

# 2014 CAP Conference



**Pietro Giampa**  
Queen's University

**DEAP-3600 Resurfacers Underground  
Deployment and Testing**

# OUTLINE

- 1) DEAP-3600
- 2) Background Reduction
- 3) Resurfacer Concept
- 4) Gas Purge System
- 5) Current Status @ SNOLAB
- 6) Final Goals
- 7) Conclusions

# DEAP-3600

## Collaboration



Science & Technology Facilities Council  
Rutherford Appleton Laboratory



Laurentian University  
Université Laurentienne



Queen's  
UNIVERSITY



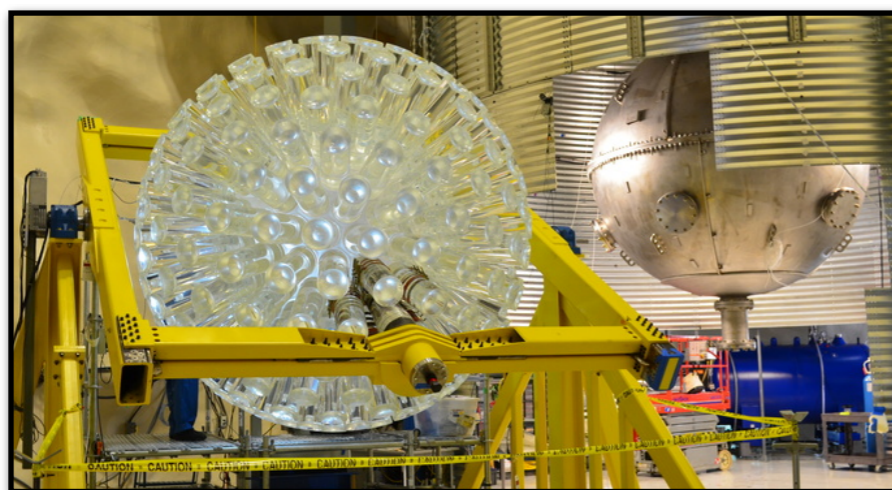
Carleton  
UNIVERSITY

US

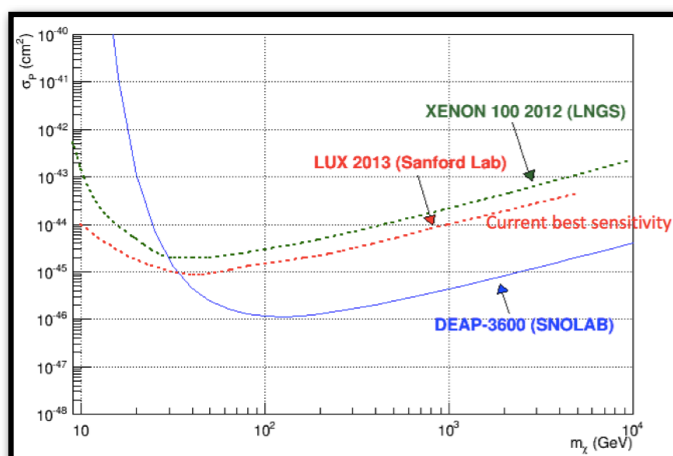
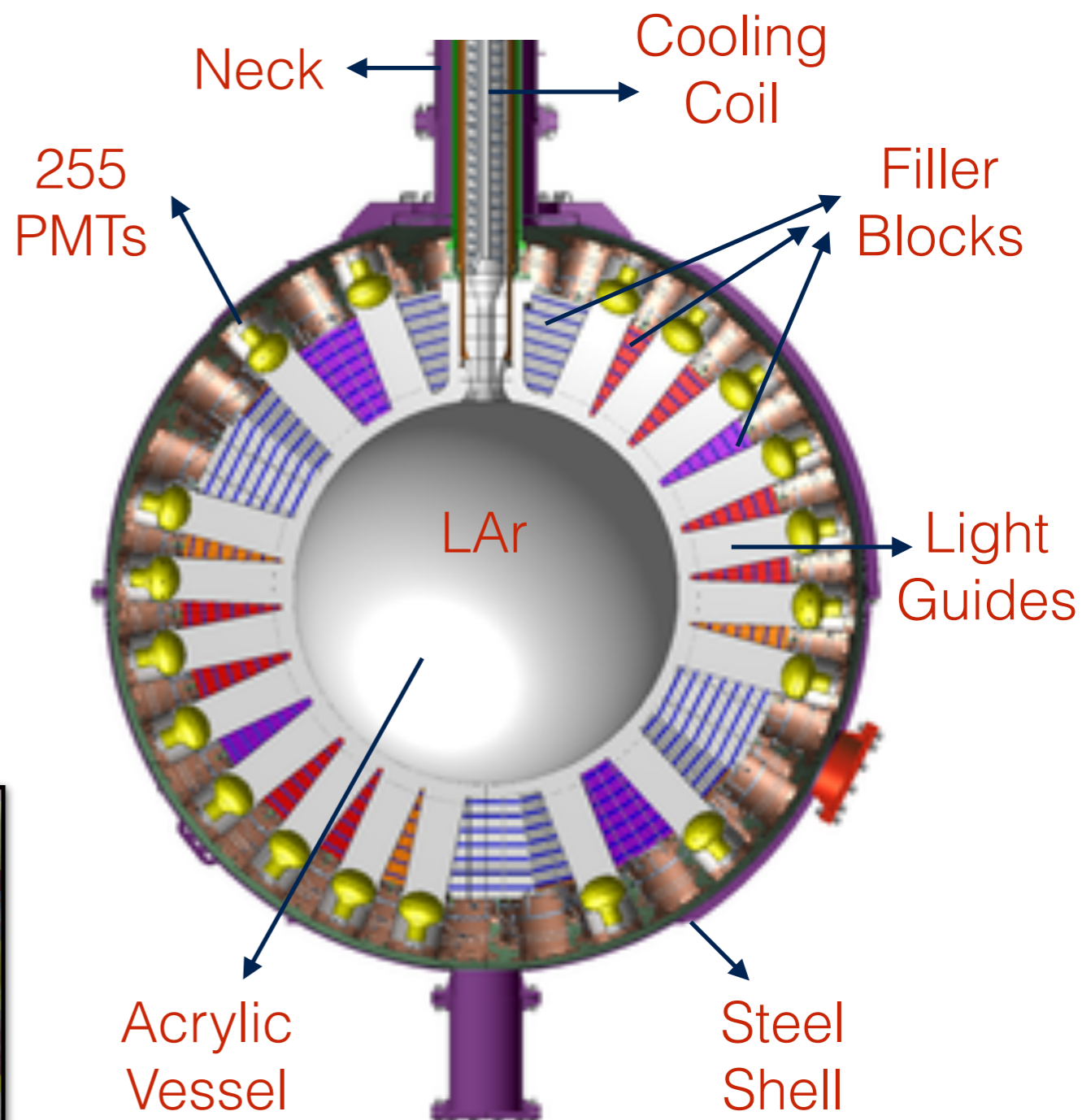
University of Sussex

# DEAP-3600

## Experiment



- Single Phase LAr Detector.
- Ar allows for great pulse-shape discrimination
- 255 PMTs, R5912 HQE 8".
- 3.6T of LAr, 1T of Fiducial Volume.
- Sensitivity of  $10^{-46}$  cm<sup>2</sup> (SI) for 100 GeV WIMP.



## Background Reduction

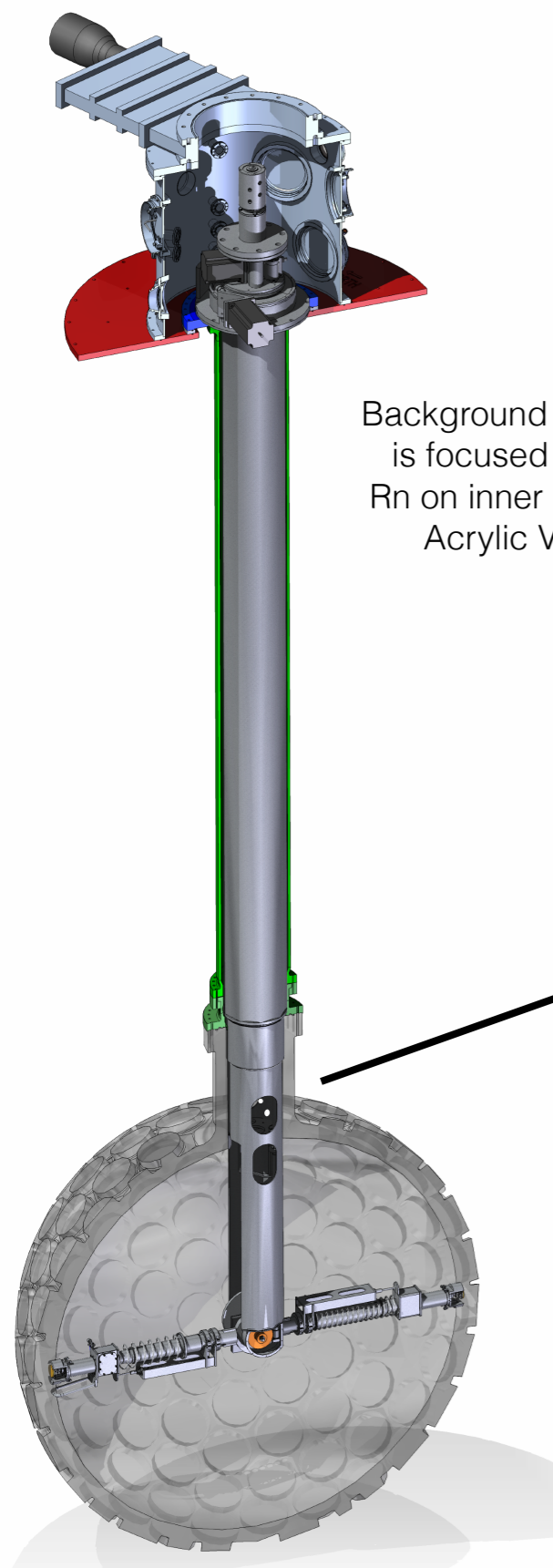
- The acrylic used for the AV was carefully fabricated in a low Rn environment, with a control to  $<10^{-20}$  g/g  $^{210}\text{Pb}$  from Rn exposure.
- The ultimate goal for the resurfacer is to remove 1mm of acrylic from the inner vessel.
- $^{210}\text{Pb} < 10^{-19}$  g/g, resulting in 0.05 events/3 years.
- To achieve that we were extra careful with all the materials used for the resurfacer, to make sure no extra radioactive backgrounds are introduced. We performed a Rn emanation test on all the component materials (very methodical).

Few Examples  
From the Actual Table

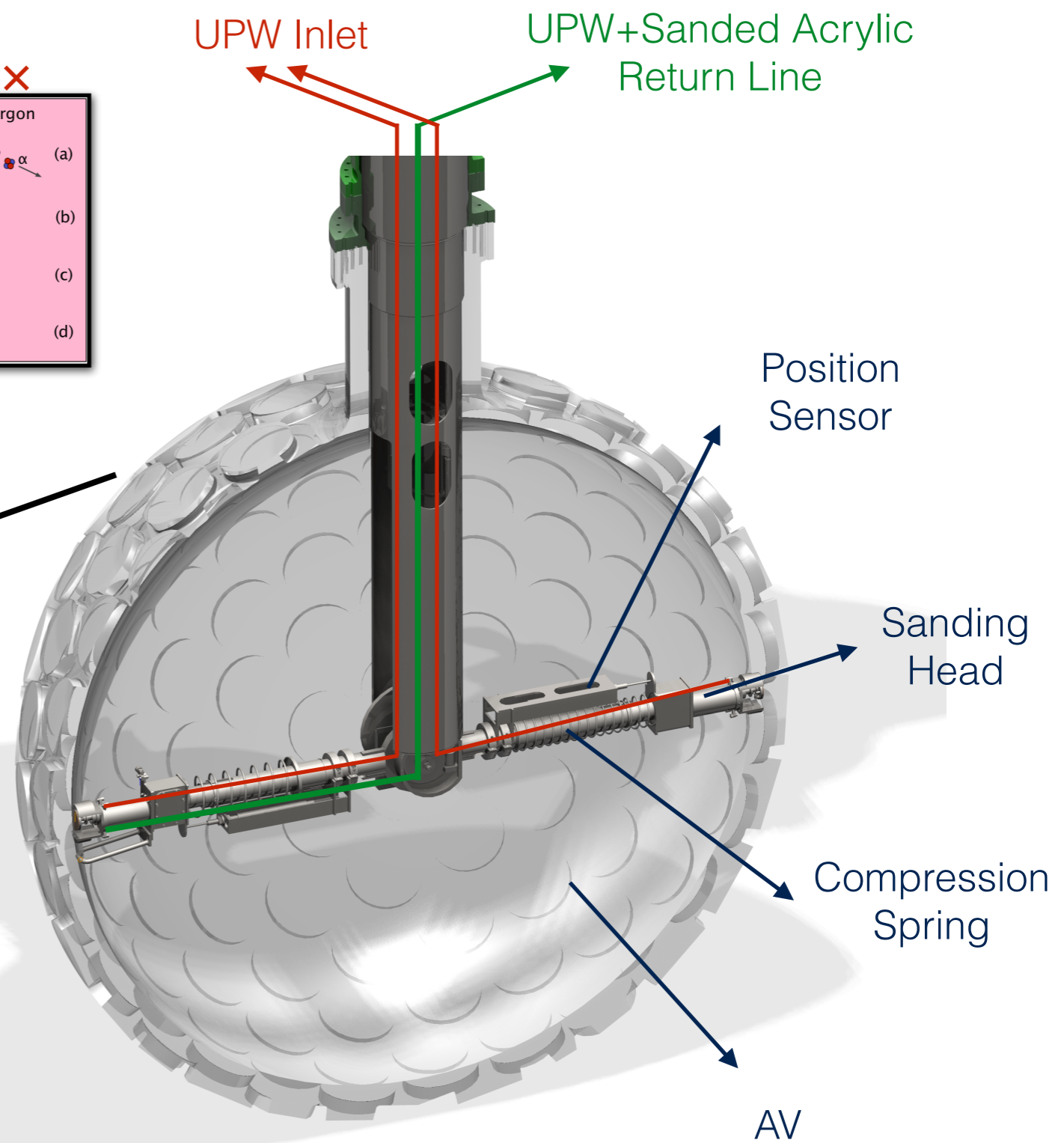
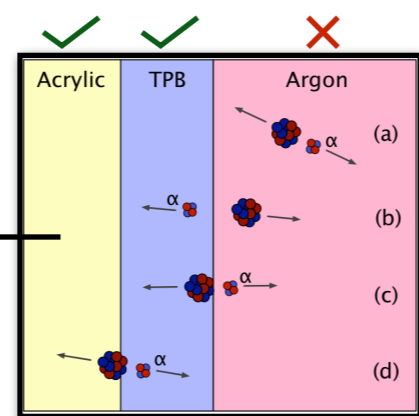
Component	Date of Measurements	Measured Rn Rate	Rn Decay Rate in AV	Scale Factor
Small Bearings	Dec, 9 2012	0.04+/-0.04 mBq	0.41+/-0.41 mBq	11
3/8" UPW Hose	Sep, 4 2012	0.24+/-0.07 mBq	2.94+/-0.82 mBq	12
Teflon Lip Seal	Feb, 12 2013	0.27+/-0.02 mBq	0.27+/-0.02 mBq	5

Few examples from the Rn emanation tables for the Resurfacer components, table includes results from more than 60 different components.

# Resurfacers Concept

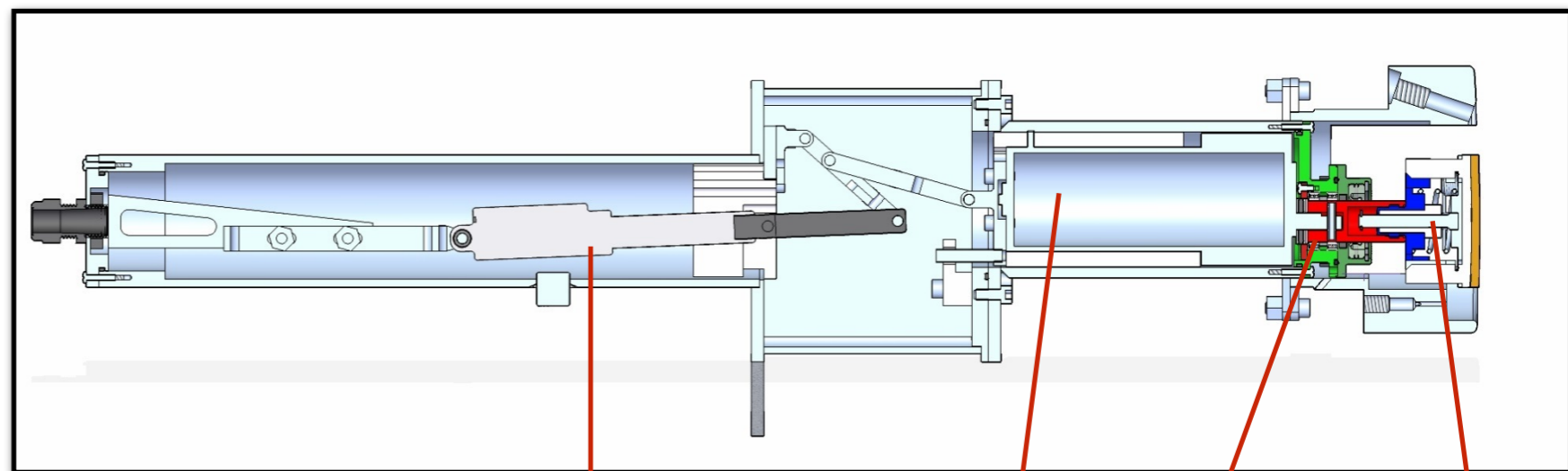


Background the Resurfacers is focused on reducing  $R_n$  on inner surface of the Acrylic Vessel (AV).



# Resurfacers Concept

Aiming to remove 1 mm from the acrylic inner surface of the detector.

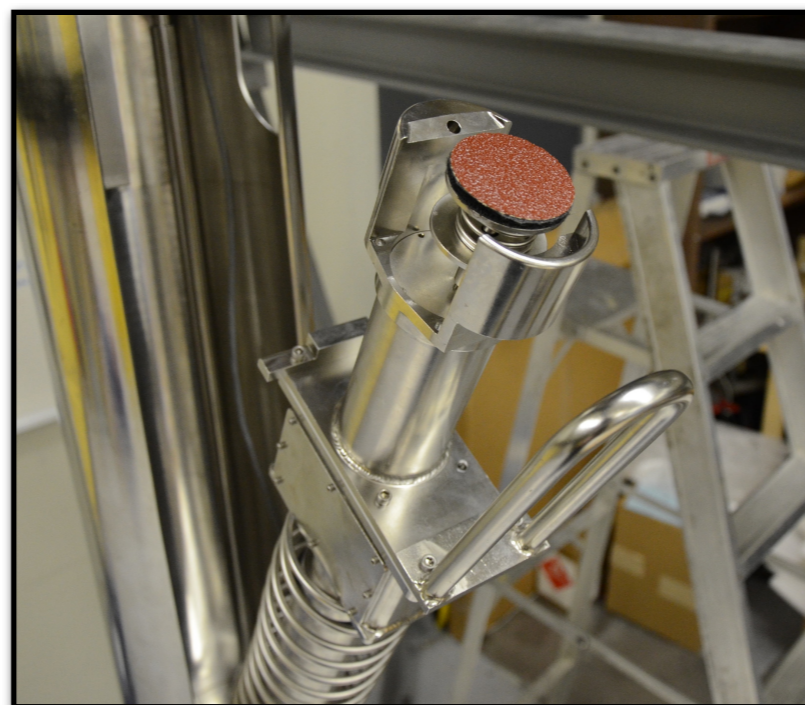
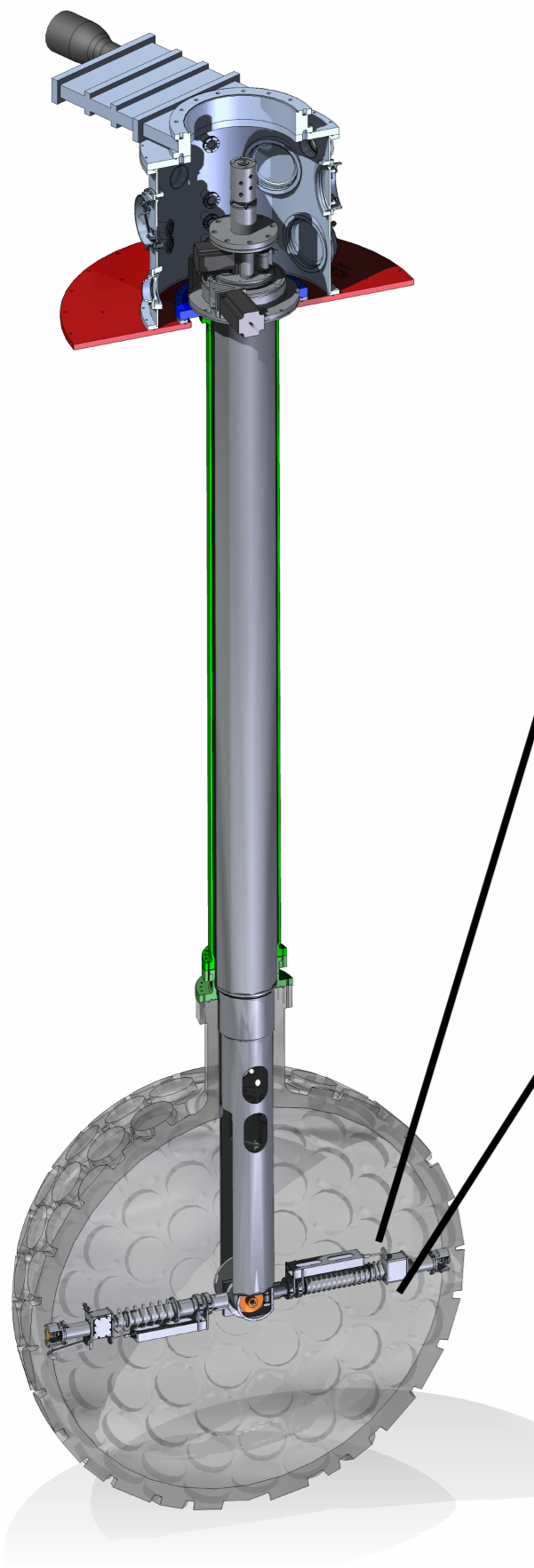


Actuator

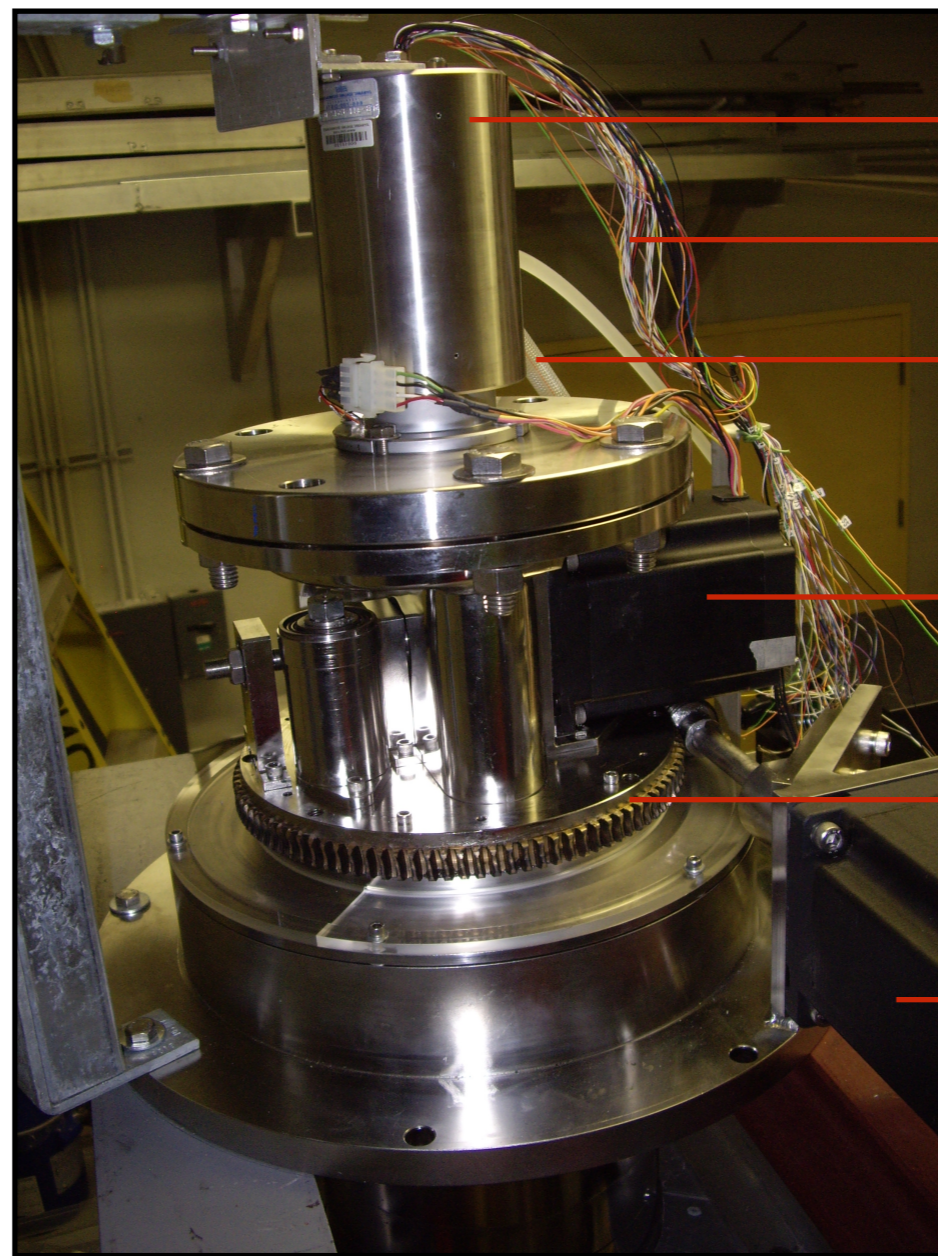
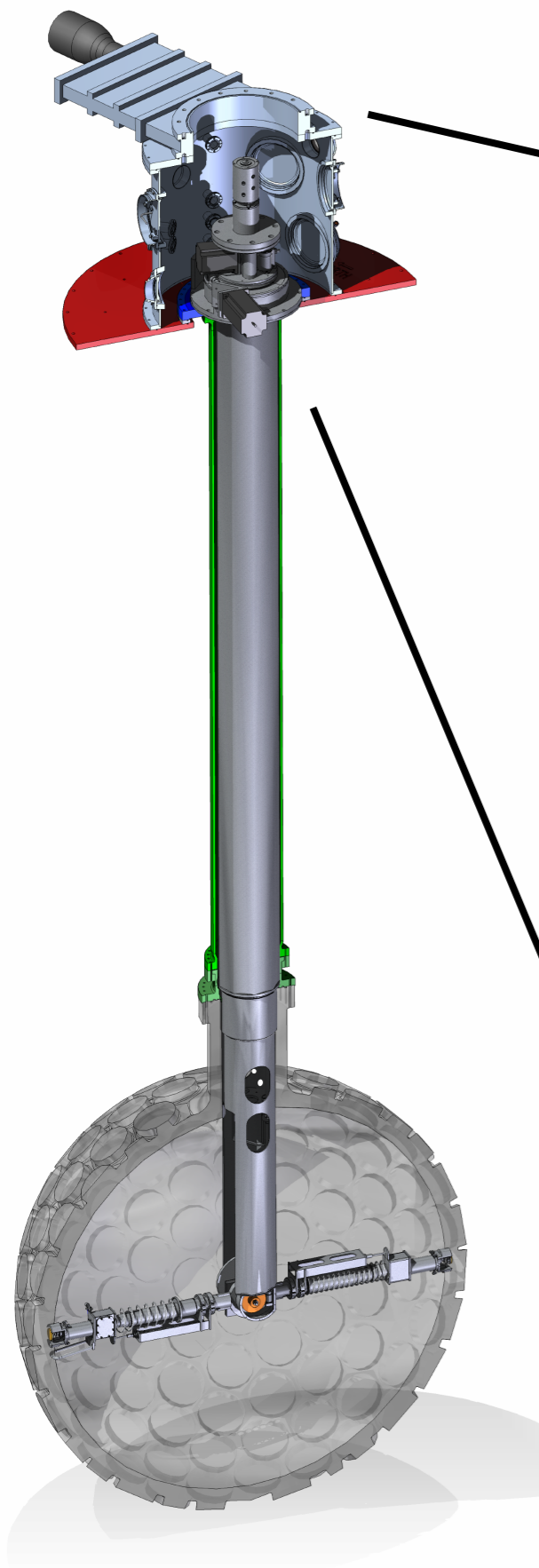
Motor

Bearings

Sanding Pad



# Resurfacers Concept



Rotating Coupling Head

Electronics Connections

UPW inlet hoses

Theta Motor

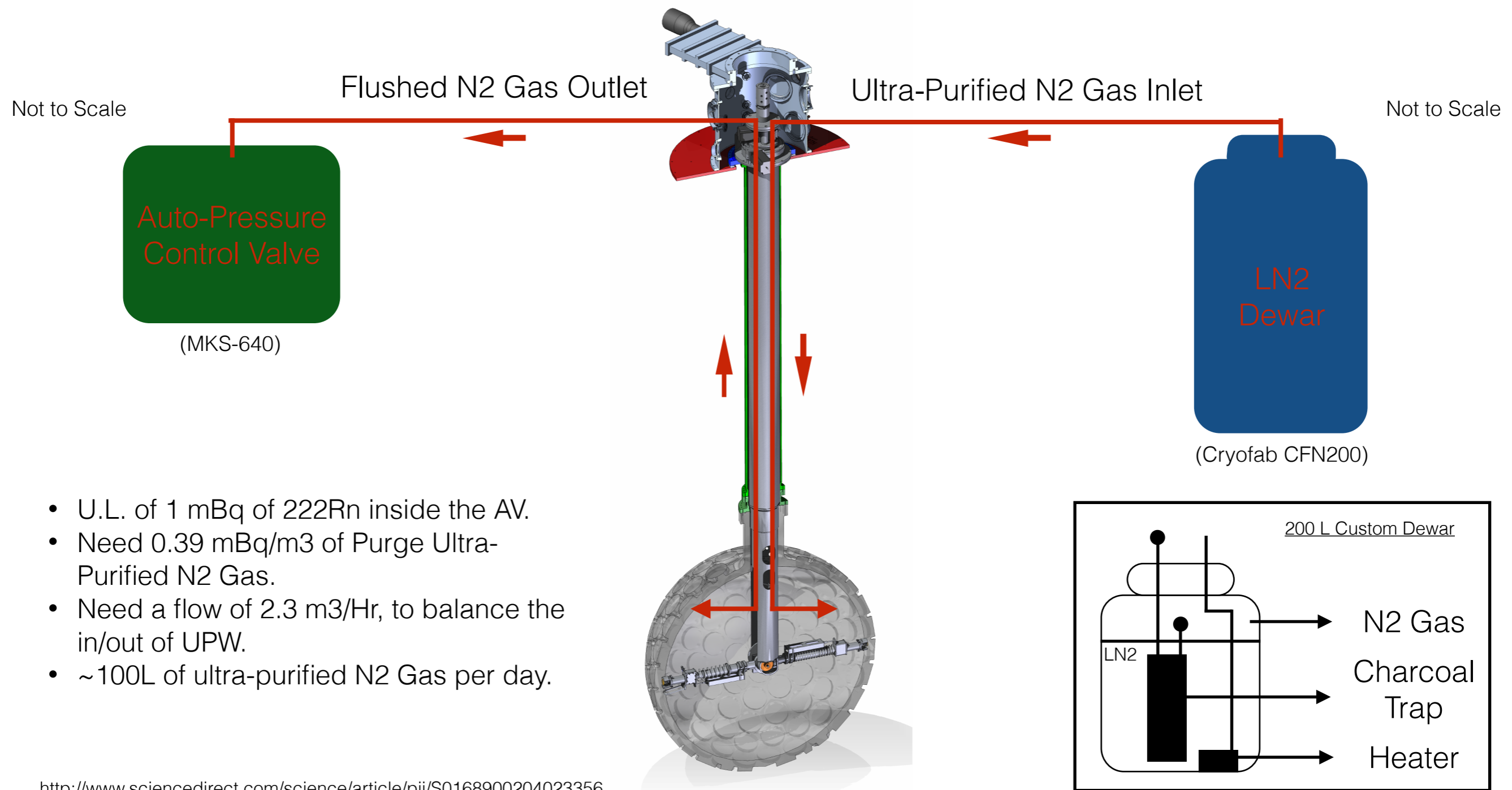
Rotating Gear

Phi Motor



# Gas Purge System

## Concept

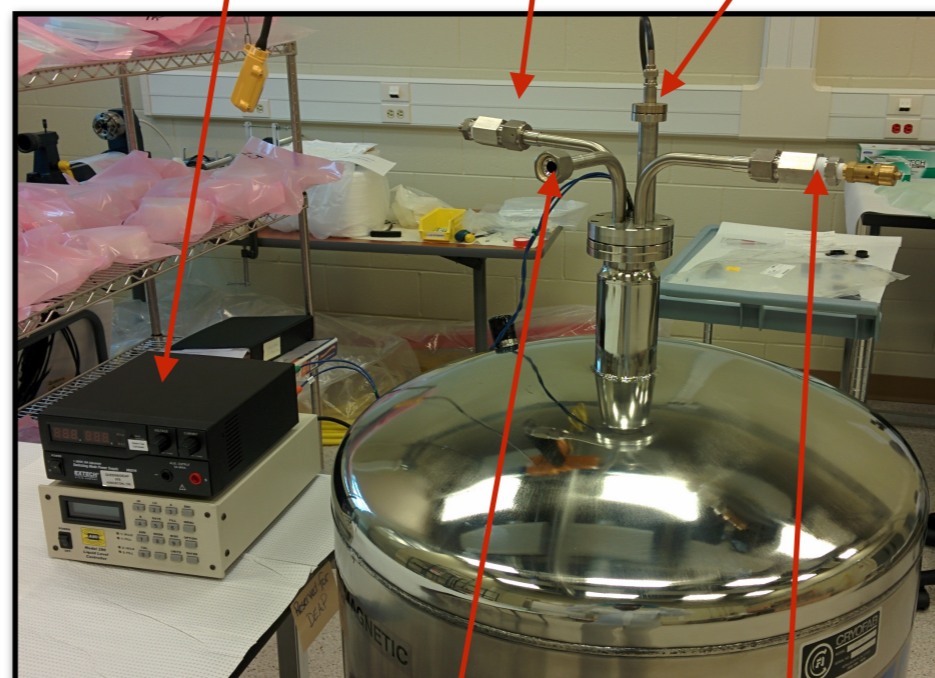


# Gas Purge System

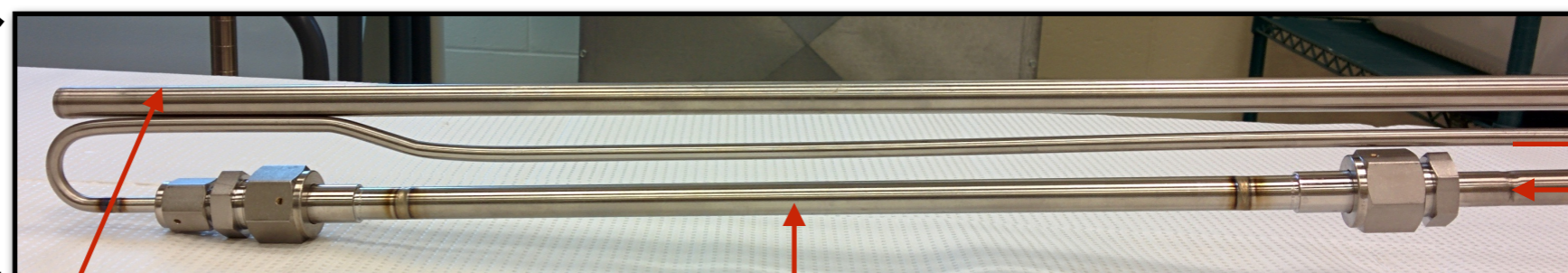
## Apparatus



Heater + LN2 Level Controllers    LN2 Fill Inlet    LN2 Level Probe



Purified N2 Outlet    Relief Valve (10psi)



Heater 3Ω

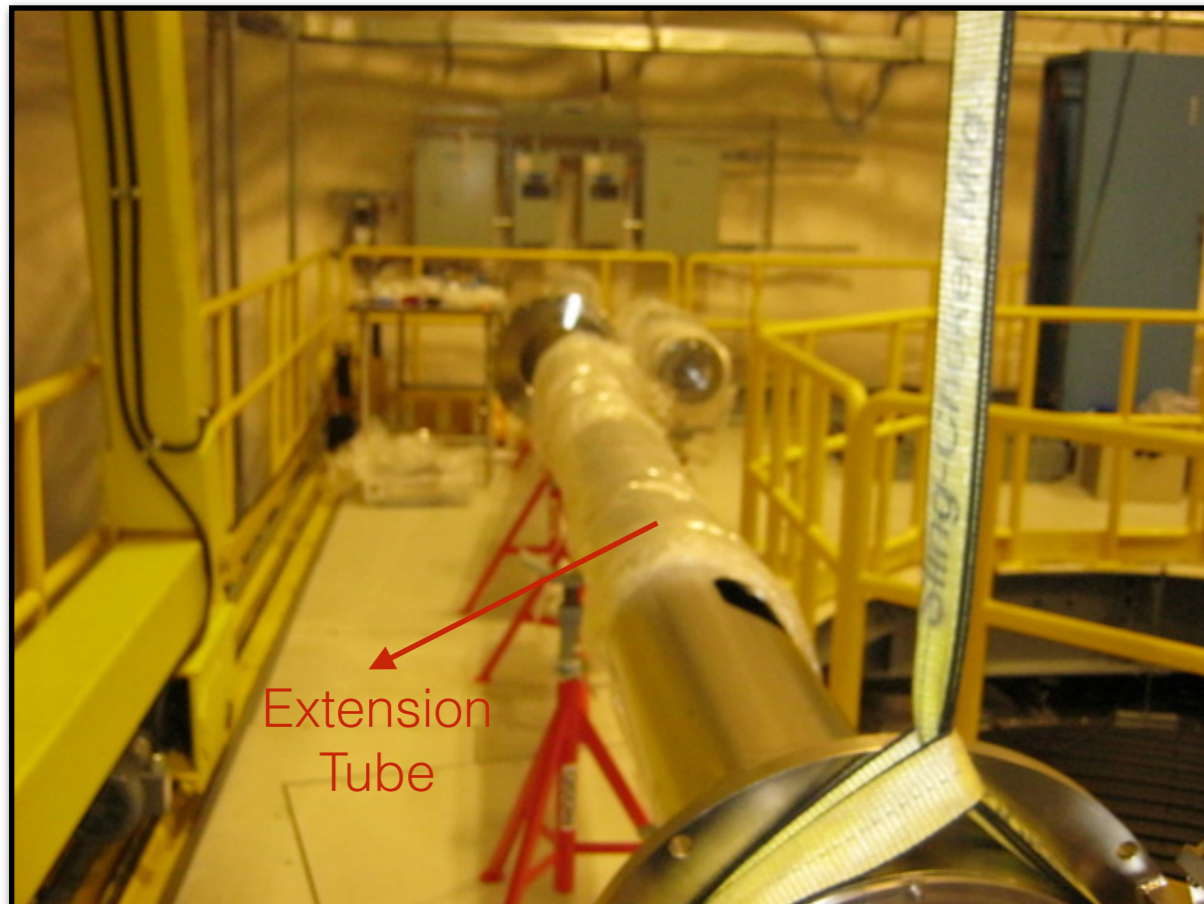
Activated Charcoal Trap

Purified N2  
N2

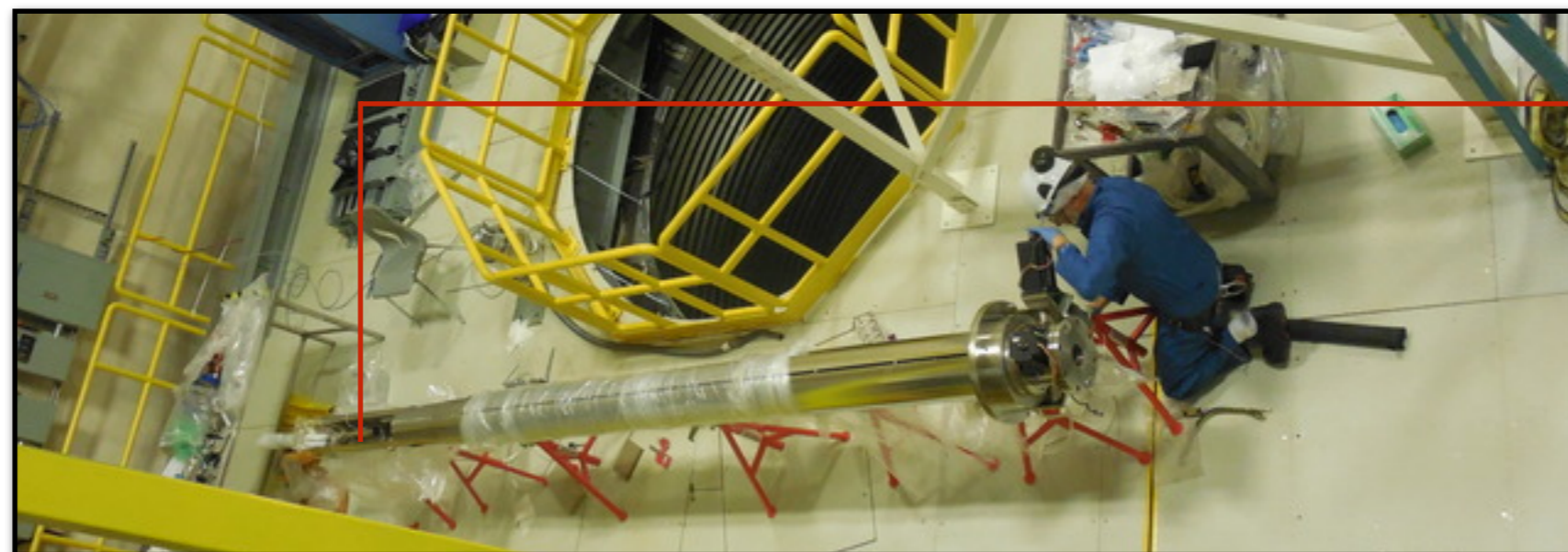
Voltage [V]	Heater Power [W]	Evap. Rate [Kg/Hr]	Run Time [Days]
5	8.33	0.1895	40.2
15	75.0	1.3956	4.3
30	300	4.3761	1.7

Table 1: Display of the flushing rate of ultra-purified N2 from the dewar and the running time (from full fill) of the dewar based on the set power of the dewar.

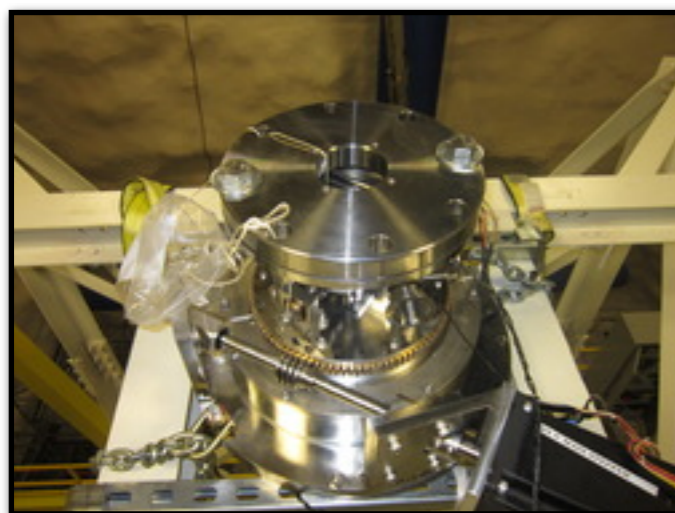
# Current Status @ SNOLAB



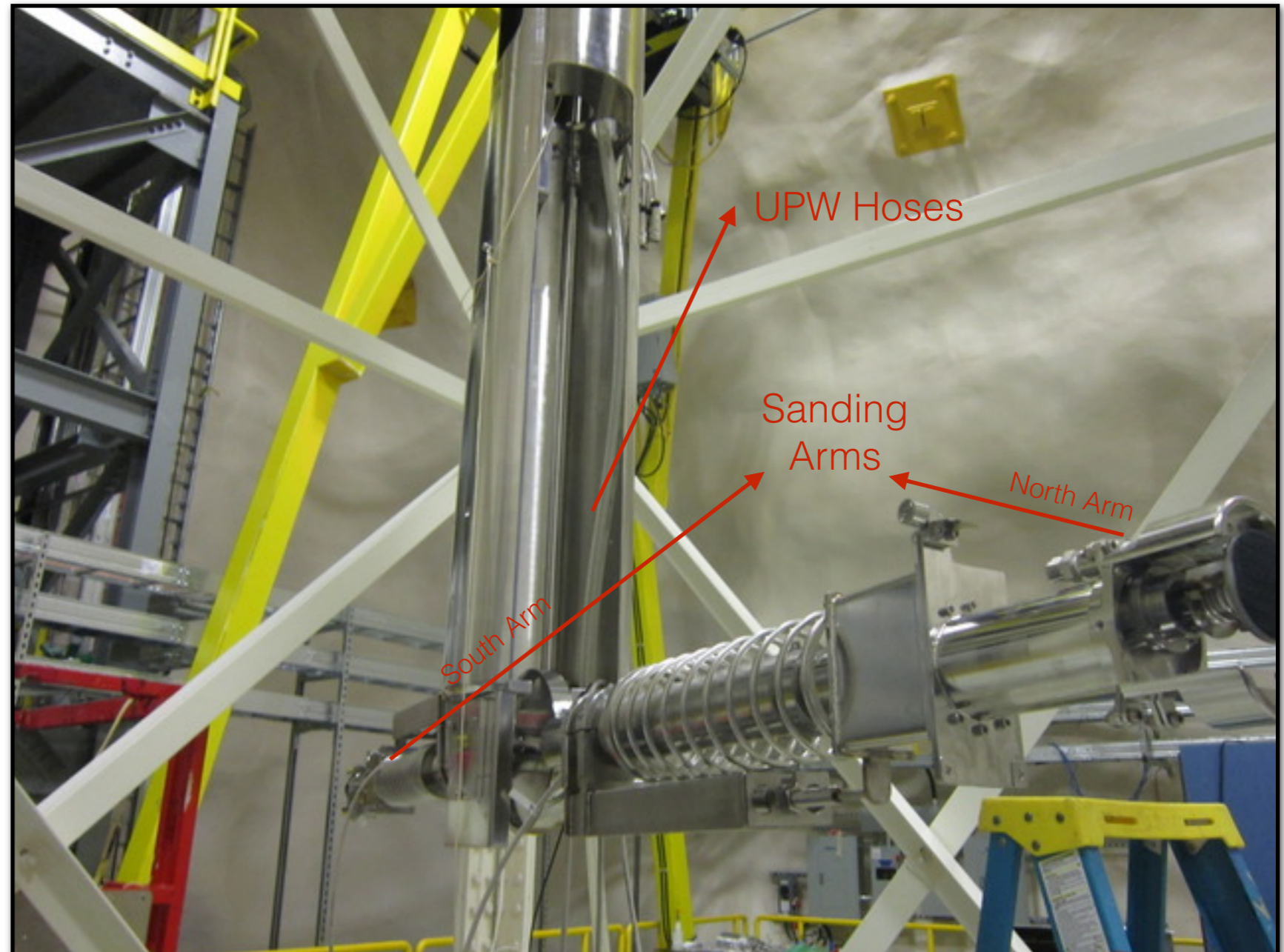
Started by assembling all the mechanical components vertically. Rotating head to sanding arms, with extension tube.



# Current Status @ SNOLAB

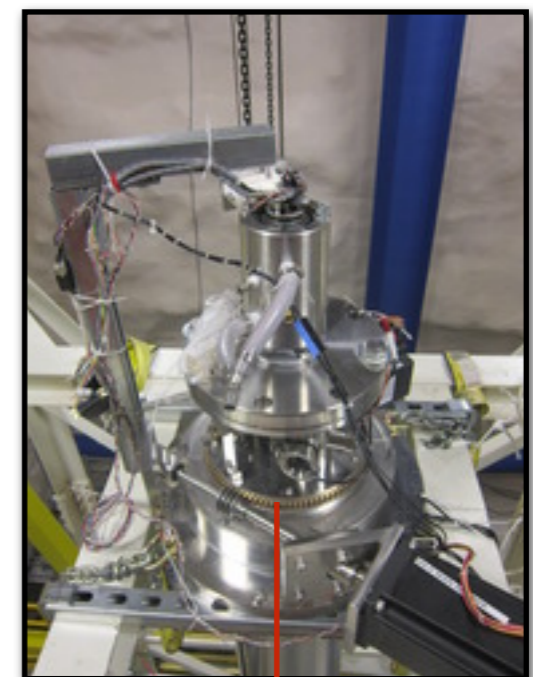
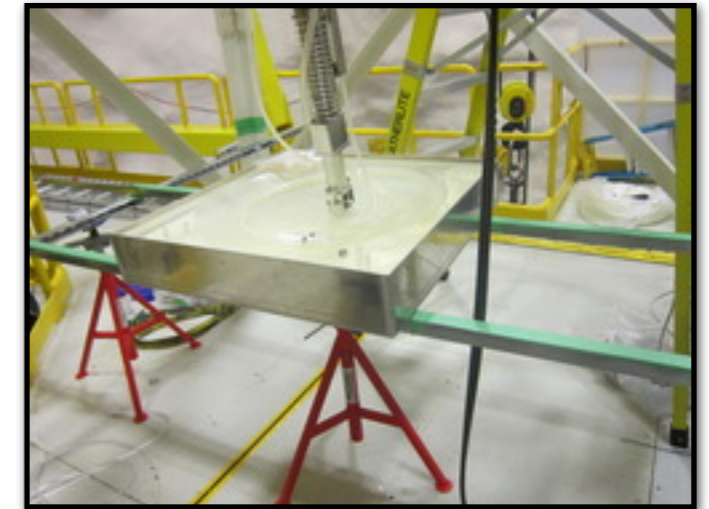
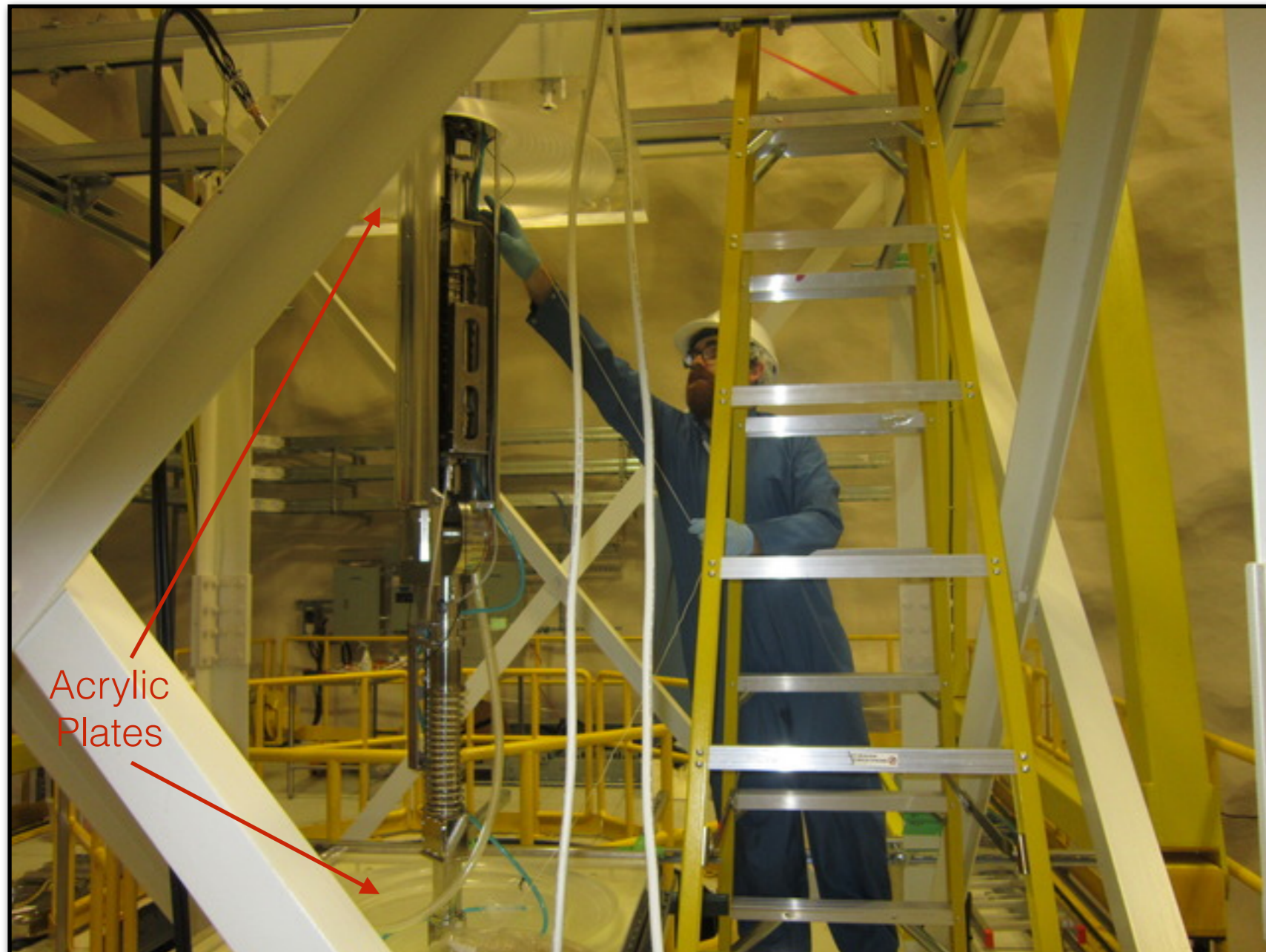


Resurfacer fully secured onto the deployment frame.



Placed the resurfacer in its deployment frame. Started preparing all the internal hosing for the inlet and outlet UPW and all electrical wiring.

# Current Status @ SNOLAB

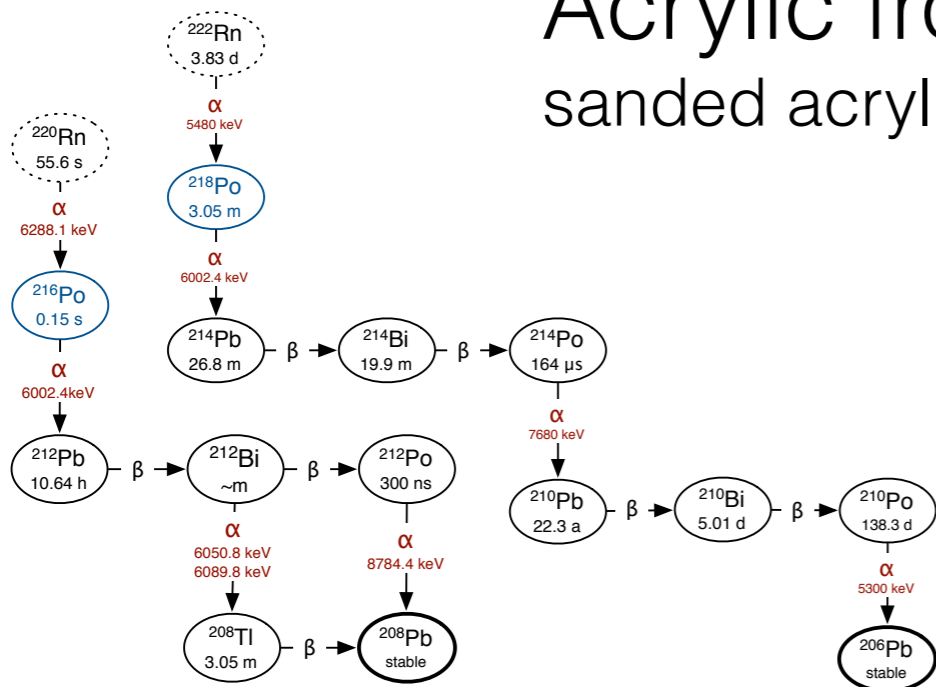


Finished  
Rotating  
Coupling Head

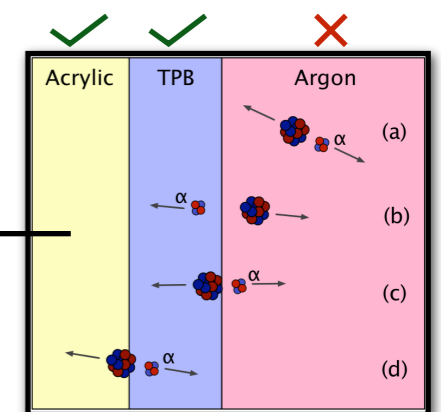
Finished setting up the rotating coupling head. Currently testing the Resurfacer response to compare it with sanding results obtained at Queen's University. Test is performed on two plates that are made of the same acrylic used for the AV.

# Final Goals

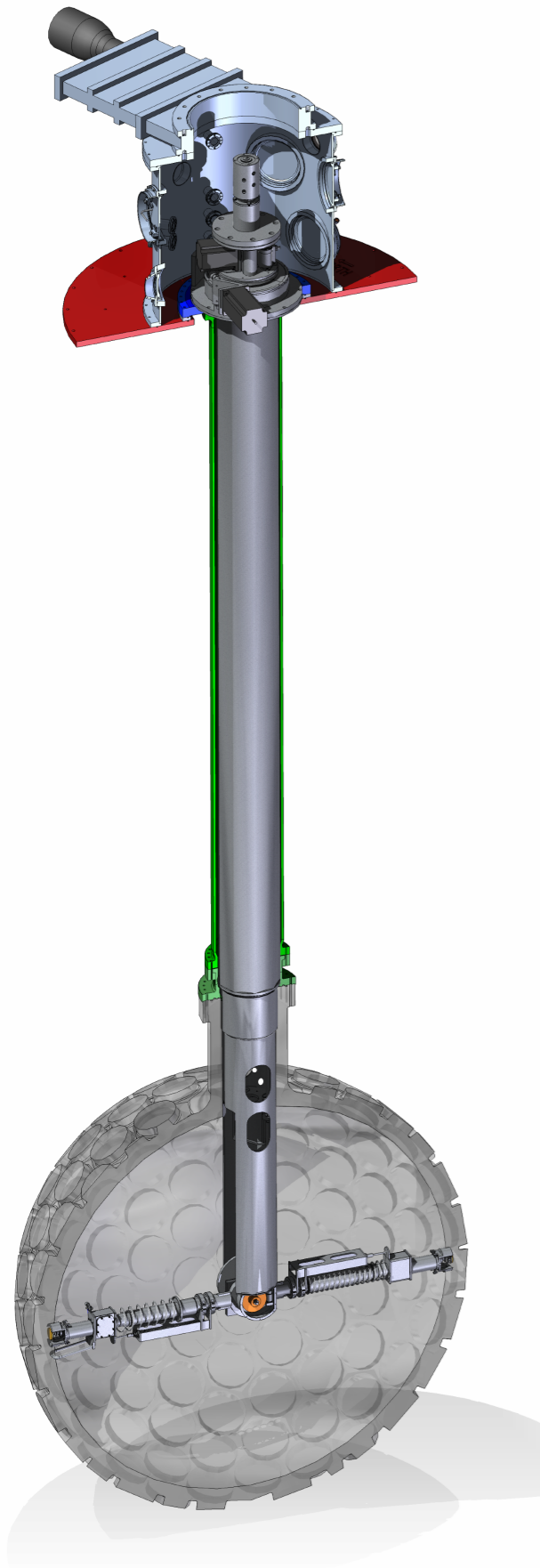
- Finishing testing all Resurfacer features. (end of June)
- Deploy Resurfacer inside the AV. (end of June/beginning of July)
- Start running Resurfacer. (July)
- Sanding till we remove 1 mm of Acrylic from the AV. (analyzing the sanded acrylic as we are sanding along)



Background the Resurfacer is focused on reducing Rn on inner surface of the Acrylic Vessel (AV).



## Conclusions



- 1) We introduced the concept of the resurfacer and how resurfacing is handled for the DEAP-3600 experiment.
- 2) We discussed the complementary ultra-purified nitrogen gas system.
- 3) We elaborated how the resurfacer comes into play for background reduction.
- 4) We gave an update of the current status at SNOLAB
- 5) Defined the goals.