TRANSVERSITY
Target Lab. Status and Spin Flip

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HALL A Collaboration Meeting
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OUTLINE

- Some of the tests done so far in the target lab.
- Spin Flip
- Target Design
- Plans for the next half year.

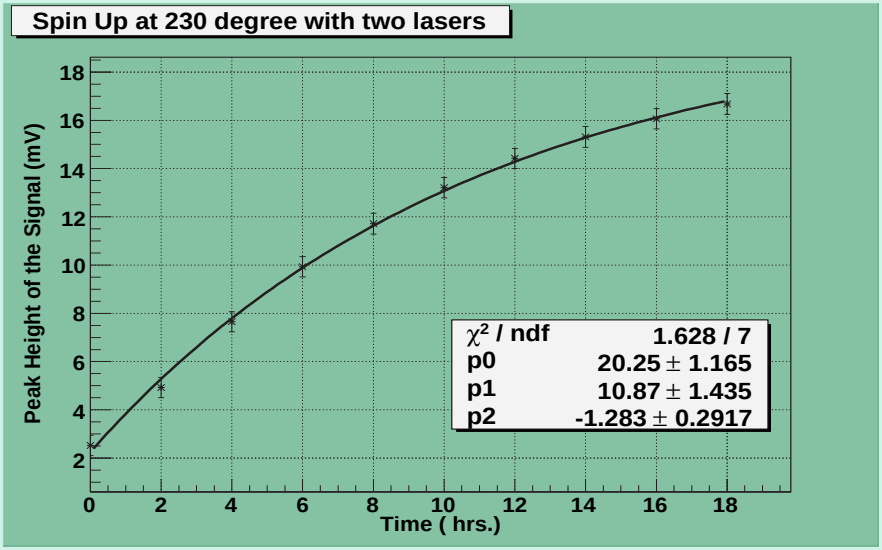
SOME OF THE MEASUREMENTS WE CARRIED OUT

- ^{3}He NMR (Field / Frequency Sweep)
- EPR
- Water NMR(Field Sweep)
- Spin Flip (with two lasers)

(All tests were performed with "Carlos")

^{3}He NMR

- Both Field Sweep NMR and Frequency Sweep NMR done successfully with 2 Lasers with 30 W each.
- Spin up curve for Carlos ::

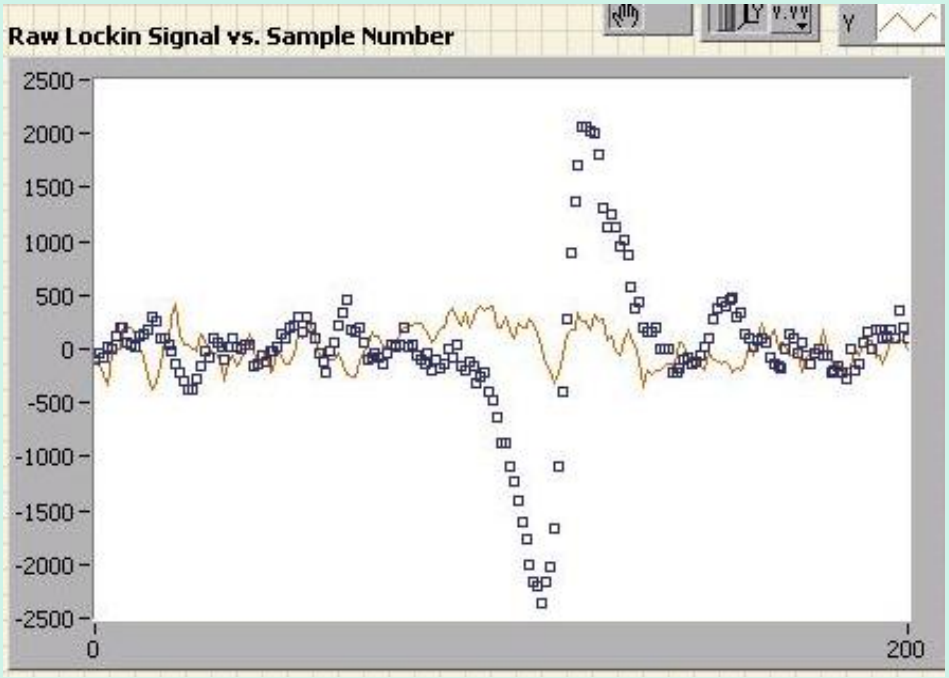


EPR

- Done with 3 lasers @30 W each and at oven temp. 240^oC
- Initially had tough time and some problems with the electronics !!
- With the new FG, successfully saw one of the K-signals at 19.59 MHz .
- Could not see any other signal !
- AFP done successfully. Thanks to Ameya !!
- Still to improve a bit in terms of NOISE etc.

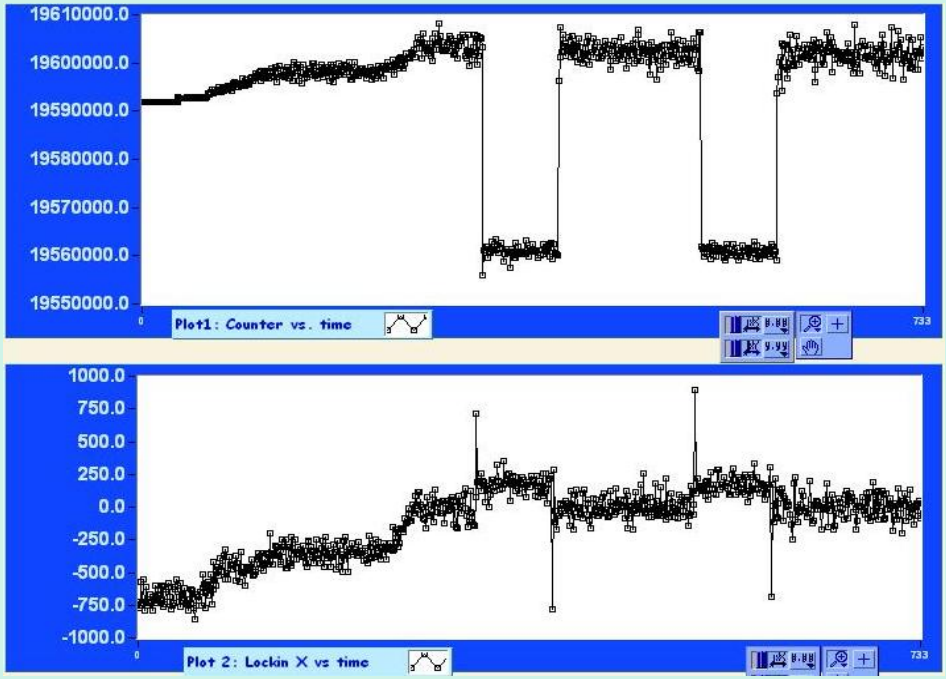
EPR

- **Frequency Lineshape :: The resonance is at 19.59 MHz**



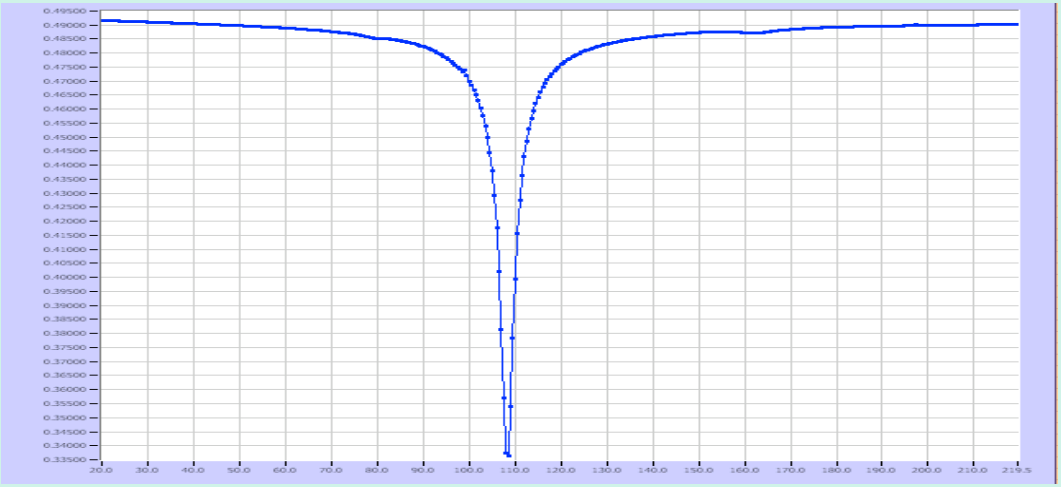
EPR

- **AFP :: Noisy !!**



WATER NMR

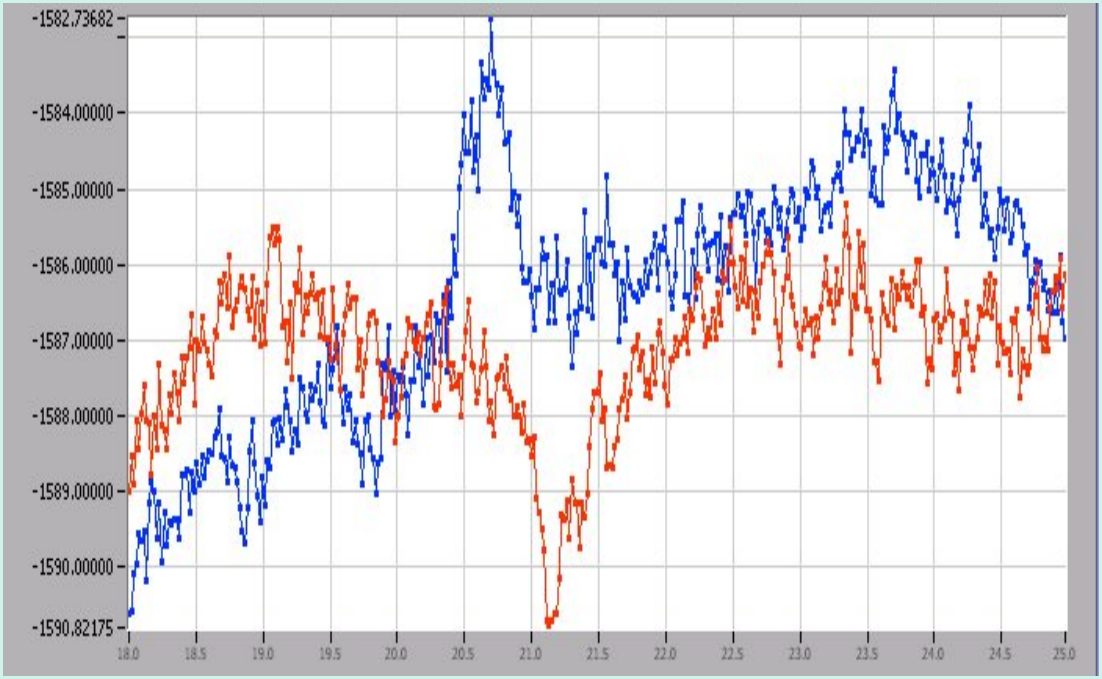
- **New pick up coils installed.**
- Q-curve ::



- **Two field sweep measurements were done.**
- **Had signal...BUT NOT EVEN CLOSE TO GOOD !!**

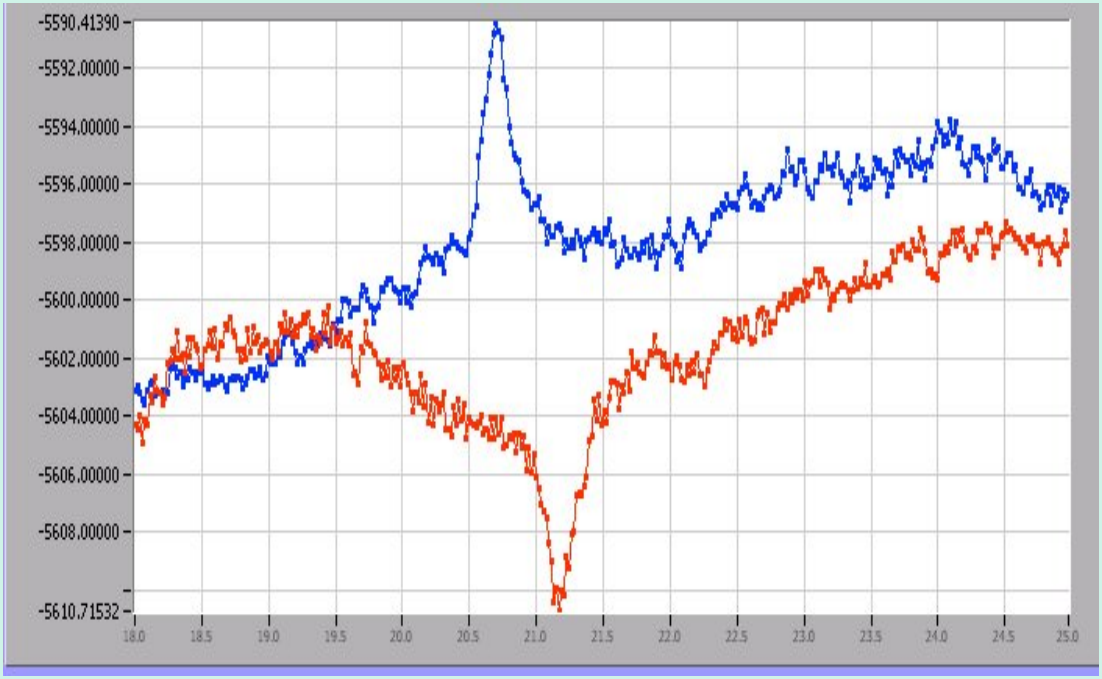
WATER NMR

- **With Pre-amp gain =100**



WATER NMR

- **With Pre-amp gain =200**



SPIN FLIP

- **Plan to measure SSA in** $n^{\uparrow}(e, e'\pi^{-})X$
- **SSA can be defined roughly as** $\frac{d\sigma^{\uparrow} - d\sigma^{\downarrow}}{d\sigma^{\uparrow} + d\sigma^{\downarrow}}$
  where
  $d\sigma^{\uparrow}$ is the cross section when the spins are polarized transversely with respect to the beam and $d\sigma^{\downarrow}$ is the cross section when the spins are flipped 180°
- **Need to flip the target spins at regular intervals**
  in such a way that the systematic errors could be reduced.

SPIN FLIP

- Done with 2 lasers @ 30W each.
- Tests performed with 10 min,15 min and 20 min wait time.
- Struggled at the beginning and huge inconsistency observed between the expected loss and the experimental loss !!
- The problem was well identified. The resonance frequency was not at the middle of the scanning range.
- As a result, spins were not completely flipped in the process.
- Now with the change in the range while keeping the sweep rate fixed, the problem is solved !

SPIN FLIP RESULTS

- **Expected Loss from theory :::**

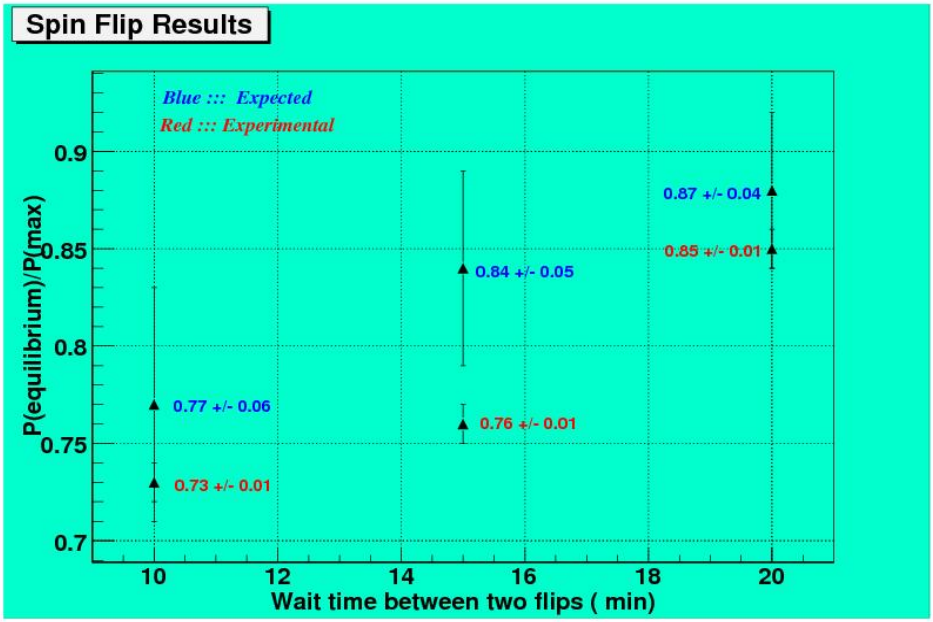
$$\frac{P_e}{P_{max}} = \frac{e^{\frac{T_w}{T_u}} - 1}{e^{\frac{T_w}{T_u}} - (1 - \delta)} \tag{1}$$

where

P_e=Polarization @ equilibrium.
P_{max}= Maximum polarization before spin flip process.
T_w=Wait time between two consecutive sweeps.
T_u=Spin up time for our target.
δ=AFP loss per sweep.

SPIN FLIP RESULTS

- **The experimental results in our lab. ::**
- **δ=0.005 and T_{up}=578 min.for "Carlos"**



Target Design Progress

- The new oven is already done. Need to be tested.
- Order for new cells is placed.
- Have lasers but probably will need couple of spare ones.
- Order for the optical fibers to be placed shortly.
- Order for the vertical coils is placed.RF coils as well.
- Support structure/ optics assembly being worked on.
- Vertical Compass design in progress.

PLANS for next few months

- New oven to be tested.
- Cell characterization to be done.
- Some improvements to be done in EPR.
- Lot of improvements to be done in WATER .
- Next ....Frequency sweep water!
- DAQ related software developement.
- Work on a few target design issues as well.

To conclude

I would like to thank Wolfgang Korsch, J P Chen, Xiaofeng Zhu,Huan,Joe Katich, Xiaohui for all their support .
And any comments, suggestions to improve the target related work are welcome from everyone.