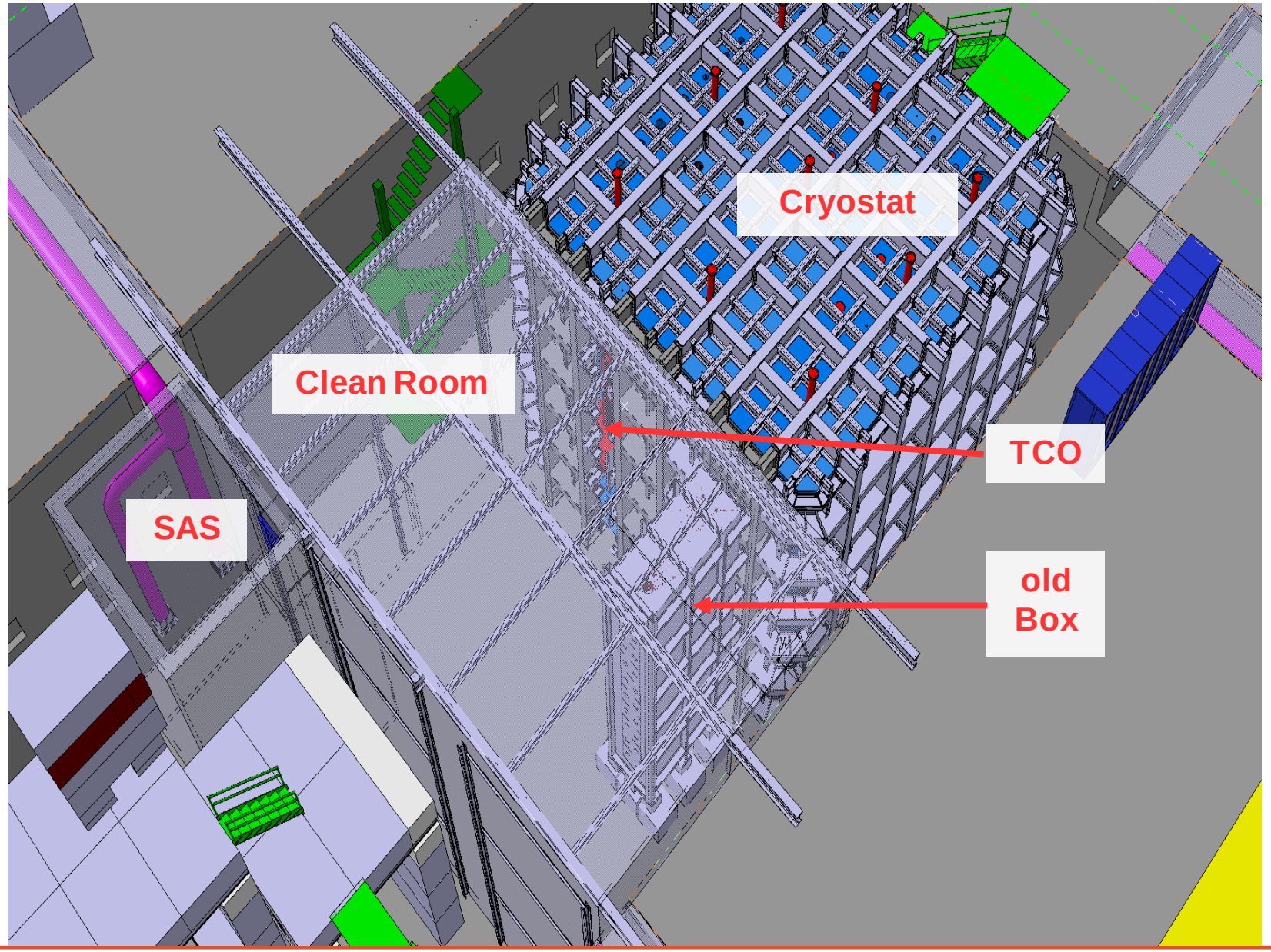
Clean room discussion

Jack Fowler

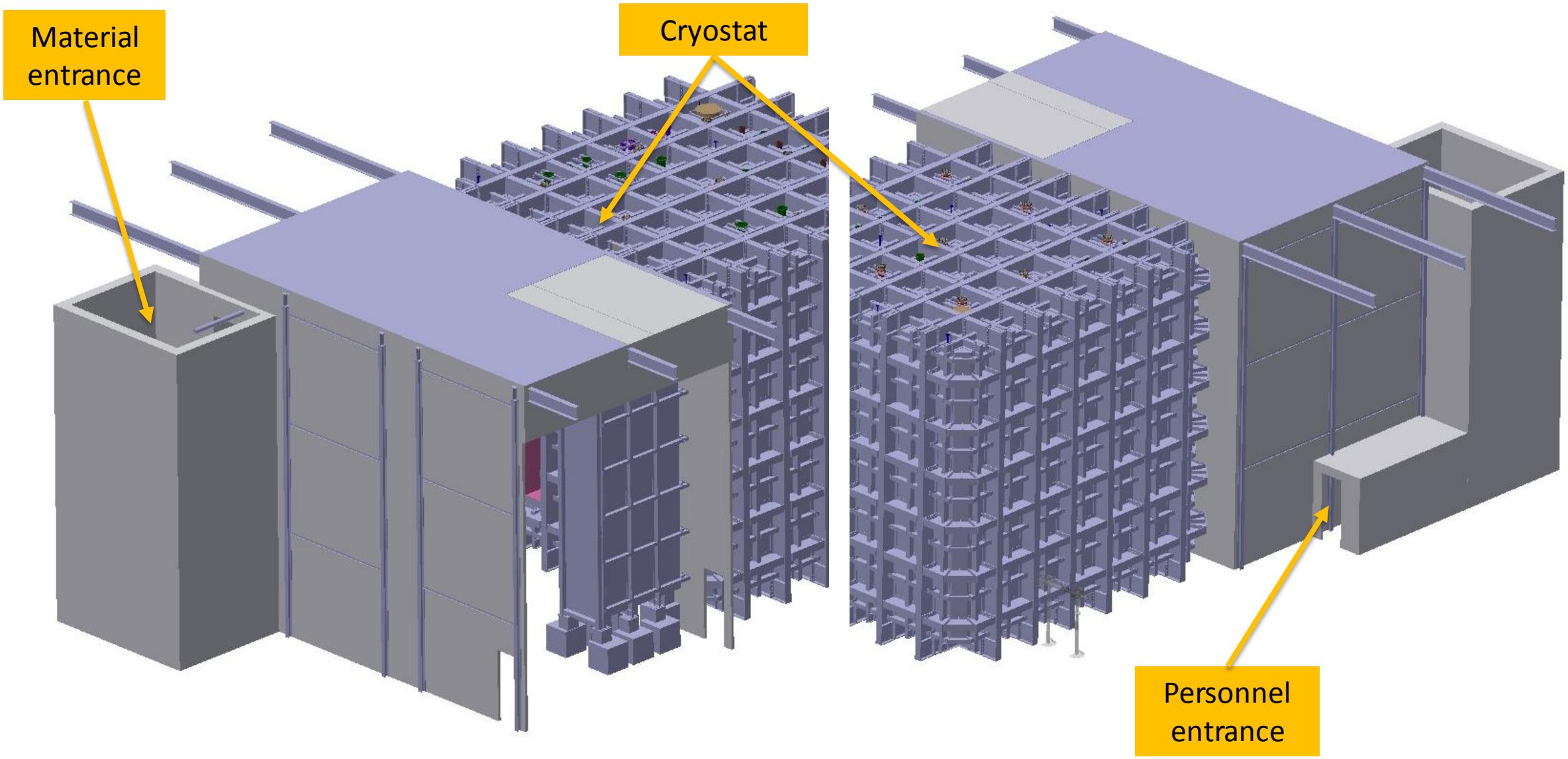
ProtoDUNE SP Installation Workshop

19-April-2017

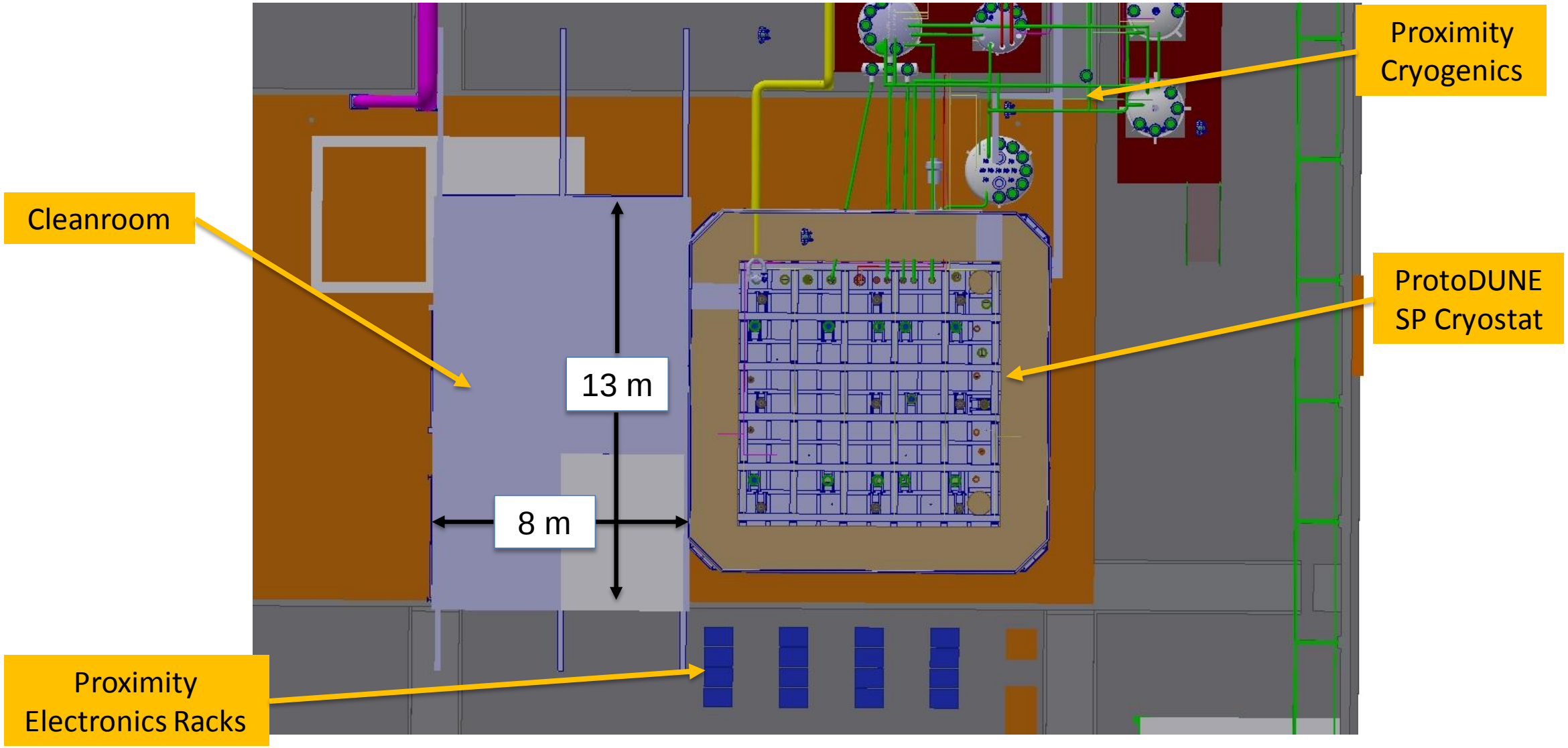
SP clean room area



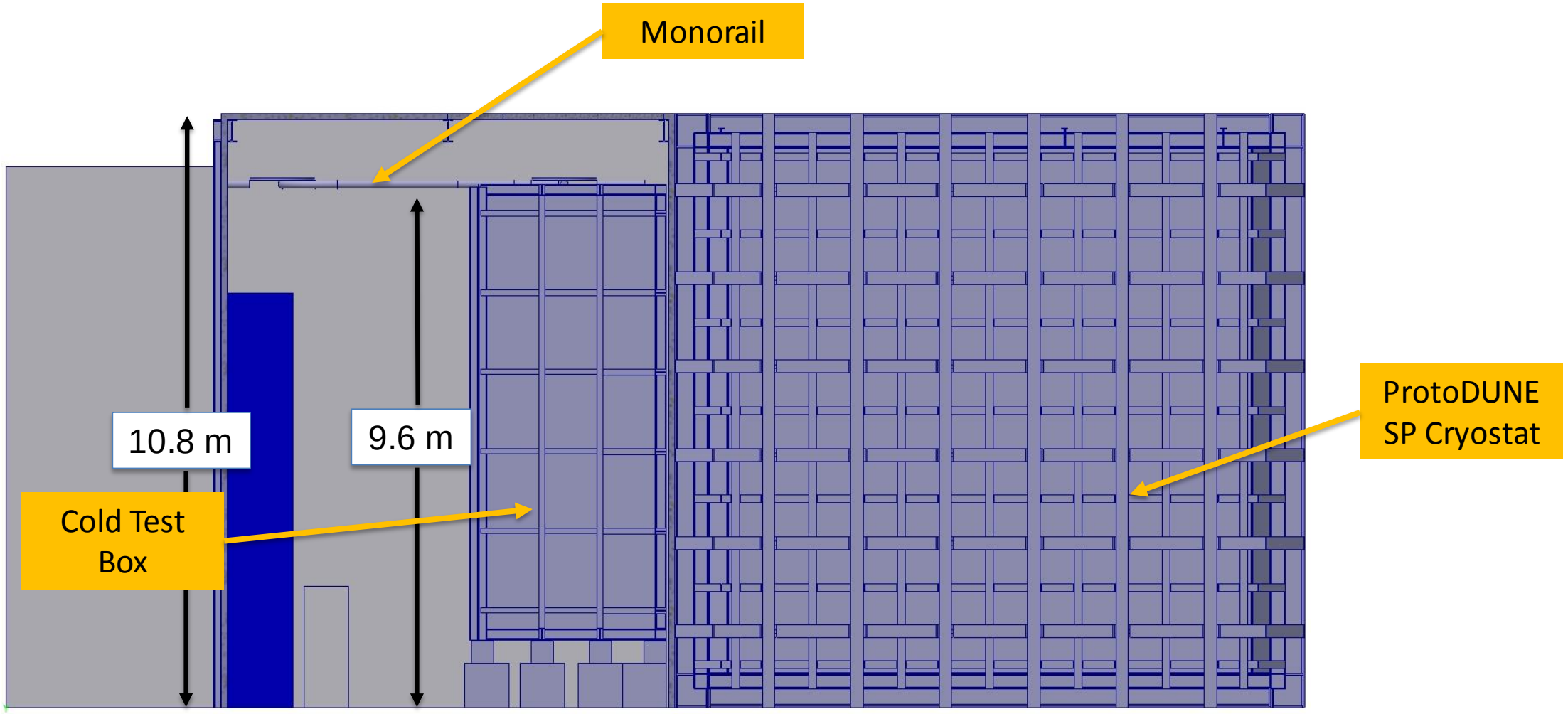
Cleanroom access



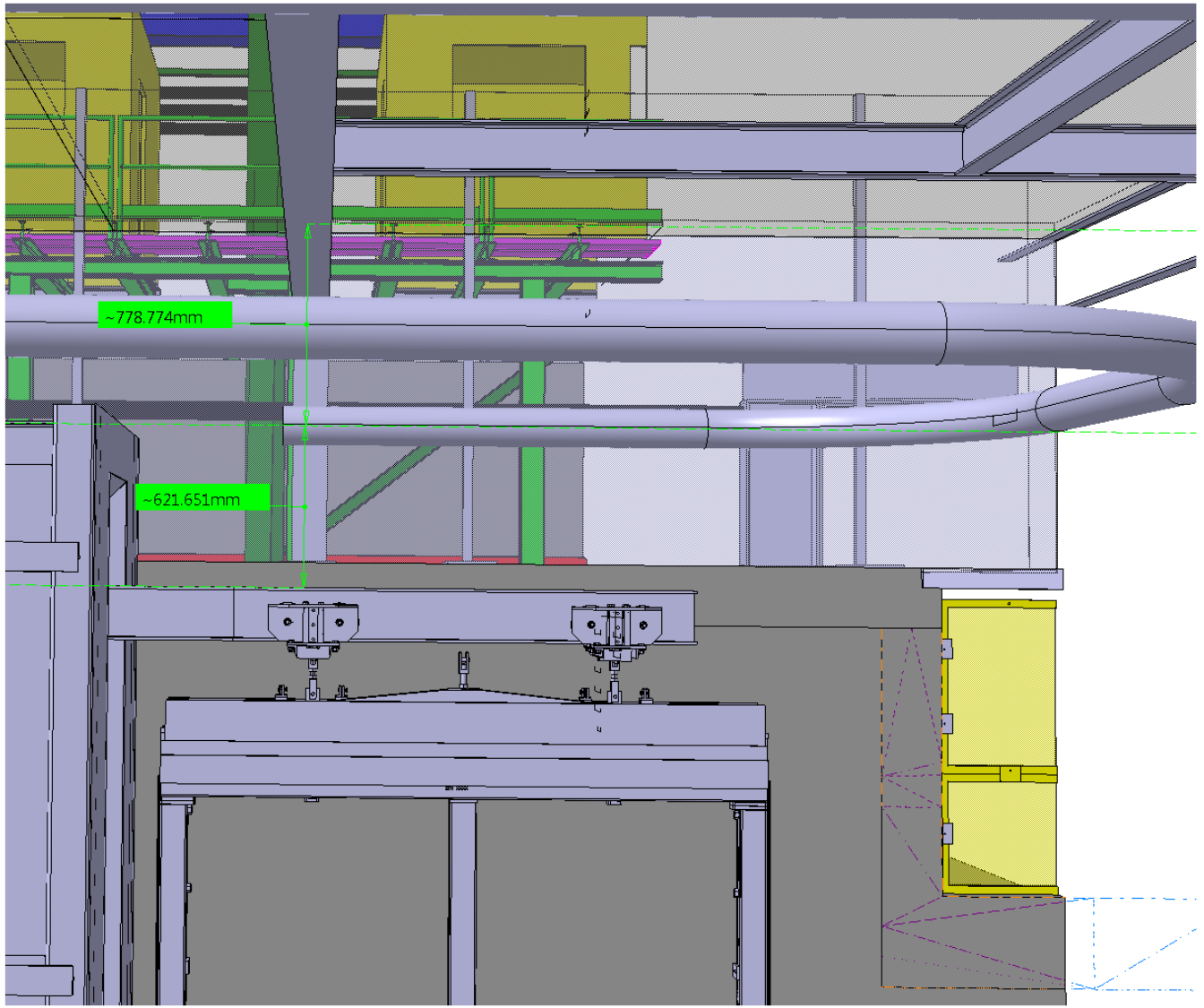
Plan view of cleanroom



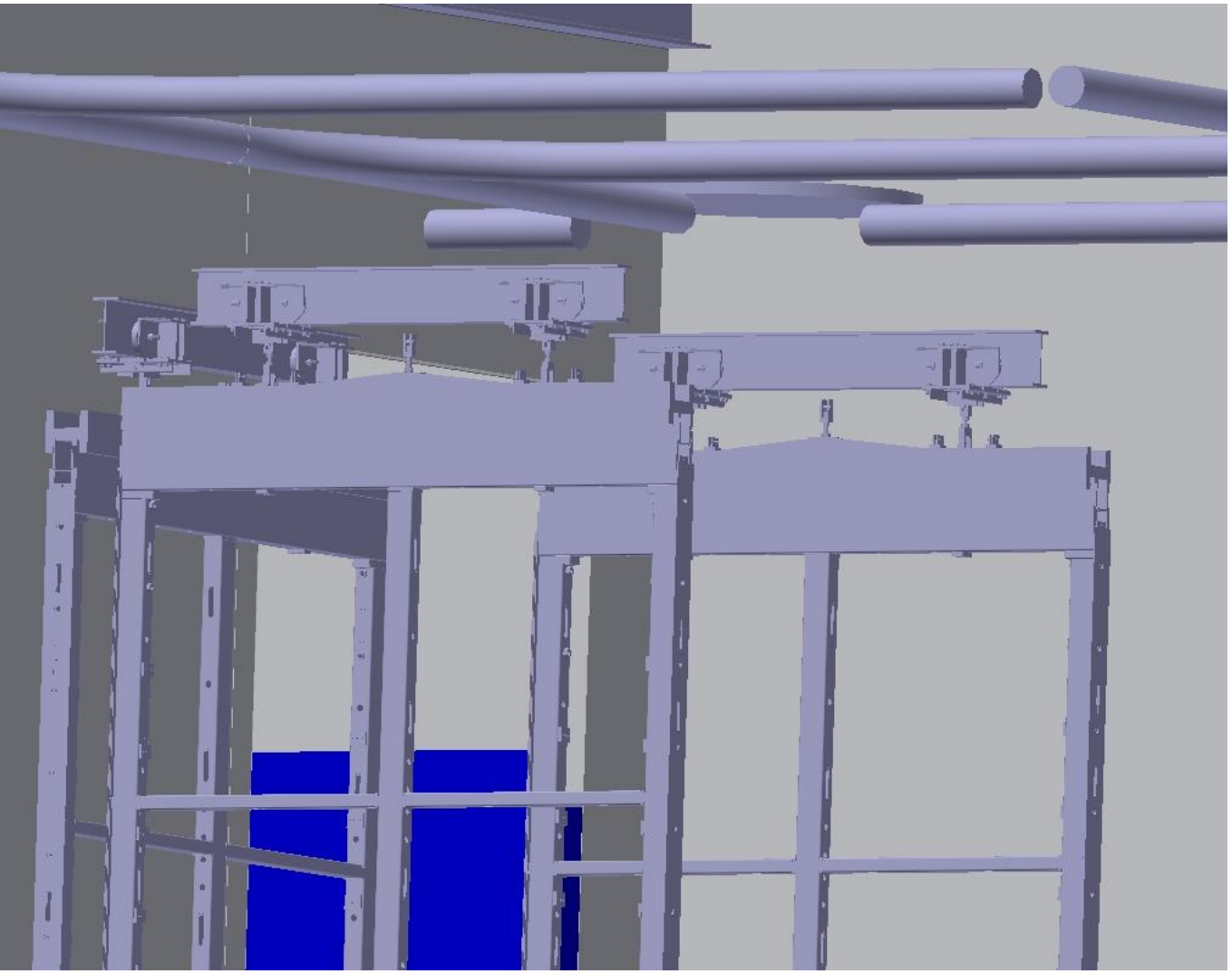
Elevation view inside cleanroom

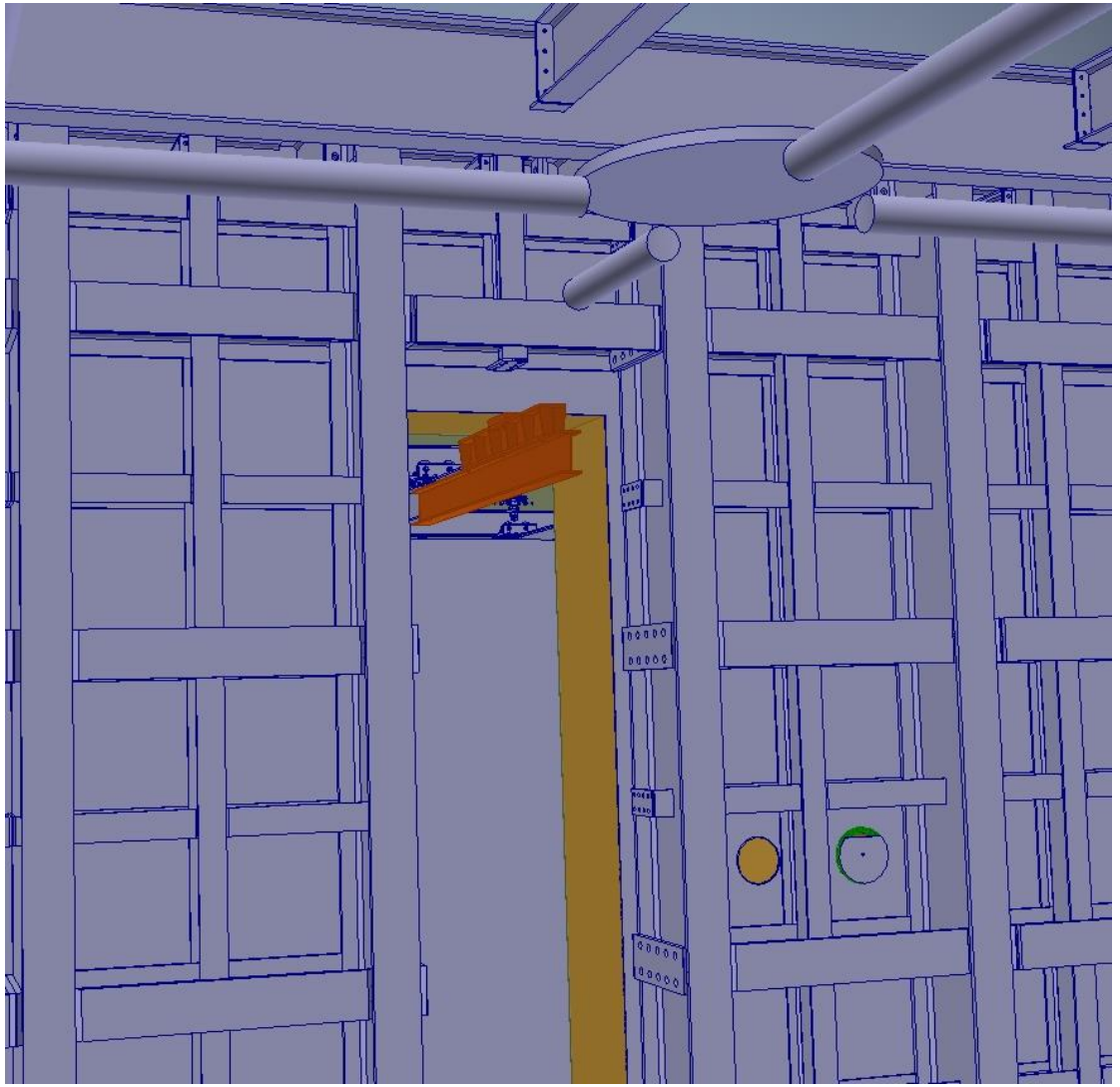


Transport rails

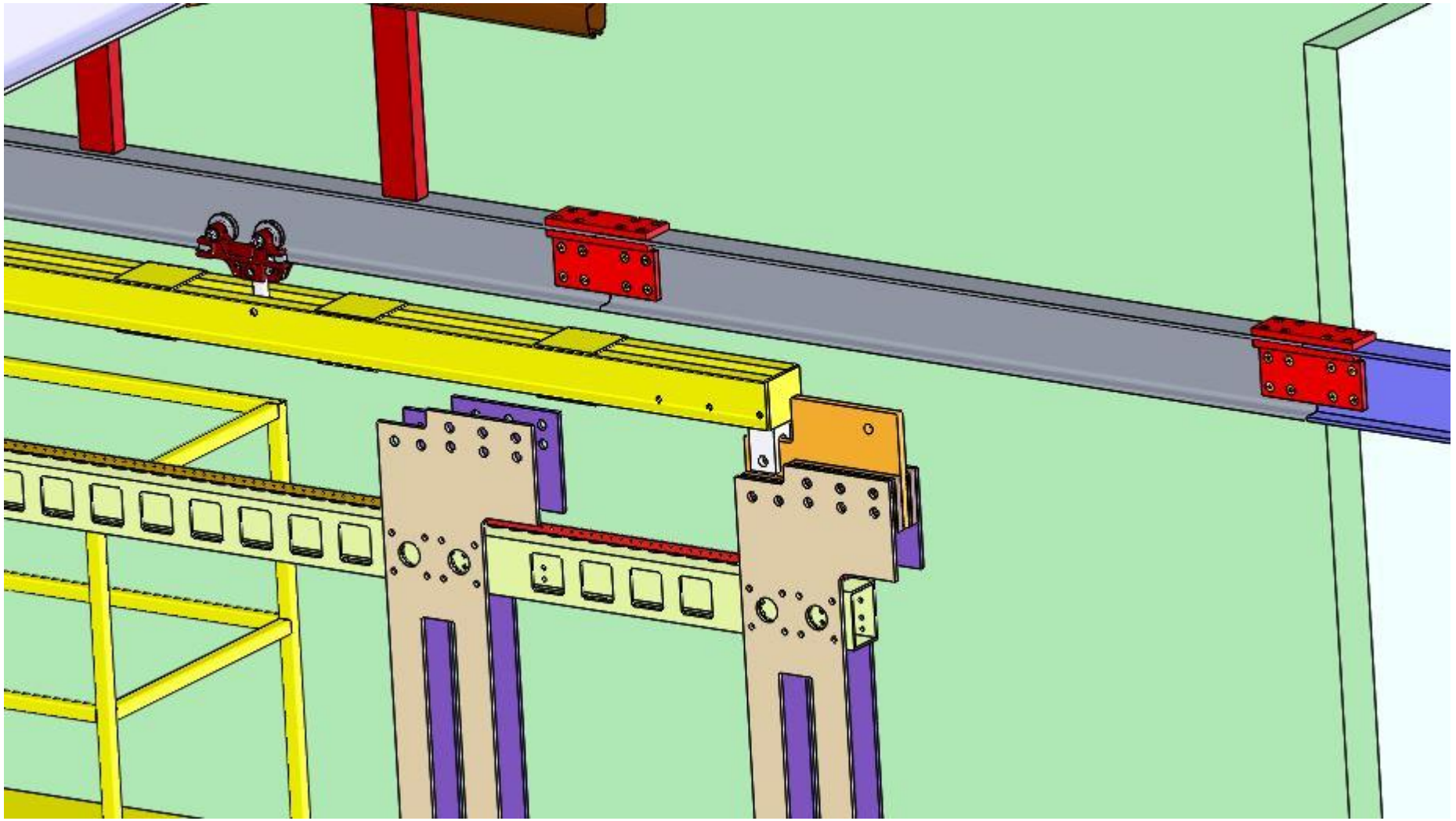


Transport beams and TCO rail





Tie plates between I beams concept



Transport Beam

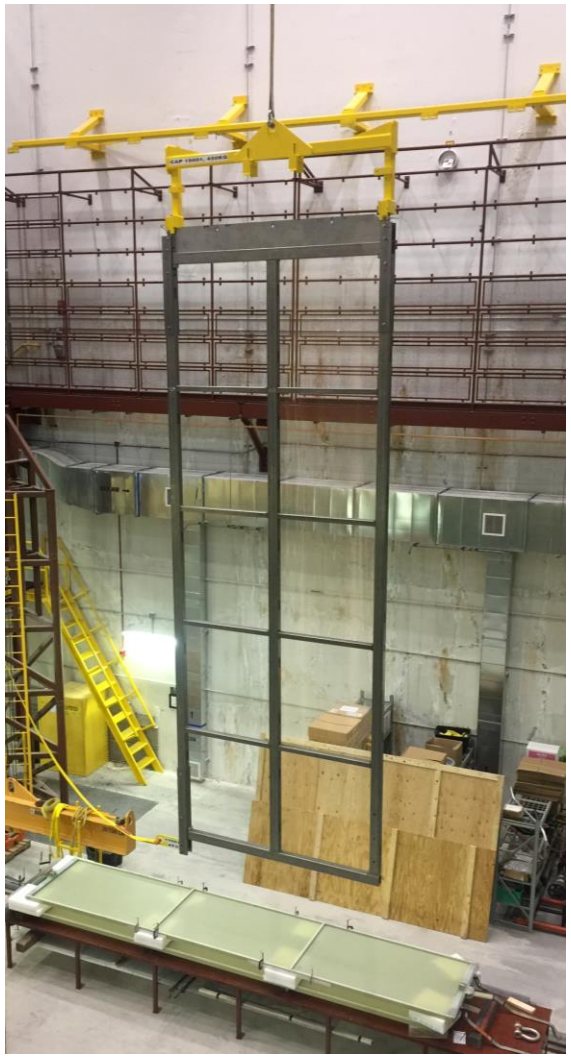
- I-beam must be the same size as the beams used in the DSS
- I-beam needs to have tie plate holes to align the transport, transition and DDS Bridge beams together as shown in figure 7.
- All transport beams should be able to move APA, CPA Pair (which includes FC) and End Wall. There should be stops set up so that TPC components cannot move when it is being rolled.
- I-beam length should be long enough to connect to the Transition Beam and the Cold Box but also compatible with the ability to rotating in the two turn styles
- The linkage between the cleanroom trolley and the transport beam should be adjustable for elevation corrections

Transition I-beam in TCO

- In order to insert detector components in the cryostat a SS I-beam must be supported by the warm structure and extended through the TCO that aligns with the DSS beams
- I-beam must be the same size as the beams used in the DSS
- I-beam must be the same height as the beams in the DSS and there must be some method for aligning them.
- I-beam must extend through the TCO and come within 10mm of its mating beam on the DSS.
- In addition it must cantilever outside of the TCO far enough to allow components on their transport beam to line up
- The transport, transition and DDS Bridge beams must be designed to tie together

Material movement through TCO

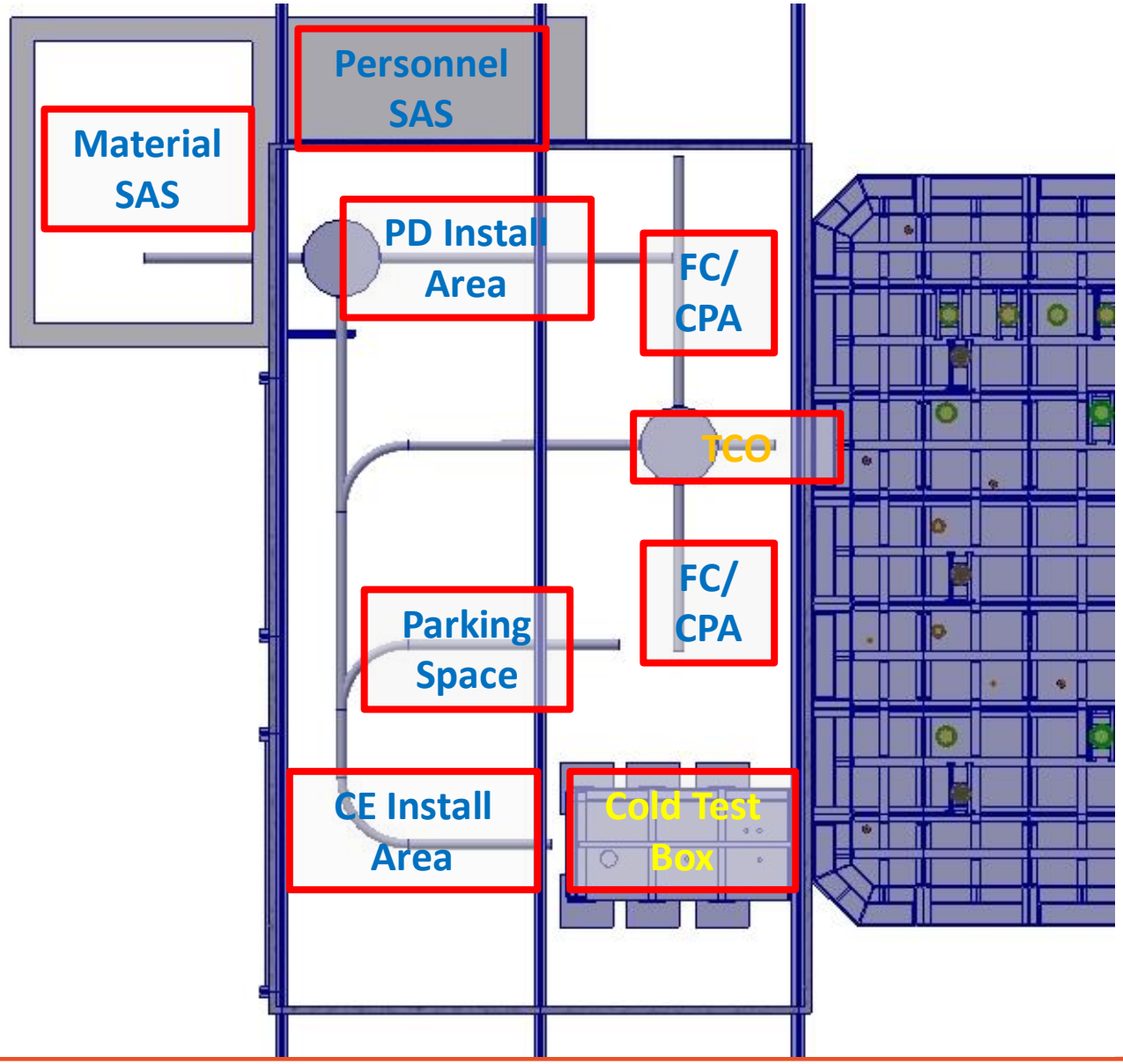
- APA lifting tool at Ash River. Needs to be modified and qualified for use at CERN with SAS extension.
- Other TPC elements currently use standard lifting straps and shackles for lowering into SAS.



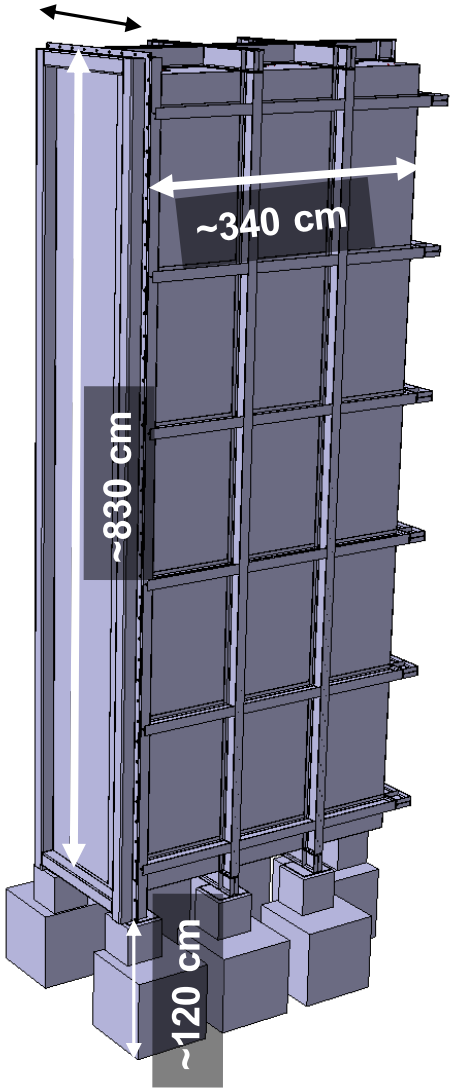
Clean room protocol

- Class 100K or ISO 8.
- Personnel protocol. Clothing, ESD, etc.
- Material protocol. Types of containers,
- Maintenance and cleaning.
- Air flow and filtration.

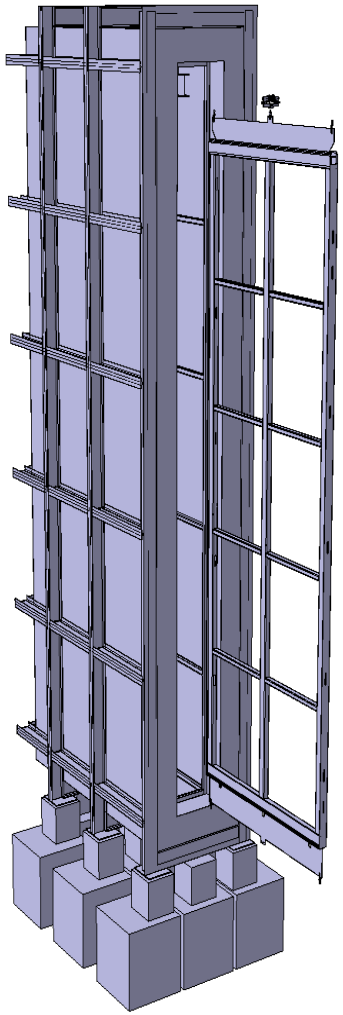
Work areas currently planned inside cleanroom



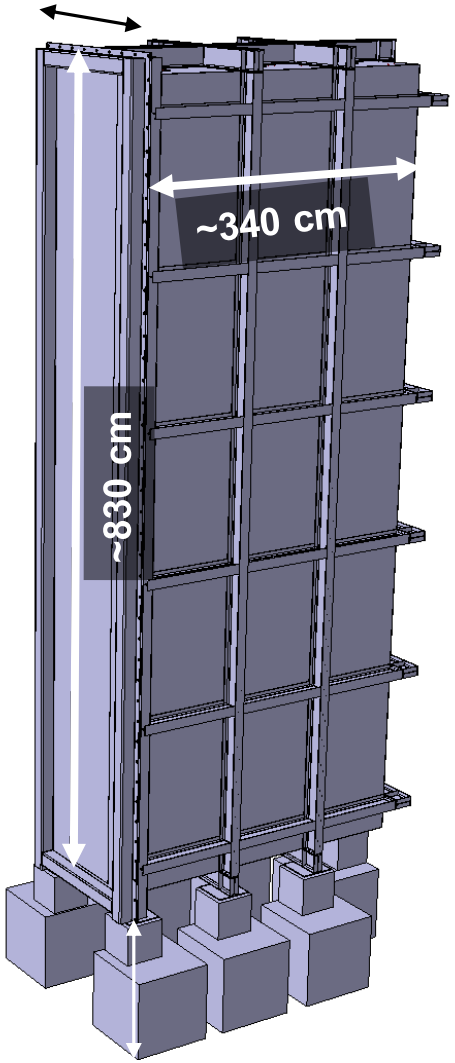
Cold test box details



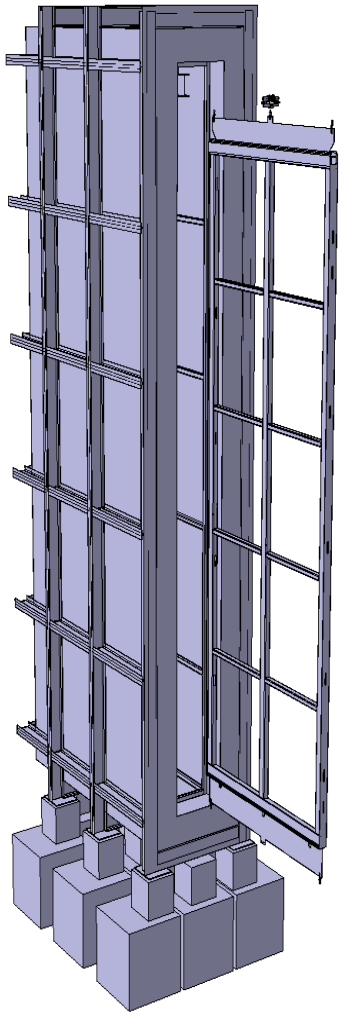
- Door on the short vertical side, removable with the building crane
- A rail like those used in the Clean Room and cryostat will be installed, allowing for APA insertion, positioning, and extraction
- External structure formed by 5 (or 10) mm SS plates surrounded by a series of 8 IPE 200 horizontal beams and 2 IPE 200 vertical beams
- 300 mm insulation on the inner walls. Material not defined yet. No metallic membrane, but a plastic cover in front of the insulation
- Inner dimensions: ~ 730 cm x 270 cm x 70 cm



More details



- 5 ports on top:
  - 1 CF250 for Tee flange with PD and CE FTs
  - 2 CF63 for gas in and out
  - 1 CF63 for optical fiber, RTDs FT and safety relief valve
  - 1 CF63 spare
- Connected to DAQ test stand for pedestal and noise measurement of PD and CE systems both in warm and cold, and in several conditions: wire bias on/off, PD and CE alternatively/both on, different CE shaping time and gain values, etc
- Possibility to use a flasher to acquire light signals from scintillating bars and possible induced signals on wires



Some test details

- After APA is inserted and cabled up, the box will be flushed with warm (room temperature) N2 gas to eliminate water
- Warm tests of PD and CE systems will be done while flushing (~ 1 day)
- Once warm tests are completed, cooldown with N2 gas will start:
  - Target operating temperature: 150 K
  - Cooldown time: 40 hours
  - N2 flow: ~ 30 m^3/h / ~20 gr/sec
  - Operating pressure: <1.1 bar
  - Max temperature gradient: requirement for the cryostat is <10 K/m and <50 K between any two points of the TPC. This will be hard to achieve in the box using N2 gas. Thus, we are aiming at 10-20 K/m
- 12h – 24h of PD and CE systems cold tests
- ~40 hours for warm up, during which the box will be flushed with room temperature N2 gas

More test details

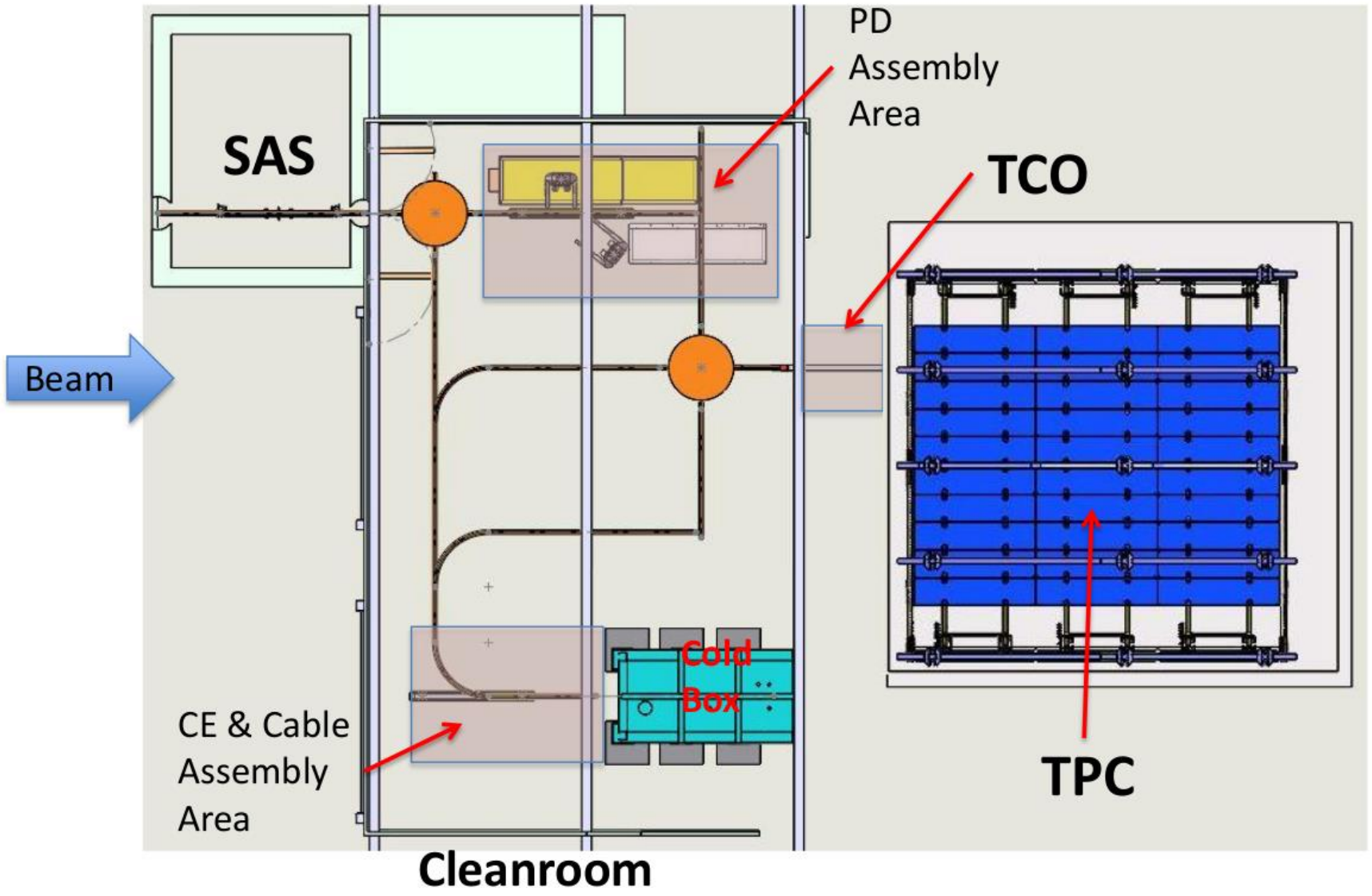
- A cooling/warming cycle test will be performed after Cold Box assembly, before inserting the first APA
- APA #1 will have a long test period: ~1 month of warm tests and ~1 month of cold tests, used for debugging, practice the cooling/warming up procedure, test procedure, and finalize the tests to be done on the following APAs
- Trying to make as much use as possible of the final detector elements: PD and CE FT and crates will have the same layout as in the cryostat, routing of warm cables towards the DAQ will be the same as for the cryostat, using the same cables and fibers wherever possible
- Cold Box will be in detector ground, electrically connected to the cryostat and isolated from the building

PD area

- The cabling and the PDs will be installed inside the APA in this area.
- Also in this area, each of the PDs will be removed from their shipping container and tested inside a light tight box.
- The installation tooling will be temporarily attached to the APA. The PDs will be inserted into the APA frame by operators on a scissor lift utilizing the tooling.
- Once inserted and fixed to the frame, the cable that is inside the APA frame, will be connected to the PD assembly.
- Testing again?
- If we don't rotate the APA frame on the cleanroom monorail, the APA will need to be indexed and the installation tooling and scissor lift will be repositioned to the opposite side of the APA.
- More details from PD group. Need detailed QA and test procedure.

CE area

- Install 20 (10 on front and 10 on back) CE boxes on the top of each of the APAs.
- This will require access on both faces of the APA.
- Manage the ~ 7 m cable bundles that are attached to the CE boxes.
- Test each box as they are installed.
- More details from CE group. Need detailed QA and test procedure.


SAS
PD
Assembly
Area
TCO
Beam
Cold
Box
CE & Cable
Assembly
Area
TPC
Cleanroom

Clean room drawing