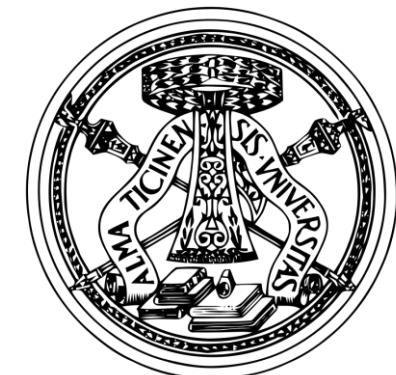
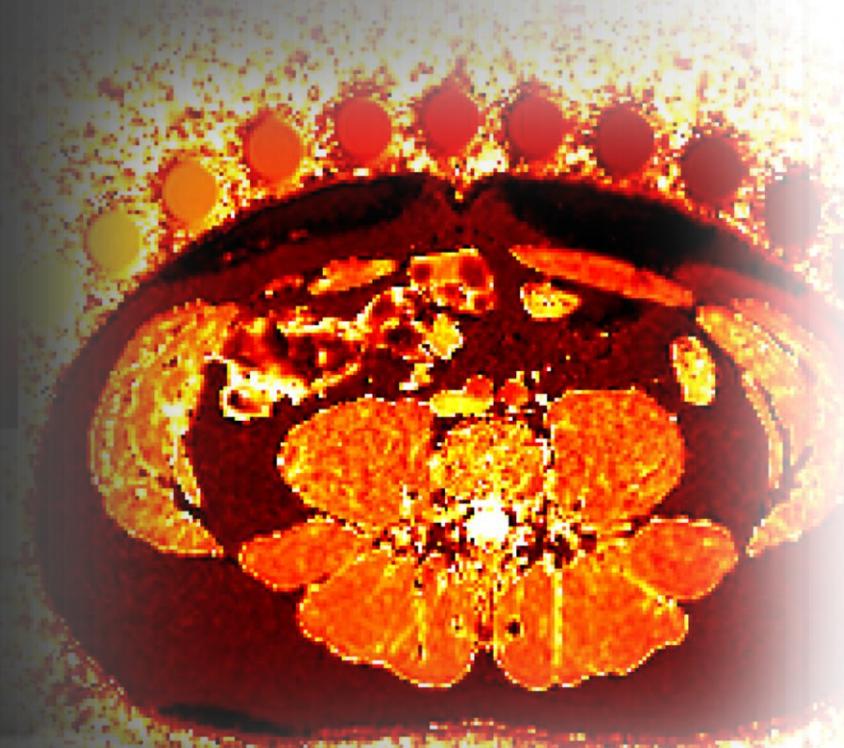


MRI phantom calibration for relaxation times maps harmonization and optimization

Davide Cicolari

davide.cicolari01@universitadipavia.it



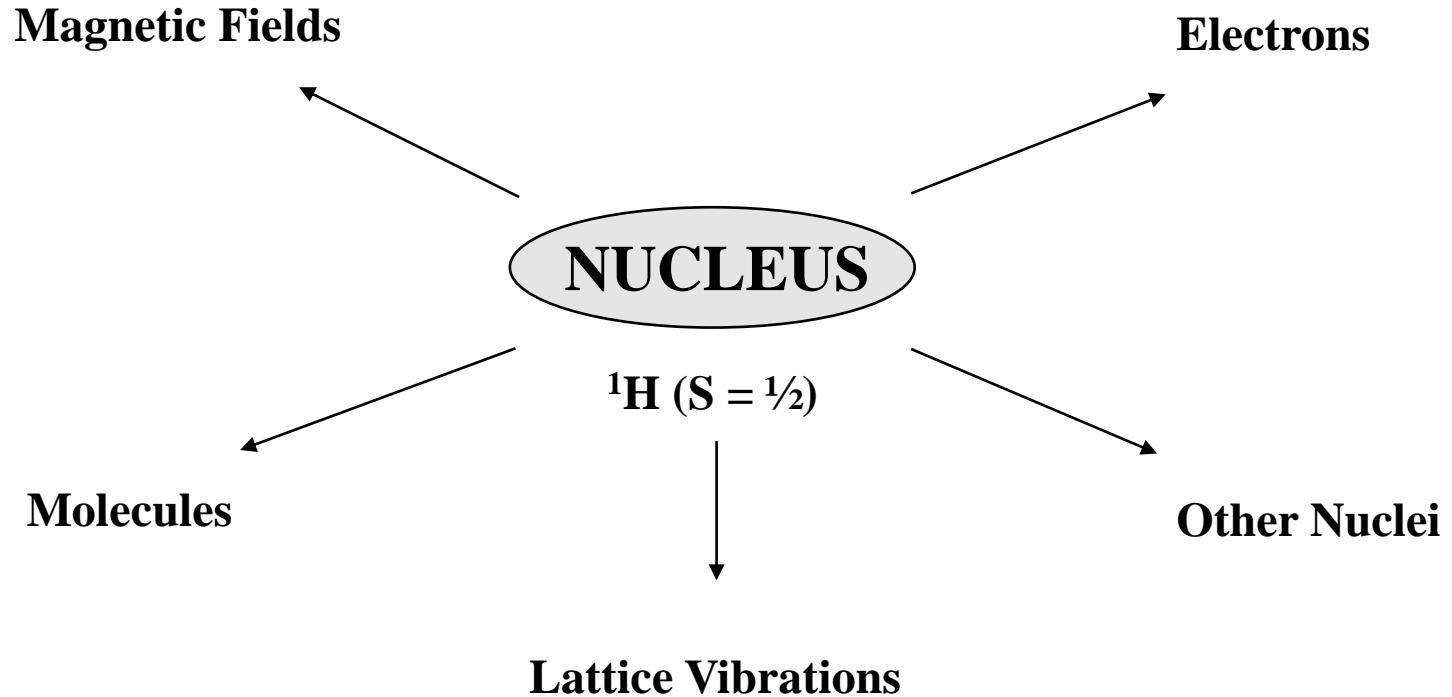
Ospedale Niguarda



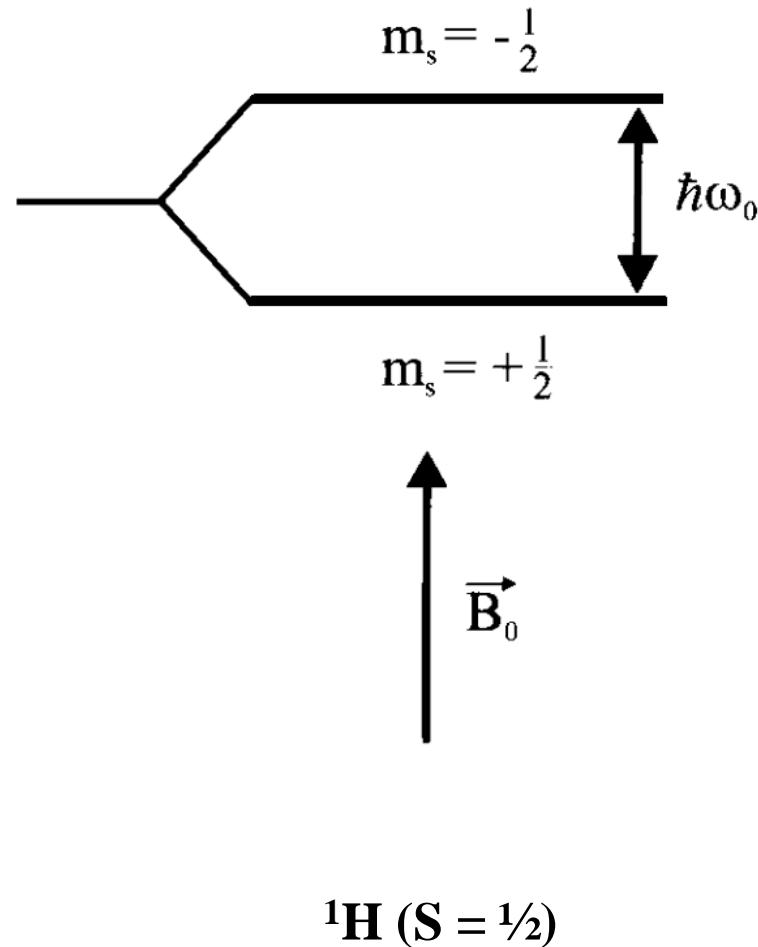
Sistema Socio Sanitario

Regione
Lombardia

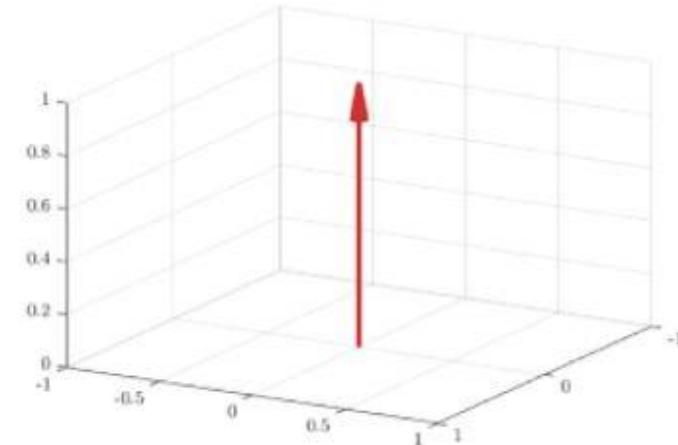
Nuclear Magnetic Resonance



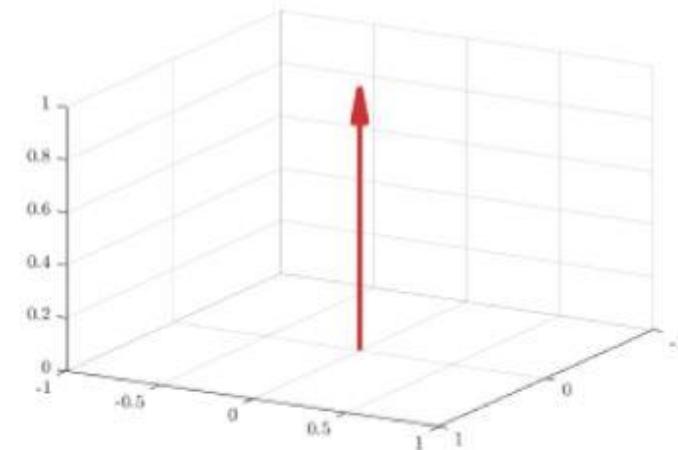
Nuclear Magnetic Resonance



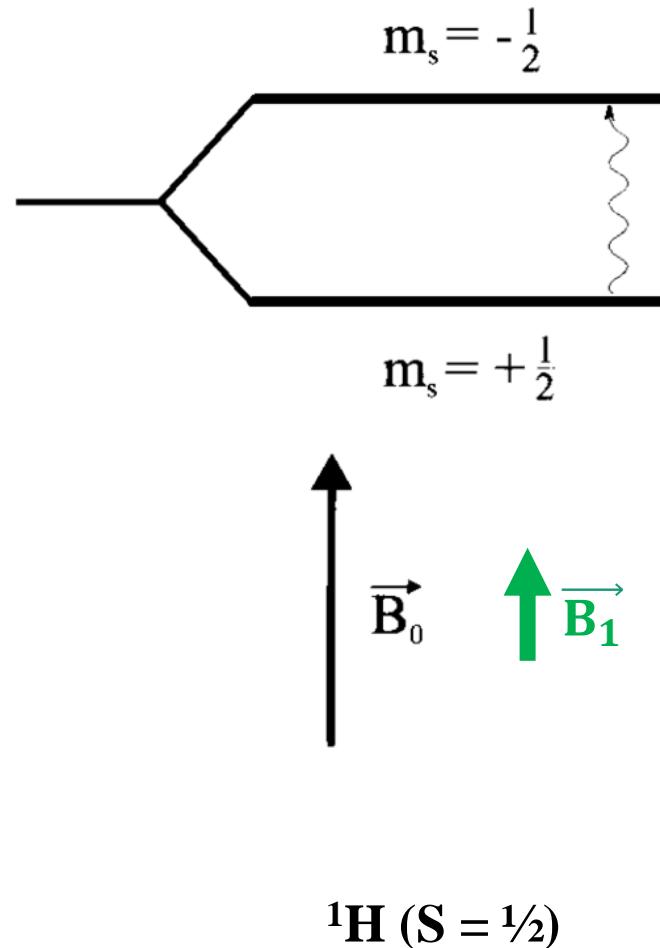
NMR Experiment - Lab Frame



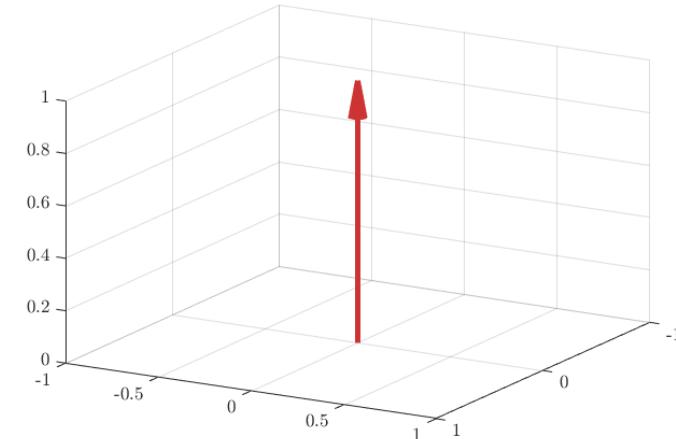
NMR Experiment - Rotating Frame



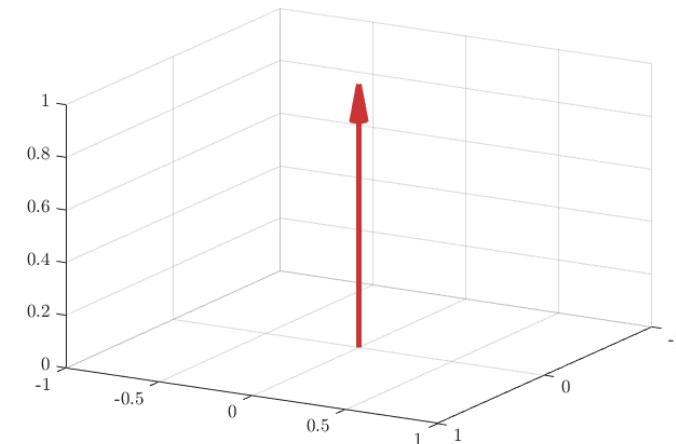
Nuclear Magnetic Resonance



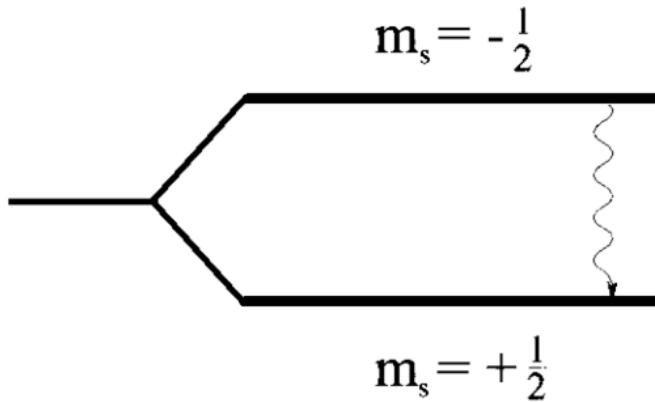
NMR Experiment - Lab Frame



NMR Experiment - Rotating Frame

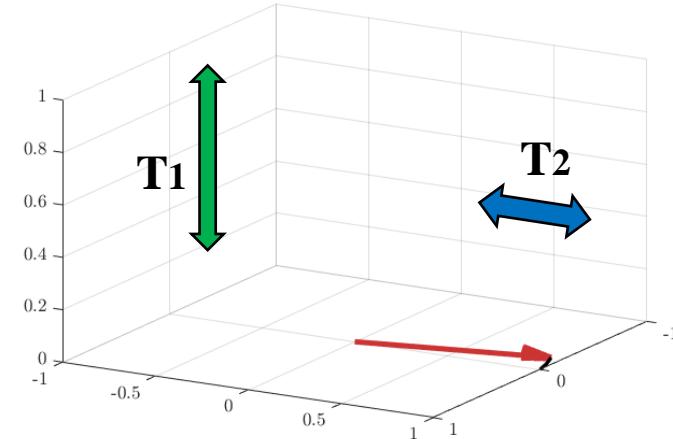


Nuclear Magnetic Resonance

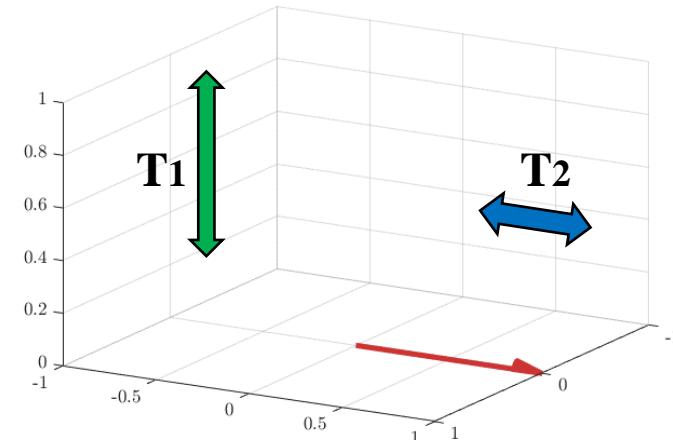


^1H ($S = \frac{1}{2}$)

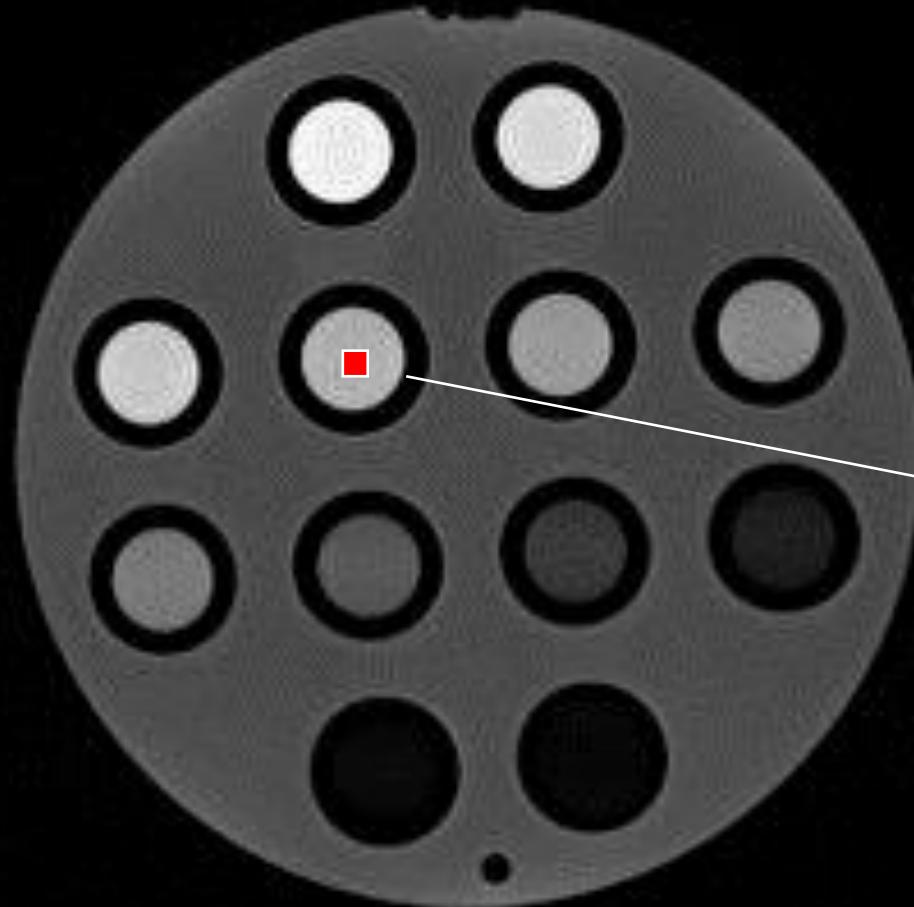
NMR Experiment - Lab Frame



NMR Experiment - Rotating Frame



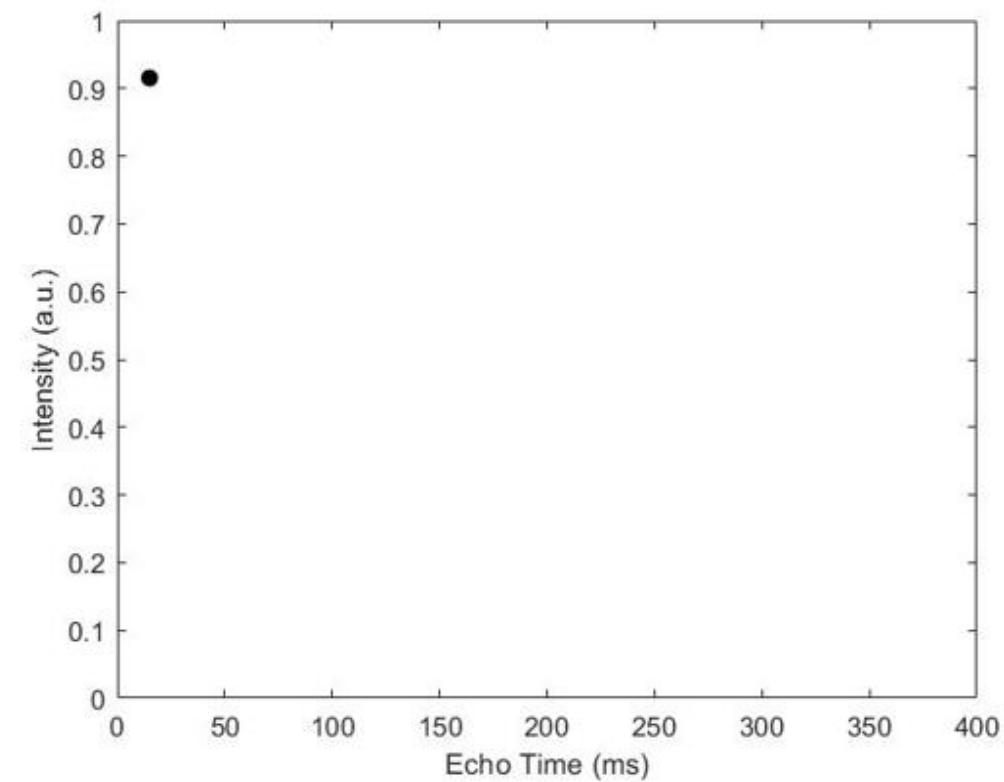
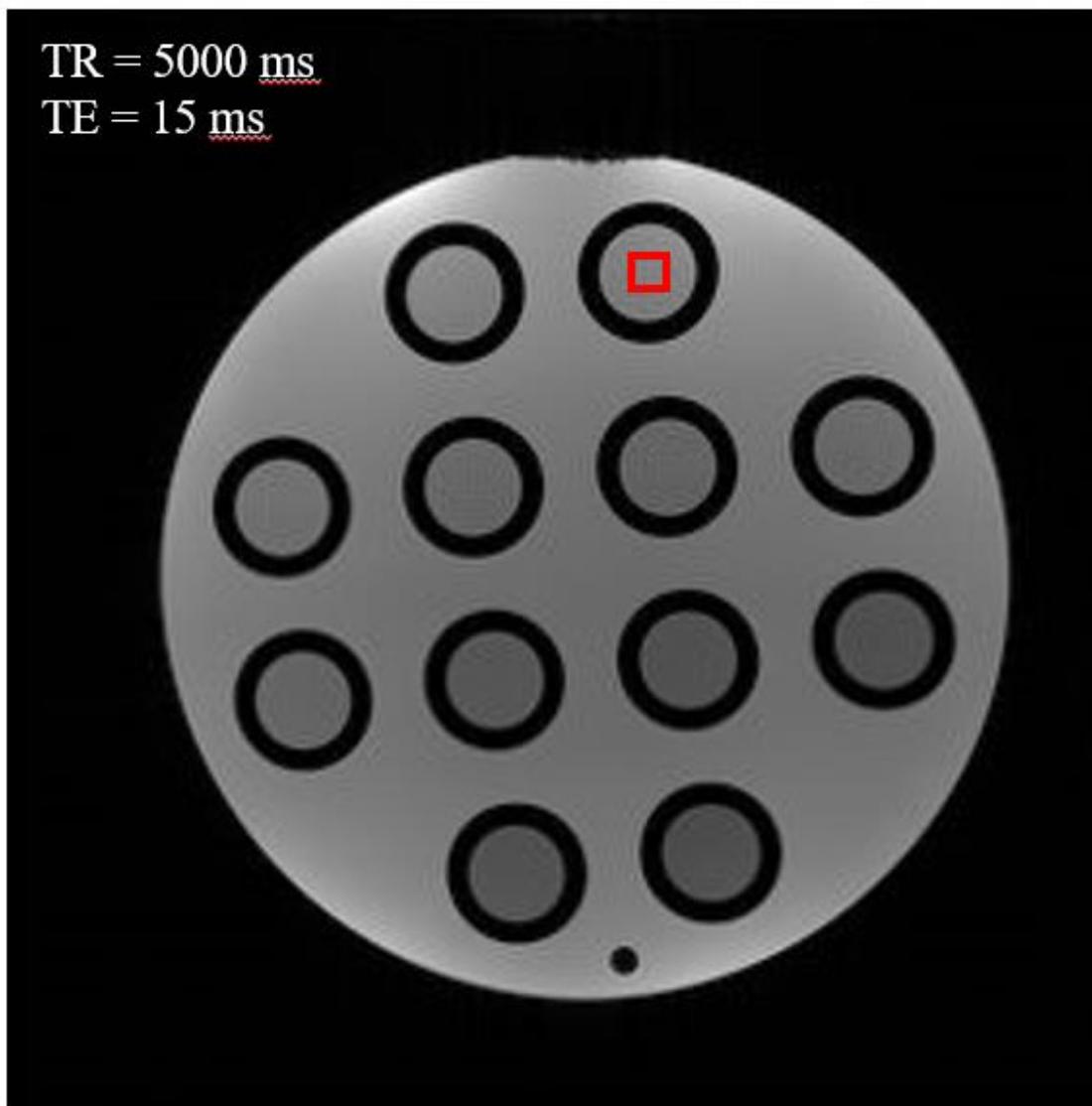
Spin-Echo



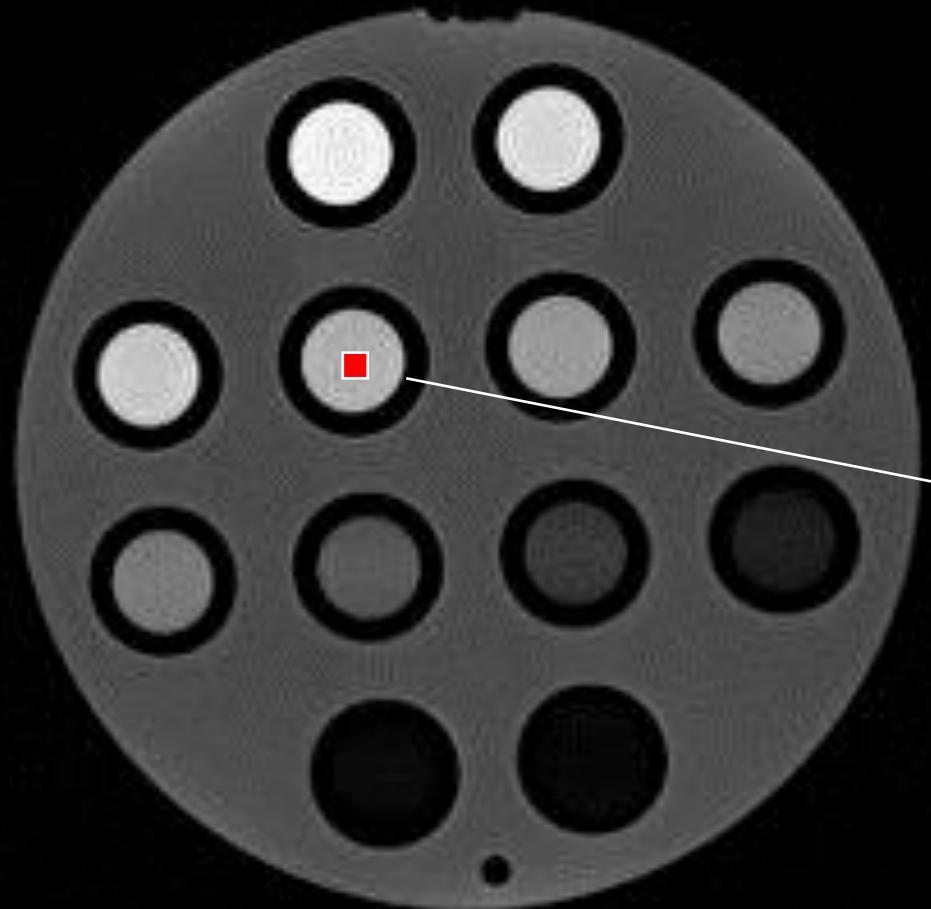
$$s(t) \propto \rho e^{-\frac{T_E}{T_2}} \left(1 - e^{-\frac{T_R}{T_1}}\right)$$



Spin-Echo



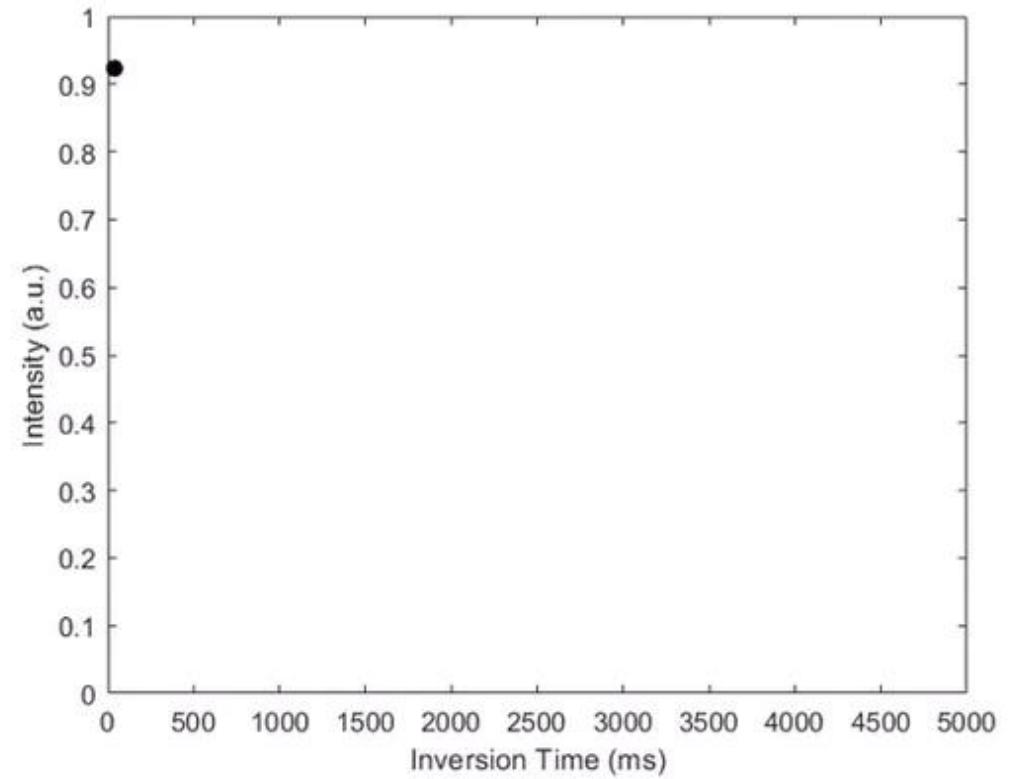
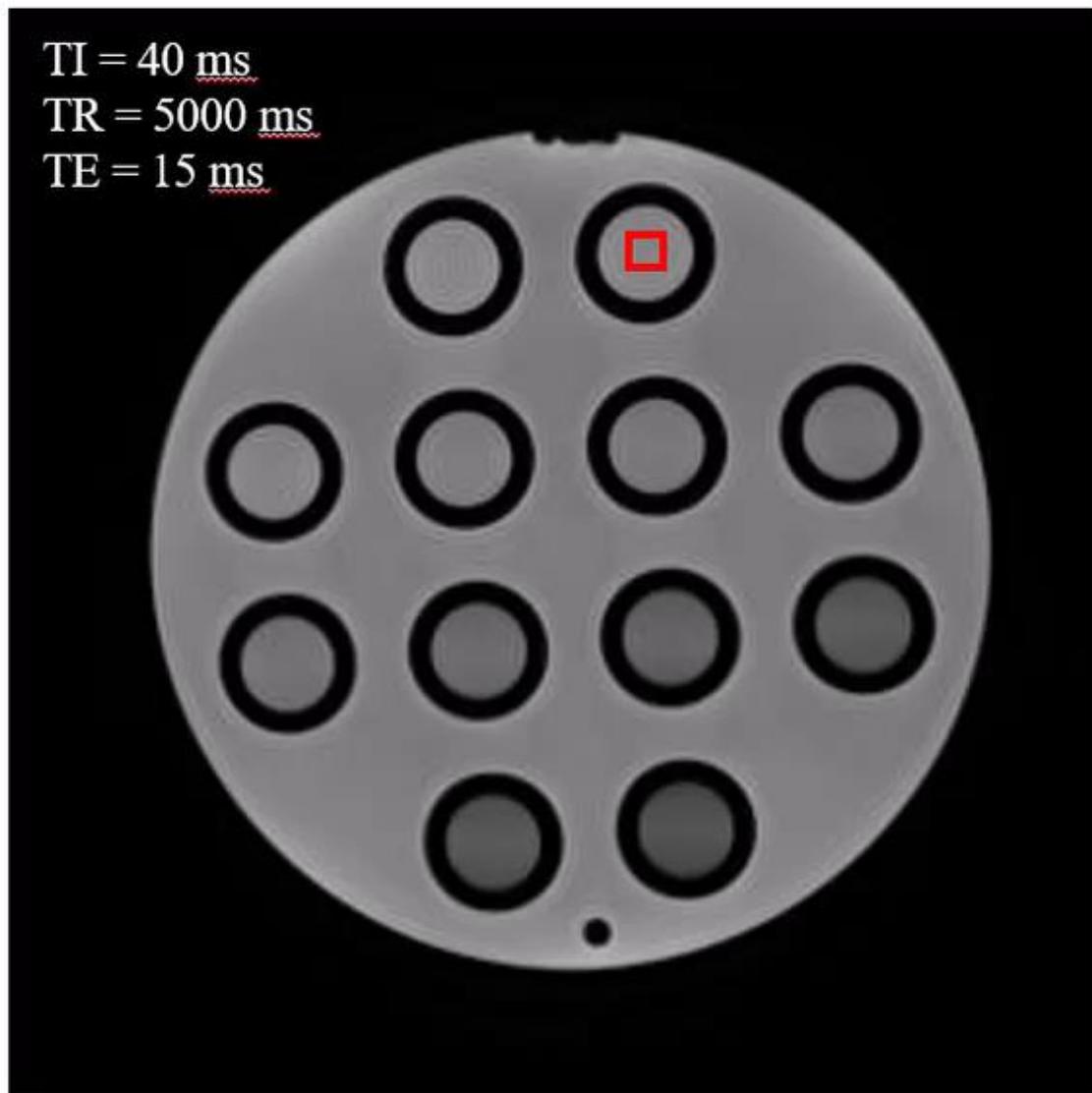
Inversion Recovery

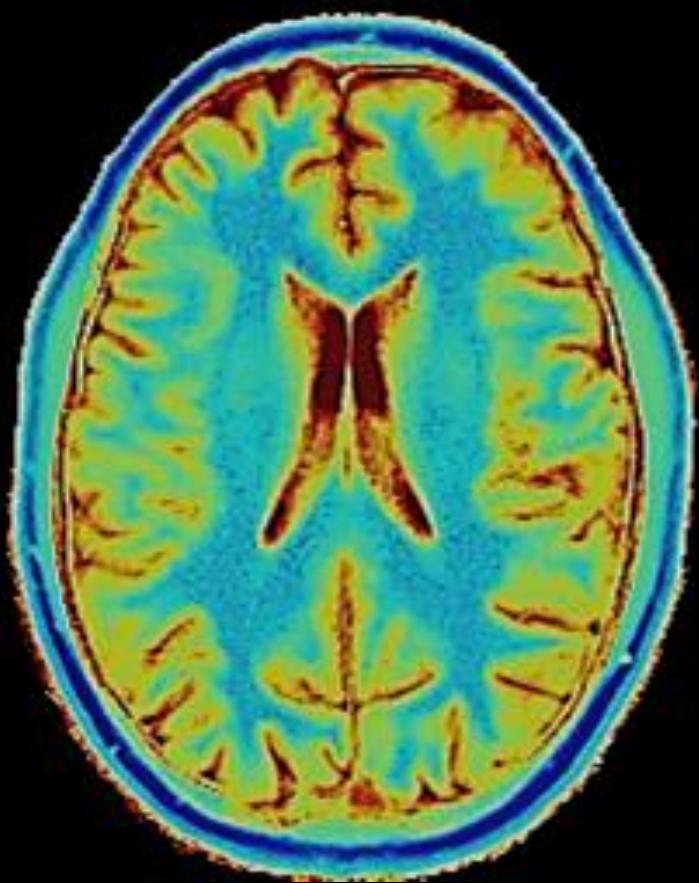


$$s(t) \propto \rho e^{-\frac{T_E}{T_2}} * (1 - 2e^{-\frac{T_I}{T_1}} + e^{-\frac{T_R}{T_1}})$$



Inversion Recovery

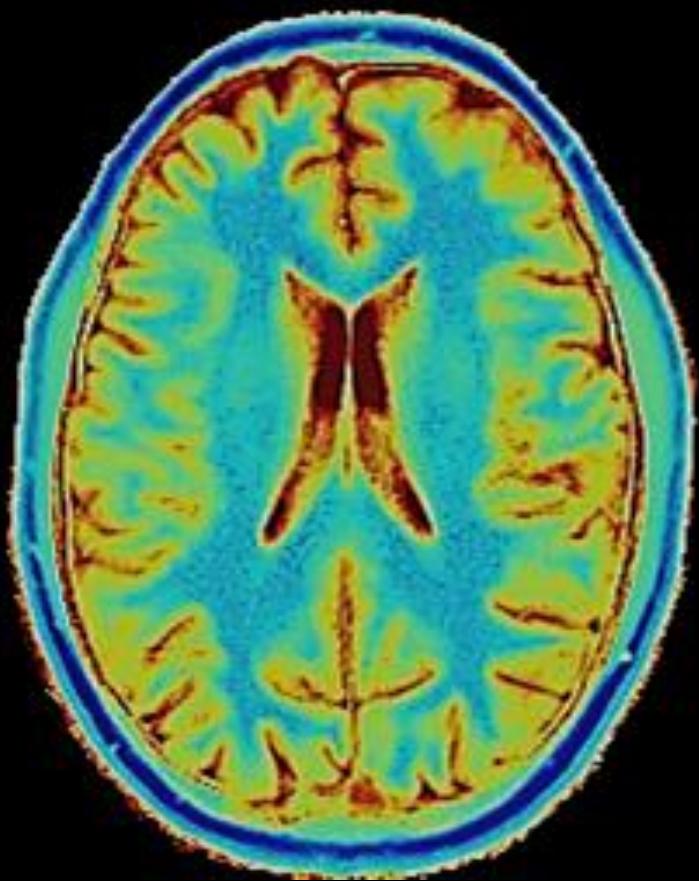




Application of Relaxation Times Maps:

- Identify tissue and morphological changes
- Correlate and monitor disease progression

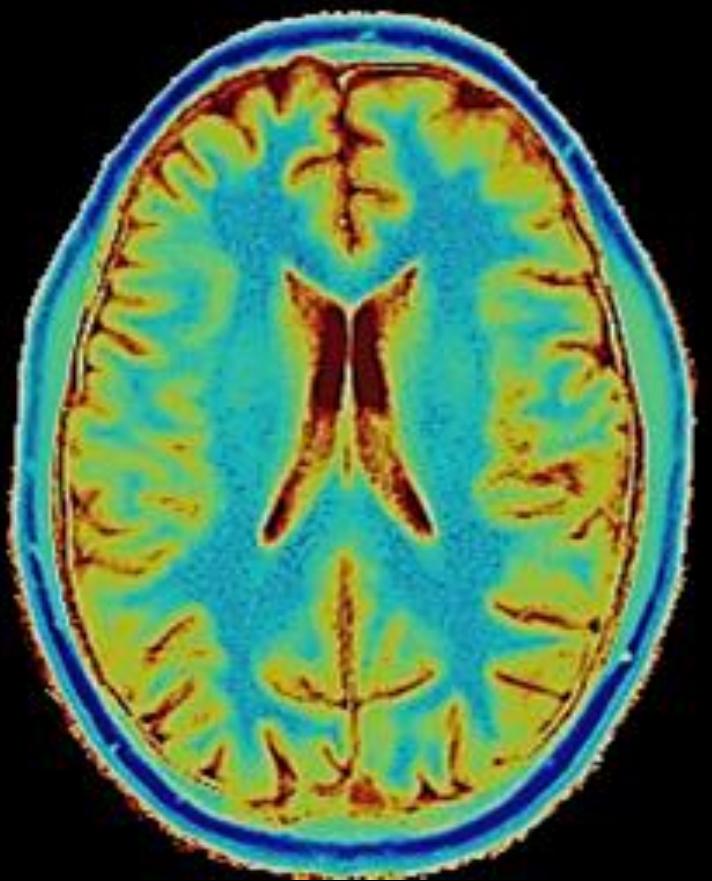




Issue of standardization between:

- Different clinical centres
- Different devices
- Different acquisition methods
- Different software processing





Issue of standardization between:

- Different clinical centres
- Different devices
- Different acquisition methods
- Different software processing

→ PHANTOM CALIBRATION!





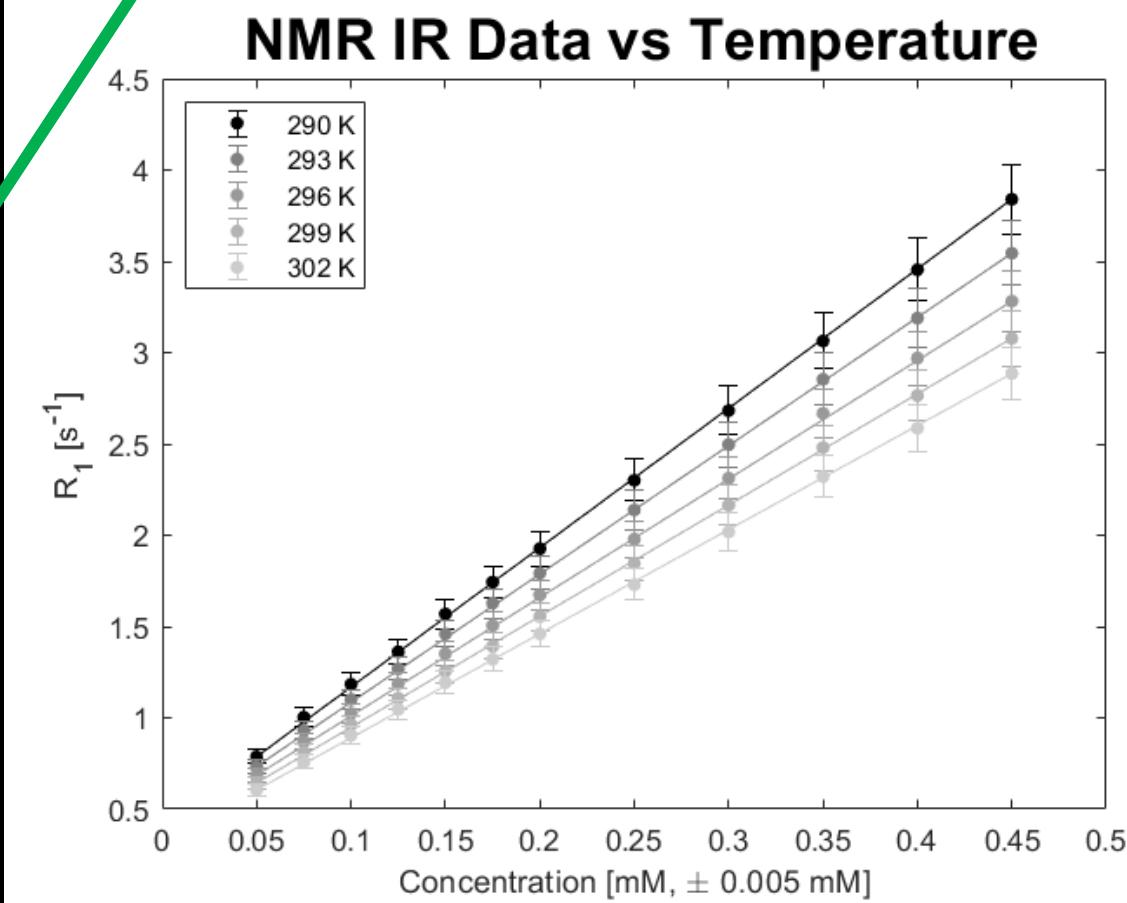


NMR Measures





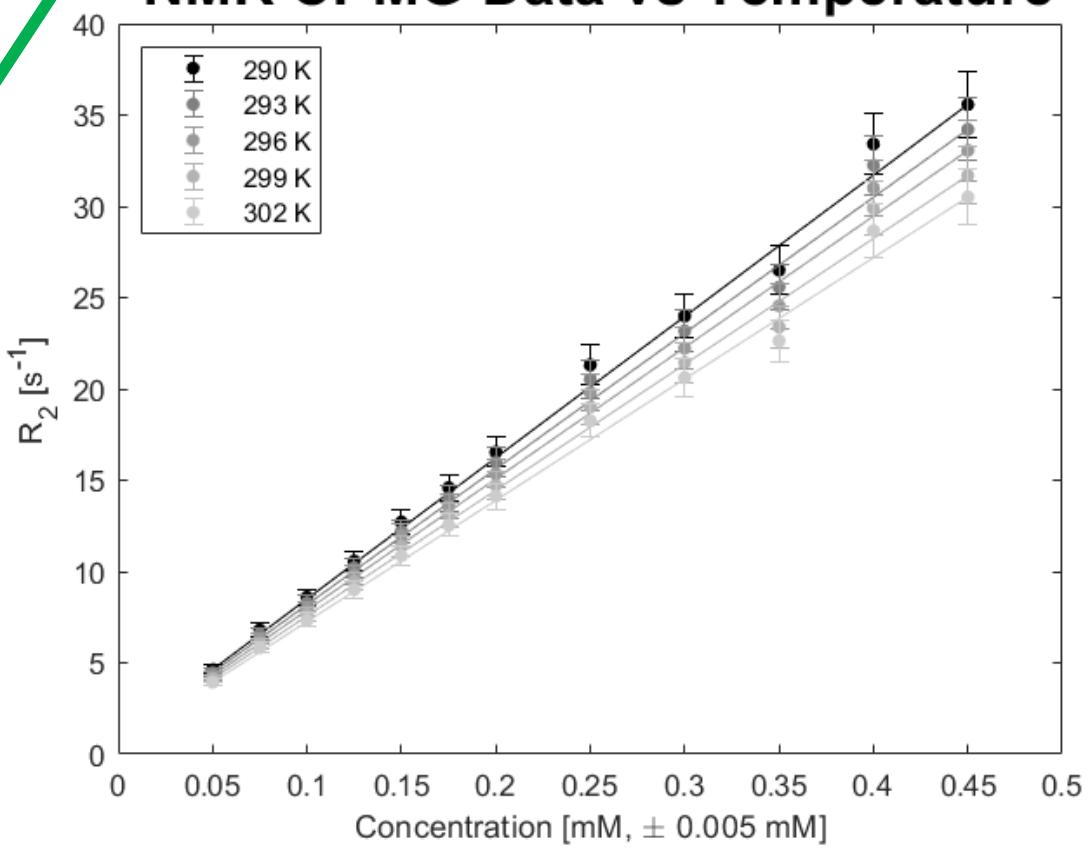
NMR Measures





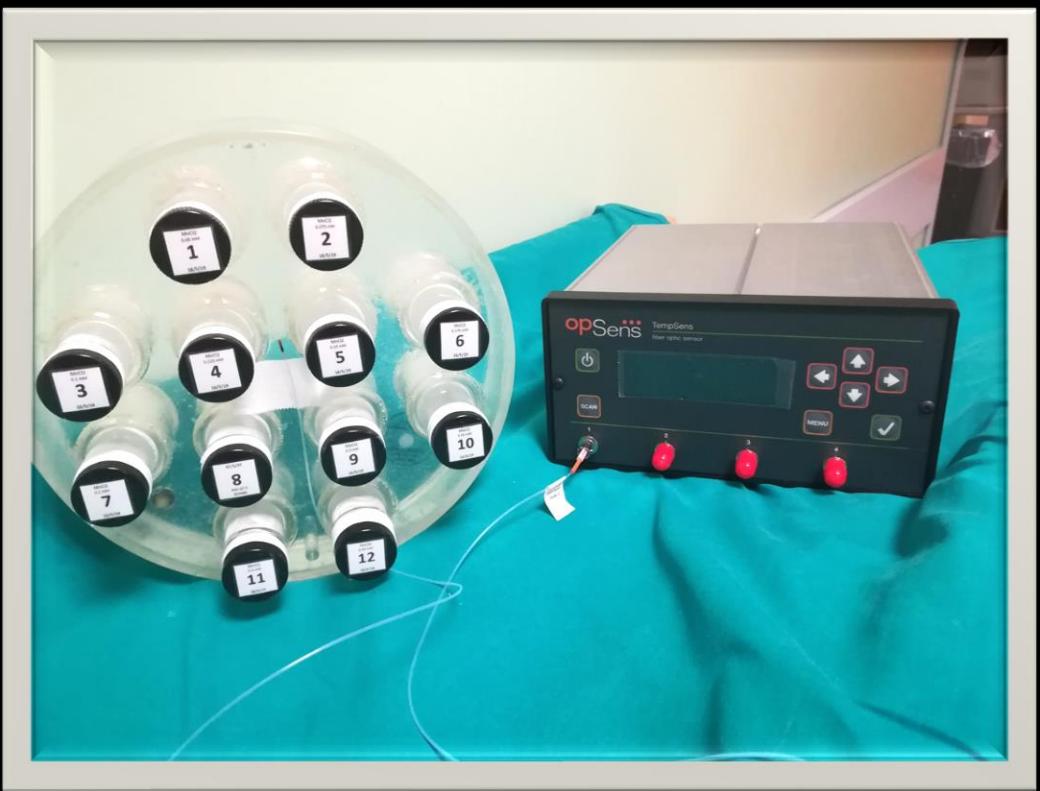
NMR Measures

NMR CPMG Data vs Temperature



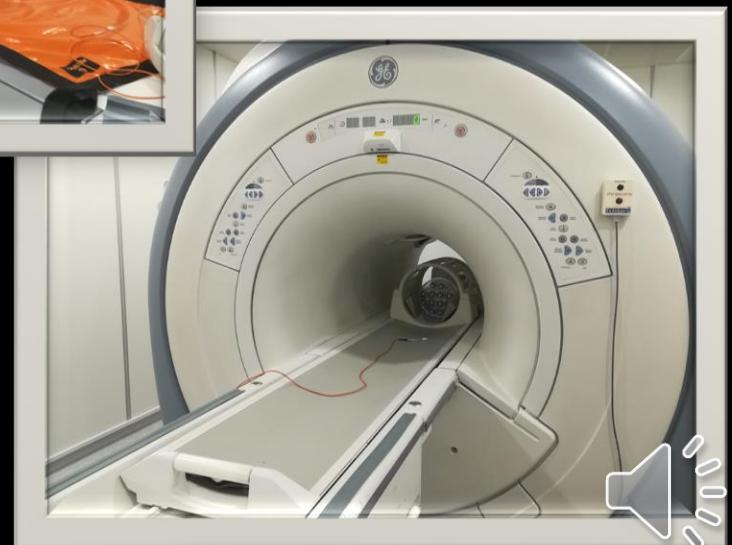
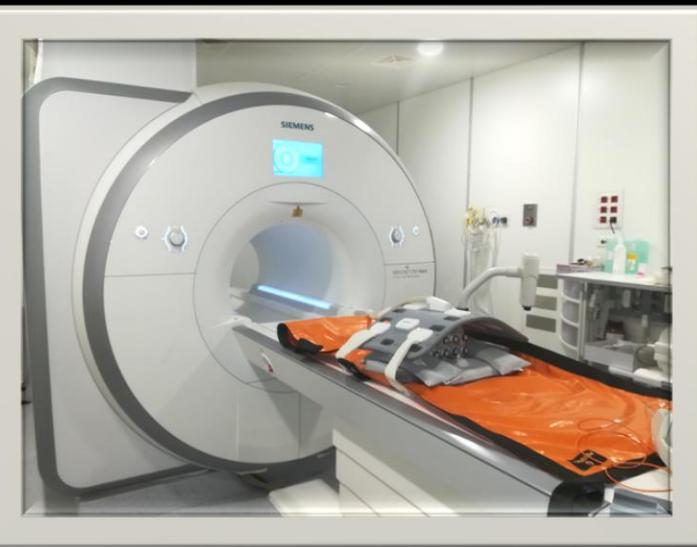


MRI Scans



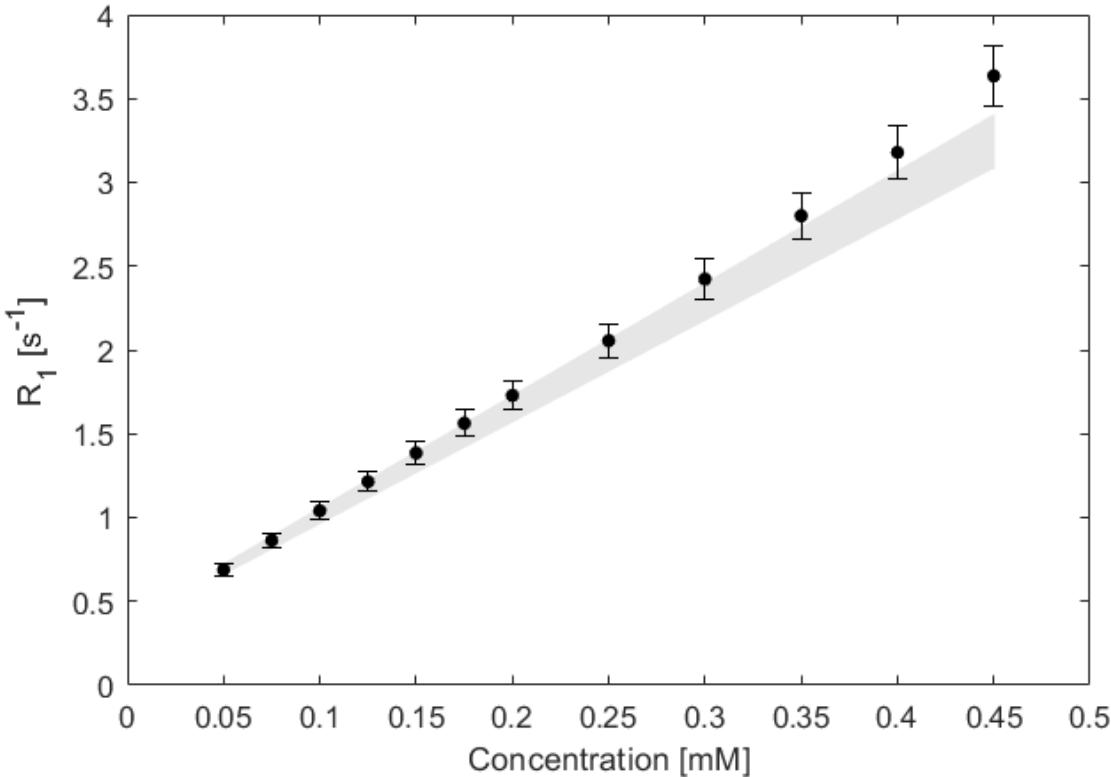


MRI Scans

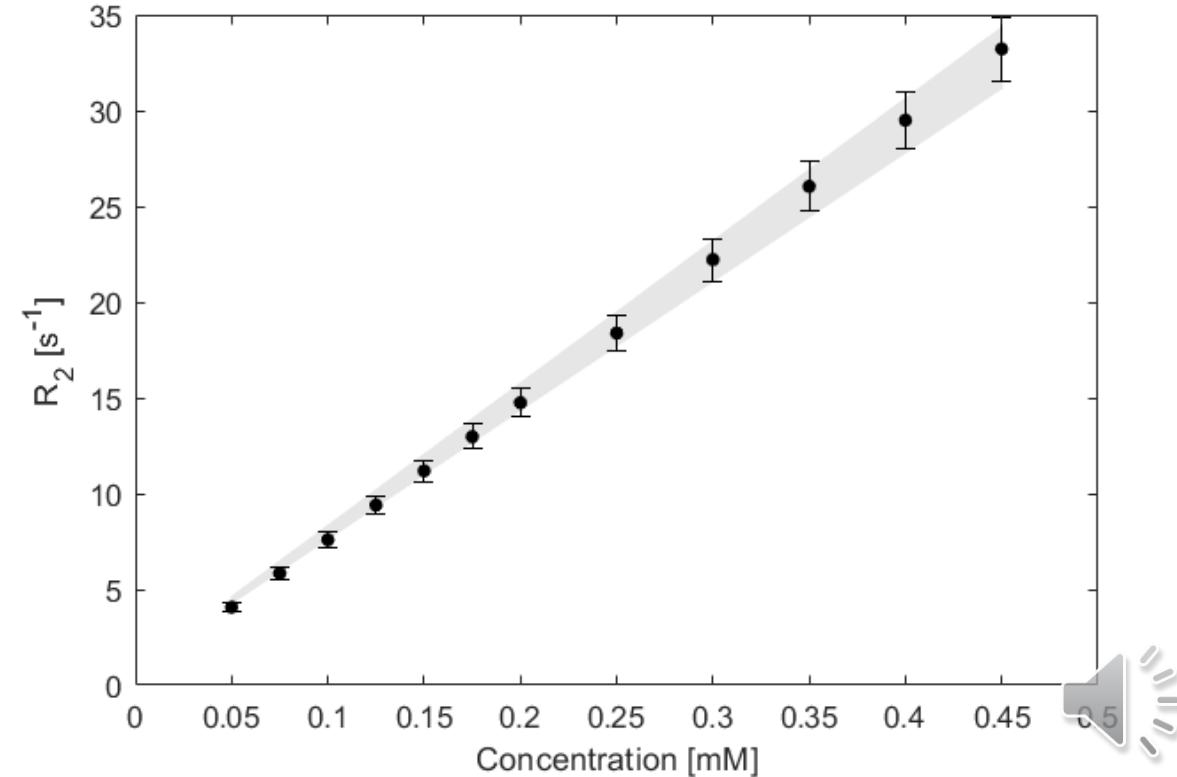


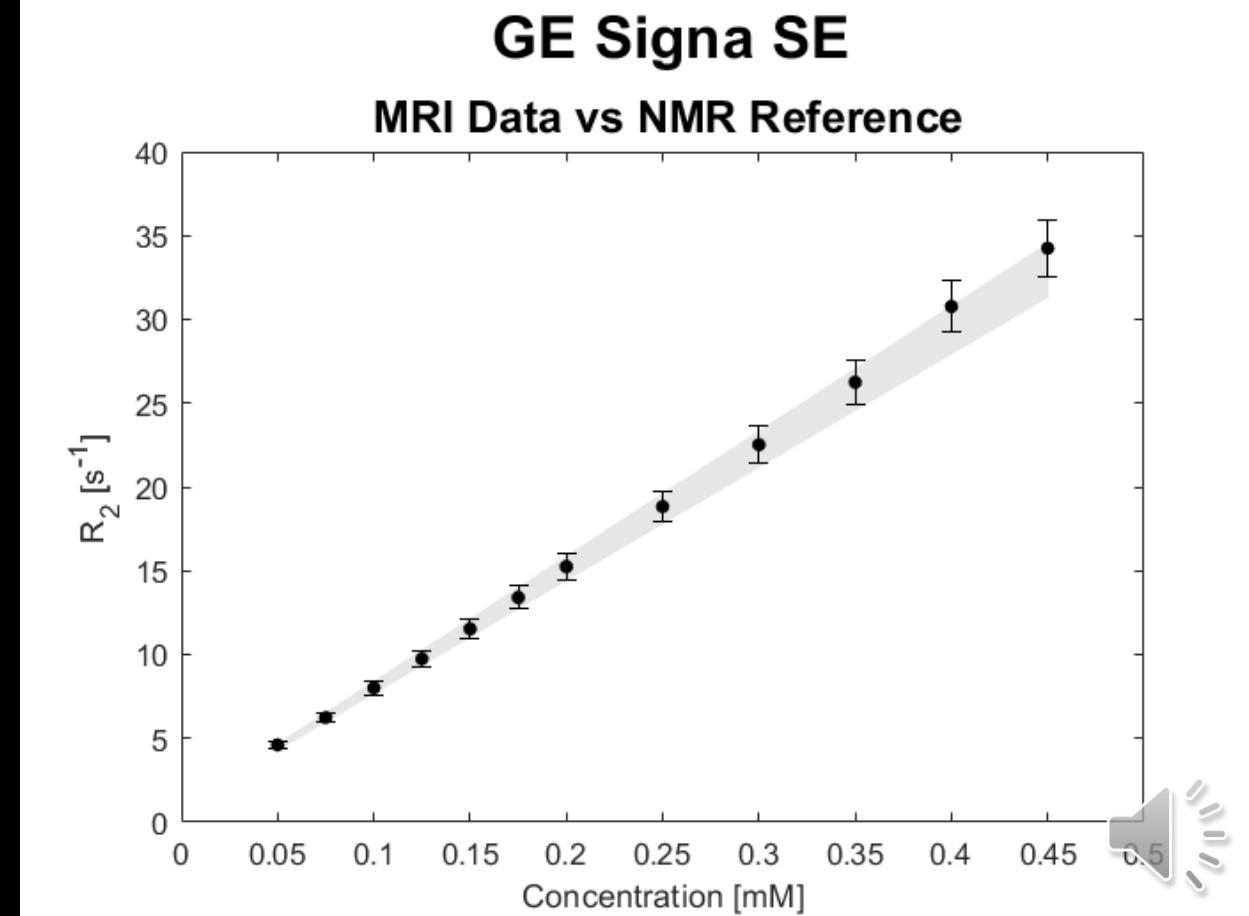
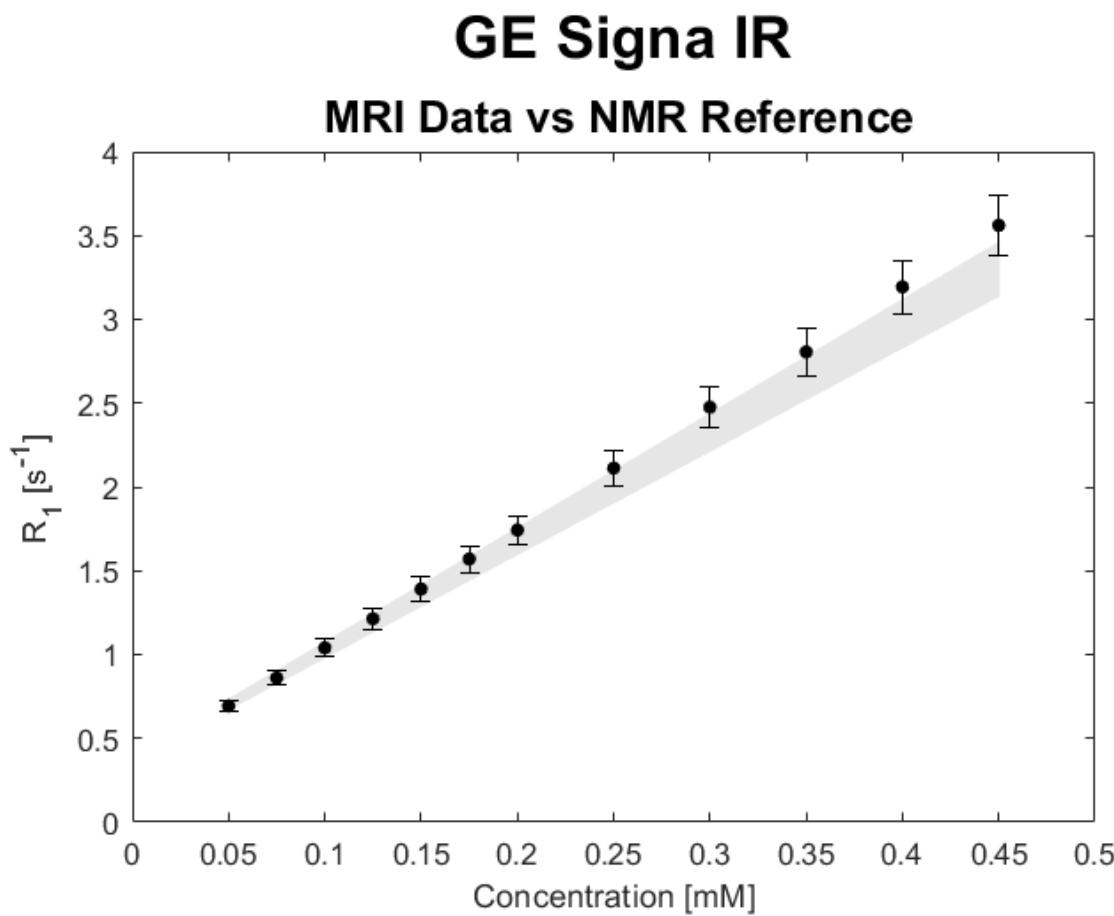
SIEMENS

Siemens Aera IR
MRI Data vs NMR Reference



Siemens Aera SE
MRI Data vs NMR Reference

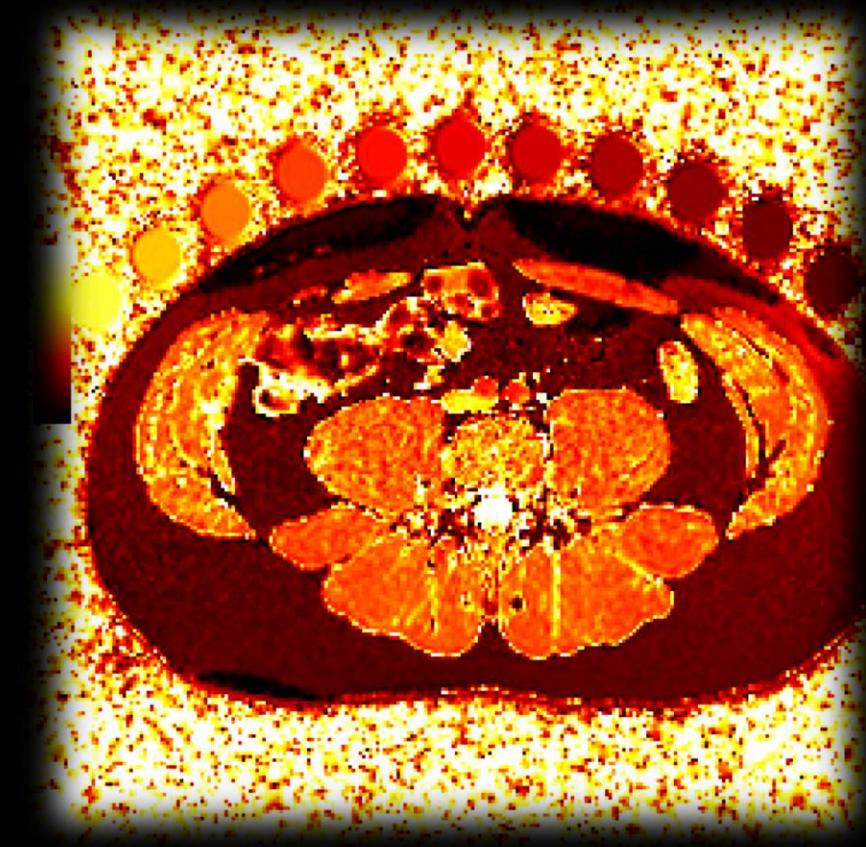




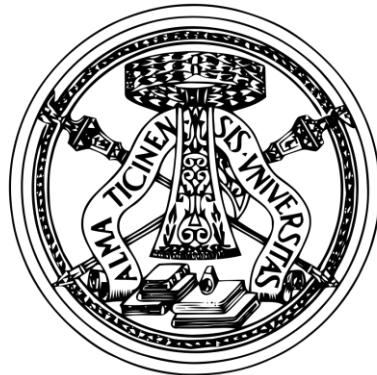
Strict relation between the temperature of the phantom and relaxation time values of each vials composing the phantom...



RECALIBRATION!



Thank you!!!



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