Outline

Aim 1

1.1 Characterize and correct for B1 field inhomogeneity
1.2 Reduce distortion due to B0 field inhomogeneity
1.3 Real-time correction of head motion during scanning
1.4 Characterize and correct for gradient distortions
1.5 Continue with the calibration of T1 acquisitions

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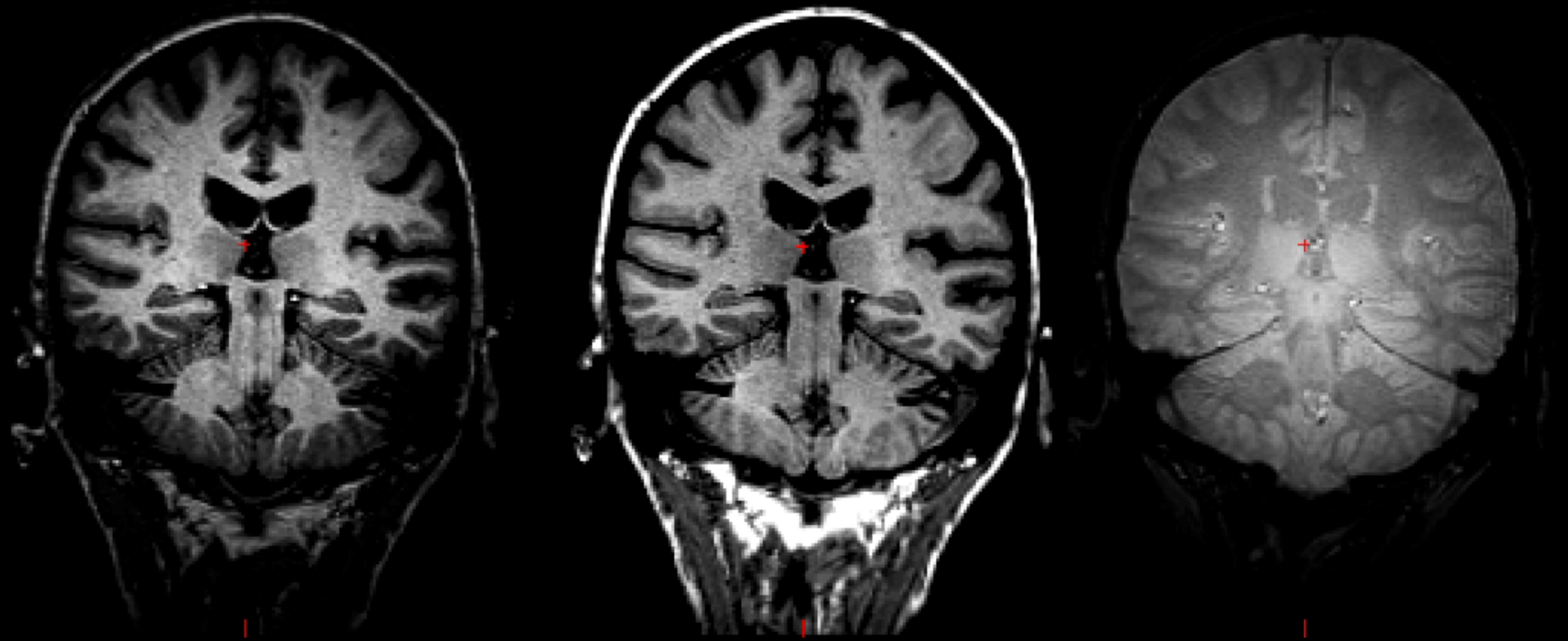
B_1 Inhomogeneity
Dielectric Resonance at 3T

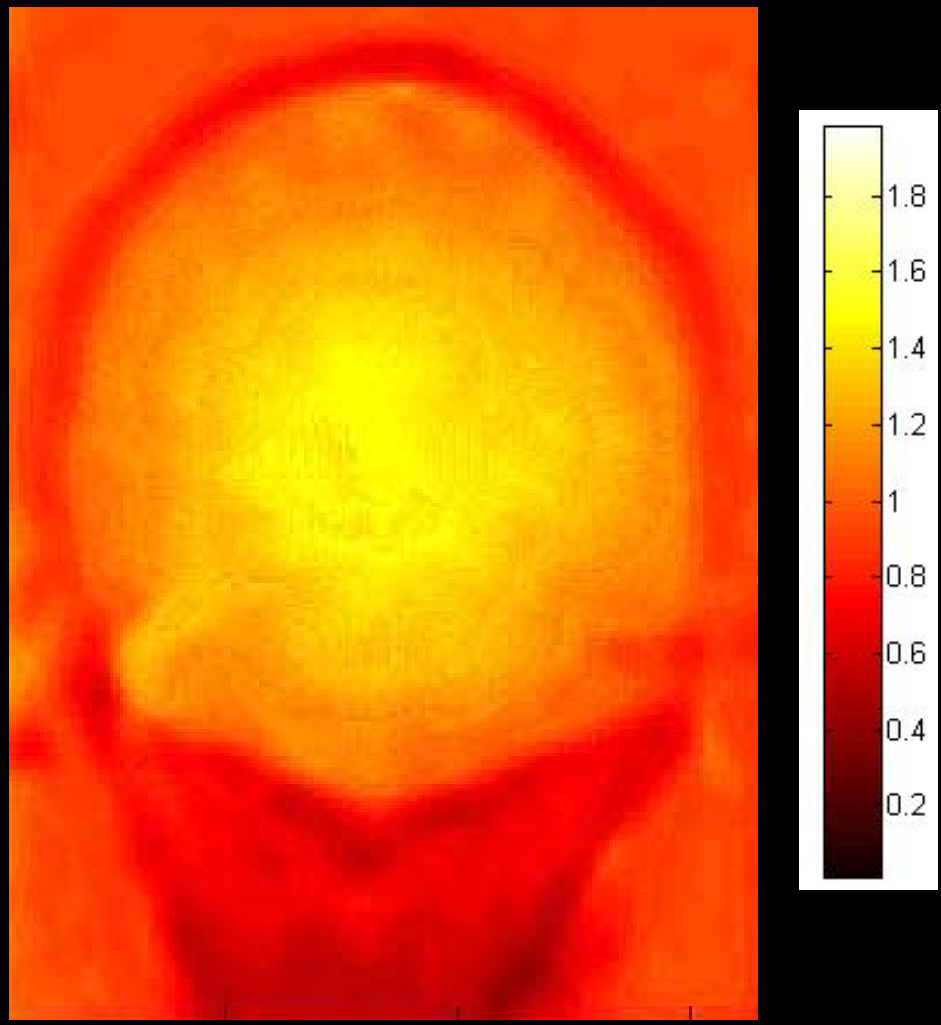


MP_RAGE

T_1-weighted GRE
TR=20ms, FA=30deg

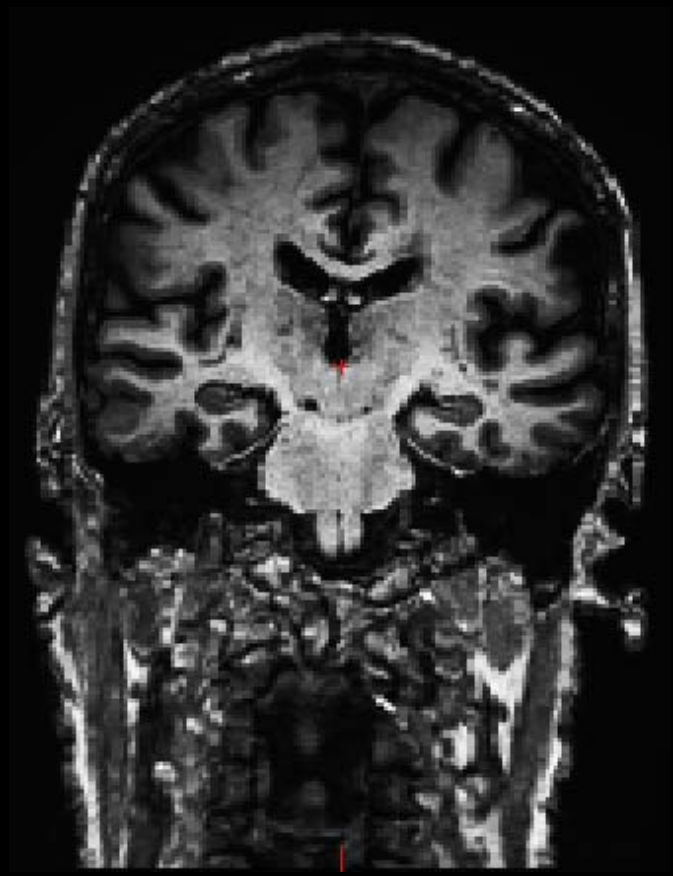
PD-weighted GRE
TR=20ms, FA=5deg

B_1 Inhomogeneity
Dielectric Resonance Effects at 3T

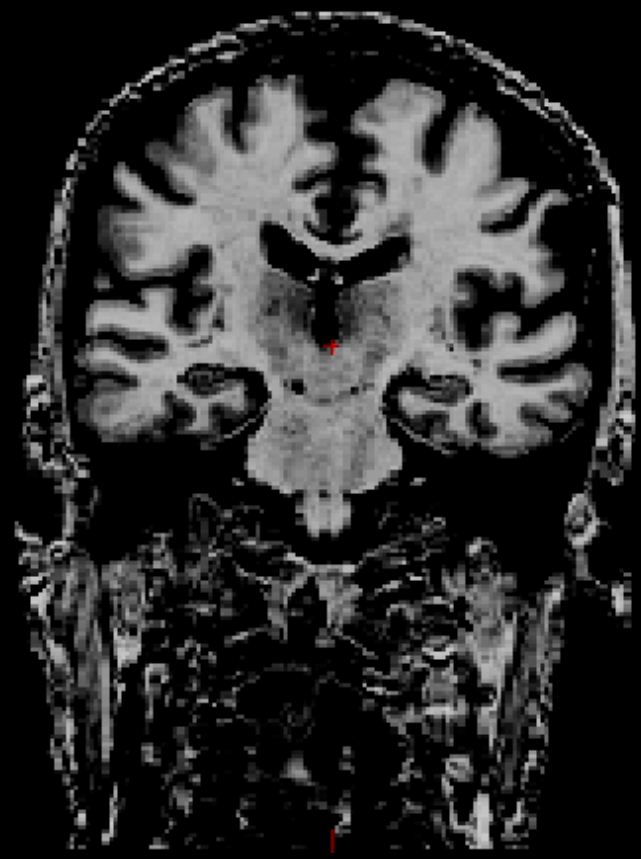


Estimated B_1 Transmit Map at 3T

B_1 Inhomogeneity
Correction for Dielectric Resonance Effects at 3T

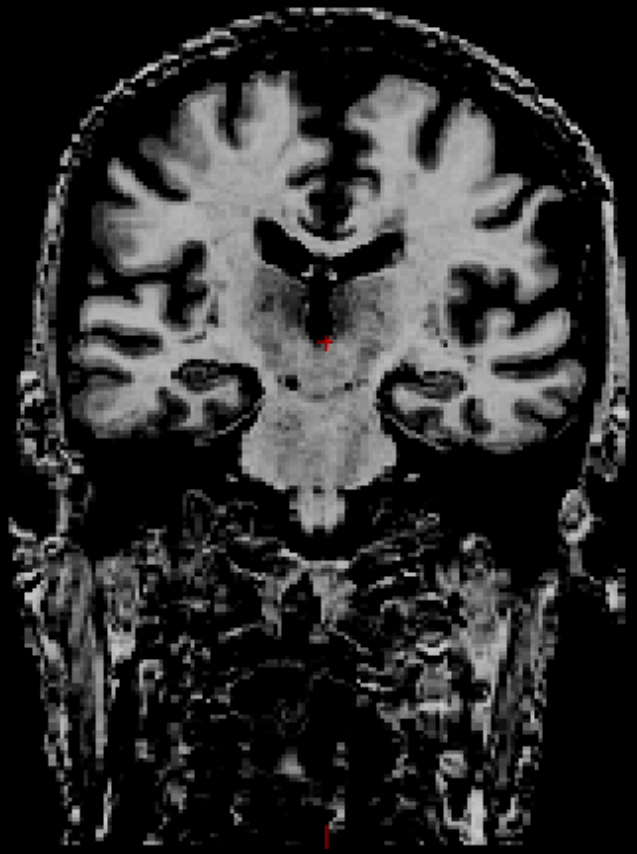


MP-RAGE

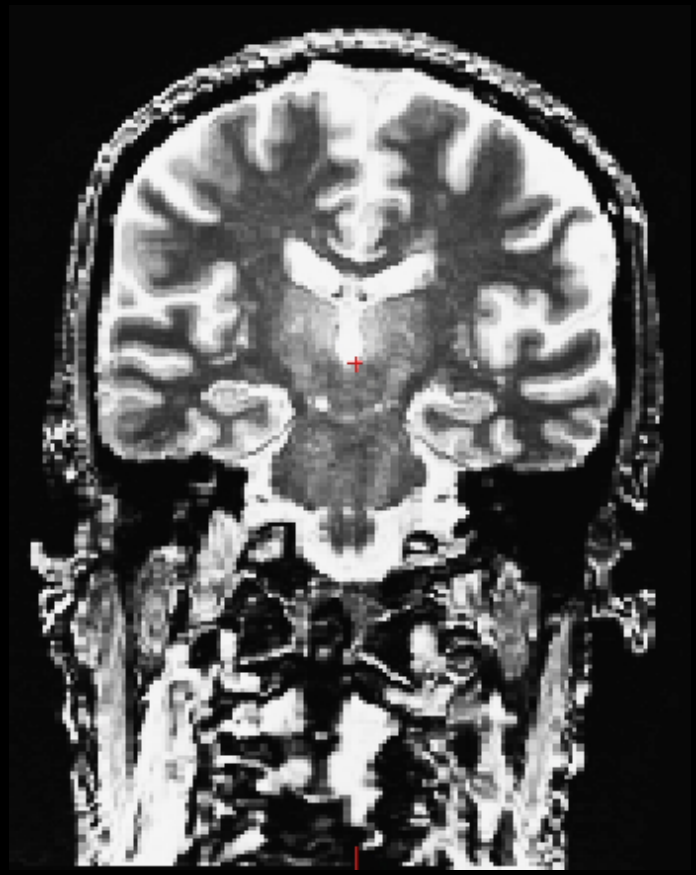


B_1 corrected
Synthetic T1-weighted

B_1 Inhomogeneity
Correction for Dielectric Resonance Effects at 3T



B_1 corrected
Synthetic T_1-weighted



B_1 corrected
Synthetic “PD-weighted”

Outline

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1.5 Continue with the calibration of T1 acquisitions

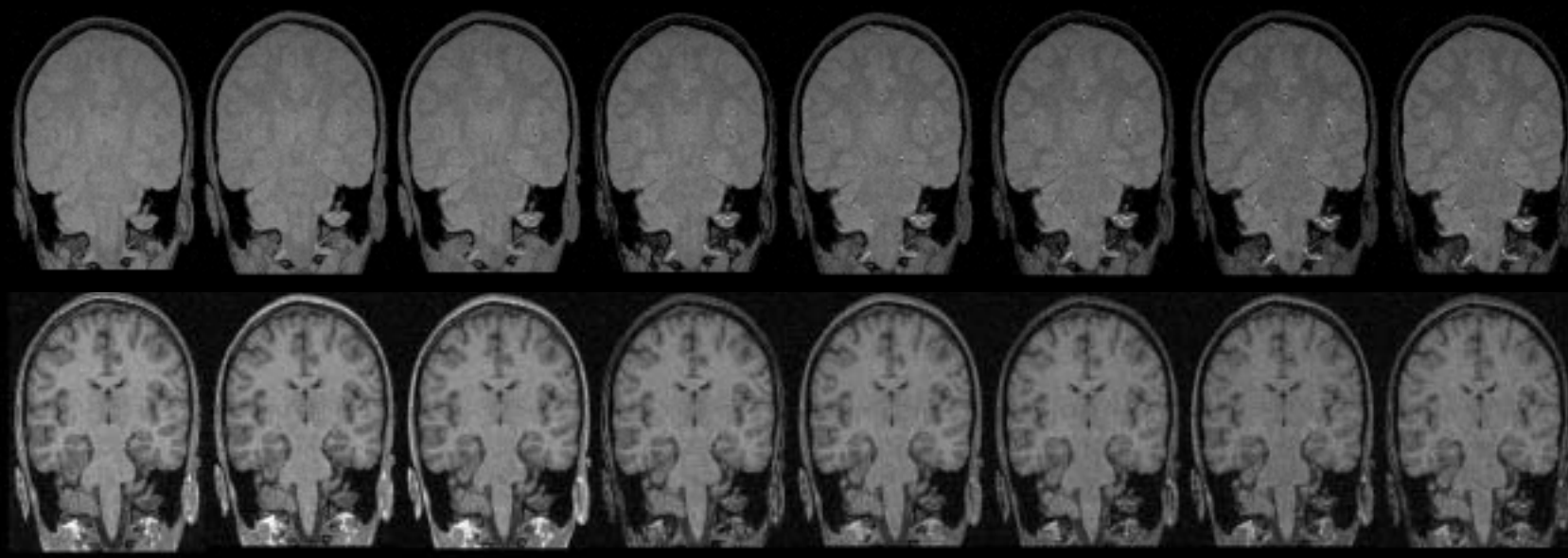
Spatial Distortion due to Magnetic Susceptibility (B_0) Pulse-Sequence Dependence (S/I readout direction)

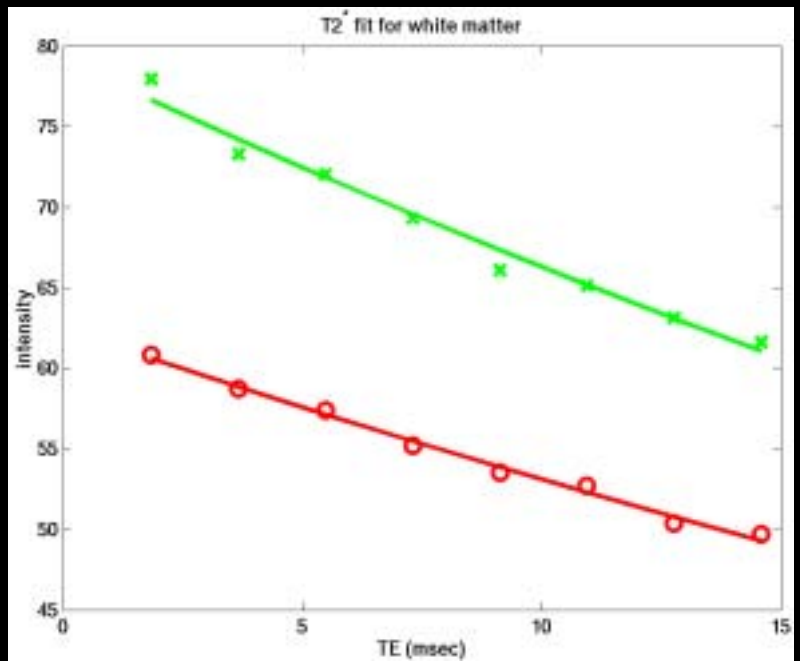
Spatial Distortion due to Magnetic Susceptibility (B_0) Pulse-Sequence Dependence (I/S readout direction)

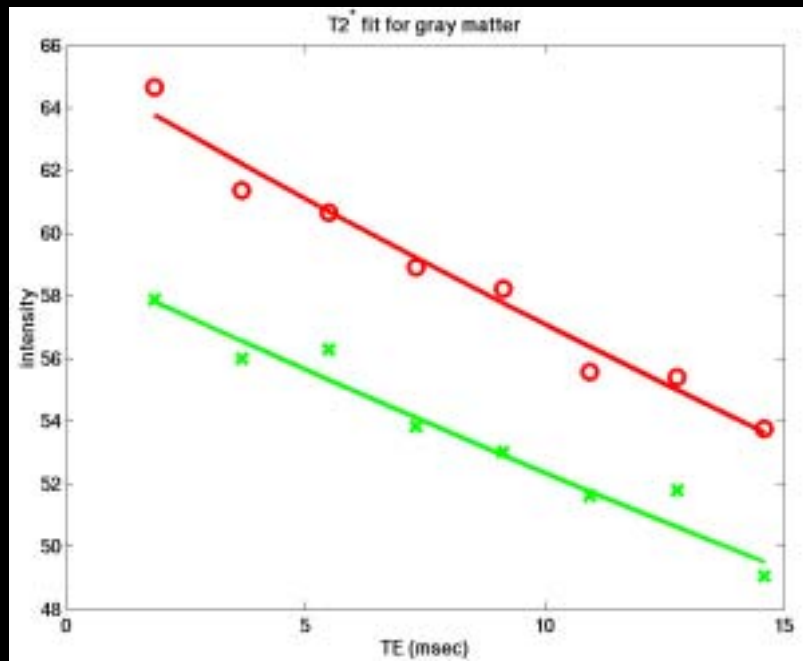
Multi-Echo 3-D FLASH/SPGR Sequence

5 deg Flip angle

30 deg Flip angle



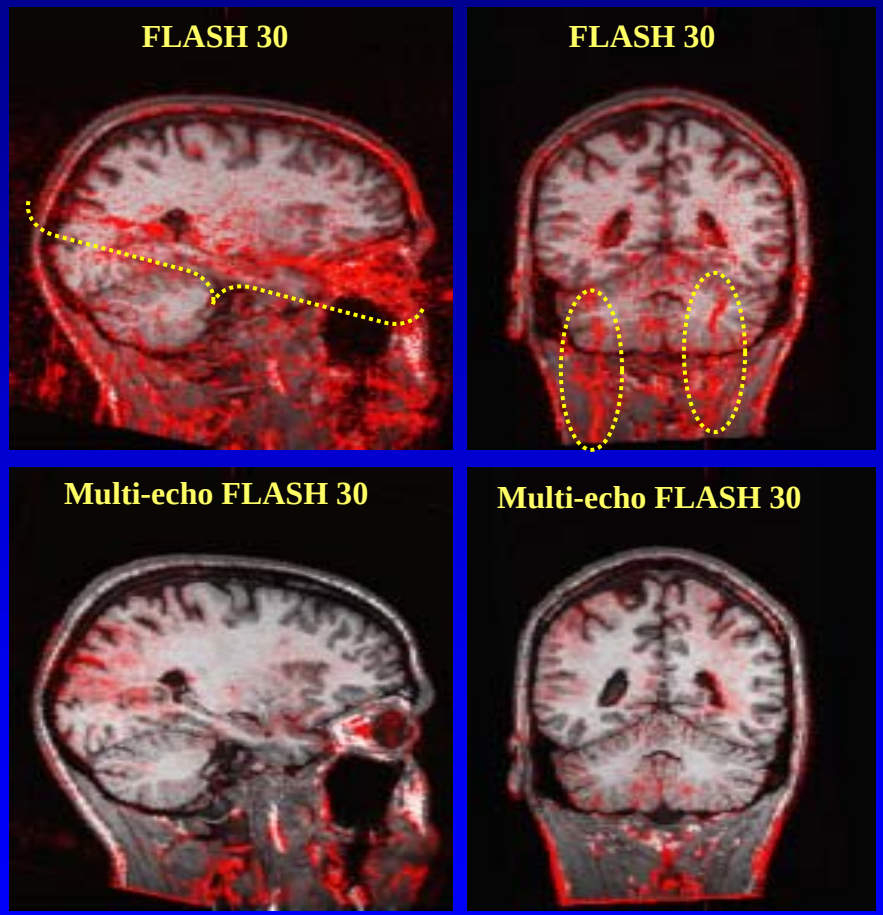




Reduction of Scan-Rescan Variance

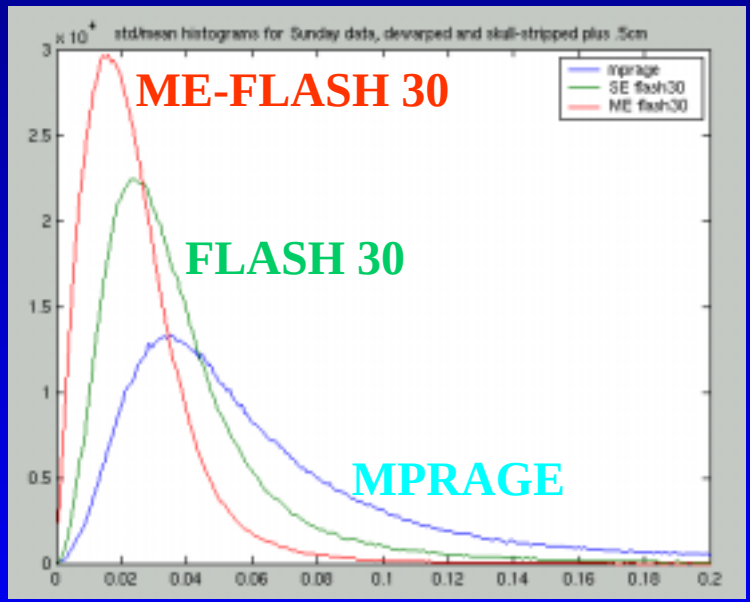
EYE MOTION

FLOW



Overlay threshold: 8%

Image intensity histogram of relative test-retest variability



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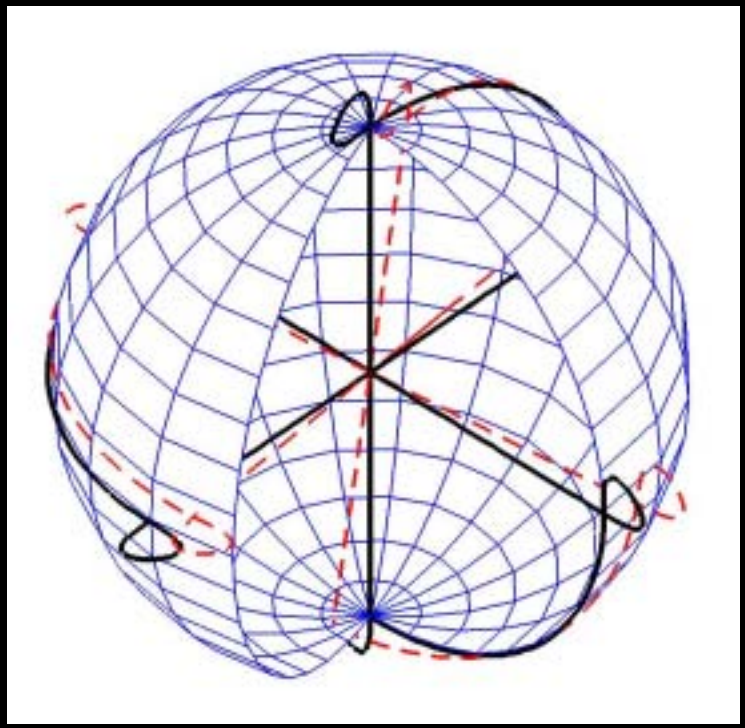
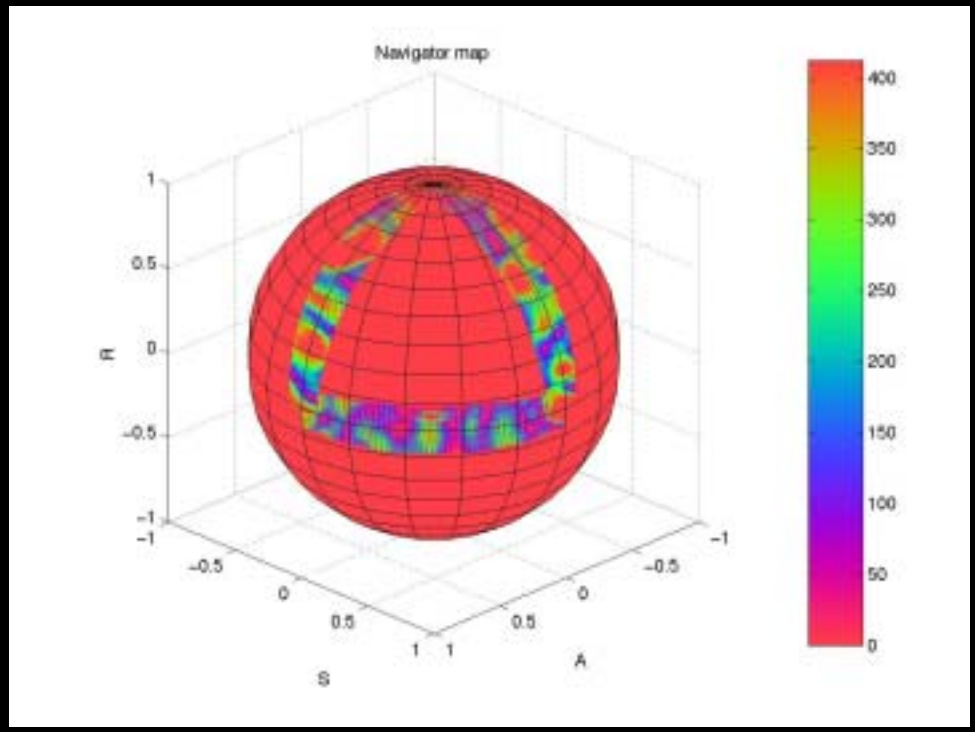
Rigid body motion is calculated every TR by comparing the new clover-leaf navigator with a pre-measured map of k-space in the vicinity of the target navigator



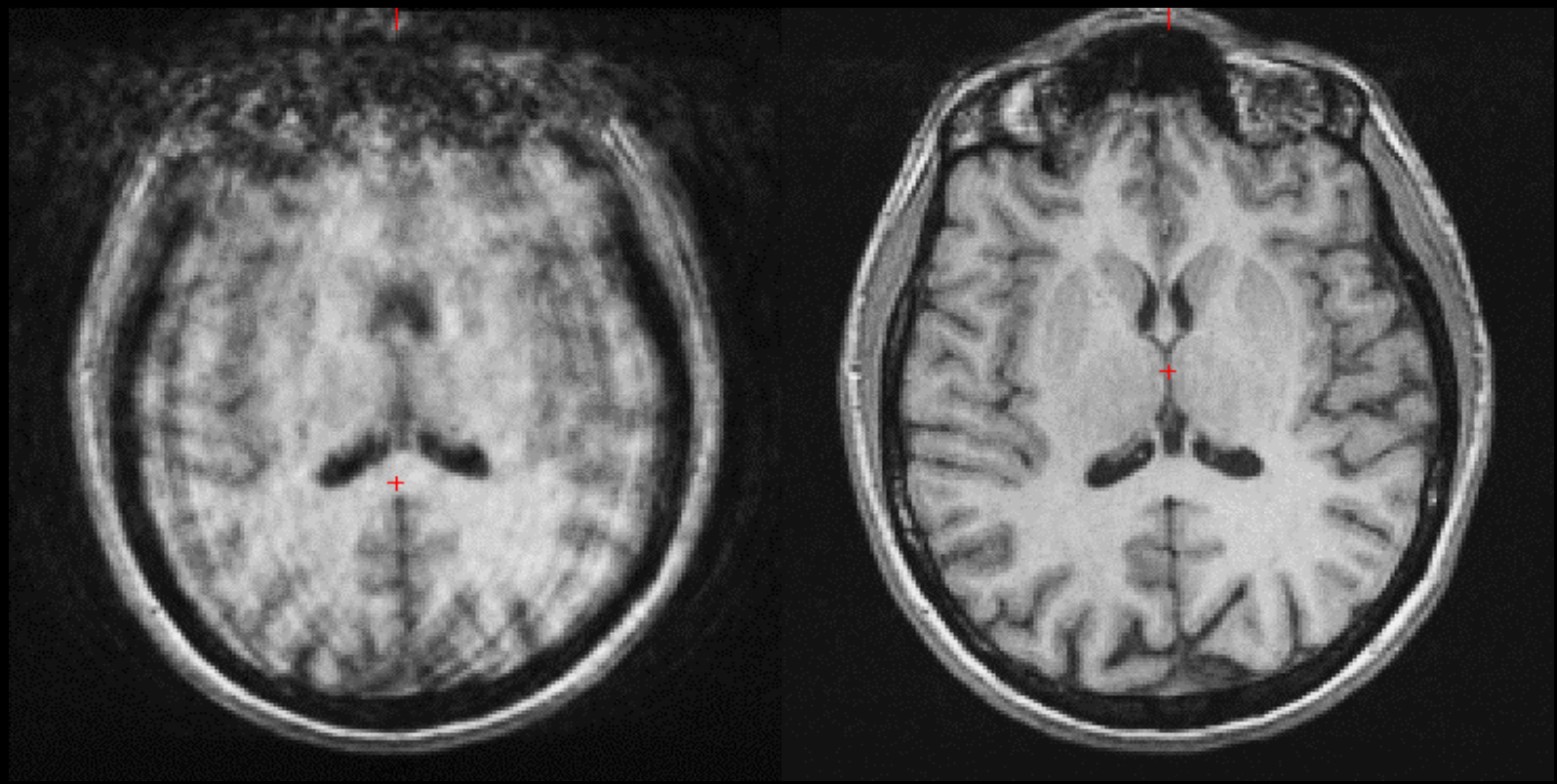
Clover-leaf navigator path in k-space



K-space values in vicinity of octant navigator

Andre van der Kouwe, MGH

Real-Time Motion Tracking using Cloverleaf Navigators

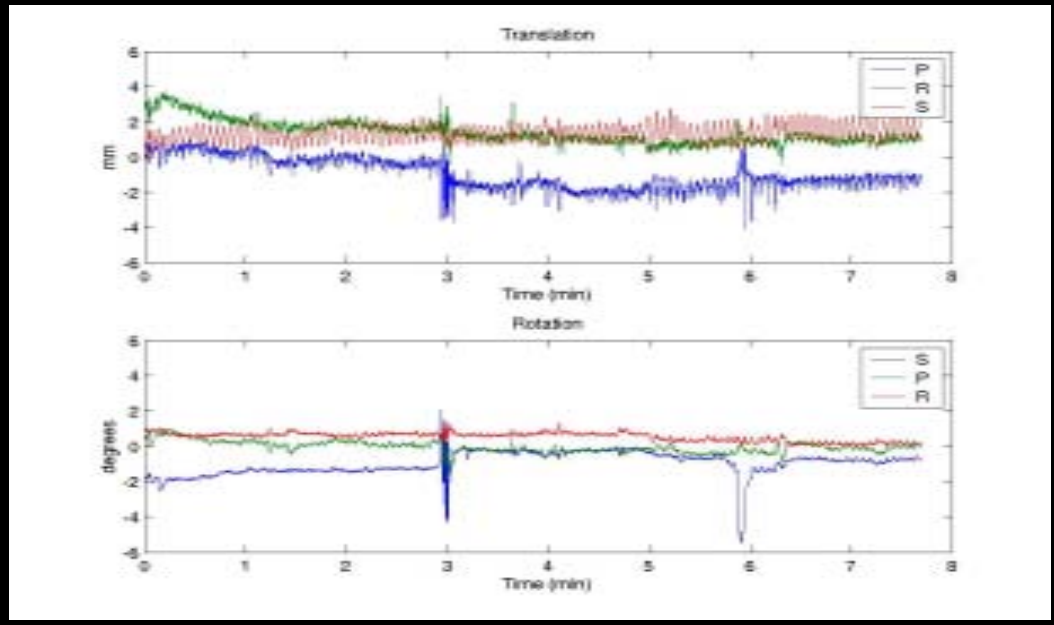


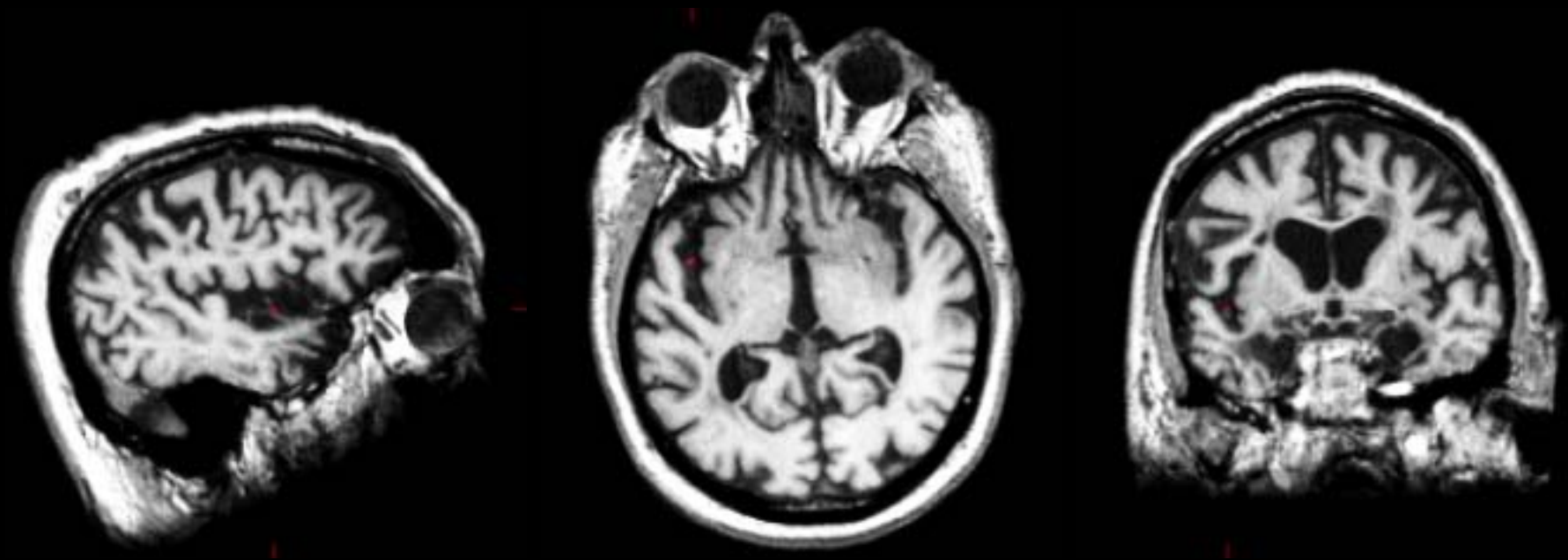
Without motion correction

With real-time motion correction

Andre van der Kouwe, MGH

With navigator motion correction it was possible to collect high resolution structural scans of the amnesic patient H.M.





3D FLASH (TR=20 ms, TE=10 ms, 1.3 x 1 x 1.3 mm, Tacq=7:45, BW=160 Hz/pixel, 6 averages)

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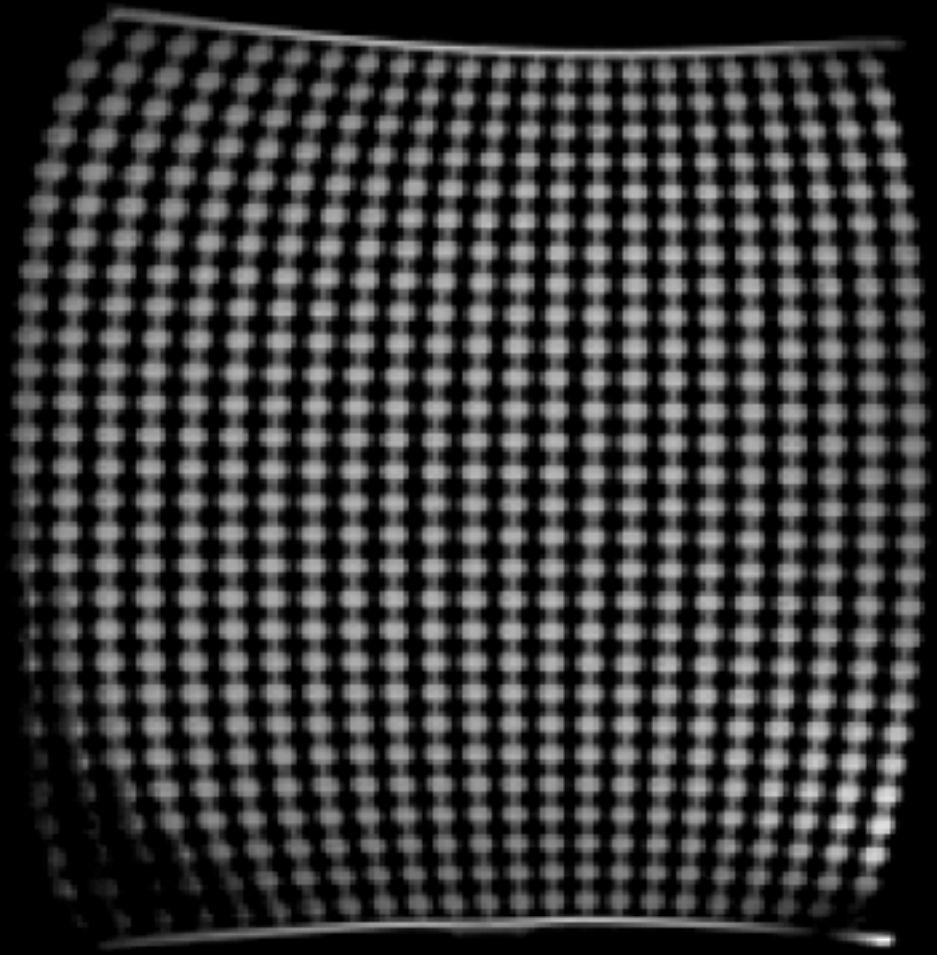
Gradient Nonlinearity Distortion
Uncorrected Phantom Data

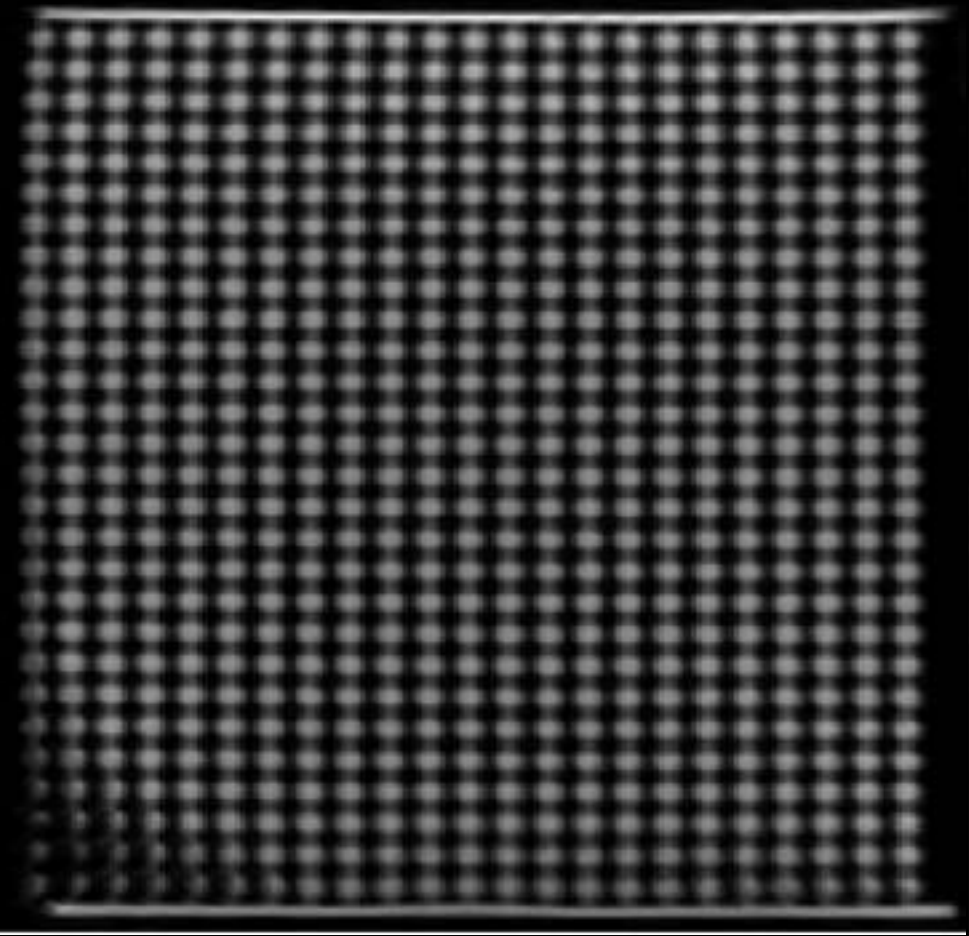
GE Whole-Body
CRM NVi/CVi



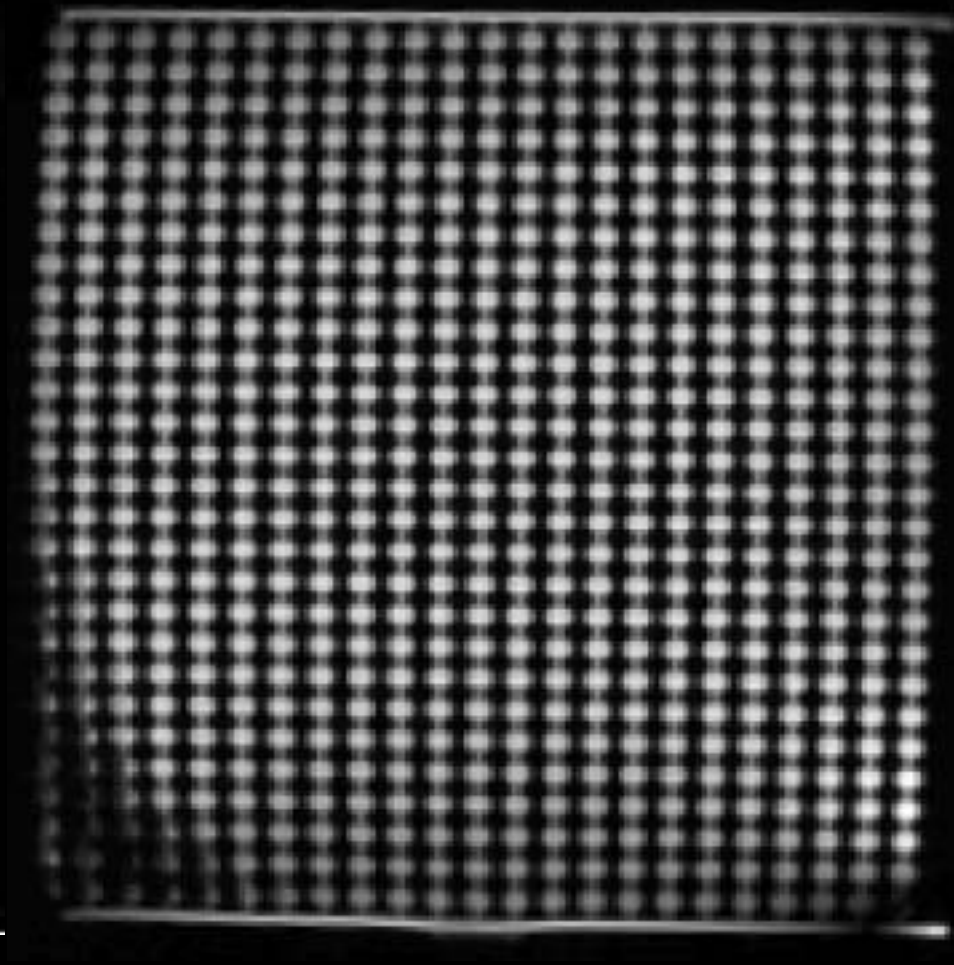
Siemens Whole-Body
Symphony/Sonata

Brain Morphometry BIRN: MGH, BWH, Duke, UCSD, UCI, UCLA

Gradient Nonlinearity Distortion
Corrected Phantom Data



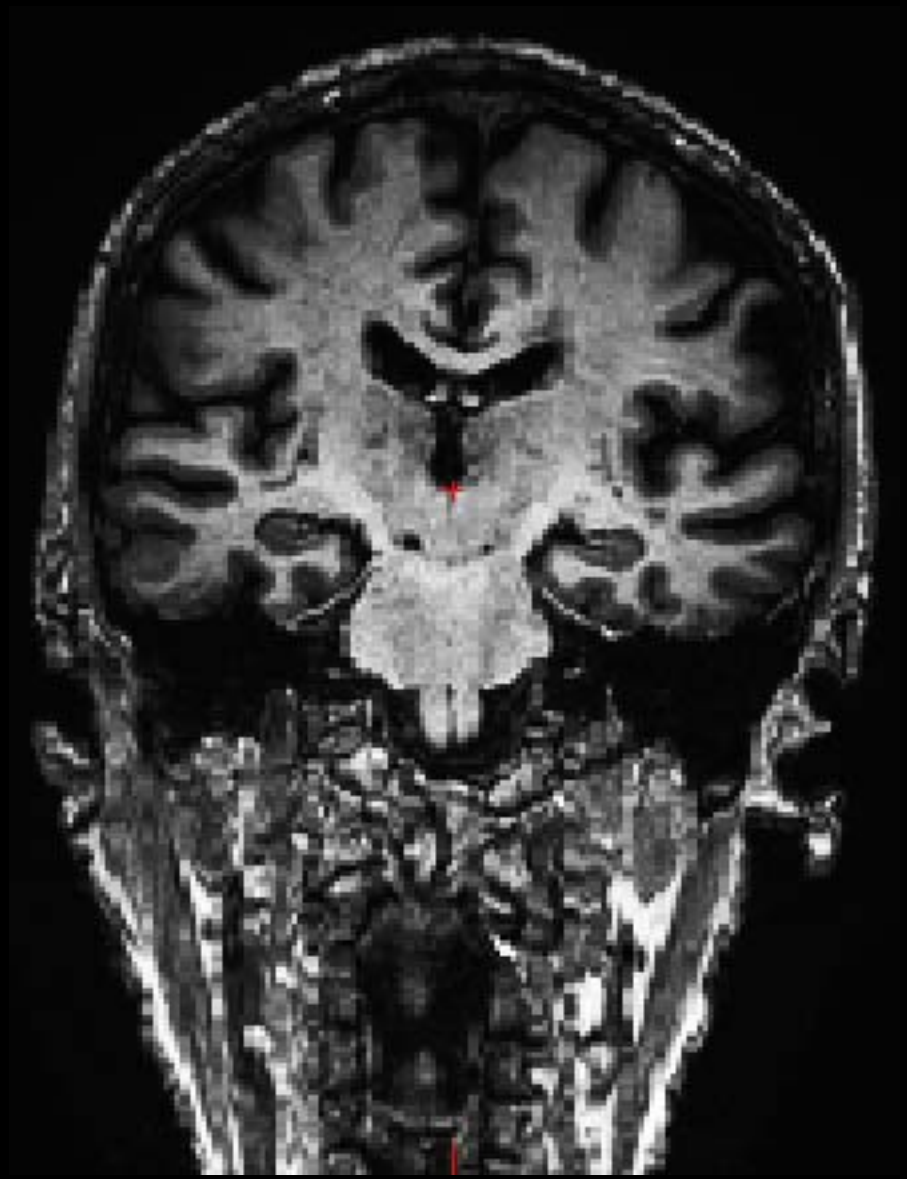
GE Whole-Body
CRM NVi/CVi



Siemens Whole-Body
Symphony/Sonata

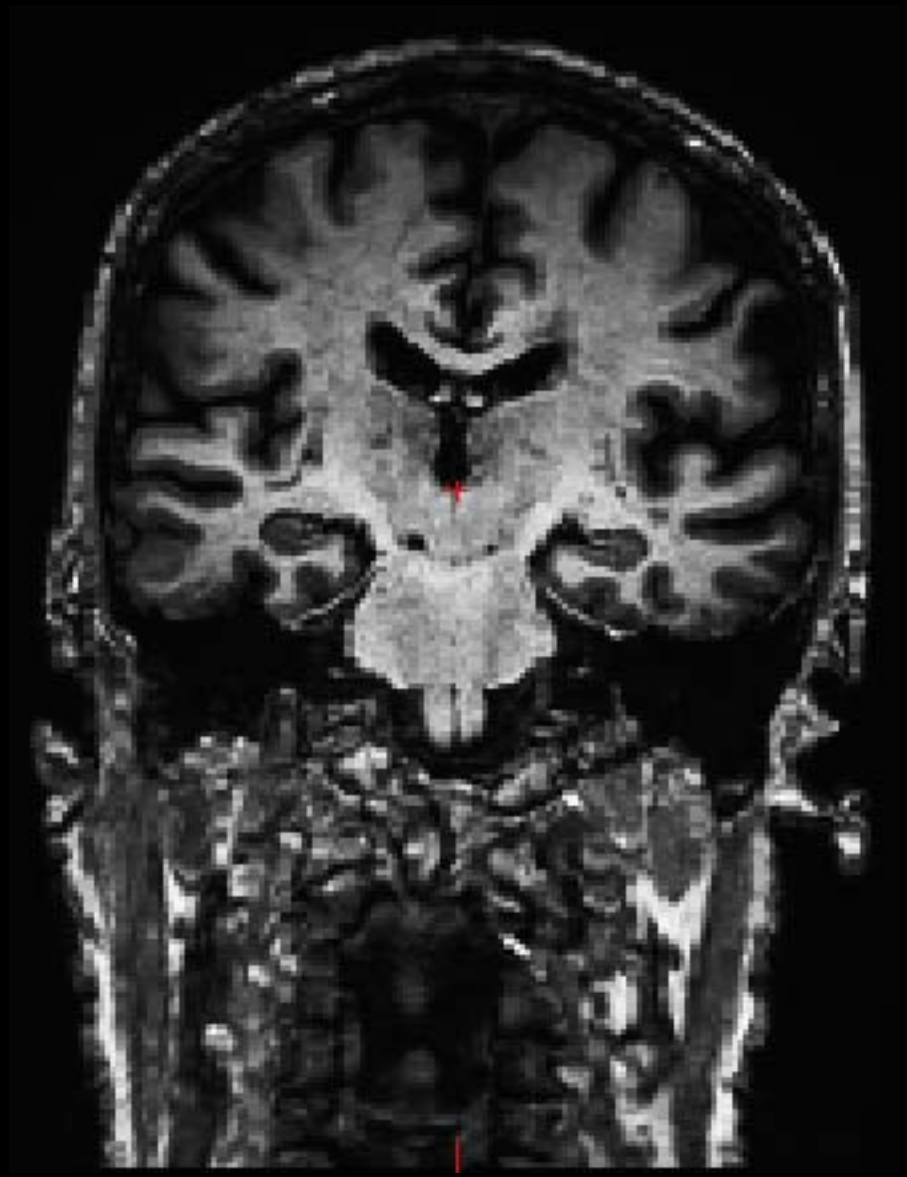
Brain Morphometry BIRN: MGH, BWH, Duke, UCSD, UCI, UCLA

Gradient Nonlinearity Distortion
Uncorrected



ADNI Prep Phase: Mayo Clinic, UCSD, MGH P41

Gradient Nonlinearity Correction Corrected



ADNI Prep Phase: Mayo Clinic, UCSD, MGH P41