UNH Target Group Status and Goals

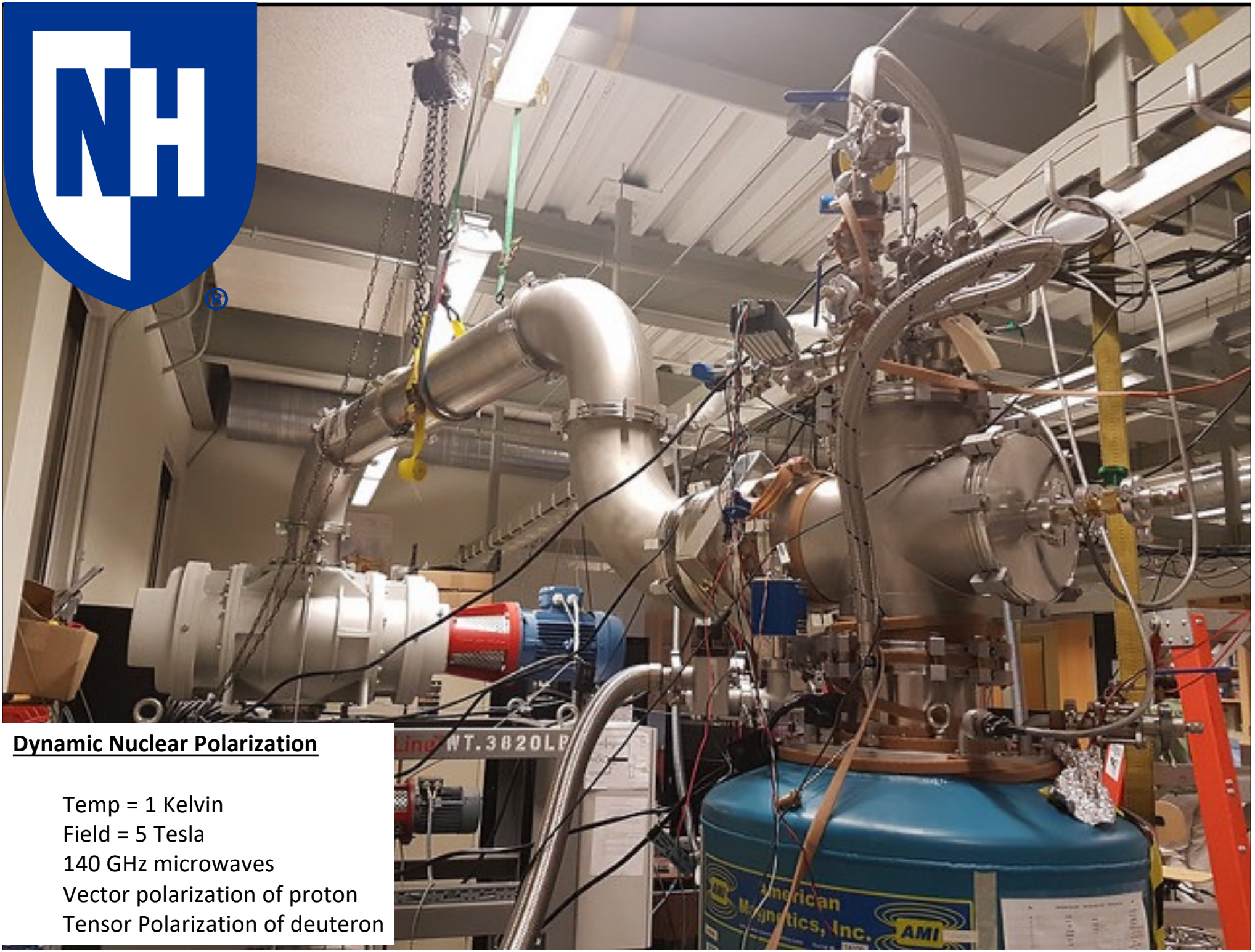
b_1/A_{zz} Tensor Collaboration

Jefferson Lab
2026-06-03

Karl J Slifer
University of New Hampshire

Polarized Target Group

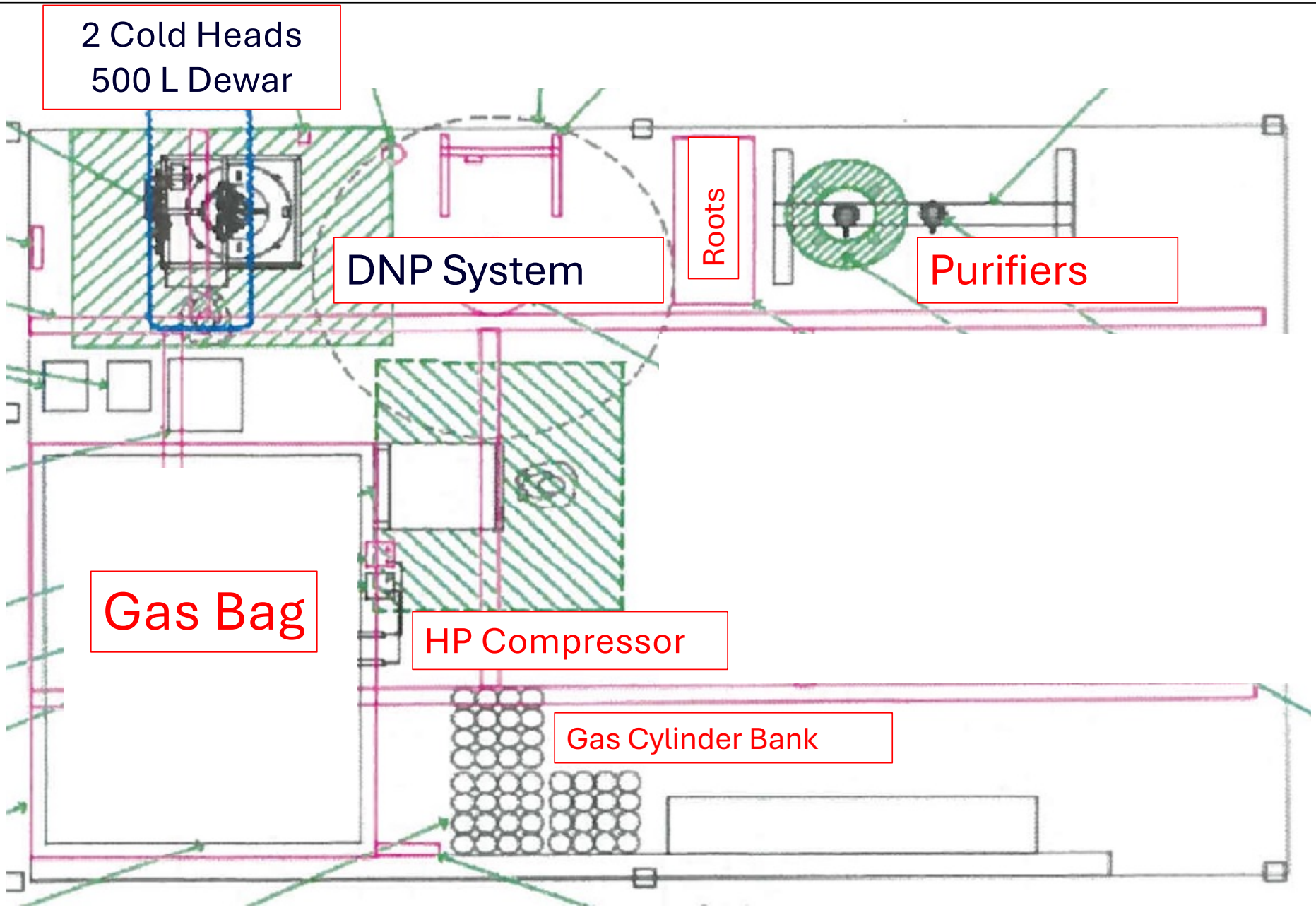
Anchit Arora (PhD Student)
Eli Phippard (Undergrad)
Ben Limric (Undergrad)
Muhammad Farooq (PhD Student)
Chhetra Lama (PhD Student)
Utsav Shrestha (Post Doc)
Sam Takwira (Masters)
Aden Whitney (PhD Student)
Elena Long
Nathaly Santiesteban
Karl Slifer



Dynamic Nuclear Polarization

Temp = 1 Kelvin
Field = 5 Tesla
140 GHz microwaves
Vector polarization of proton
Tensor Polarization of deuteron

Helium Recovery System



Helium Recovery System

HP Gas cylinders

Gas Bag

Helium Purifier (dual)

Cold Heads
500 L Mother Dewar

Helium Recovery System Status

Rate: 40 L/day (average), 30-50L/day (variable)

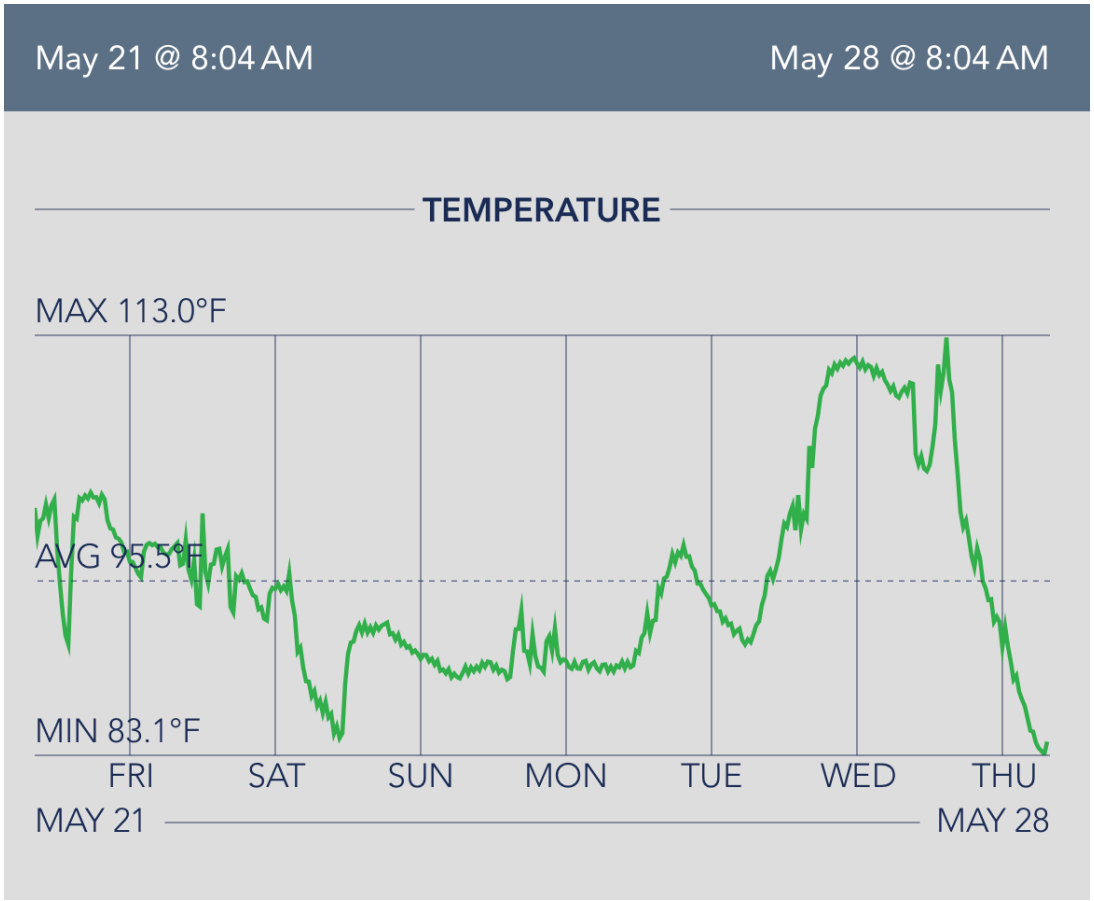
Recapture efficiency : >90%

Liquid Capacity: 500-800 Liquid Liters Storage

Gas Capacity: 580 Liquid Liters Equivalent in 48 HP cylinders

Duty cycle: 5 days of physics followed by 3 weeks of recovery

New Cooling Unit



Installed Monday!

ANALYSIS OF THE COMPLEX NMR LINESHAPE OF POLARIZED DEUTERONS

BY

MICHAEL J. J. P. MCCLELLAN

BS, Central Connecticut State University, 2012

MS, Christopher Newport University, 2017

DISSERTATION

Submitted to the University of New Hampshire

in Partial Fulfillment of

the Requirements for the Degree of

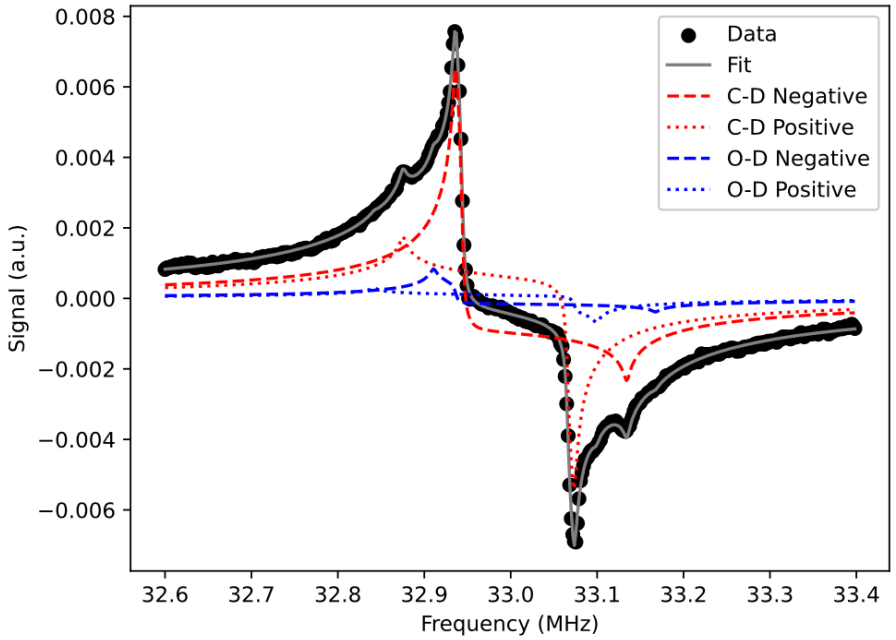
Doctor of Philosophy

In

Physics

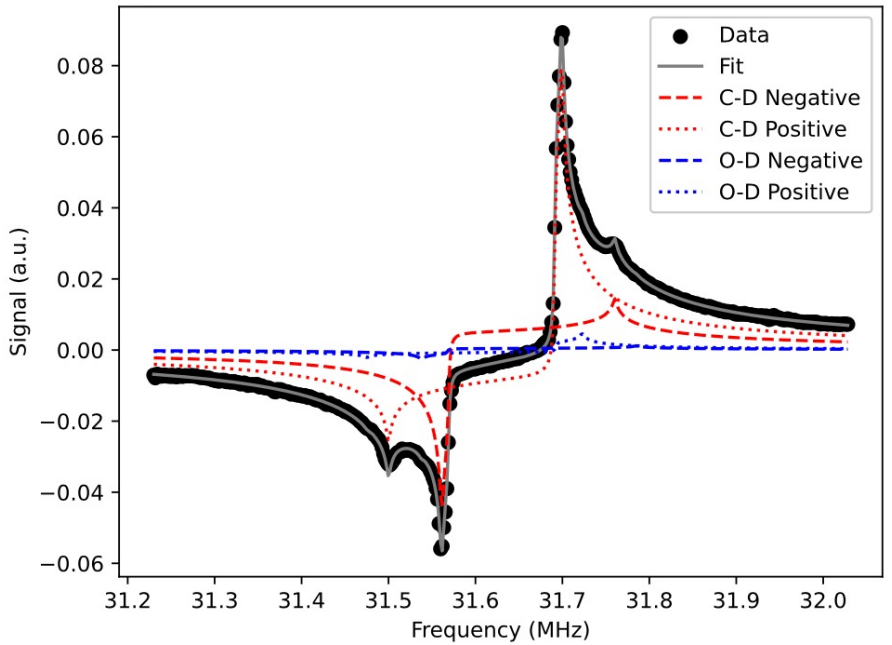
May, 2026

Irradiated D-Butanol Complex NMR Signal



Aug. 29, 2024
Theta=-87 deg

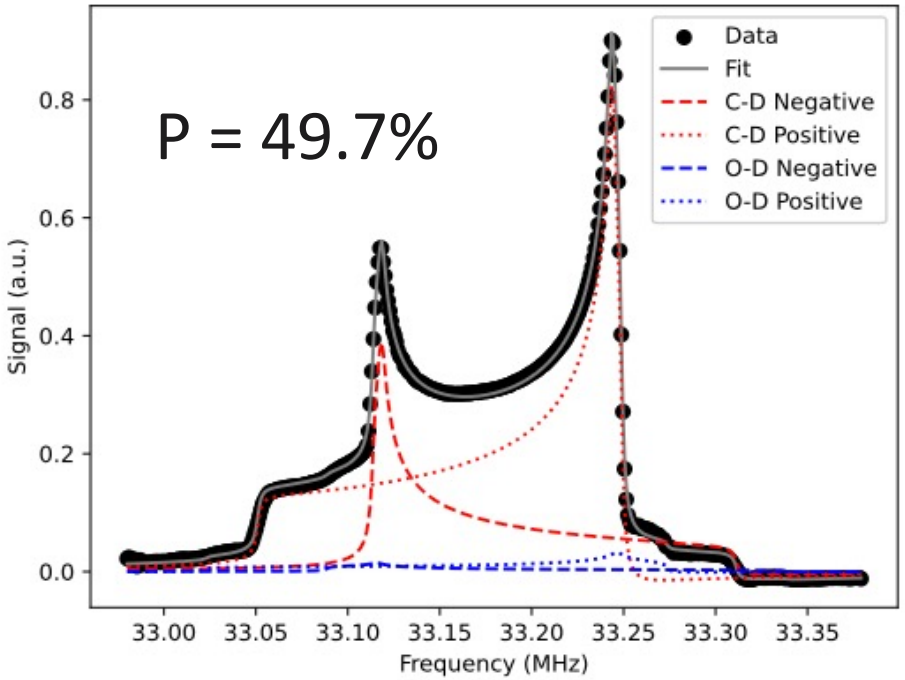
P= -16.9%

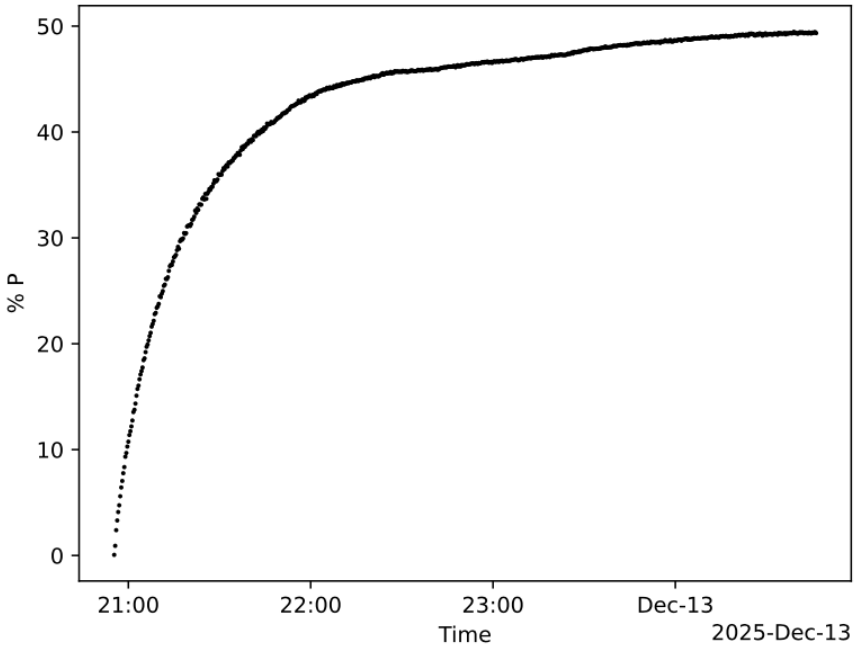


Aug. 29, 2024
Theta=-88.5 deg

P= +36.8%

Irradiated D-Butanol

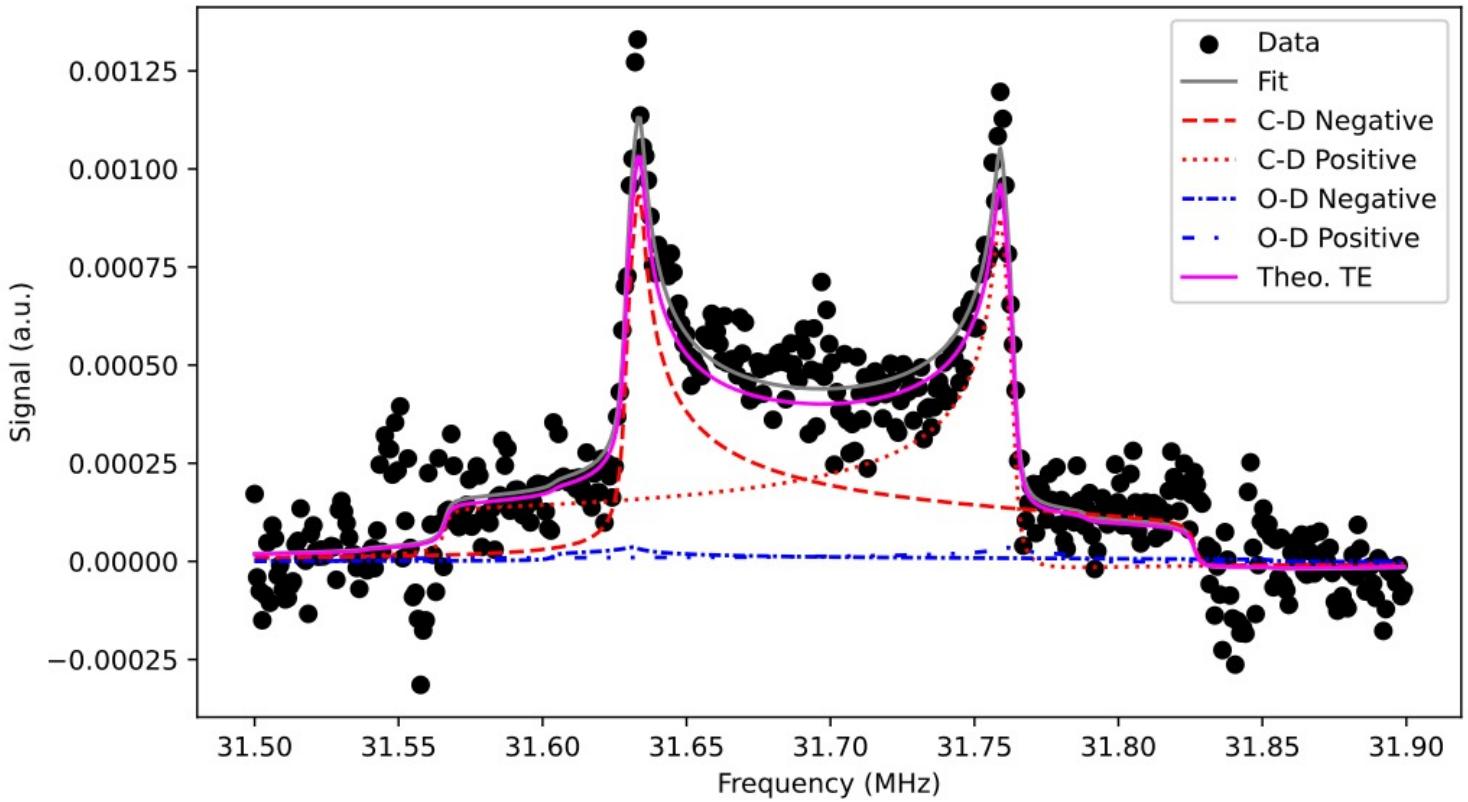




Dec. 13, 2025

B=5.077T
142.2731 GHz

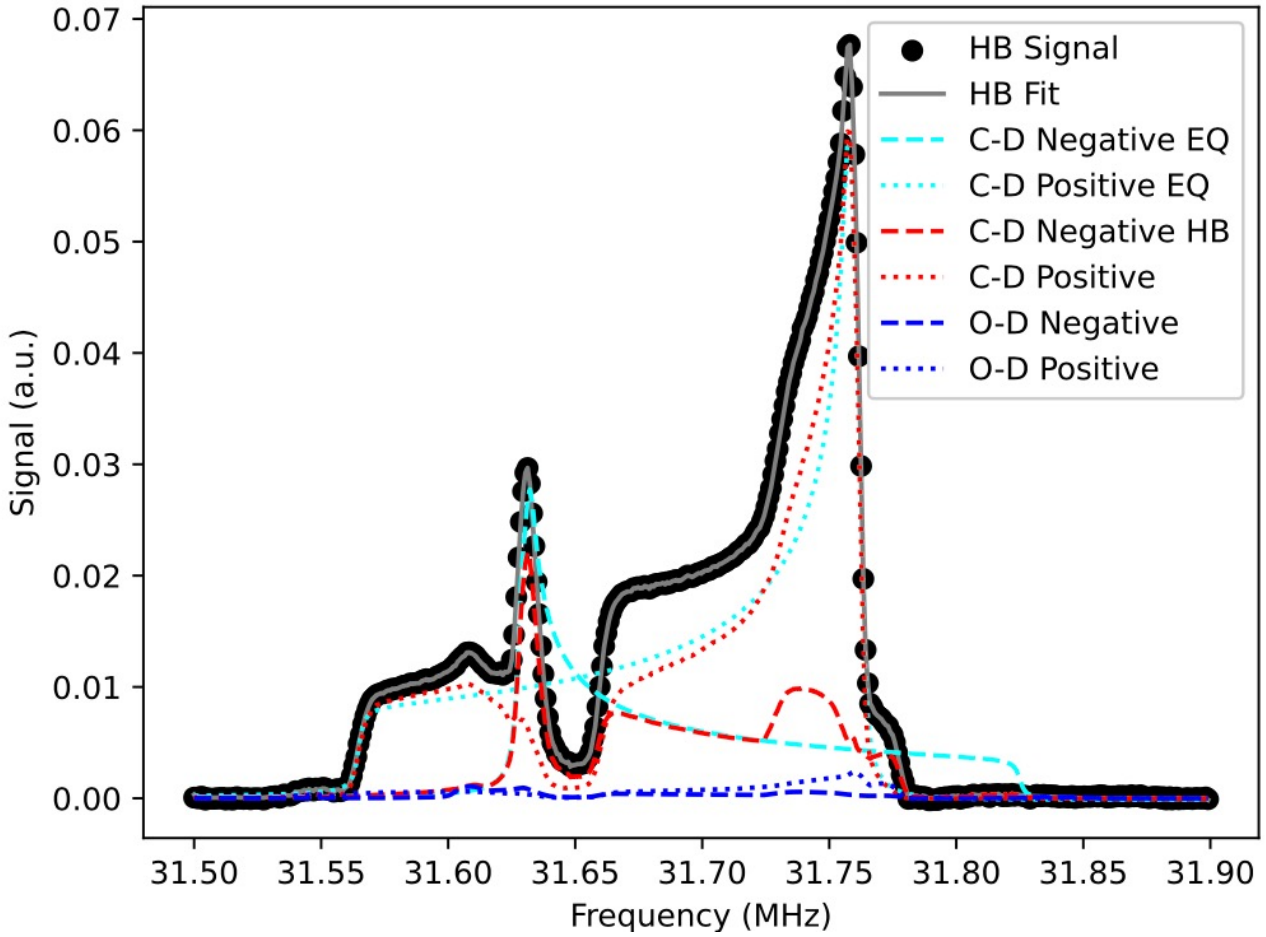
Irradiated D-Butanol T.E.



Dec. 15, 2025

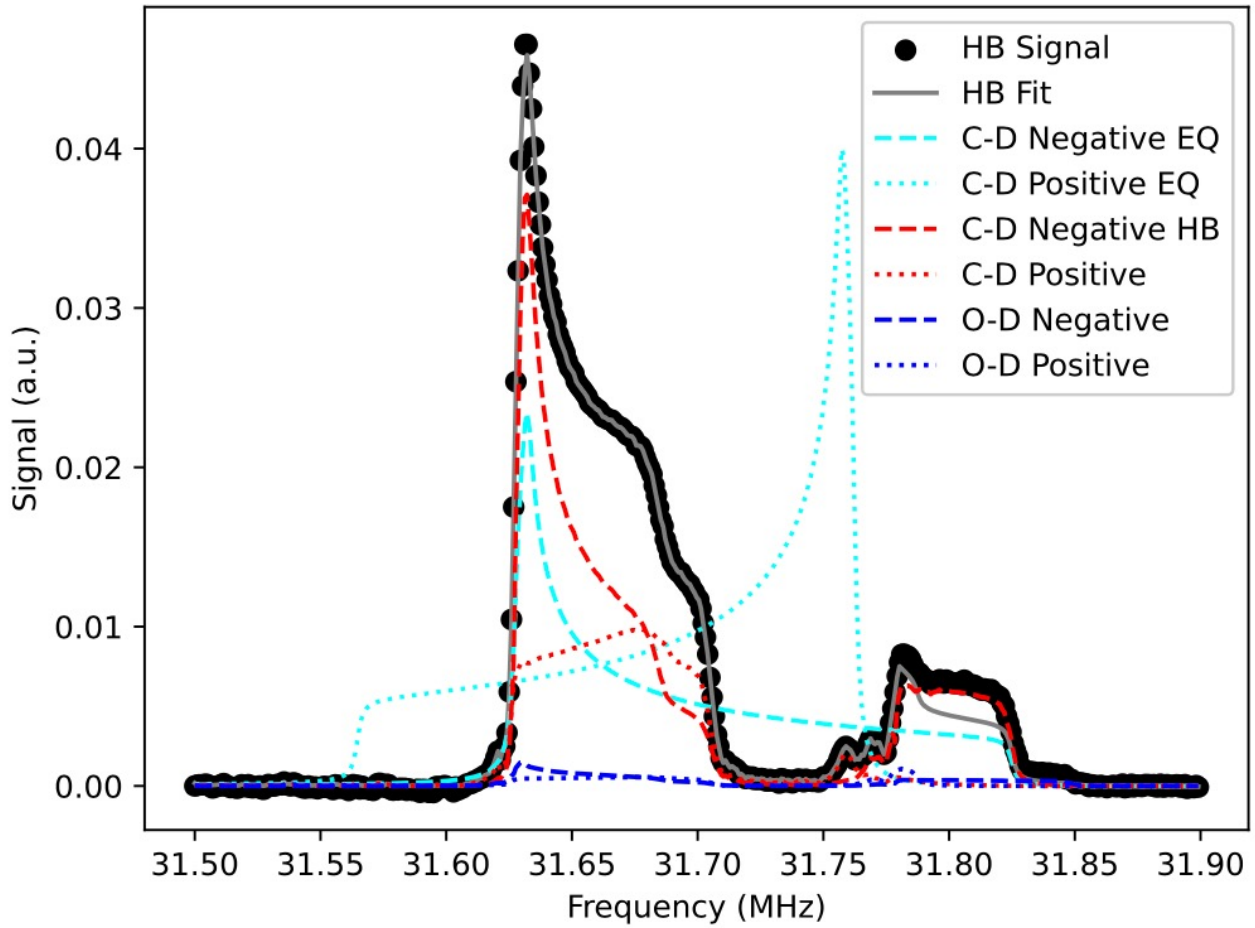
4.850 T
1.67 K
P=0.061%

Irradiated D-Butanol



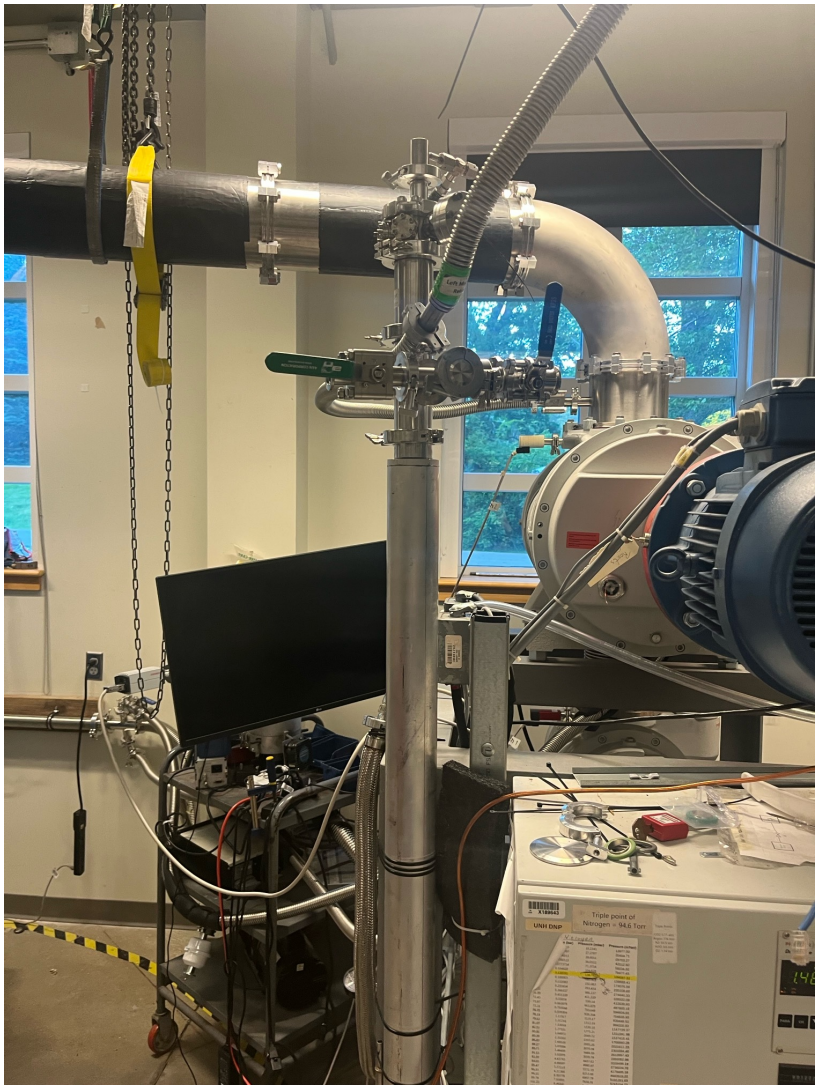
Dec 16, 2025
P=43%
Q=19%

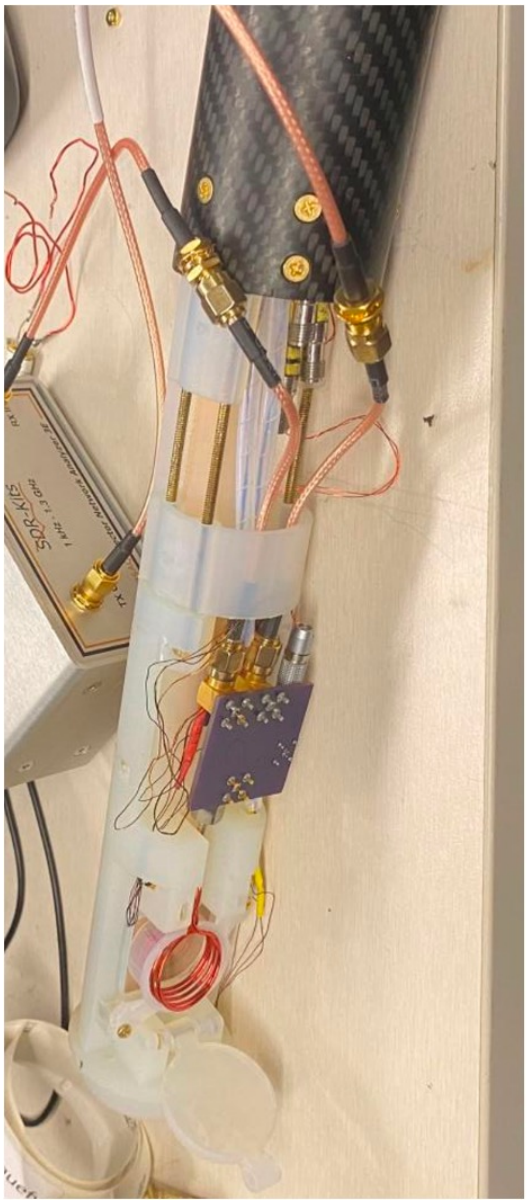
Irradiated D-Butanol



Dec 16, 2025
P = 22.5%
Q= -6.8%

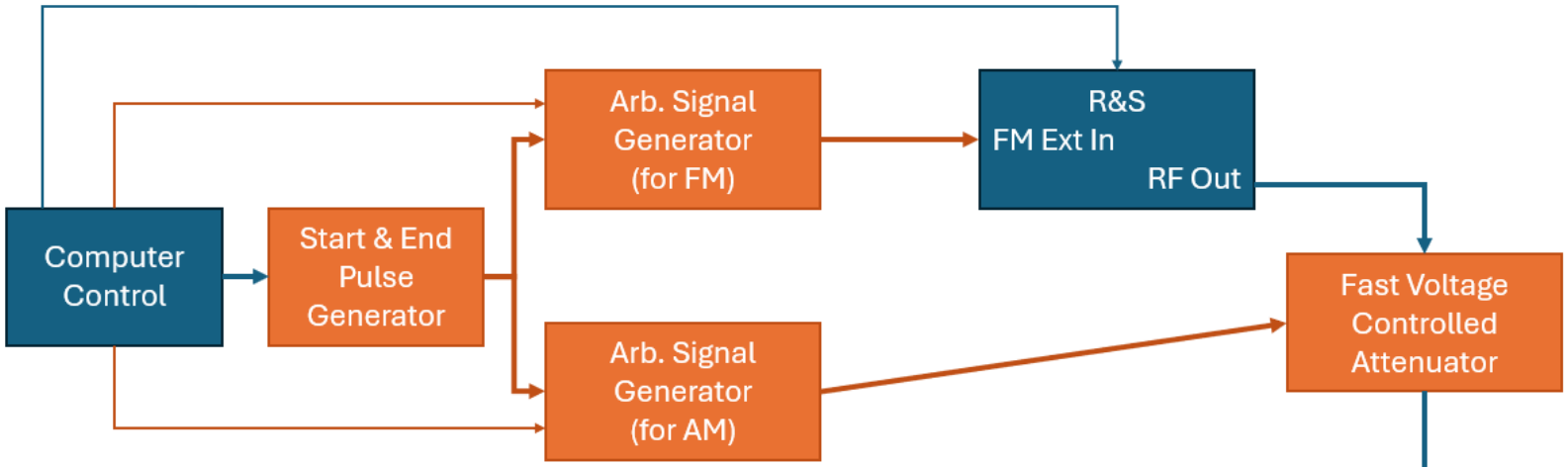
New Target Ladder





See Anchit's talk

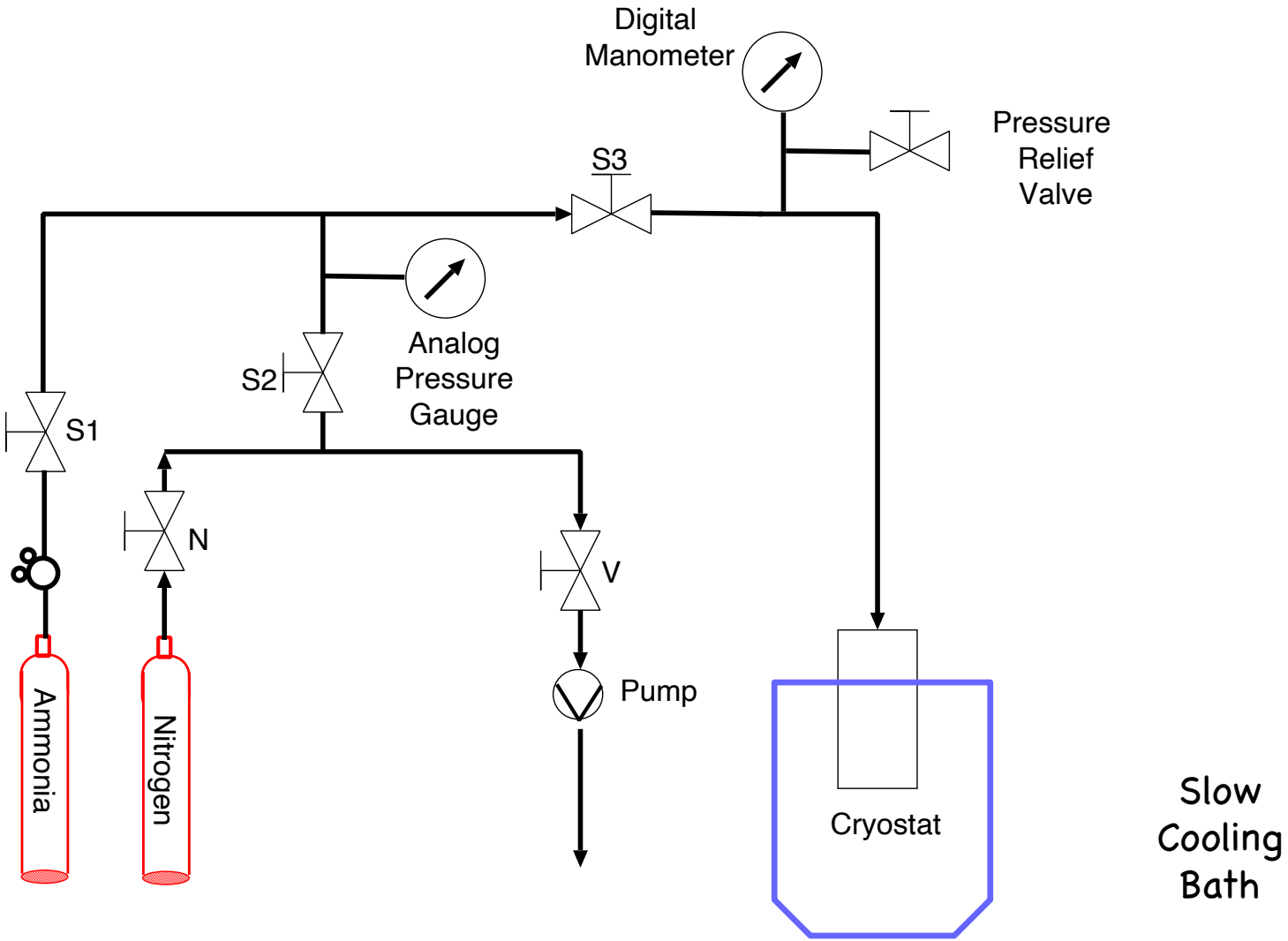
New SSRF Circuit



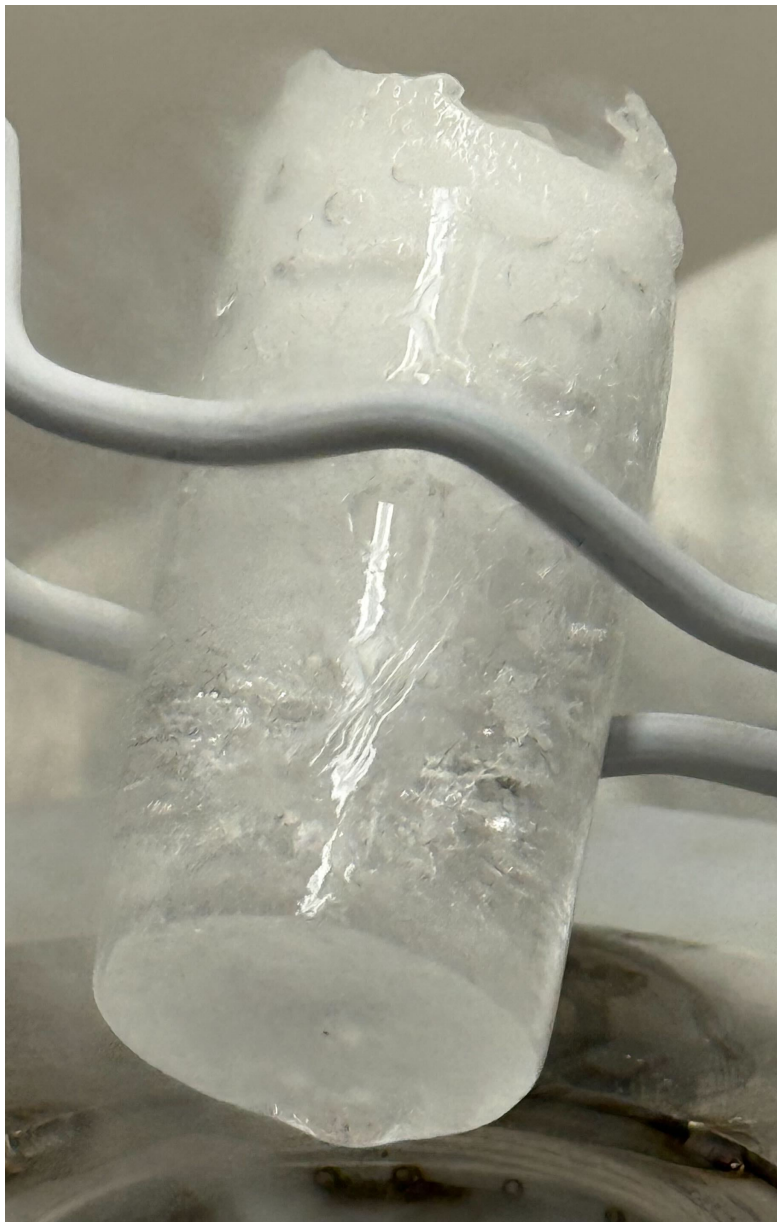
- Computer sends custom FM & AM signals to the arbitrary signal generators
- Computer tells Pulse Generator Δt between start & end, and when to start
- Pulse generator sends Start Pulse simultaneously to FM & AM Arbitrary Signal Generators
- Arb. Signal Generators simultaneous send out their signals
  - FM is sent to R&S like the current set-up
  - AM is sent to a VCA capable of >100kHz response
- FM'ed RF signal is sent to VCA, where it gets AM'ed
- Final signal sent to RF amplifier & ssRF coils
- Pulse generator sends End Pulse to FM & AM Sig Gens, setting FM outside NMR window and setting AM to Amplitude = 0

See Farooq's talk

Target Material Production



Target Material Production



Quantitative study of Flash Freezing vs Slow Cooling

Eli Phippard Undergrad Thesis

May 2026

Summary

Helium Recapture System

Generating more heat than our lab can dissipate
New Air Handler Installed
In-situ Chiller being replaced with Building Water

Target Sticks

Building redundancy to avoid further delays
Goal is to have atleast two sticks working this summer.

DNP and ssRF Results

We've hit max expected polarization in d-Butanol

HB spectrum looks ideal.
But we've using too much power on SSRf burns
kills polarization. New SSRF control software.

Demonstrated small amount of negative tensor polarization

Material Production

Reliable method to slow cool creates higher quality material