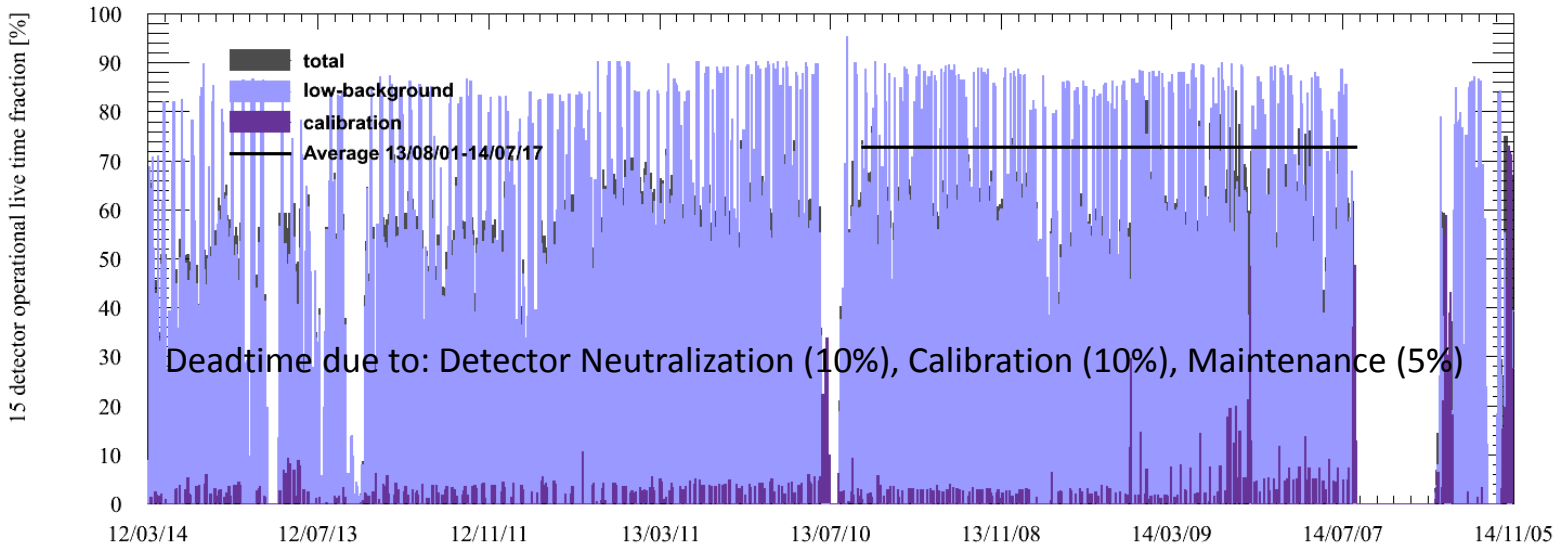
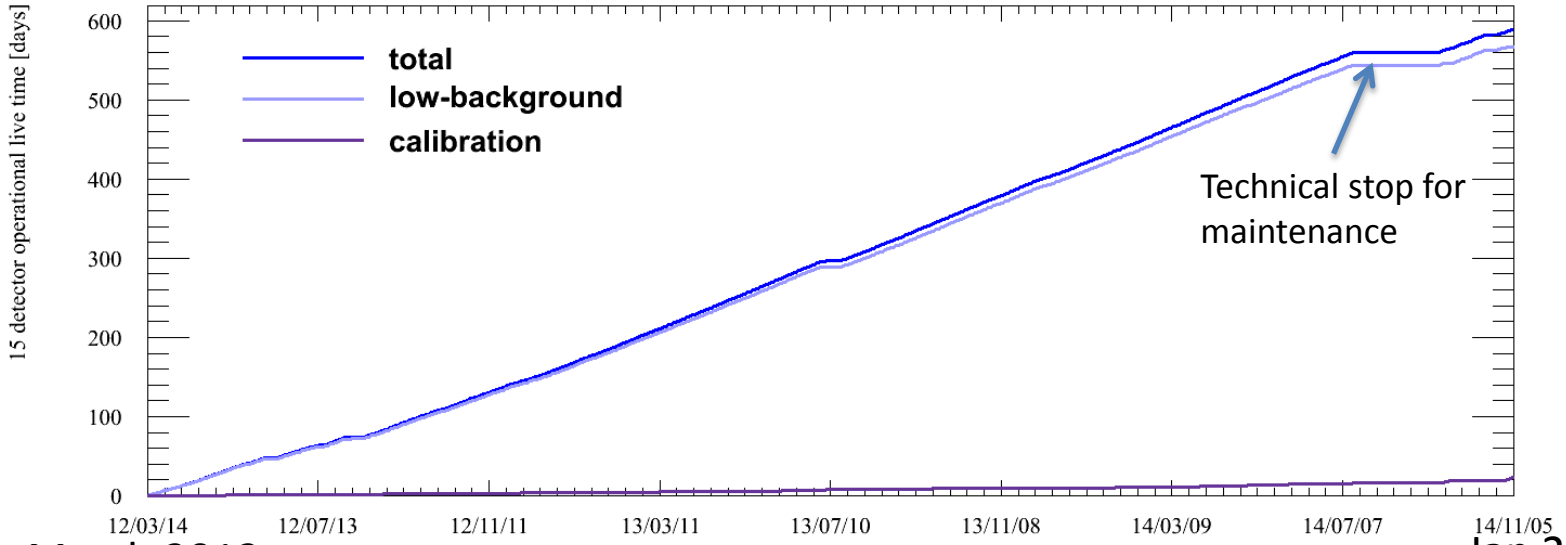
Cosmic Frontier Experiment Status

Feb 2, 2015

Experiment	Location	Status	Start of operations	Nominal end of operations	Physics
SuperCDMS	Soudan	Operating	Mar 2012	Sep 2015	Dark Matter
COUPP/PICO 2L	SNOLAB	Operating	Dec 2013	Sep 2017	Dark Matter
COUPP/PICO 60	SNOLAB	Operating	June 2013	Sep 2017	Dark Matter
Darkside 50	LNGS (Gran Sasso)	Operating/Calibrating	Jan 2014	Sep 2017	Dark Matter
DAMIC	SNOLAB	Operating	Dec 2012	Sep 2016	Dark Matter
Dark Energy Survey	CTIO, Chile	Operating	Sep 2013	Feb 2018	Dark Energy
Pierre Auger	Argentina	Operating	2008	Sep 2015 (for FNAL)	High Energy Cosmic Rays
Holometer	Meson Lab	Operating	Sep 2014	Sep 2016	Spacetime

SuperCDMS Soudan – 3 years of data taking





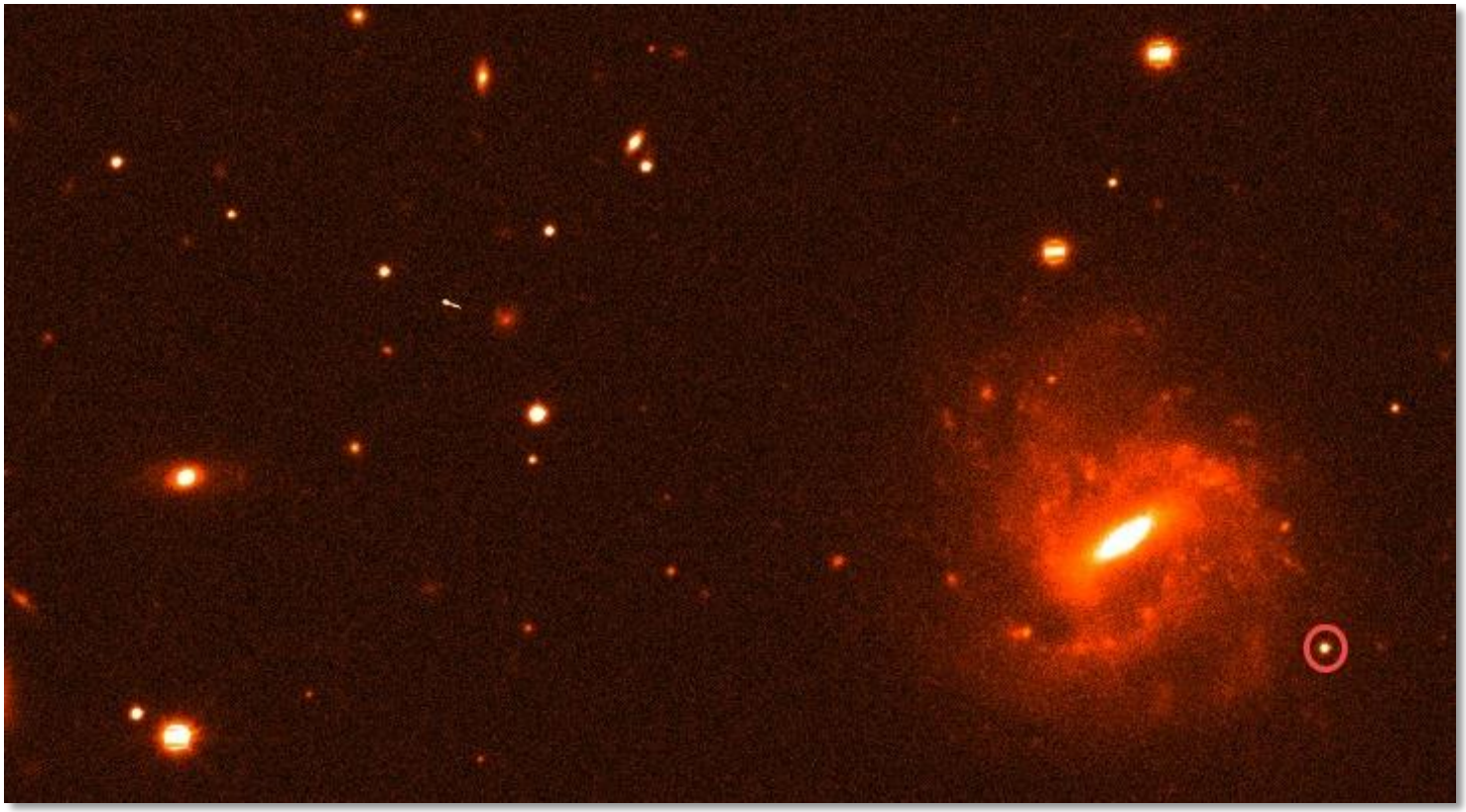
March 2012

Jan 2015

SuperCDMS Soudan FY15 Operations Plan

- Calibration data and systematic studies
  - Extended calibration data sets
    - Neutrons (252Cf) and Gammas (133Ba, 60Co)
    - Mono-energetic neutrons (Y/Be, Sn/Be) for nuclear recoil E scale
  - Better understanding of backgrounds
    - Source studies in stems and outside shield
  - Study electrical and vibrational noise sources, and ways to reduce these
  - Determine reasons for failures of detector channels
- CDMSlite Run 3
  - Additional 3-4 months of running with even lower energy thresholds and better electric field geometry will give substantial improvement in sensitivity to very low mass WIMPs

Most Crisp Images in DES History



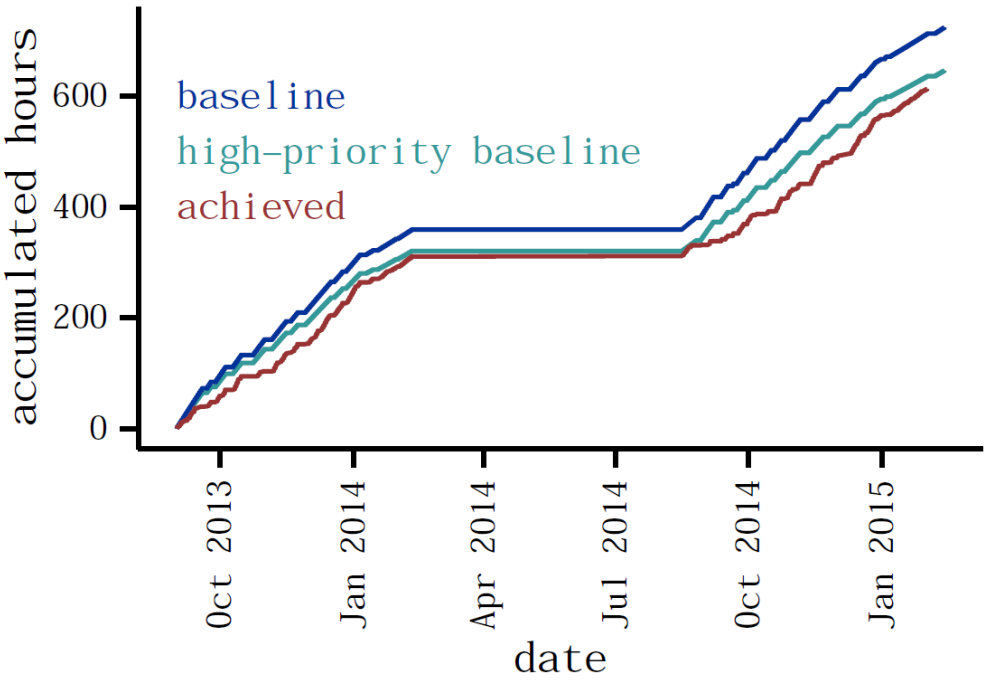
- z-band seeing (point spread function) 0.66” may be the best seeing so far for DECam 01/27/15
- New records for darkest sky
- **We finish Y2 (2nd year of 5) on the night of Feb. 15th**

Y2 Observing Summary (up-to-date)

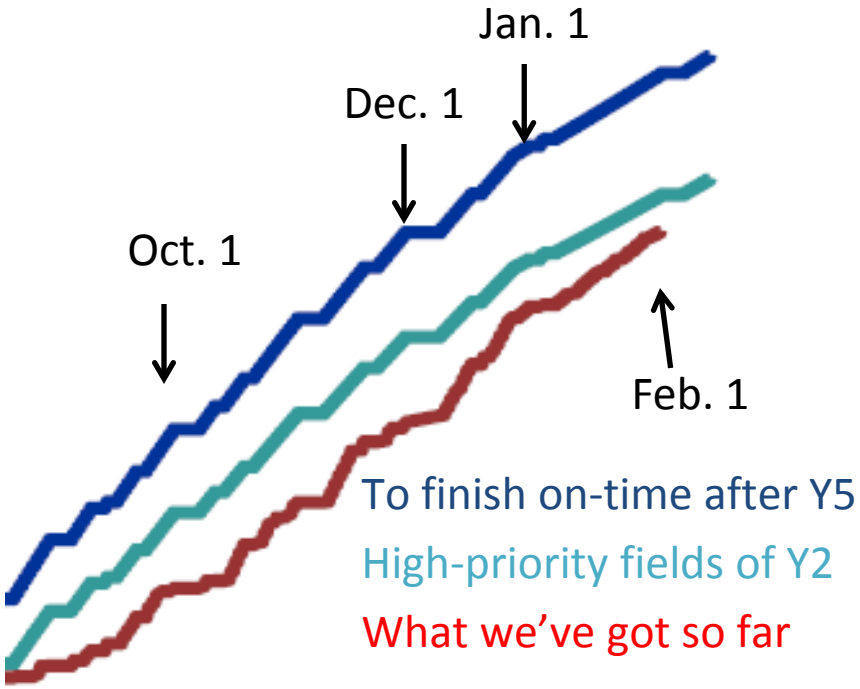
- So far DES has had 101 scheduled observing nights (for Y2).
- **Bad weather (clouds, mainly) has caused us to fall behind our nominal rate of accumulating good exposures.**

	# Nights	Total Hours	Hours Observing	Lost Camera or Telescope	Lost Obs. Error	Lost Weather
Aug.	9	92 ¾	58 ¾	0	0	34
Sept.	18	181 ¼	122 ¼	¾	0	58 ¼
Oct.	21	201 ½	165 ½	2 ¼	¼	33 ½
Nov.	21	178	163 ¼	½	0	14 ¼
Dec.	18	131 ¼	130 ¾	½	0	0
Jan.	14	105 ¼	103 ½	1 ¾	0	0
Total	**101**	**890**	**744**	**5 ¾**	**¼**	**140**
		100%	**83.6%**	**0.6 %**	**0%**	**15.7%**

Accumulated Observations



- Comparison vs. typical simulation for Y1 and Y2 (to date)
- Bad Weather is distributed evenly
- We are behind "baseline Y1 + Y2"

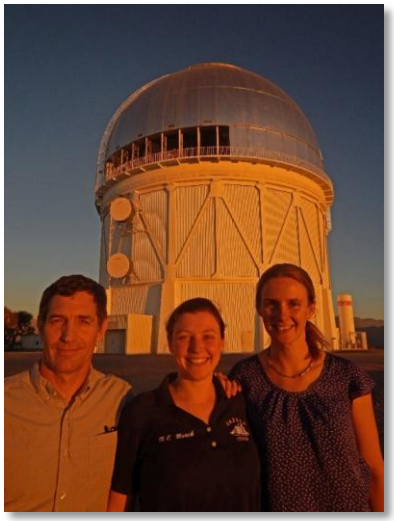


- Fell behind in September.
- Gained no ground by end Nov.
- Catching up vs. the simulation after November.
- I don't think we can get all the way back in Y2. The good news is that when conditions are good we gain ground.

DARK ENERGY SURVEY

Progress on Improvements for DECam/Blanco for Y2

- New Dome Environmental Controls:
  - 2 large glycol-cooled **air-handlers will better maintain the primary mirror at or just below the air-temperature**: this improves baseline for clarity in images.
- New Primary Mirror Support Pad air-pressure controls:
  - This allows a kind of “adaptive optics” to improve image quality
  - The present system controls mirror shape depending on gravity vector with an astigmatic correction. **Higher-resolution air-pad controls installed: may be improving image quality already**.

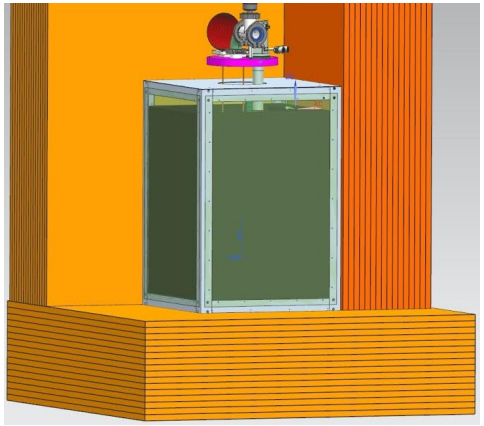


DAMIC – Dark Matter In CCDs

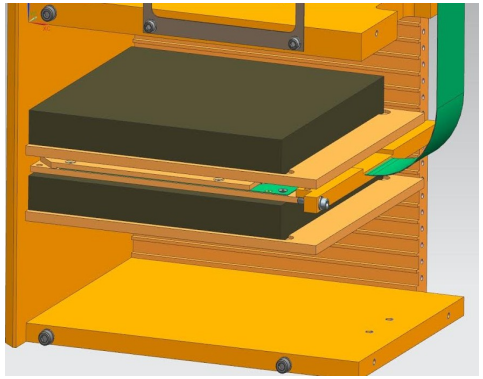
FNAL, UChicago, UMich, Mexico, Argentina, Paraguay, Zurich

January 2015 – February 2015

- DAMIC-100 first phase upgrade at Snolab
  - All detectors working with unprecedented low background levels.
  - Running in asymmetric binning mode to lower the energy threshold.
  - Fabrication of the new nitrogen purge box to reduce Radon background is almost completed.



- DAMIC@Snolab: Next Upgrade - February
  - Packaging two new detectors to be installed during the next upgrade.
  - Fabricating a new inner ancient lead shield to produce a super-shielded CCD to test the limits of the current package design.

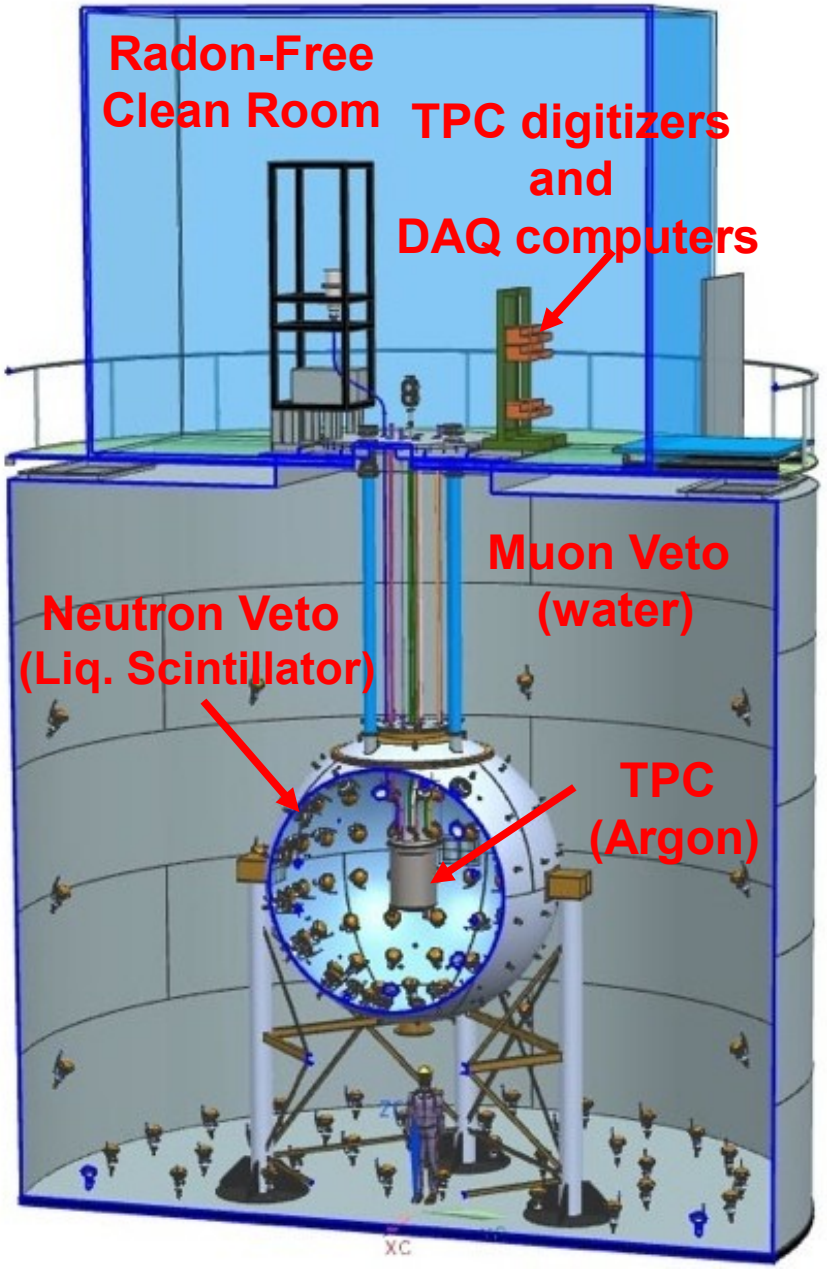


Status: taking data with prototype detectors. Uptime >95%. High quality data.

DarkSide-50 Status

- **TPC: major step**
  - In December the underground Ar left Fermilab
  - **Underground Ar arrived to Italy on Jan 27th and is on its way to LNGS.**

- **Neutron Veto**
  - Initially we ran with TMB and PC mixture
  - Observed high rate of 14C rate due to TMB
  - TMB removal: achieved <0.1%
  - Acquired new batch of clean TMB
  - **During January new batch was deployed reaching a 5% concentration with no LY reduction**
  - **Calibration campaign with neutron source for one week**
  - **More PPO is being added today to increase the LY**



Holometer Operations Status

2/2/2015

- Mode of operation for next few months:
  - Analyze data to discover systematics
  - Modify apparatus to quantify/correct systematics
  - Take more data

- Currently analyzing 25 hours of high-quality data taken in November, 2014
- Another 25 hours of data taken in January, 2015.
  - Duty cycle at night = 95%
  - Duty cycle during day = 40% due to "cultural" seismic noise
  - New bugs in control system due to upgrade of EPICS being investigated
  - More running planned for February as students return from job interviews

- Supplementary analysis/measurements on injecting correlated signals into both interferometers; studying mirror vibrations, laser phase noise, etc.

- Technical paper on calibration in preparation for submission this month
- 1st graduate student thesis defense this week

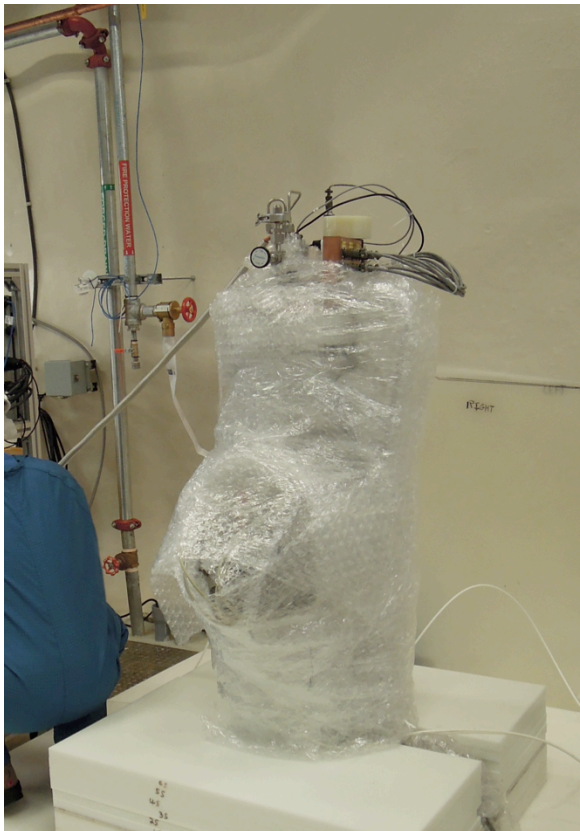
COUPP/PICO Operations Summary

- We continue to learn about particulates extracted from PICO-2L and COUPP/PICO60 last year
- Goal remains to eliminate
  - Prevent them from getting in
  - Remove them in situ

COUPP/PICO Operations Summary

- PICO-2L with new jar flange and cleaning process is now installed at SNOLAB
  - Fill to follow this month, on next trip up
  - Engineering run to test whether particulates come in from the fill or are produced in situ

Meanwhile, as the presence of thorium contamination points to steel as the source, retrofit designs to isolate bellows from active fluid are being pursued



COUPP/PICO Operations Summary

- PICO60 prototype vessel was disassembled
- Galvanic rust found near the gold wire seal
- Replacement seal design (PTFE gasket) in place ready for testing on prototype vessel

Next step is likely removal and disassembly of actual vessel for seal replacement