STATUS of the POLARIZED TARGET

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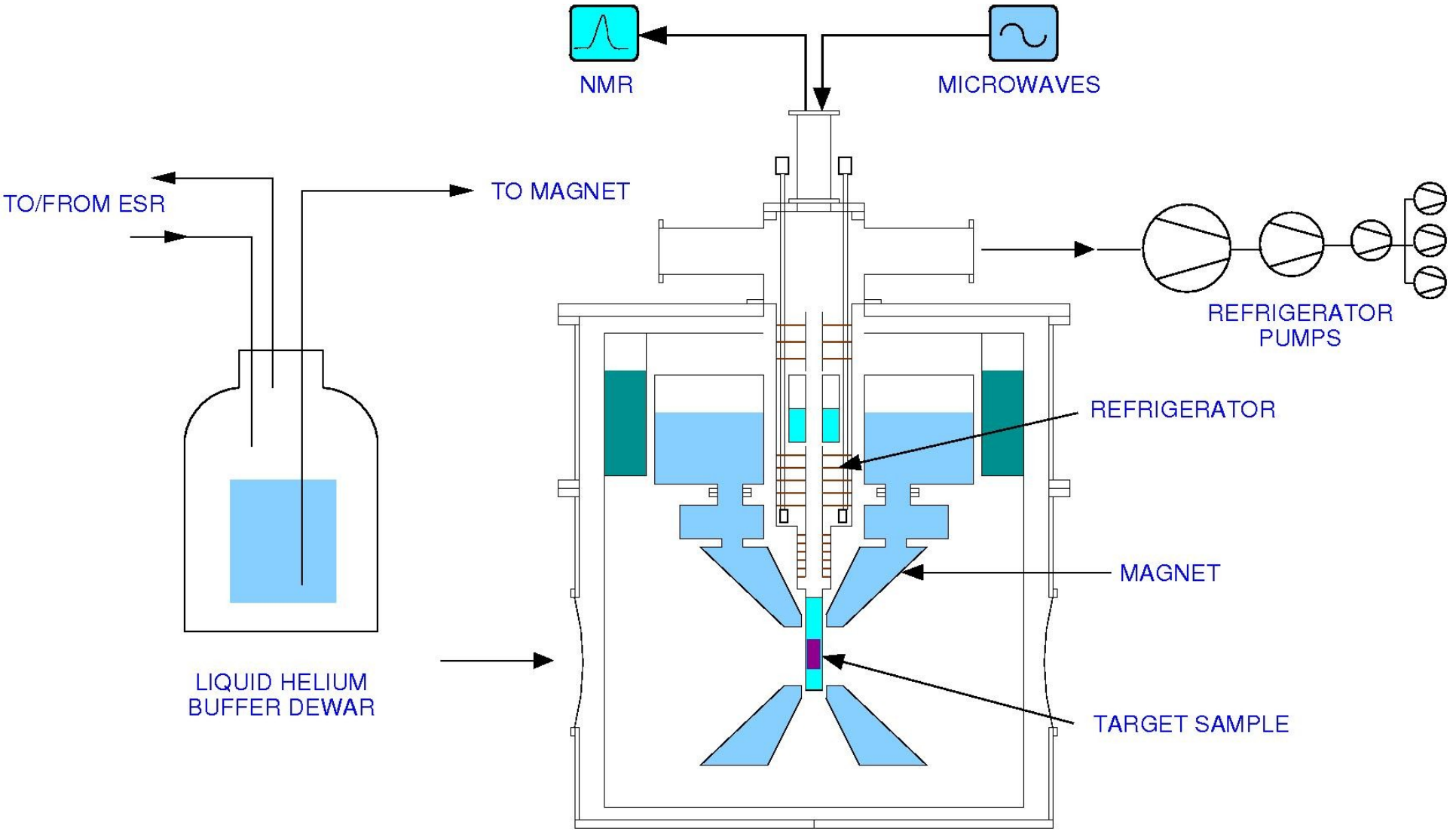
JLab Target Group

g2p/GEP Readiness Review
May 6, 2011

Talk Outline

- Overview of the Target System
- Target history and status prior to g2p/GEp
- Modifications necessary for g2p/GEp
- Current status of subsystems
- Schedule

POLARIZED TARGET: OVERVIEW

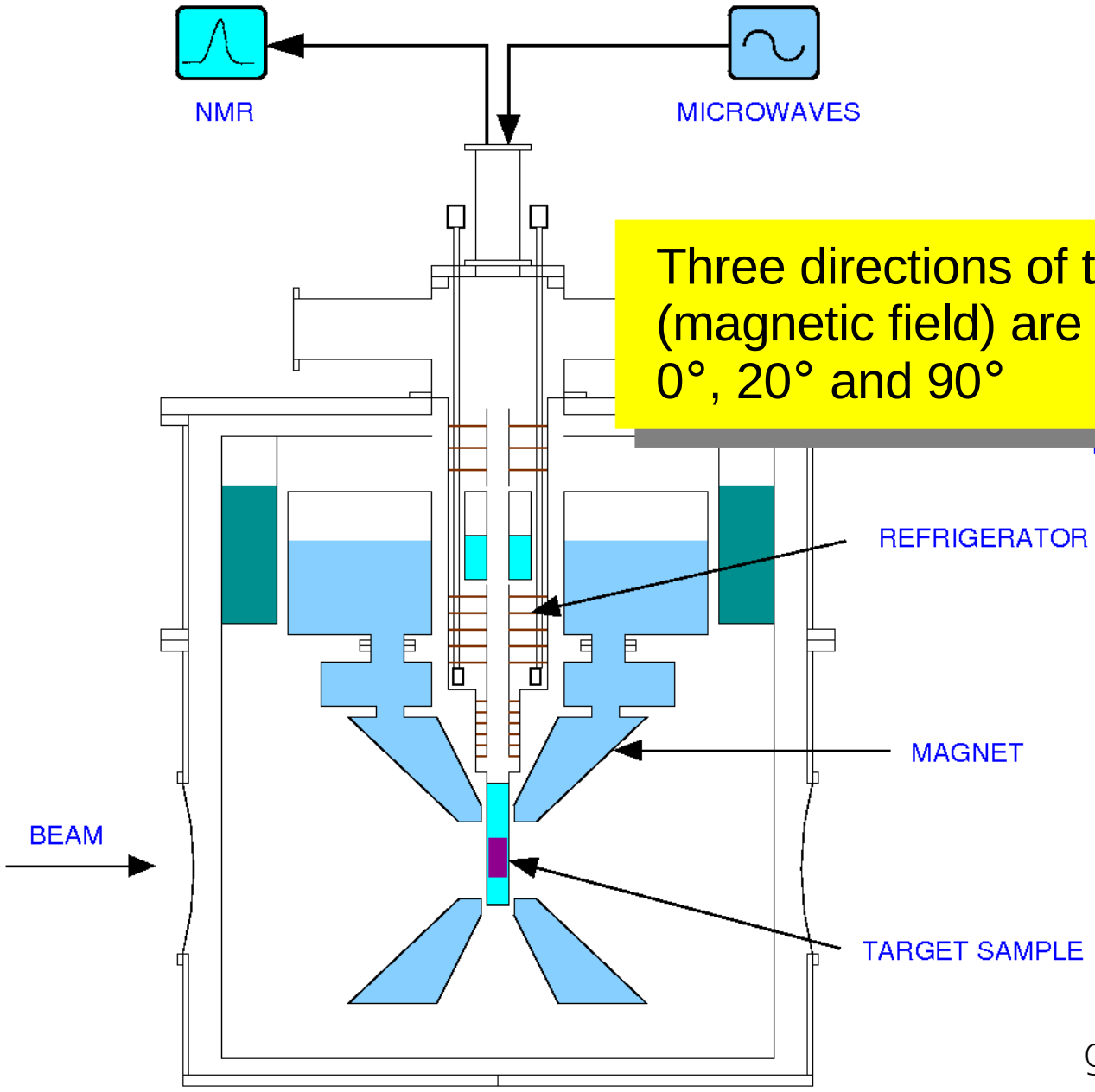


Polarized Target: History

- The target system has been used at SLAC on 3 occasions
  - E143 (1993)
  - E155 (1997)
  - E155X (1999)
- and at JLab on 3 occasions
  - Gen (1998)
  - Gen + RSS (2000)
  - SANE (2008)
- Performance during SANE was compromised by failures of:
  - Superconducting magnet
  - 1K refrigerator
  - Pumping system
  - Target motion mechanism

These (and other) subsystems require substantial repair, modification, or refurbishment for use in Hall A

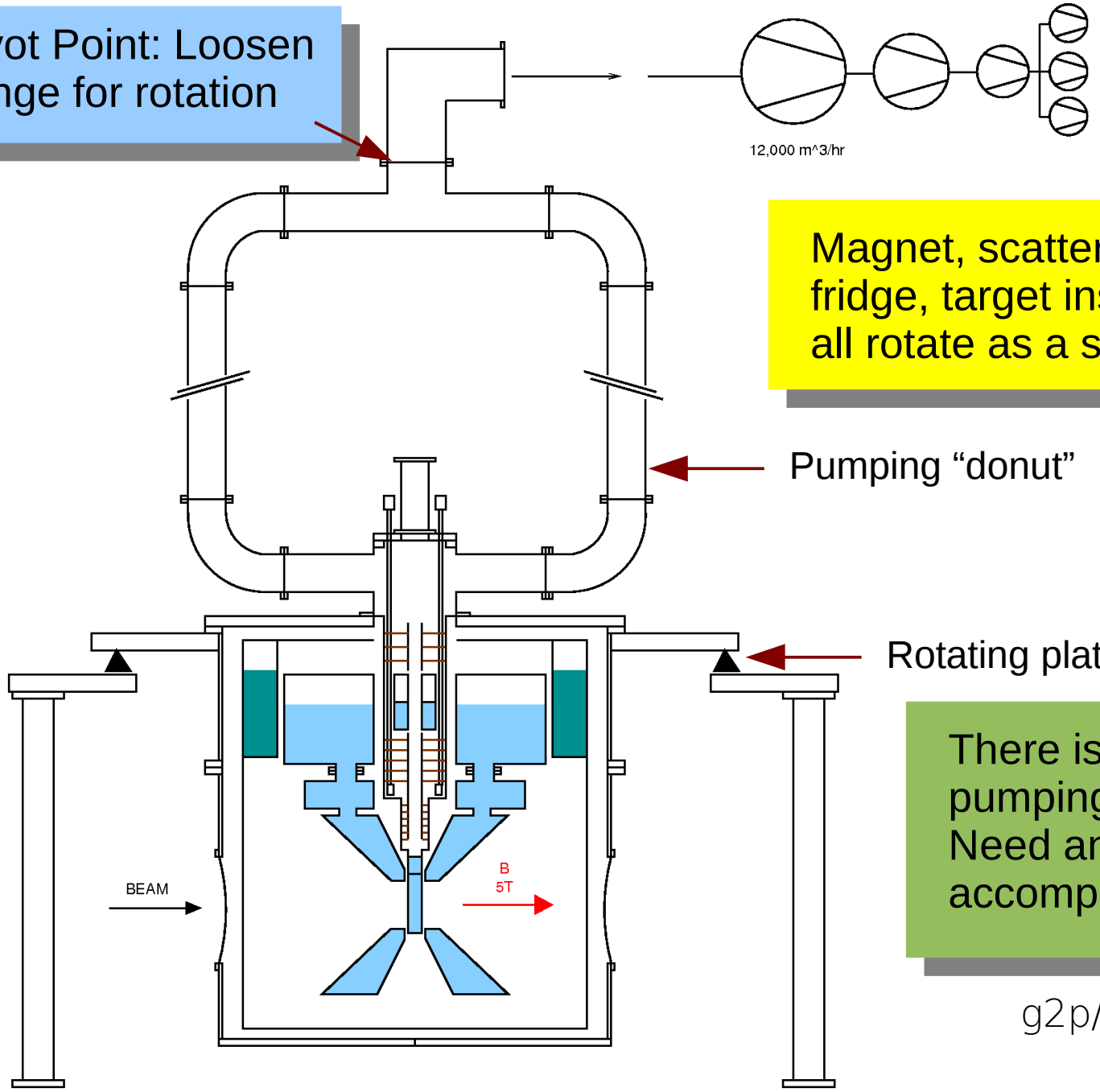
POLARIZED TARGET: ROTATION



Three directions of target polarization (magnetic field) are required for g2p/GEp: 0°, 20° and 90°

POLARIZED TARGET: ROTATION (old)

Pivot Point: Loosen flange for rotation



Magnet, scattering chamber, fridge, target insert & donut all rotate as a single entity.

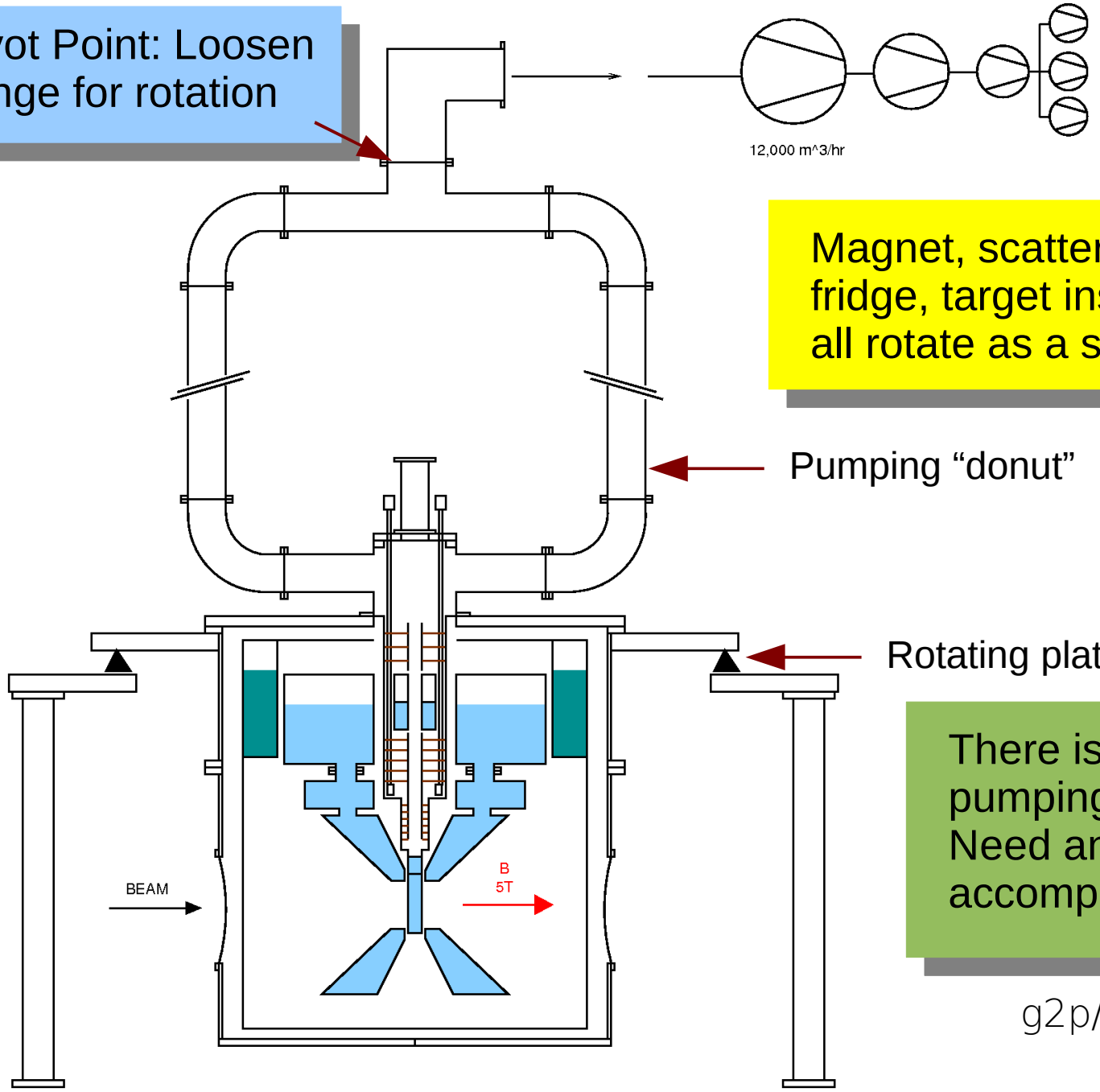
Pumping “donut”

Rotating platform

There is no room for the pumping donut in Hall A! Need another way to accomplish magnet rotation.

POLARIZED TARGET: ROTATION (old)

Pivot Point: Loosen flange for rotation



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Pumping “donut”

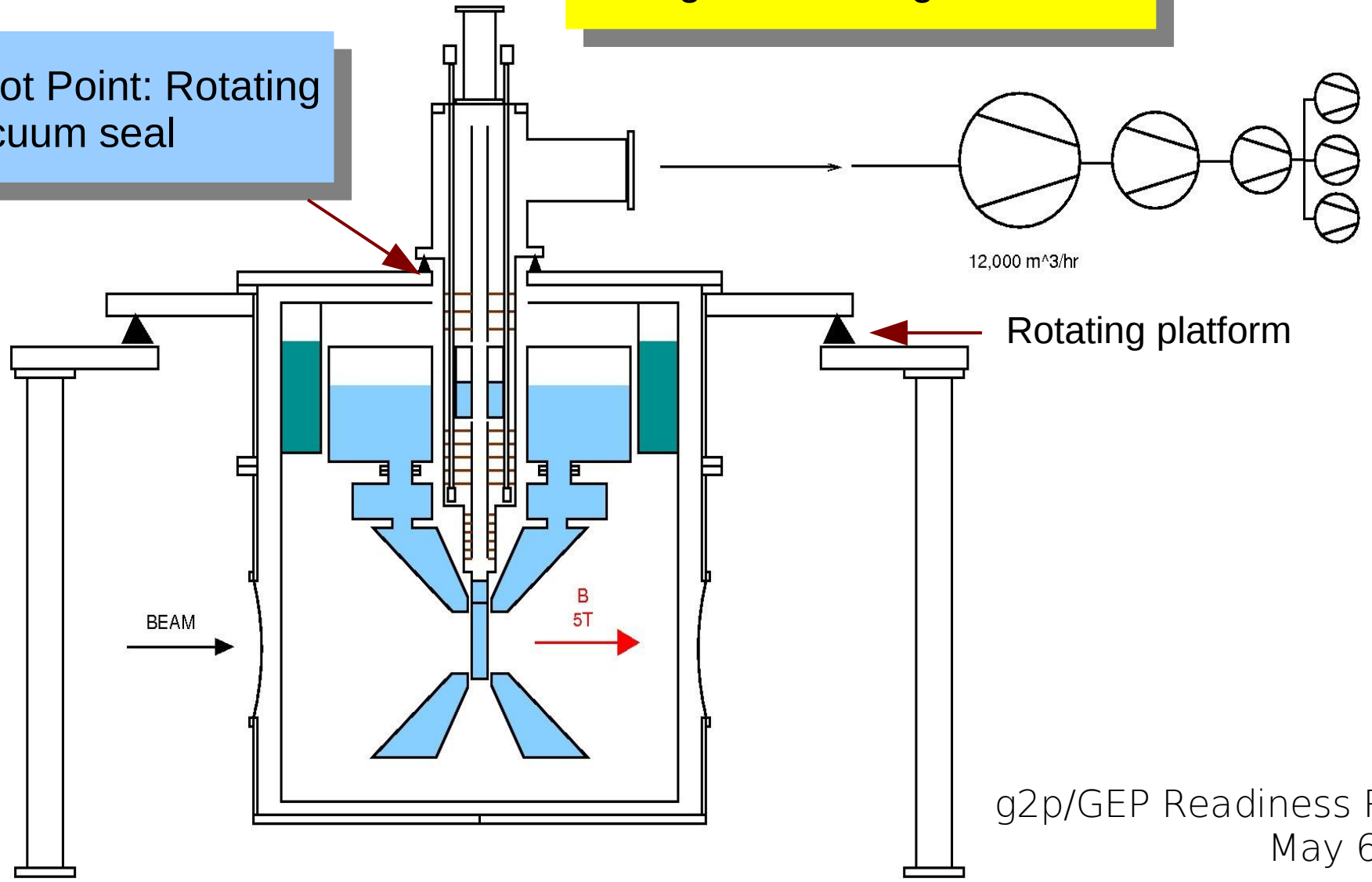
Rotating platform

There is no room for the pumping donut in Hall A! Need another way to accomplish magnet rotation.

POLARIZED TARGET: ROTATION (new)

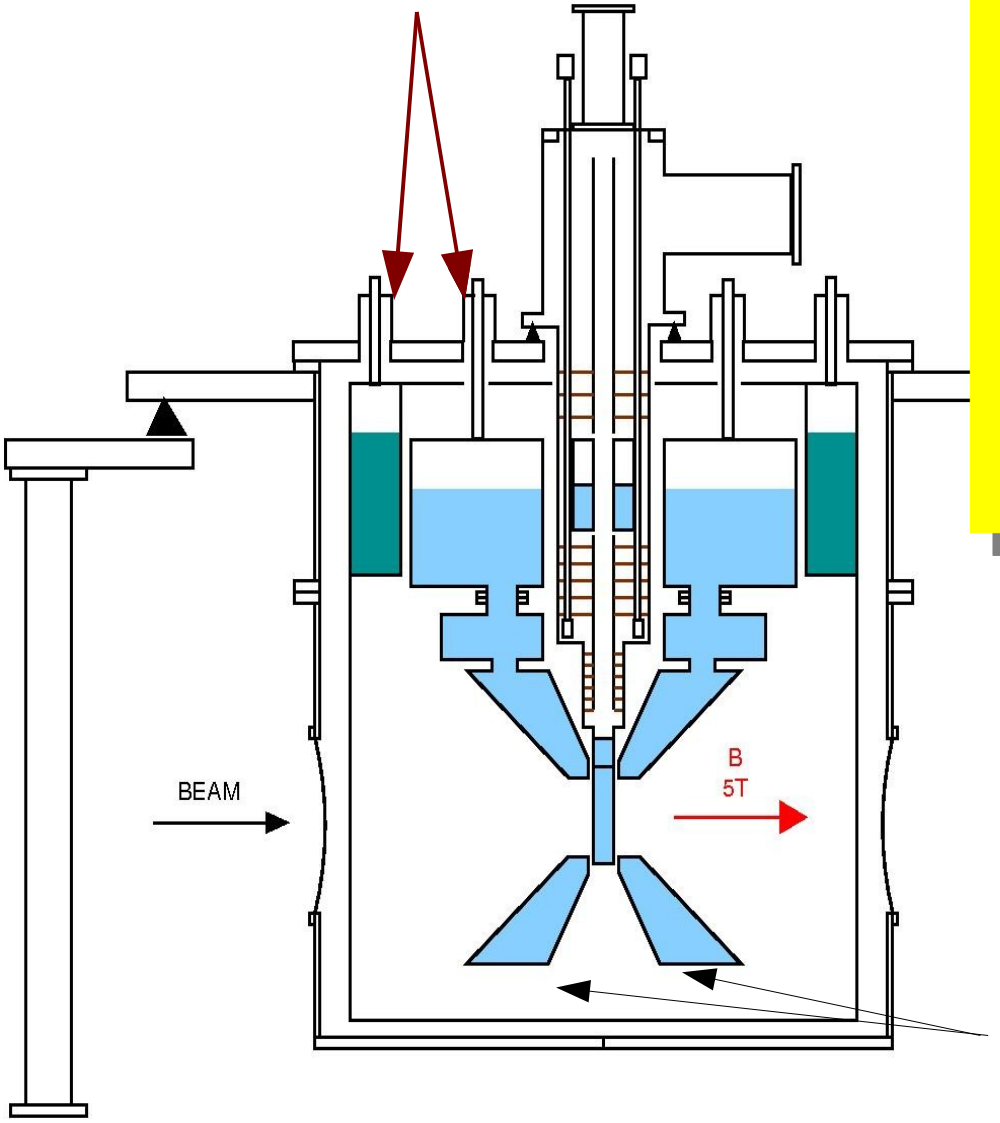
Magnet & vacuum jacket rotate independently of refrigerator & target insert

Pivot Point: Rotating vacuum seal



POLARIZED TARGET: ROTATION (new)

Refrigerator has to rise 15” in order to clear LHe and LN2 penetrations



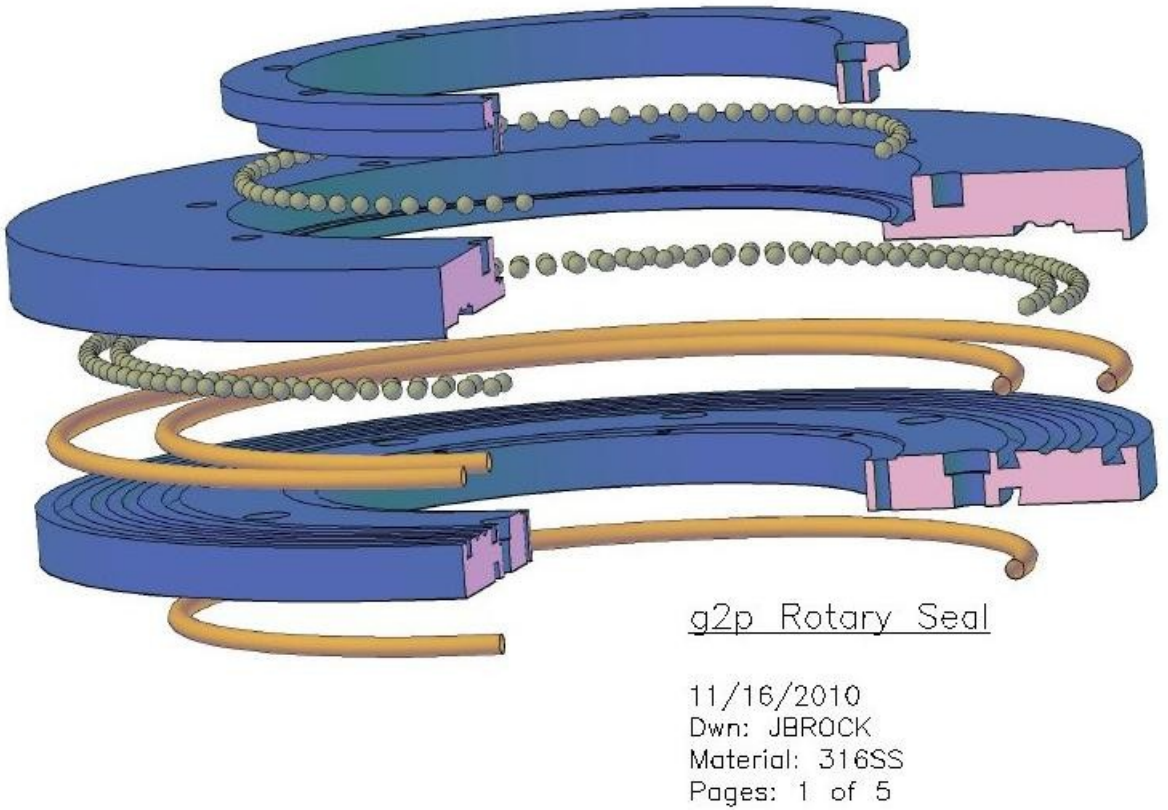
REQUIRES

- New rotating seal
  → Designed, fabricated, tested
- New pumping TEE
  → Design ~~ongoing~~ *completed*
- New, longer fridge
  → Design ~~ongoing~~ *completed*
- New, longer target insert
  → Design ~~ongoing~~ *completed*

POLARIZED TARGET: Rotating Seal

- Differentially pumped, rotating vacuum seal has been designed, fabricated and successfully tested.

- Completion date: Jan 2011.

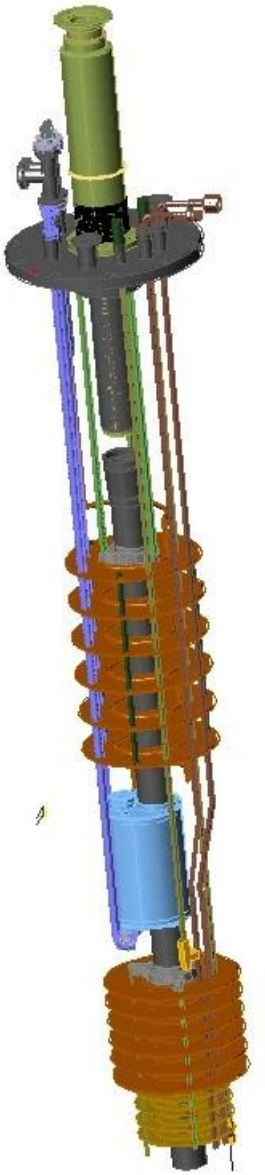


Polarized Target: 1K Refrigerator

- New 1K refrigerator must be constructed because SANE fridge is dead, and UVa fridge is too short for new rotation scheme.

- Design complete.
Fabrication to begin in 1-2 weeks.

- Completion date: July 31

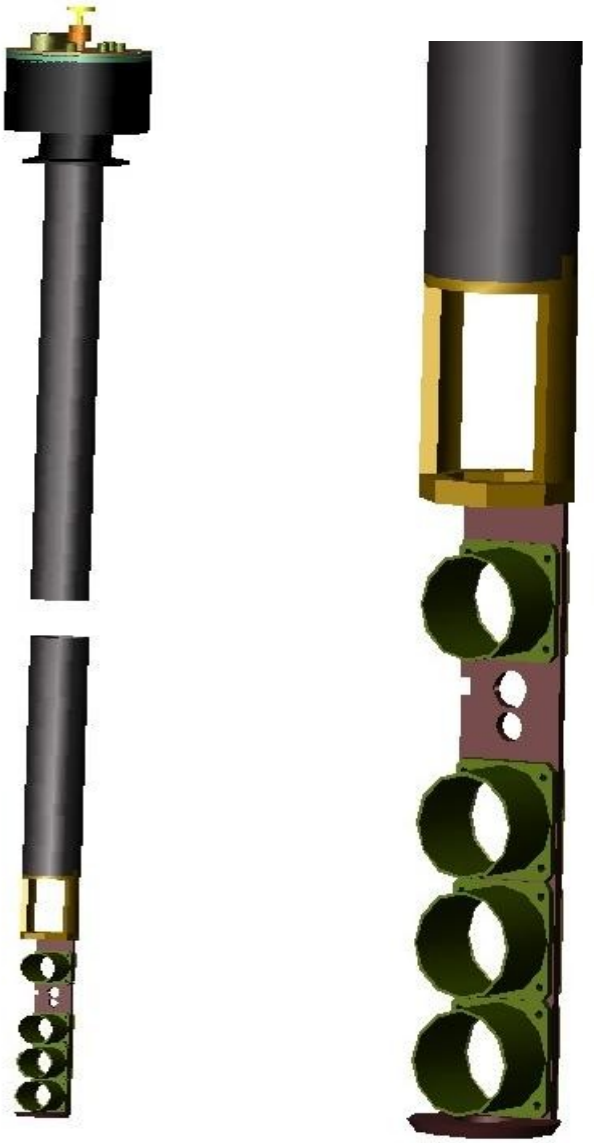


POLARIZED TARGET: Sample Insert

- Longer insert necessary to match new rotation scheme.

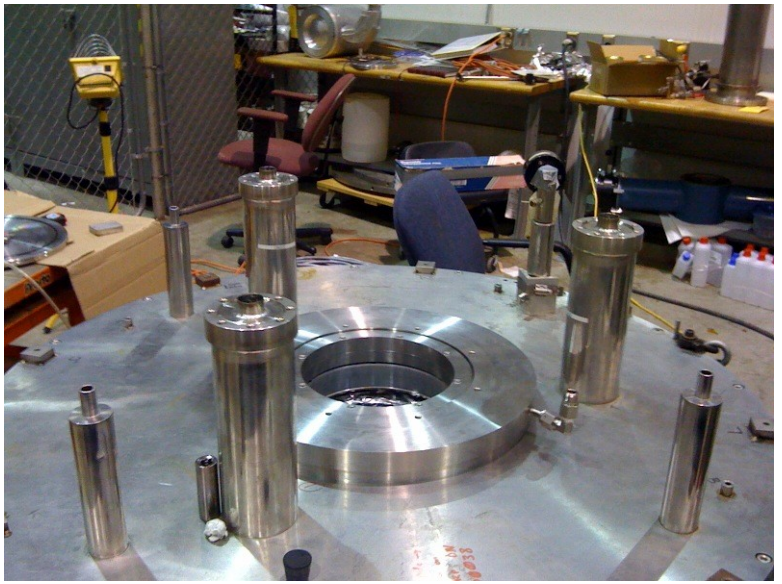
- Carbon fiber insert is more rigid and pinned at the *top* of the fridge, not at the *bottom*.

- Design complete.
Fabrication underway.
Completion date: May 31



Polarized Target: Cryostat

- LHe penetrations on top of cryostat have a history of leaks.
- All three have been refurbished and tested. Replaced rubber o-rings with CF metal seals.
- Installation of magnet leads, wiring, level probes, etc is currently underway.
- Completion date: May 20



Polarized Target: Pump System

- Three Alcatel 2060H rotary vane pumps were damaged during SANE. Subsequently rebuilt at JLab.
- Replaced with Pfeiffer DUO65 magnetically-coupled rotary vane pumps.
- Pump controls to be refurbished in manner of Hall B polarized target.
- Completion date: June 1

Polarized Target: Microwaves & NMR

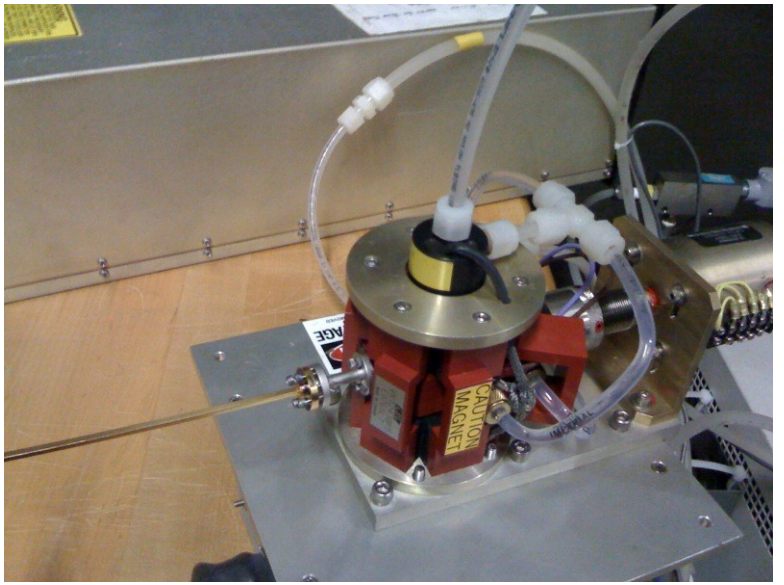
- UVa and JLab Target Groups have multiple EIO tubes and power supplies and various microwave components for 5T operation (140 GHz).

- JLab & UVa Target Groups have multiple Liverpool Q-meters and other NMR electronics for 5T operation (213 MHz).

- For operation at 2.5 Tesla, we will need microwave tube, power supply and other components for 70 GHz.
  Existing NMR components can be modified to operate at 107 MHz.

- All other electronics are currently in house.

- Software (LabView and EPICS) will be updated clones of SANE software.



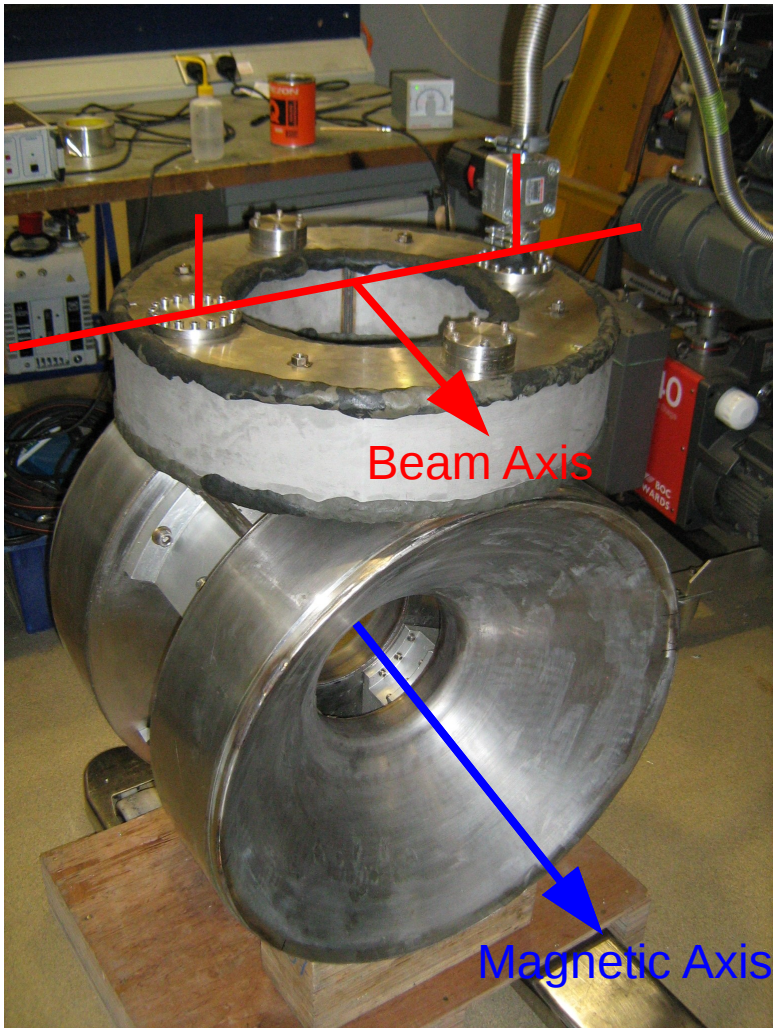
POLARIZED TARGET: Magnet

- Oxford has completed repairs to 5T magnet.
- Arrived at JLab April 25.
- These tubes were cut to length and welded at JLab with assistance from the Survey & Alignment Group...

Room temperature leak check
Oxford, 4-4-11

POLARIZED TARGET: Magnet

- Oxford has completed repairs to 5T magnet.
- Arrived at JLab April 25.
- These tubes were cut to length and welded at JLab with assistance from the Survey & Alignment Group...
- Align “beam” axis with “magnetic” axis, and correct for roll and yaw.
- Final welding completed May 4, leak check now in progress.
- Final survey scheduled for May 10.



POLARIZED TARGET: Buffer Dewar System

- Will utilize the same 500 liter LHe dewar as SANE. No modifications required.

- Dewar will be filled from ESR via distribution can normally used by Hall A cryotarget. Boil-off returned at 5 – 6 K.

- This requires construction of two 30' transfer lines with integrated JT valves. Currently under construction. Completion date May 31.

- Cryo Group has requested construction of a short jumper necessary to provide 4K to cryotarget distribution can. Currently under design by Cryo.
Completion date: June 15.

Polarized Target: Schedule

May 6 Magnet alignment and welding complete

May 23 Cool and test magnet in EEL (3 days)

July 27 Final alignment of refrigerator/magnet/cryostat (2 days)

→ Aug 15 Cool down and polarization test in EEL (5 days)

→ Sep 1 Begin target installation (45 days)

Sep 23 Align target in Hall A (2 days)

Nov 1 Cool and fill buffer dewar (2 days)

→ Nov 7 Cool target, begin NMR calibrations (3 days)

Nov 14 Polarize target, ready for beam