

Bioengineering 278: Magnetic Resonance Imaging Laboratory

Winter 2014

Lab 2

1. Chemical Shift

Find the difference in γ between water and oil using MR imaging. You will be supplied with a phantom containing both oil and water. At 3T, the difference in precession frequency between water and oil is a few hundred Hz. You have control over: TE, TR, flip angle, resolution, sampling rate (via bandwidth), and FOV. Choose imaging parameters such that the image contains information from which you can calculate the frequency difference, and from that calculate the difference in γ . (4 points)

2. Shim Gain

The scanner has a shim system to correct for linear inhomogeneity in the static field. This system applies a static gradient offset (simply a DC current offset in the gradient coil), and can be manually adjusted. Use imaging to find the gain of the X and Y shim systems (in G/cm per unit shim adjustment). You have control over the same parameters as above. (4 points)

3. Image Aliasing

Prescribe a gradient echo scan with TR=50ms, $\alpha=20^\circ$ and TE=min_full. Prescribe the location of the slice so that the phantom extends beyond the field of view in the phase encoding direction and scan. Repeat with the phantom extending beyond the FOV in the frequency encoding direction. What happens to the signal that originates from outside the FOV and why? (6 points)

4. SNR

Prescribe a spin echo scan with TR=500ms and TE=30ms. Scan under the following conditions, and predict and measure the SNR of each scan, relative to the first. Use the mean signal in a patch of image outside the phantom as a noise metric. (6 points)

Scan	FOV(cm)	Freq Res	Phase Res	Bandwidth
1	24	256	256	16KHz
2	24	256	256	32KHz
3	24	256	128	16KHz
4	24	512	256	16KHz
5	30	256	256	16KHz