Physics 290 – Winter 2004

Assignement 7

Due March 18, 2004

1. In the slice selection step of a clinical MRI sequence, a z-gradient of 0.1 Tesla/meter is applied with an RF (resonant oscillating magnetic field) pulse that has a frequency spread of 32 kHz. Clinical MRI scanners operate at 1.5 Tesla, and the proton resonance frequency is 64 MHz. What is the slice thickness?

2. In the acquisition phase of the MRI sequence, an x-gradient of 0.01 Tesla/meter is applied in one step. What range of proton frequencies appear if the field of view is 30 cm × 30 cm?

3. Use the data collected in class to estimate your reaction time. Remember to combine your data by finding the average of several trials. Discuss the uncertainty to your reaction time (see the standard deviation described in lecture 1). Do you see any trends, for example conditioning or getting better at it as you do it more times? Helpful information:

The distance traveled by a falling object, starting at rest is

$$\Delta s = \frac{1}{2}gt^2$$

The standard deviation of a set of measurments of a quantity x with mean $\bar{x}$ is given by

$$s^2 = \frac{1}{N-1}\sum_{i=1}^{N}(x - \bar{x})^2$$

4. You reaction time is due to several factors. List these and estimate the various contributions. You should use the results of our experiments with the strobe light to estimate one factor. Do your estimates add up to the measured reaction time?

Possible Final Paper Topics

Relation of basal metabolism to body mass	Artificial bones and joints
CT or PET	Radiation oncology
Radiation exposure risk assessment	Lung diseases
Artificial Hearts, valves, pacemakers	Ultrasound
Regional Cerebral Blood Flow	MRI/fMRI
Cochlear Implants	Localization of sound