The n3He Experiment: Target Ion Chamber

for the n3He Collaboration
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June 3, 2014

ACNS 2014 Knoxville, TN.

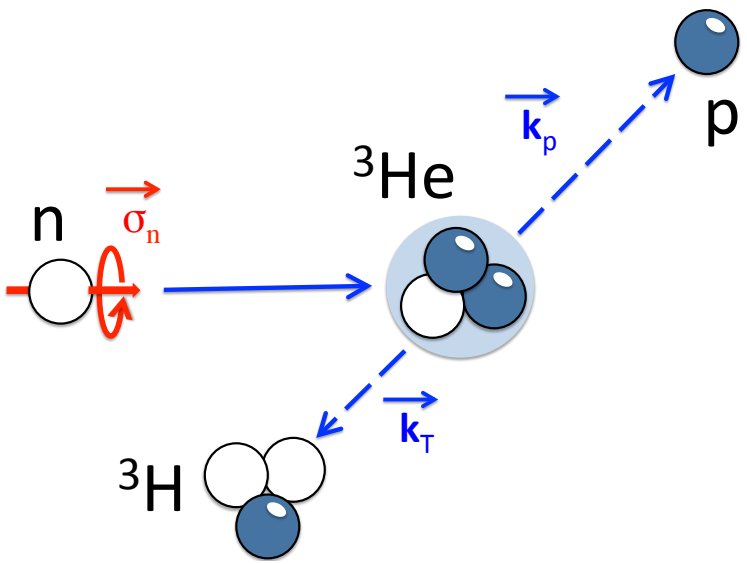
n3He: Target Ion Chamber

1. Introduction
2. Experiment Setup
3. Ion Chamber Assembly
4. Current Status

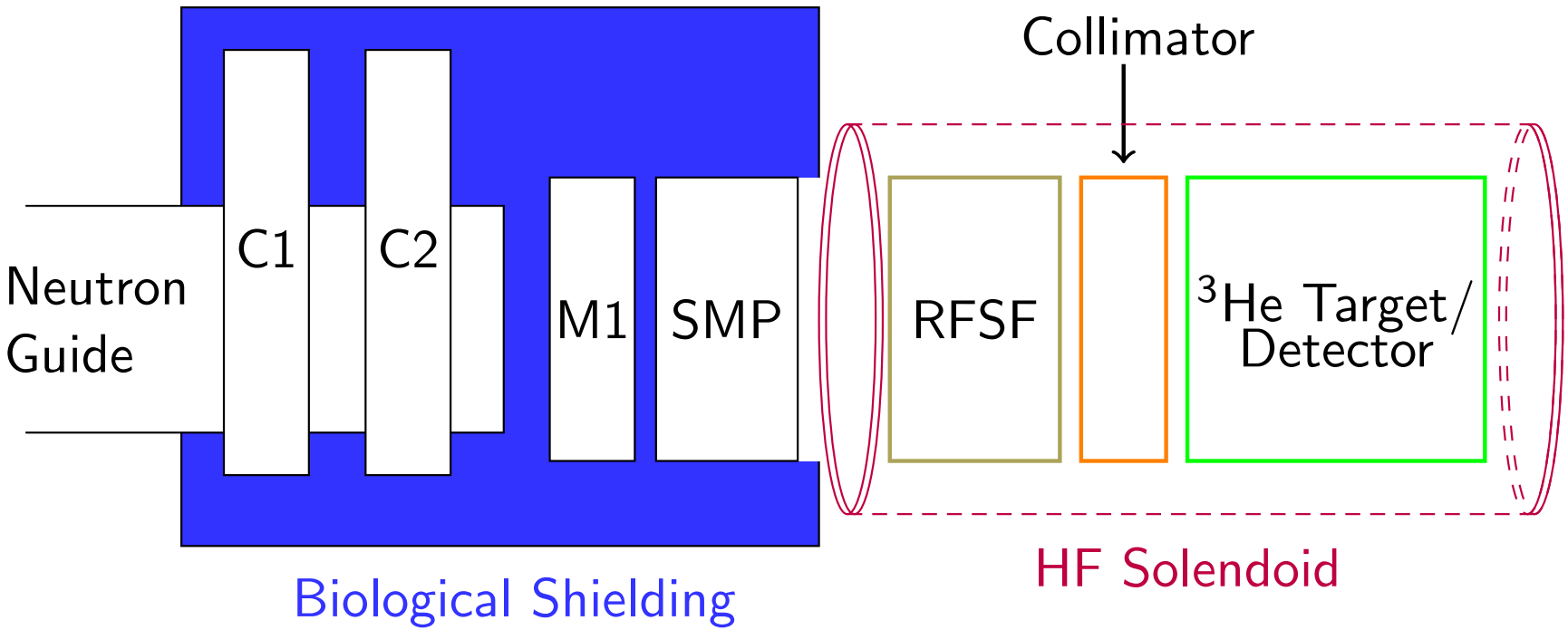
n3He Introduction

n3He probes the weak nucleon-nucleon interaction by measuring the parity violating directional asymmetry between the polarization direction of the incoming cold neutrons and the direction of the outgoing protons in the reaction

$$\vec{n} + {}^3He \rightarrow {}^4He \rightarrow p + T + 765keV$$

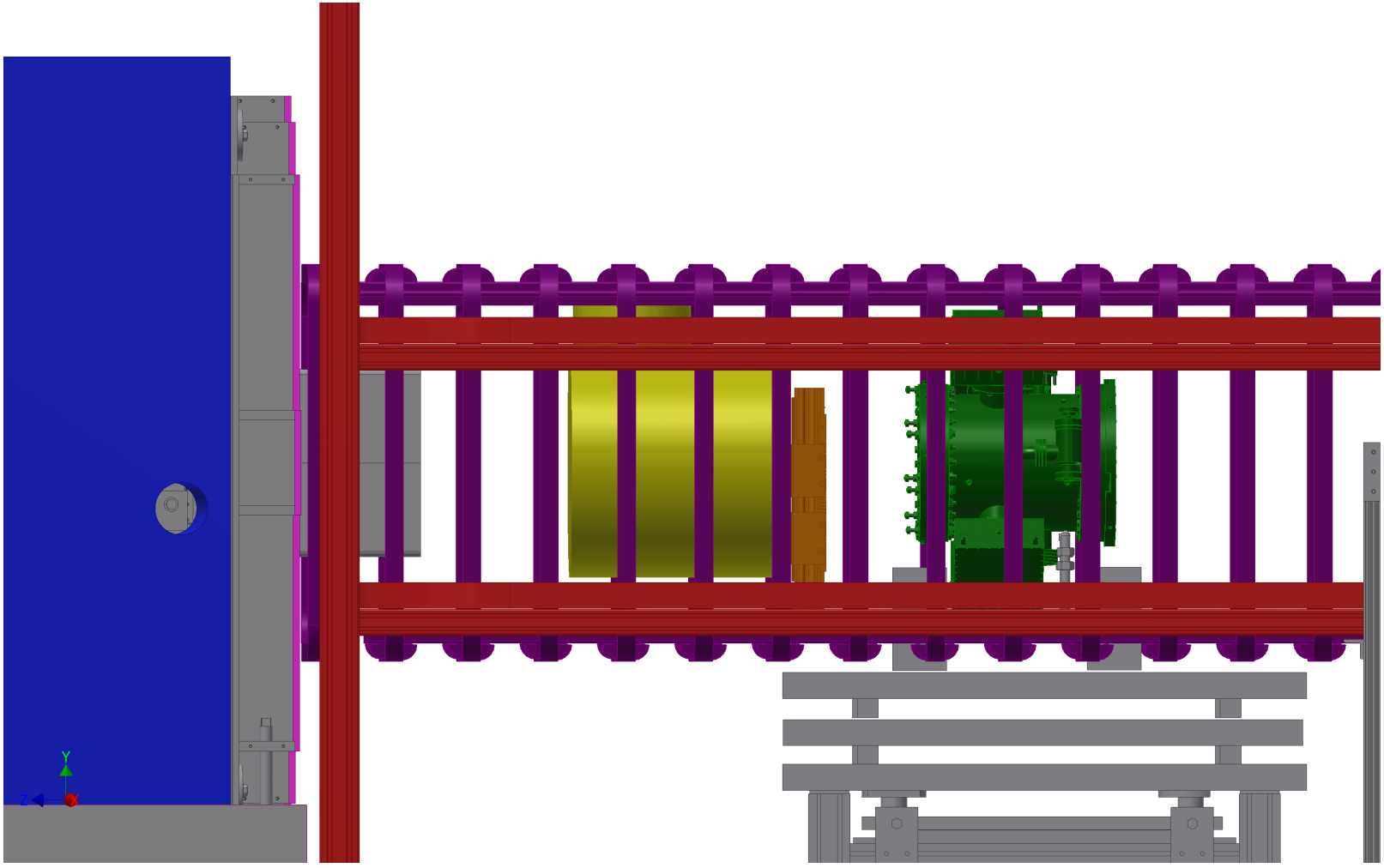


n3He Schematic Diagram in FnPB

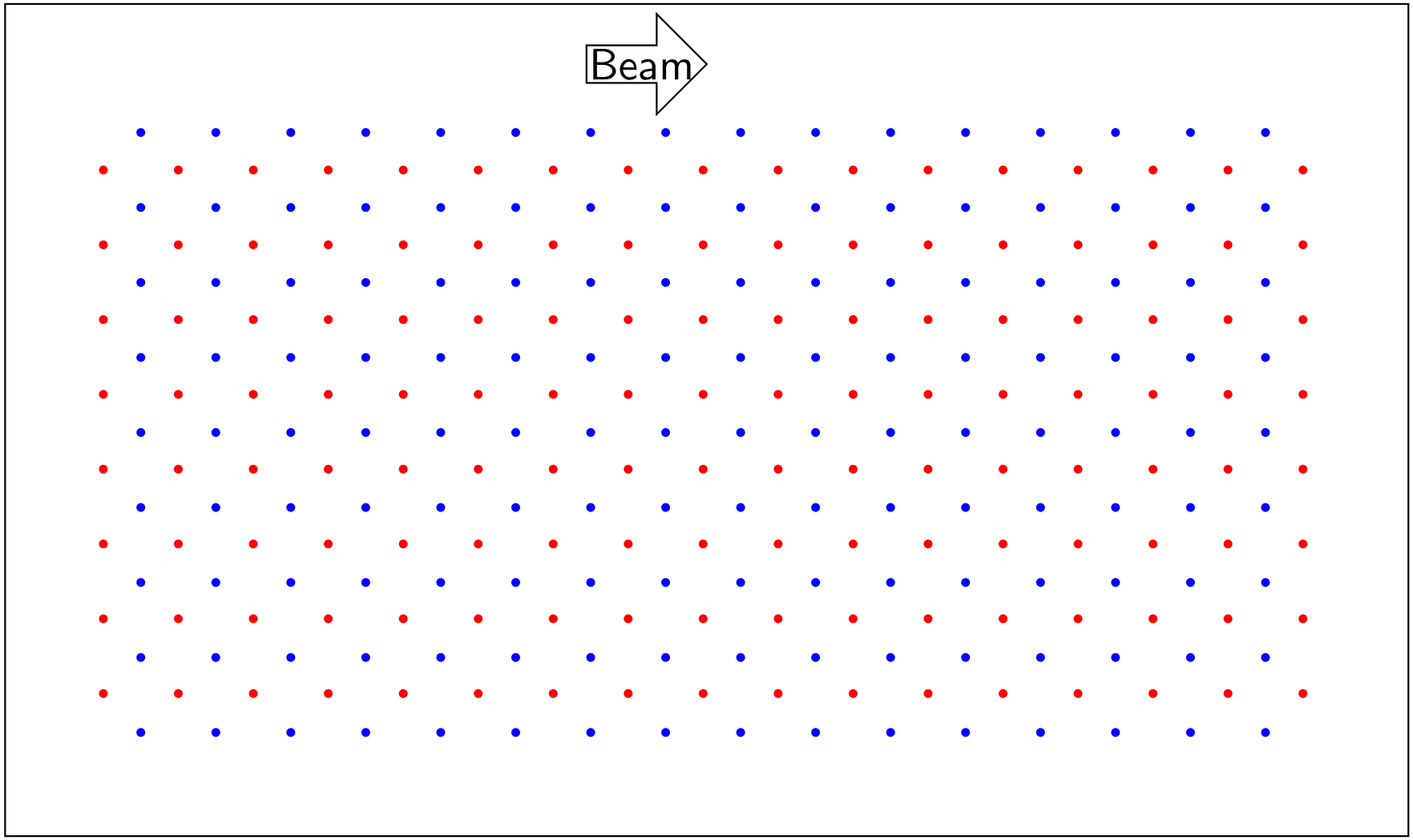


H2.05: Resonant Frequency Spin Rotator for the n3He Experiment, Christopher B. Hayes

Beamline CAD Model



n3He Target/Detector Chamber

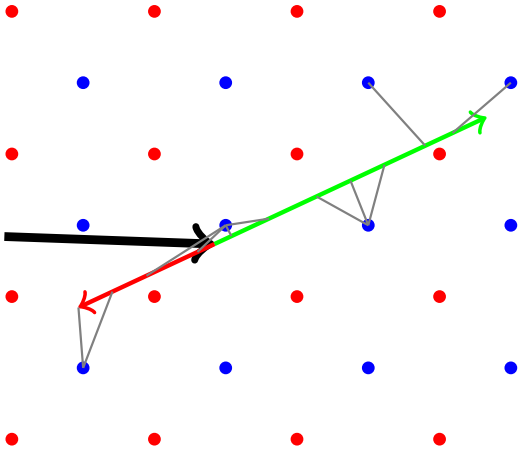


- HV 17 HV Frames with 8 wires each
- Signal 16 signal Frames with 9 wires each

1 atm. He-3

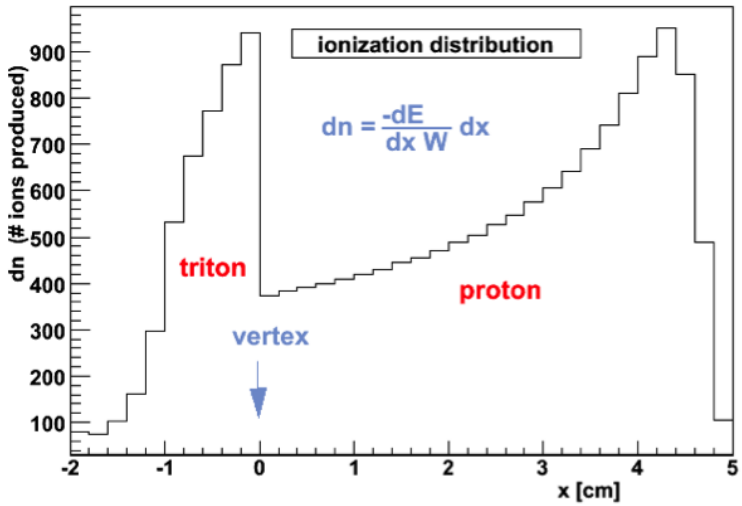
Proton Asymmetry in Chamber

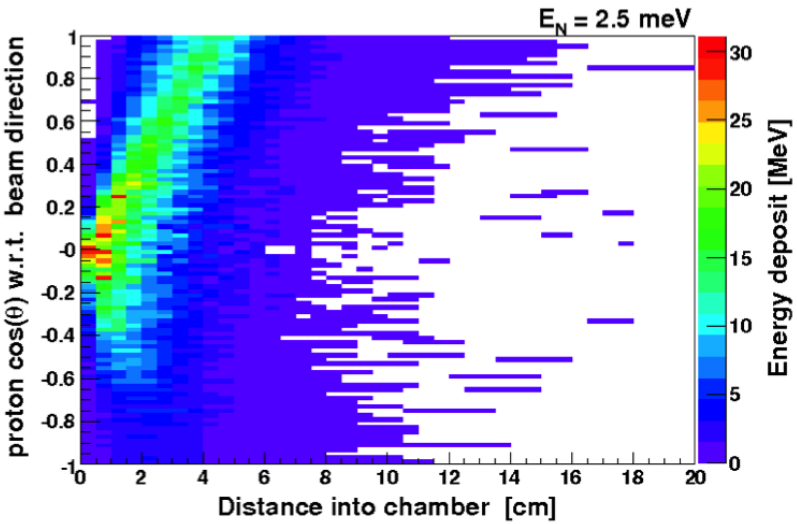
$$\vec{n} + {}^3He \rightarrow p + T + 765keV$$

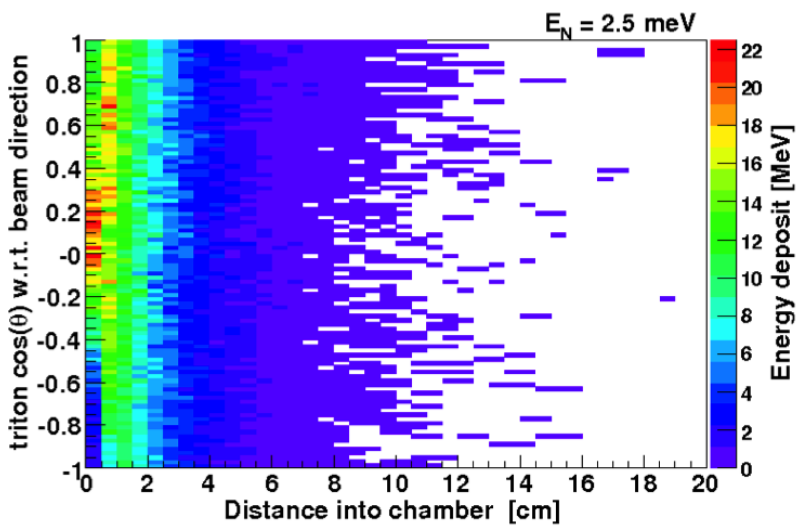


neutron proton Triton

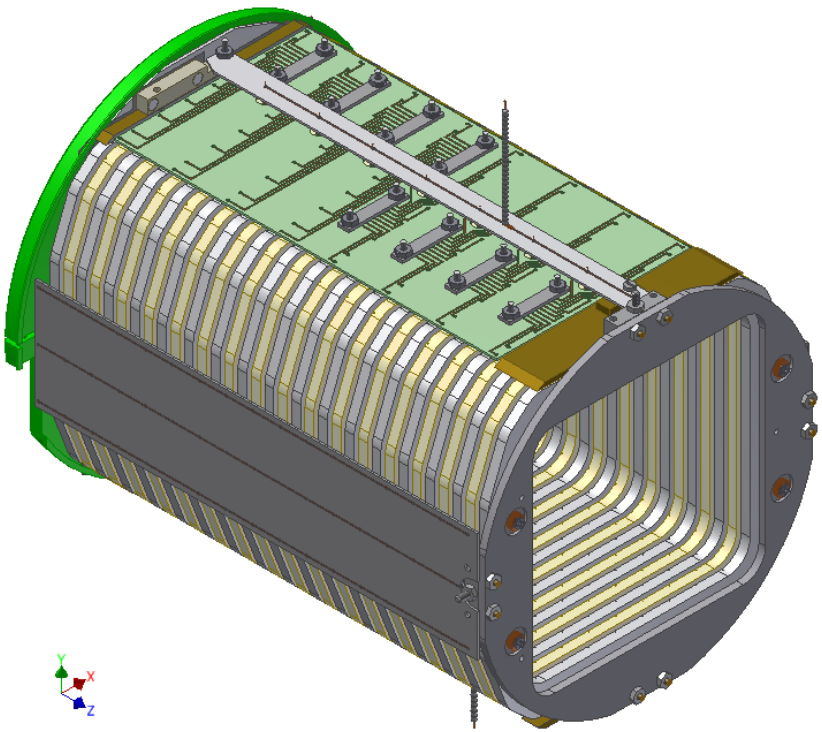
Charge Collection



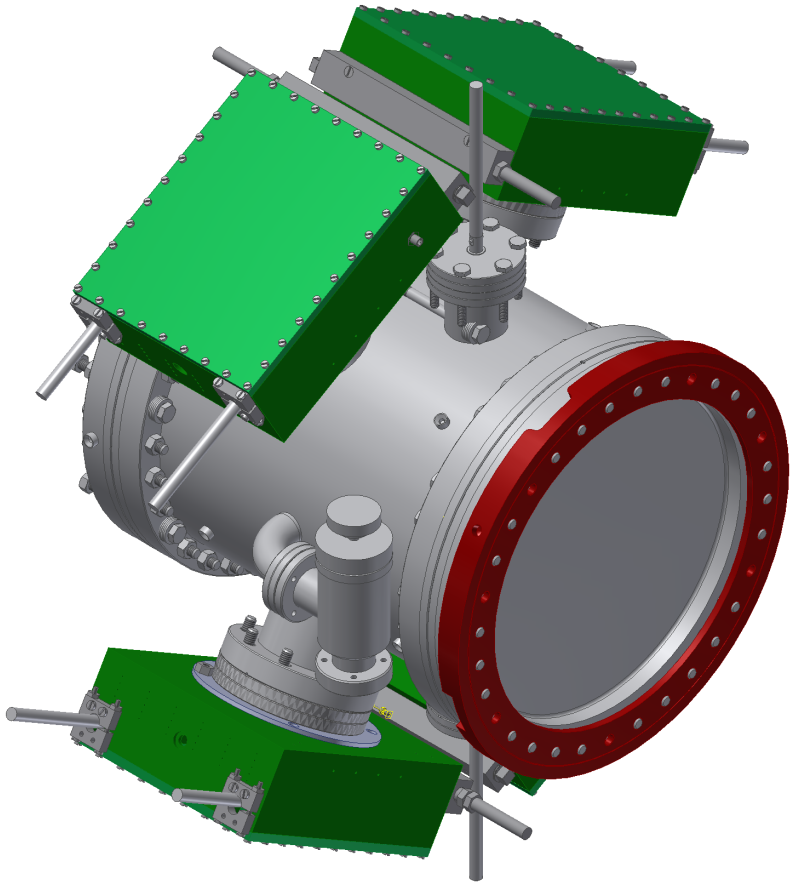




Target CAD Drawing



Frame Stack with signal and HV PCB on mount plate



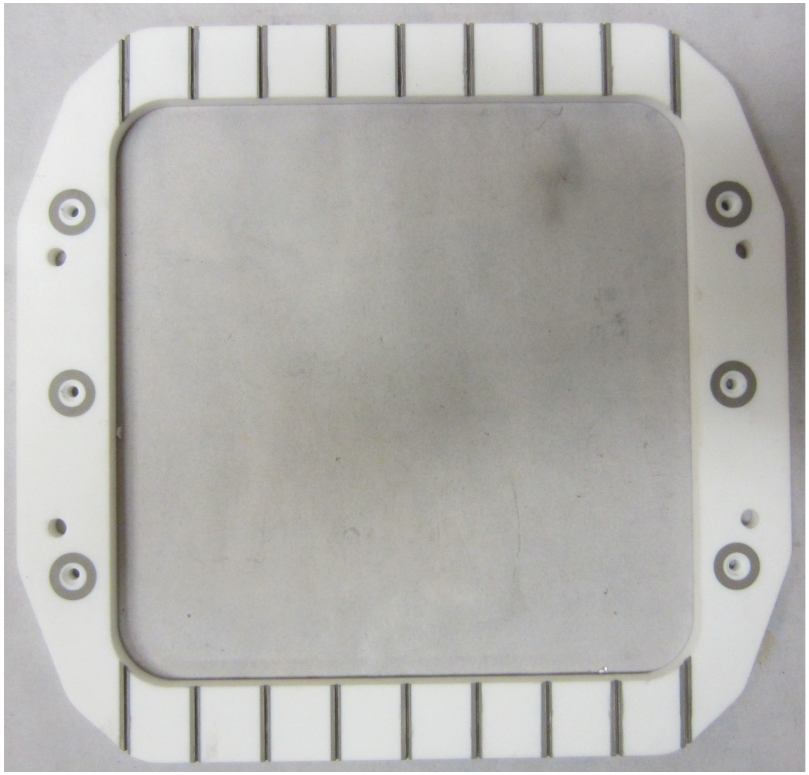
Chamber exterior with all flanges in place.

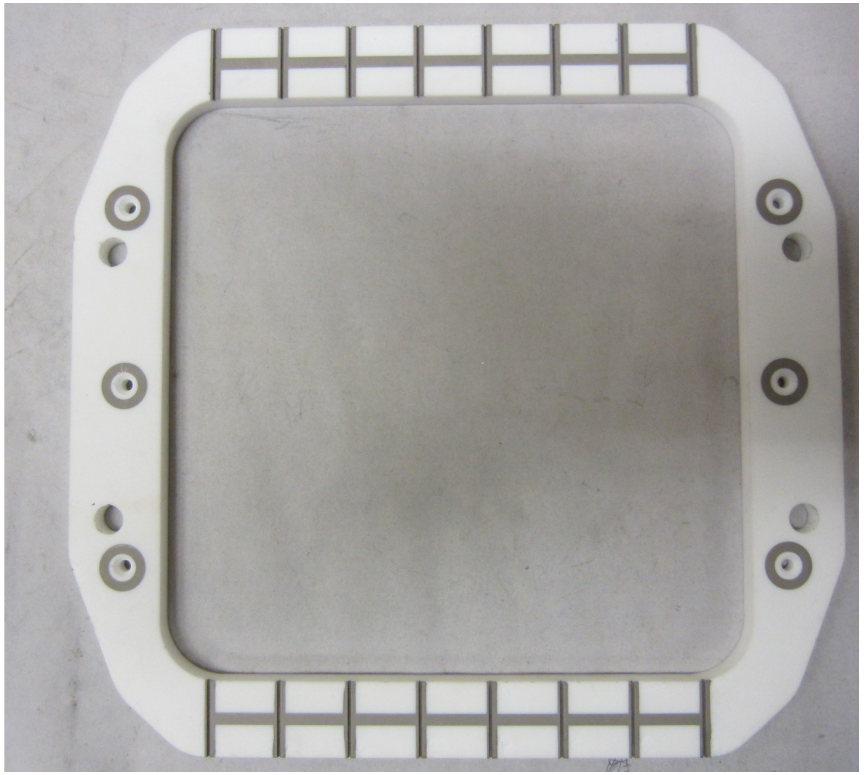
Aluminum Chamber Vessel

- 10" conflat end flanges
- windows are 1mm thick Al
- 4 signal feed thrus
- 2 gas feed thrus
- 2 HV feed thrus
- Al body, SS knife edges

Target Frames

1/4" thick macor ceramic





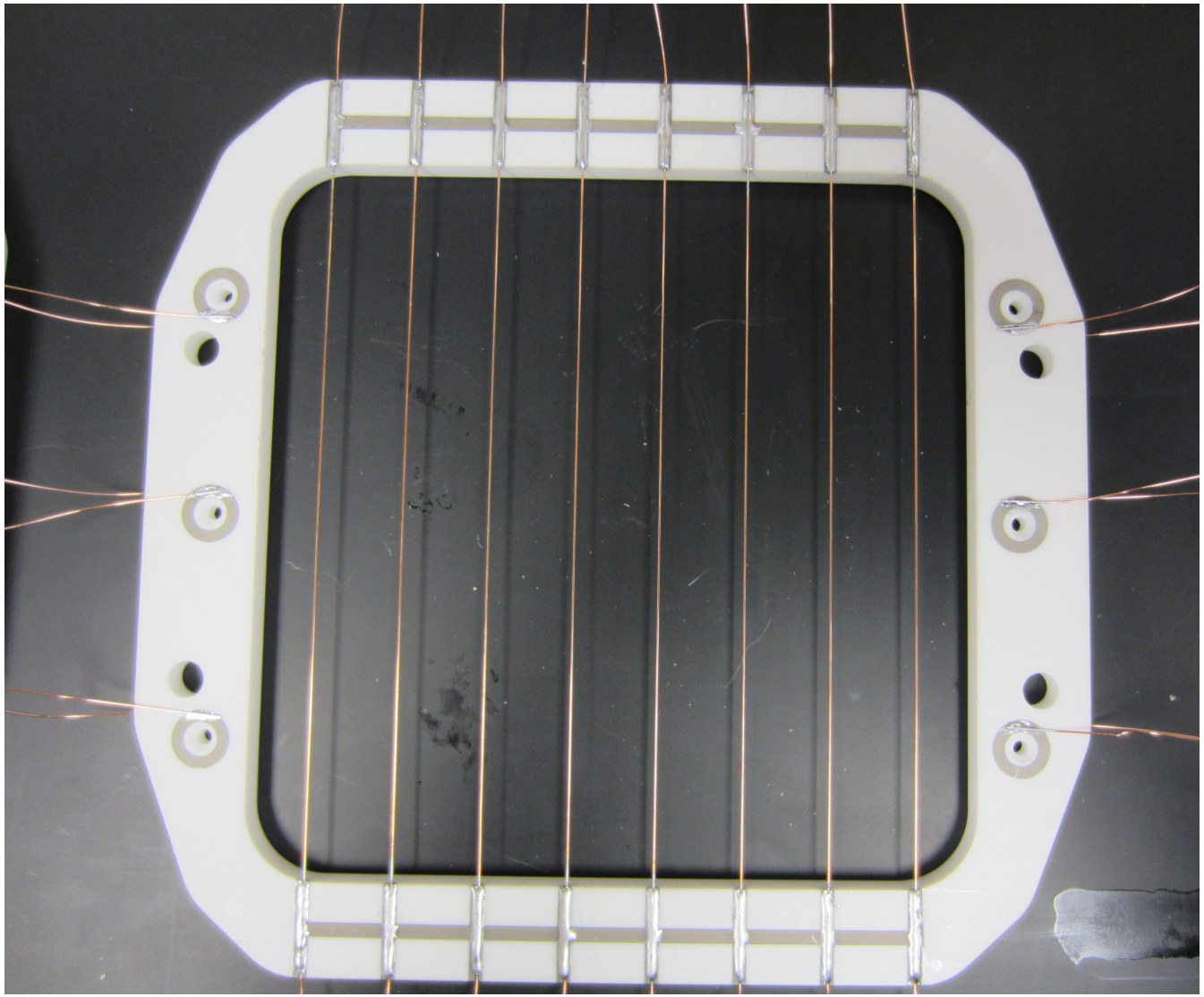
Signal Frame

- 9 wires

HV Frame

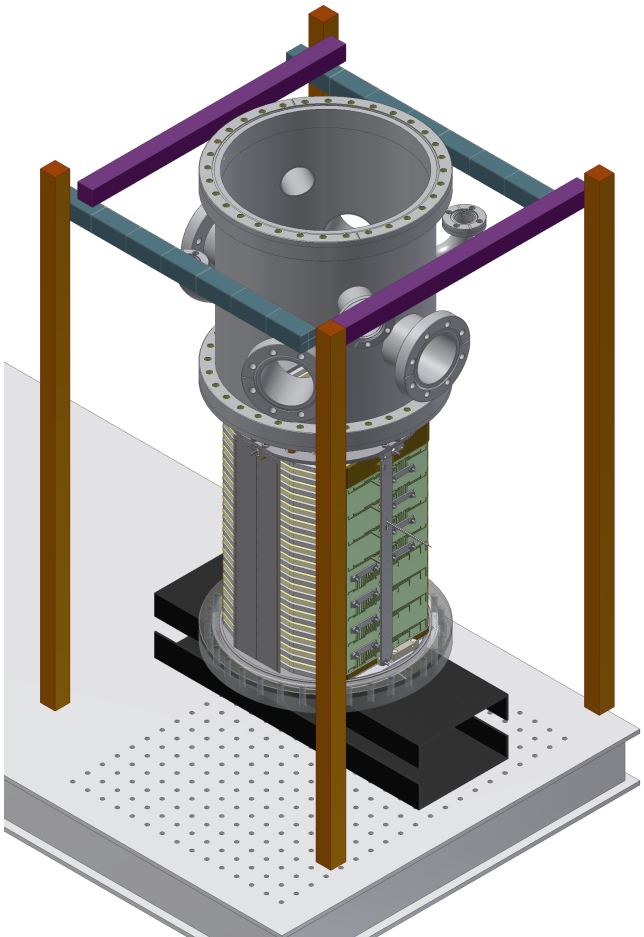
- 8 wires

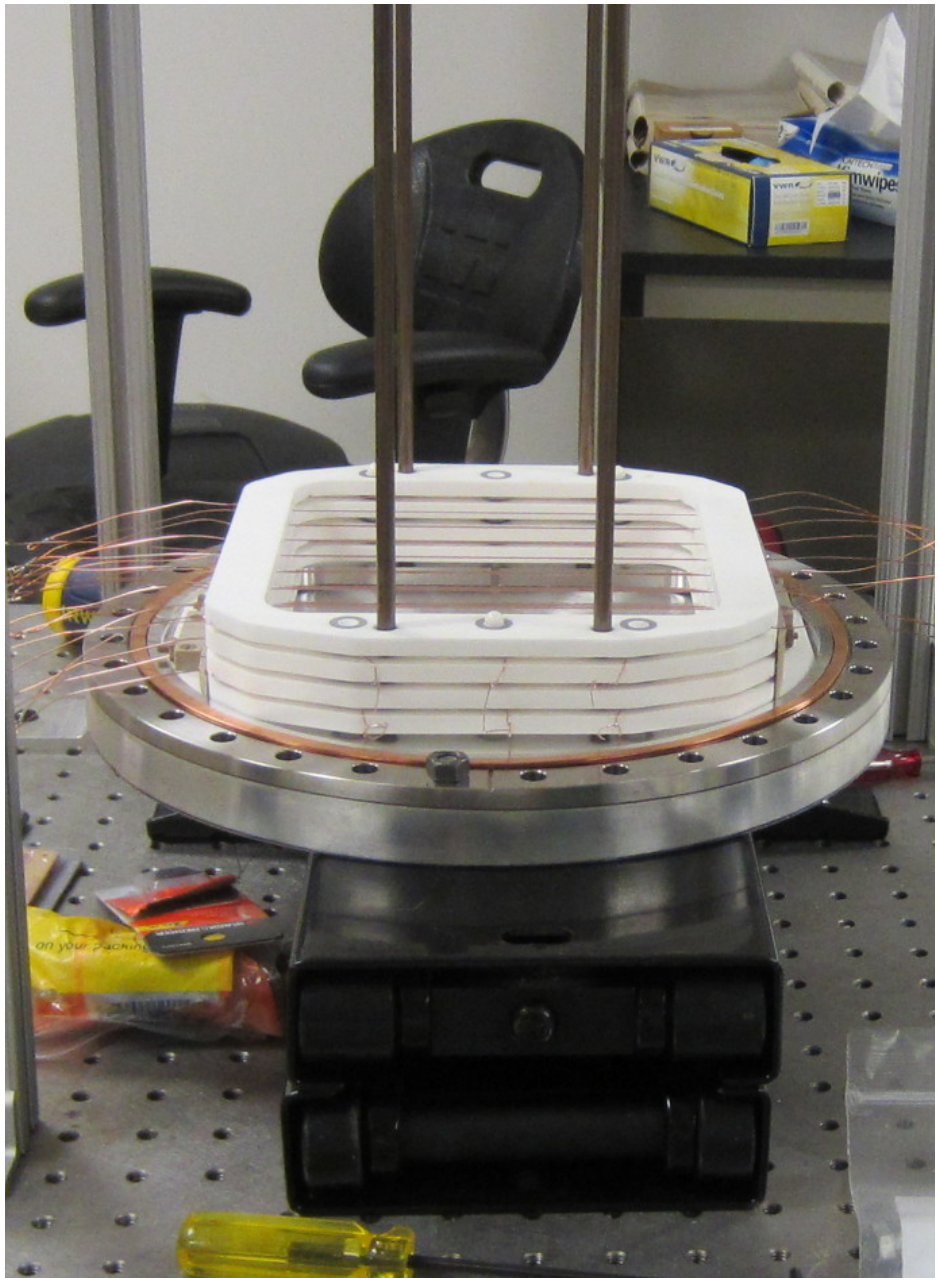
Completed Frame - HV



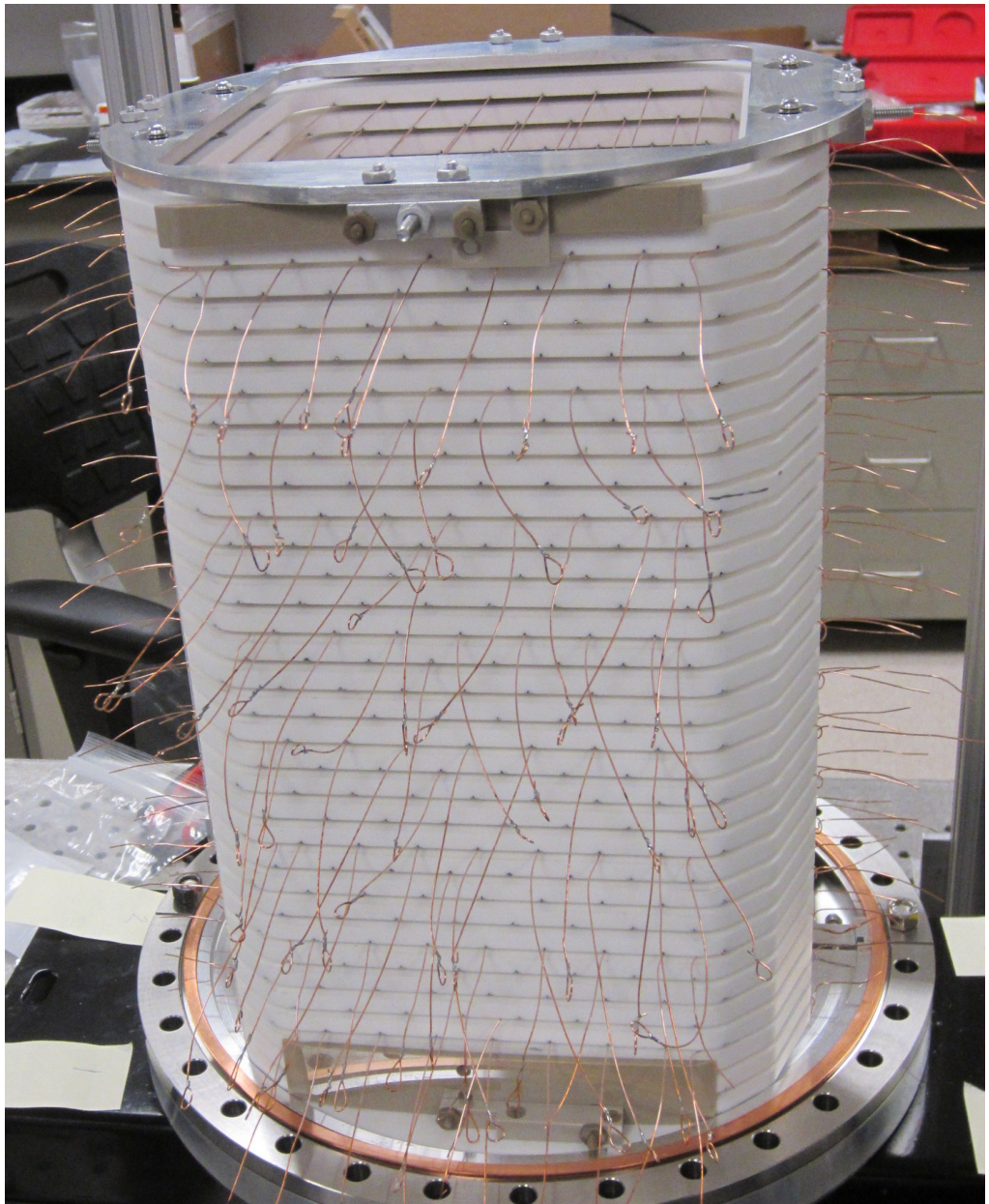
- 0.02” dia. wire
- 0.8kg Tension

Frame Stack Assembly

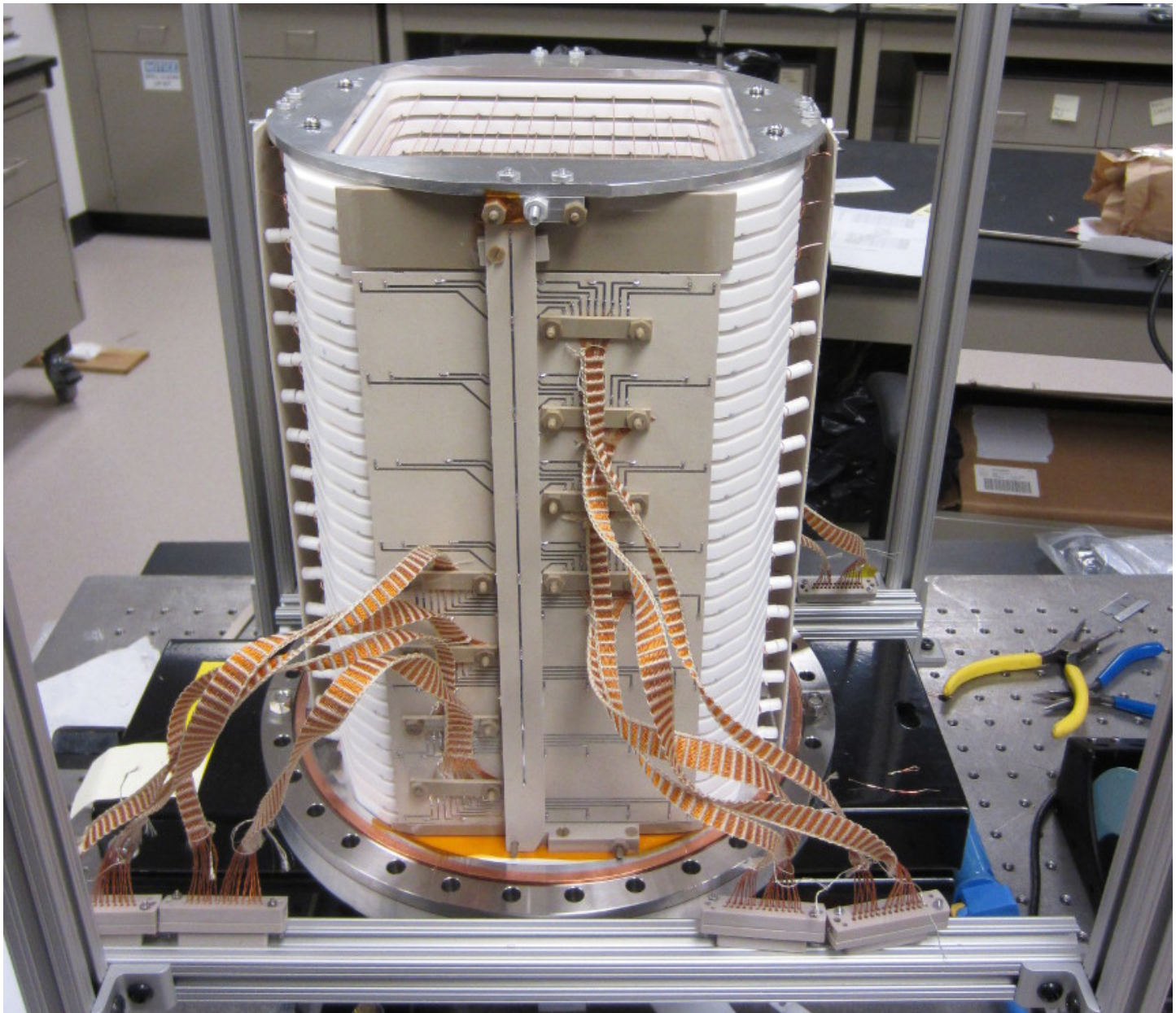




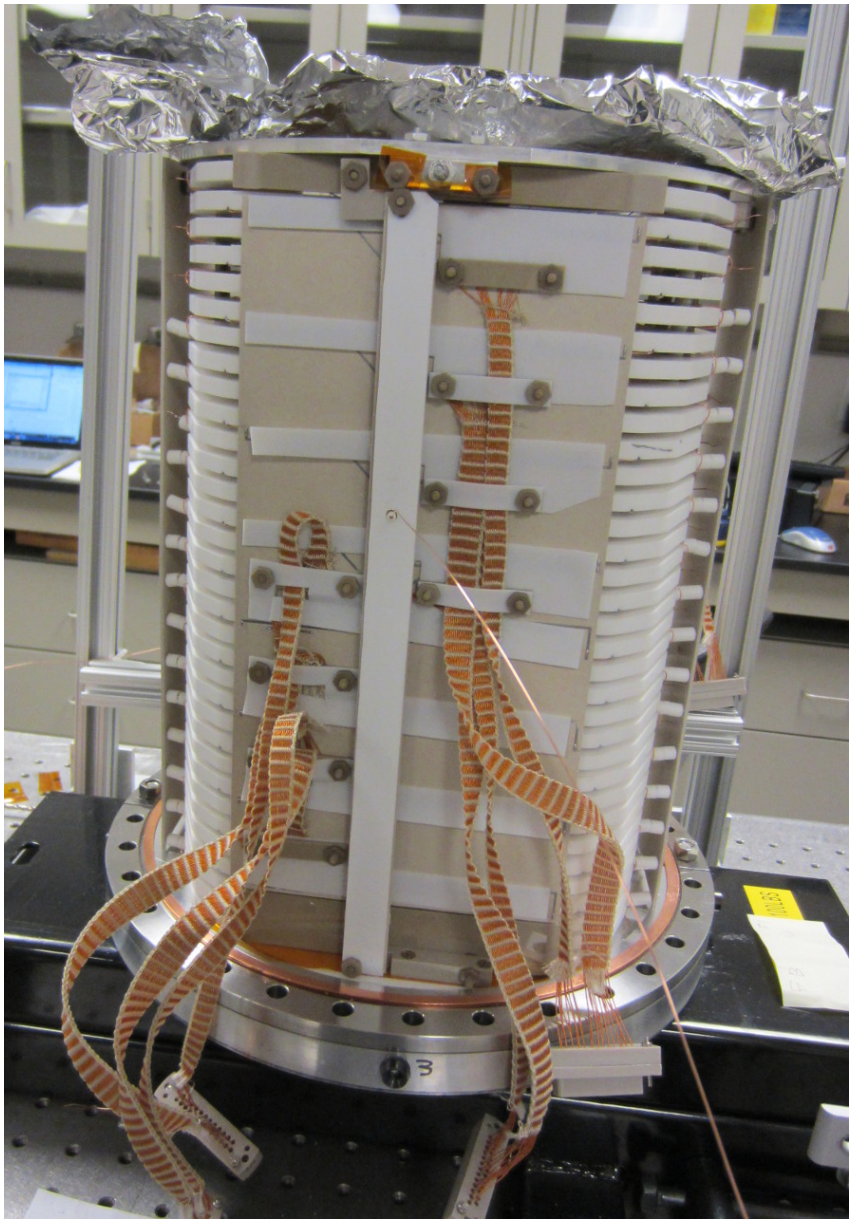
Assembled Frame Stack



Circuit Boards Attached

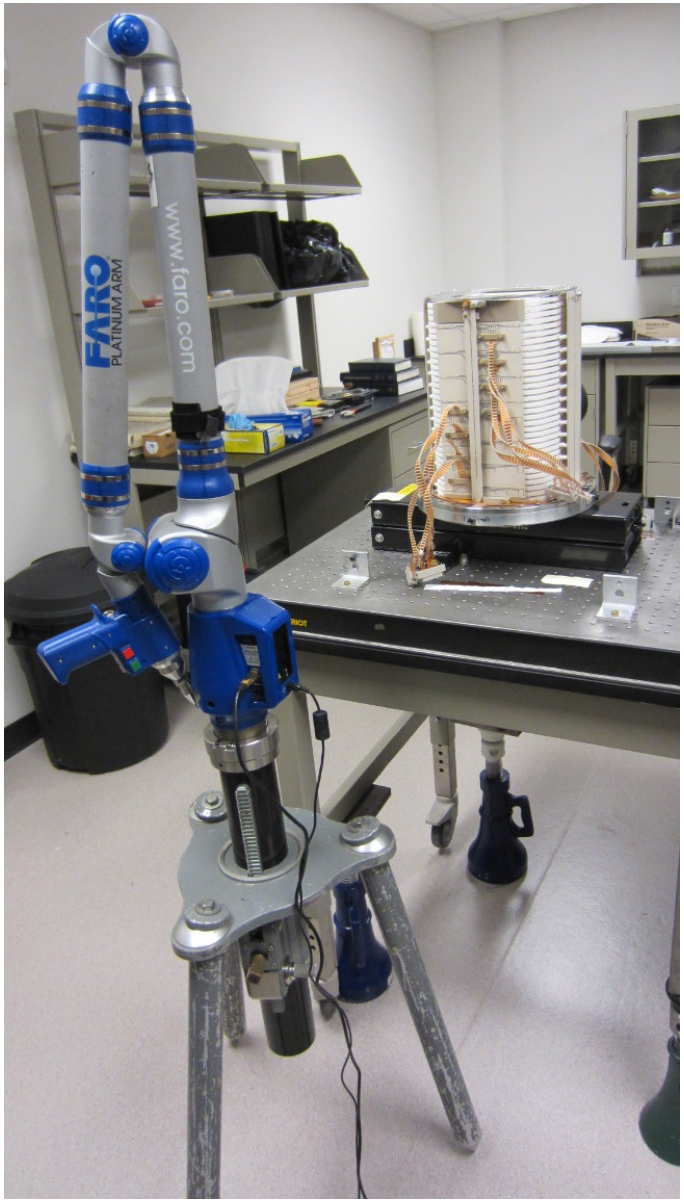


Frame Stack Shielding



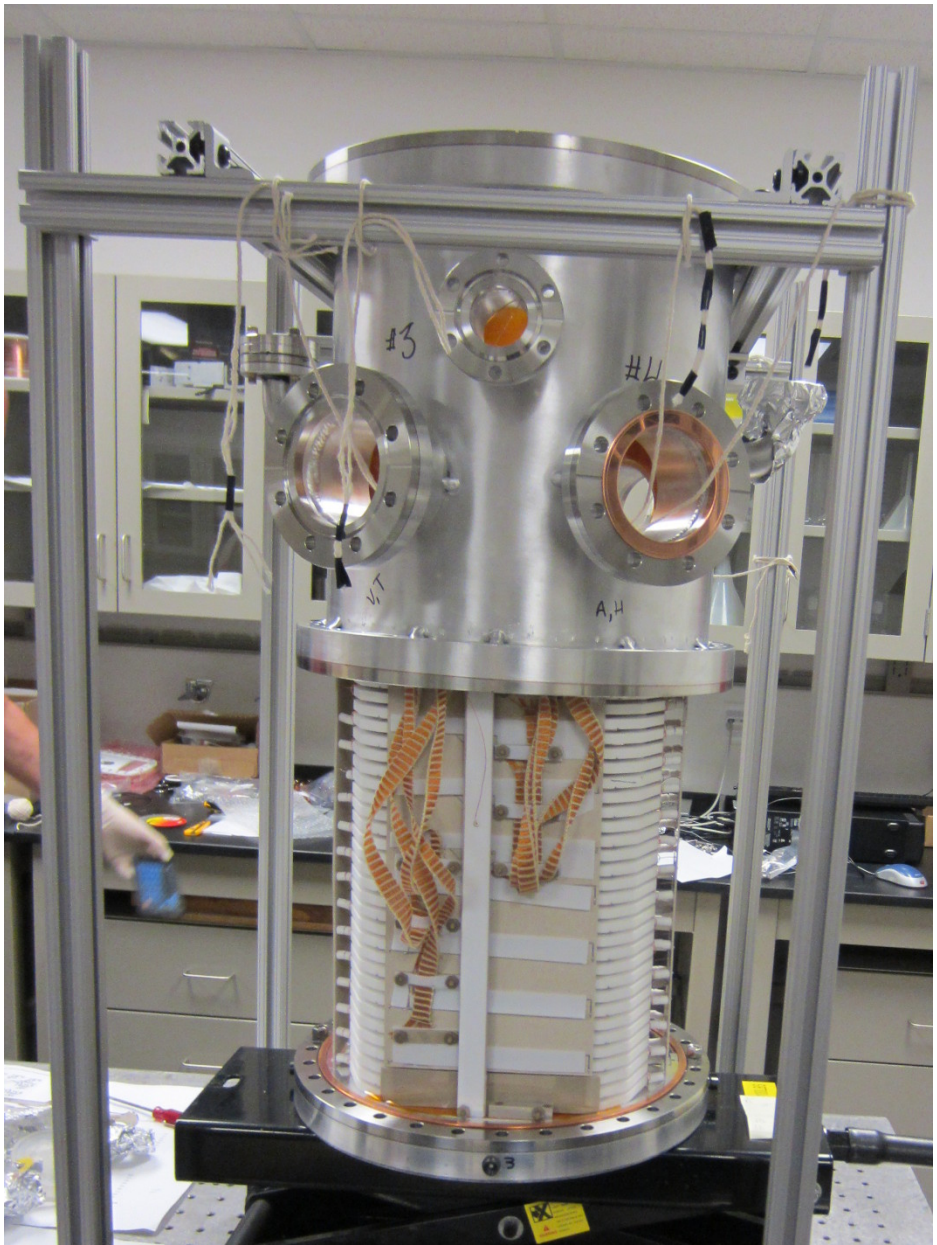
- Teflon Shielding on signal board to stop stray charge collection
- Teflon on HV to stop unwanted discharge
- Kapton around ends to stop unwanted discharge
- Ceramic beads on bare wires when possible

Survey and Alignment

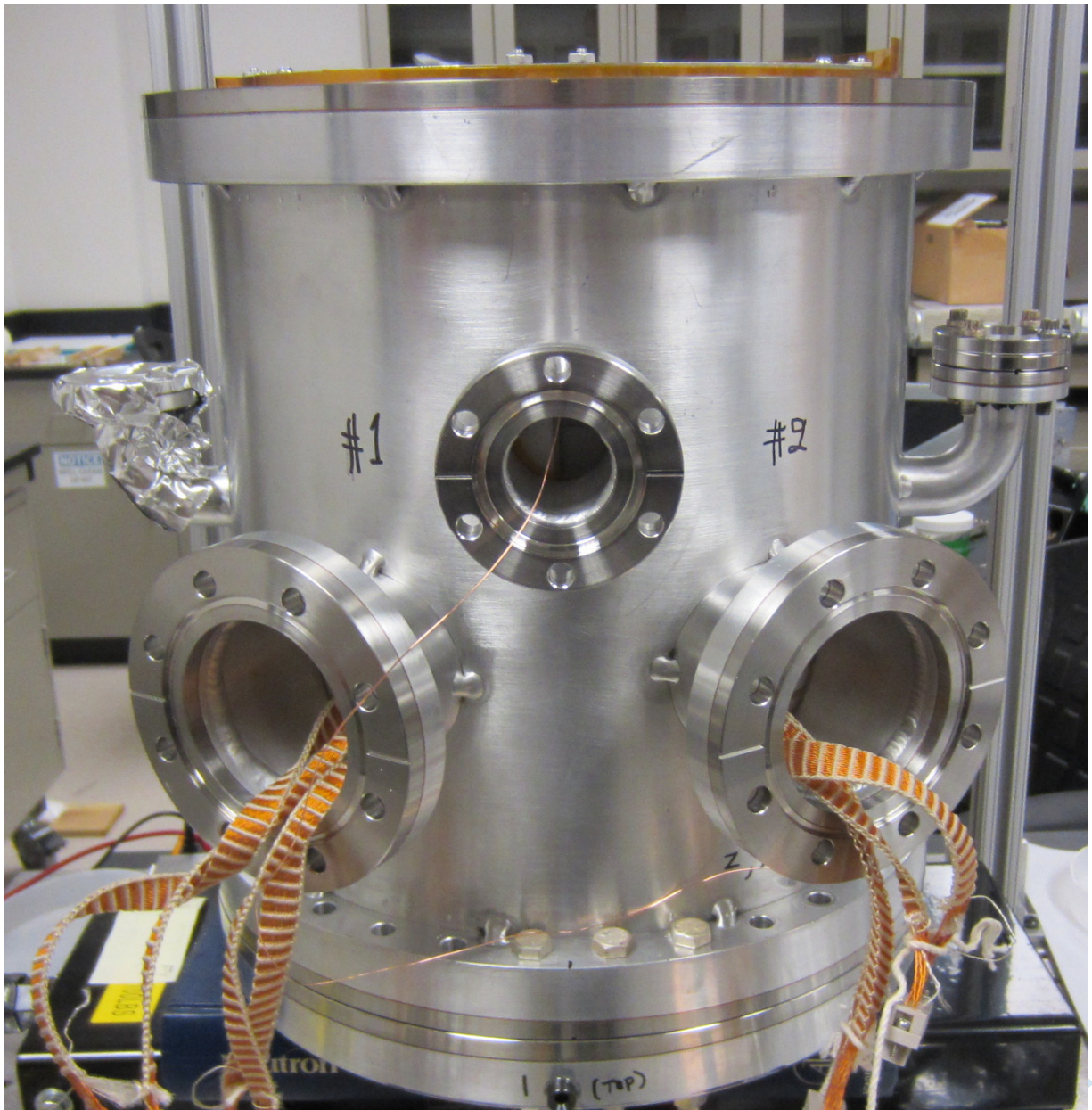


- The position and angle of the frame stack inside the housing needs to be known to align it to the neutron beam.
- Faro Arms are 3D measurement devices.
- Position and angle of frame stack measured to base flange
- Compression plate was approx. 1.5 milliradian from parallel to the base

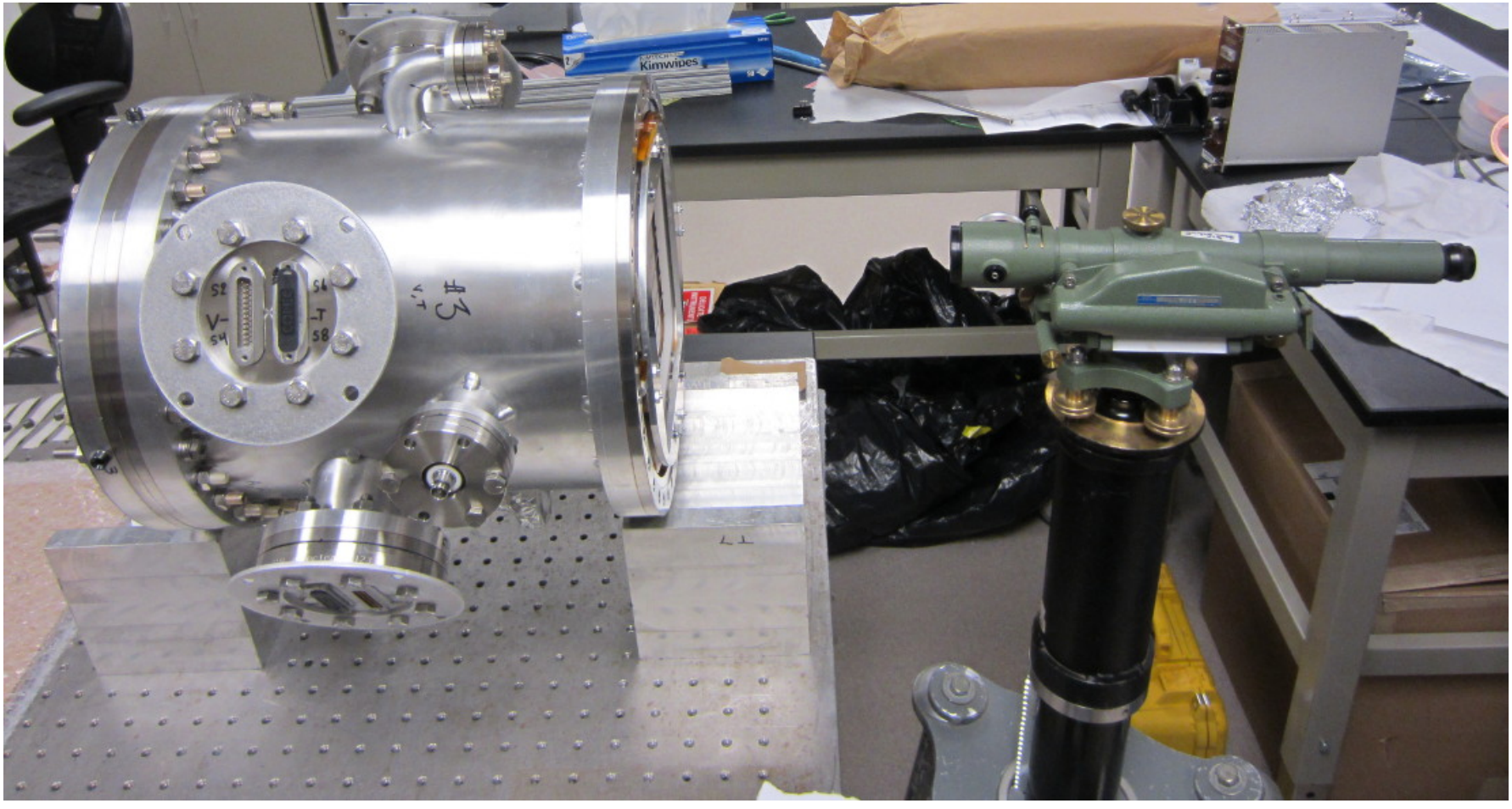
Mounting Housing on Frame Stack



Housing In Place

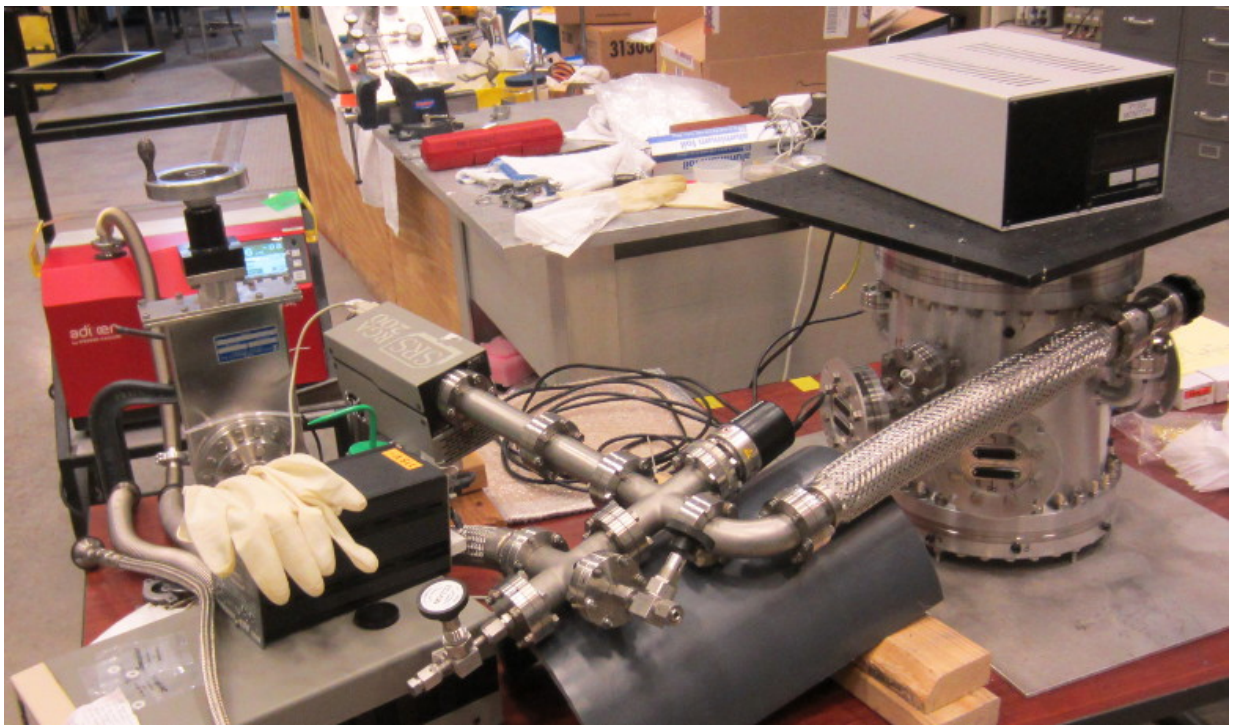


Survey and Alignment Checking for Frame Stack



Vacuum Testing

- Fully Assembled Chamber currently pumped down to less than 10^{-6} Torr
- Leak checked at $10 \times 10^{-10} mbar.l/s$ level to be helium tight



Current Status:

- n3He Chamber Assembled.
- Initial HV testing passed
  - 1.5×10^{-8} amps at 1400V from HV to ground
- Initial leak check passed
- Currently pumping chamber to remove degassing residuals

Upcoming Tasks:

- fill with pure 4He for final HV testing and electronics testing
- fill with pure 3He for short testing on beam before SNS summer maintenance break

n3He Collaboration

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