

LBNF Cryogenics Progress

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LBNC Review

18-21 February 2018



Thanks to

- Mark Adamowski (Fermilab).
- Jean-Baptiste Mayolini (CERN).
- Mike Delaney (Fermilab).
- Aurélien Diaz (CERN).
- Roza Doubnik (Fermilab).
- Jack Fowler (Duke University).
- Kevin Haaf (Fermilab).
- Marzio Nesi (CERN).
- Adrien Parchet (CERN).
- Erik Voirin (Fermilab).

Outline

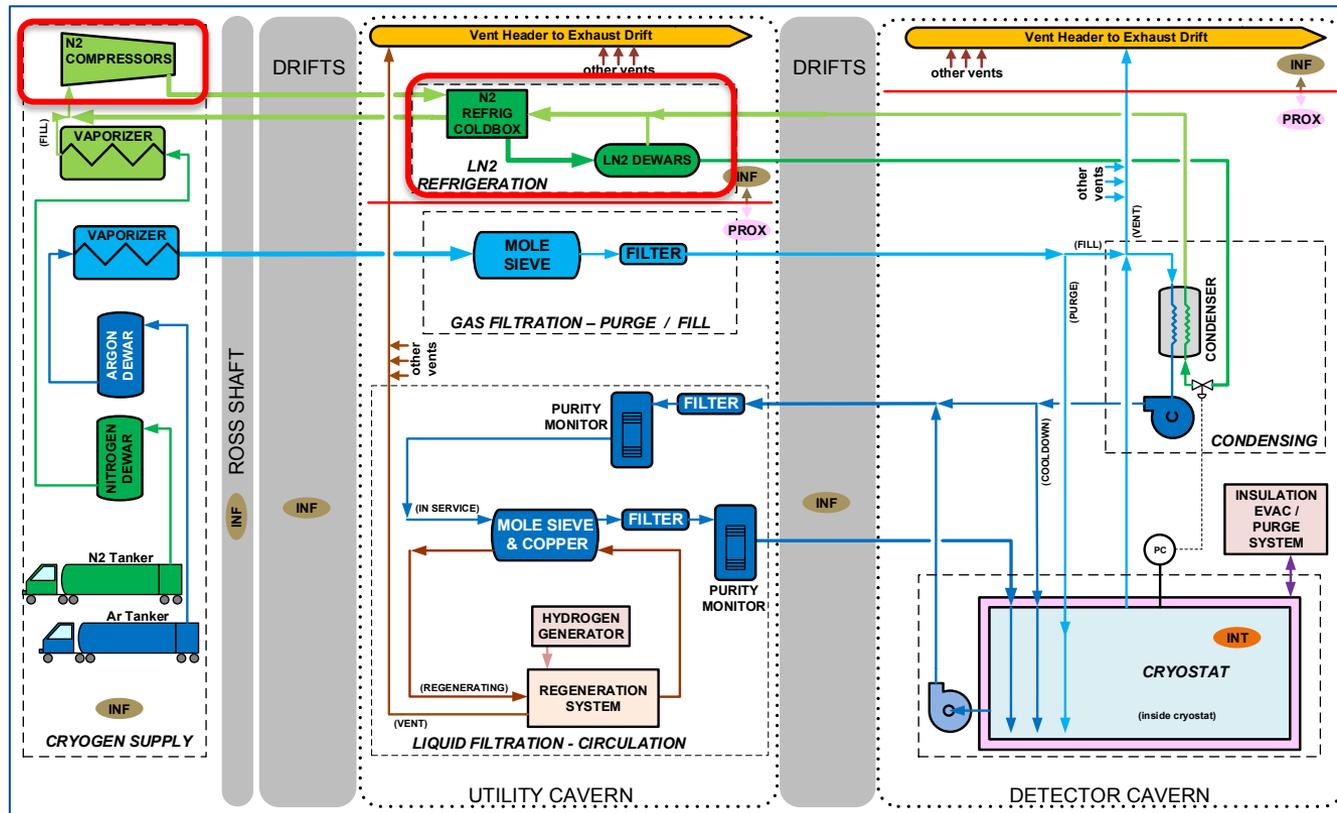
- Nitrogen System.
- Proximity Cryogenics in the Detector Cavern.
- Proximity Cryogenics in the CUC.
- Internal Cryogenics (during LBNF/DUNE Interfaces breakout).
- Summary.

Nitrogen System

Nitrogen System

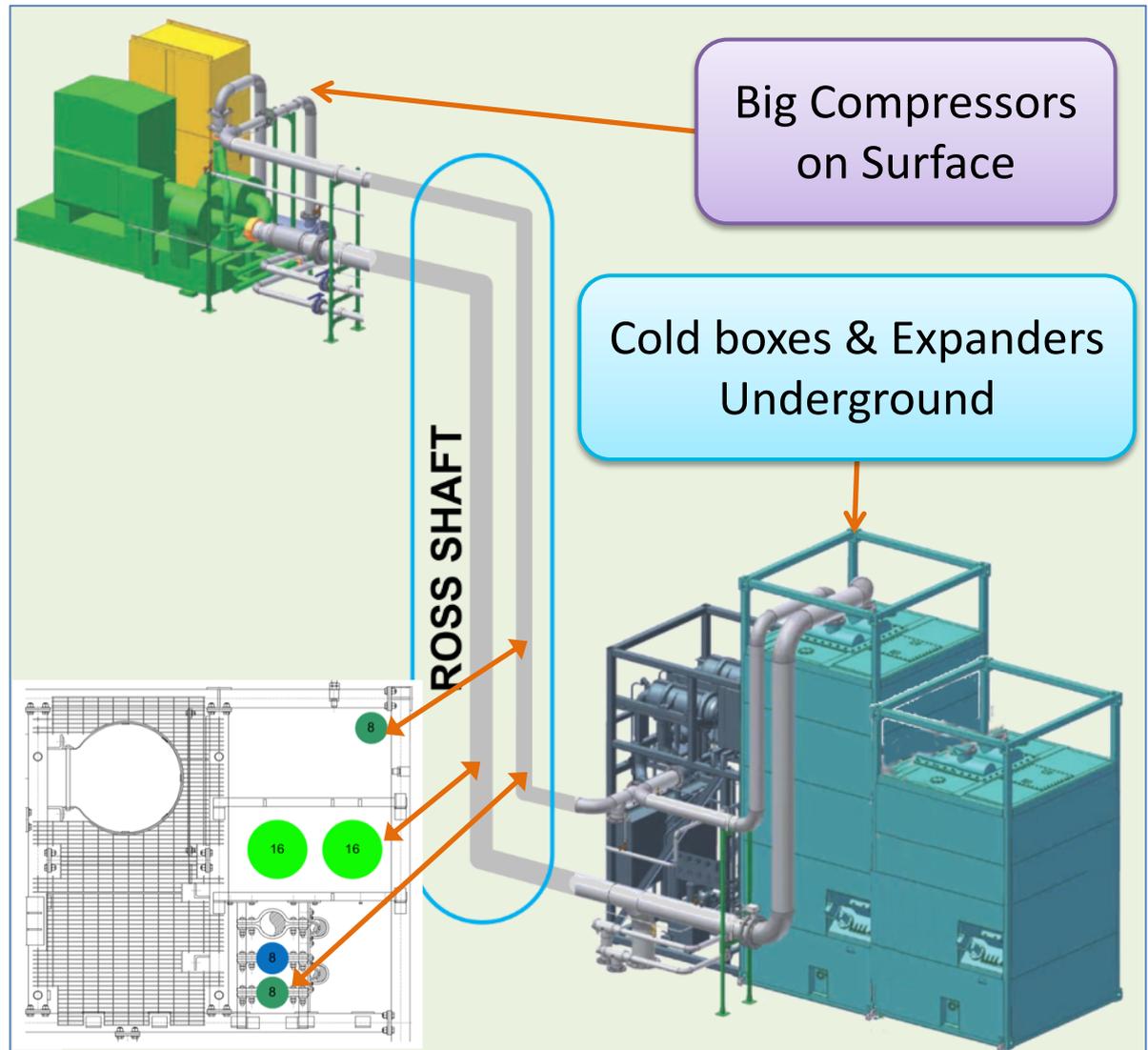
- Infrastructure
- Proximity
- Internal

- Nitrogen System is:
 - LN2 Refrigeration System (4 x 100 kW units).
 - LN2 Storage in CUC (50 m³).



LN2 Refrigeration System – Description

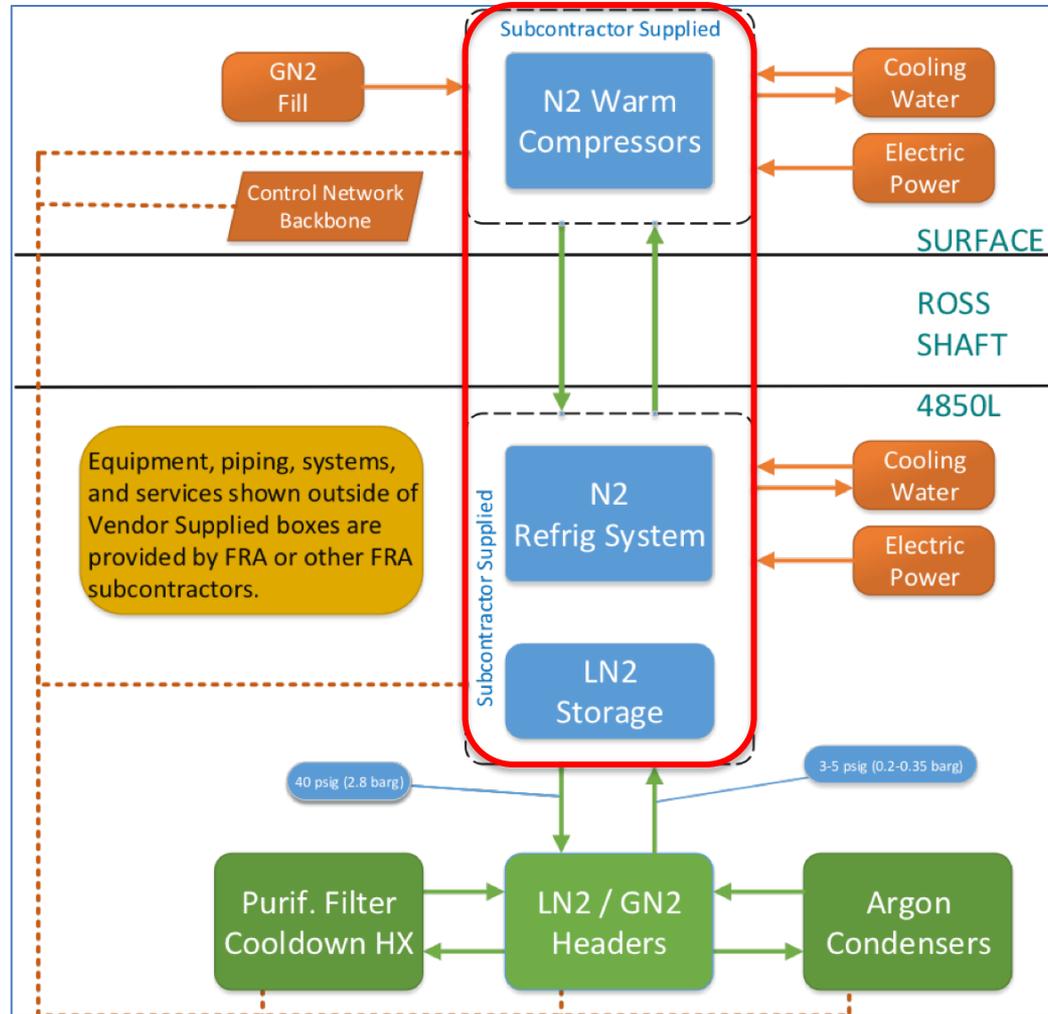
- 4 **Commercial** units:
 - Cold boxes and gas boosters in the cavern.
 - GN2 compressors above ground.
- Units assembled in cavern, based on transport limits.
- 3 units for cryostats 1, 2 and 4th unit added for cryostats 3, 4.
- 4 x 100 kW units.



Nitrogen System – Acquisition Status

- Iterating with DOE on Acquisition Plan (AP).
- Review of Scope Of Work (SOW) in progress.
- Procurement established Source Evaluation Board (SEB):
 - “Evaluate bids and make management recommendations to the Source Selection Official regarding the firm that proposes the best value solution for the design, fabrication, installation, and commissioning of a LN2 refrigeration system at SURF under an FRA Subcontract”.
 - Kick-off meeting Mon Feb 19.
 - Prepare Source Evaluation Plan (SEP) to evaluate competitive proposals.
 - Review Request For Proposals (RFP) package prior to submission to DOE.
- In addition to typical reviews for a procurement of this magnitude (FSO, IRB, HCA), this procurement has been selected for DOE/MA Business Clearance Review.

Nitrogen System – Scope for RFP



SEB Members

Voting Members:

Chris Bushman	Chairperson	Finance/LBNF Procurement
David Montanari	Member	LBNF/Cryogenics Infrastructure Project
Mark Adamowski	Member	LBNF/Cryogenics Infrastructure Project
Arkadiy Klebaner	Member	TD/ Cryogenics Sector
Barry Norris	Member	ND/ Technical Support Dept

Non-Voting Members:

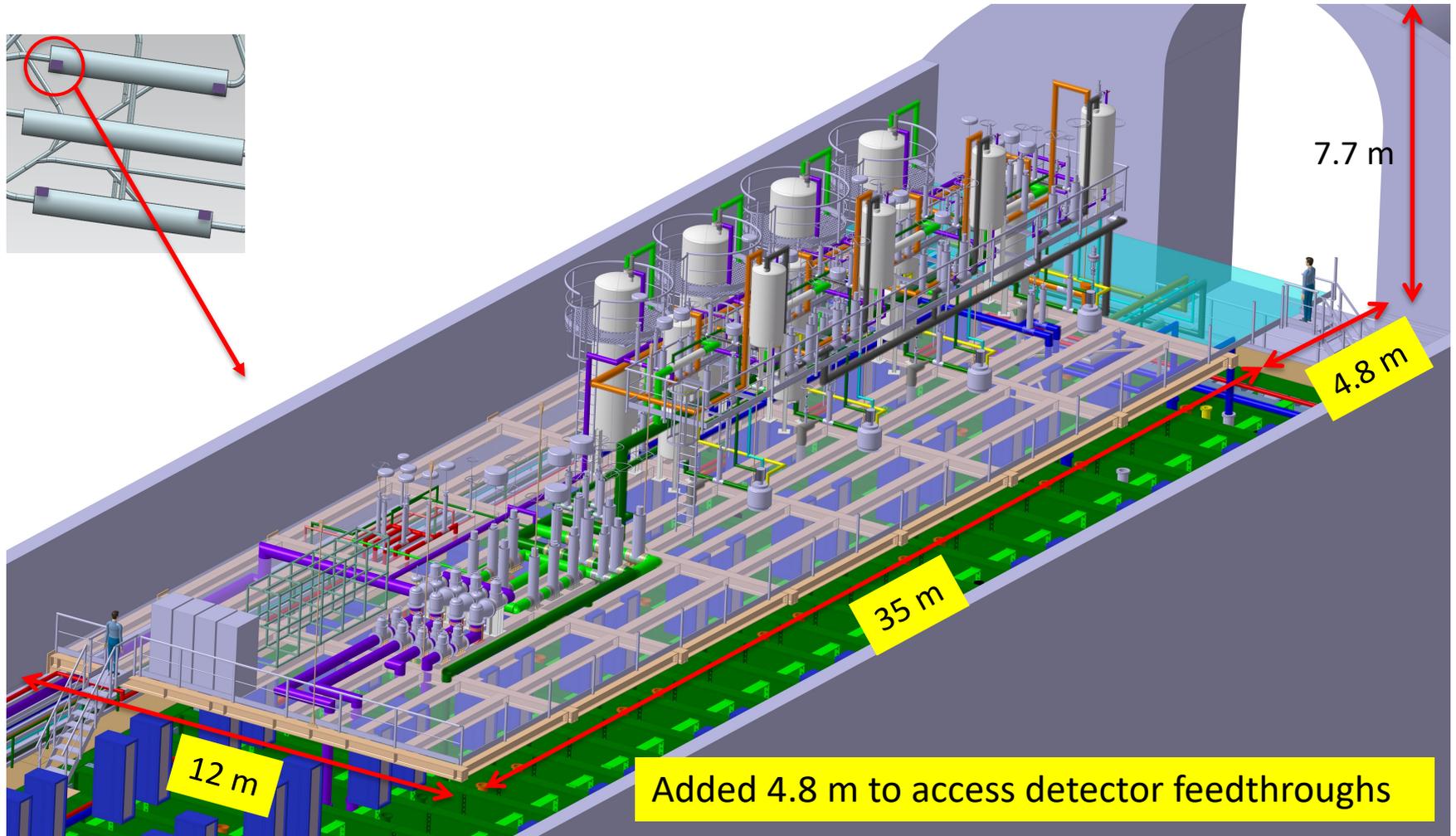
Chris Mossey	Advisor	Fermilab Deputy Director for LBNF
Elaine McCluskey	Advisor	LBNF Project Office
Mike Andrews	Advisor	LBNF Project Office/Environment, Safety, Health
Kevin Fahey	Advisor	LBNF Project Office/Quality
Kevin Haaf	Advisor	LBNF/Cryogenics Infrastructure Project
Josh Willhite	Advisor	LBNF/FSCF Project
Jack Fowler	Advisor	Duke University/LBNF-DUNE Systems Engineering
Johan Bremer	Advisor	CERN/Cryogenics
Troy Lark	Advisor	Finance/LBNF Procurement
Sandra Efstathiou	Advisor	Finance/LBNF Procurement
John Myer	Legal Advisor	OGC
Beth Fancsali	Legal Advisor	OGC

Nitrogen System – Acquisition strategy and schedule

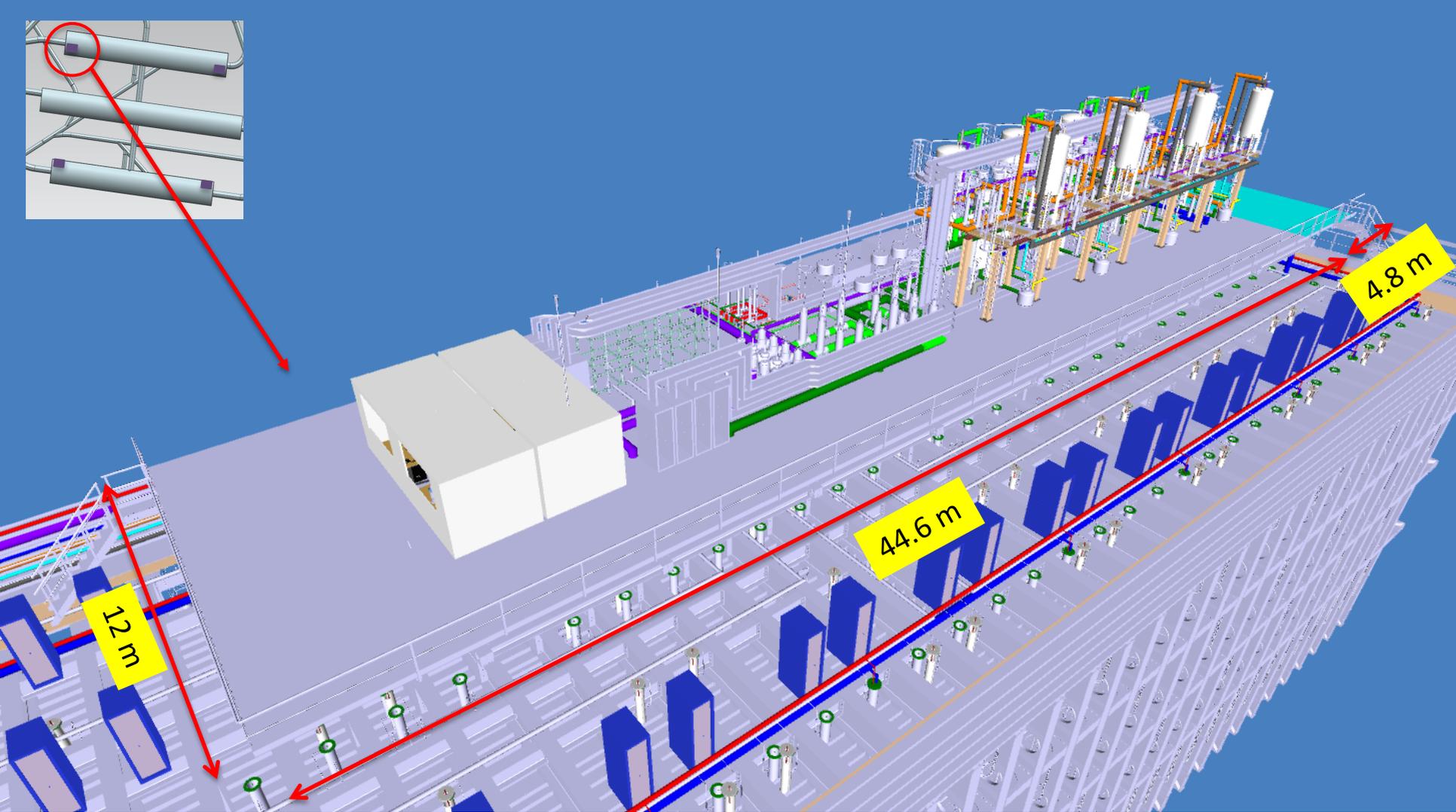
- Performance based Scope of Work with Functional Requirements, 3D envelopes, Interfaces.
- **Base Scope:**
 - Preliminary and Final Designs of whole system (full scope: 4x100 kW units + 50 m³ LN2 storage).
 - Fabrication of first 3 units only (needed for Detectors #1, #2).
 - Fabrication/Supply of 50 m³ LN2 storage.
- **Option 1:**
 - Installation and Commissioning of first 3 units.
- **Option 2:**
 - Fabrication of 4th unit (needed for Detectors #3, #4).
- **Option 3:**
 - Installation and Commissioning of 4th unit.
- Goal: award contract by Nov 2018.
- Design should be at 50% Preliminary Design by Jun 2019 (LBNC Review preceding CD-2).
- Current Schedule:
 - AP Approval in Mar 2018.
 - Submit RFP to DOE in Mar 2018 and receive approval by DOE in May 2018.
 - Issue RFP to Industry in Jun 2018.
- Most recent news from DOE: remove Fabrication from “Base Scope” and make it an Option. Will add language to the contract to explain that we intend to continue with same company for design/fabrication/installation/commissioning.

Proximity Cryogenics in Detector's Cavern

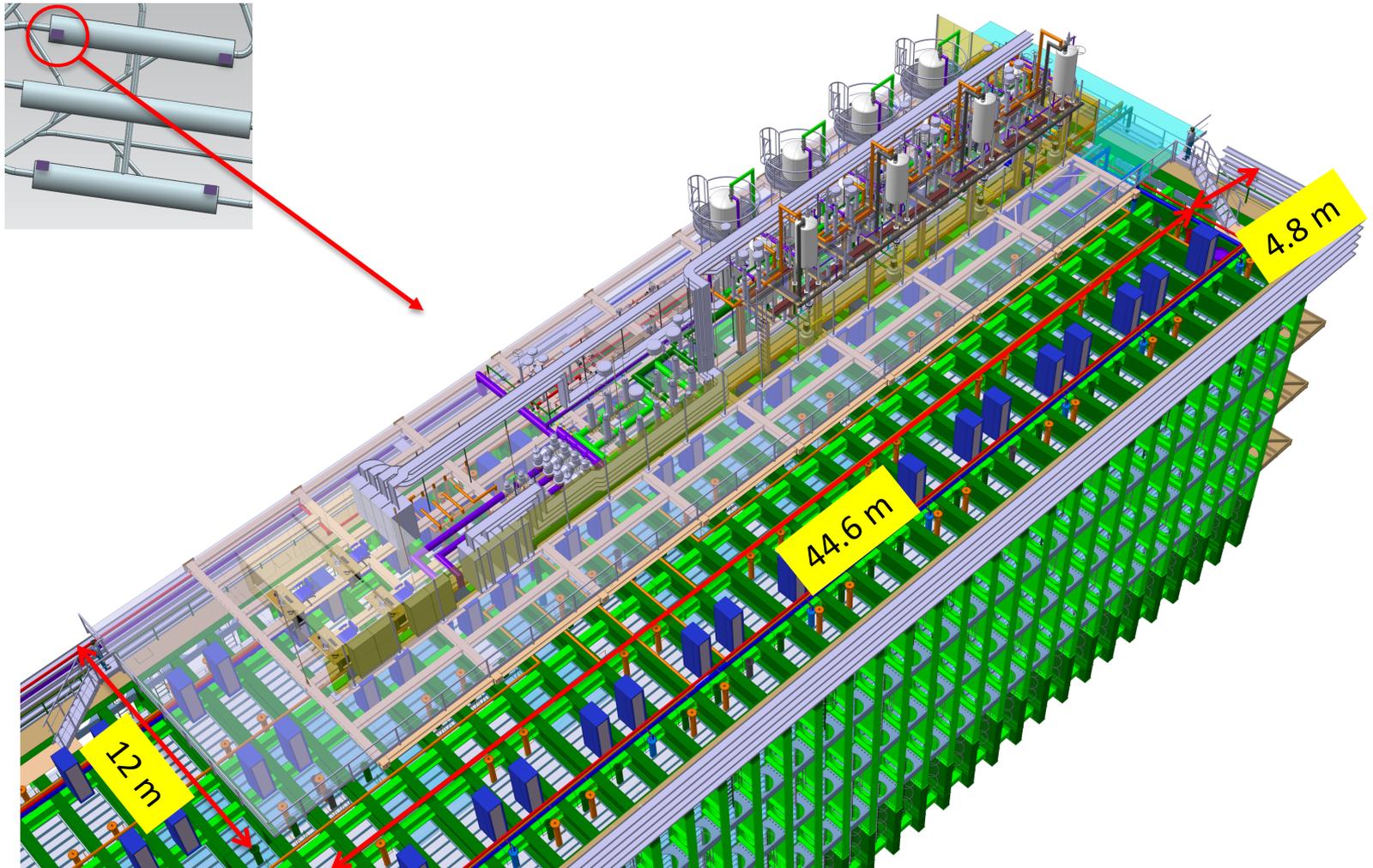
Proximity Cryogenics on Mezzanine – Iso View (as Oct 2017)



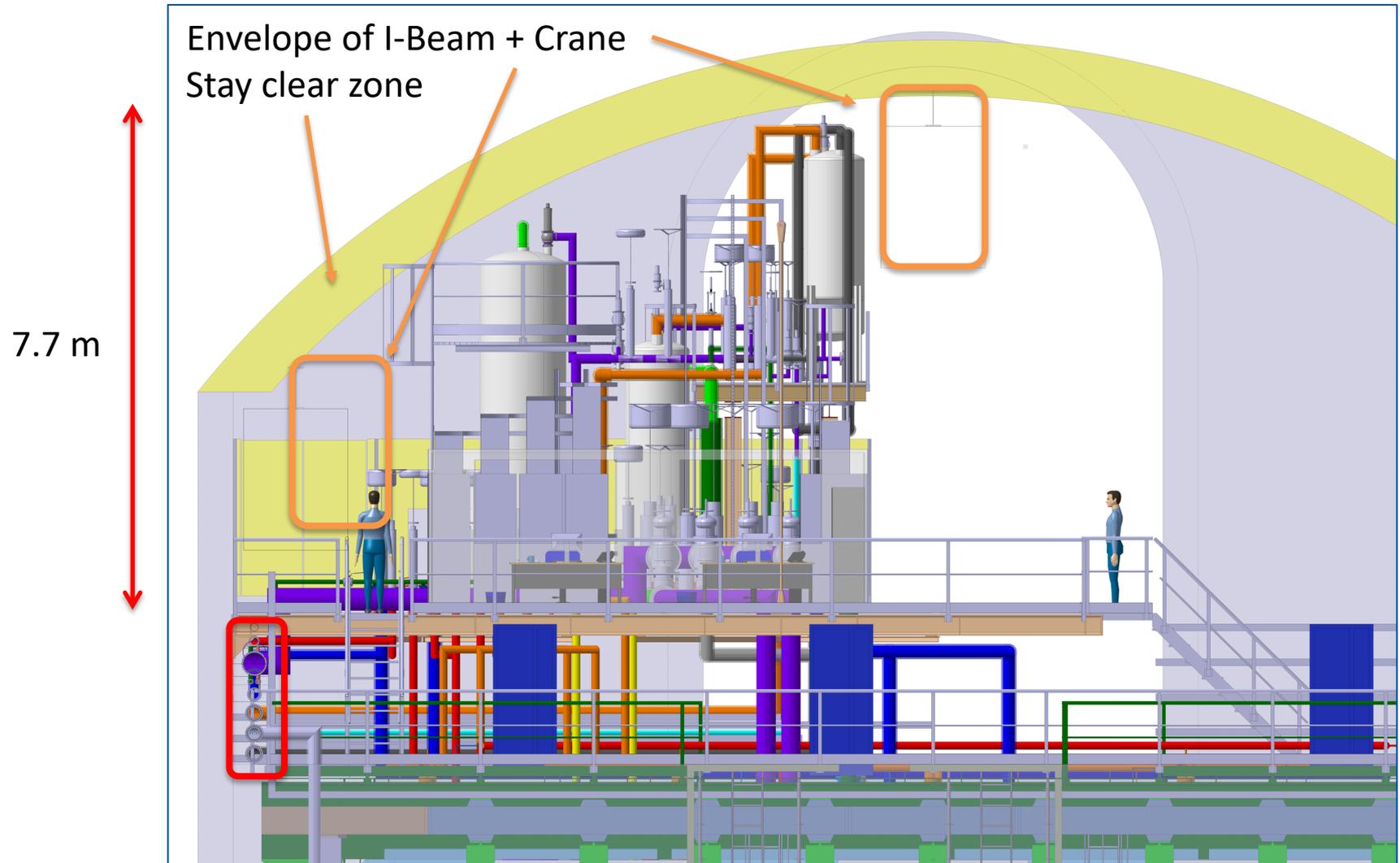
Proximity Cryogenics on Mezzanine – Iso View (Current)



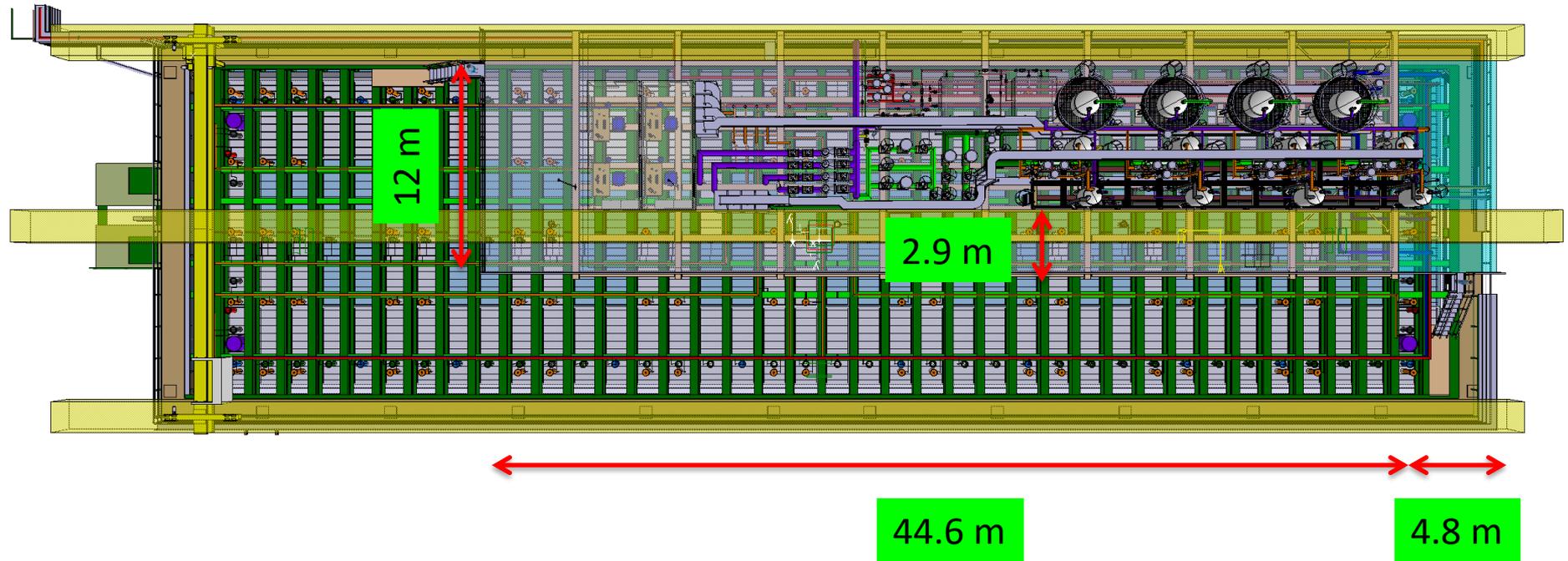
Proximity Cryogenics on Mezzanine – Iso View (Current)



Proximity Cryogenics on Mezzanine – Side View (Current)



Proximity Cryogenics on Mezzanine – Top View

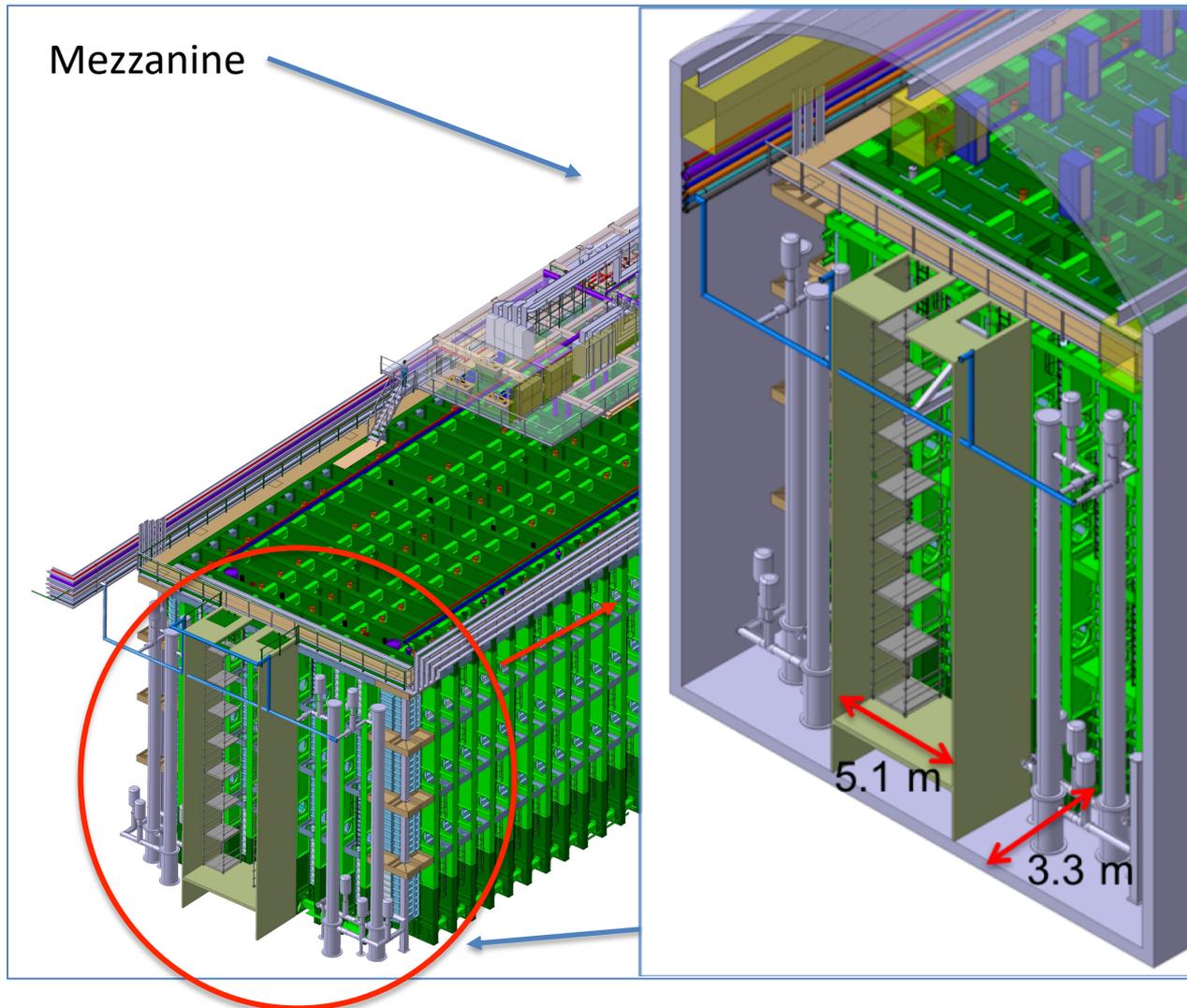


Proximity Cryogenics on Mezzanine – Highlights

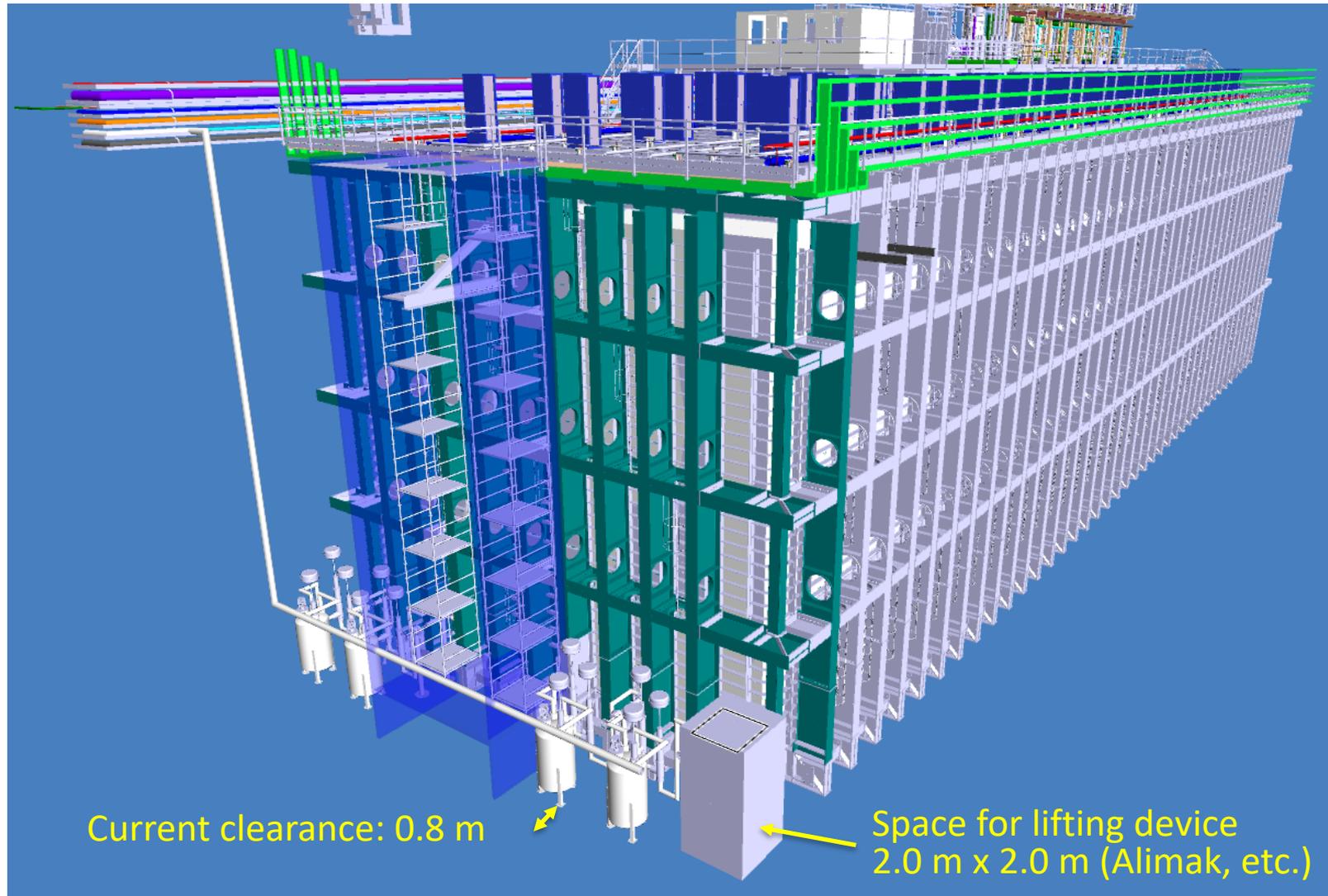
- Extended mezzanine platform by 9.6 m (Was 39.8 m, now 49.4).
- Added two office-type spaces.
- Increased number of controls racks (from 4 to 8).
- Added collectors for purges in feedthroughs.
- Added panel for GAr Analyzers to collect lines from purges.
- Cleanup and minor modifications to pipe routing.

LAr Pumps

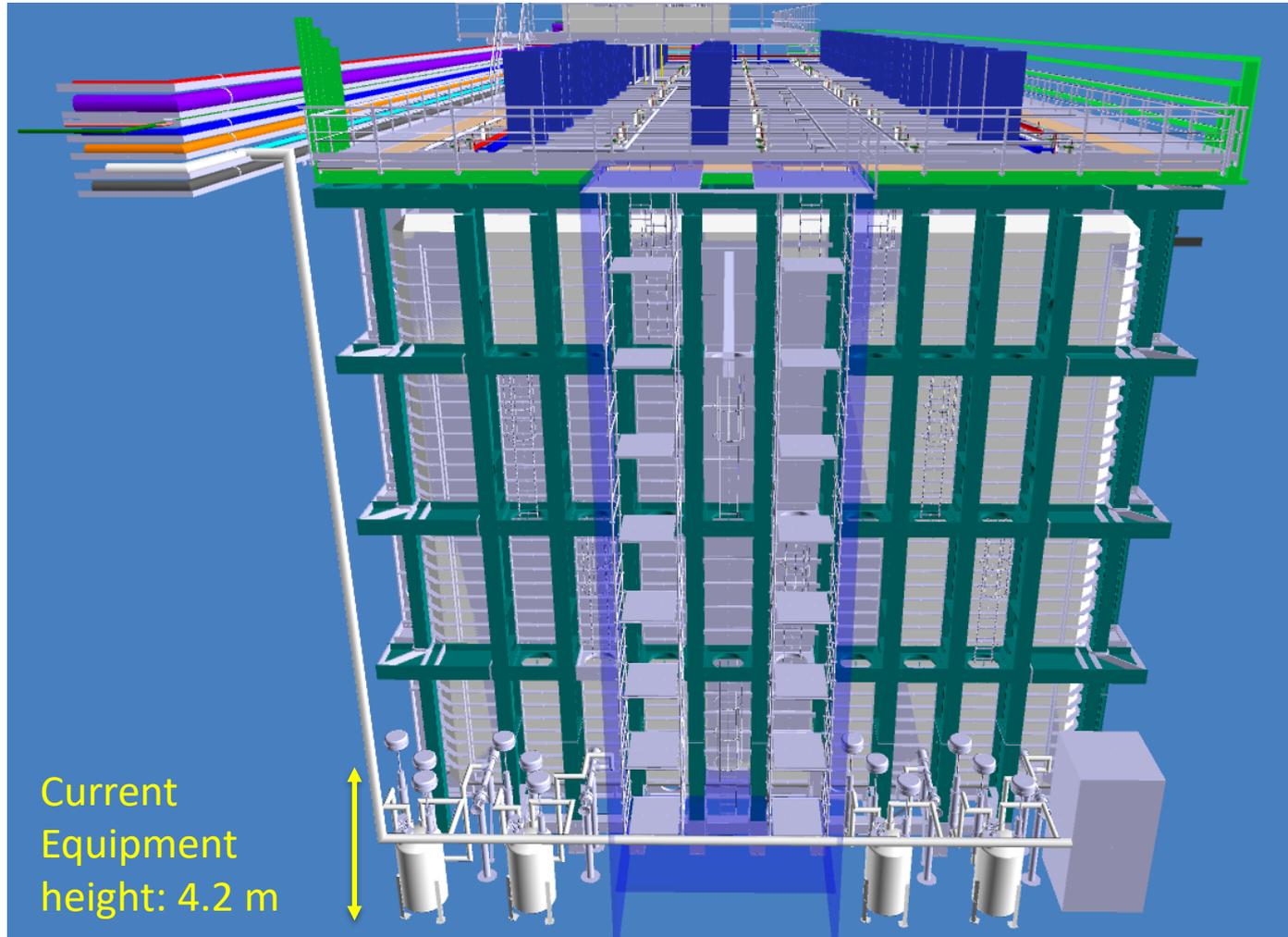
LAr Pumps Configuration (as of Oct 2017)



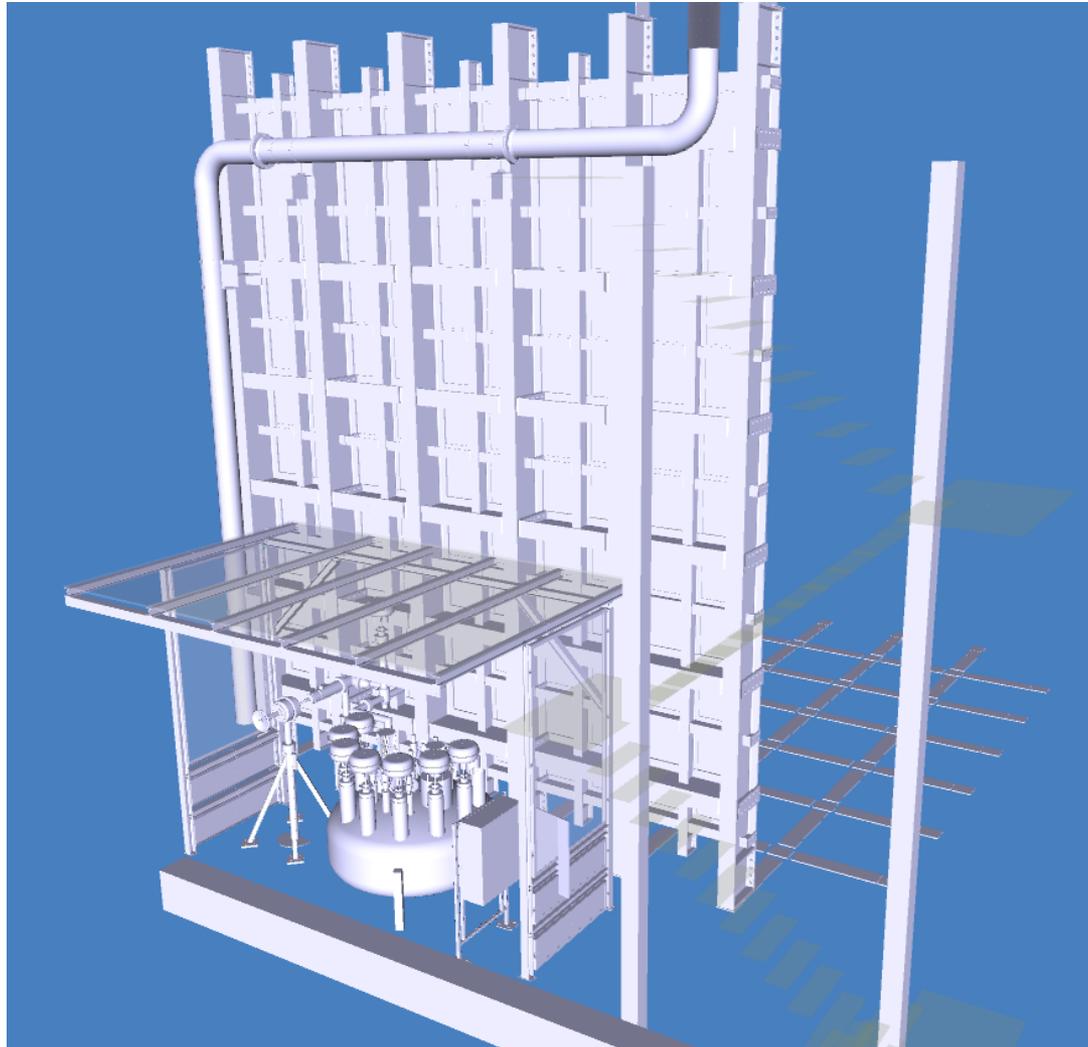
LAr Pumps Configuration (Current) – 1/2



LAr Pumps Configuration (Current) – 2/2



NP-04 – Protection for Protego + Valve Box

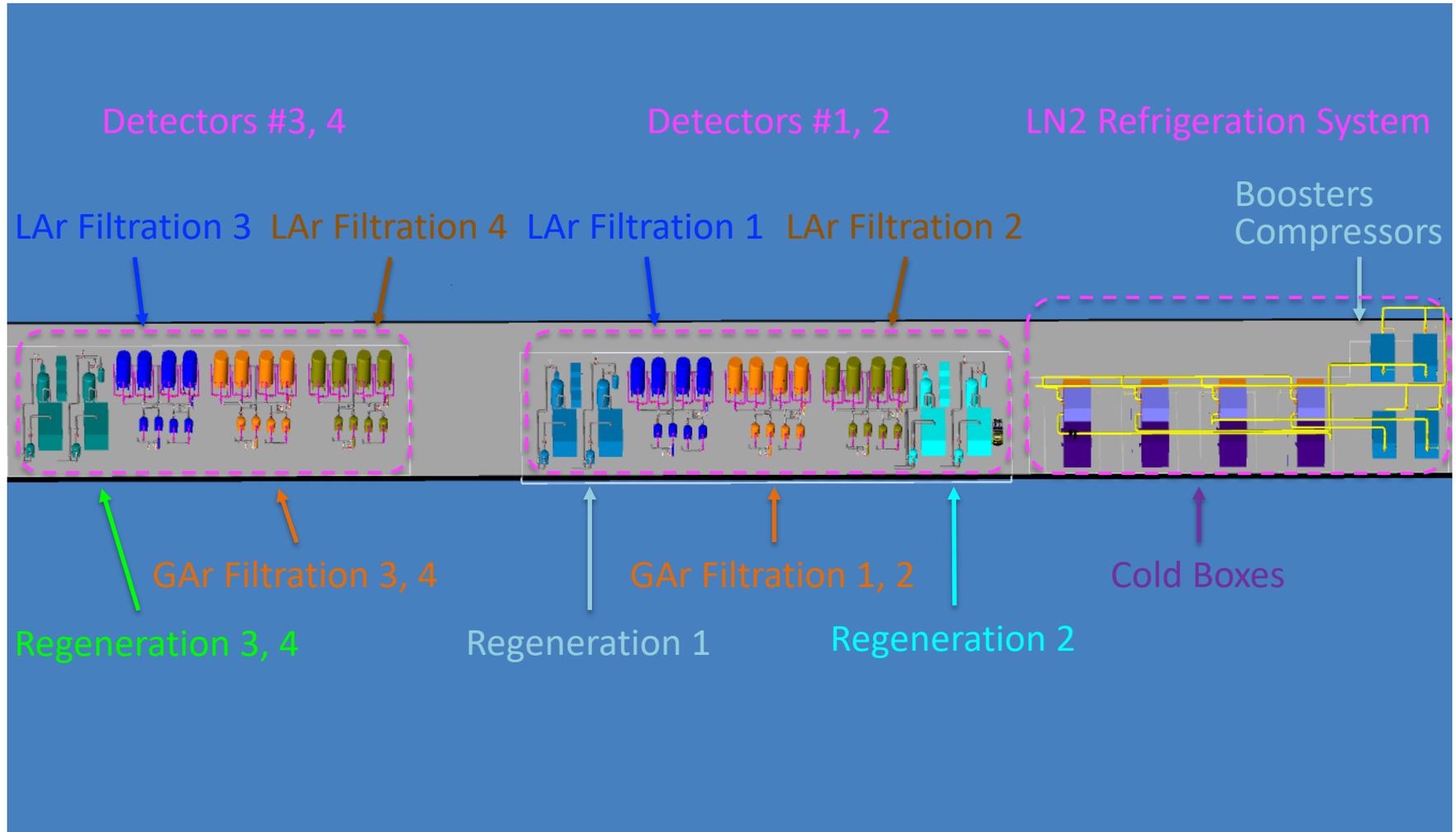


LAr Pumps – Highlights

- Removed pump towers and replaced with inline pumps + valve boxes.
- Verified size of pipes and updated model. Inlet/outlet to/from LAr pumps are now smaller:
 - 3 in SCH 10 (DN 80) process.
 - 5 in SCH 10 (DN 125) vacuum jacket.
- Left 2.0 m x 2.0 m in NE corner for lifting device/stairs.
- Need to add protective structure that might be 5.0-5.5 m high.
- Working with Far Detector on Clean Room requirements and interfaces. Access and space are shared in this area.
- Working with Cryostat, Far Detector, Systems Engineering on installation sequence.
- Ongoing discussion on rock septum and whether it is removed.

Proximity Cryogenics in CUC

Proximity Cryogenics in CUC – Layout (unchanged)



Proximity Cryogenics in CUC – Highlights

- Working on documentation for LAr Purification #1:
 - Prepared DRAFT Interface Control Document (ICD).
 - Working on Engineering Design Specifications (EDS).
 - Working on 3D envelopes.
- Goal is to have a design package for LAr Purification #1 (ICD, EDS, Interface Drawings, 3D envelopes) to discuss with potential partners and procure as Design/Fabrication/Installation contract.
- Next packages are:
 - GAr Purification #1.
 - Regen Purification #1.
 - LAr Purification #2.

Thanks