## EXPERIMENTS

This brief section will suggest a series of experiments that can be carried out using your spectrometer. This is by no means an encyclopedic list; rather a collection of experiments that will provide a challenging experience to undergraduate and graduate students. They all require reading of the literature for a thorough physical explanation.

A. $T_1$ and $T_2$ in water doped with paramagnetic ions.

Paramagnetic ions, with their large electronic magnetic moment, profoundly effect relaxation times of the protons in water. The materials are easy to obtain and reasonably safe to handle. Paramagnetic ions that dissolve in water are: $CuSO_4$ and $Fe(NO_3)_3$
Effects can be measured over a wide range of concentrations.

B. $T_1$ and $T_2$ in Glycerin and water mixtures

Glycerin and water mix in any ratio. The motion of the protons in glycerin is significantly changed by the change of the liquid viscosity with the addition of water. The relaxation times can be correlated with the viscosity of the liquid, as well as the water concentration.

C. $T_1$ and $T_2$ in mineral oil with solvents.

The relaxation times of protons in mineral oil diluted with organic solvents shows effects of diffusion and correlation's times.

D. $T_1$ and $T_2$ in Petroleum Jelly

Vaseline is not a solid. The two relaxation times indicate fast molecular motion which is characteristic of a liquid. Sample can be heated and $T_1$ as well as $T_2$ can be estimated as the sample cools to room temperature. Other organic greases with sufficient proton concentrations can also be studied.

E. Biological Materials

Most biological materials have proton, usually in water molecules. Measurements of $T_1$ and $T_2$ in biological materials gives detailed information about the local environment of these water molecules. This area of exploration is wide open. This might be an area appropriate for an undergraduate research participation project.

F. Natural Products

All types of natural products contain water which can be studied by this spectrometer. Use your imagination.

G. Other Magnetic Nuclei

Should you have your own electromagnetic with sufficient stability, homogeneity, and field, you can use the PS1-A to study PNMR in other nuclei. The easiest is Fluorine, which requires a 6% higher field than our magnet, but the alkali metal ( Na, K, Li, Rb ) provide interesting systems. Other nuclei might also be attempted.

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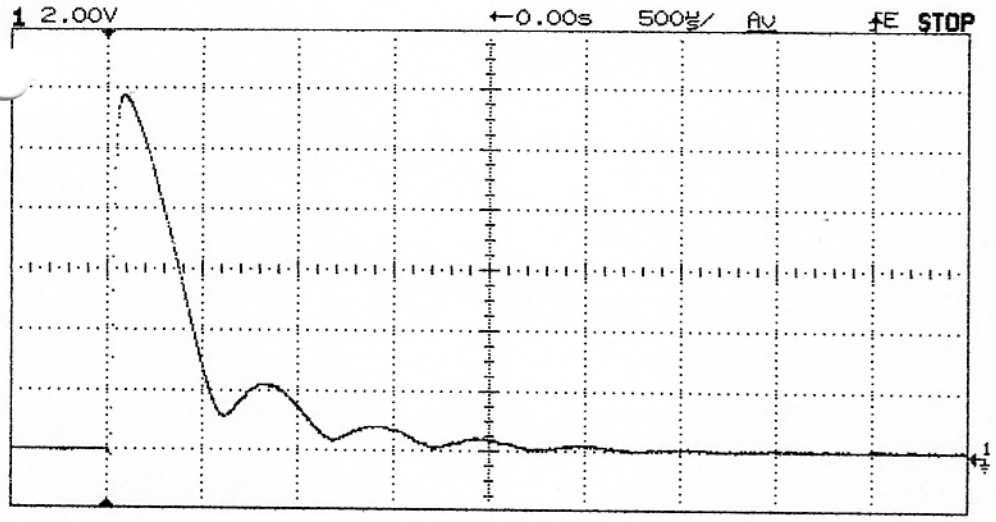
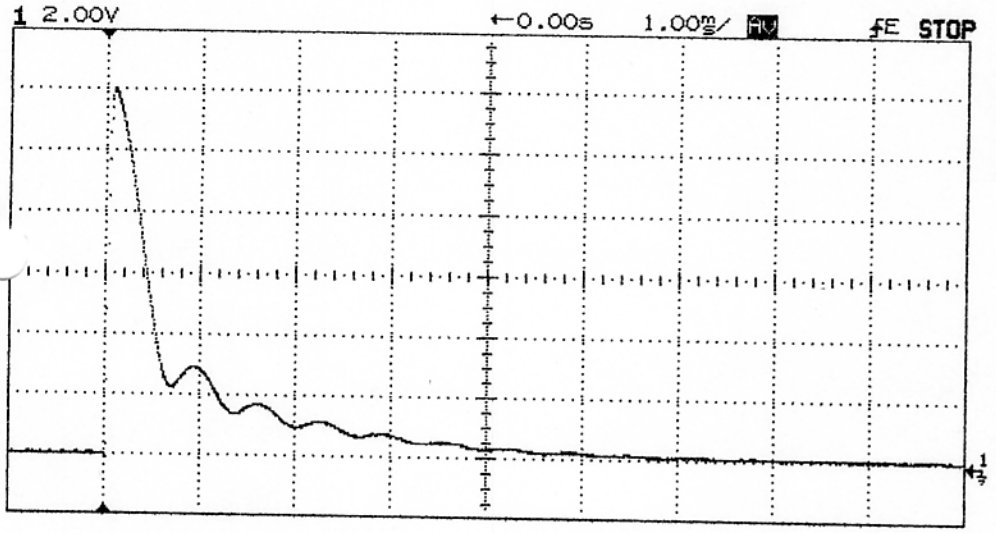
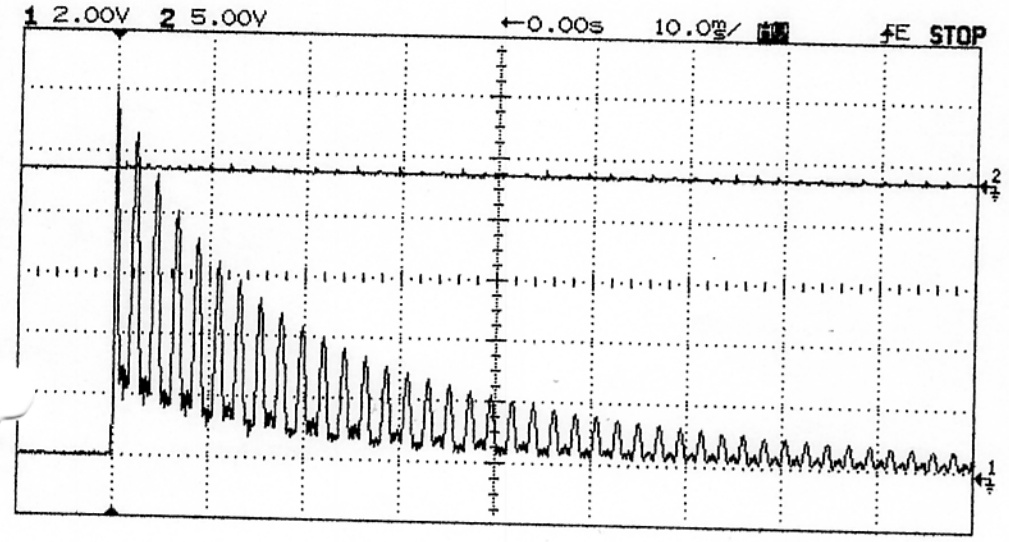



PS1-B
SERIAL 187
CENTER FIELD
FID MINERAL OIL
FREQ 15.54 MHZ
Feb 11-2002
J.F. REICHERT




PS1-B
SERIAL 187
SWEET SPOT
X = -.2
ROT = 16
FID MINERAL OIL
Feb 11-2002
J.F. Reichert




$T_2$ - MINERAL OIL
GM PULSE SEQ.
SWEETSPOT

## SPECIFICATIONS PS1-B

PULSED NUCLEAR MAGNETIC RESONANCE SPECTROMETER

MAGNET - FIELD STRENGTH IN GAP 3500 GAUSS (NOMINAL)
GAP 1.1 inches
UNIFORMITY .01% over 1cm? volume
CARRIAGE Horizontal - Vertical Motion ±2cm
TEMPERATURE COEFFICIENT 4 Gauss/°c
WEIGHT 42 LBS.
LUBRICATE BEARINGS WITH WD-40

CASE WITH POWER SUPPLY

POWER SUPPLY - TRIPLE OUTPUT
+5 volts @ 6A
+15 volts @ 1A
-15 volts @ 1A
Line regulation ±.05% for 10% line change
Ripple 2 mv rms maximum
Load regulation ±.05% for 50% load change
Two empty slots for additional modules
WEIGHT 15 LBS.

PULSE PROGRAMMER PP-101

| | | |
|---|---|---|
| A-PULSE | 1-30 ms | 4 volt positive |
| B-PULSE | 1-30 ms | 4 volt positive |
| Delay Time | 10 ms ($0.01 \times 10^0$) - 9.99 s ($9.99 \times 10^3$) | |
| MODE: | Internal, External Pulse, Manual | |

REPETITION TIME: 1 ms to 10 s
Meiboom - Gill Phase shift pulse
Scope Synchronizing Pulse either at A or B
NUMBER OF B PULSES: 0-99

OSCILLATOR / AMPLIFIER / MIXER PT-1501
15 MHz DIGITALLY SYNTHESIZED OSCILLATOR
FREQUENCY RESOLUTION 10 Hz
FREQUENCY ACCURACY: .005%
CW-RF OUTPUT LEVEL - 13 db
PEAK OUTPUT POWER 150 watts (nominal)
MIXER INPUT LEVEL: 50 mv rms (max)
MIXER OUTPUT LEVEL: 2 v rms (max)
MIXER BANDWIDTH: 500 KHz

RECEIVER PR 1501

CENTER FREQUENCY: 15 MHz (nominal) TUNABLE
BANDWIDTH 200 KHz (3db)
SENSITIVITY 8$\mu V$ for full scale output
OUTPUT VOLTAGE / RANGE: 0-10 volts
GAIN RANGE: 60db (typical)
EQUIVALENT NOISE VOLTAGE: 1.5 mV rms
RF OUTPUT LEVEL: 50 mV for full scale signal
TIME CONSTANTS: .01, .03, .1, .3 ms

SAMPLE PROBE

TRANSMITTER COILS IN HELMHOLTZ CONFIGURATION
12 GAUSS ROTATING FIELD AT SAMPLE
RECEIVER COIL
SPECIAL CABLES FOR TRANSMITTER AND RECEIVER

SAMPLE STORAGE CASE

WITH 25 VIALS AND 5 O-RINGS

DUMMY SIGNAL AND TRANSMITTER PROBES.

# TeachSpin, Inc.
# WARRANTY

****Do not attempt to repair this instrument while under warranty****

TeachSpin, Inc. is proud of the quality and workmanship of it teaching apparatus. We offer a warranty, which is unique in the industry because we are confident of the reliability of our instruments.

This instrument is warranted for a period of **two (2) years** from the date of purchase. We will pay for all labor and parts to repair the instrument to new working specification due to defects in components, workmanship or ordinary use.

Should an electronic module malfunction, TeachSpin, Inc. will ship to you within one work week a replacement module at no charge. TeachSpin, Inc. will accept phone or fax requests for such replacement. You are responsible to ship to TeachSpin, Inc. the malfunctioning module, fully insured, within a period of three (3) weeks. Failure to do so will result in charging you full retail price for the replacement module. Your defective module will be repaired and returned to you at no charge. You are obligated to return, fully insured, the replacement module originally sent by TeachSpin, Inc. This one week replacement program assures your students that they can finish the experiments assigned without significant interruption. This warranty is void under the following circumstances:

a) The instrument has been dropped, damaged, or mutilated.
b) Repairs or attempted repairs not authorized by TeachSpin, Inc. have been done to the module.
c) Instrument has been subjected to high voltages, plugged into 210 volts AC or otherwise electrically abused.
d) Instrument has been dropped or damaged by impact or extreme heat.

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2) Any other damages, whether incidental, consequential or otherwise.

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