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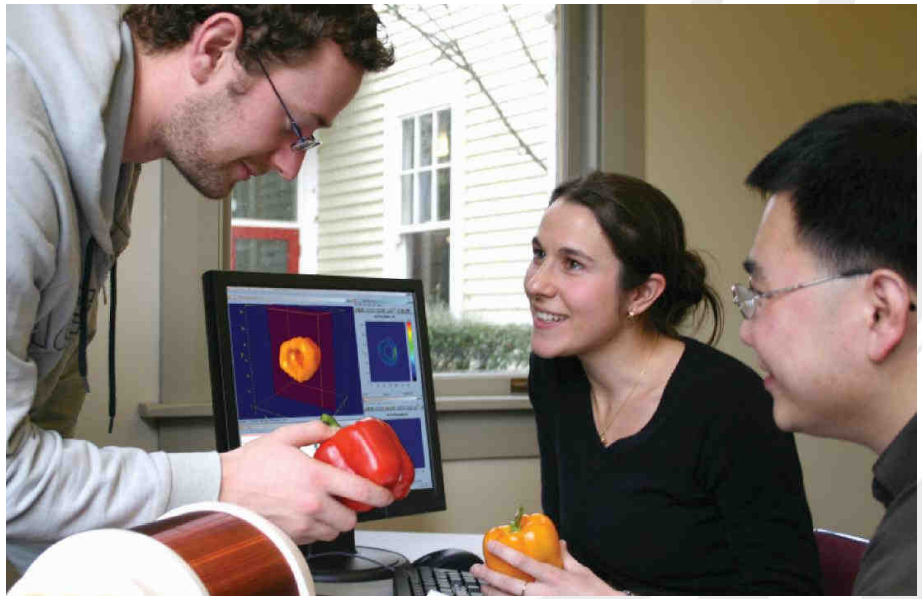
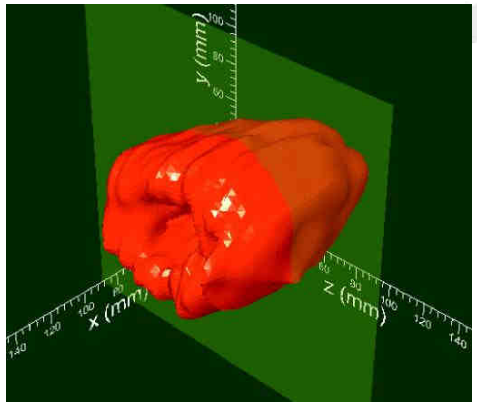
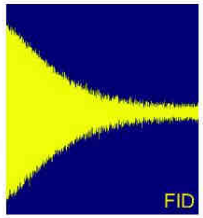
Terranova-MRI

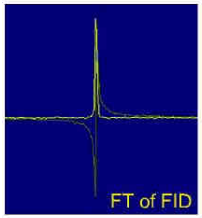
Presentation 2008

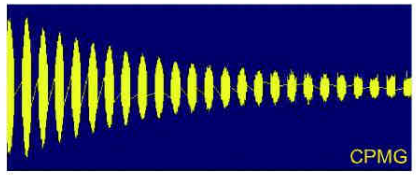
Teach MRI and NMR with the Terranova-MRI Earth Field System











Take students from basic NMR concepts such as Free Induction Decay, Spin Echo and CPMG, through to full 3D imaging experiments

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Terranova-MRI is a Lab Course in a Box…

Includes

- Comprehensive Student Guide
- User Manual
- Phantom sample
- 3D Compass

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Can be used Inside or Outside

Spectrometer runs on 24V DC

In lab environment use the DC power supply provided with the system

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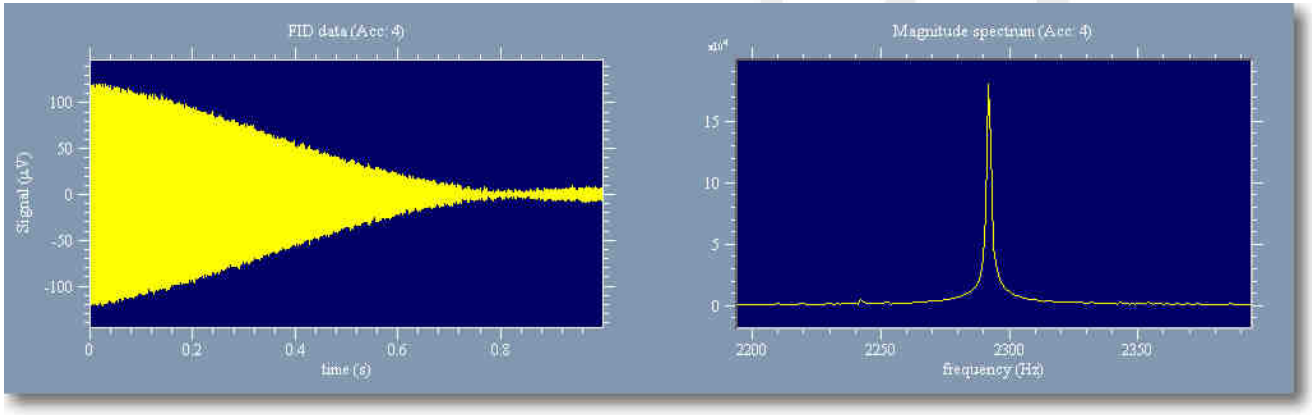
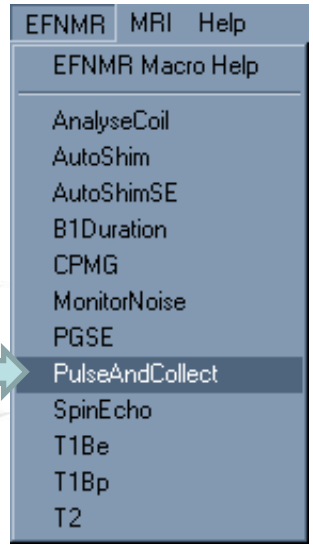
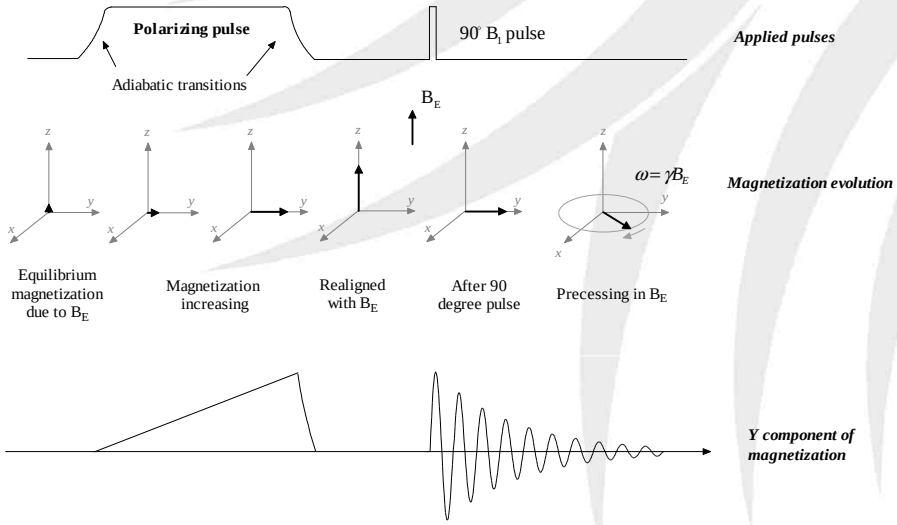
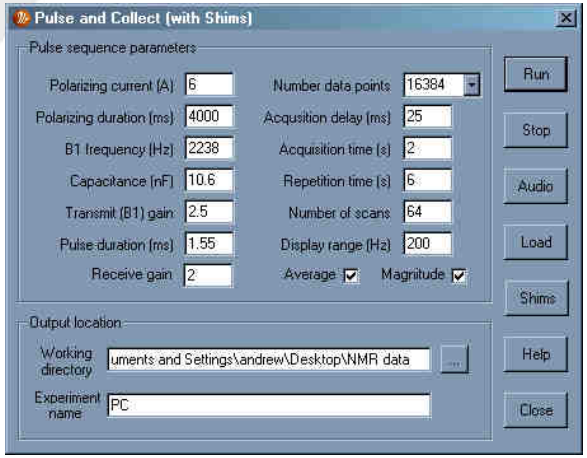
NMR Signal Acquisition: Pulse and Collect









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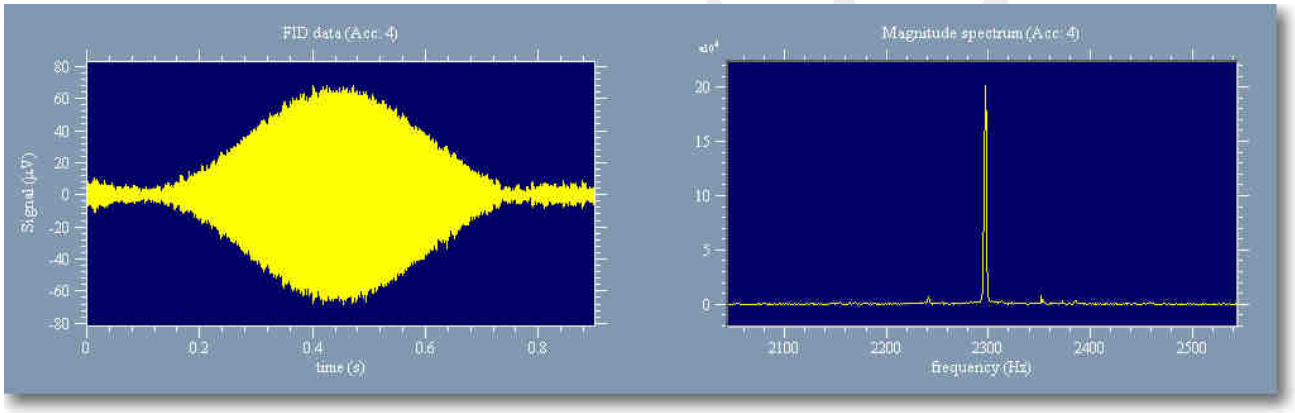
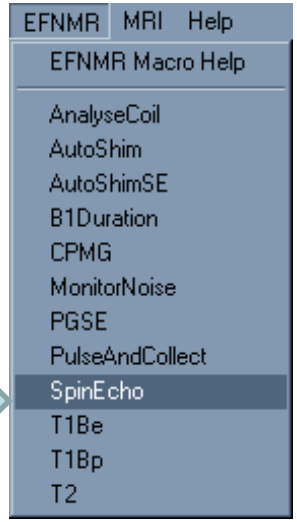
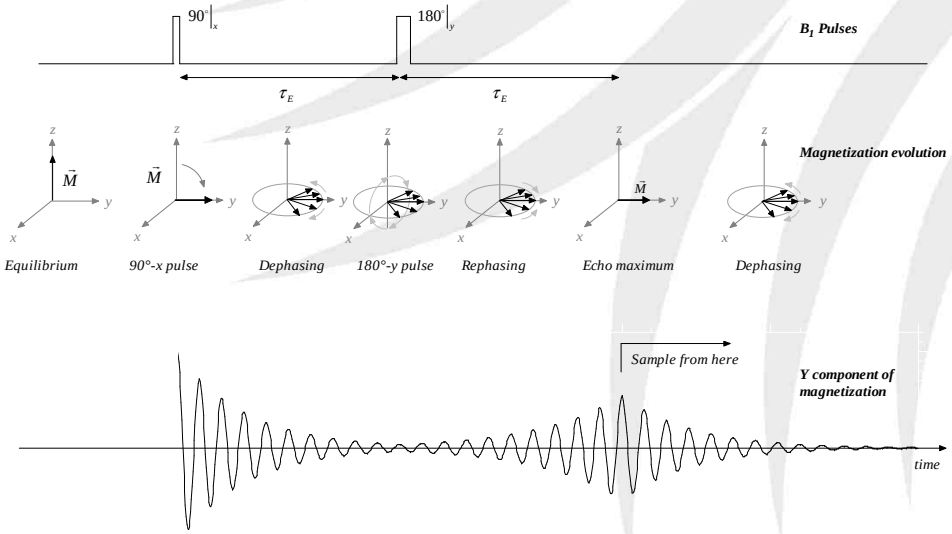
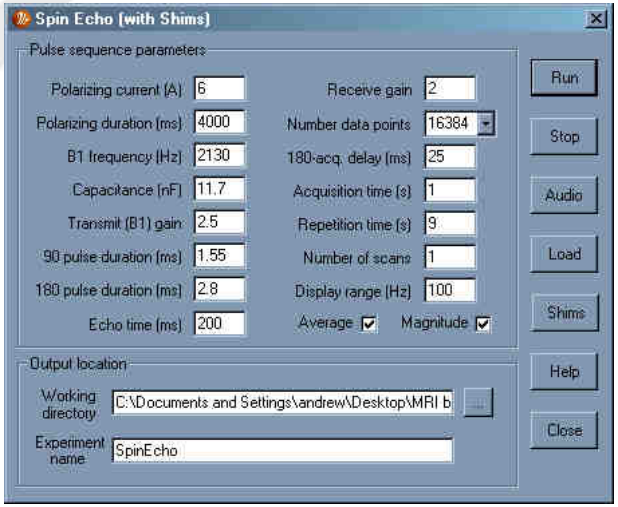
Spin-Echo









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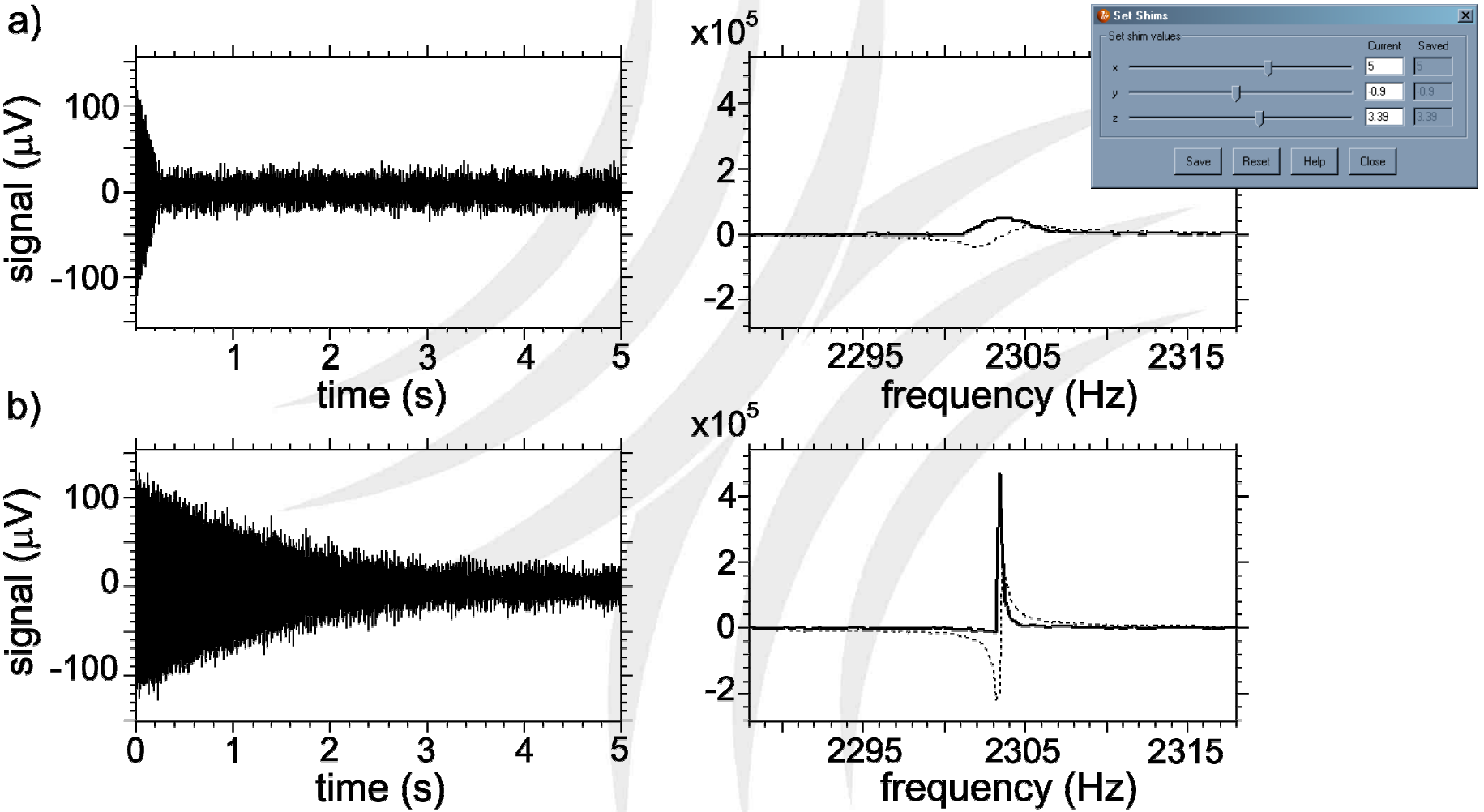
Slider Control Shimming (4 Gradient Coils)



500 mL Water Sample

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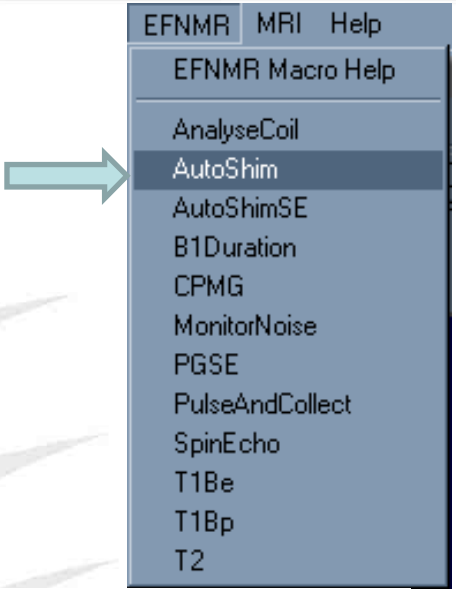
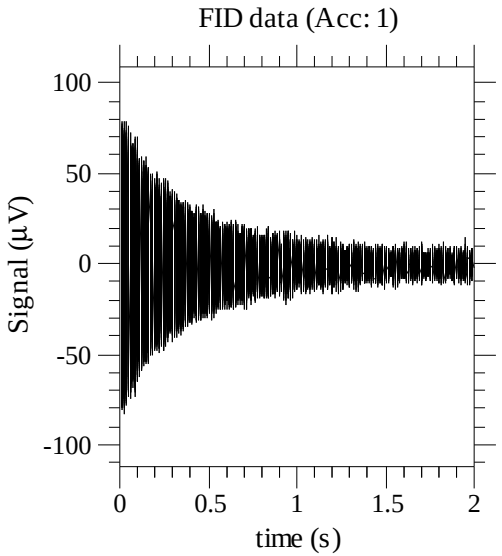
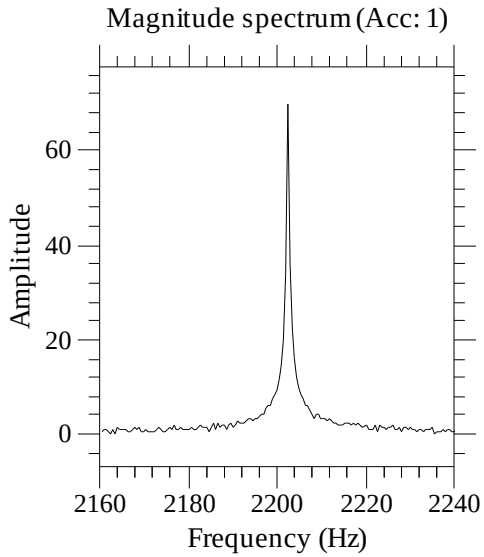
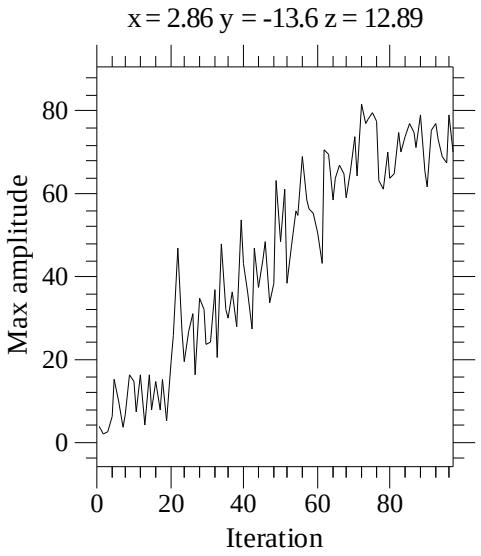
Auto-Shimming









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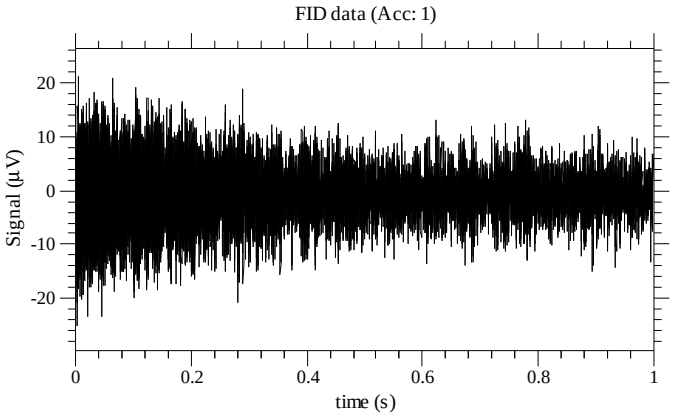
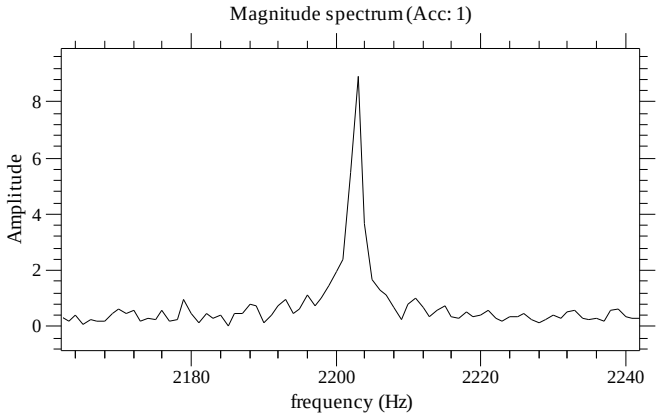
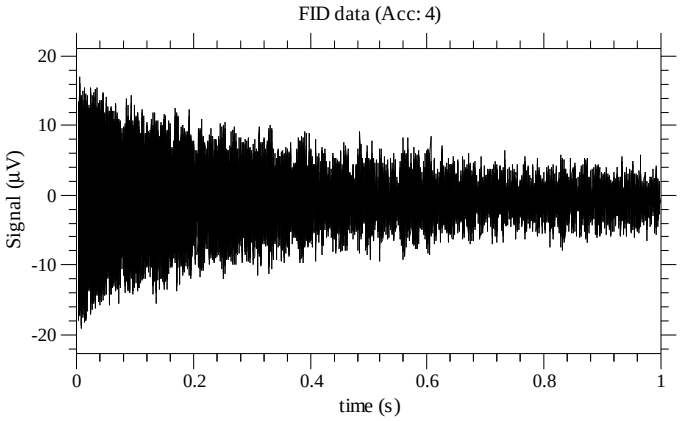
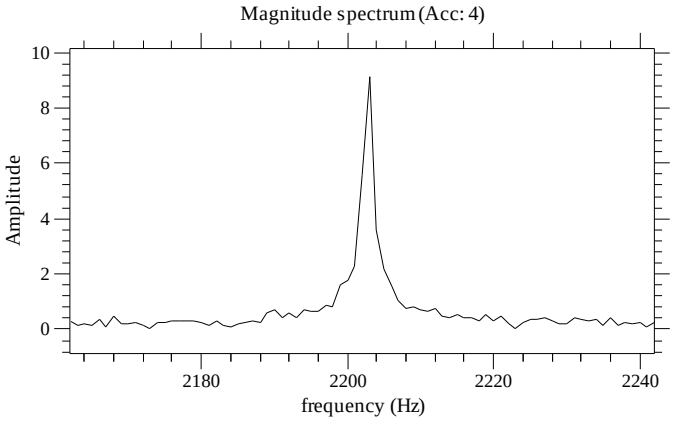
Signal Averaging





1 scan





4 scans

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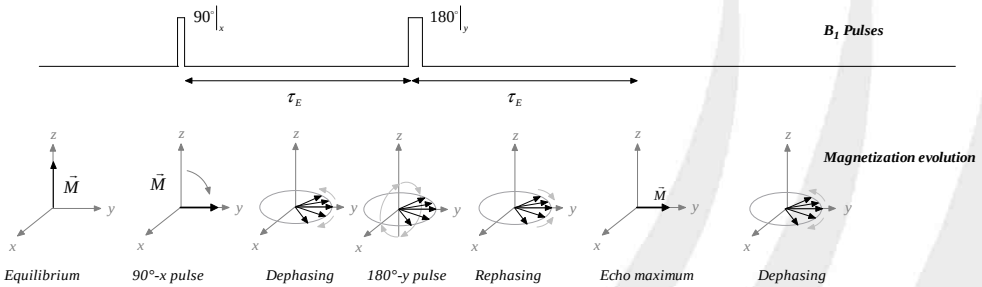
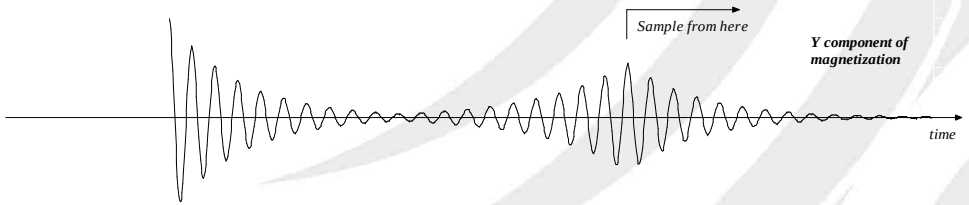
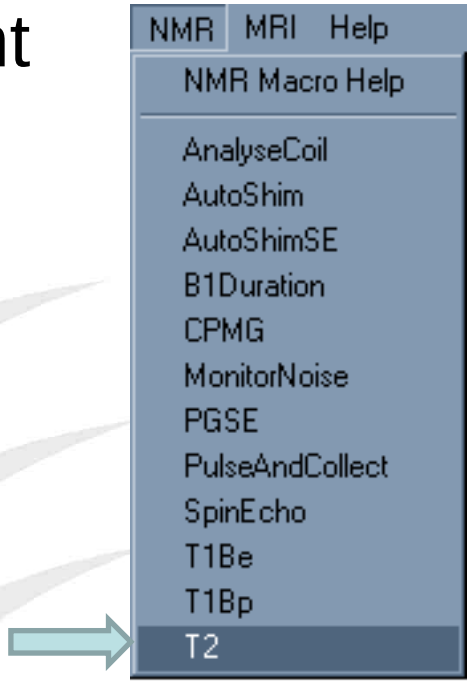
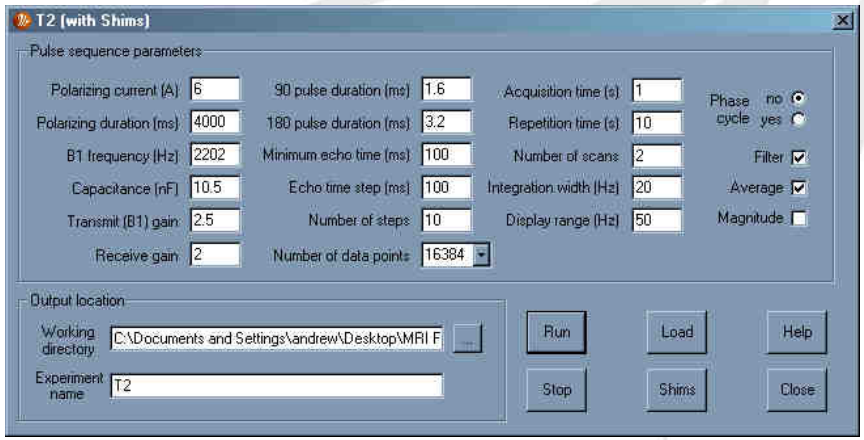
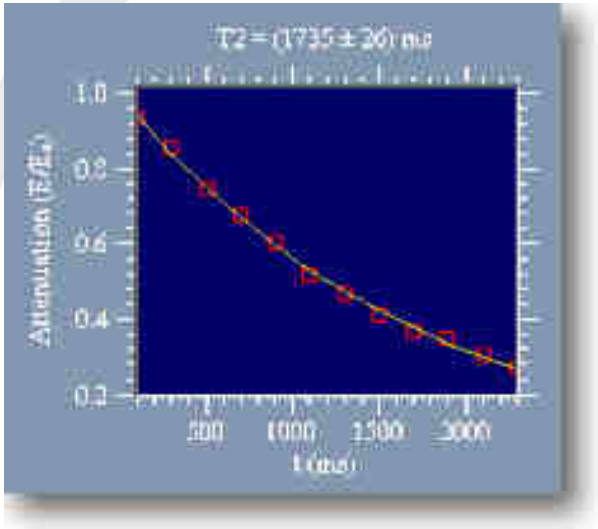
Spin-echo T_2 Measurement











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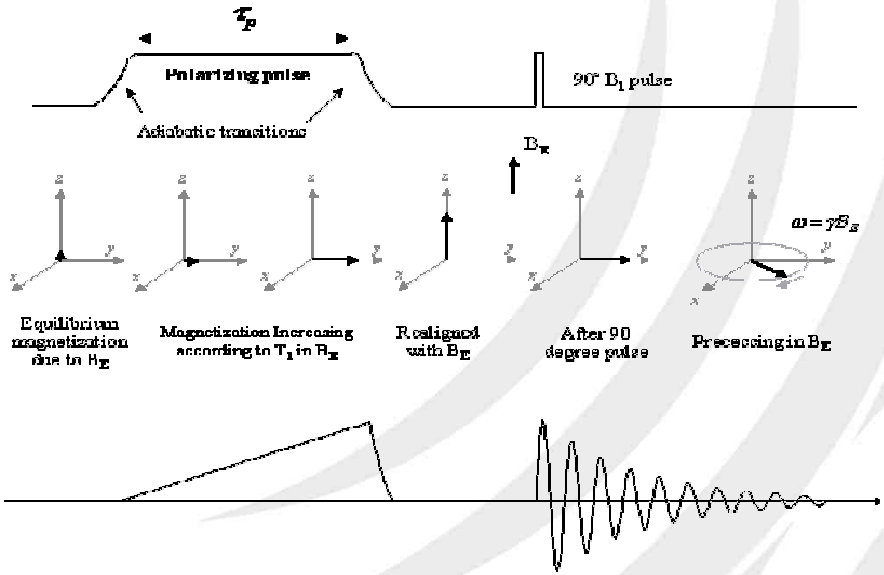
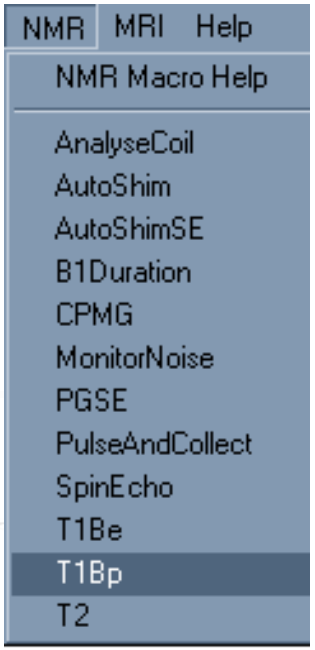
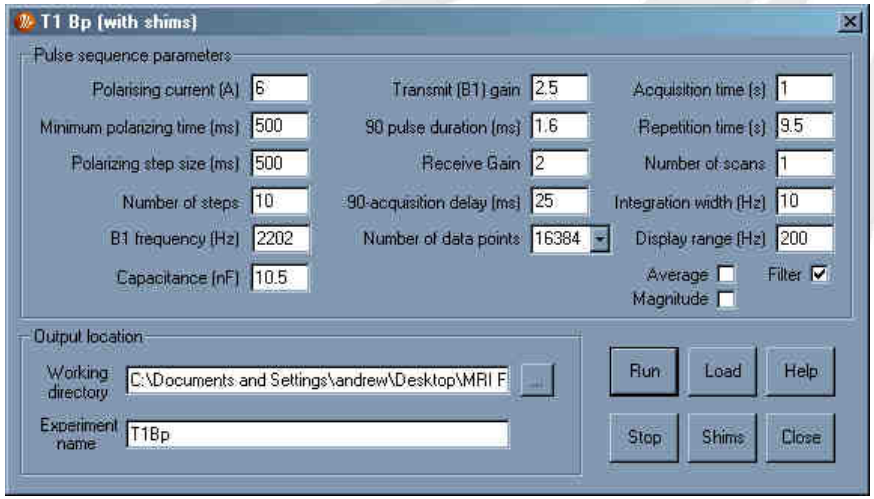
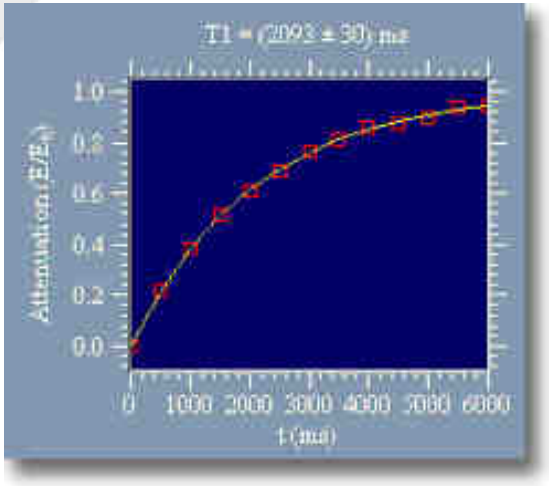
T_1 in Polarizing Field (B_p)









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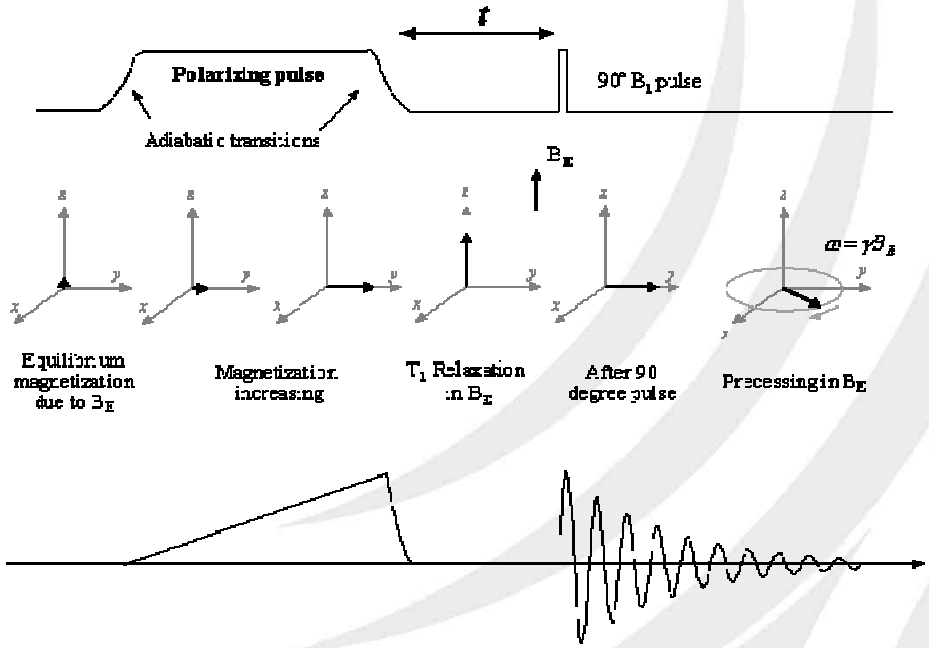
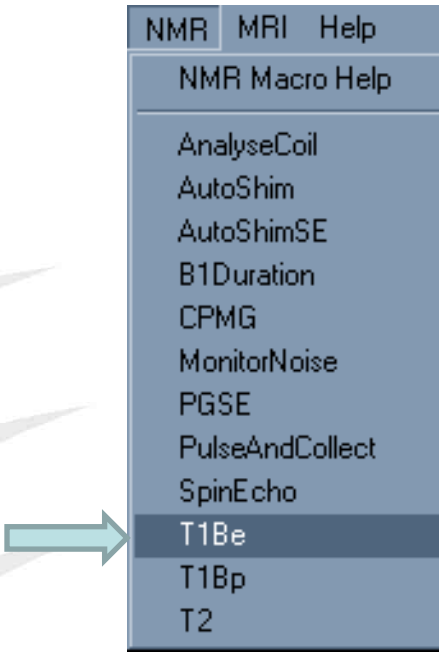
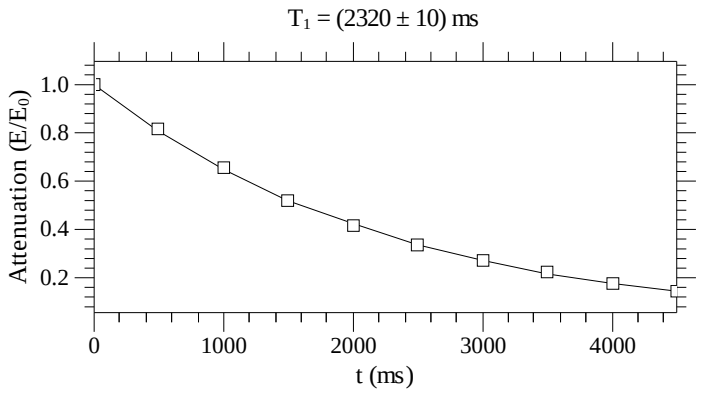
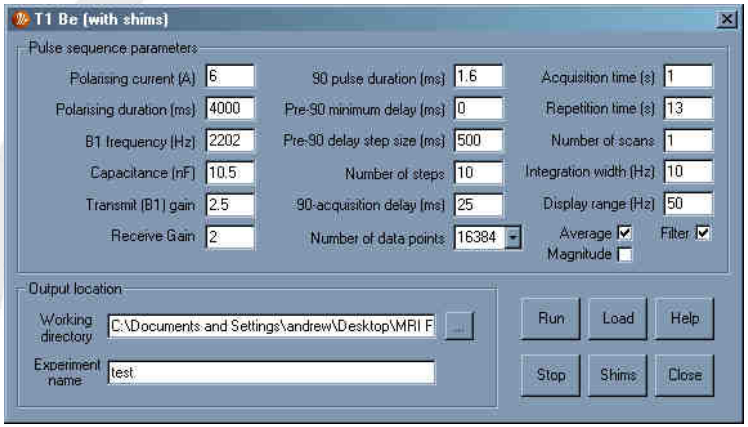
T_1 in the Earth's Field (B_E)









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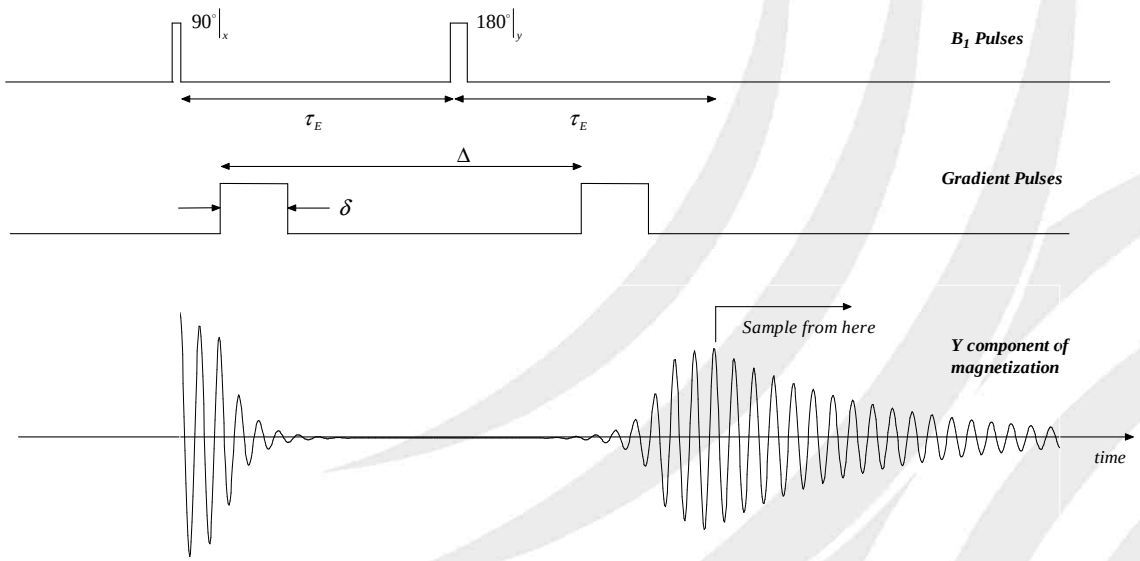
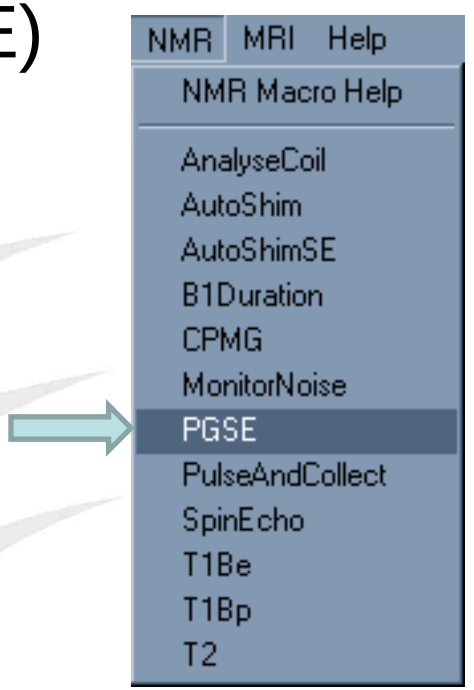
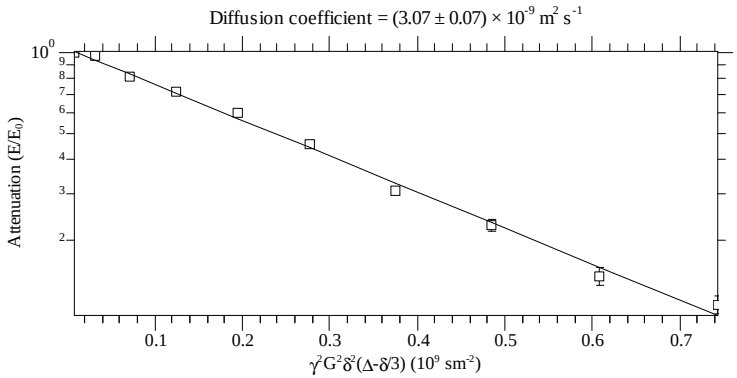
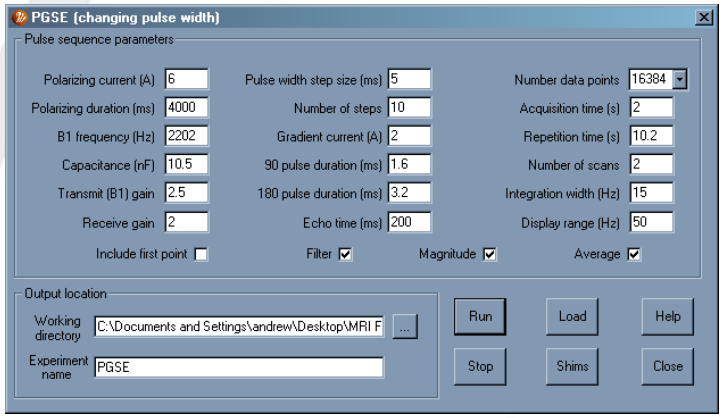
Pulsed-Gradient-Spin-Echo (PGSE)









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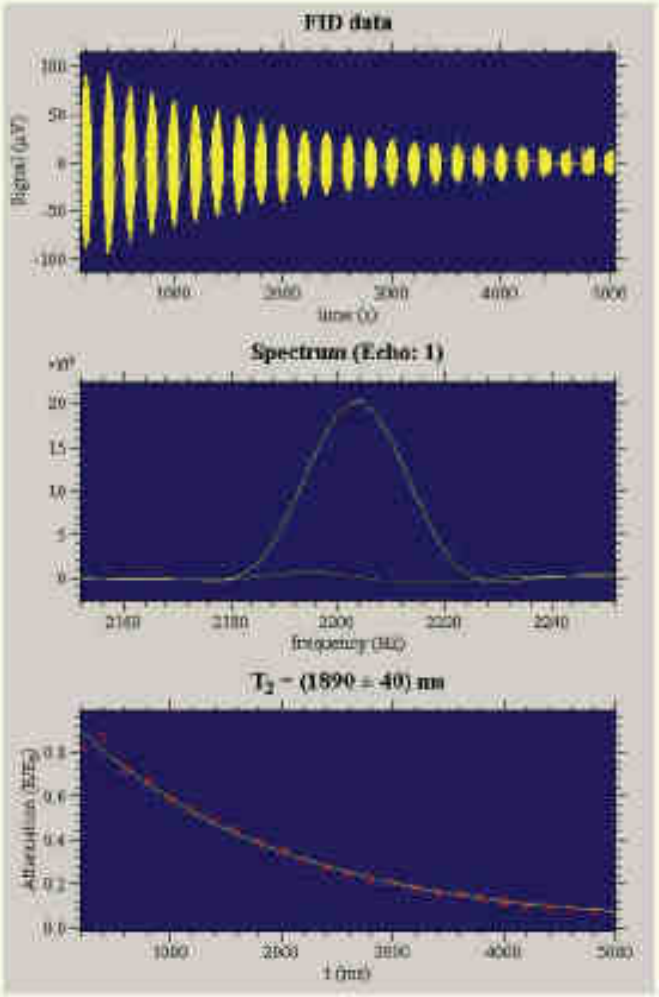
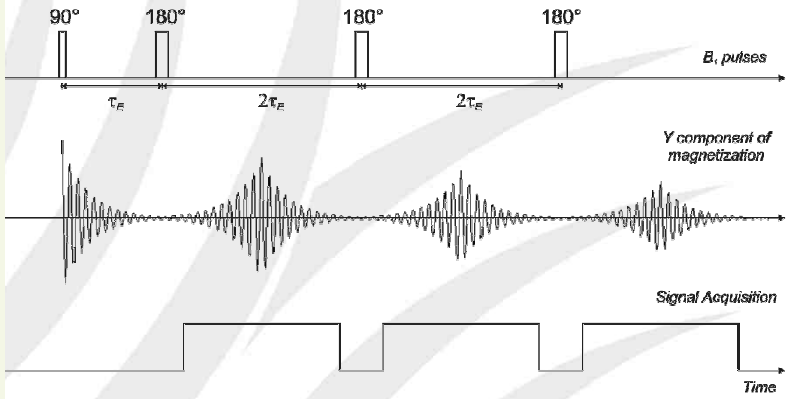
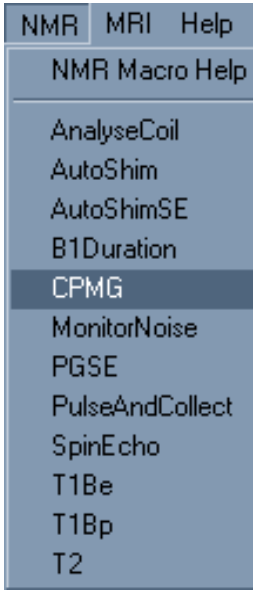
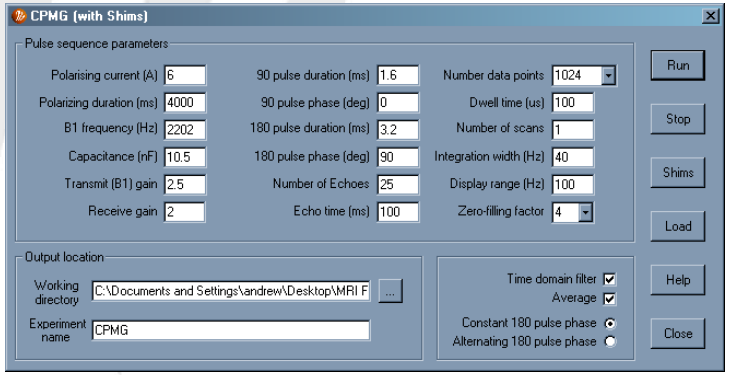
Carr-Purcell-Meiboom-Gill (CPMG)



A single shot T_2 measurement of water using the CPMG sequence.







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Teaching Imaging with Terranova-MRI

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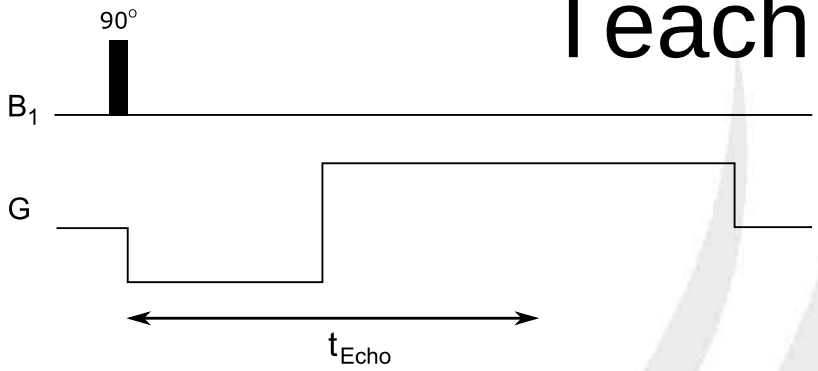
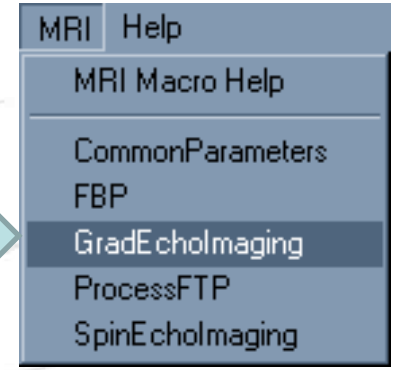
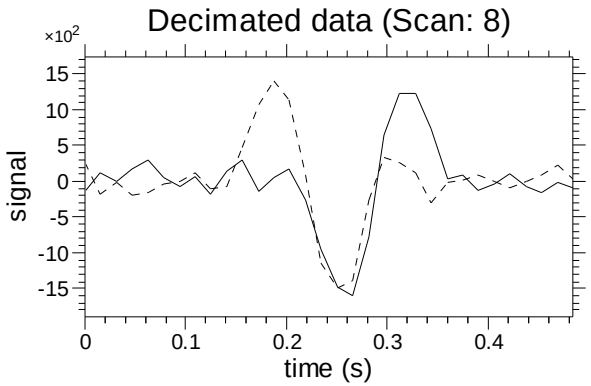
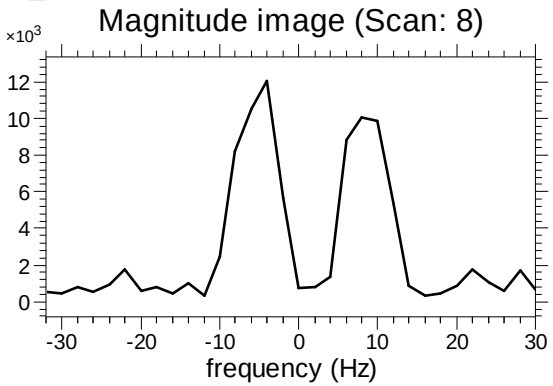
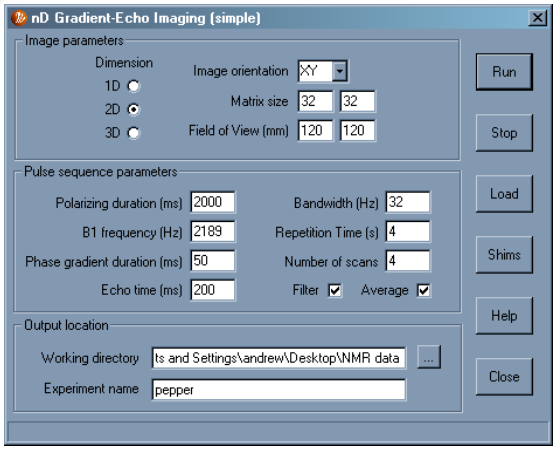
Teach 1D MRI

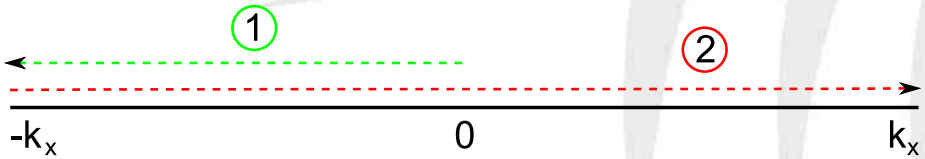












1D image along z of the two compartment phantom filled with tap water (FOV = 160 mm).

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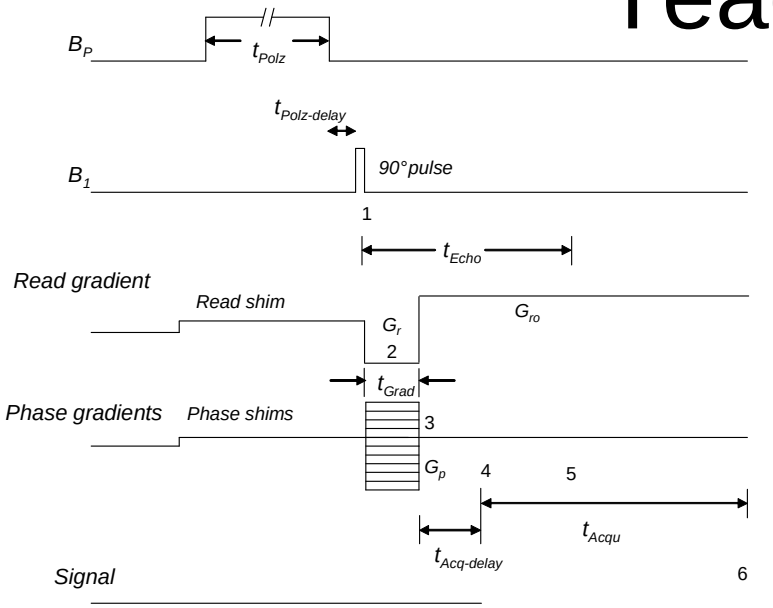
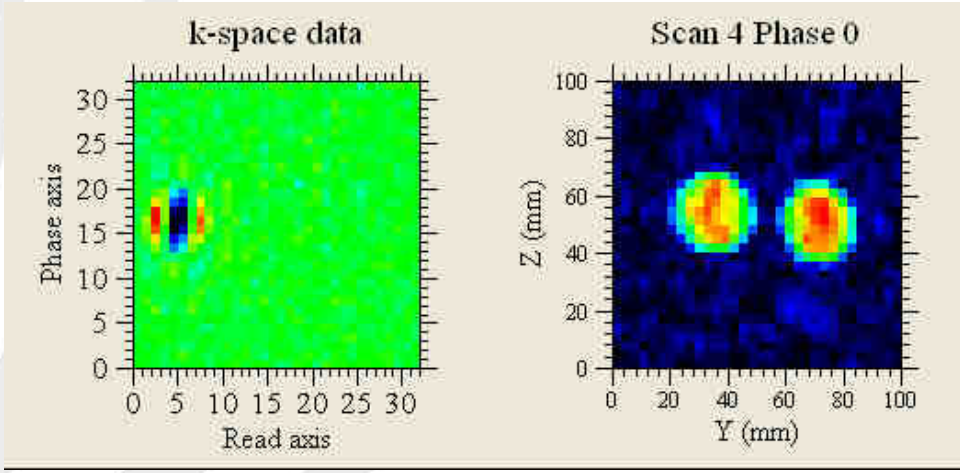
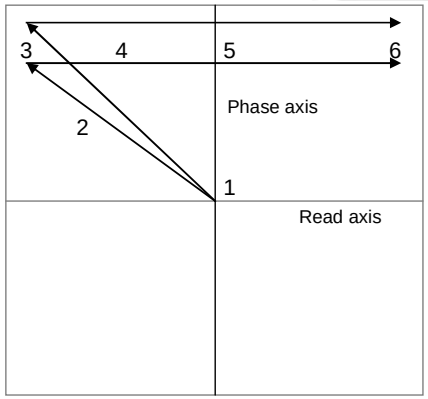
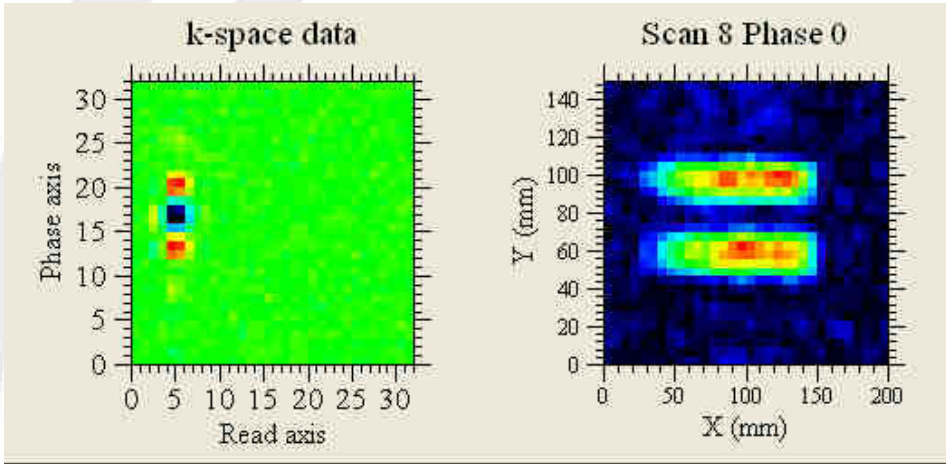
Teach 2D MRI





2D Gradient echo imaging





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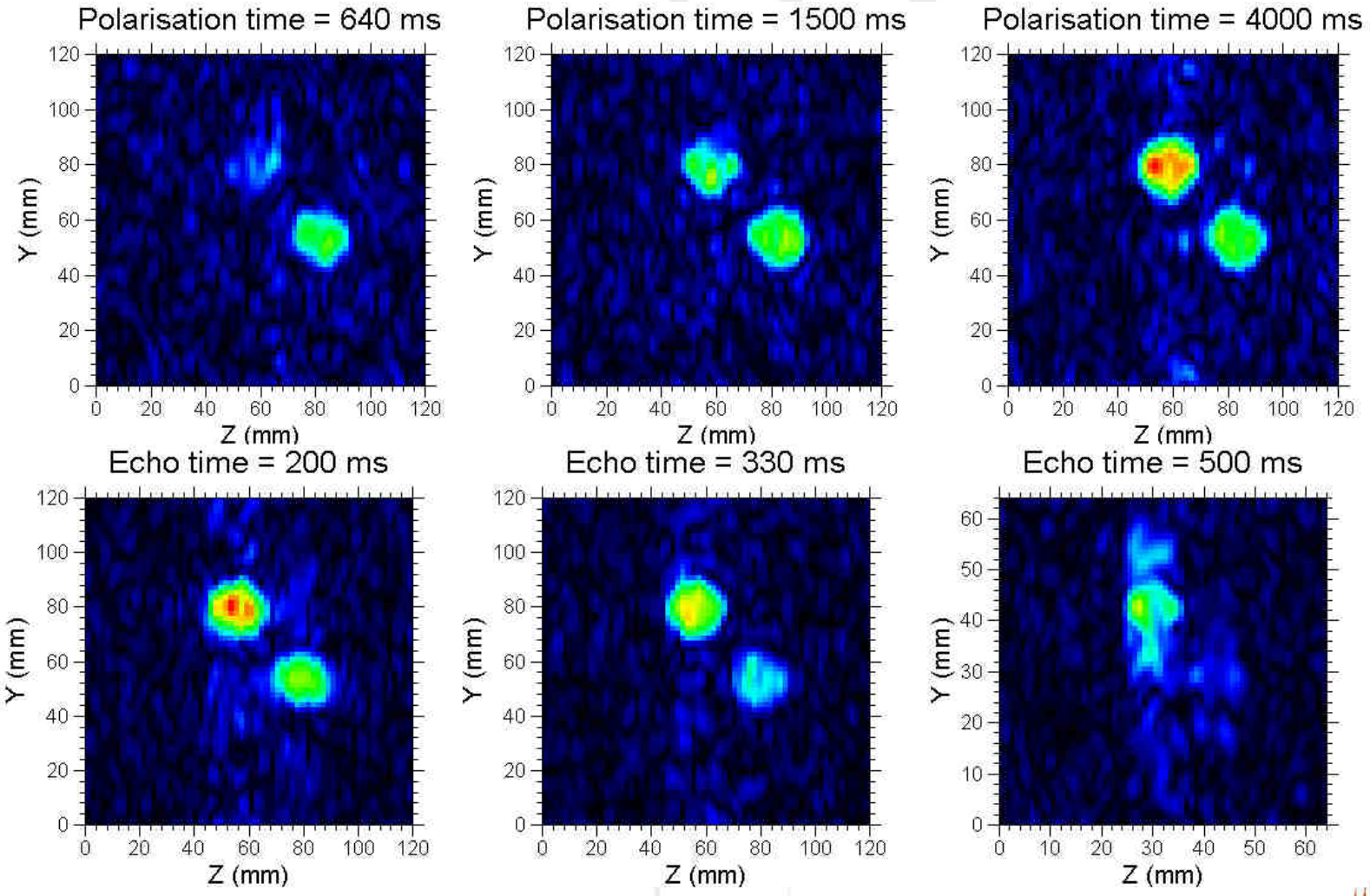
T_1 and T_2 relaxation contrast imaging



Lower tube has a shorter T_1 and T_2

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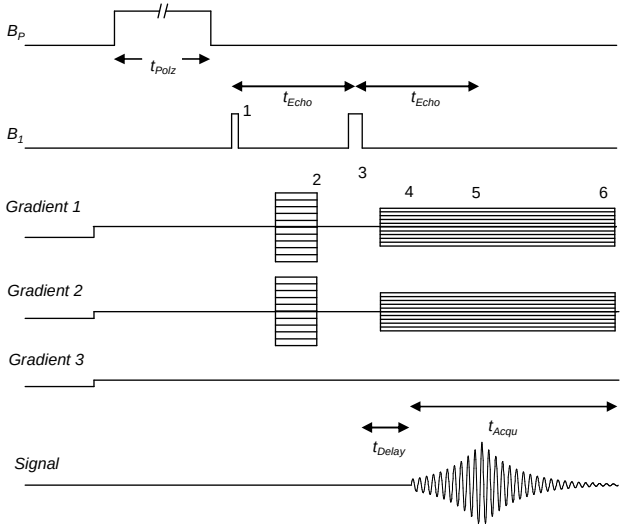
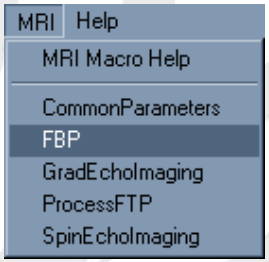
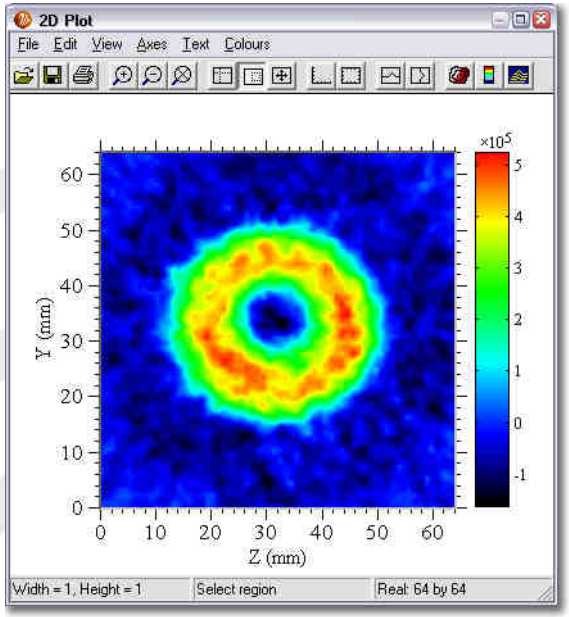
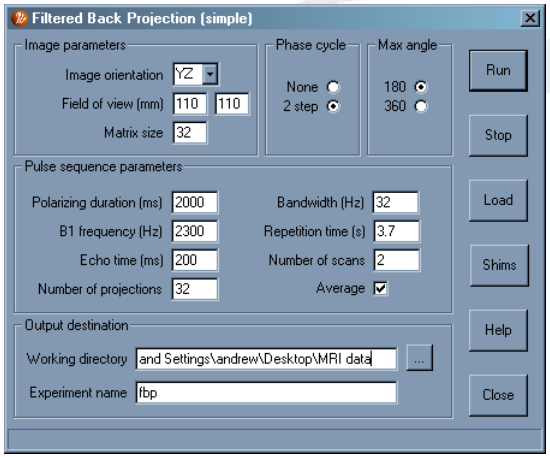
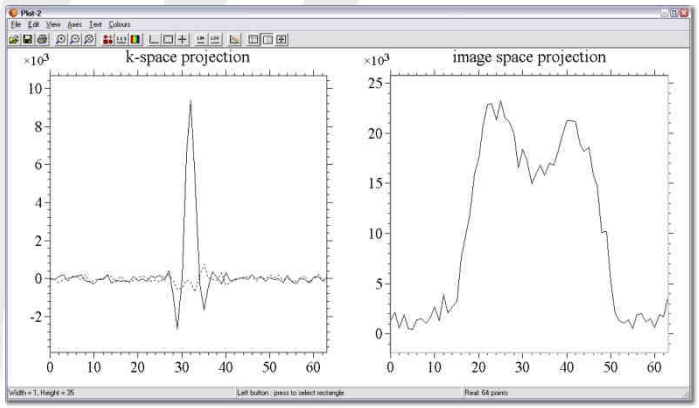
2D Filtered Back Projection (FBP)











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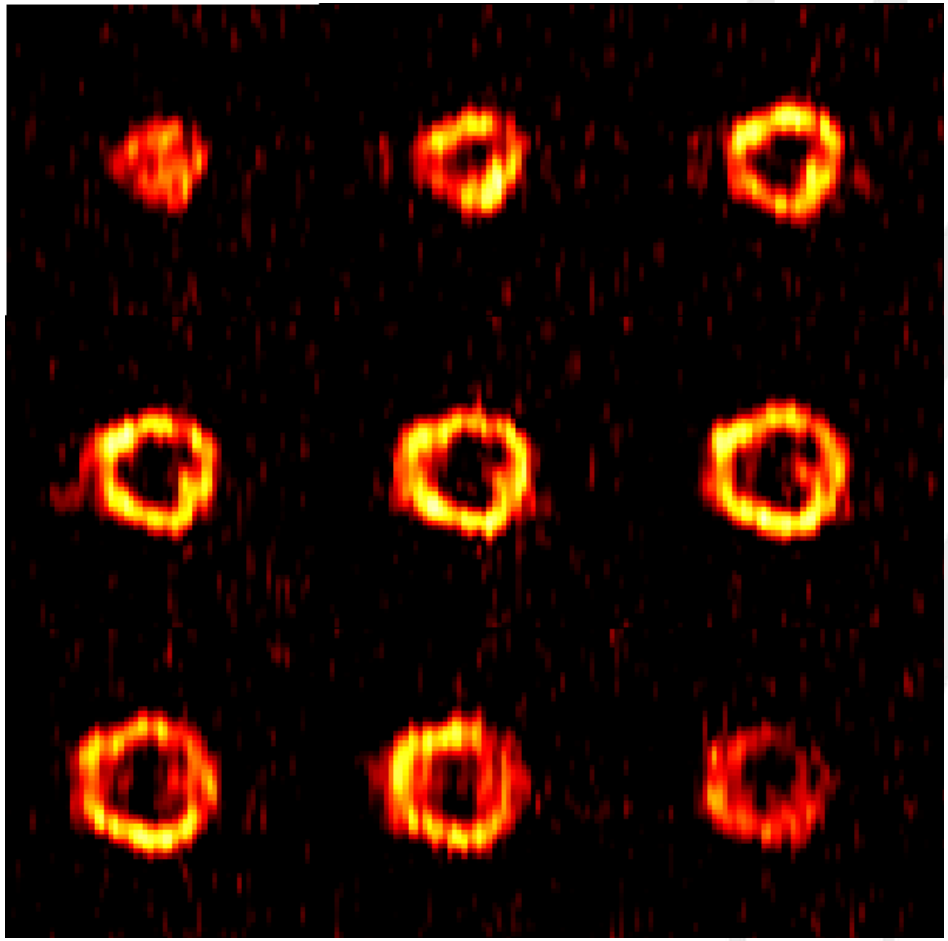
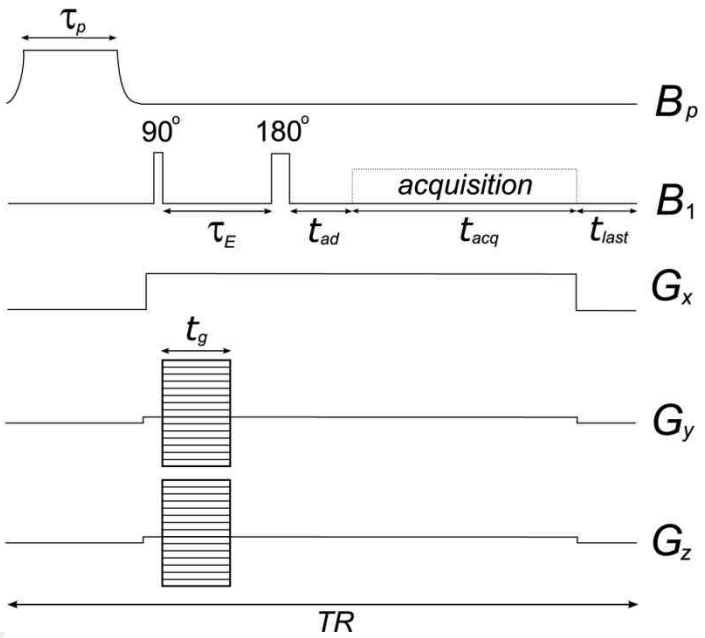
3D NMR Imaging in the Earth's Field



Red pepper (capsicum)



3D spin-echo imaging

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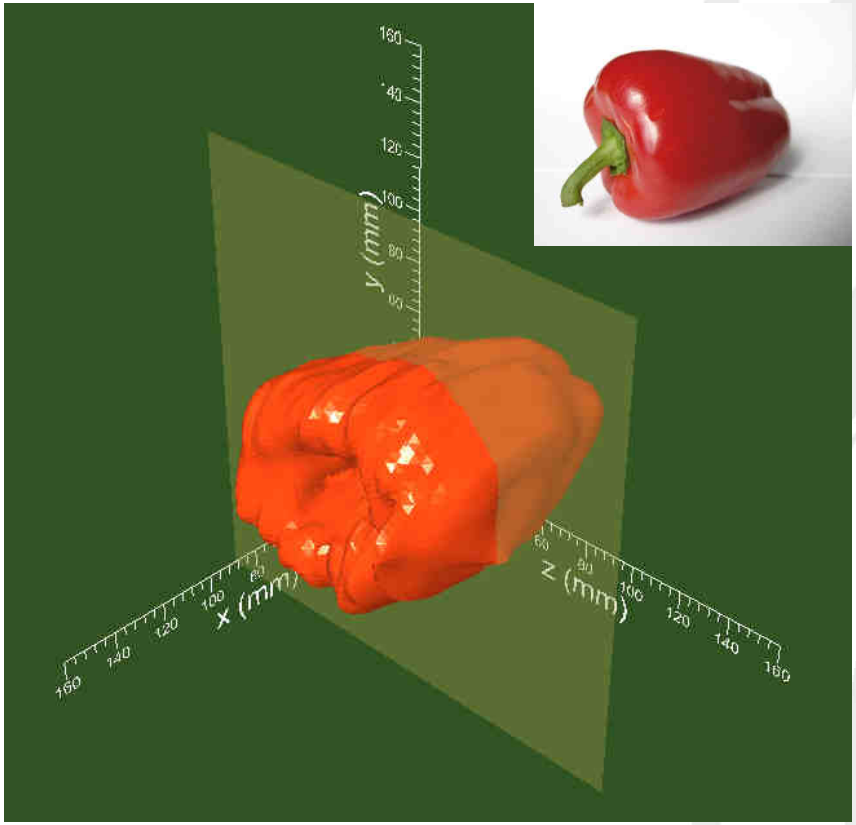
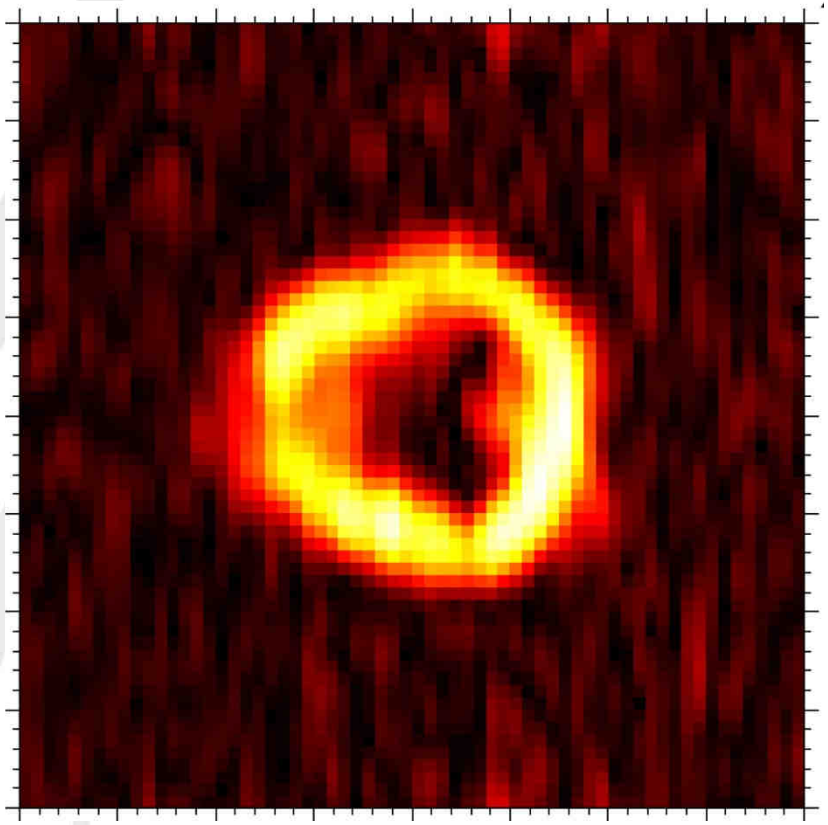
3D ^{1}H Spin-echo MRI

Red Pepper (Capsicum)





Halse *et. al.* JMR **182** (2006) 75-83

Teaching Spectroscopy with Terranova-MRI

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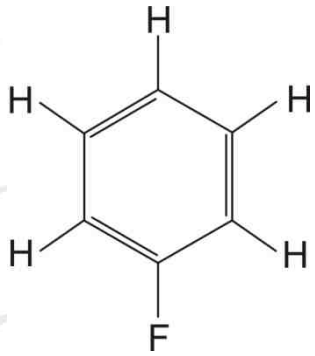
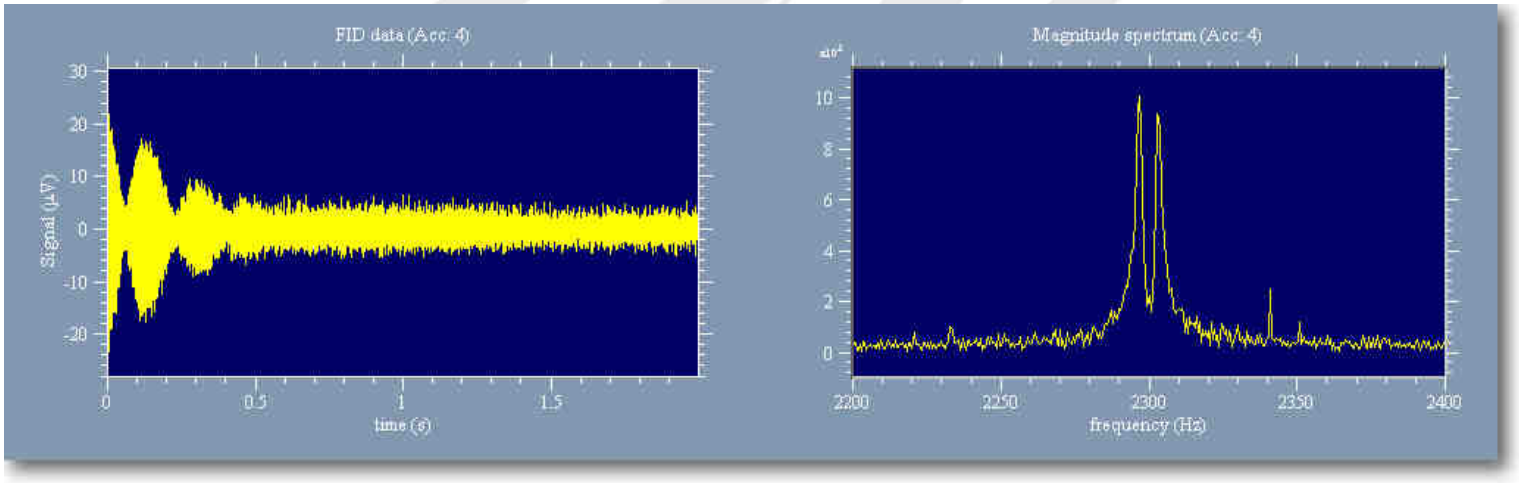
Heteronuclear *J*-coupling: Fluorobenzene

Earth's field NMR is well suited to observing purely *J* coupled spectra. *J* coupling constants are independent of field and, for the case of different nuclei species, *J* coupling can be resolved easily in the Earth's field.





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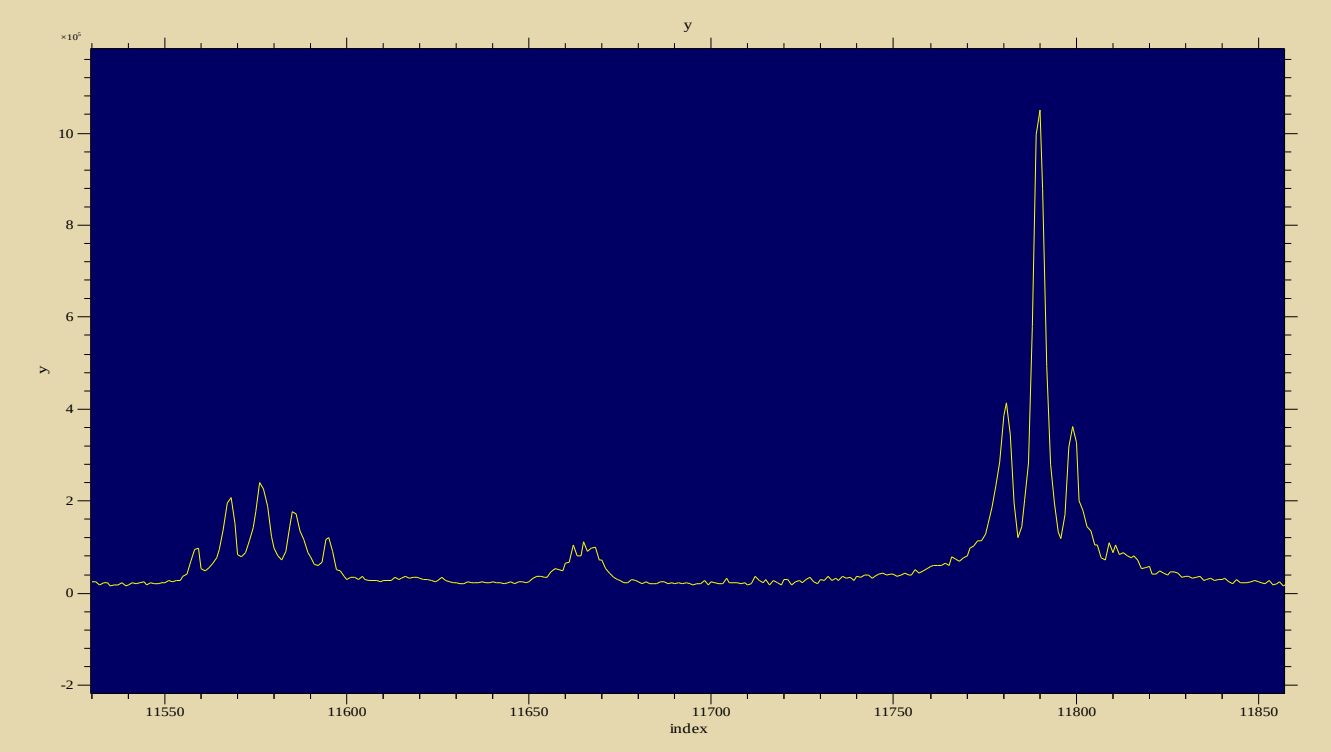
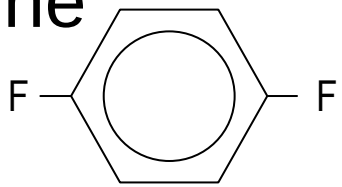
Heteronuclear *J*-coupling: Fluorobenzene





1,4-difluorobenzene

2 fluorine atoms coupled to 4 protons

Expect a proton triplet and a fluorine quintuplet

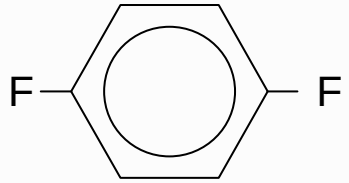
Fluorine F^{19}
~ 2275 Hz

Noise
~2350Hz
(50Hz harmonic)

Protons H^{1}
~ 2425 Hz

Hetero-nuclear spin-spin J-coupling via electron (through bond).
J-coupling is independent of frequency (measured in Hz)
Note: Simultaneous acquisition of both F and H signals.

2D Spectroscopy: 2D COSY



1,4-difluorobenzene

Fluorine

Cross-peaks

Robinson *et. al.* JMR **182** (2006)

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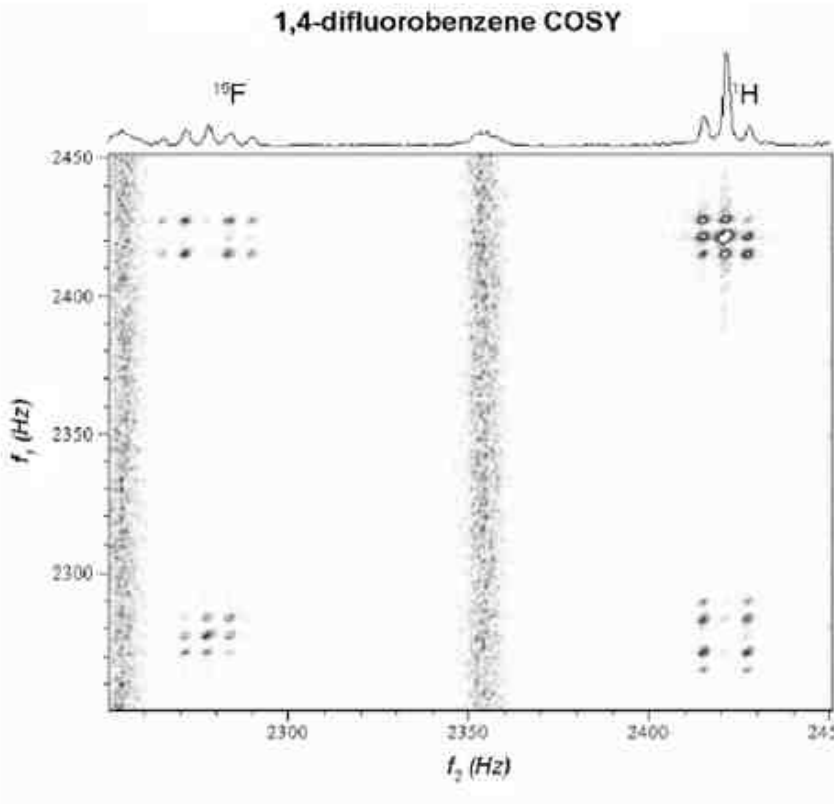
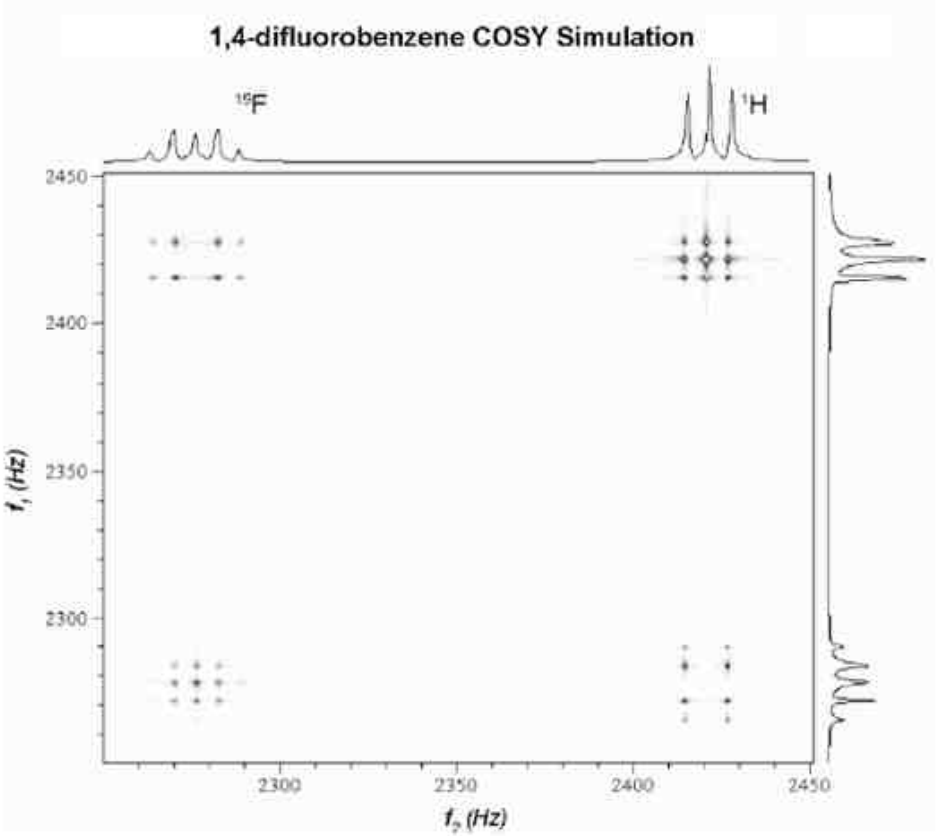
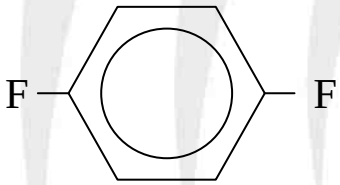




Experiment



1,4-difluorobenzene

Theory

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Thank you

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