D. Spielman
spielman@stanford.edu

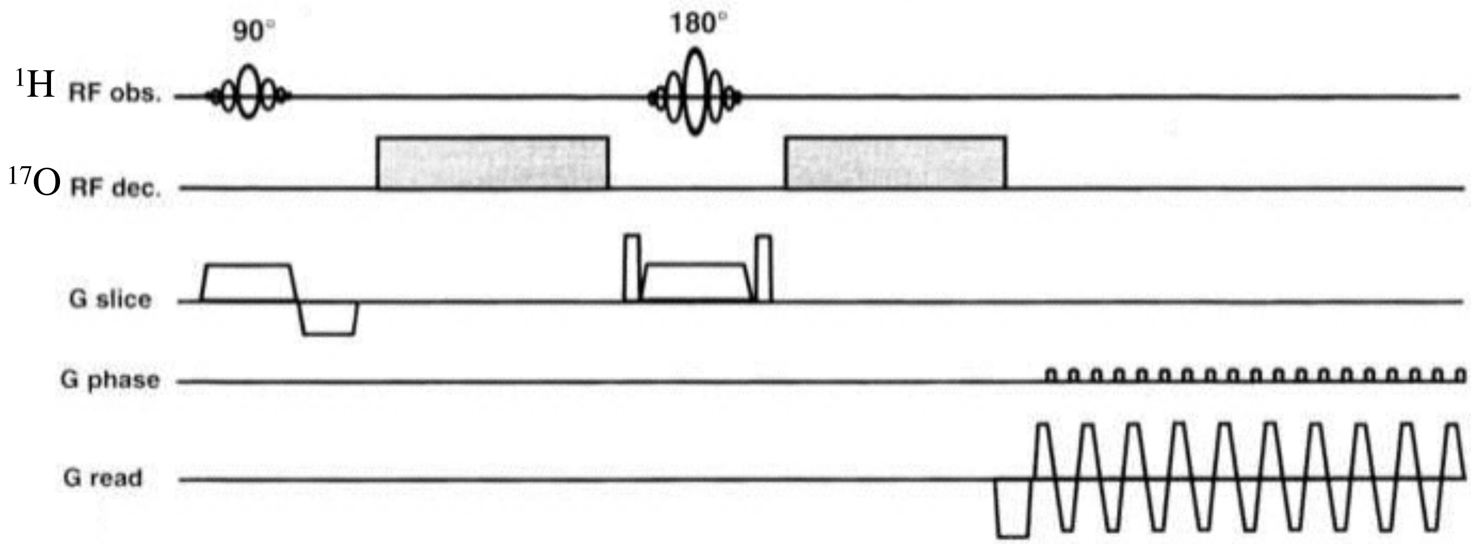
Problem Set #7
BioE 326B/Rad 226B

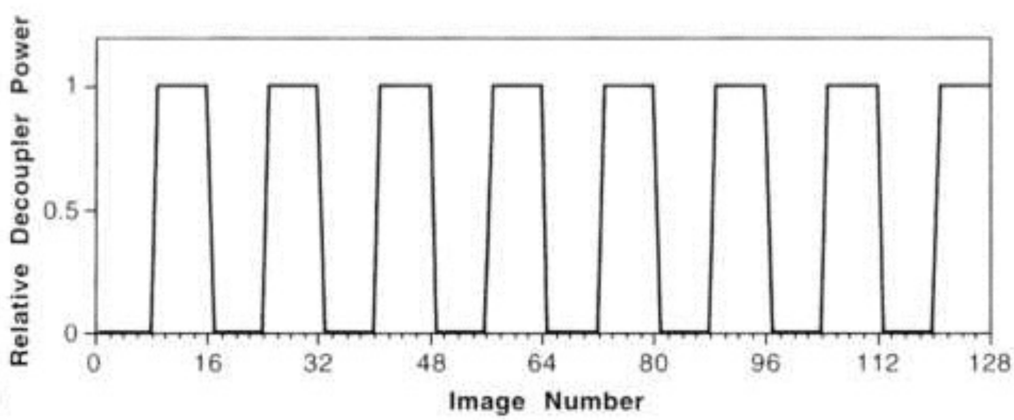
1. $^{17}0$ imaging
2. NMRD curves

D. Spielman
spielman@stanford.edu

^{17}O imaging.

A research team decides to measure in vivo levels of $H_2{}^{17}O$ (^{17}O is a spin 5/2 nuclei with a natural abundance of 0.037%) using an indirect detection approach in which serial T_2-weighted echo planar images are acquired with the decoupler power alternately on and off every eighth image. The pulse sequence diagram is shown below.

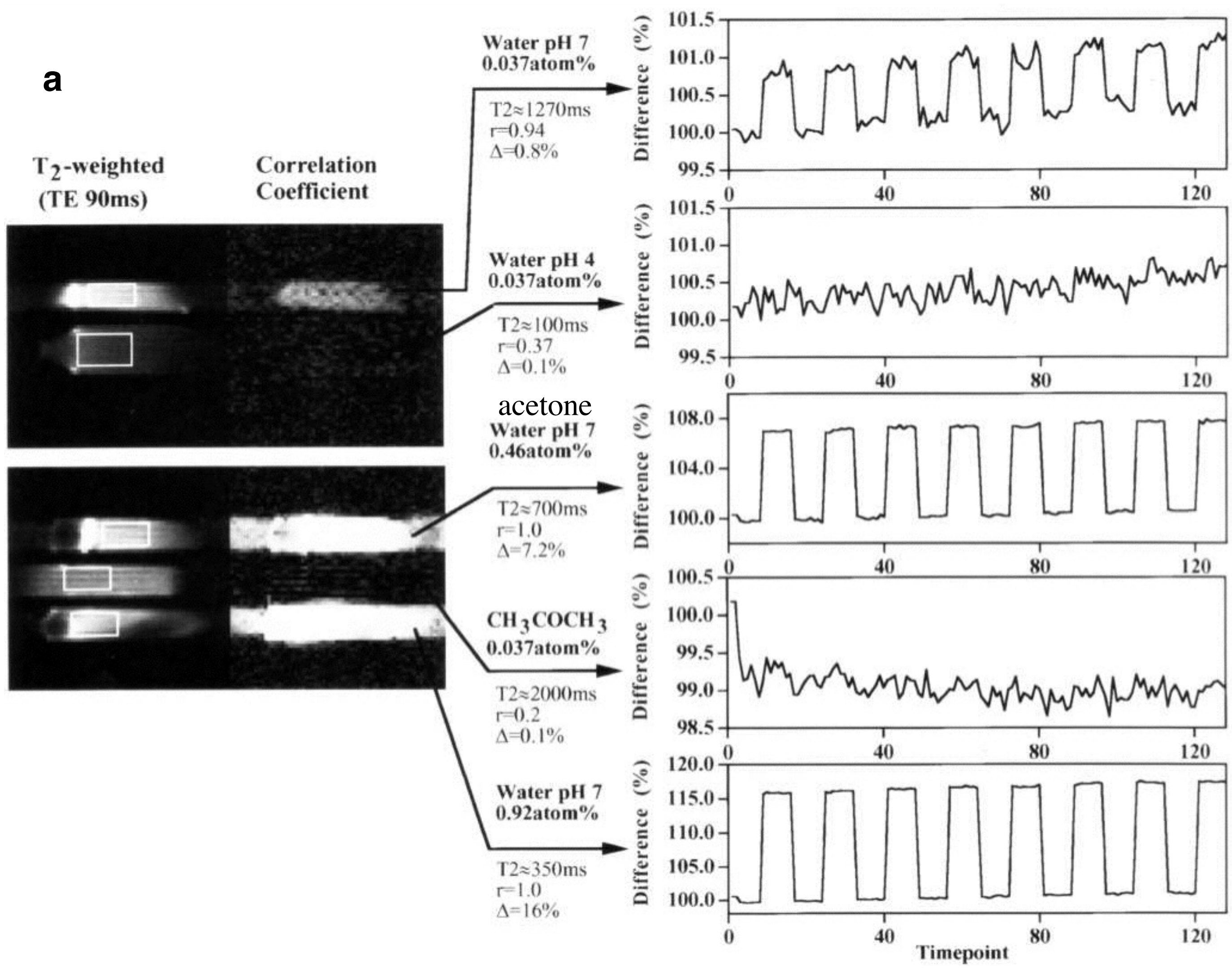




D. Spielman
spielman@stanford.edu

^{17}O imaging (cont.)

The following in vitro and in vivo data are obtained. In particular, the data show: (**a**) signal time courses during a serial decoupling experiment for four tubes of water and one tube of acetone. Baseline T_2-weighted EPI images of the tubes are shown on the left. Next to these are maps of the correlation coefficient between the signal timecourse for each pixel and the decoupler power waveform. The plots are from retangular ROIs indicated on the T_2-weighted images. (**b**) in vivo data from normal and ischemic rat brain.

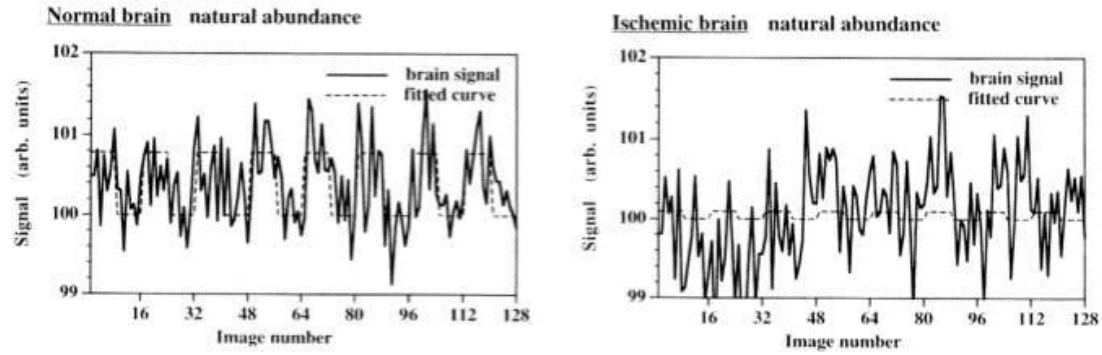


D. Spielman
spielman@stanford.edu

^{17}O imaging (cont.)

b

Rat brain



Give a theoretical explaination for the observed data. In particular:

a) Why does image signal intensity increase when the decoupler in on and why does the effect increase with increasing ^{17}O fractional enrichment?

b) Why does the effect dissapear at low pH (pH = 4) or with the use of acetone instead of water?

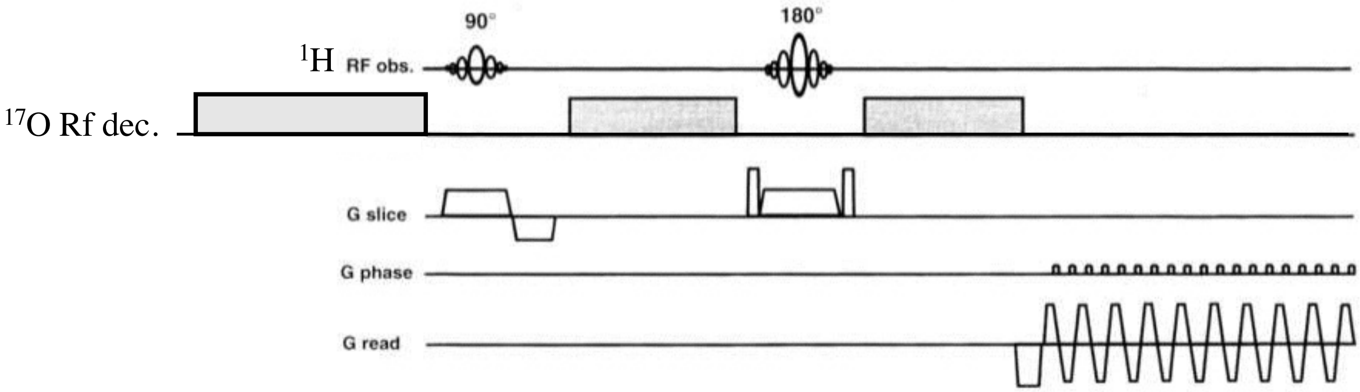
c) Give an explaination for the differential response between normal and ischemic brain.

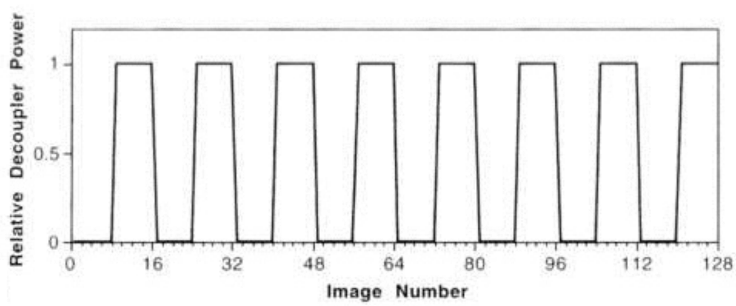
d) Discuss potential applications for $H_2{}^{17}O$ imaging.

e) A graduate student proposes to improve the sensitivity of the method by turning on the decoupler prior to the 90^o excitation (see pulse sequence diagram on next page) in order to exploit the Nuclear Overhauser Effect (NOE). Will this change the sensitivity and by what factor?

D. Spielman
spielman@stanford.edu

^{17}O imaging (cont.)





D. Spielman
spielman@stanford.edu

NMRD Curves

Plot T_1 relaxivity NMRD curves for Gd-DTPA and Gd-DTPA bound to serum albumin.