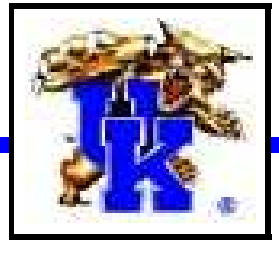
Progress in UK Lab

K. Allada, S. Dhamija, C. Dutta, A. Kolarkar,
W. Korsch

Polarized ^{3}He Collaboration Meeting
Jefferson Lab, April 8, 2005



NMR Polarimetry

- Gradient Detector (= Pickup Double-Coil)
- H_2O NMR without H_2O
- Measurement of $T_{1\rho}$ ($\longrightarrow T_2^\star$) using Spin-Locking
- Measurement of T_1

NMR Running Conditions

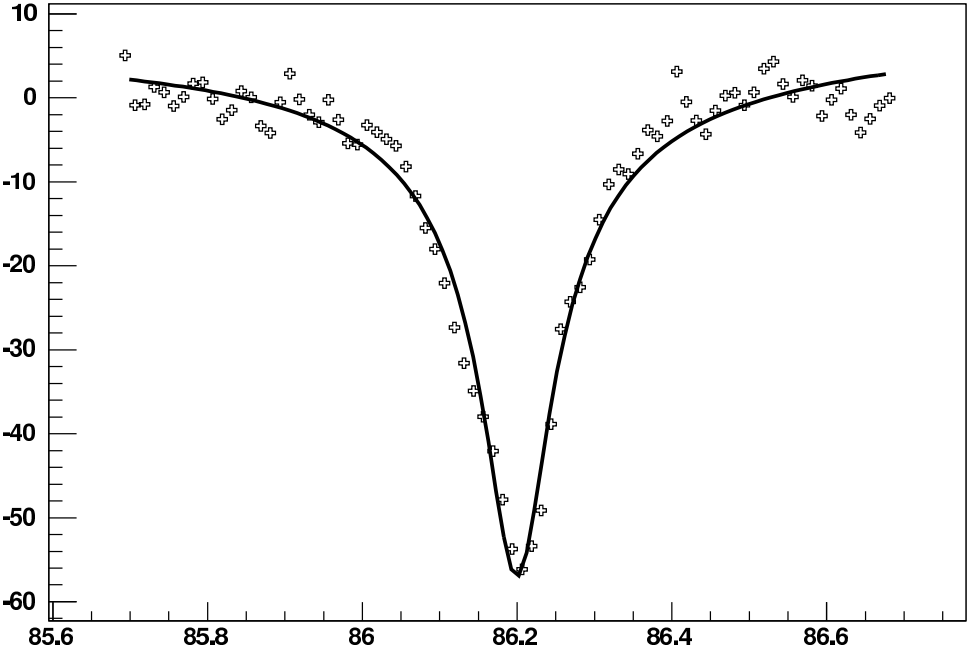
Double Coil Pick-up: **Gradient Detector** $\Rightarrow$ better signal-to-noise.

- f_{res} = 270 kHz (for double coil) $\Rightarrow$ make f_{res} large to minimize frequency response of double coil system during FS.
- L = 1.1 mH $\rightarrow$ L = 4.2 mH (per single coil)
- R = 11 Ω $\rightarrow$ R = 21 Ω
- keep f_{res} far away from f_0: frequency response of pick-up coils too large: $\approx$ 0 mV $\rightarrow$ 2 mV ok!!
- to keep LC constant: adjust cable length

2 and 10 Sweep H_2O NMR Spectra

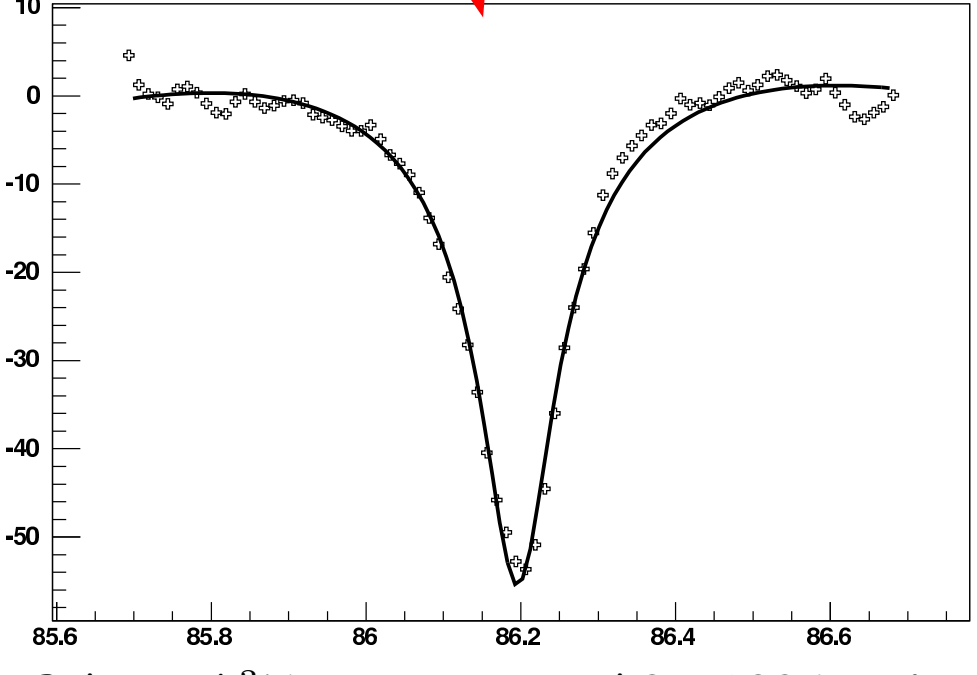
pre-amp gain: 100

fill factor: ≈ 1



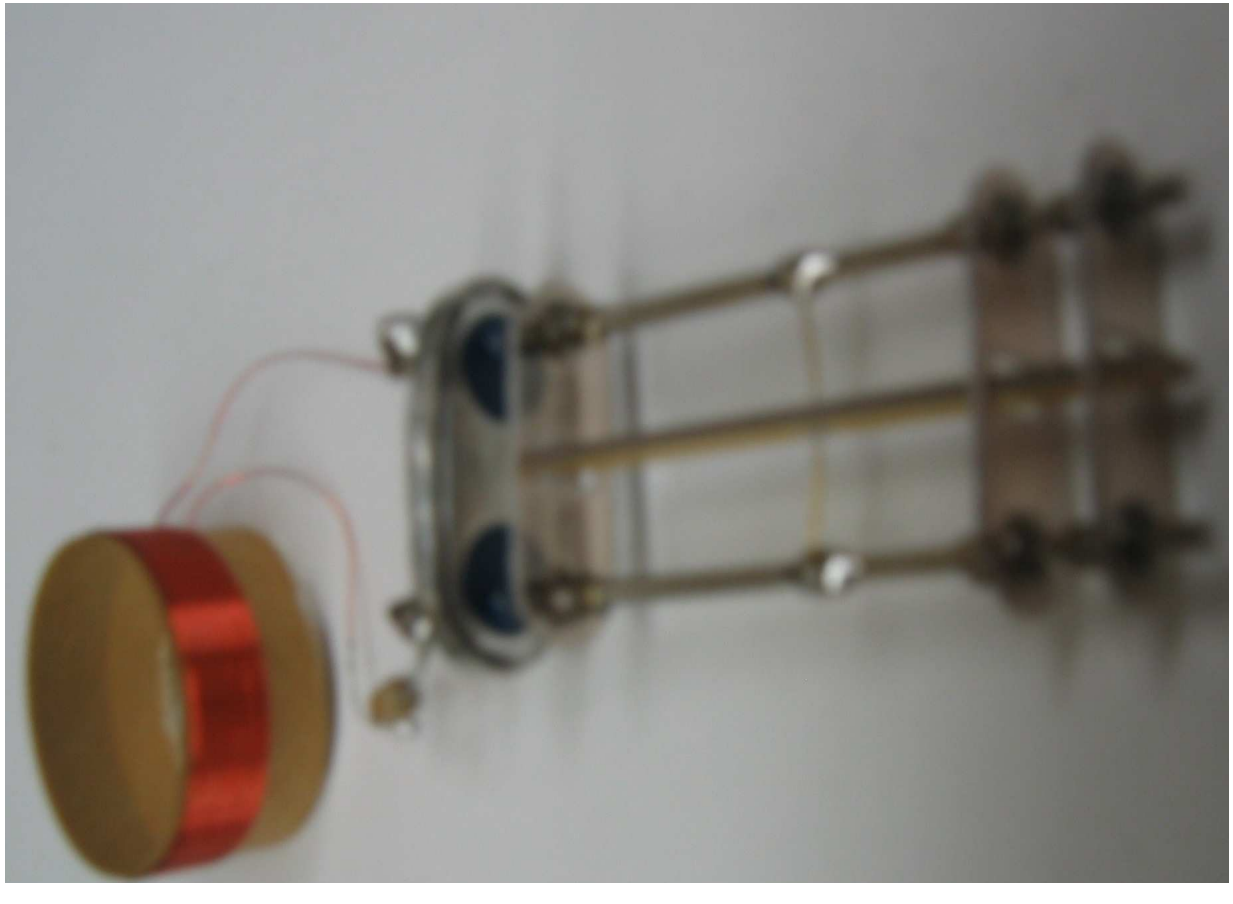
2 Sweeps!!

10 Sweeps!!

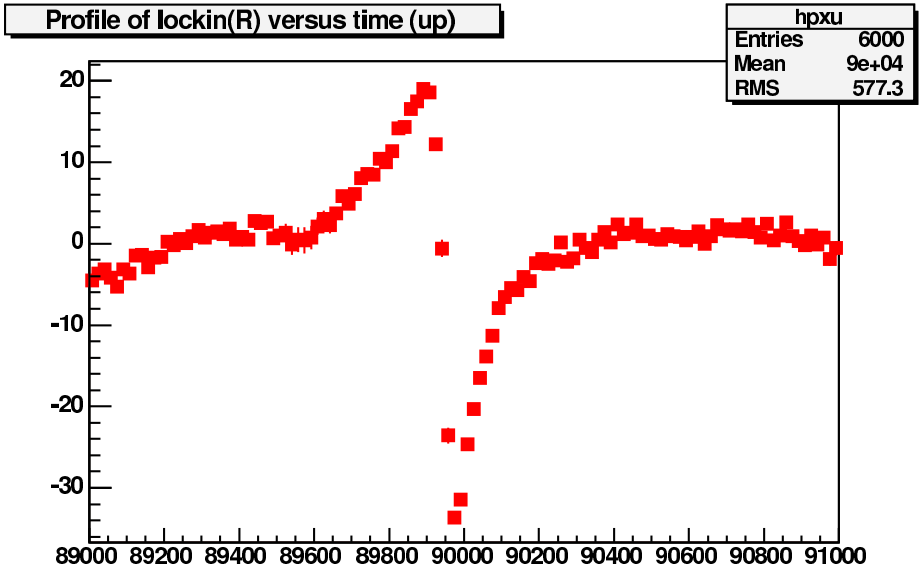


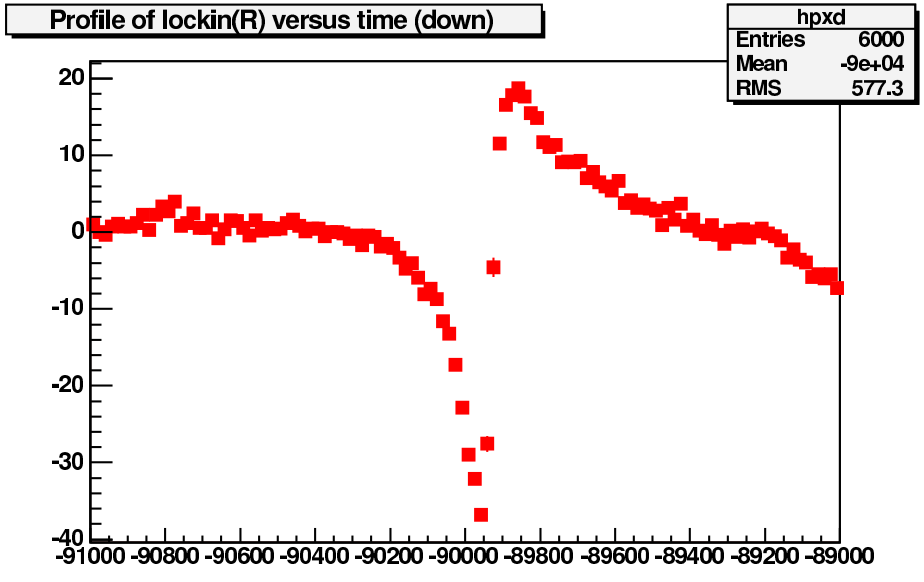
H_2O NMR without H_2O

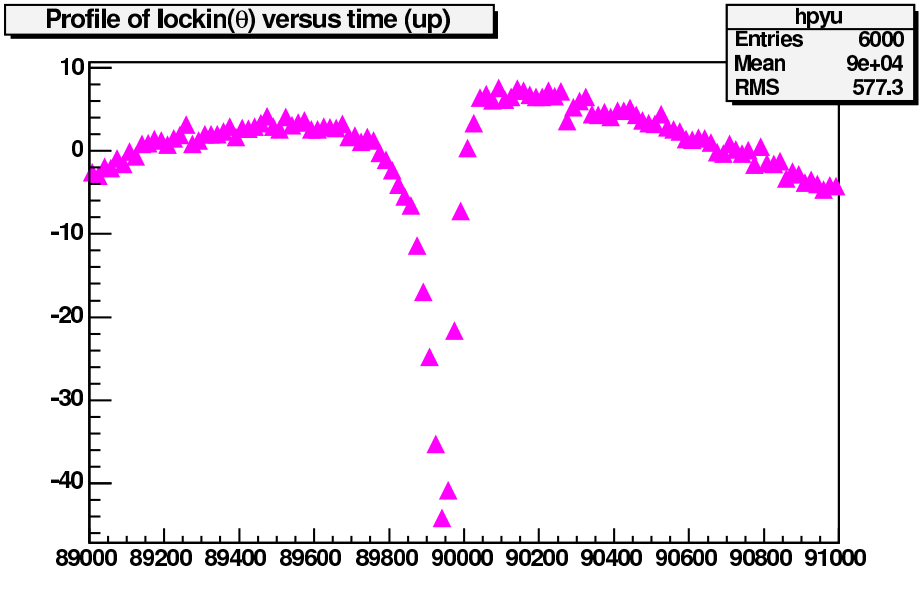
Use *quartz crystal* to simulate water NMR spectrum $\Rightarrow$ good for calibration.

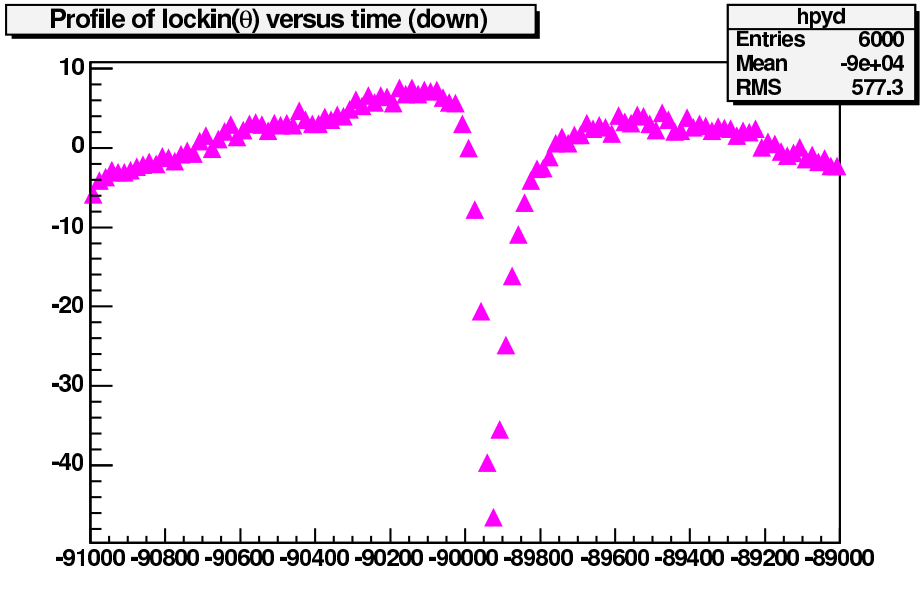


Online Spectrum, not optimized

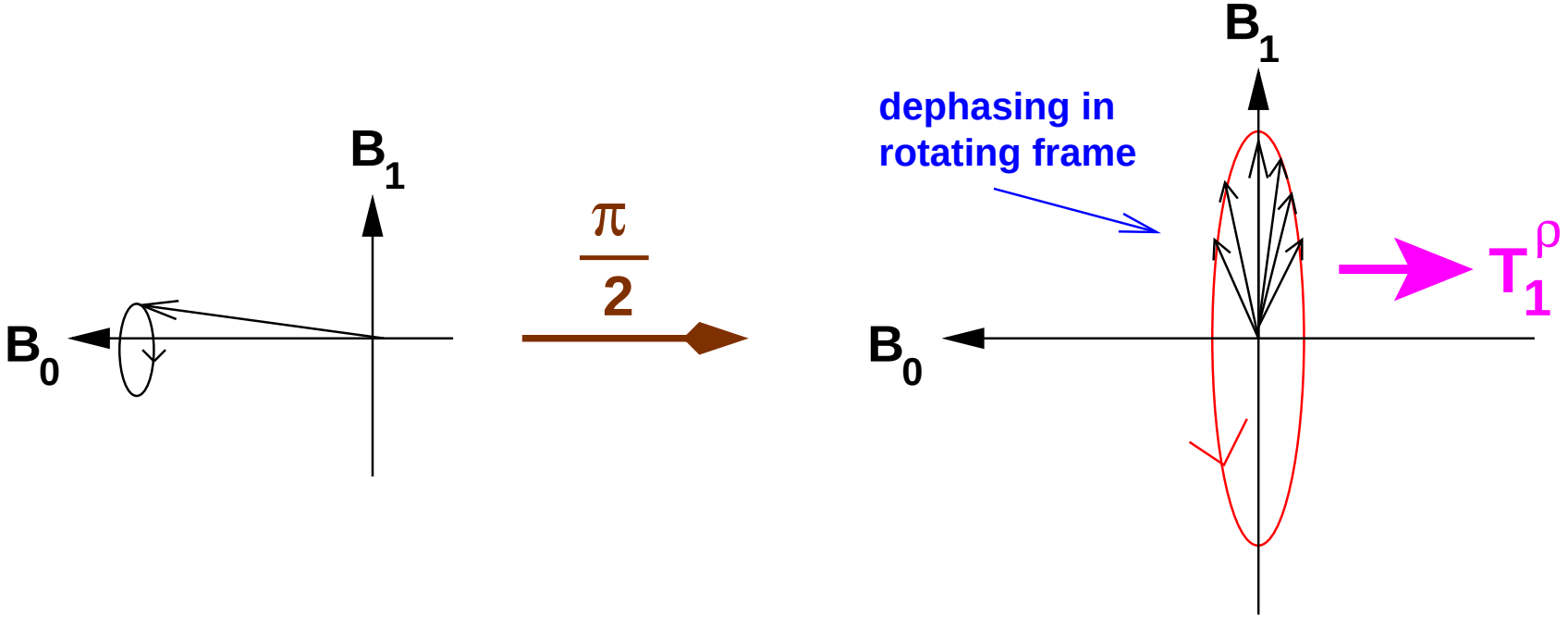






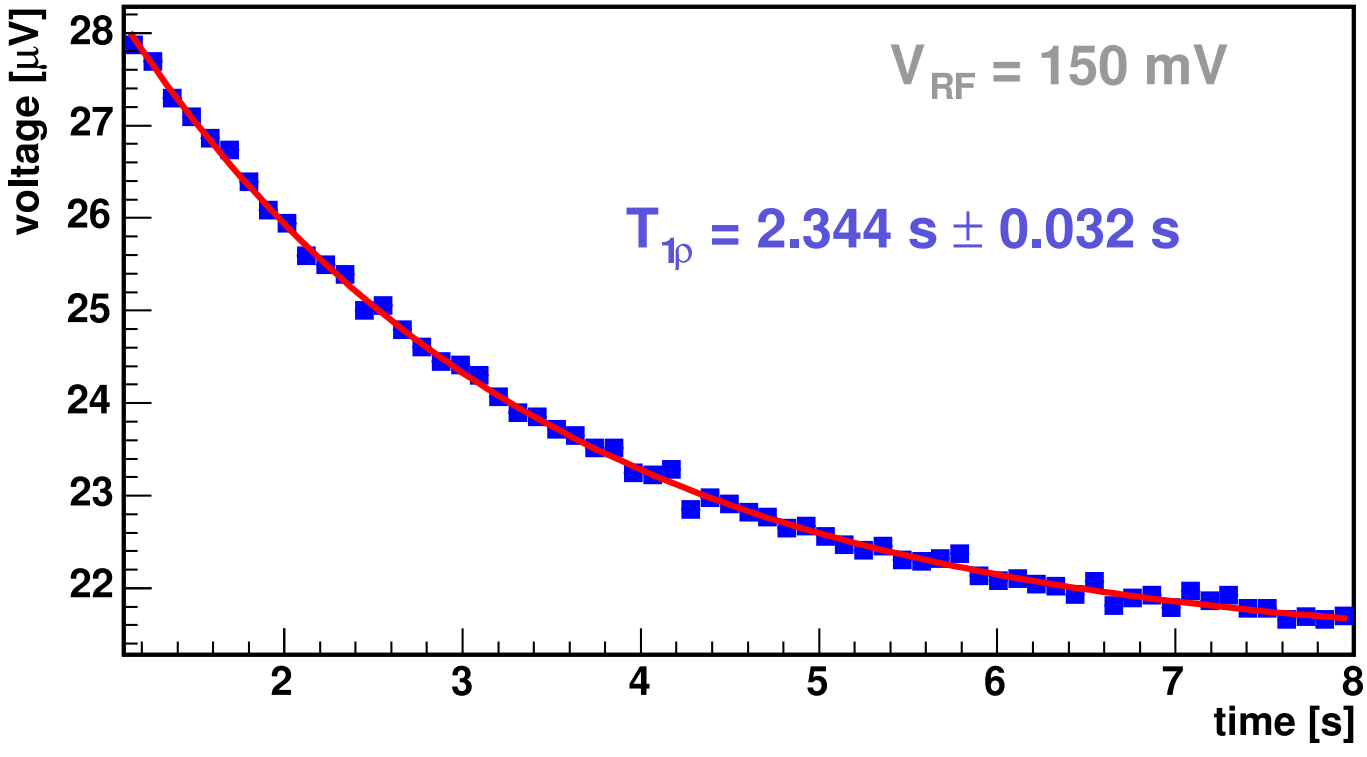


Measurement of $T_{1\rho}$

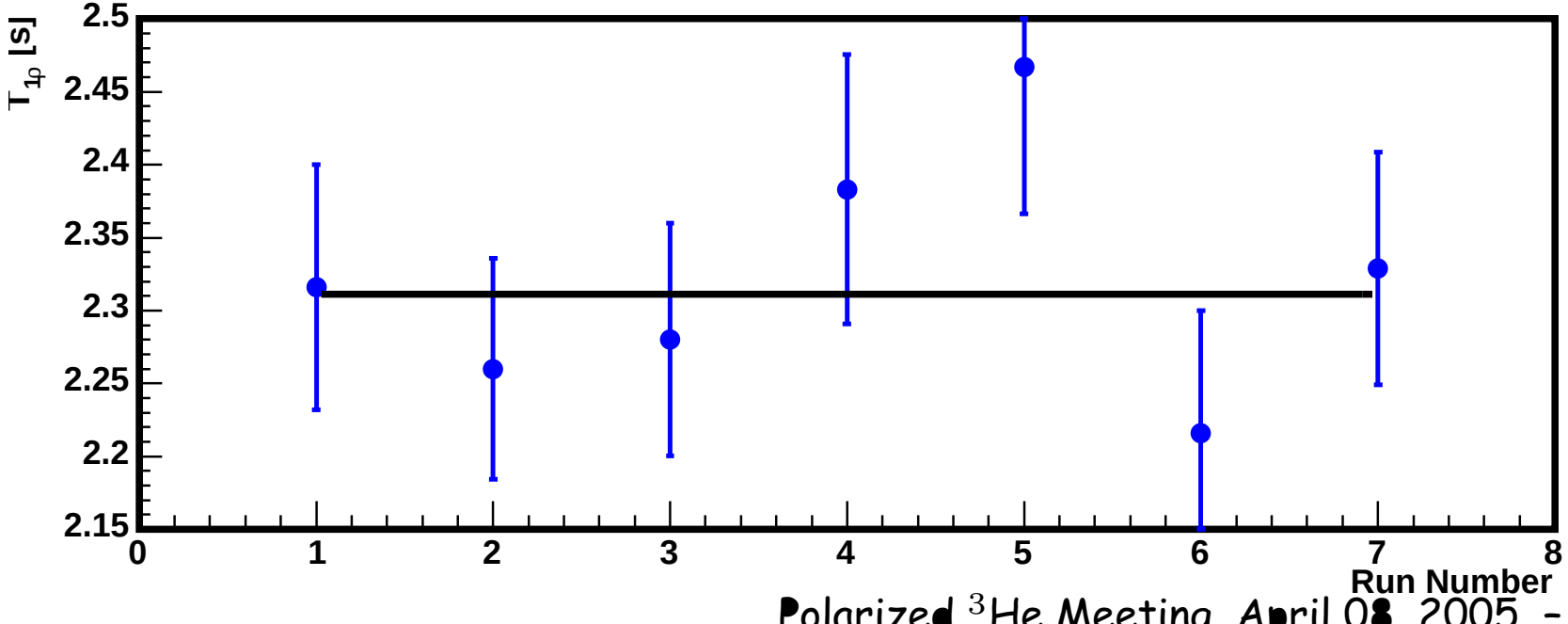


$\Rightarrow$ **Spin-Locking**

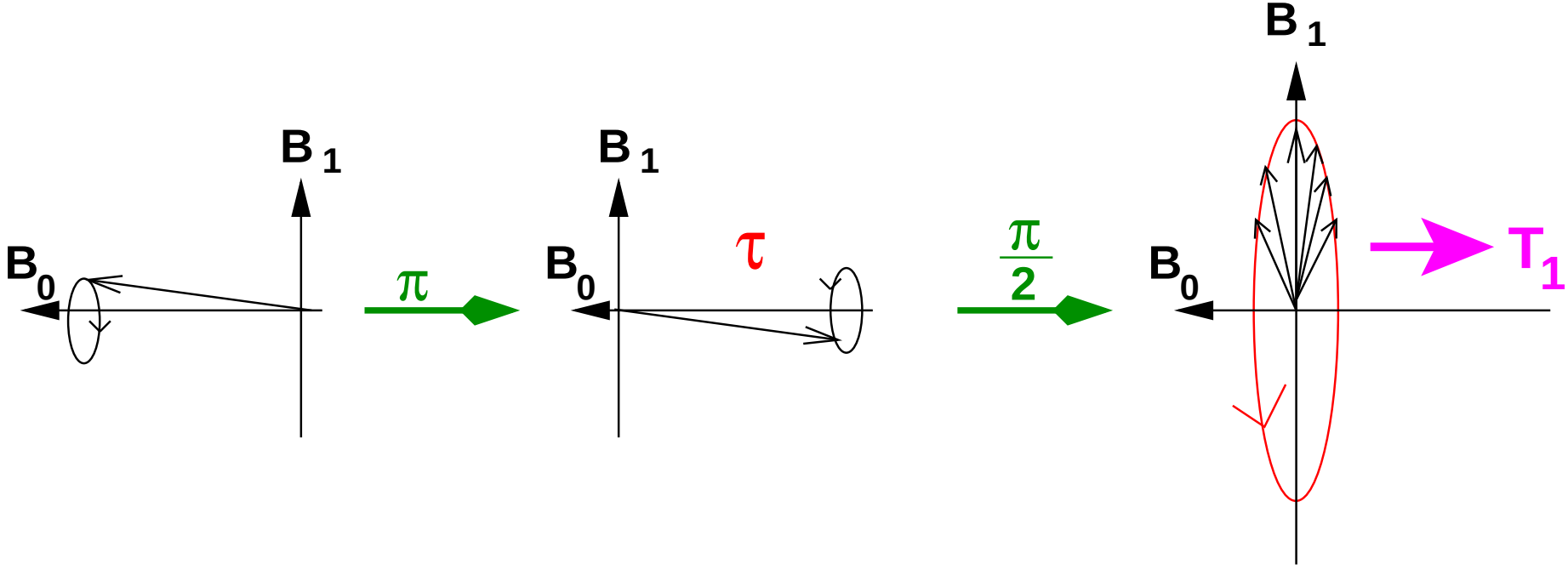
$$\lim_{B_1 \to 0} T_{1\rho} = T_2 \; (T_2^\star) \qquad \lim_{B_1 \to B_0} T_{1\rho} = T_1$$



$T_{1\rho}$ = (2.311 ± 0.032) s



Possibility to Measure T_1



Further Tests

- frequency mixer $\Rightarrow$ constant frequency into lockin amplifier (over $\approx$ 20 kHz)
- better *electric* shielding of pick-up coils
- magnetic flux compensation coil

EPR Polarimetry

- **Rb-EPR**: $T_{max} \approx 205^{\circ}C$ using standard cell.
- **Observation**: signal drop $\approx$ factor of 3 every $10^{\circ}C$.

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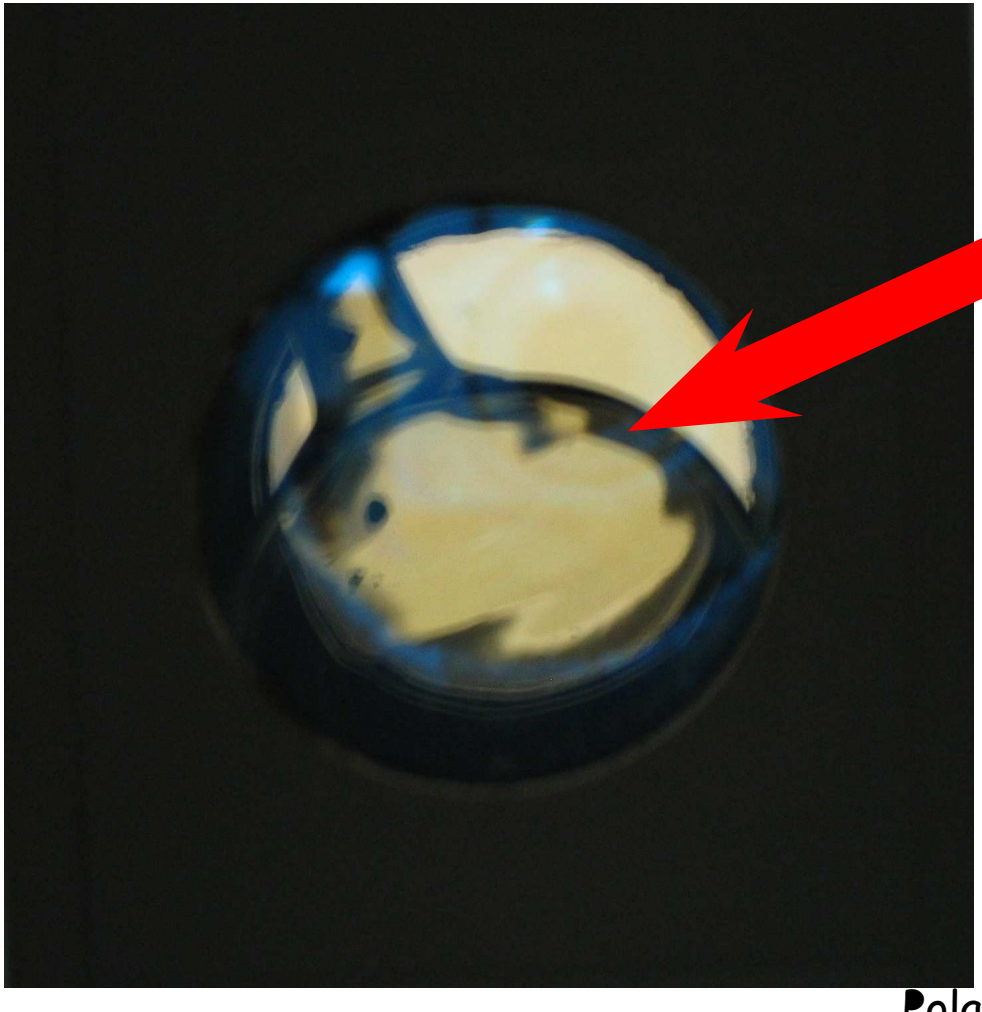
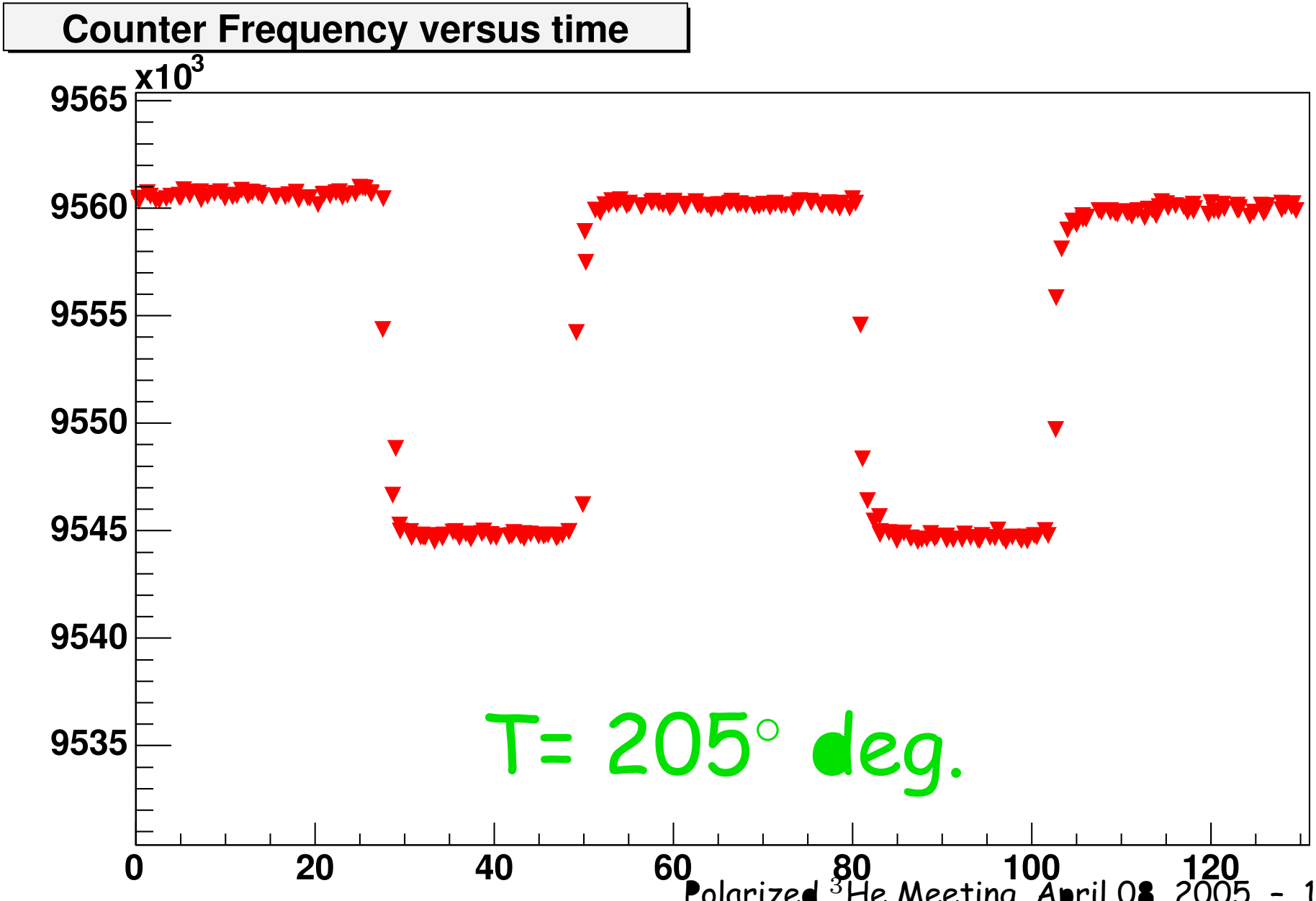
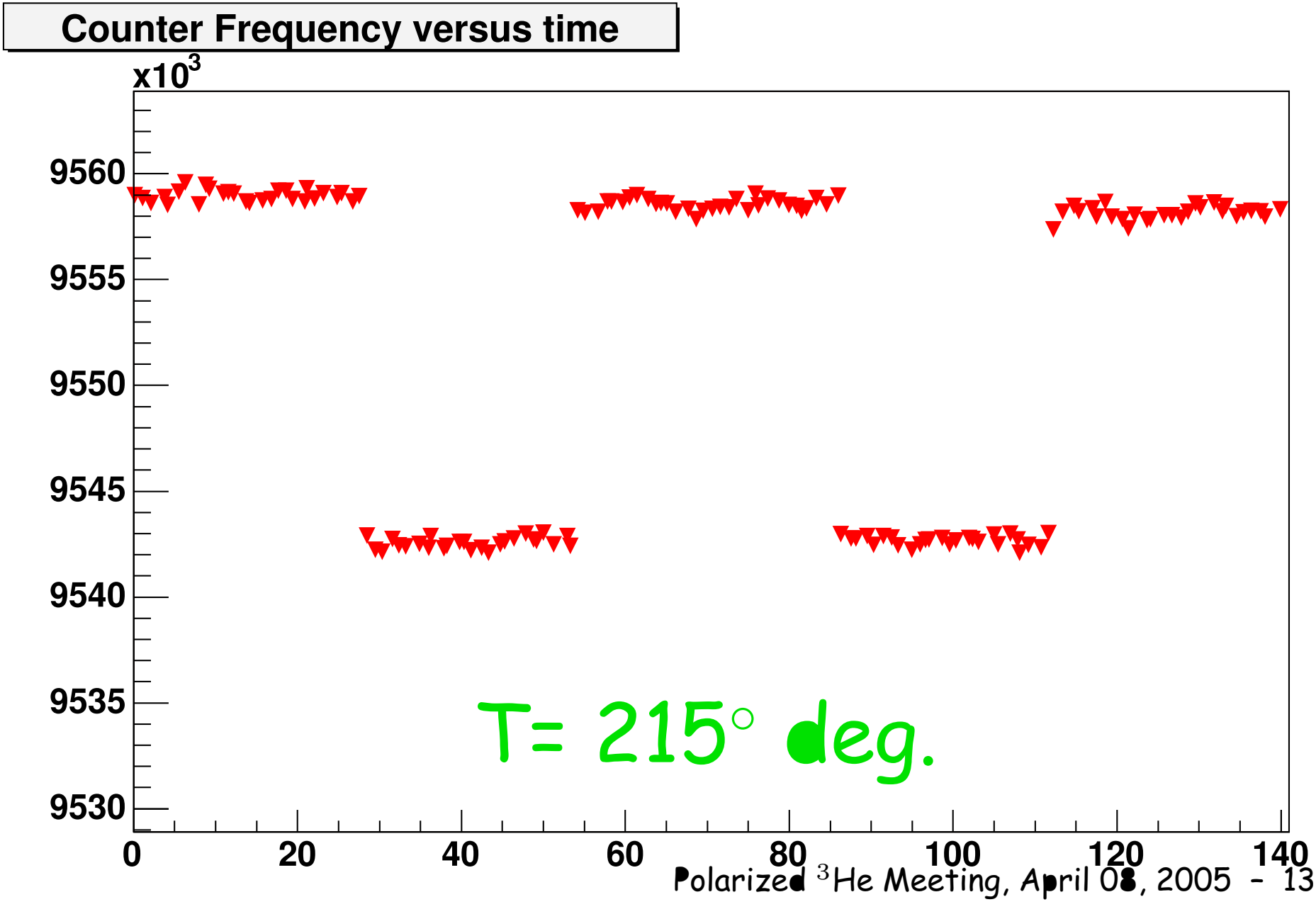


Hybrid Cell

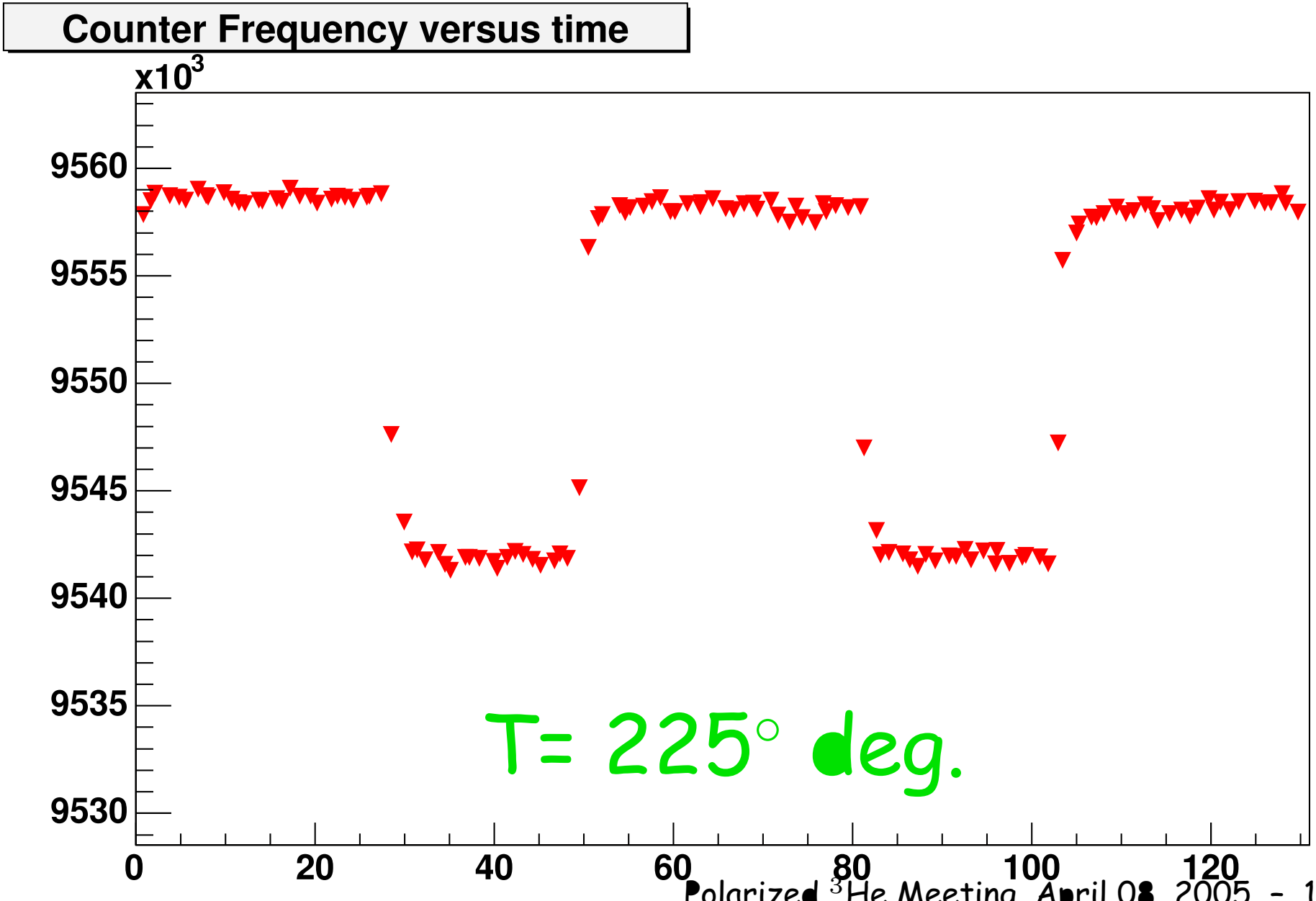
Rb-EPR Signal: T = 205° deg



Rb-EPR Signal: T = 215° deg



Rb-EPR Signal: T = 225° deg



K-Rb-EPR Signal: T = 220° deg