

# Polarized $^3\text{He}$ Target Update for Transversity/ $d_2^n$

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*Duke University*

for Hall A Collaboration Meeting

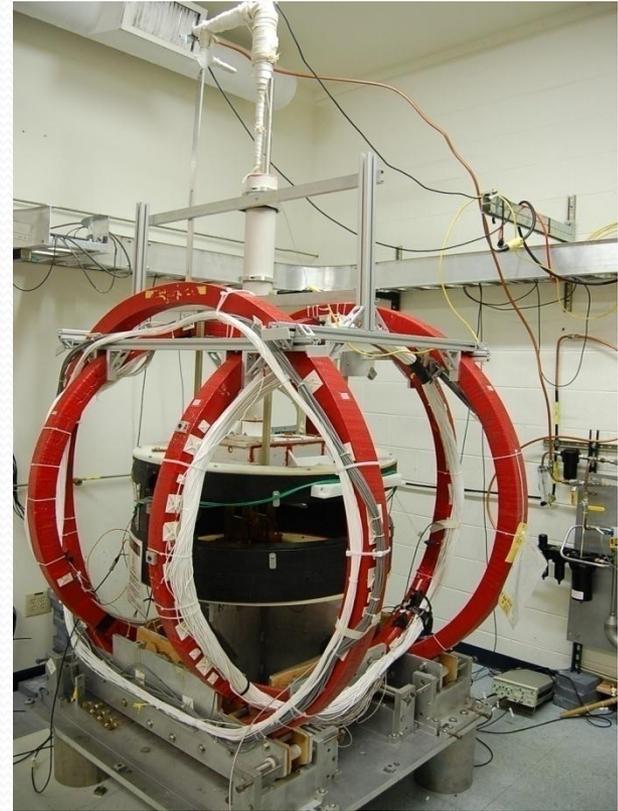
June 12, 2008

# Outline

- Previous Meeting.
- New Oven System.
- Spin Polarimetries: NMR/EPR.
- Water NMR Test.
- Spin State Signal.
- Cell Preparation and Characterization.
- Compass.
- Status Summary.
- Future Plan.

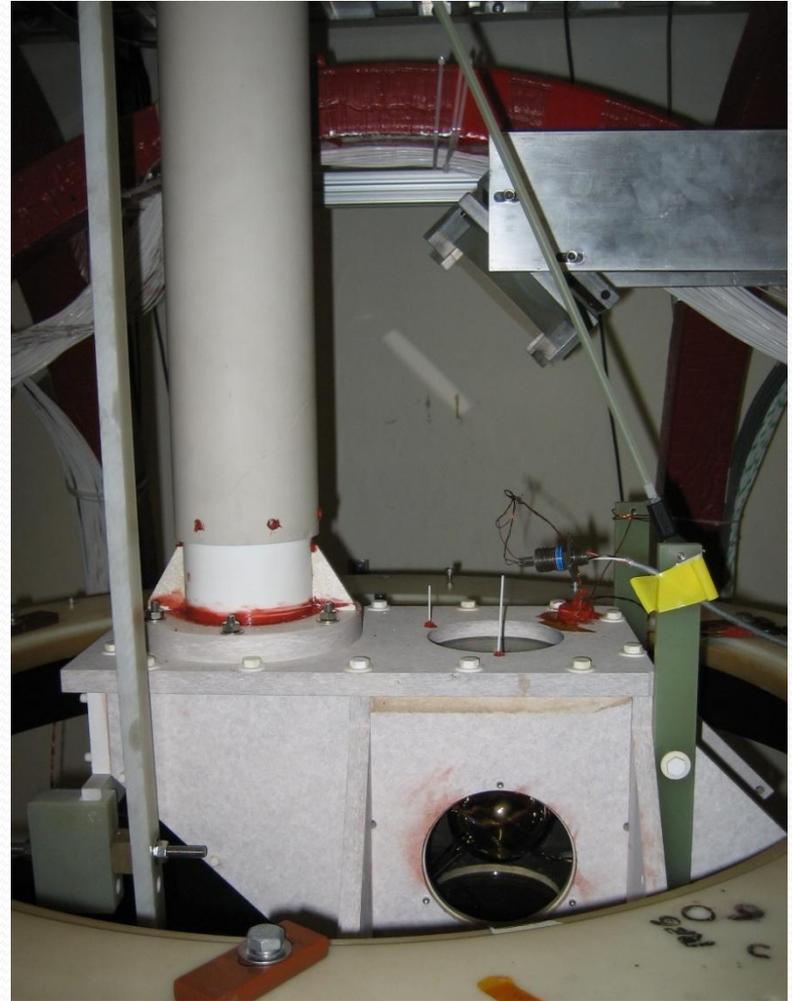
# Previous Meeting

- Optics alignment was done.
- New oven was designed.
- Got NMR field sweep signal.
- Vertical coils test was done.
- BigBite fringe field mapping was done.
- 16 cells were produced.



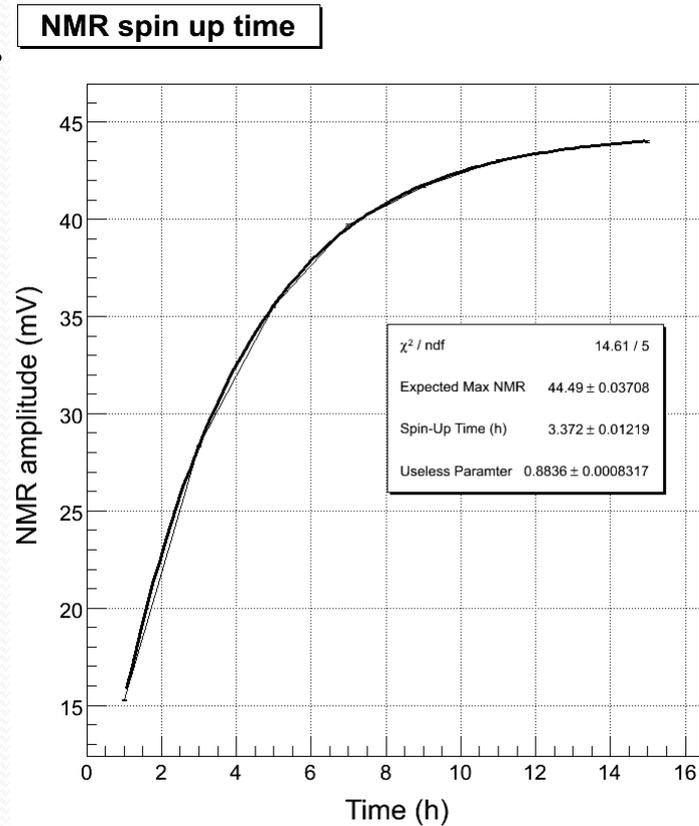
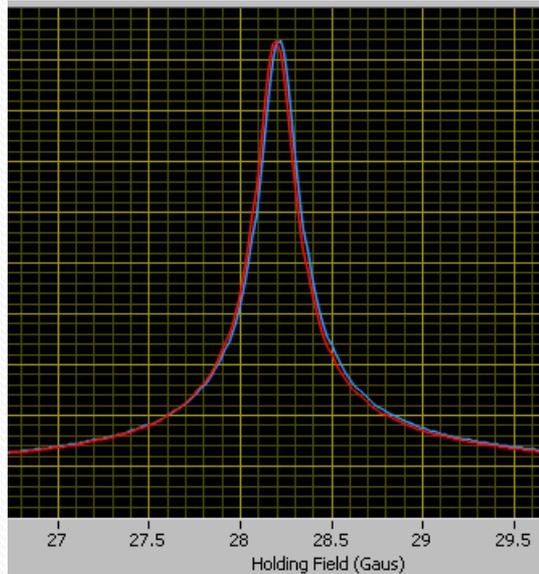
# New Oven System

- New material: CS85 Structural Insulation.
- Better insulation, less weight (29 lb. compared with previous one ~ 45 lb.).
- Black interior painting.
- One is in use, another one is being assembled.
- A new tube was designed and is being manufactured



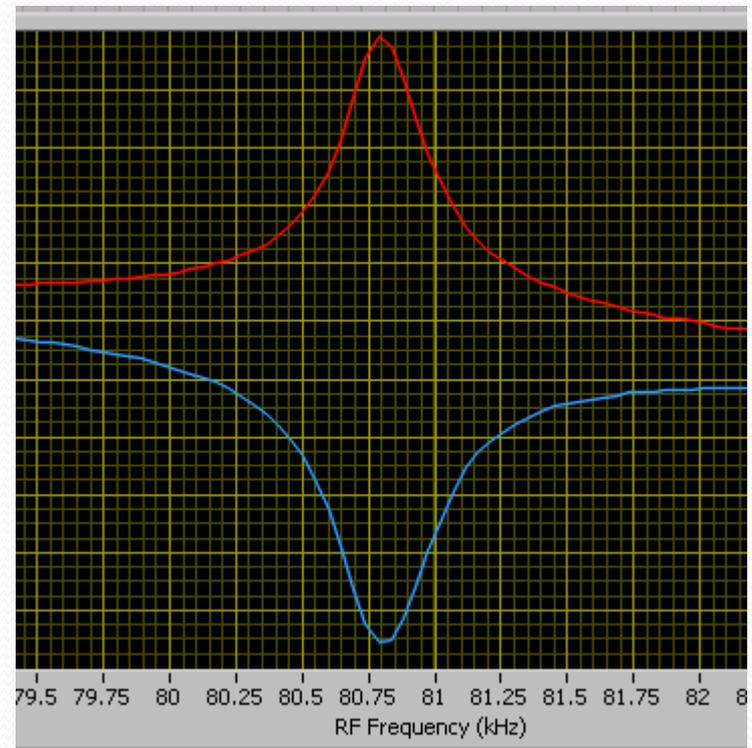
# NMR Measurement

- Working very well.
- 3 Laser (90W total), 240°C.
- Spin-up time ~ 3 hours



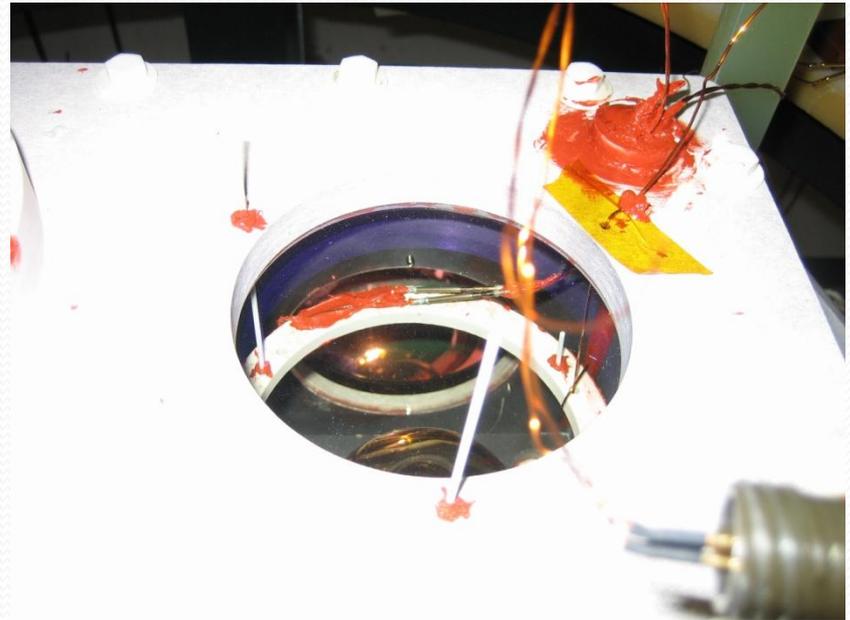
# NMR Frequency Sweep

- NMR signal will change sign with different initial spin state when the frequency is always swept in the same direction (low  $\rightarrow$  high or high  $\rightarrow$  low)
- This sign change can be used in the spin state identification.



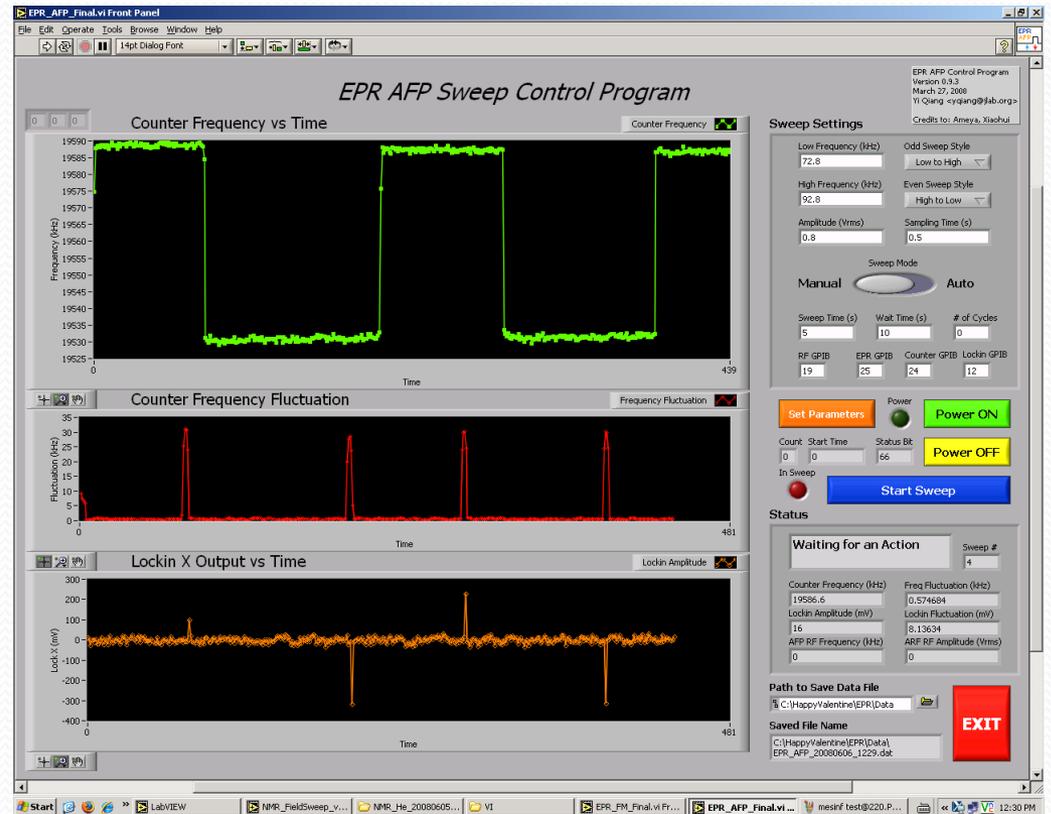
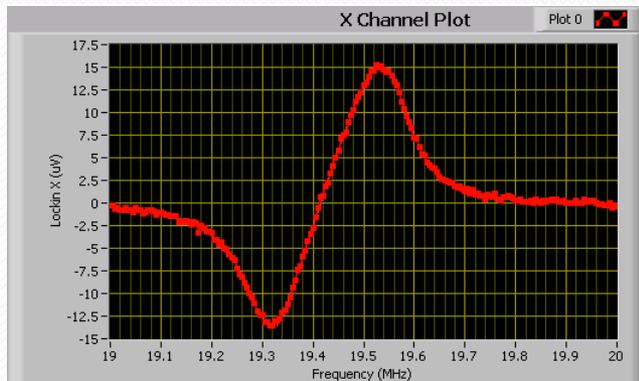
# EPR Measurement

- Struggled at the beginning.
- Not enough EPR RF?
- Reflection light?
- Solution:
  - Put the EPR coil inside (made with high temperature wire).
  - Black interior painting.



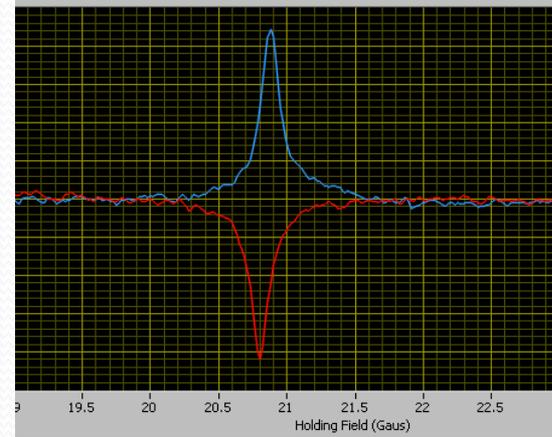
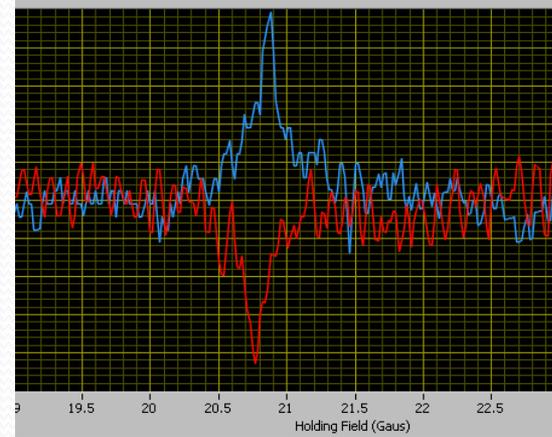
# EPR Measurement

- Clean EPR FM shape and frequency lock.
- Both Rb and K signals can be used.
- Polarization  $\sim 50\%$



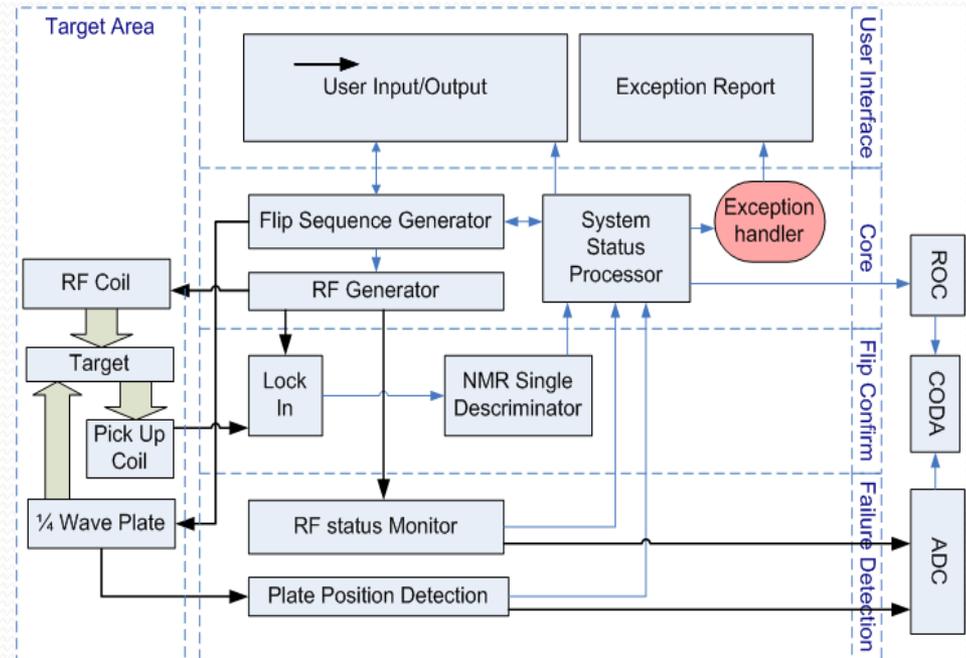
# Water NMR Test

- New adjustment capability of the pickup coils makes the fine tuning very easy.
- Water NMR signal is visible after **one single** sweep.
- 100 sweeps give enough signal to background ratio.



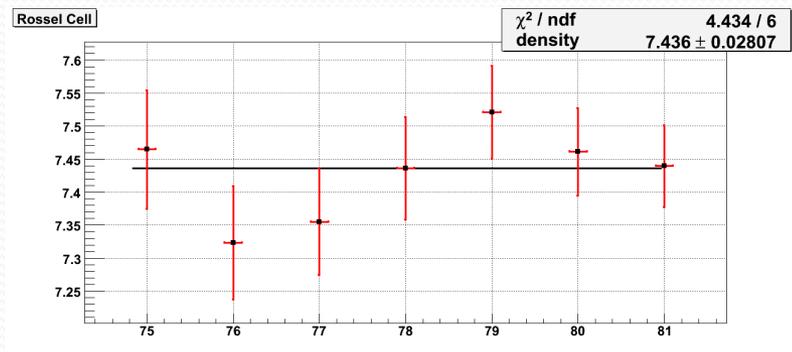
# Spin State Signal

- Hardware signals from lock-in during NMR frequency sweep form state gates.
- Redundant information will be injected into EPICS.
- The whole system is built and working.
- Stress test coming soon.



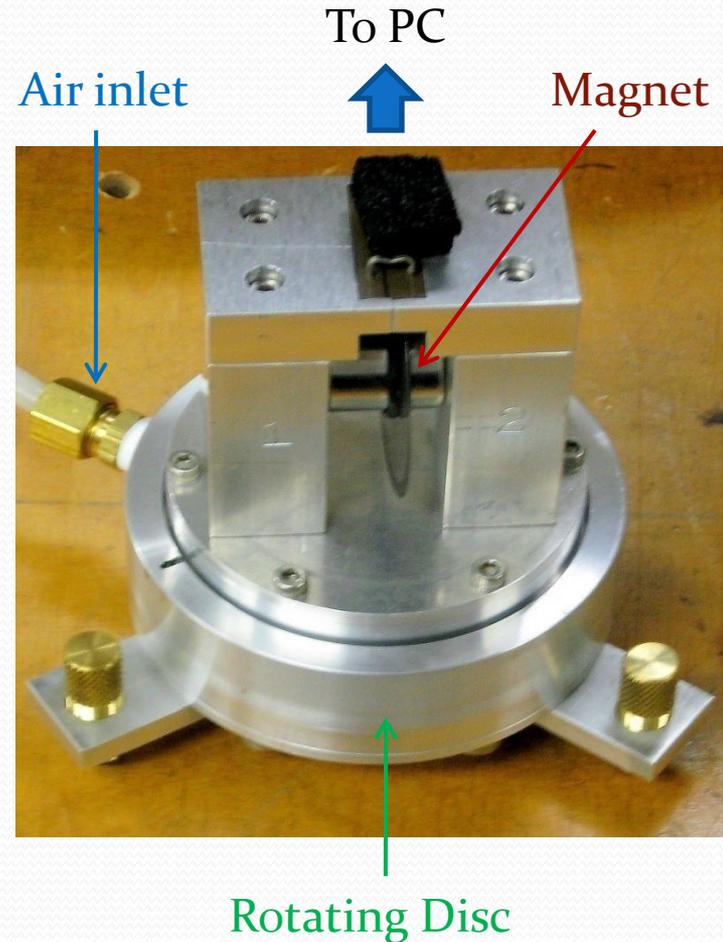
# Cell Preparation and Characterization

- All 20 cells are filled (10 vertical, 10 transverse).
- 2 cells exploded in the oven during density measurement, probably due to the high temperature.
- Characterization are underway in all three labs: UVA, W&M and JLab.
- Density measurement:
  - Statistic error <1%
  - Systematic error is being studied.



# Compass

- Have been built and tested.
- The plan to do the survey is under discussion with JLab survey group.



# Status Summary

- All systems are working well now.
  - NMR, EPR, Water, Spin Signal ...
- Major design work is completed.
- Most of the hardware are on site.
- Post docs: Yi Qiang (Duke U)
- Students:
  - Chiranjib Dutta (Kentucky U)
  - Joe Katich (W&M)
  - Yi Zhang (Lanzhou U)
  - Jin Huang (MIT)

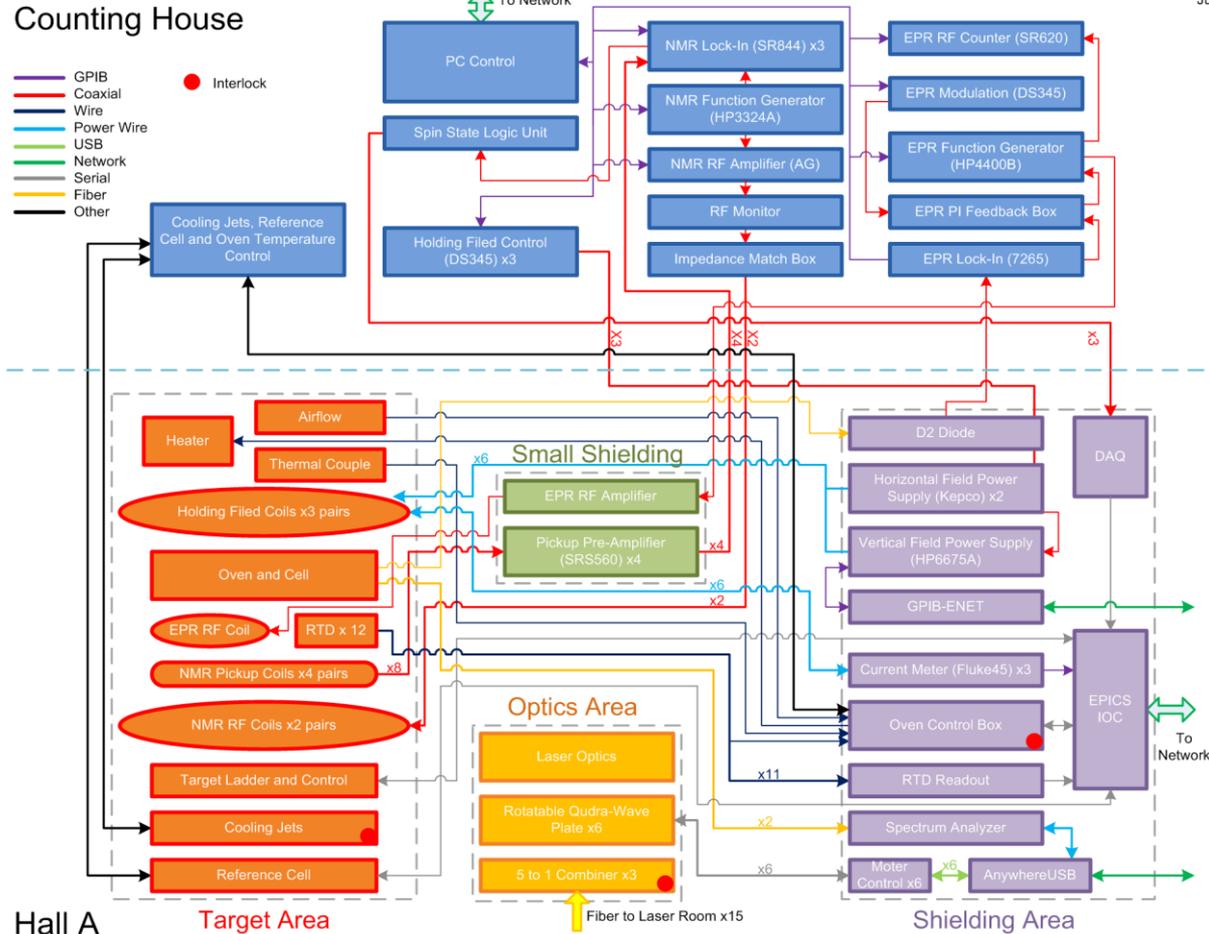
# Future Plan

- Finish spin state signal stress test.
- Optics test with 5 to 1 combiner.
- Continue tests with new cells.
- Get ready to move target system into the Hall in early July.
- Test the new tube.
- Test all equipments, make sure good spares exist.
- Complete fail safe strategies.
- Prepare procedures and documents.
- Install target and get ready for the experiment.

# Target System Diagram

Hall A He3 Polarized Target Diagram

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Hall A

Target Area

Shielding Area