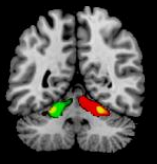
SPM8 for Basic and Clinical Investigators

Functional MRI Data Acquisition: Spatial



fMRI Acquisition Spatial Effects

- Field strength
- Head coil
- Sequence type - EPI, spiral
- Echo time
- Voxel dimensions
- Slice acquisition order
- Slice angle
- Field map
- Whole vs. partial head coverage

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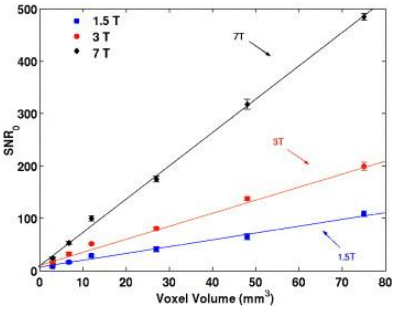
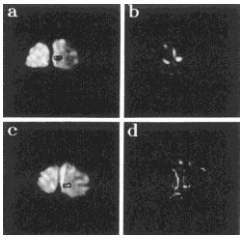
SNR Increases with Static Field Strength



Triantafyllou al., Neuroimage (2005)

BOLD-Contrast Increases with Static Field Strength



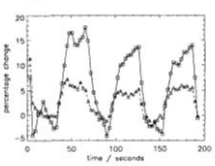
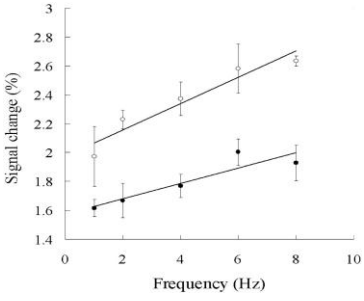


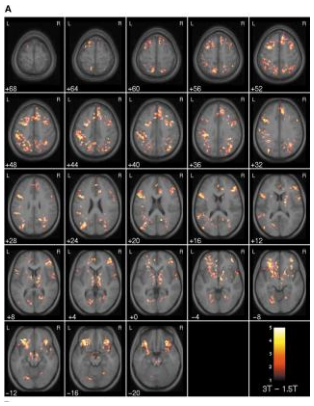
FIG. 2. Plot of fractional change in 4 T (squares) and 1.5 T (triangles) EPI image intensity versus time in the eight-voxel regions of interest in the visual cortex shown in Fig. 1, for a volunteer experiencing alternate 30-s periods of rest and photic stimulation. Details of acquisition for the 4 and 1.5 T data are described in the caption for Fig. 1.

Turner et al., MRM (1993)

BOLD-Contrast Increases with Static Field Strength



Okada et al., Academic Radiology (200



BOLD-Contrast Increases with Static Field Strength

working memory task

Kransnow et al., Neuroimage (2003)

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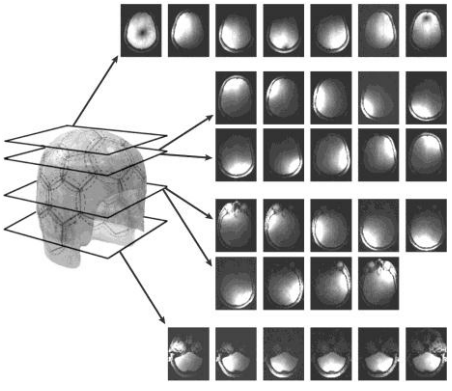
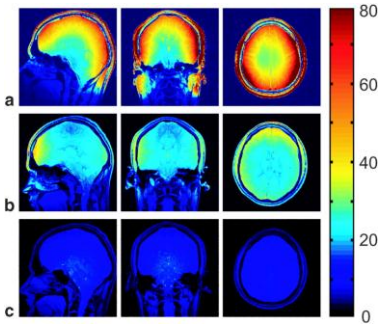


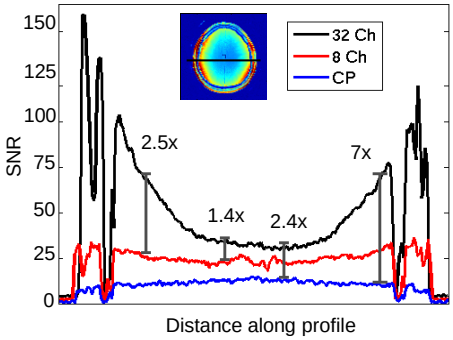
Wiggins et al., MRM (2006)

SNR Increases with Coil Density



Wiggins et al., MRM (2006)

SNR Profile Changes with Coil Density



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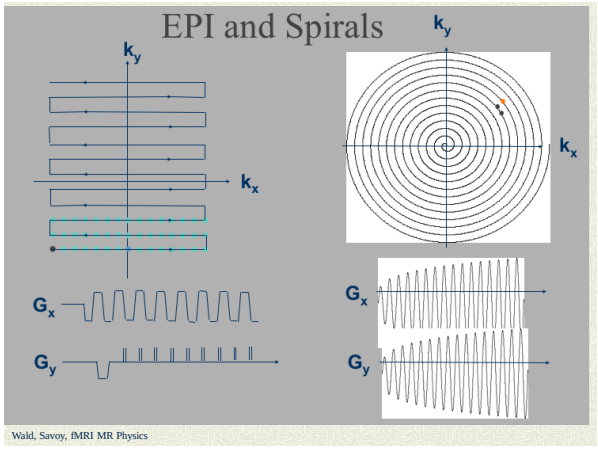
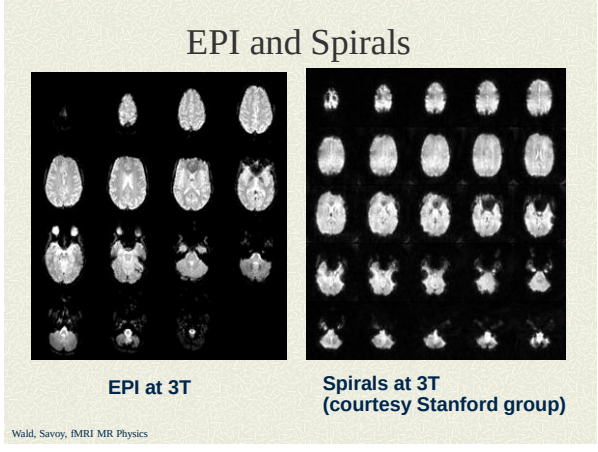


	EPI	Spirals
Susceptibility:	distortion, dephasing	blurring, dephasing
Eddy currents:	ghosts	blurring
k = 0 is sampled:	1/2 through	1st
Corners of kspace:	yes	no
Gradient demands:	very high	pretty high

Wald, Savoy, fMRI MR Physics



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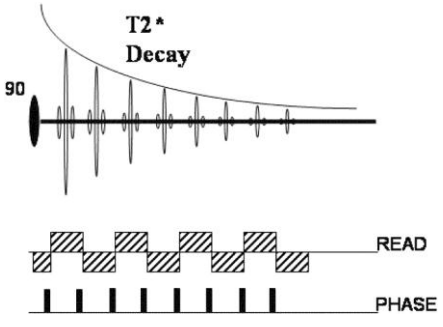
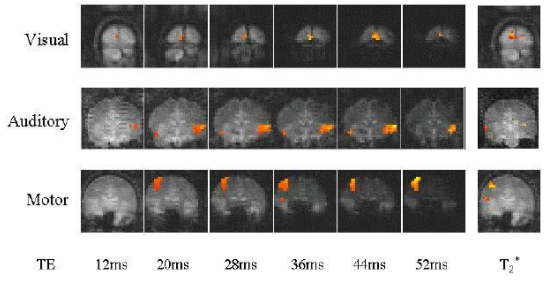
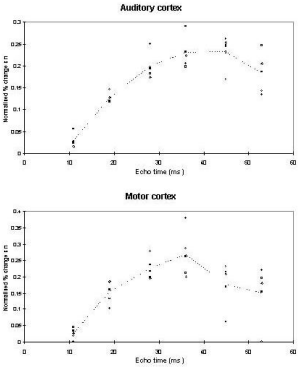


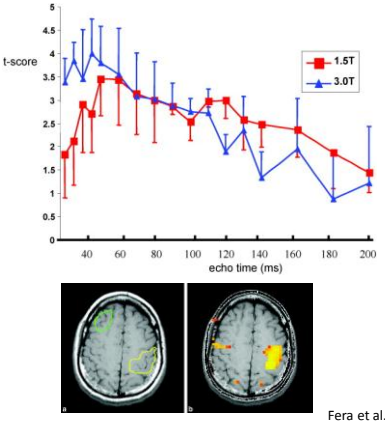
Roberts and Mikulis, JMRI (2007



Clare, Functional MRI : Methods and Applications (1997)



Clare, Functional MRI : Methods and Applications (1997)



Fera et al., MRM (2003)

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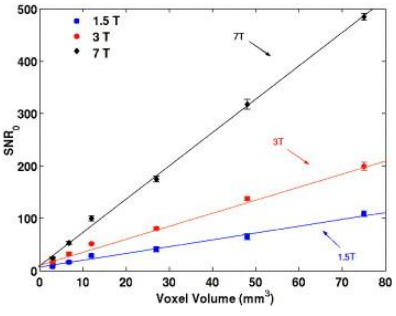
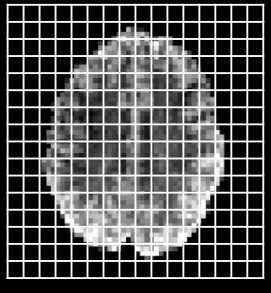
SNR Increases Linearly with Voxel Volume

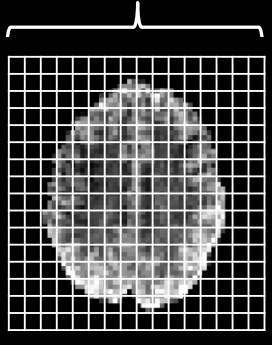


Triantafyllou al., Neuroimage (2005)

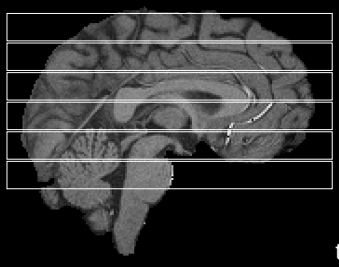
Slice Matrix



Slice Field of View

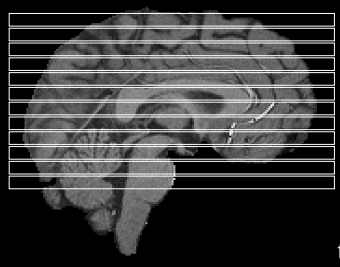


Slice Thickness



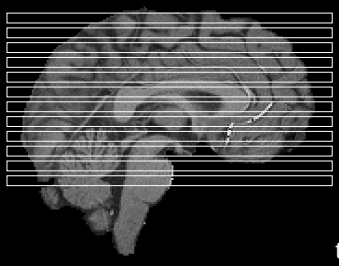
thick

Slice Thickness



thin

Slice Thickness



thin with gap

Voxel Volume

- field of view (FOV)
- matrix size
- slice thickness

Signal strength is proportional to voxel volume.

1x1x1 mm = 1 mm^3
2x2x2 mm = 8 mm^3
3x3x3 mm = 27 mm^3

Voxels should be isotropic.

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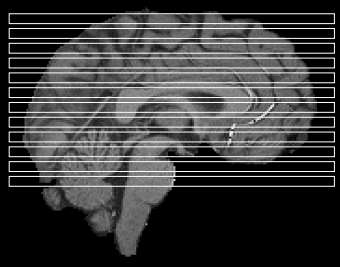
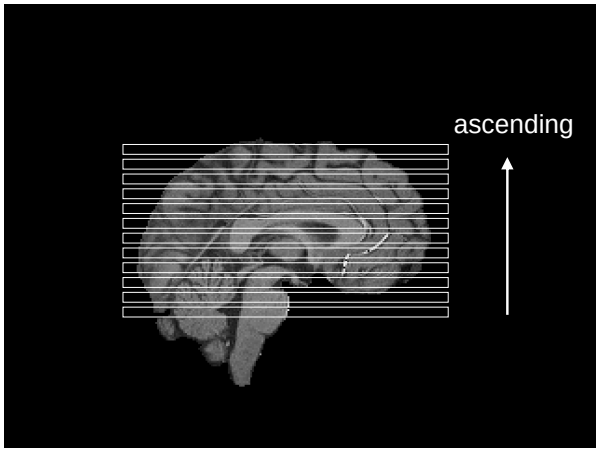
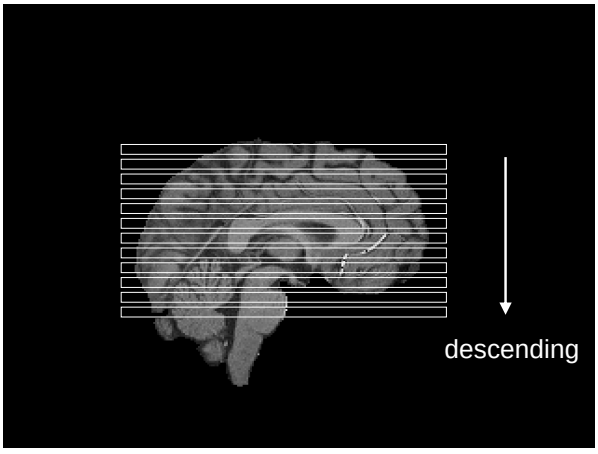
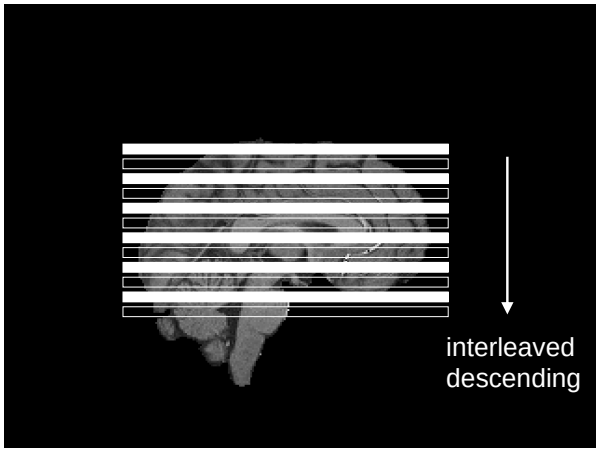
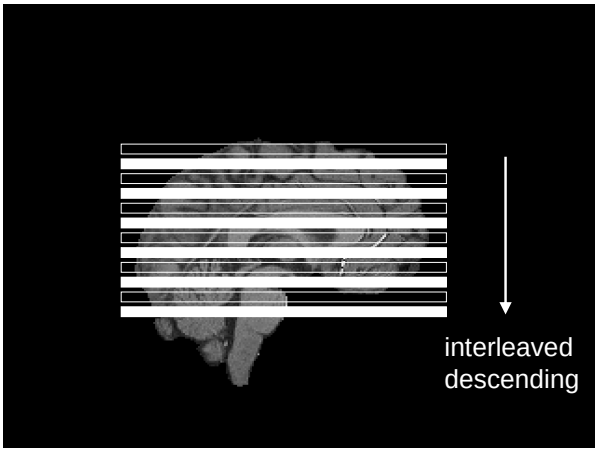
EPI Data Are Acquired Serially











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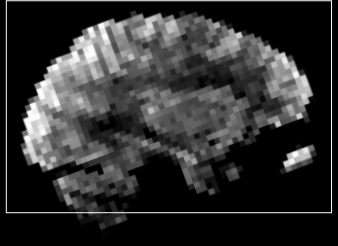
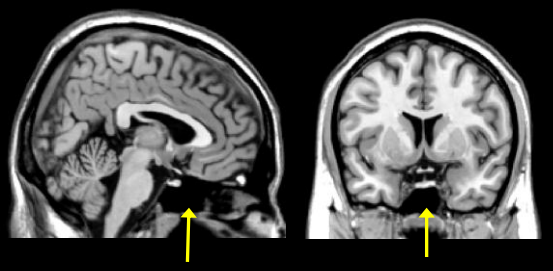
Reducing Susceptibility Artifacts with Oblique Slice Acquisition



Sources of Susceptibility Artifacts



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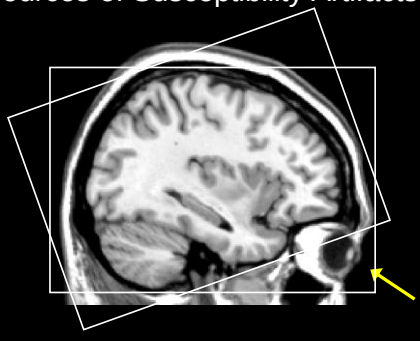
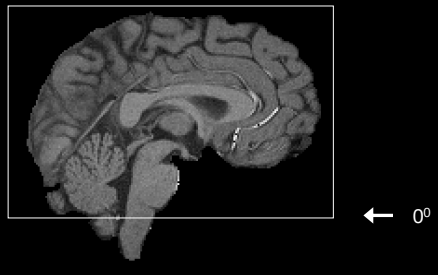


Reducing Susceptibility Artifacts with Oblique Slice Acquisition



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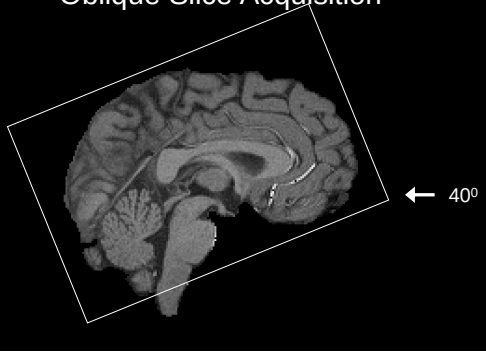

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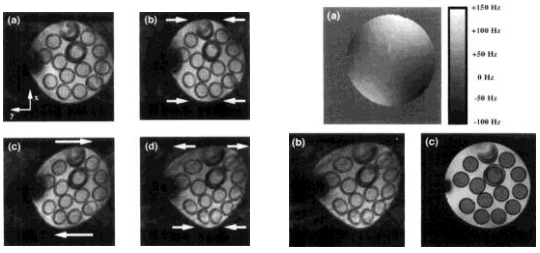
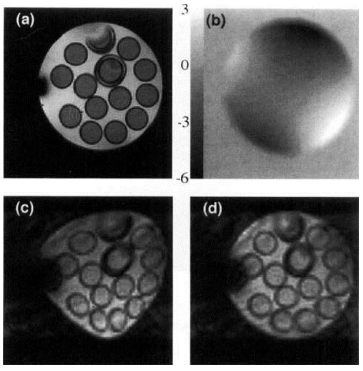
Signal Dropout and Geometric Distortion

Inadequate Shimming Causes Image Geometric Distortions



Jezzard and Balaban, MRM (1995)



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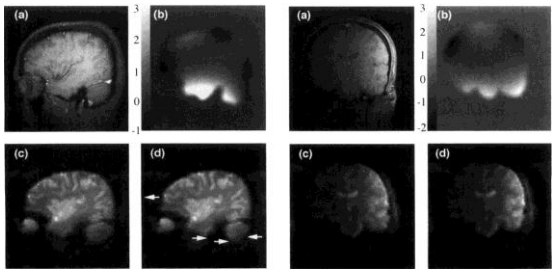
Field Maps Can Correct Image Geometric Distortions



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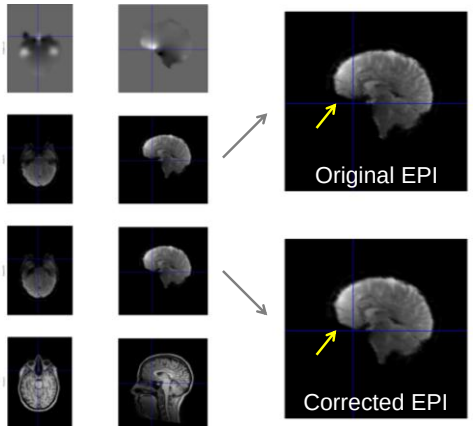

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