Bioengineering 278: Magnetic Resonance Imaging Laboratory
Winter 2009
Lab 3- Week of 1/19

1. **The spin echo.** Place a phantom in the birdcage coil.
    a. **Measure the dependence of the signal on the flip angle of the refocusing pulse.** Prescribe an axial single slice spin echo scan. Record the value of the CVs flip_rf2 and ia_rf2. These should be the flip angle and hardware pulse amplitude of the refocusing pulse. Changing ia_rf2 will create a linear change in the flip angle. Auto prescan and scan using the default values, setting rh_execctrl to save raw data. Rescan with flip angles of [30,60,90,120,150], using ia_rf2 to control the prescribed flip angle. Calculate a B_1 map, in the form of an actual flip angle map at a given nominal flip angle, much like in Lab 1. Assume that the excitation pulse is a perfect 90° pulse. (5 points)
    b. Prescribe a two echo spin echo sequence. While the scanner is scanning, look very carefully at the pulse sequence on the oscilloscope. Sketch the sequence. Describe the function of each pulse and which pulses destroy the stimulated echo pathway while the first and second spin echoes are preserved. (5 points)
2. **Gradient echoes.** Place the BIRN phantom in the birdcage coil. You will be scanning the phantom using a single axial slice:
    a. **Understanding the pulse sequence diagram.** For each of the following pulse sequences, observe the RF and 3 gradient channels on the oscilloscope. Observe both the amplitude and phase of the RF pulses. Sketch all pulses within one TR interval and label each pulse. Describe as precisely as you can in words the function of each pulse in each sequence. Point out the key differences between the sequences. (5points)
        i. **SPGR (spoiled GRASS)**
        ii. **GRASS**
        iii. **FIESTA**
    b. **Resonance offset sensitivity in FIESTA (balanced SSFP, FISP).** Using the FIESTA sequence, determine the gain of the manual X shim adjustment (in G/cm per unit shim offset). (5 points)