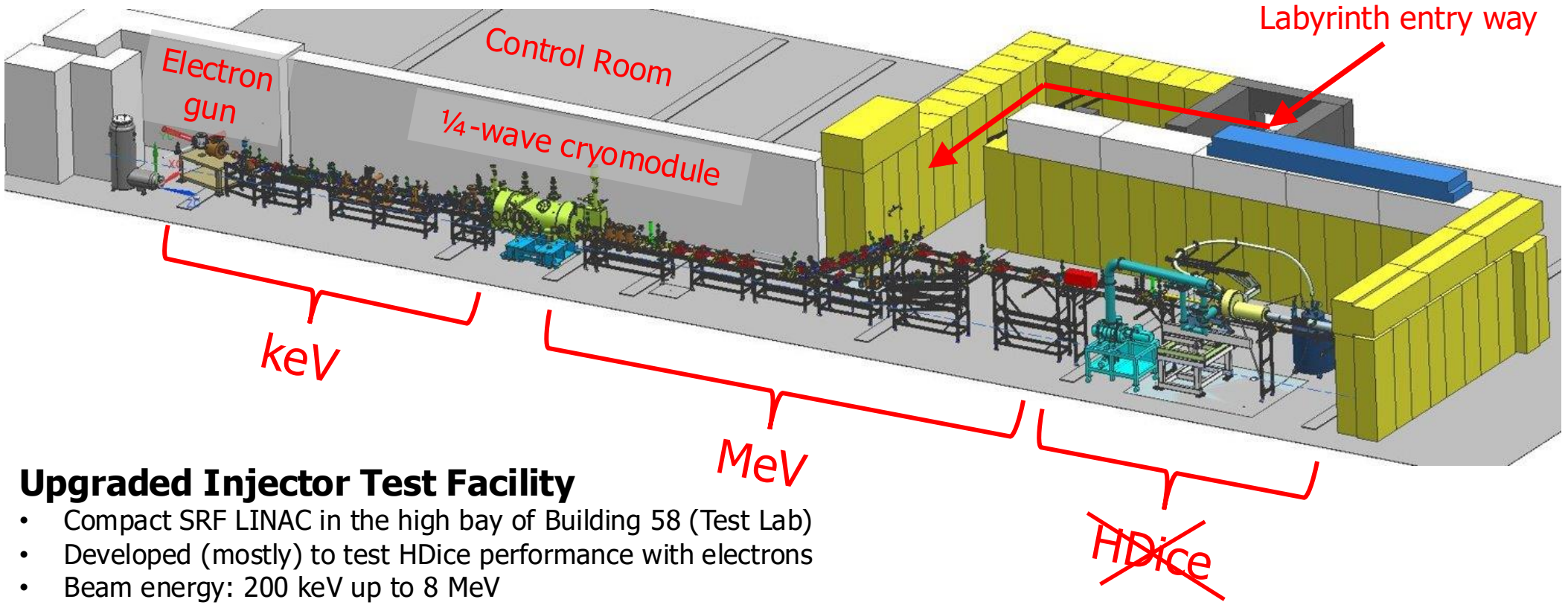
Status of Irradiations at the Upgraded Injector Test Facility

Chris Keith
JLab Target Group

Outline

- The UITF
- Irradiation of target material
- Status
- Remaining

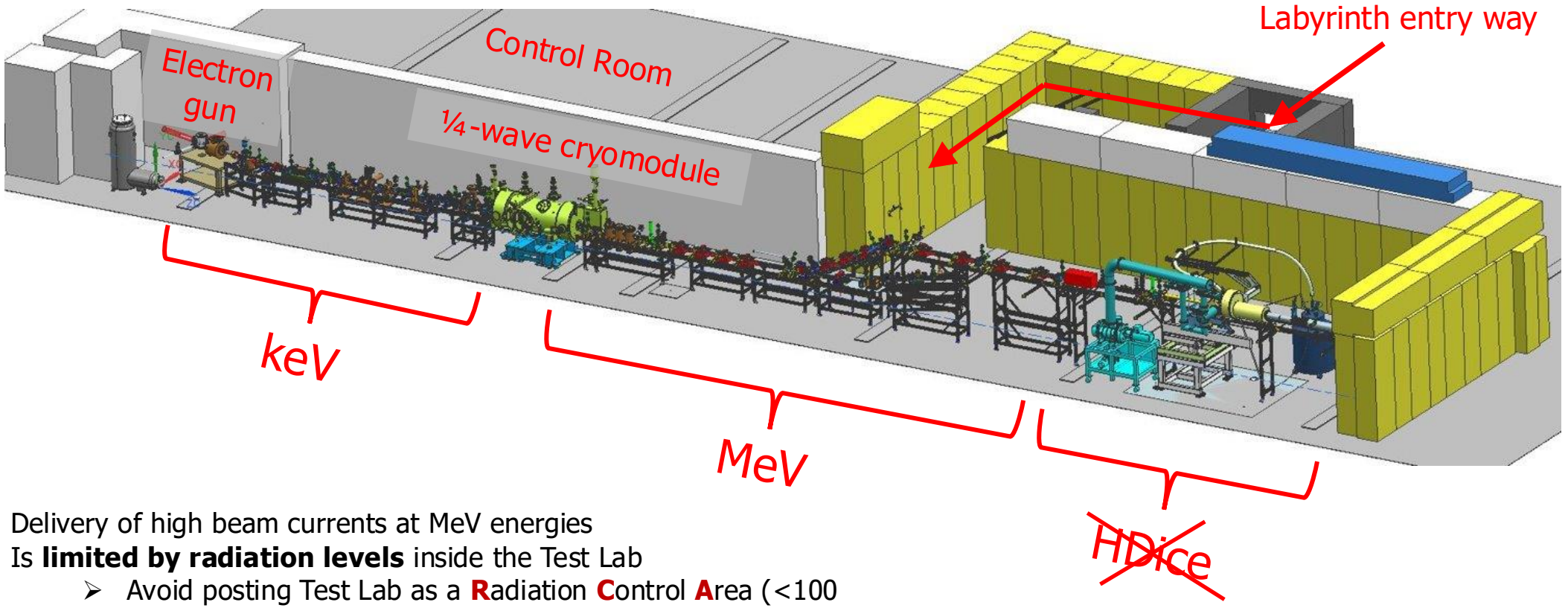
The UITF



Upgraded Injector Test Facility

- Compact SRF LINAC in the high bay of Building 58 (Test Lab)
- Developed (mostly) to test HDice performance with electrons
- Beam energy: 200 keV up to 8 MeV
- Polarization: 90%
- Beam Current: 100 μA @ keV
  100 nA @ MeV *(radiation limited)*

The UITF

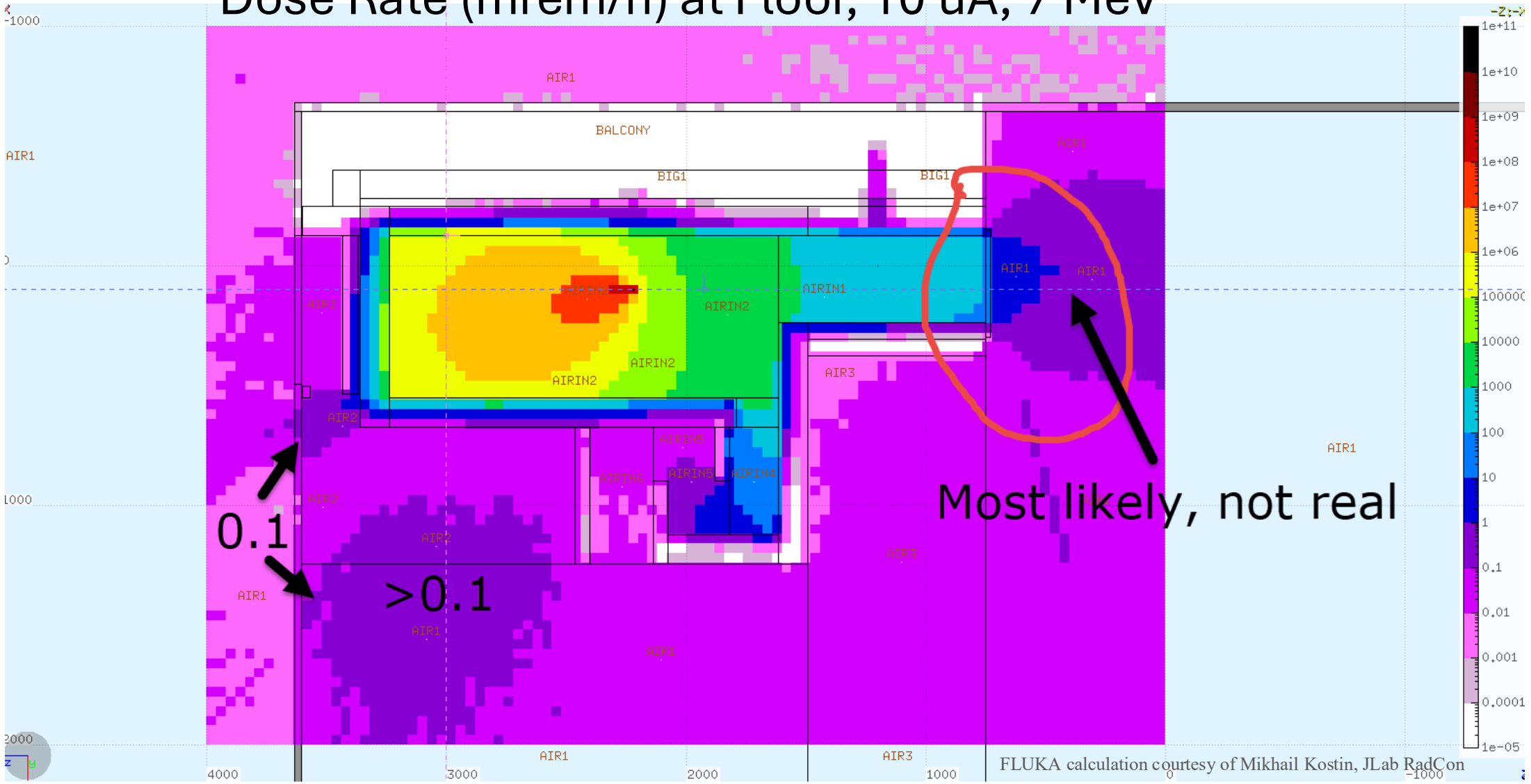


Delivery of high beam currents at MeV energies
Is **limited by radiation levels** inside the Test Lab

- Avoid posting Test Lab as a **R**adiation **C**ontrol **A**rea (<100 mREM/yr)*
- Assume 1000 hours/yr at high current
- Keep levels below 0.1 mREM/hr*

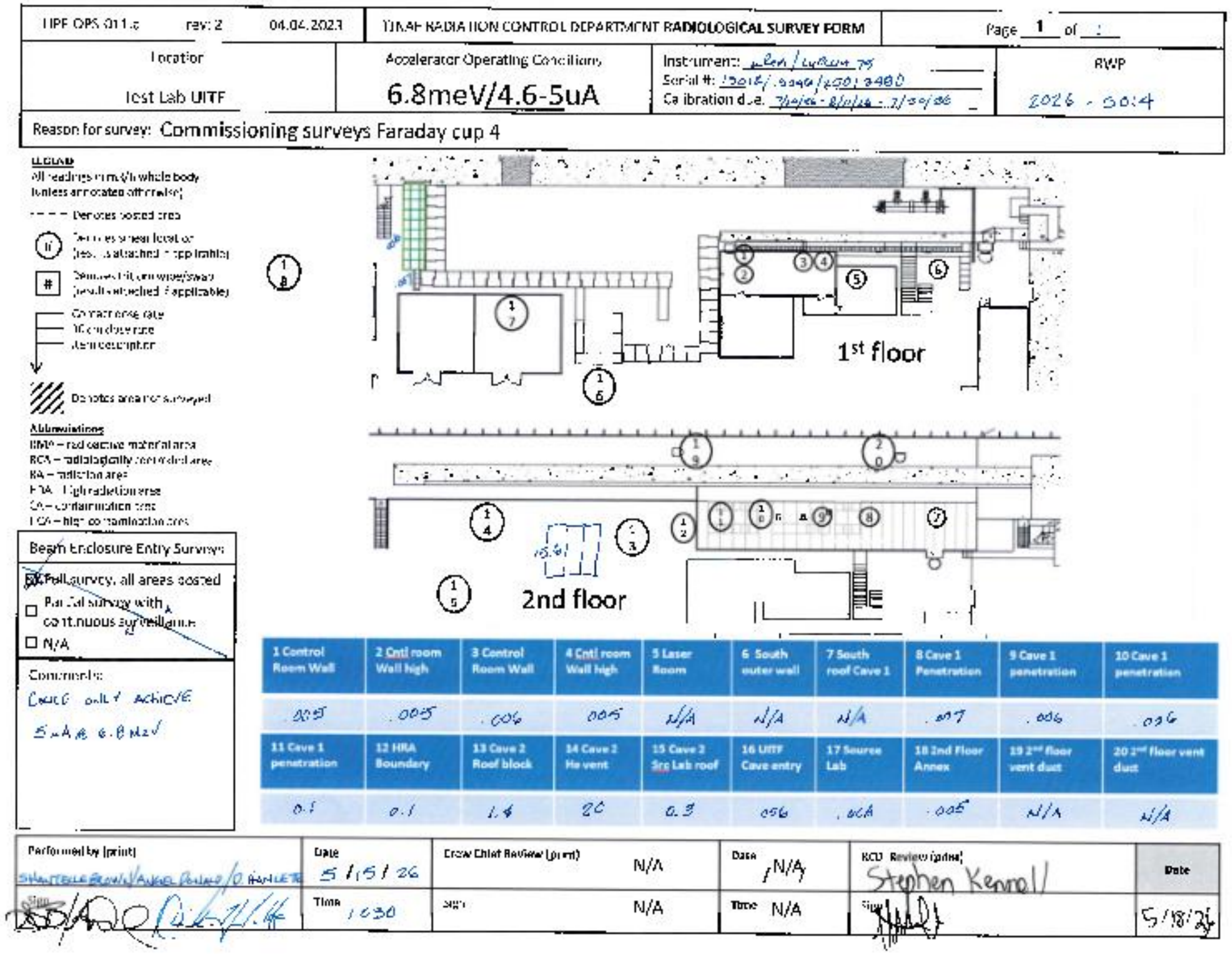
*beware the caveats!

Dose Rate (mrem/h) at Floor, 10 uA, 7 MeV



FLUKA calculation courtesy of Mikhail Kostin, JLab RadCon

Dose Rate (mR/h) at Floor, 5 uA, 6.8 MeV



JLAB RADIATION CONTROL DEPARTMENT RADIOLOGICAL SURVEY FORM

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Location: Test Lab UITF

Accelerator Operating Conditions: 6.8meV/4.6-5uA

RWP: 2026 - 5014

Reason for survey: Commissioning surveys Faraday cup 4

1 Control Room Wall	2 Cntl room Wall high	3 Control Room Wall	4 Cntl room Wall high	5 Laser Room	6 South outer wall	7 South roof Cave 1	8 Cave 1 Penetration	9 Cave 1 penetration	10 Cave 1 penetration
.005	.005	.006	.005	N/A	N/A	N/A	.007	.006	.026

11 Cave 1 penetration	12 HRA Boundary	13 Cave 2 Roof block	14 Cave 2 He vent	15 Cave 2 Src Lab roof	16 UITF Cave entry	17 Source Lab	18 2nd Floor Annex	19 2nd floor vent duct	20 2nd floor vent duct
0.1	0.1	1.4	20	0.3	.056	.004	.005	N/A	N/A

Date: 5/15/26

Crew Chief Review (print): N/A

RCD Review (print): Stephen Kennell

Date: 5/18/26

Radiation survey of 5/15/26 matches FLUKA calculations reasonably well.

Radiation levels outside Cave 2 at 5 μA and 7 MeV are acceptably low.

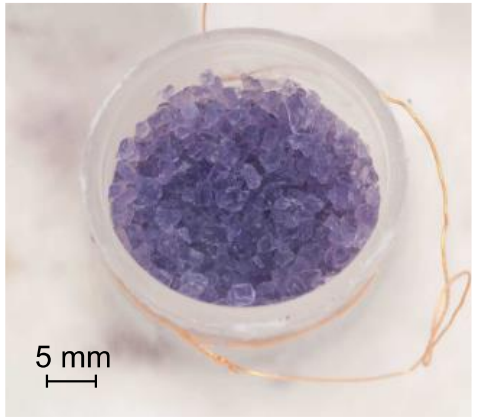
Levels are high on top of the UITF are high, but access to this area can be restricted during beam operations.

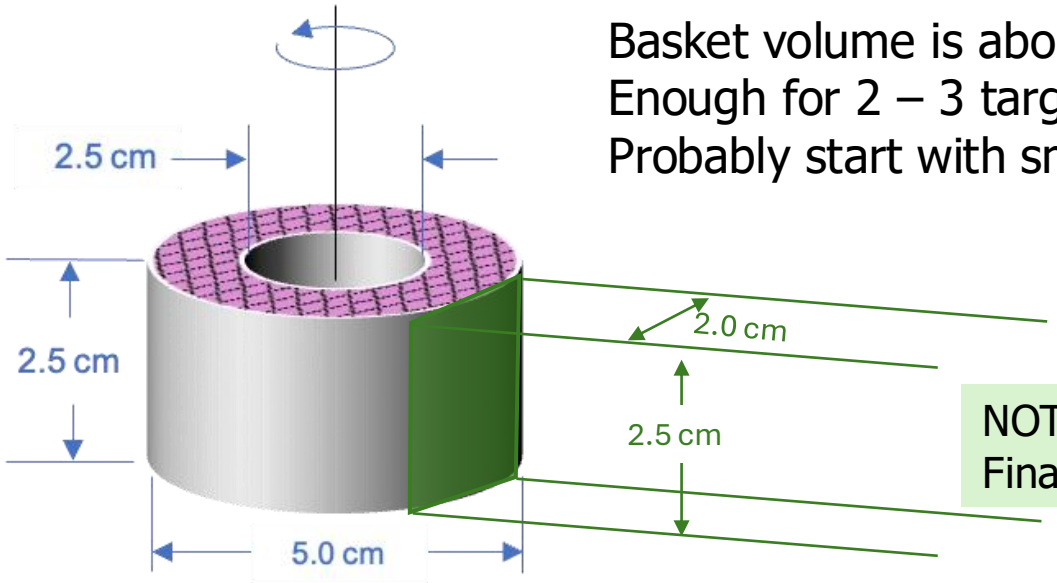
Things are looking positive!

Irradiation of target material

Materials for irradiation are mainly NH_3, ND_3, and ^7LiD

The typical dose on a sample for good polarization is ~ 10^{17} e-/cm^2
At 10 μA on a (2.5 x 5) cm^2 sample, this will take about 5 – 6 hr



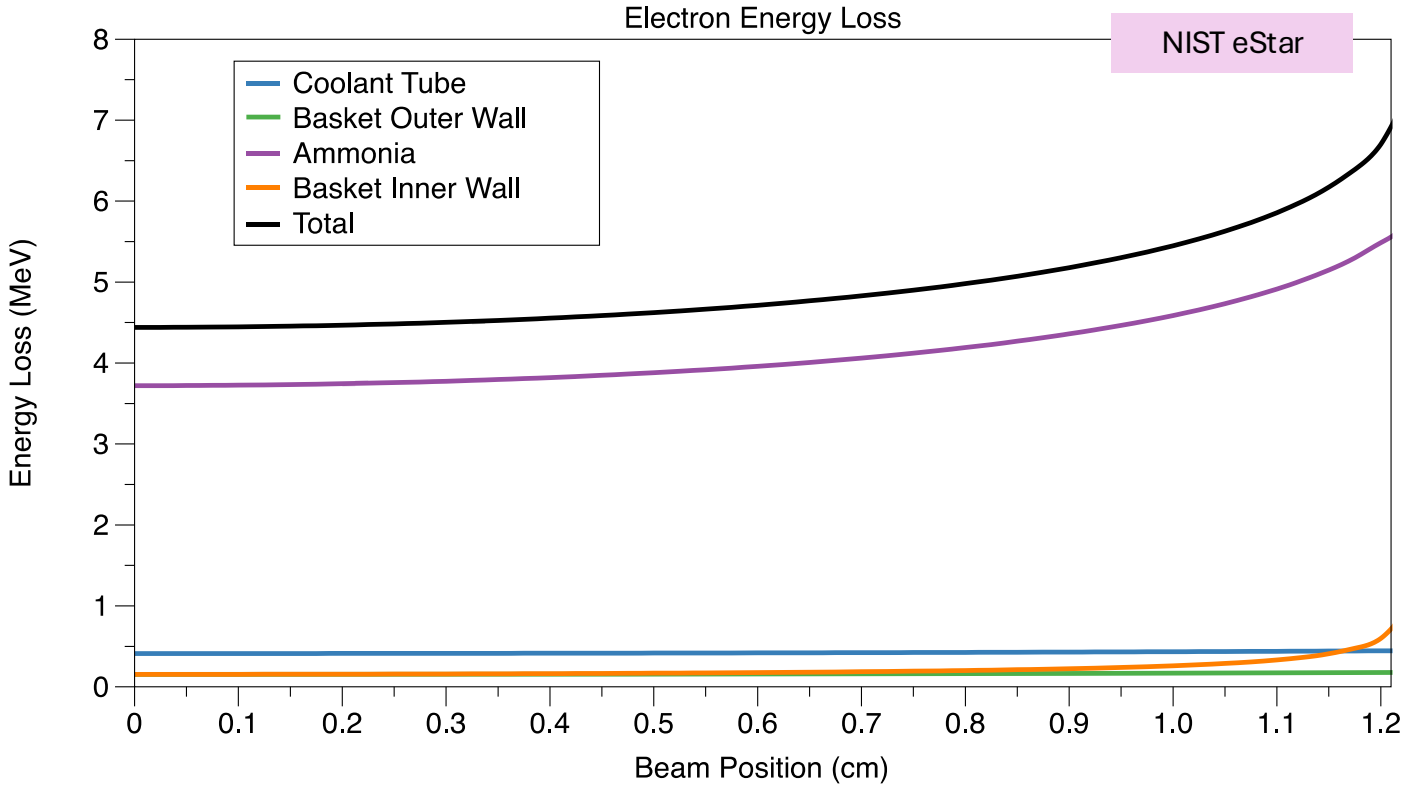


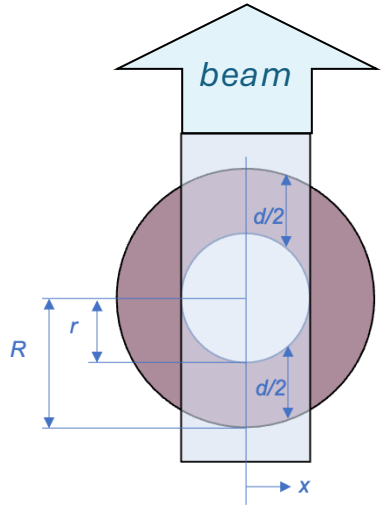
Basket volume is about 37 cc (22 g)
Enough for 2 – 3 target cells in Hall B or Hall C
Probably start with smaller samples

NOTE: Rastered beam, 2.5 x 2.0 cm^2
Final number TBD.

Irradiation of target material

Energy Loss and Power Deposition



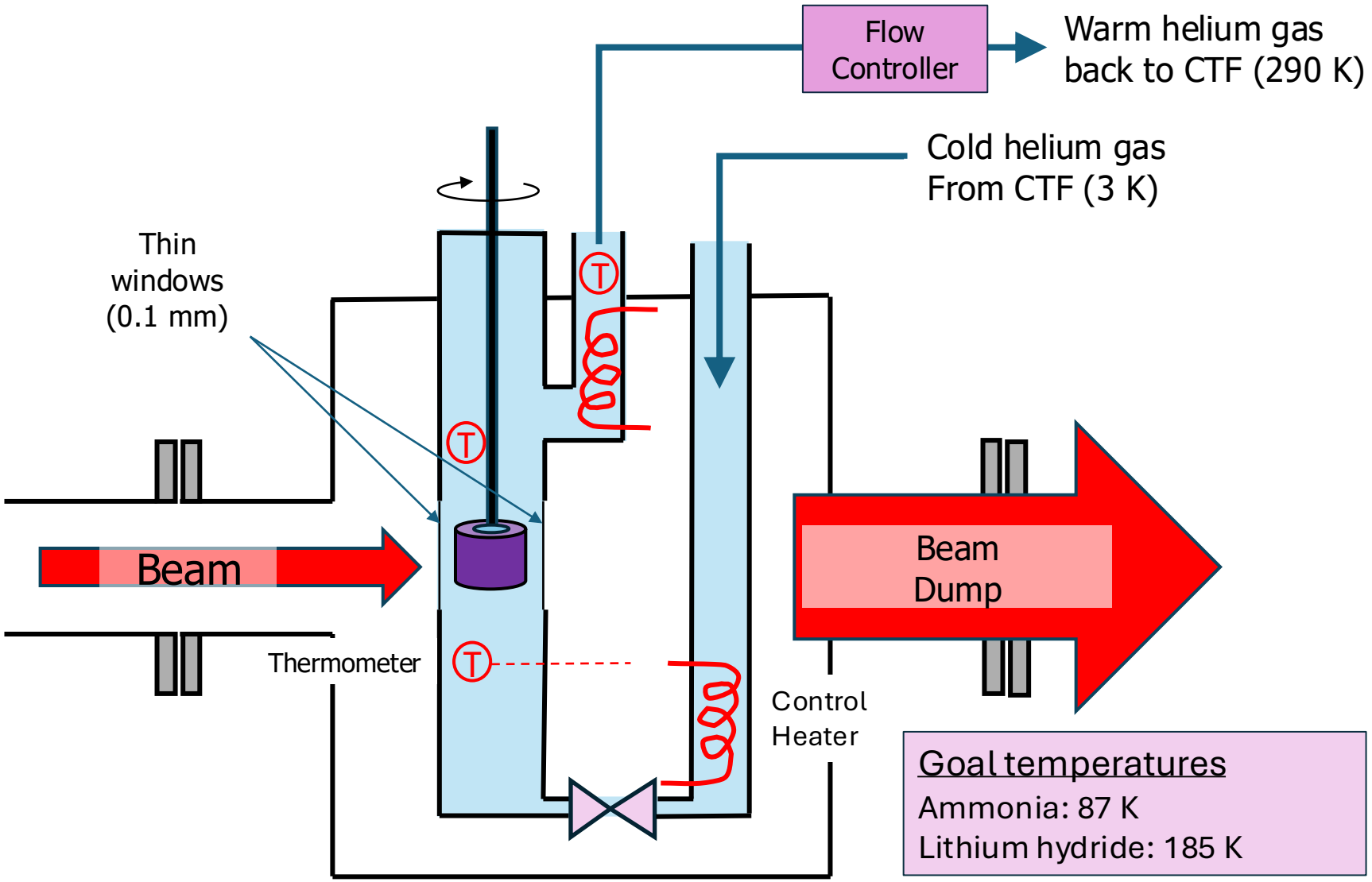


The *mean* energy loss of 8 MeV electrons will be about 4.4 MeV (3.2 MeV for LiH)

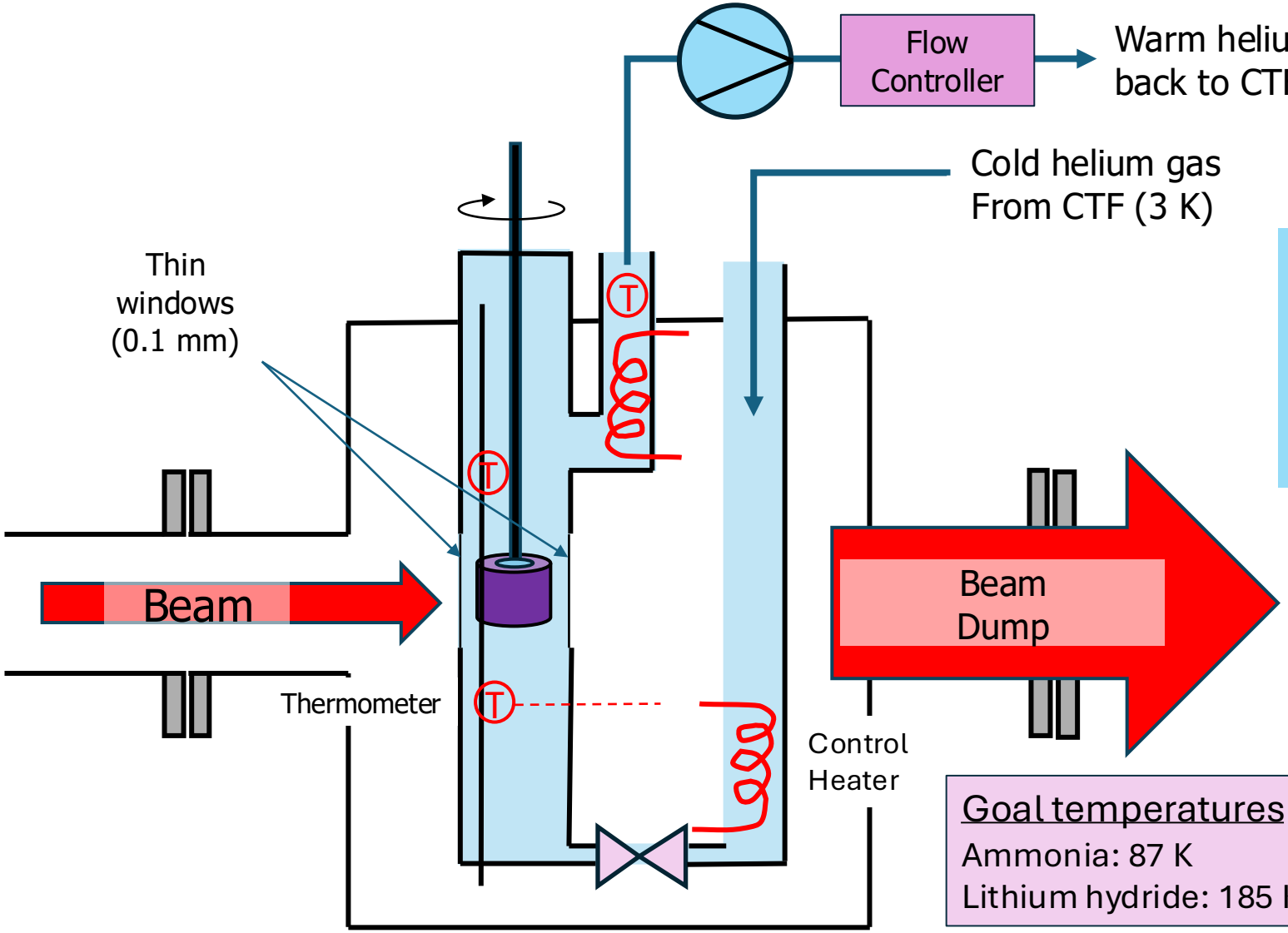
➔ 44 W at 10 μA

➔ $\Delta T \approx 8$ K (1 g/s coolant)

Irradiation of target material



Irradiation of target material

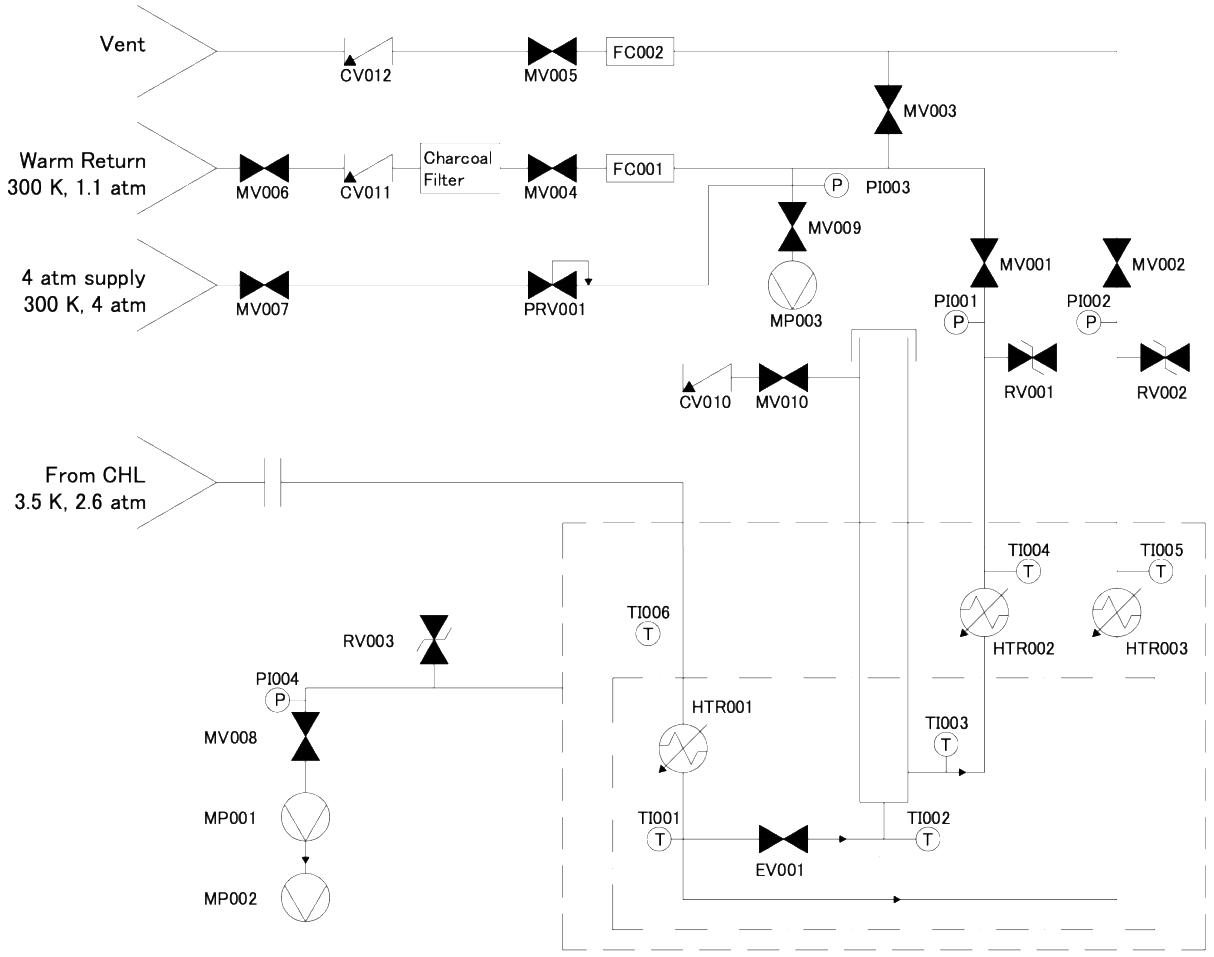


With a modest vacuum pump, we can reduce the temperature to about 2 K for a **cold dose** on ND_3

- A few hours at 1 μA

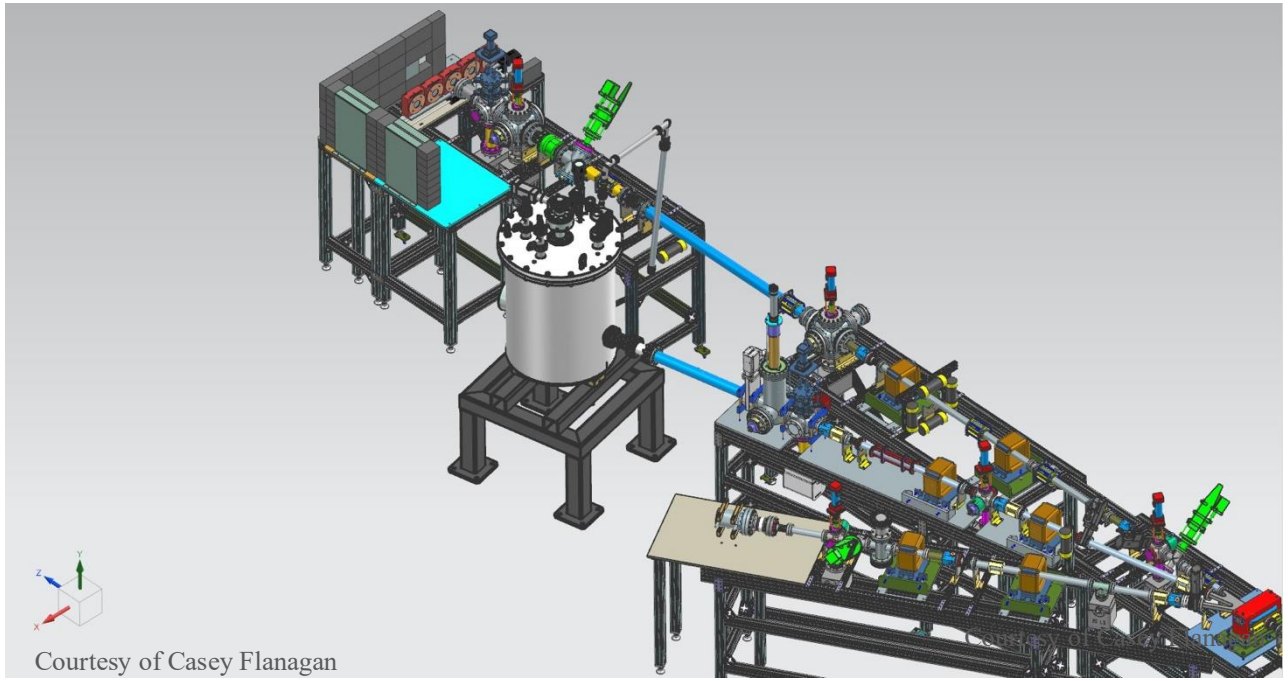
Goal temperatures
Ammonia: 87 K
Lithium hydride: 185 K

Irradiation of target material



P&I Diagram courtesy of Daniel Akers

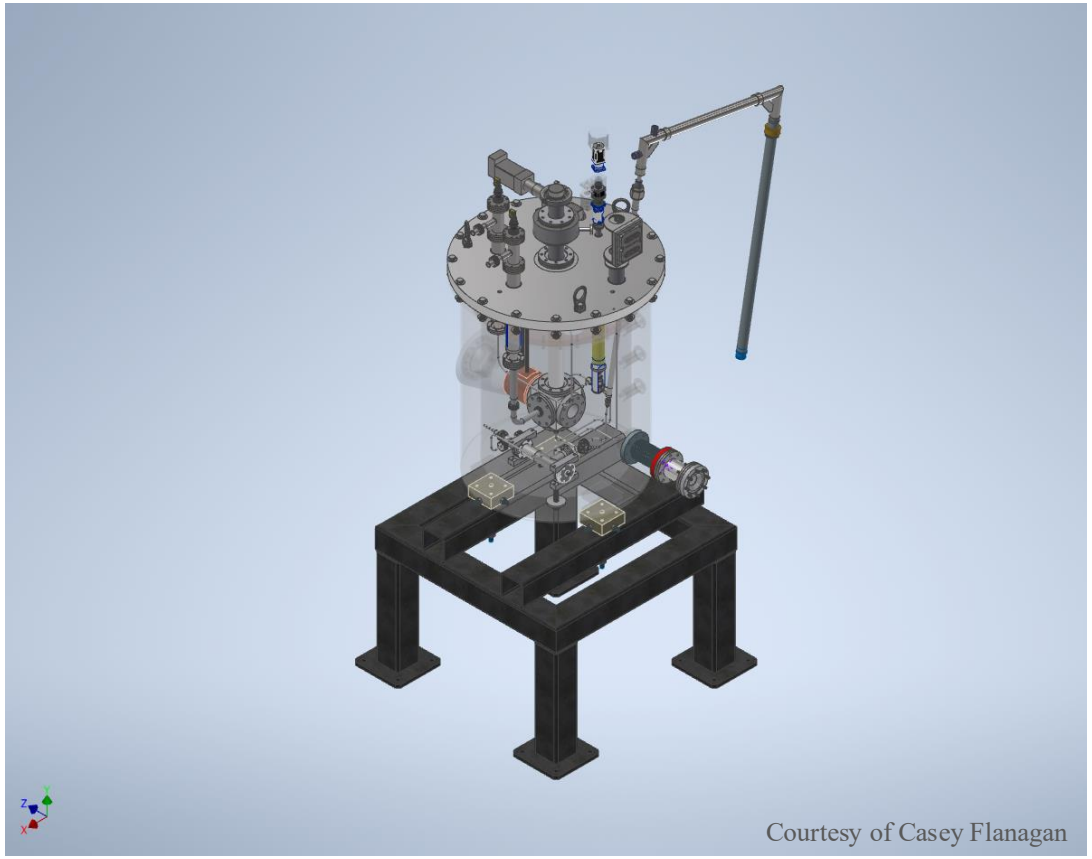
Status



Matt Poelker is building a dedicated beam line for polarized target irradiations.

The irradiation cryostat will be a permanent installation.

Status



Almost all procurements for the cryostat are complete, and construction is underway (in parallel with MOLLER and the DNP test refrigerator).

Remaining

Complete beam line

Complete cryostat

Final word from RadCon on shielding requirements

EHS requirements for ammonia

Warm return helium piping

Software controls

Accelerator Readiness Review

The end

- QUESTIONS? -