

# Procedure for $T_1$ measurements in the Production Dewar

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This note describes the procedure for measuring  $T_1$  in the PD. It is aimed at short  $T_1$  measurements so the steps of a measurement should be kept as short as possible.

For longer  $T_1$ , the requirement of shortest steps is not necessary. Also, low RF power should be used (-15dbm) to avoid 2nd order effects in the  $T_1$  measurement stemming from RF losses.

Steps:

1. Set PD temperature to 1.8K. This will minimize the statistical fluctuations by increasing the signal/noise ratio.
2. Sit at the NMR frequency that provides the best signal/noise ratio. This is usually on the  $\lambda/2$  resonance. This minimizes the statistical fluctuations.
3. Use high RF power (e.g. -5dBm) to minimize statistical fluctuations. FOR SHORT  $T_1$  MEAS. ONLY.
4. Determine the NMR field and phase for  $T_{down,up} = 16s$  and  $B_{span} = 20$  gauss. This will provide fast NMR scans (we assume 1 minute for each scan).
5. The number of cycles should be adapted to the expected  $T_1$ . Typically, 7 cycles for  $T_1 \sim 1min$  and 10 for  $T_1 \sim 2min$ .
6. Kill the TE signal using RF. To do that, run the SFP labview VI with high RF power and with RF modulation. Typical parameters are for H: frequency=12.3MHz, B center=2847 Gauss, Bspan=20 Gauss, Sweep rate=-.28Amp/min, Mod. freq=80Hz, FM dev.=6000Hz. The power can be -12dbm for the attenuation box and the amplification box dial knob at 2.46.
7. Run NMR VI immediately after the SFP VI run. (Do not spend time witting comments for the run).

H target, toverh=0.1min, tup=0.5, twait=0.02, B=12300G., Bspan=50. t1=1, T=1.8K

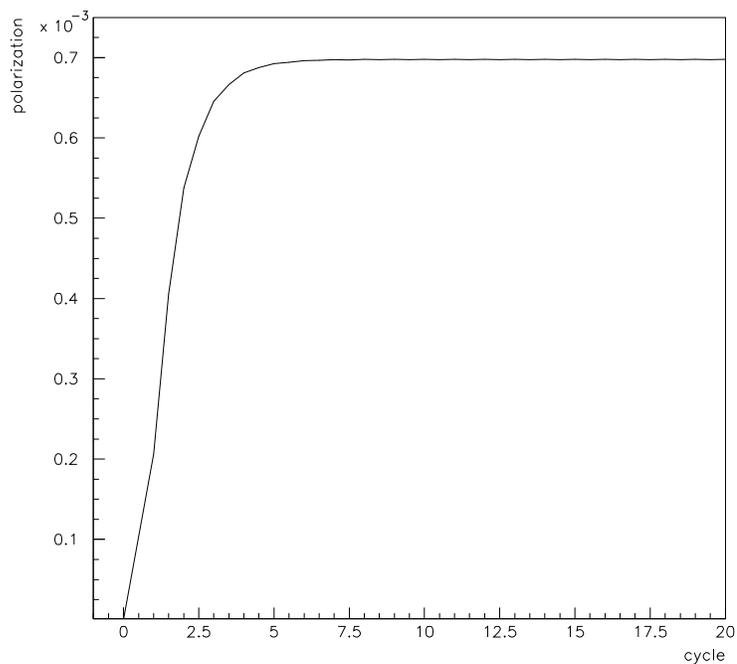


Figure 1:  
Expected signal for a Hydrogen  $T_1$  measurement done at 1.8K and a  $T_1$  of 1 minute.

8. Repeat the measurement from step 6 onward several times if necessary, depending on the signal/noise ratio.

Fig. 1 and 2 show the signal expected for H  $T_1$  measurements done at 1.8K. This assumes a 1 minute duration for a sweep and 6 seconds delay between the time at which the polarization is erased (step 6) and the start of the measurement (step 7).

H target, toverh=0.1min, tup=0.5, twait=0.02, B=12300G., Bspan=50, t1=2, T=1.8K

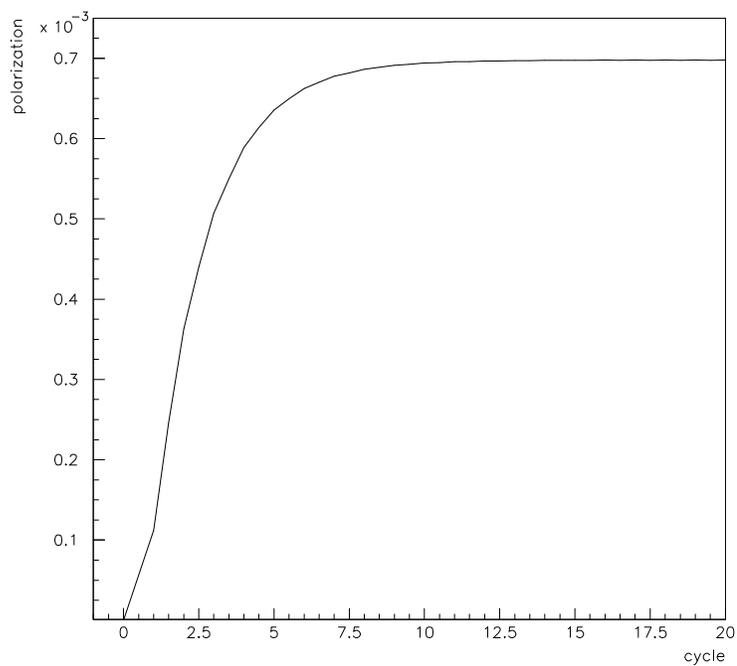


Figure 2:  
Expected signal for a Hydrogen  $T_1$  measurement done at 1.8K and a  $T_1$  of 2 minutes.