

Procedure for Teachspin PNMR

Make connections as shown in figure 1.3 pg. 28 in Teachspin manual.
Allow unit to operate at least 20 min. prior to any measurement or tuning.

Initial Switch Conditions

Gain: 40%
Blanking: ON
Time Constant: 0.1
Mode: INT
Rep Time: 100ms
Variable: 100%
Number of B pulses: 1
CW-RF: OFF
M-G: OFF

I. Tuning

Adjust Receiver tuning knob until Channel 1/Detector Out A-pulse signal is at a maximum.

II. Creating a 90° pulse¹ for pulse A or pulse B

Adjust width control from zero until Channel 1/Detector Out voltage level goes to minimum and then to a maximum.

III. Creating a 180° pulse² for pulse A or pulse B

Adjust width control from zero until Channel 1/Detector Out voltage level goes to minimum, to maximum, and back to minimum.

IV. Finding Resonate Frequency

Turn on pulse A.
Create a 90° pulse.
Turn on CW-RF.
Observe Channel 2/Mixer Out Signal.
Adjust Frequency until beats smooth out.
Turn off CW-RF

V. Measuring T_1 (180° – τ – 90°) Spin-Lattice Relaxation³

Create pulse sequence (A pulse - delay time – B pulse).
Measure voltage of pulse B as a function of τ from 1 to 100ms in increments of three.

Enter data into excel (voltage vs. τ).
From this data create graph similar to Fig 2.1 pg. 4.
From this create graph of $-\ln(1 - \{\mu/\mu_0\}/2)$ vs. τ .
The inverse of the slope of this line is time T_1 .

VI. Measuring T_2 ($90^\circ - \tau - 180^\circ - \tau$ - echo) Spin-Spin Relaxation⁴

Create pulse sequence (A pulse - delay time - B pulse).

Measure voltage of echo signal (follows A pulse by time 2τ) as a function of the position of the echo (2τ) from 0 to 50ms in increments of two.

Enter data into excel (voltage vs. 2τ).

From this data create graph of $(-1) \cdot \ln(\text{voltage})$ vs. 2τ .

The inverse of the slope of this line is time T_2 .

1. A 90° pulse creates a $\frac{1}{4}$ dipole rotation from the yz plane into the y direction.
2. A 180° pulse creates a $\frac{1}{2}$ dipole rotation from the yz plane into the $-z$ direction.
3. Spin-lattice relaxation (T_1) is a measure of the interactions between a spin system and the lattice in which it resides.
4. Spin-spin relaxation (T_2) is a measure of the interactions between spins within a spin system. Instead of transferring energy out of the system, as is the case with spin-lattice interactions, spin-spin interactions induce a loss of coherence.

