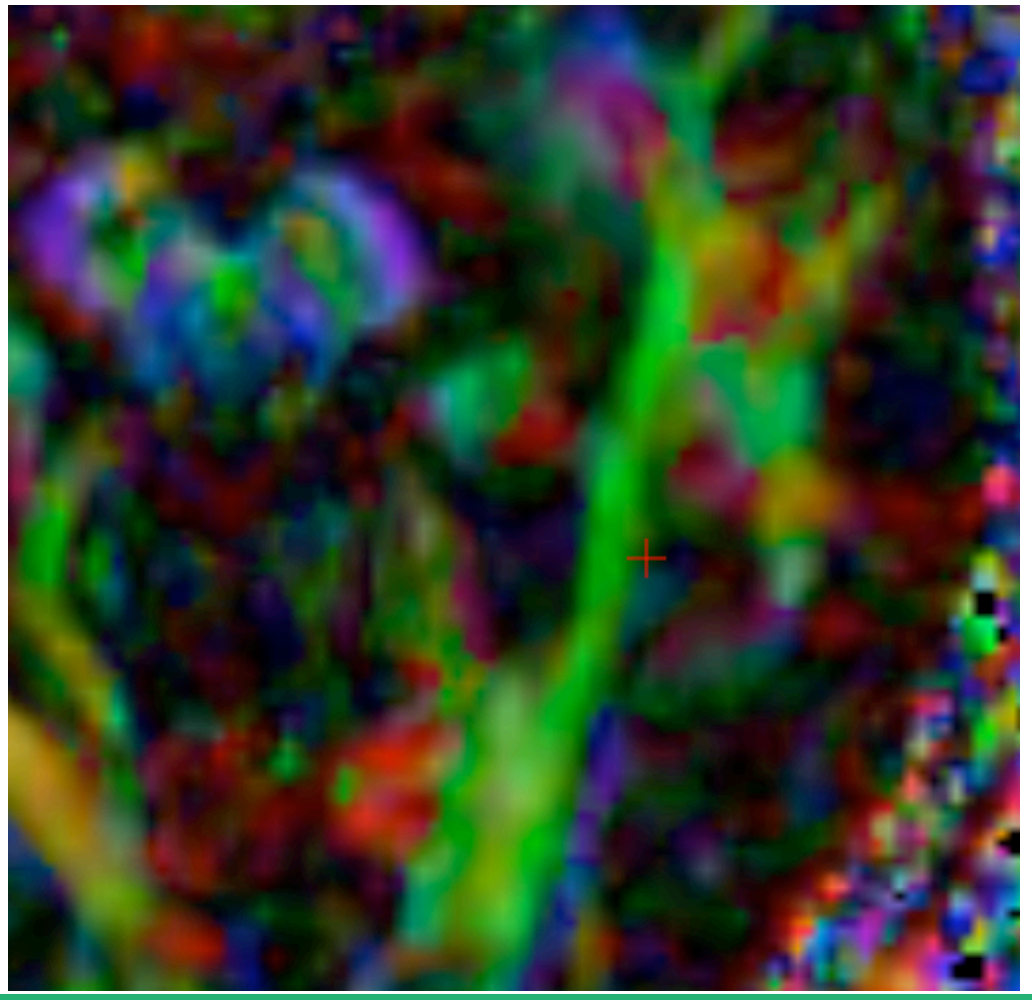
Language localization in 7 year old boy.



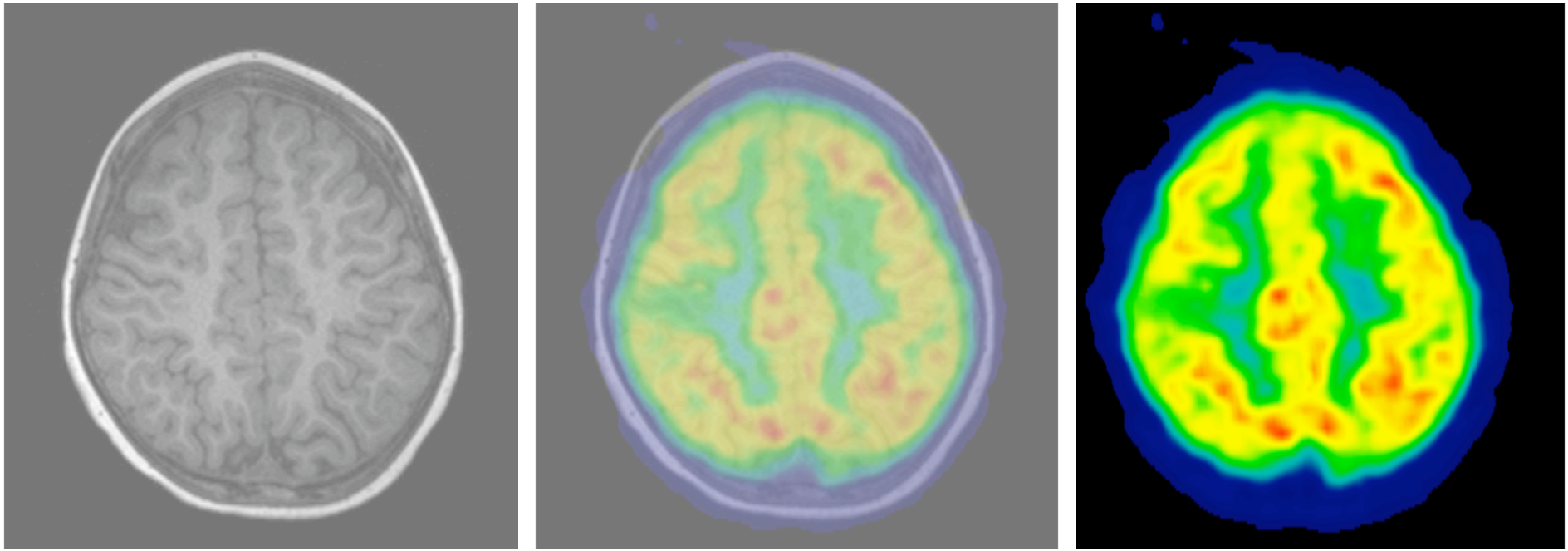
Preoperative visualization



FLAIR cortical dysplasia with MRI, DTI

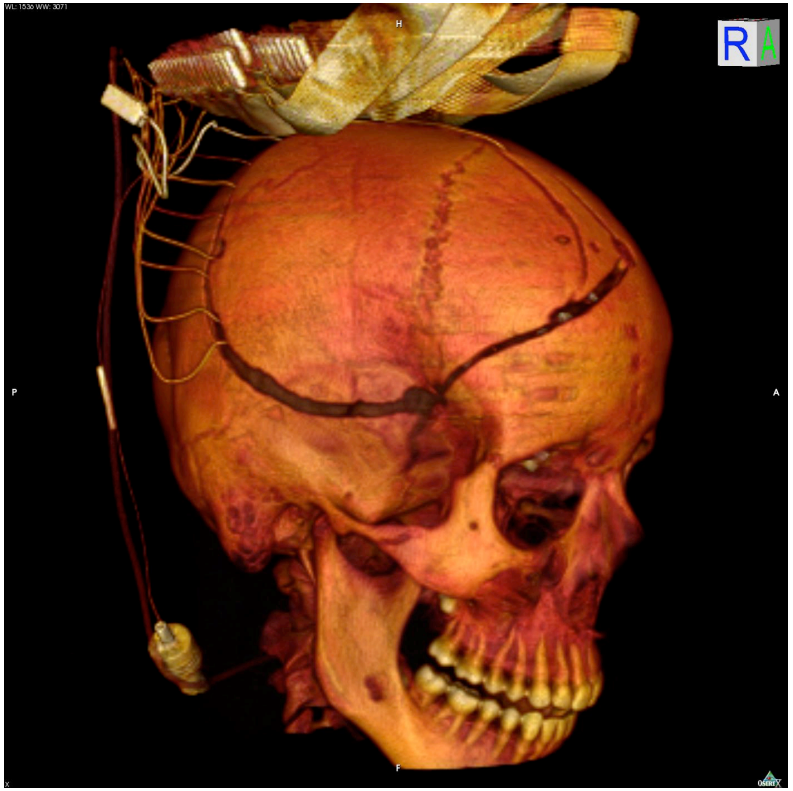


PET and MRI fusion



Localization of PET hypoperfusion with MRI.

Invasive Source Localization



Visualization of CT with intracranial strips and grids allows precise determination of anatomical location of electrodes that detected seizures during long-term monitoring.

Invasive Source Localization