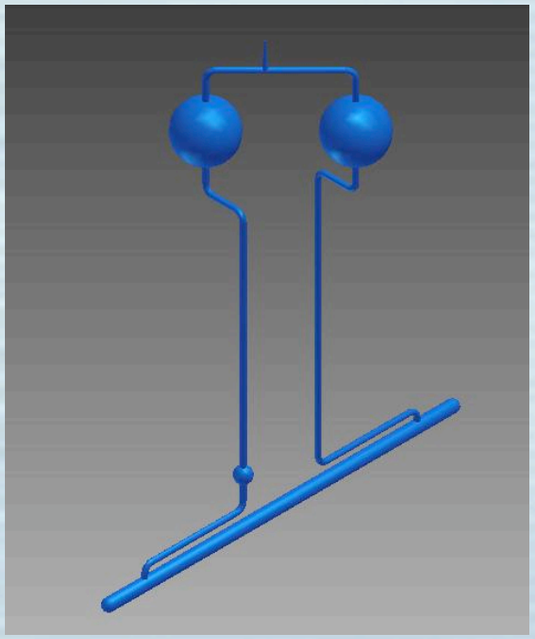
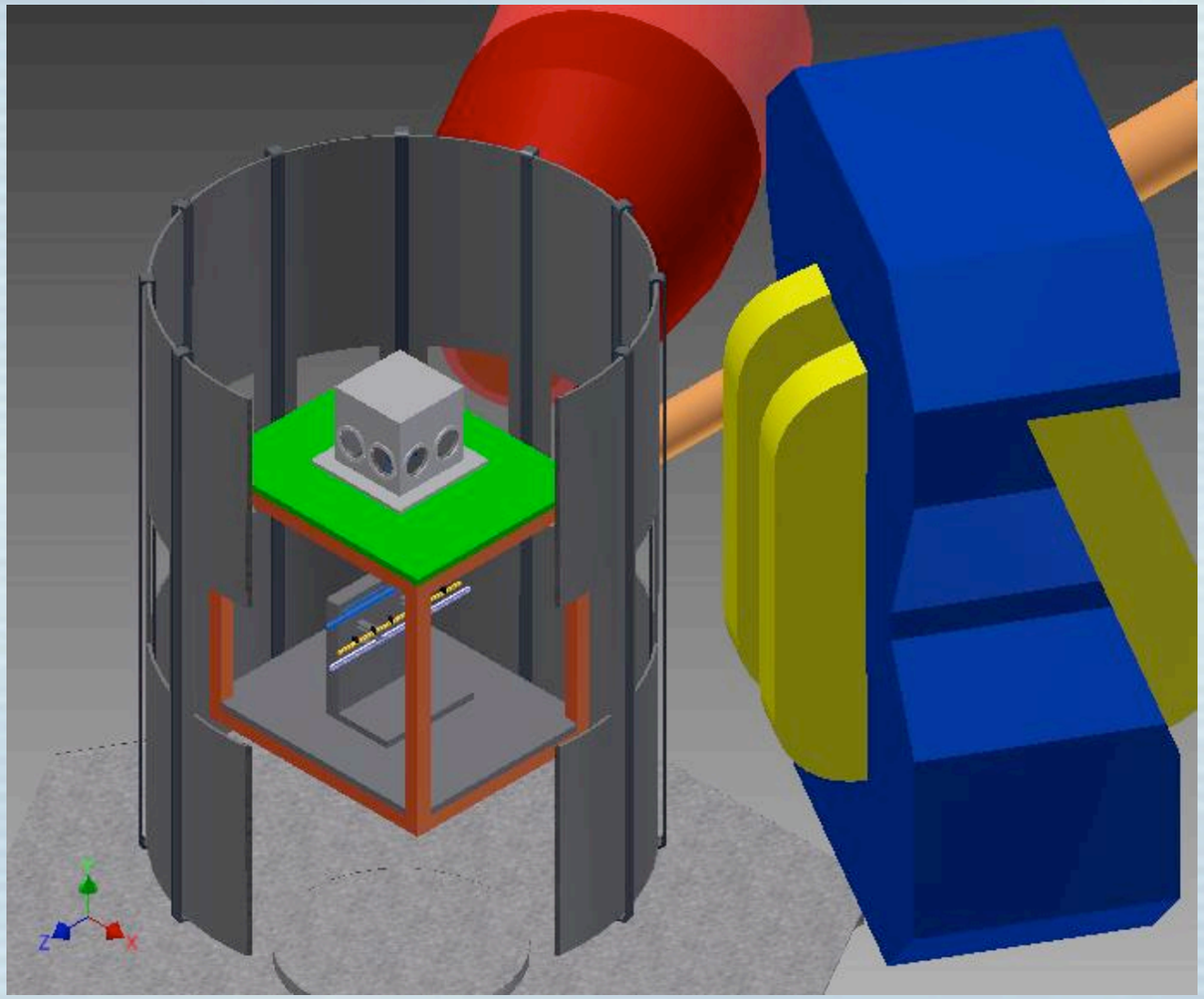
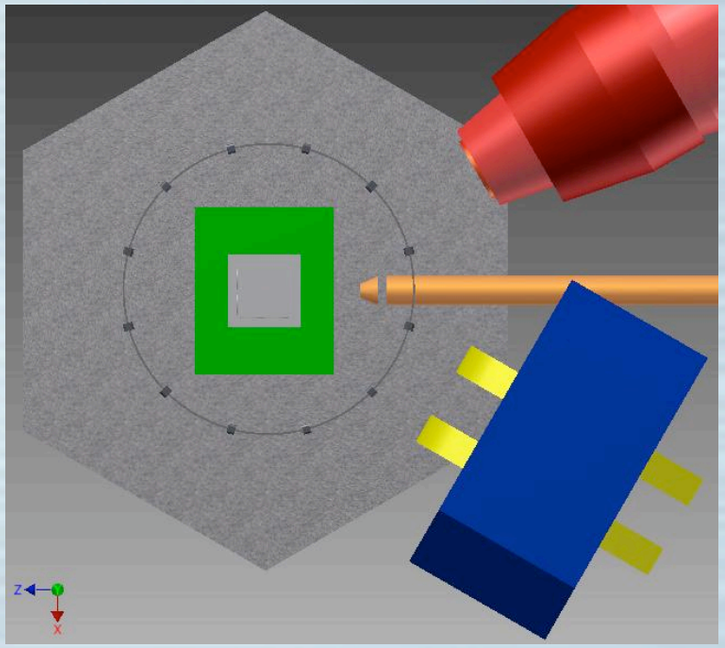
# Conceptual design for the $A_1^n$ targets

- Use the Transversity and GEn targets as empirical starting points.
- Hall A A1n will have three times the luminosity.
  - If we triple the amount of gas being polarized, (6-7 STP liters of $^3$He) we are virtually guaranteed equivalent polarization.
- According to our simulations, a 6-7 STP liter target would actually achieve 63% even with six times the Transversity luminosity.

# Design concept for the Hall A $A_1^n$ target

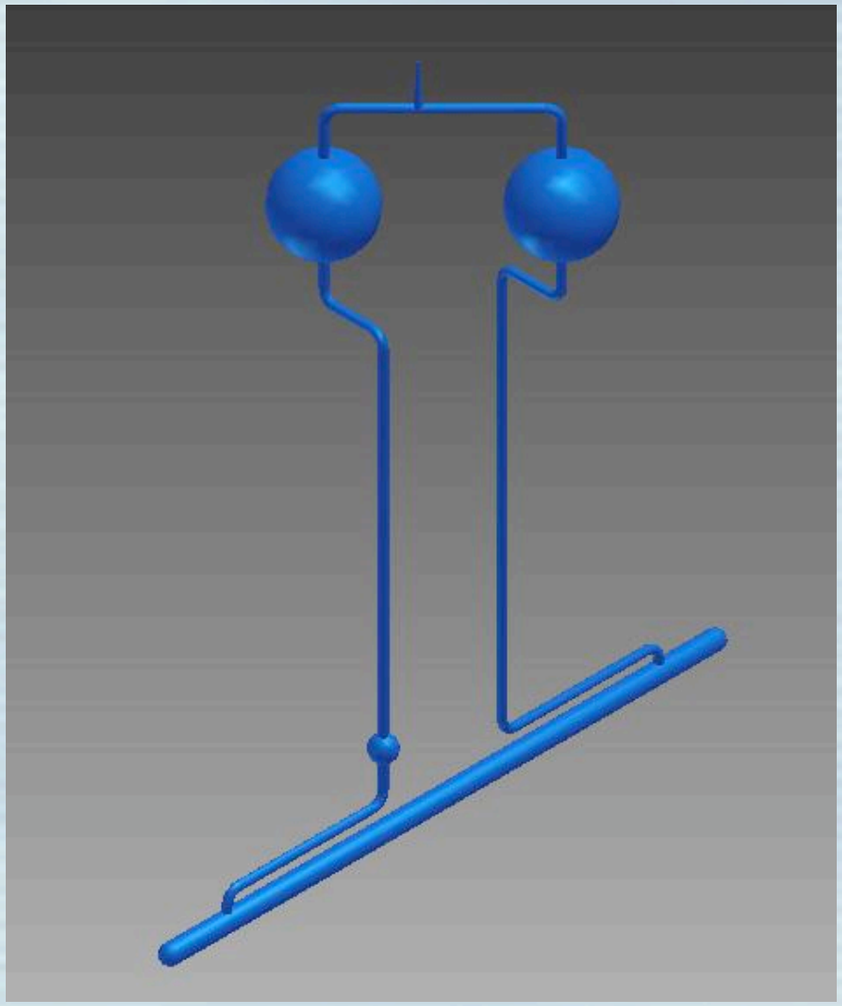


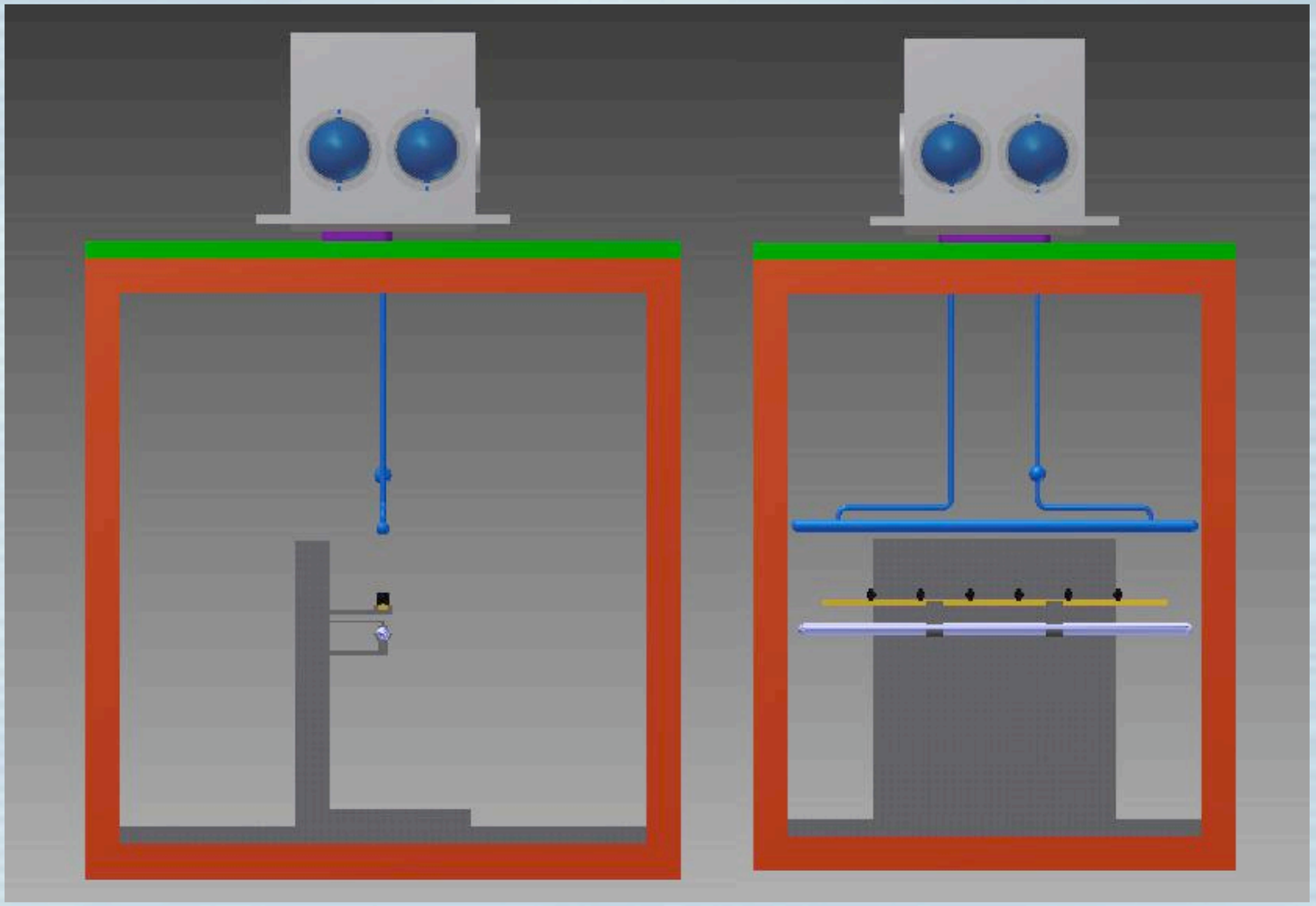




- Convection-driven double-pumping chamber cell to handle high current.
- SBS magnet will deflect protons making charge identification much more straightforward.
- GEM Trackers in BigBite will accomodate much higher singles rates, and hence luminosity.

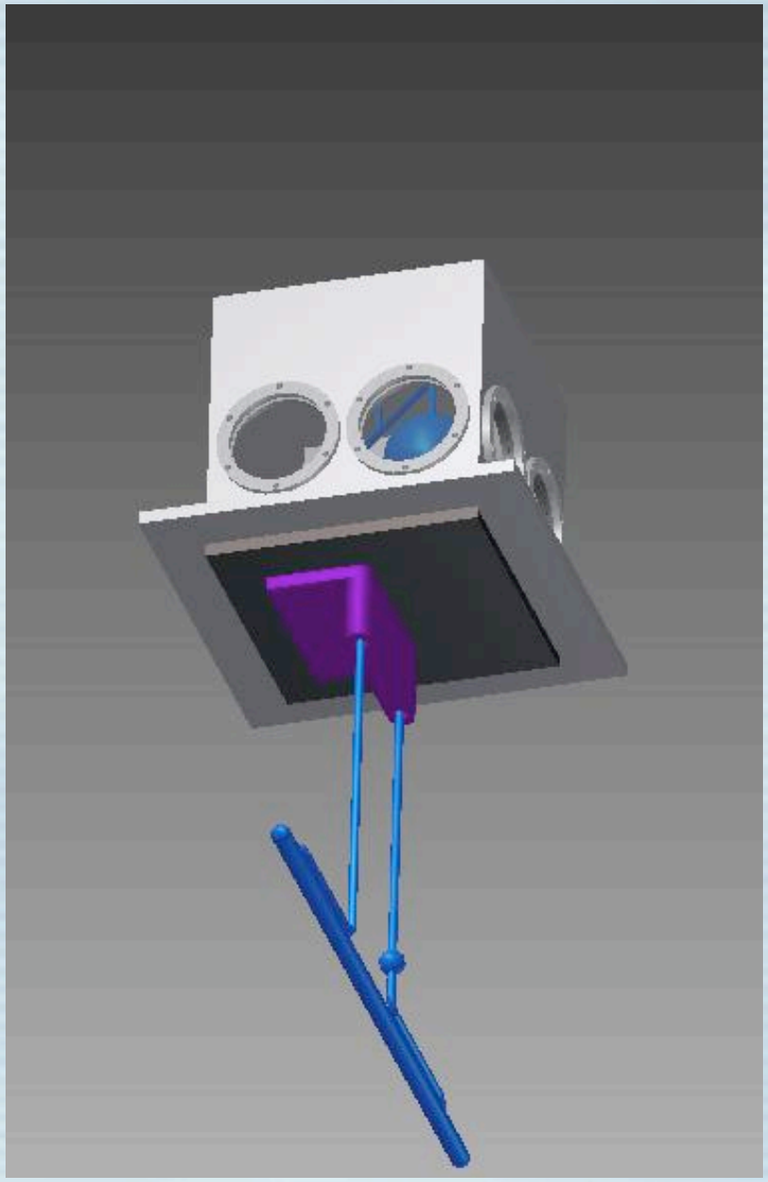
# Design concept for the Hall A $A_1^n$ target

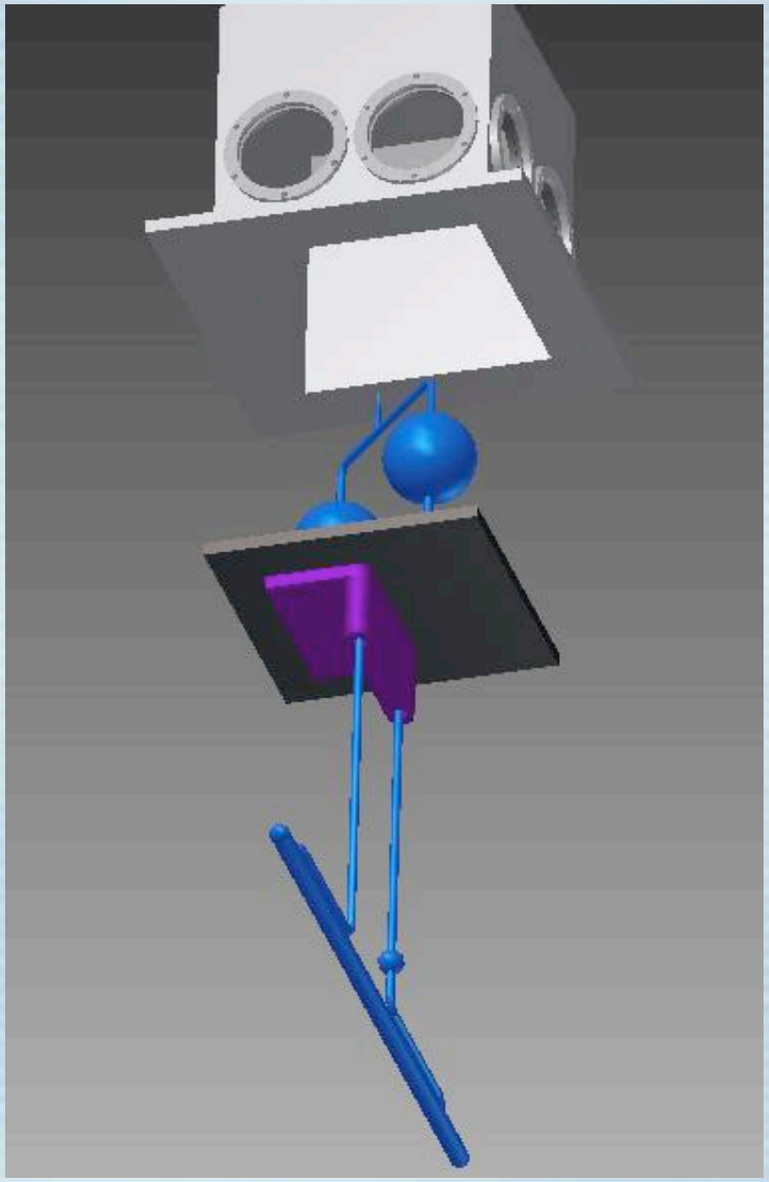




All target components are mounted in an aluminum frame that can be translated up, down and sideways.

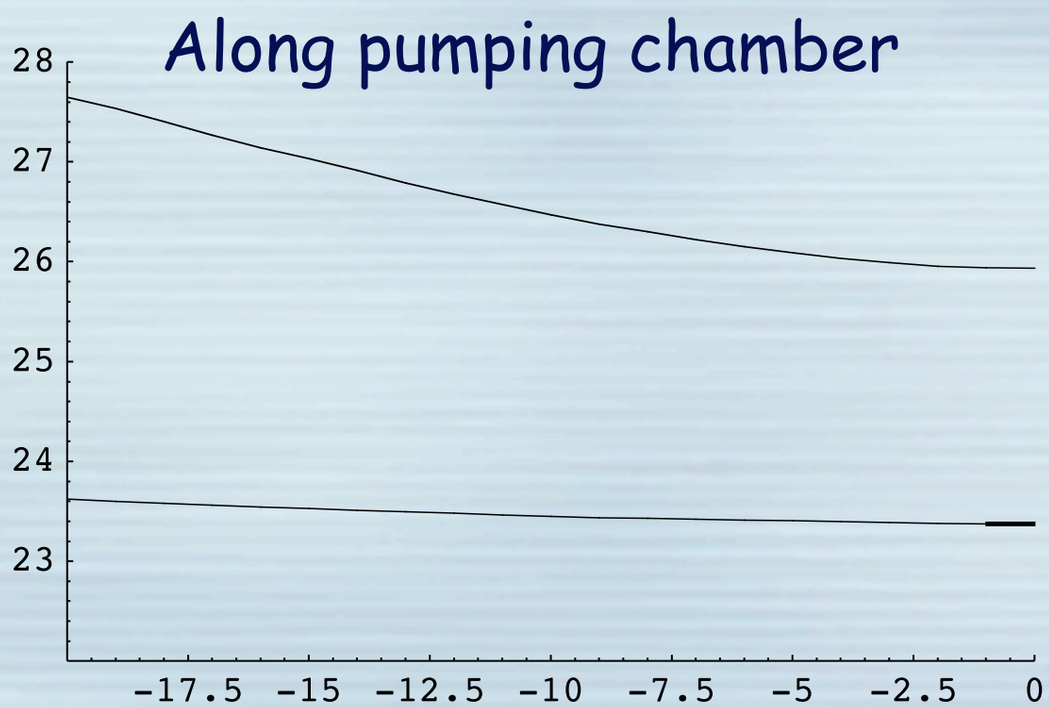
# Design concept for the Hall A $A_1^n$ target

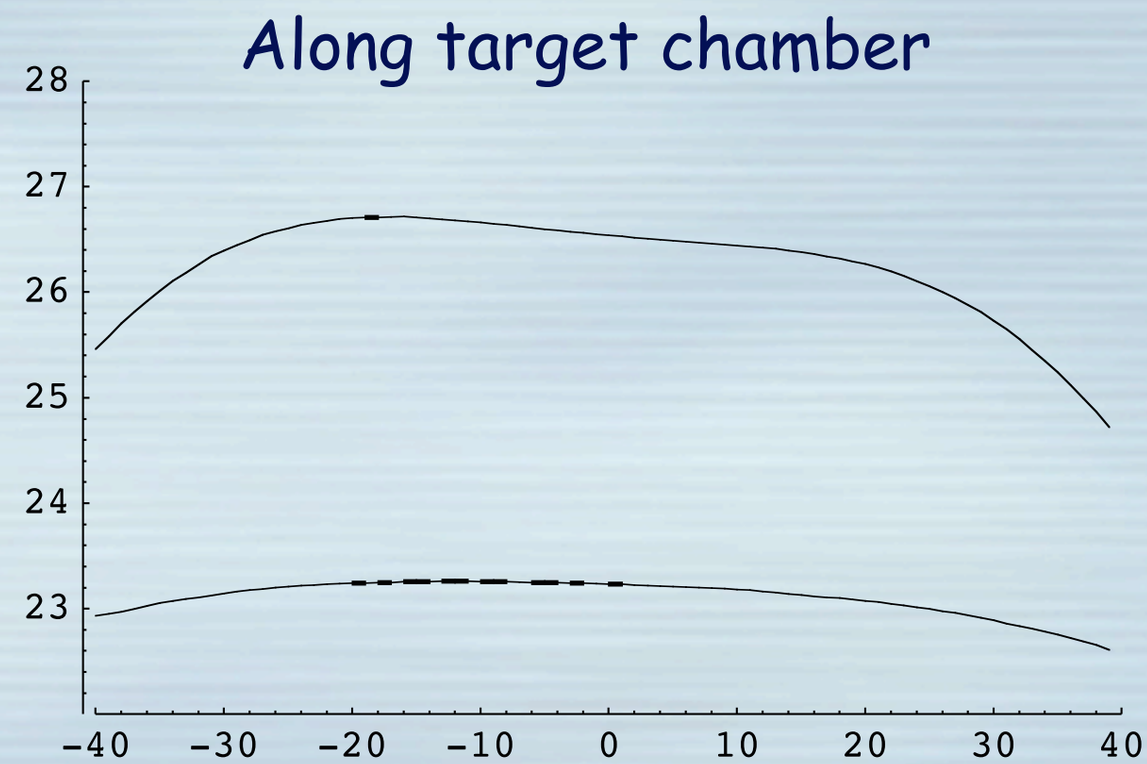




The cell, the cell-mounting plate (two pieces) and the cell-mounting bracket (two pieces) comprise the "cell assembly", which will make it possible to replace cell relatively easily

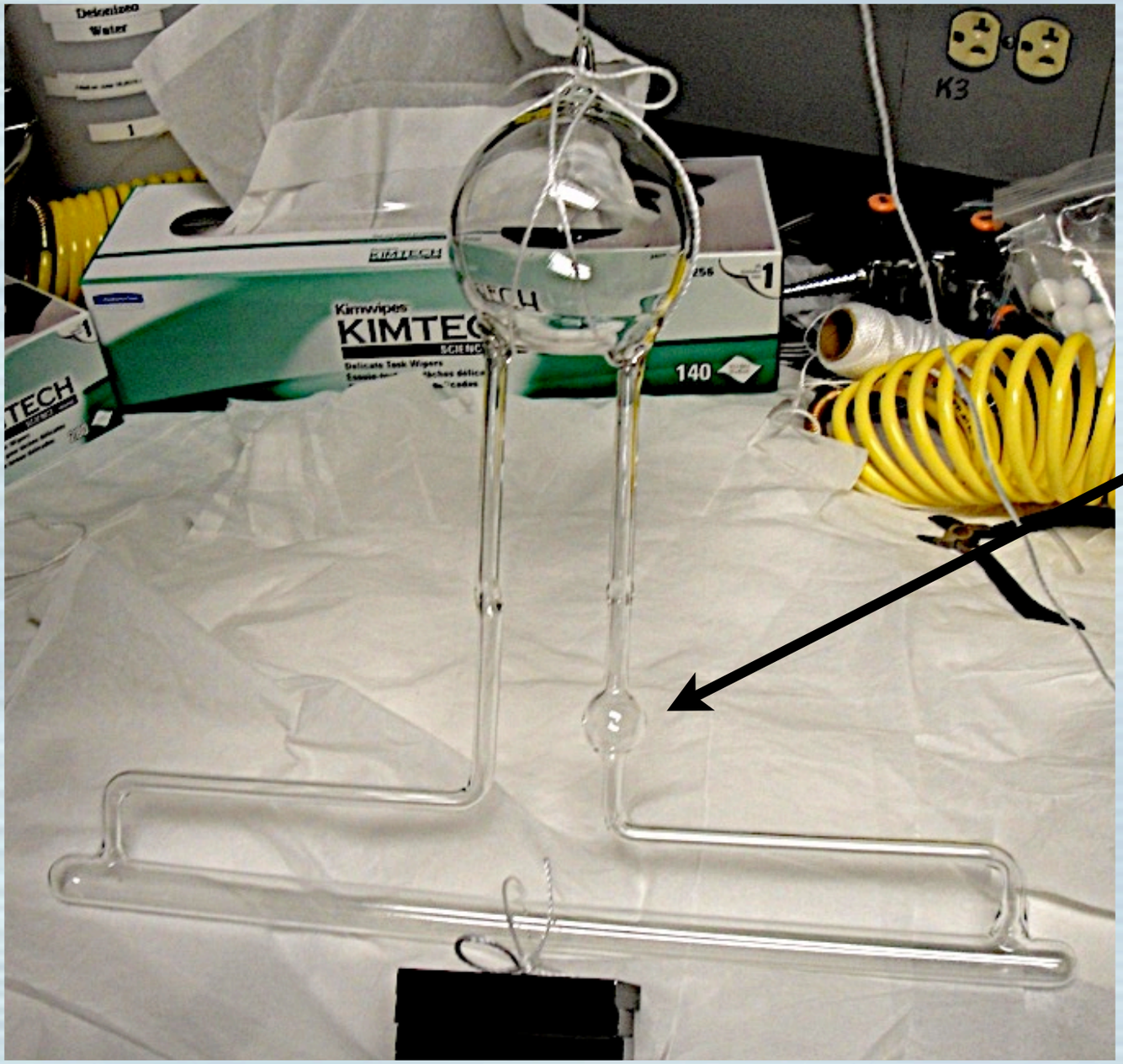
# Design concept for the Hall A $A_1^n$ target



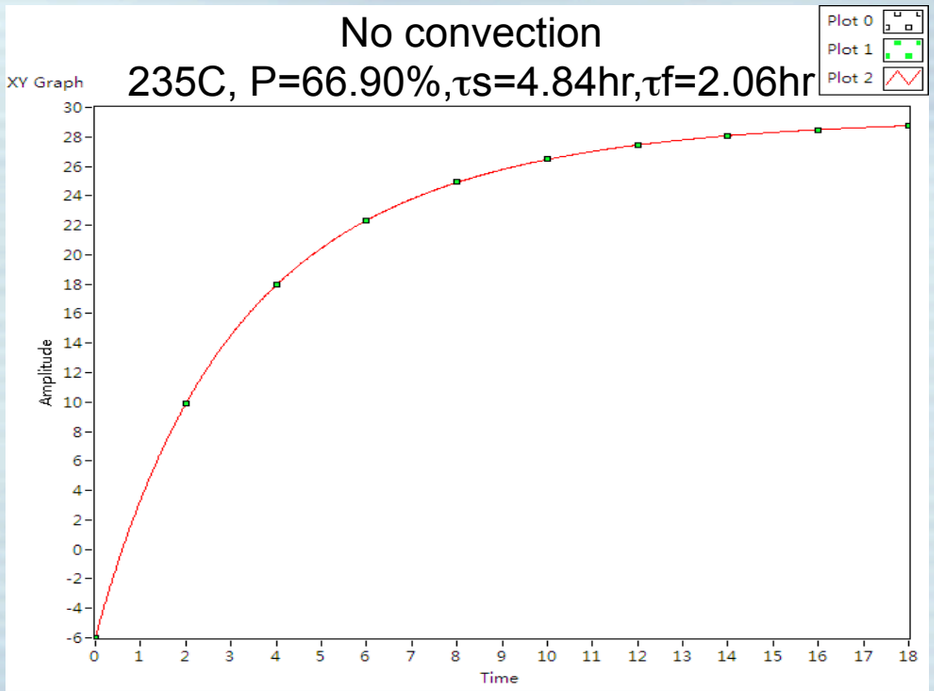

These plots, still very preliminary, illustrate the greater homogeneity provided by the barrel design.

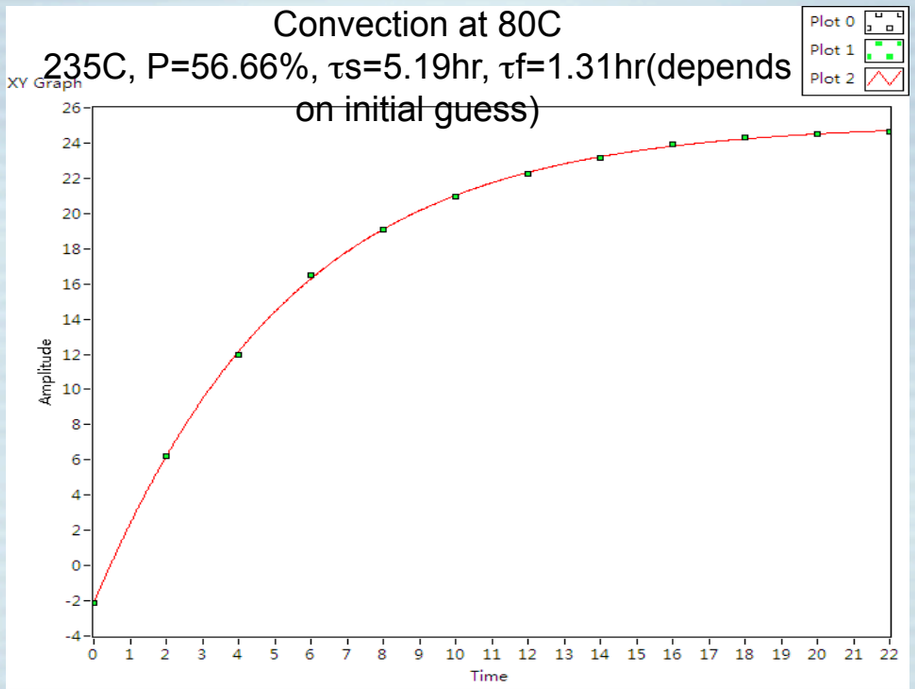
# Half-volume $A_1^n$ test target

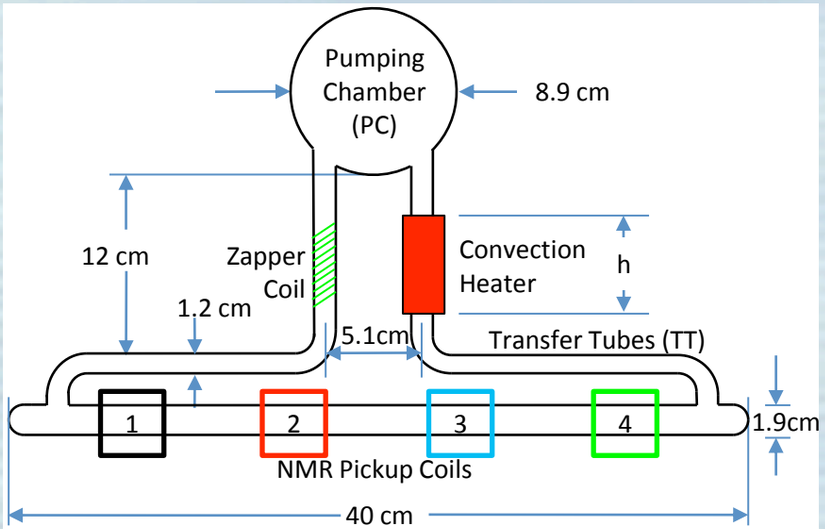



- Largest volume of 3He in JLab target cell to date.
- Incorporates a bulb for pulse NMR polarimetry
- Transfer tubes have realistic size (smaller diameter) for the full-sized target.

# Results from half-volume $A_1^n$ test target

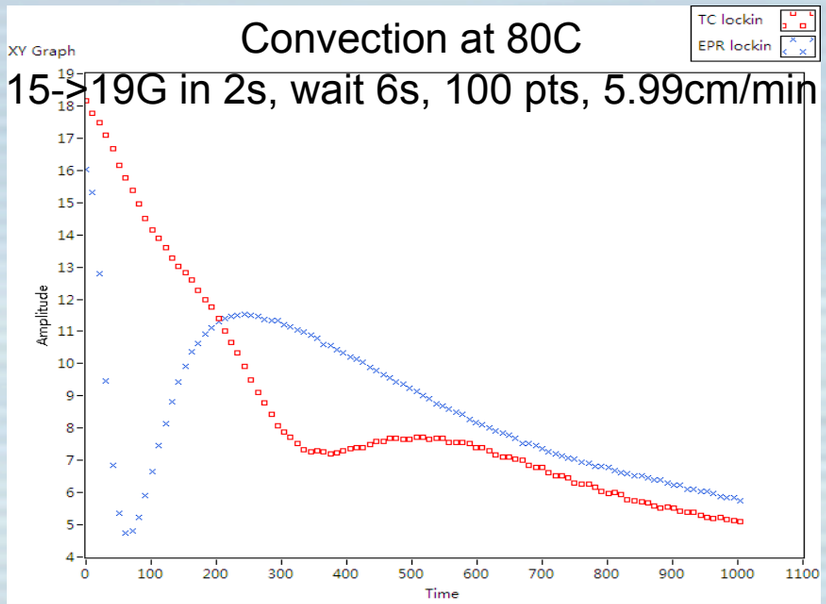


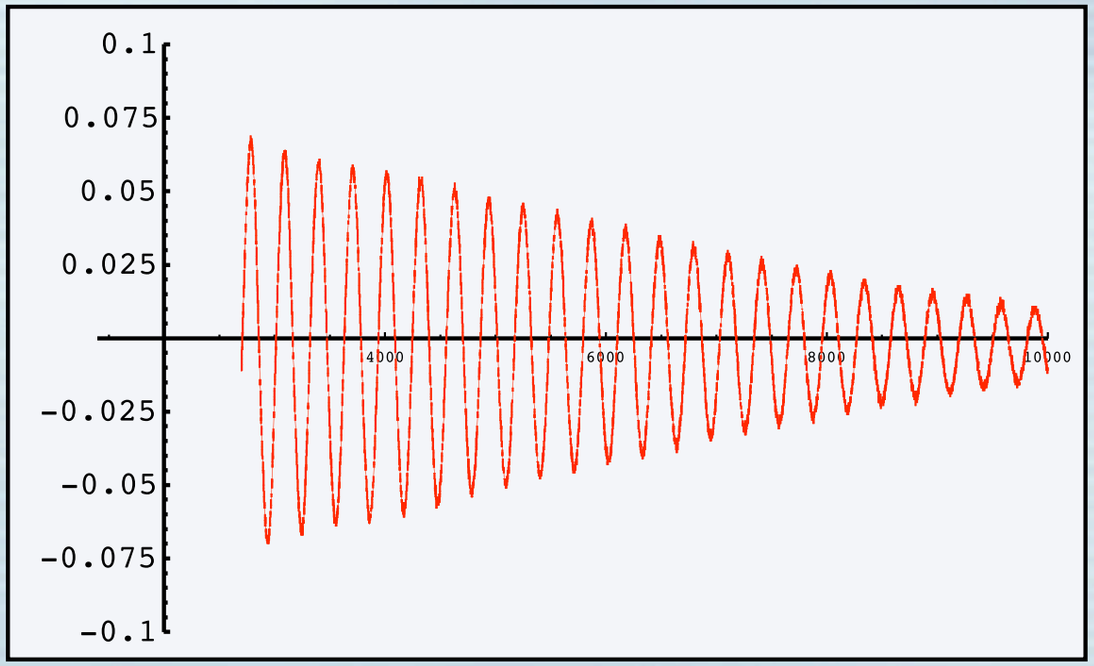




Dolph, Singh, et al., PRC v84, pg 065201 (2011)

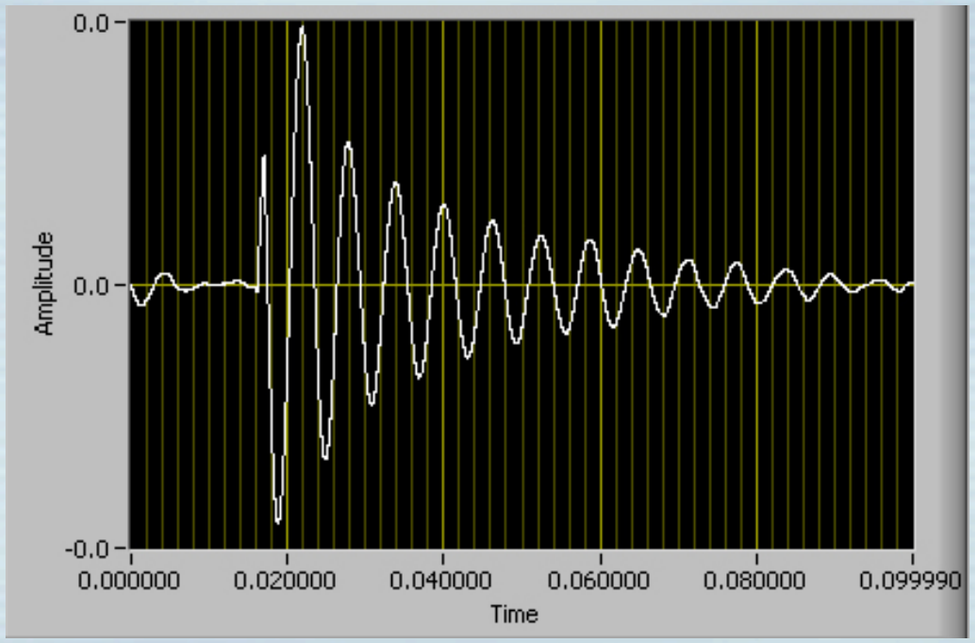
- Convection provides well-controled circulation of the gas.
- New half-volume $A_1^n$ cell is the first in which we have simultaneously achieved high polarization.
- 57% was achieved with an unoptimized system, 3 (instead of 4-5) lasers,



# Polarimetry for hybrid glass/metal cells using low field pulse NMR



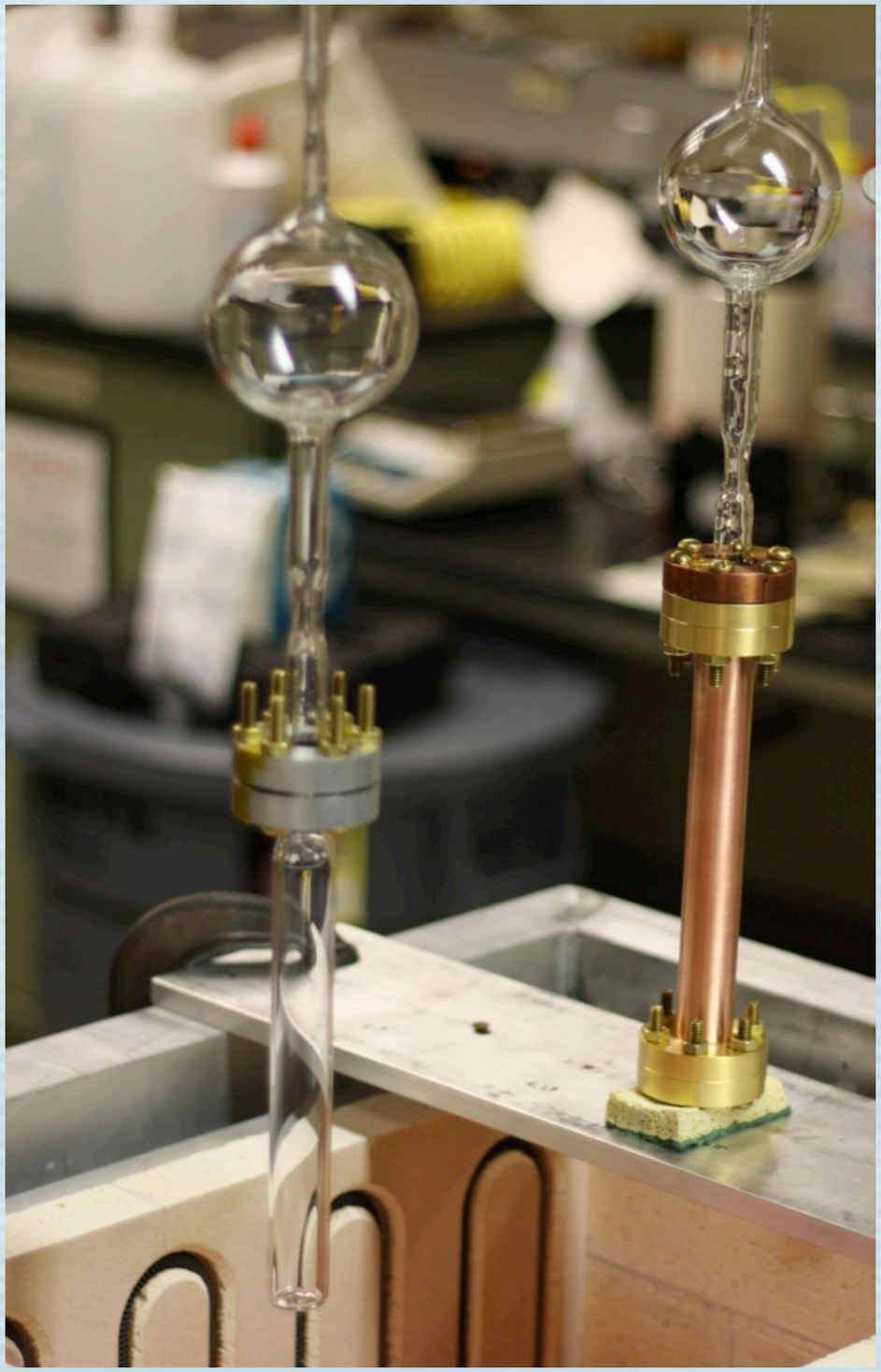
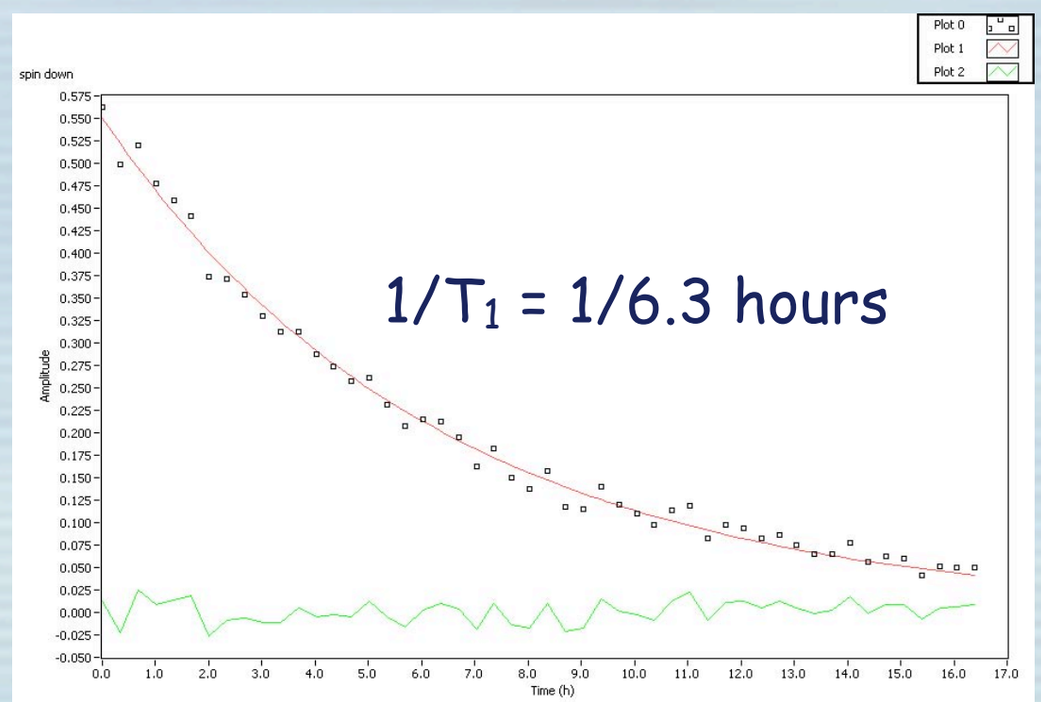

Free Induction Decay of $^3$He
at around 20 Gauss




Free Induction Decay of
$^1$H in water at 17 Gauss
(Johnson noise limited, 500 averages in 100 seconds, using digital filter)

Since RF is heavily attenuated by metal, the NMR technique of adiabatic fast passage (AFP) is not suitable for hybrid glass/metal cells

# Tests of gold-coated OFHC copper



- An OFHC copper spool piece was gold coated by Epnor's company.
- The assembly required O-rings.
- A control was also prepared that was all-glass except for O-rings.
- With several tests, lifetimes of up to around six hours were obtained.
- It was clear that we were never able to completely get rid of leaks (as evidenced by oxidation of the Rb).