12 November 2025

Building in SNOLAB's Underground Laboratory

Erica Caden (she/her)

Research Scientist

* Thanks to Mike Stoddart & Brian Morissette for Slides

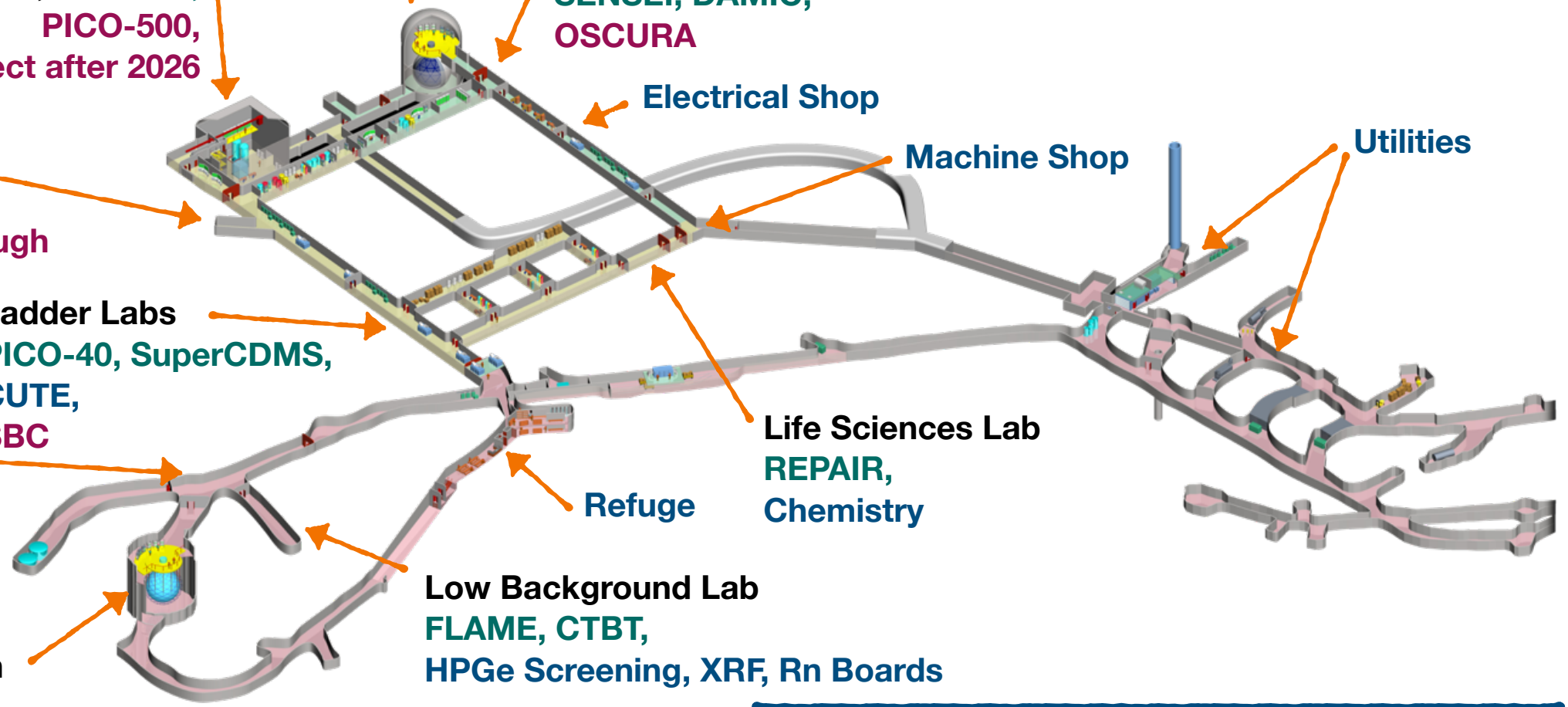
SNOLAB

SNOLAB is located on the traditional territory of the Robinson-Huron Treaty of 1850, shared by the Indigenous people of the surrounding Atikameksheng Anishnawbek First Nation as part of the larger Anishinabek Nation.

We acknowledge those who came before us and honour those who are the caretakers of the land and the waters.

SNOLAB

Experiment Areas
Current Experiments
Laboratory Facilities
Future Experiments



Cryopit
Future 0νββ

Cube Hall
DEAP-3600, NEWS-G,
PICO-500,
Potential for large project after 2026

J-Drift
SENSEI, DAMIC,
OSCURA

Electrical Shop

Halo Stub
HALO,
Potential breakthrough
for expansion

Machine Shop

Utilities

Ladder Labs
PICO-40, SuperCDMS,
CUTE,
SBC

Plants
UPW, LN2, Scintillator,
TeDiol, TeA

Life Sciences Lab
REPAIR,
Chemistry

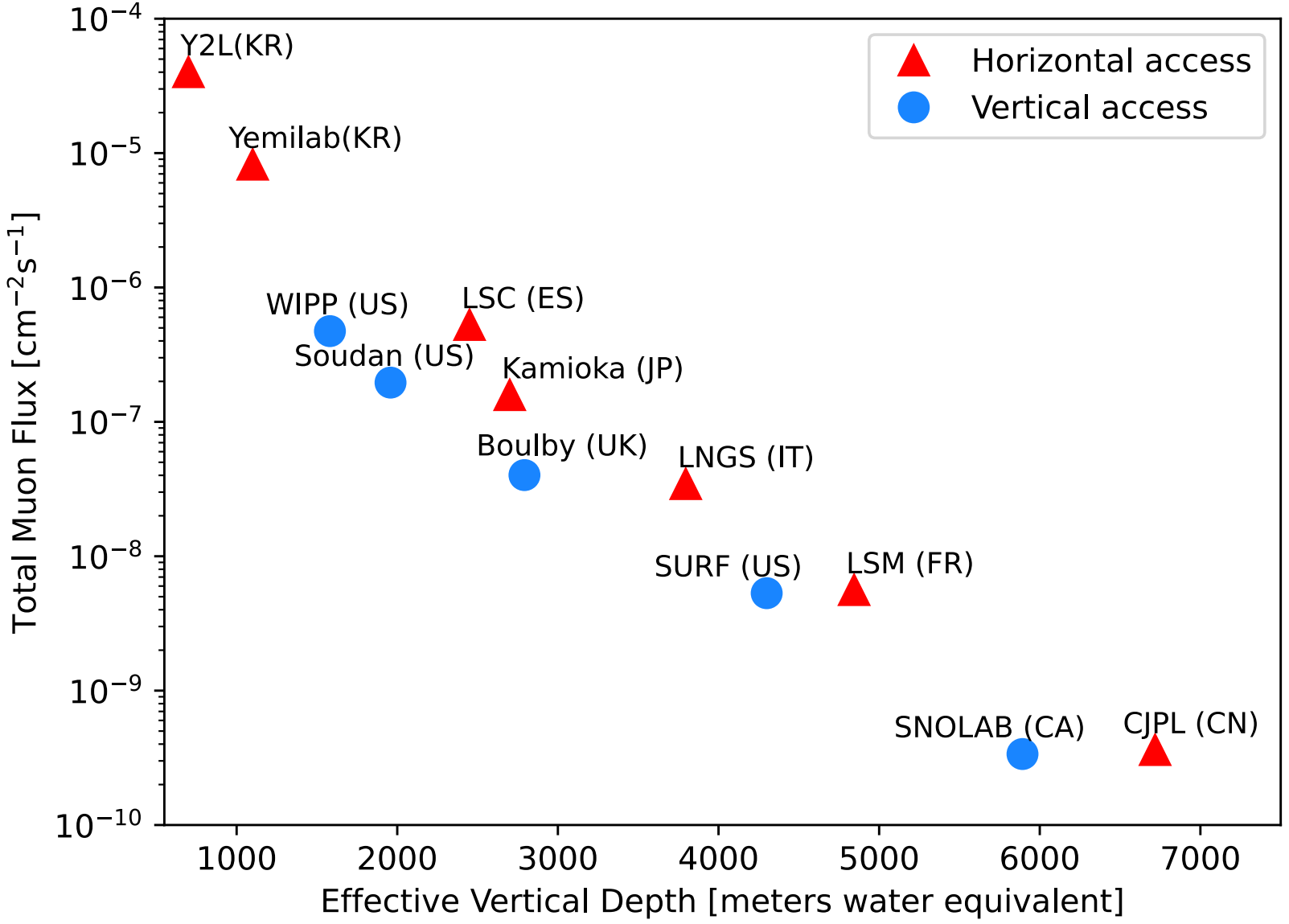
Refuge

Low Background Lab
FLAME, CTBT,
HPGe Screening, XRF, Rn Boards

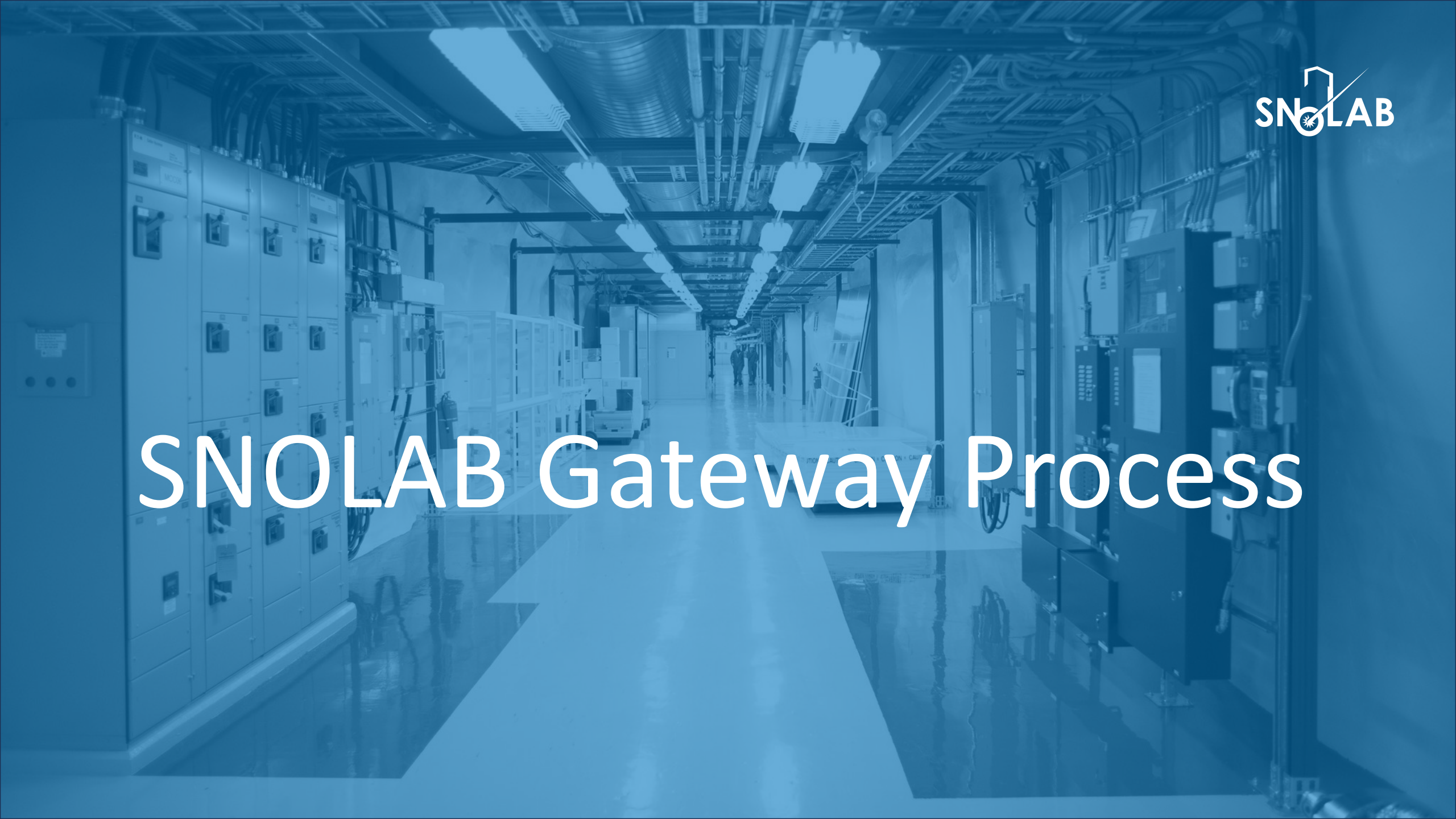
SNO Cavern
SNO+,
Potential for large project after 2035

- 5,000 m^2 of class 2000 cleanroom
- <2000 particles >0.5 μm in diameter per ft^3

Laboratory Depths

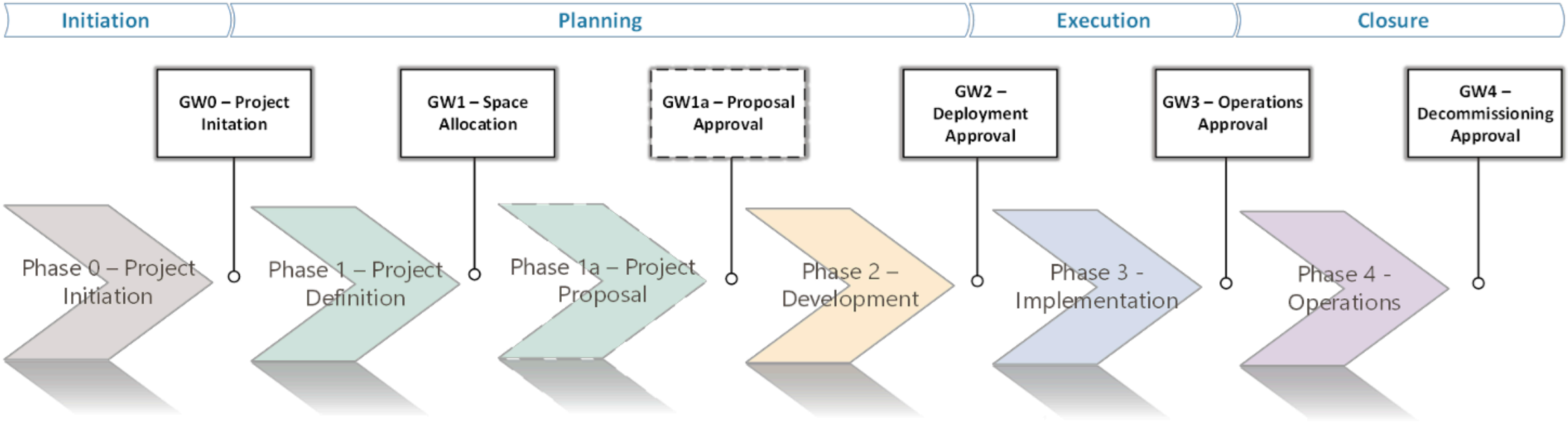


adapted from
Chin. Phys. C 45.2 (2021)



SNOLAB Gateway Process

SNOLAB Project Lifecycle

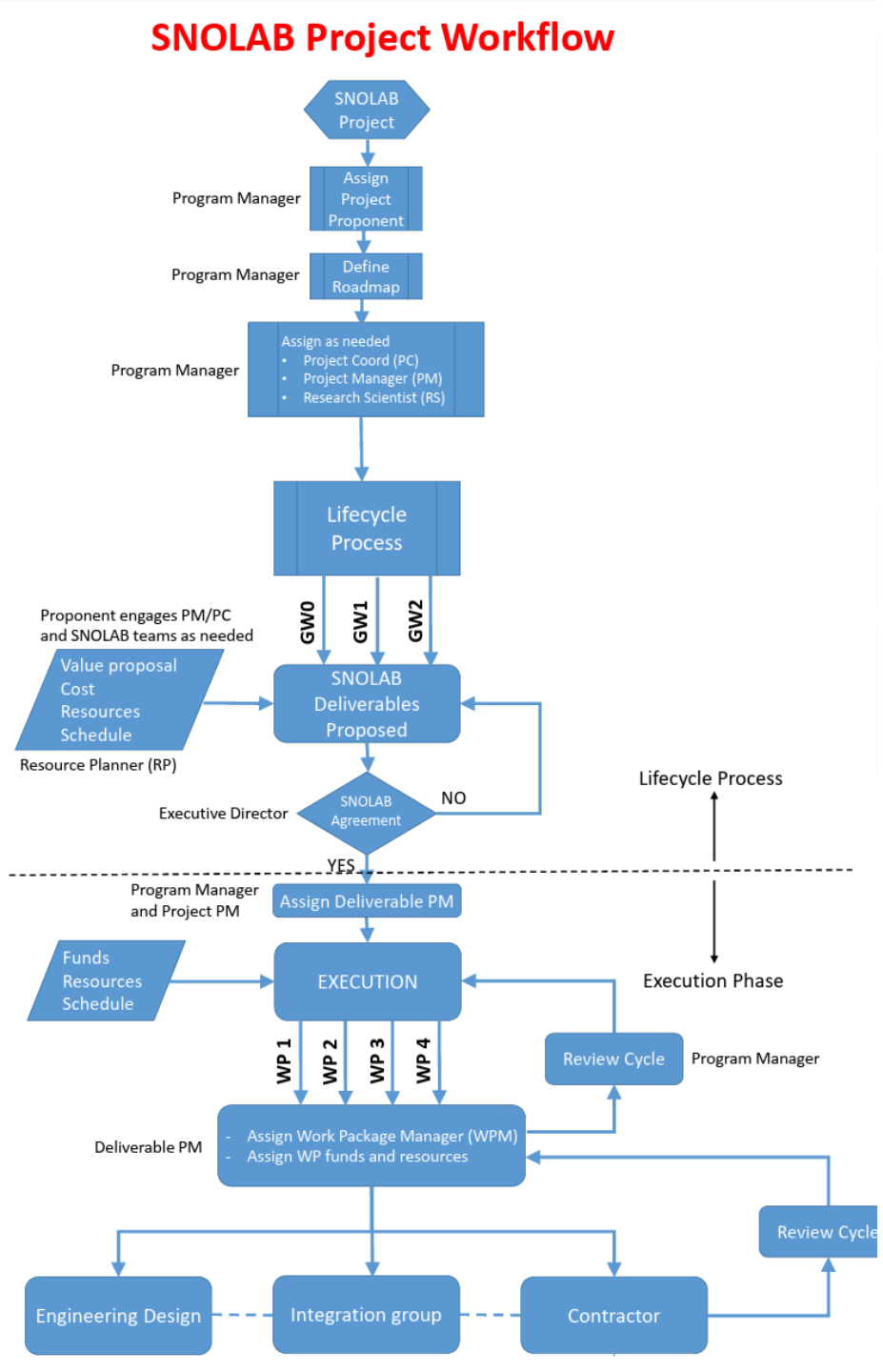


SNOLAB life cycle process whereby SNOLAB supports experiments through their life cycle at the lab.

All collaborations seeking space allocations are required to have both a Code of Conduct and an EDI plan is reviewed as part of the life cycle process for an experiment.

Project Oversight & Priorities

- Efforts split into Experiments and Projects
  - Experiments often result in projects
- Both internal upgrades and external projects subject to review
  - External Advisory Committee
    Project Oversight Group
- Regular gait for project oversight
  - External advisory committee reviews experiments biannually
  - POG meets to review projects monthly
  - New project intake once per year



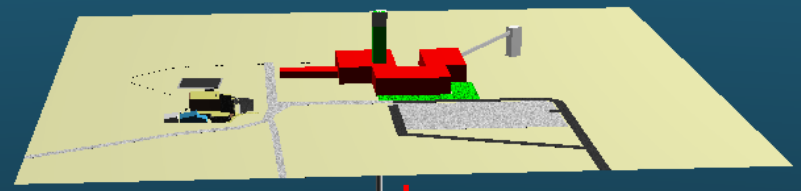
Project Oversight & Priorities

- Efforts split into Experiments and Projects
  - Experiments often result in projects
- Both internal upgrades and external projects subject to review
  - External Advisory Committee
    Project Oversight Group
- Regular gait for project oversight
  - External advisory committee reviews experiments biannually
  - POG meets to review projects monthly
  - New project intake once per year

RESOURCE CONFLICT MATRIX of PRIORITIES - November 2025

PRIORITY #	STRAT PLAN OBJ	POG PROJECT #		GATEWA
00			Imminent Safety Issues and Facility Emergency Repairs	
01			Facility Operations	
02			Executive Requirements	
03-SP1			Experiment Operations (CUTE, DAMIC, DEAP-3600, FLAME, HALO, HC Environmental Monitoring Station, Low Background Measurements, NEWS-G, PICO-40, REPAIR, SENSEI, SNO+, SuperCDMS, Xe-Still)	GW-3
04-SP2		P2102C	Information Security	GW-2
05-SP1		P2007	CTBT Counter	GW-2
06-SP1		P2101	PICO-500	GW-2
07-SP1		P2204	SNO+ Te	GW-2
08-SP2		P2511	CUTE Cryogenic Fridge Enhancement	GW-2
09-SP1		P2614	POLAR	GW-0
10-SP1		P2512	IceCube DOM Test	GW-0
11-SP1		P2616	XLZD	GW-0
12-SP1		P2105	SBC	GW-1
13-SP1		P2615	ARGO	GW-0
14-SP1		P1902	nEXO	GW-0
15-SP1		P2617	Theia	GW-0
16-SP2		P2104	MPC Breaker Upgrade	GW-2
17-SP2		P2606	Metal Assay and Production Laboratory using Electroforming (MAPLE)	GW-0
18-SP2		P2604	Radioactive Isotope Measurement Program at SNOLAB (RAMPS)	GW-0
19-SP2		P2602	Electronics Workstations	GW-0
20-SP1		P2505	Underground Monitoring Security	GW-0
21-SP2		P2613	TAD Extension - Floor and Block Wall	GW-0
22-SP2		P2609	Cleanliness: Particle Counters	GW-0
23-SP2		P2503	Underground Flooring Pilot	GW-2
24-SP2		P2501	Argon Removal from LN2	GW-0
25-SP2		P2612	Underground High-Density Storage	GW-0
26-SP2		P2601	Power Reliability Study	GW-0
27-SP2		P2610	Underground Pressure Zones & Differential Pressure Study	GW-0
28-SP1		P2608	Automated Radon Trap for Assays	GW-0
29-SP1		P2605	General Use Neutron Detector	GW-0
30-SP1		P2611	EV Charging Trade Study	GW-0
31-SP2		P2607	Tellurium Acetylacetonate Solid Double Beta Decay Target (TeAS-0bbv)	GW-0
32-SP1		P2506	Underground Monuments	GW-0
33-SP2		P2603	DT Generator Repair and Upgrades	GW-0
34-SP2		P2206	OSCURA	GW-1
35-SP2		P2205	Denka Boom	GW-2

Installing your experiment at SNOLAB



2km

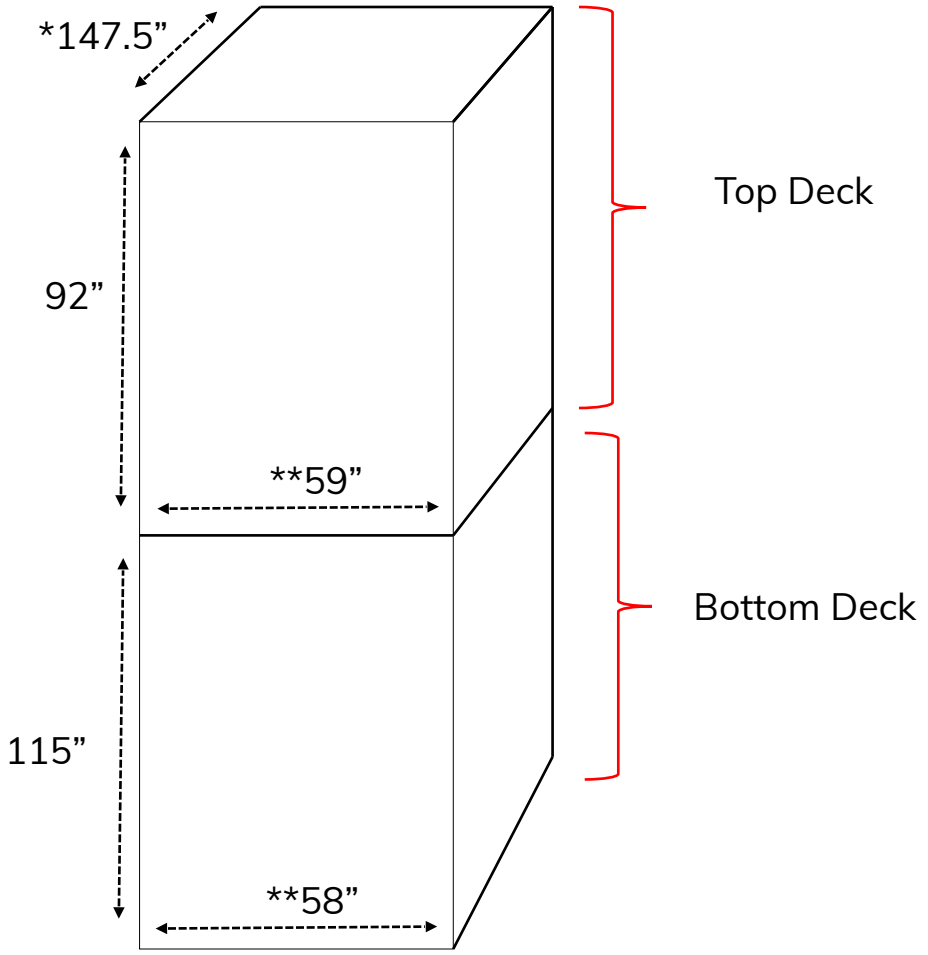
1.5km

Normal shipping

- SNOLAB personnel load crates onto mine railcars, then stage them outdoors
- Railcars loaded on & off cage by personnel from host mine
- SNOLAB personnel tram the railcars from the shaft station to the laboratory

Two-level cage Considerations

- Fitting on the cage does not guarantee it will fit down the drift!
- Maximum drift height clearance is 90” (cage bottom deck is 115”)
- With careful planning, objects can be tilted / rotated (think of the Tetris video game)
- Anything outside of standard envelope needs special approval by SNOLAB



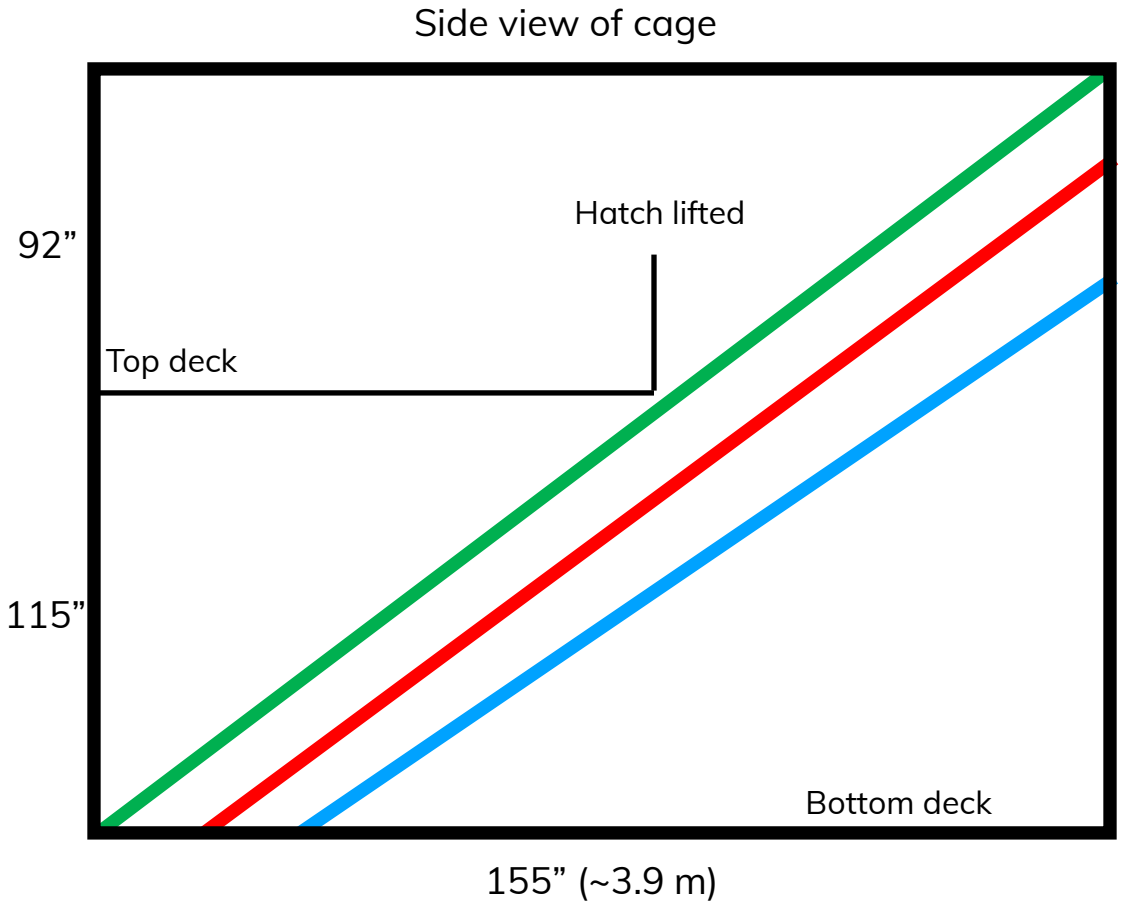
*depth with bumper block. Bumper can be removed, provides up to 155” depth

** Yes... the doors are different widths

Standard dimensions envelope

144” long	x	55” high	x	48” wide
3.7 m long	x	1.4 m high	x	1.2 m wide

Long objects



- Hatch between decks allows for long items
- Requires more planning (special cage run)
- Maximum length impacted by object width:

12” thick → 240” long

24” thick → 214” long

36” thick → 191” long

Guided & Unguided Sling Loads

- If an item to be slung doesn't fit between the front timber guides, the item will have to be set up with 4 corner guides. Both the DEAP AV and MiniCLEAN IV shipping containers were set up with corner guides. The design of the two guides assemblies were different but both worked equally well.
- Sling decent speed is typically 83-100 ft/m compared to normal cage speed (2100 ft/m)
- Slings are usually scheduled between 12-5am, and can take ~68 minutes

- Prior to the actual sling date (weeks or months) Vale will confirm the bolts on the front timber guides are in good shape and will replace if necessary. This ensures on the night of the sling there are no issues in removing the timbers.
- Unguided slings are items that hang in the centre of the shaft, have lots of clearance and will not move significantly once they pass the air intake at 1420 Level.

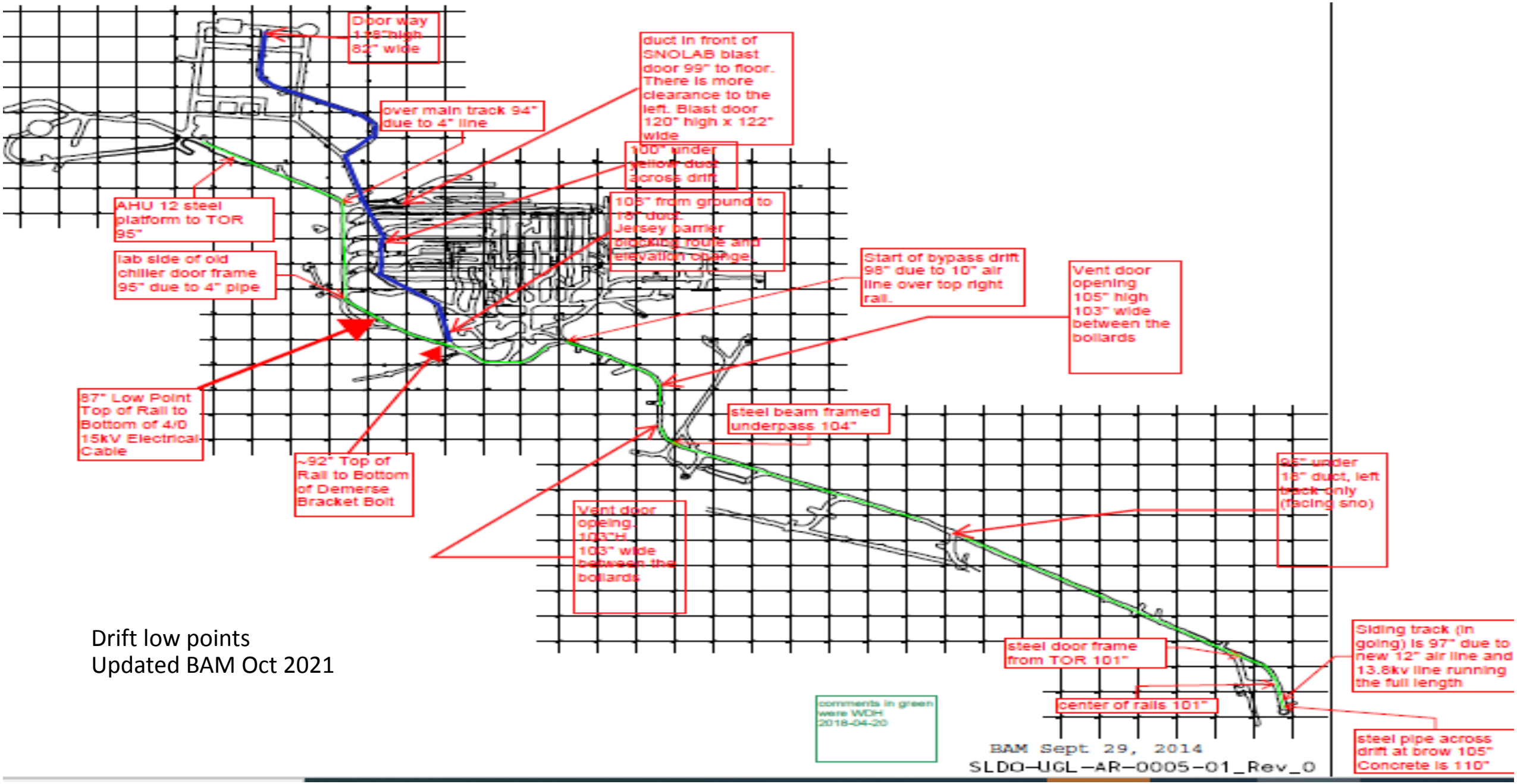
Oversize example: long items & tall crates

- Crane parts for existing experiment
- Superstructure around crate for protection
- Item was tilted into the cage using a manual hoist
- Slow trip through the drift to make sure it didn't bump into the walls!

- Shield component for existing experiment
- Special crate & packaging for 90° rotation to fit on the cage
- Forklift run to fit through the drift

Photo by Terence Hayes


FIRE
EXTINGUISHER
AAF



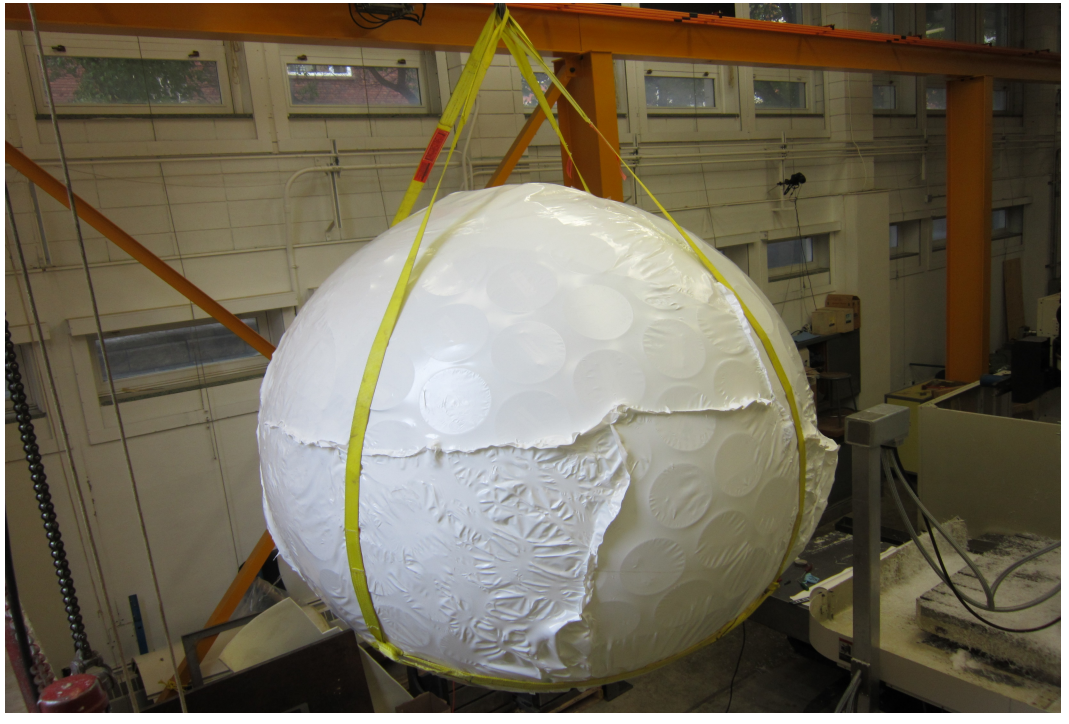
Drift low points
Updated BAM Oct 2021

Clean Welding

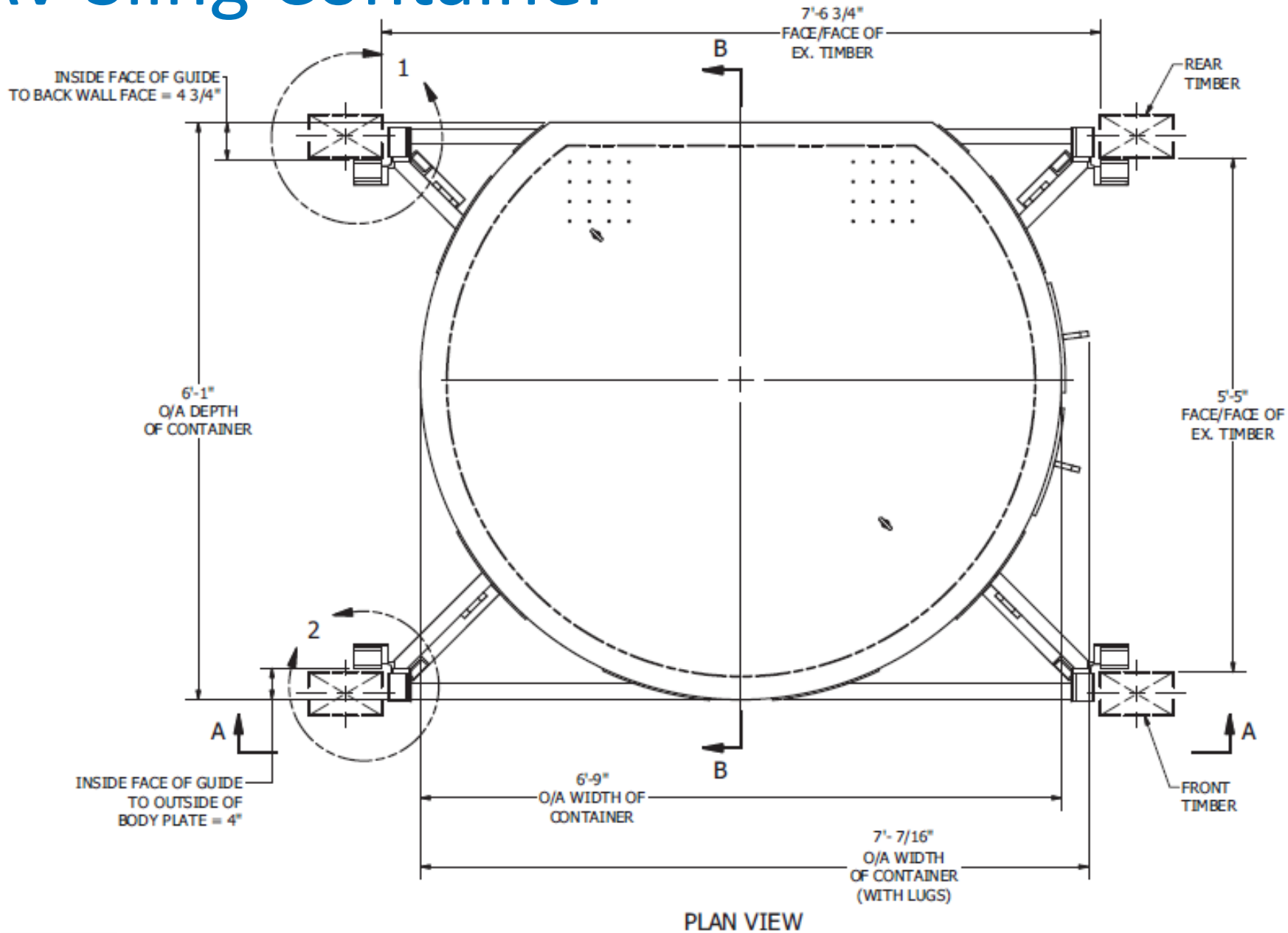
DEAP Acrylic Vessel - Guided Sling

AV at University of Alberta

- Machining and cleaning of DEAP Acrylic Vessel (AV) complete
- Ready to be placed on a saddle for sealed wrapping
- This rigging setup stayed on the AV all the way to its final resting spot in the Cube Hall



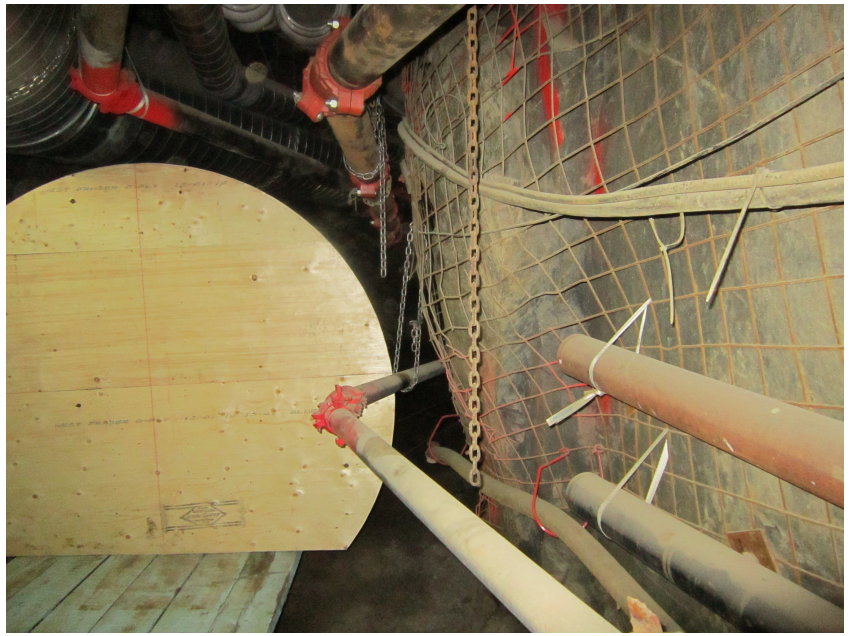
DEAP AV Sling Container

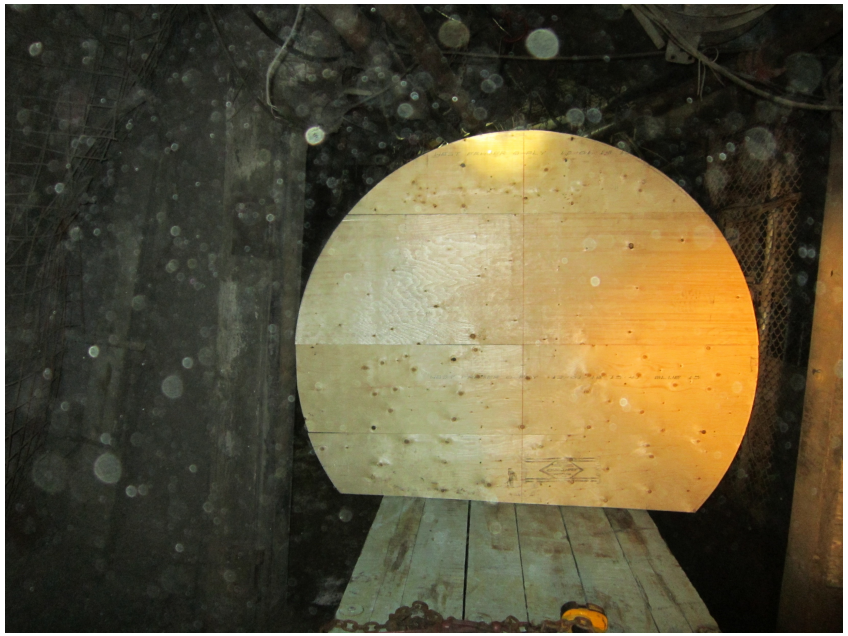


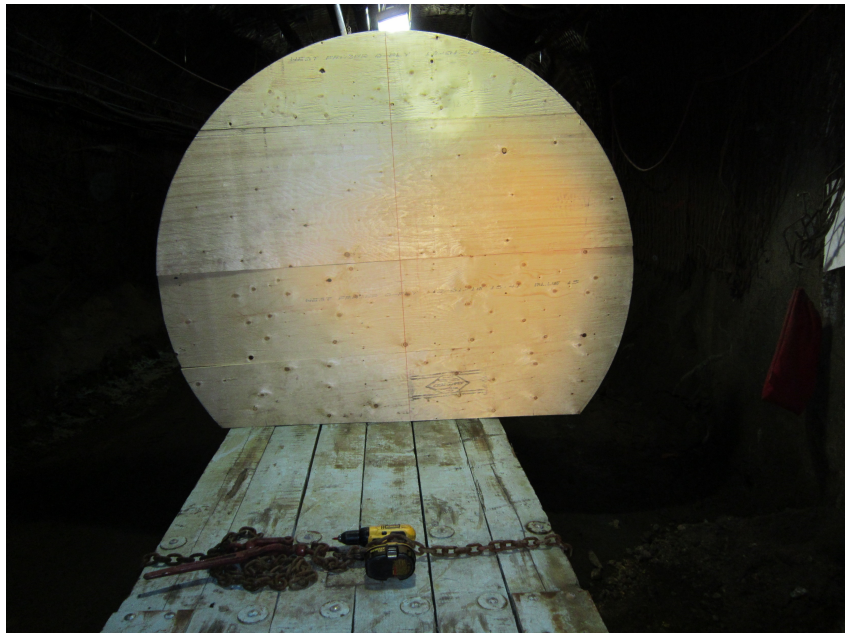
DEAP AV drift plywood fit test

This test was completed prior to approving the design for the sling container.

You ***must*** know the item fits before building it.

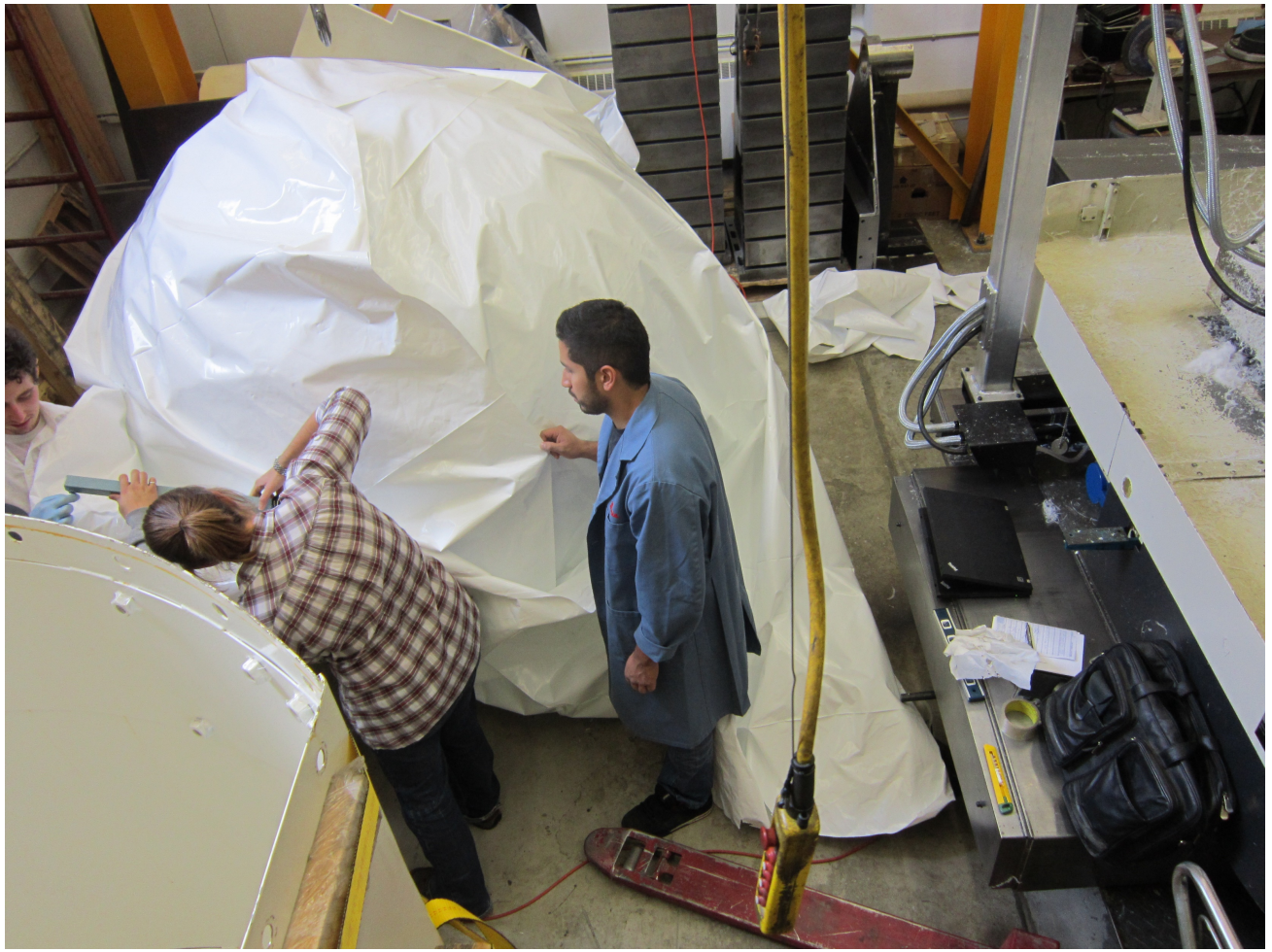






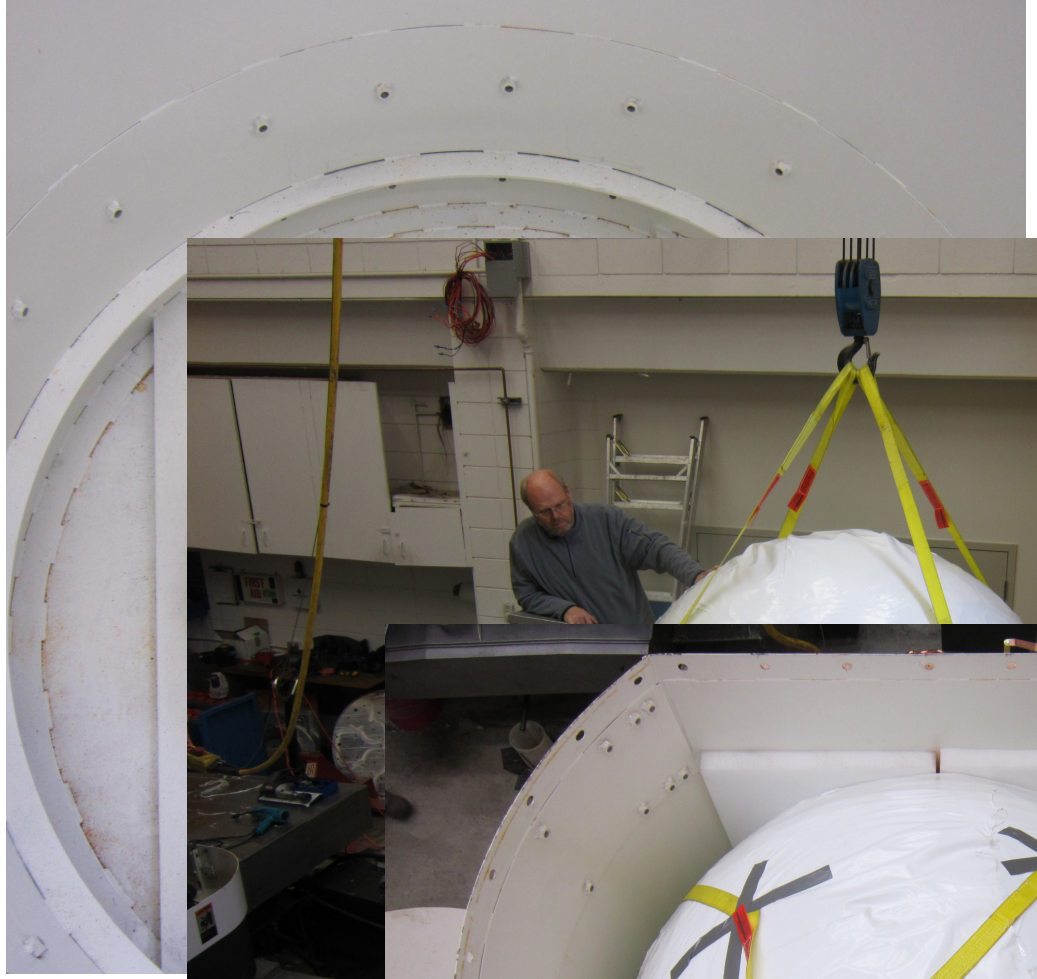
AV at U of A

- Wrapping of the AV was a bit time consuming as it had to be hermetically sealed and shrink wrapped.
- The slinging container is not hermetically sealed so the team had to make sure the AV would stay clean and free from mine dust.
- Going underground the ambient pressure increases so hermetically sealing the AV was safe.



Packing the AV

- A foam saddle was placed on the bottom of the shipping container to rest the AV on
- Slings taped to plastic wrap to ensure they don’t fall down around the AV.
- Same slings will be used until delivered to the Cube Hall
- Prior to expanding foam being applied



Supports added

- Void Space in container was to be filed with expanding foam, which would likely bow out the large flat side of the shipping container.
- Installed timbers and straps to ensure the shape was maintained.
- An out of shape box would probably have meant the lid would not fit, the guides misaligned and possibly not even fit into the shaft.
- Travelling to the project is cheap compared to possible remedial work.

DEAP AV test lift

- Once the road trip from Alberta and the cage ride and rail car were all done the accelerometer showed the road trip had the greatest accelerations.
- All items intended to the slung in the shaft will be subjected to a test lift and witnessed by Vale IM people. The test lift is completed to ensure the item hangs plumb, the slings are long enough, slings and rigging are matched, rigging is appropriately rated.
- Once the lift is successful all rigging must remain on the item to be slung.

Slinging

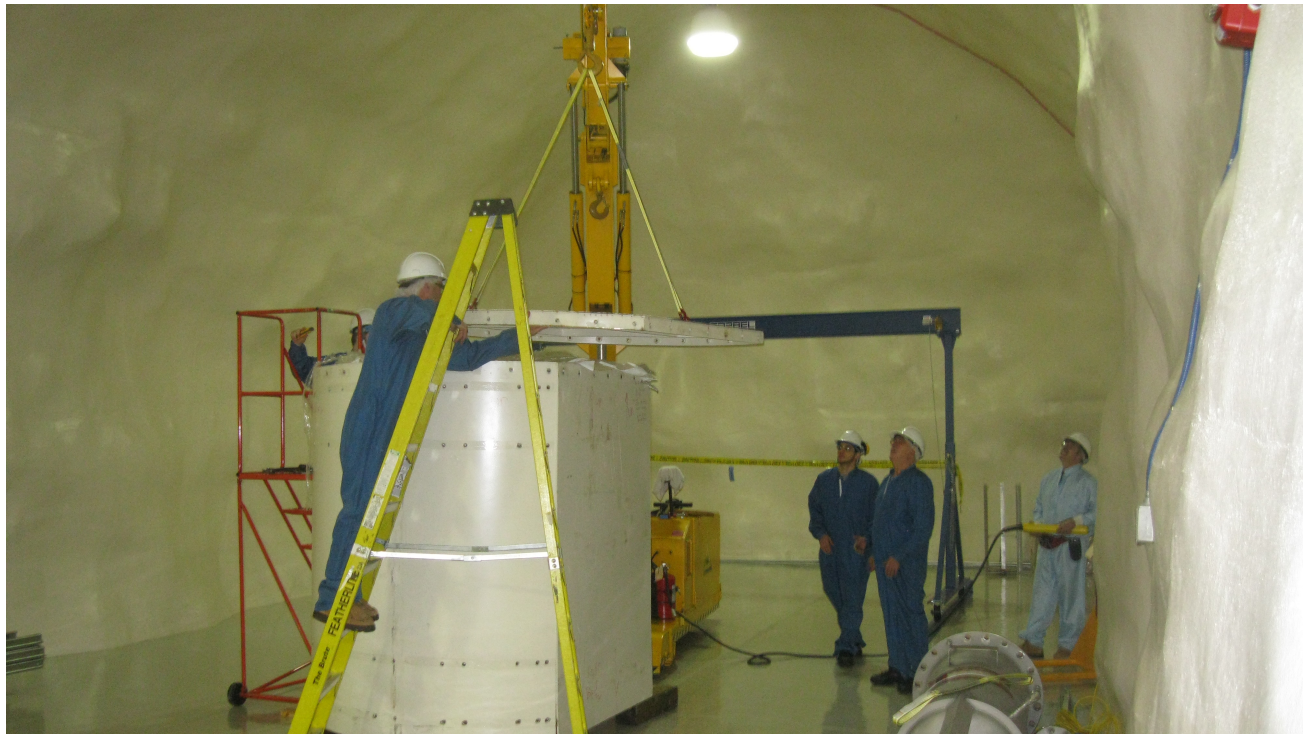
- Note 20ft slings from the shipping container to the crane hook. Vale needs a minimum length of sling to be able to pull the item out of the shaft on 6800
- The slings can't be too long either as there is only so much height in the head frame. Item + sling + cage + cable return
- SNOLAB Cost to sling 2012 ~50K
- Makami 17k, Lopes 21K, Vale 4k, Sling Choker 1K, labor including travel ~4K

In the Clean Lab!!

- Entered in through the TAD airlock/machine shop
- Outer Container was wiped down
- RBK was used to bring the package in from the TAD airlock then placed on pallet carts for the trip through the Chem lab

In the Ladder Labs

- Once the lid was removed the inside was wiped down. The shipping container lid had ventilation holes.
- Packing foam was removed.
- AV was removed from the shipping container and placed on its aluminum saddle and brought to the Cube Hall.



AV in Cube Hall

MiniCLEAN Inner Vessel – Guided Sling

MC IV test hang

Must hang plumb.

MC in Collar, waiting to go UG

Don’t be afraid to show the weight and use pictures. The shaft crew like to talk about the special things they move for us.

Having the weight up front is a good reminder to all what is being moved.

MC in the shaft going down

MC on 6800

MiniCLEAN on 6800

All the structure is removed for the forklift trip to the lab

Unpacked and ready for the trip to the lab.
Brought in through the Bottom Access Ramp air lock

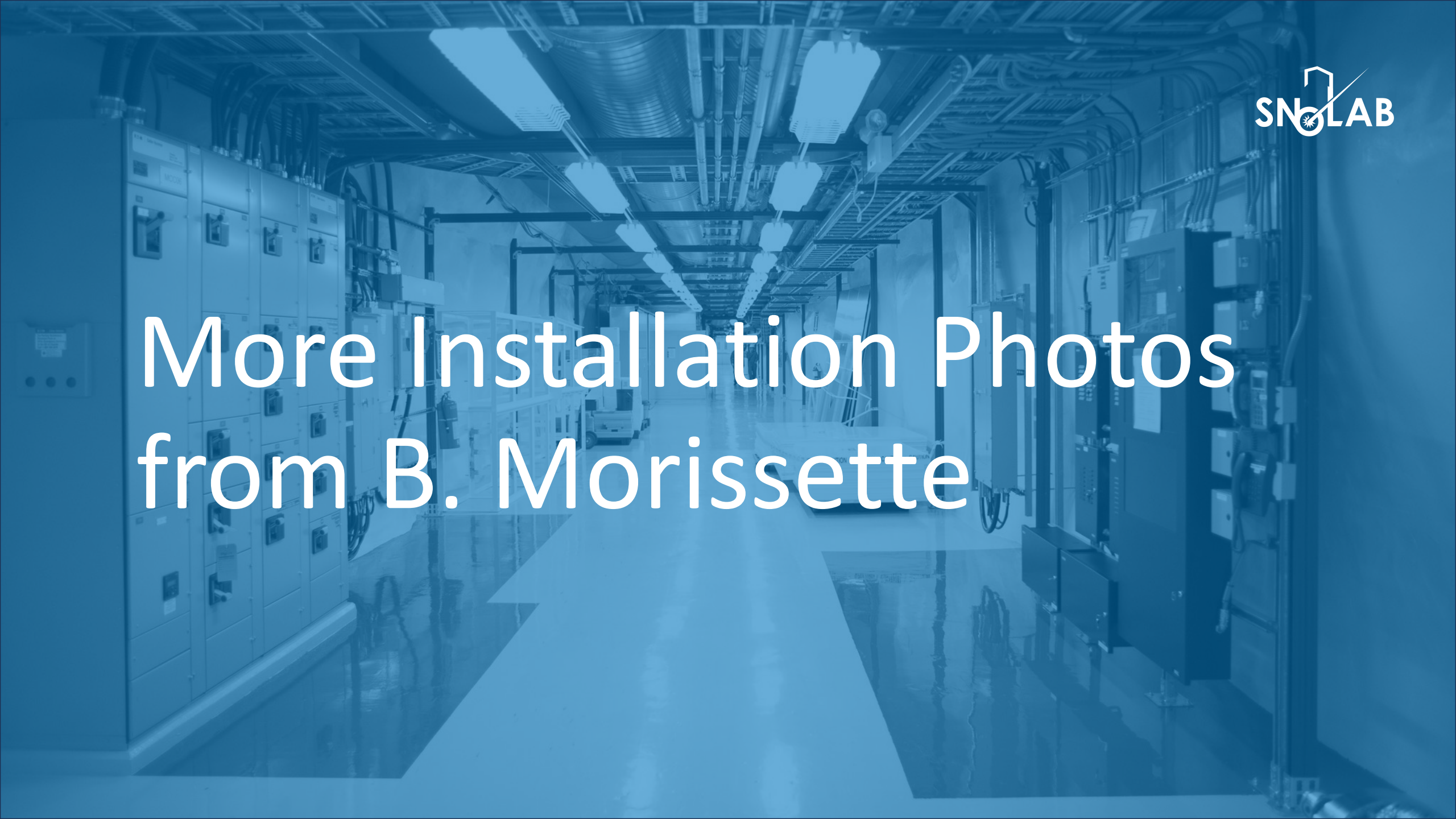
SNO+ C300 Column - Unguided Sling

SNO+ C300 Distillation Column

SNO+ C300 Distillation Column

Install Your Experiment at SNOLAB!

- Large Items can be moved through the vertical access shaft
- And Navigated through the drift
- Then cleaned and finally installed in the clean lab
- Project Management and Technical Services Groups are available to assist
- Gateway Process has guides for each step



More Installation Photos from B. Morissette

Miniclean

- Following a sit down with Miniclean PI and designers it was obvious we had to confirm their OV sections would fit some how in the drift.
- We built a coroplast test piece that was the same size as the largest single section of the OV
- The test piece although pretty big only weighed ~20 lbs and could easily be manipulated by two people.
- The construction of the test piece had many holes to allow its construction, hand holds, made it lighter and less wind resistant.

MC test Jig 6800

- Imagine this is one of the two OV center sections with the strong back mounted on it and being mounted in a stone boat.
- Small tubing on the floor represented the stone boat
- It was pulled out of the cage and stopped just before it contacted the above 12T hitch.
- The cage door could not close so we had to swivel the stone boat CCW to get the cage door to close,
- OSB was informed we were working in the 10ft exclusion zone
- The forklift with the rotator engaged the strong back
- The OV section was unbolted from the stone boat
- The OV section was lifted slightly then rotated to get under the 12t hitch and red fire water line.
- Travelled to the lab rotating as needed to clear obstacles and was taken down the ramp to the BAR airlock

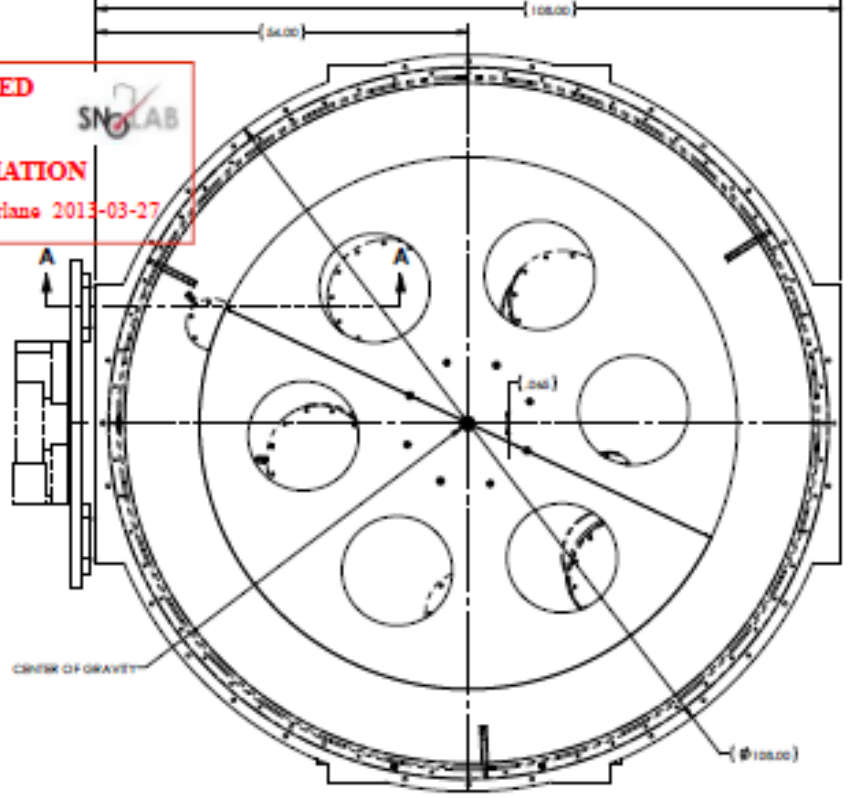
MC outer Vessel

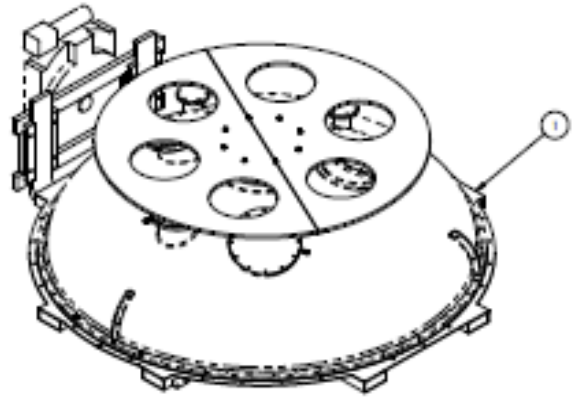
- The vessel was delivered underground in 4 pieces,
- 1 Top dome, 2 center sections, 1 bottom dome
- Diameter of 110” pieces did not fit through the drift and did not fit past the 12 ton hitch immediately outside the shaft

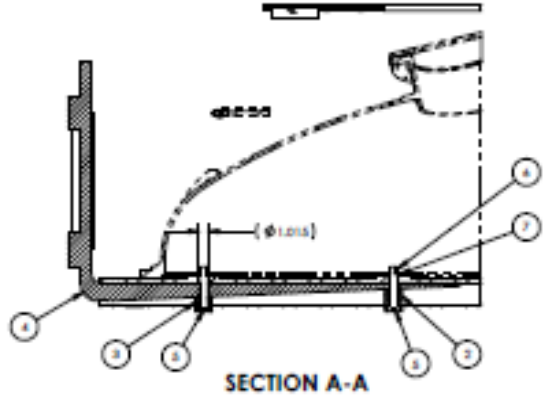
RELEASED FOR INFORMATION
K. McFarlane 2013-03-27

RELEASED FOR PRODUCTION
Signature: Date: 9/5/2012

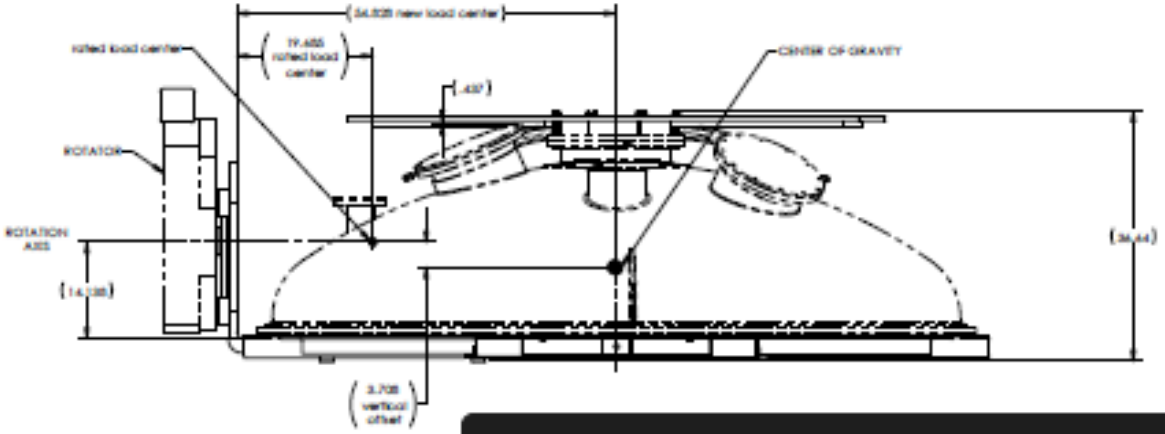
REV.	DESCRIPTION	DATE	APPROVED
A	ORIGINAL RELEASE	9/14/12	A. HIMB







SECTION A-A



THIS PARTS LIST FOR THIS CONFIGURATION ONLY

ITEM NO.	upper dome/QTY.	PART NUMBER	DESCRIPTION	MATERIAL
			PARTS LIST	
7	4		WASHER, FLAT, .75 NOMINAL, HARDENED	
6	4		NUT, HEX, .75-10UNC, GRADE B	
5	4	MCMASTER CARR 91128A140	SHOULDER SCREW, 1.000 DIAMETER X 3.50 LG SHOULDER, 3/4-10UNC THREAD	316L
4	1	78Y-1766255	HOME LPR ROTATOR TINS MODS	
3	2	78Y-1756140	OV SHP CONTAINER SHORT ANGLED BUSHING	316L
2	2	78Y-1756139	OV SHP CONTAINER LONG ANGLED BUSHING	316L
1	1	78Y-1756127	OV UPPER DOME CARRIER	

Los Alamos — Los Alamos National Laboratory, Los Alamos, New Mexico 87545

P-23 DARK MATTER
MINI-CLEAN 360
OV UPPER DOME TRANSPORT

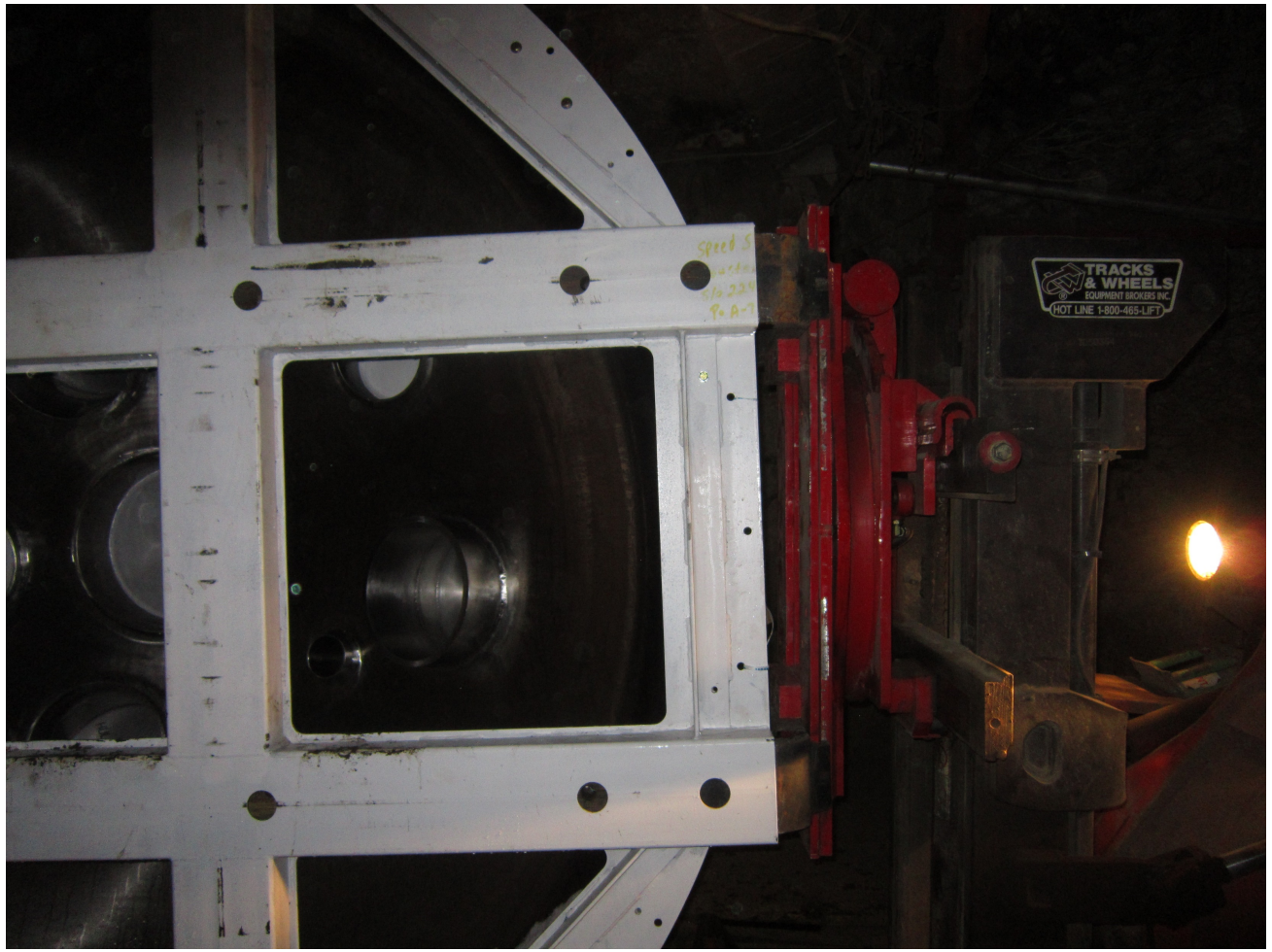
SIZE	FSCM NO.	DWG NO.	REV
D	88516	78Y-1766273	A

SCALE: 1:10 — WEIGHT: — SHEET 1 OF 3

45.8%

Rotator mounted on SNOLAB R420 forklift

- Purchase used rotator from Tracks & Wheels 30K
- Installation by T&W 6K
- Top section of OV mounted on rotator



To the lab

- Top section of OV mounted to strong back (white frame) which is mounted on the rotator forks.
- Because of the diameter of +110” the top section had to be rotated from 0-180* so it would fit through the drift.
- Notice no wrapping of the vessel section

Dome on rotator

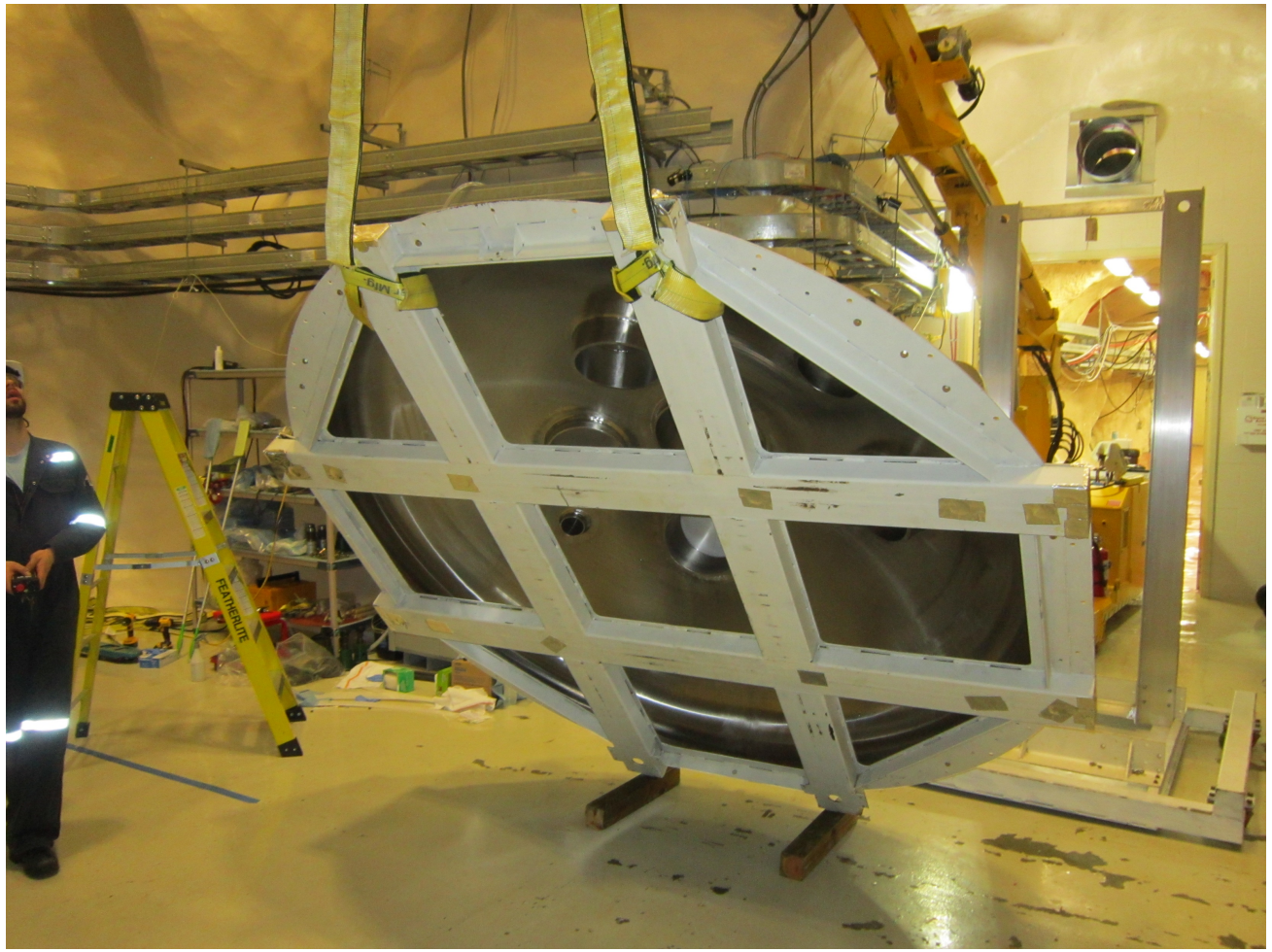
- The long slow trip to the lab with the dome being rotated as required to fit
- A similar exercise was conducted for the other 3 MC OV sections

Dome in BAR airlock

- The Dome while still attached to the forklift rotator was held in the vertical so it could be mounted in the wheeled frame for transit into the lab.
- Airlock although not fully ready to be used as a proper airlock was cleaned and used to successfully process oversize experimental items into the lab.

OV section in Cube Hall

- OV Dome now removed from the wheel frame and is being laid down on the Cube Hall floor so the strong back can be removed.
- This was repeated for the 4 OV sections



SNO+ E302

SNO+ C100

Couple things to note here

- Pipe fitting pointing down off the end of the vessel was a mistake. We should have rigged this in the other direction so as to keep the fragile components on top.
- The vessel starts to bind at the collar
- Think about how you want to receive the item at the lab.
- Is there room to rotate if it comes underground in the wrong orientation.
- The 3 D20 RO vessels arrived underground in the proper orientation but we just got lucky as we didn’t think about it until they were sitting on 6800 level.

SNO+ C100

Note how the vessel is attached to the timbers. Vale specifically requested steel bands around the vessel and held down with threaded rods, not lag bolts.

Sling hanging off the bottom end of the vessel used to pull the vessel out of the shaft at 6800 level

SNO+ E302

This vessel did not have a lifting lugs so an adaptor plate was engineered and used.

Note the NDE testing on the lug weld.

Structural steel assemblies (bolt nut washer) were used to secure the plate to the vessel.

All welded lugs must be tested before being used to sling in the shaft.

GE shipping wagon

- This wagon was constructed on surface and will be used to move a Ge detector from 4600 to 6800 level.
- Pneumatic tires were intentionally selected for their soft ride.
- In fact, once the Ge was loaded on 4600, air was removed from the tires to give the Ge a very soft, non-jarring ride.

4600 level GE

- Not all items to be moved require heavy equipment.
- This Ge detector was moved from the 4600 level lab to 6800 LBCL
- Floor of the box was secured to the wagon
- Floor was built with two elevations, one for the dewar and one a bit higher for the detector

Lots of bubble wrap

Bubble wrap was used to secure the dewar and detector prior to closing the box

Ge 4600 lab

- Loaded and ready to be hand pulled to the shaft.
- We had it prearranged for the cage to stop on the way down and pick us up. Definitely didn’t want the Ge detector to goes to surface and be exposed
- We also arranged to ride on the cage with the detector to ensure we controlled the on and off the cage. The cage doesn’t always stop exactly on the level.
- Walked with the detector to the lab.

DEAP Ln2 dewar

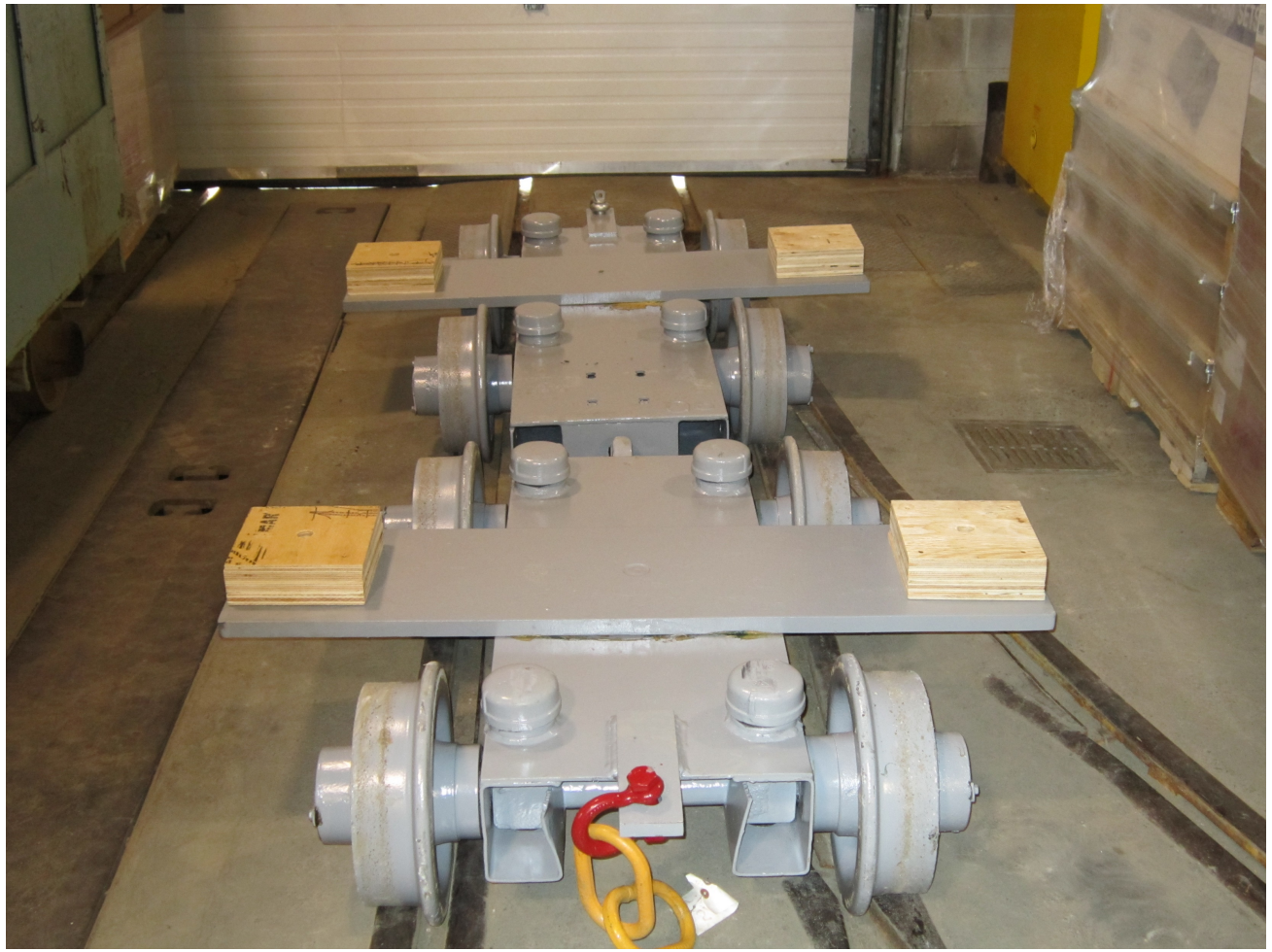
- Wooden jig was made to mimic the Ln2 dewar pipes on a railcar.
- Recall the top of the pipes were just under 96”
- Underside of AHU 12 beams is ~95.75”

Drift interferences

•Several items had to be adjusted to clear the Ln2 dewar pipes

D20 railcar

- To move the Ln2 dewar underground we used the chassis from a D20 rail tanker.
- Original bunks were removed and plates installed
- Dewar was bolted rigidly to the railcar



Dewar to shaft

- Once the dewar was sealed with plastic it was loaded on a trailer for the trip to the collar.
- The same crane was used to off load the dewar on the tracks at the collar
- Stirling approved the lifting of the tank and railcar together
- Typically lifting lugs on vessels are only to be used when empty

6800 station

- Dewar arrival on 6800.
- Was pull to the lab with a long tow bar attached to SNOLAB forlift

In the carwash

- Dewar inside the carwash ready for cleaning
- Railcar was removed and wheels installed