IIWG update

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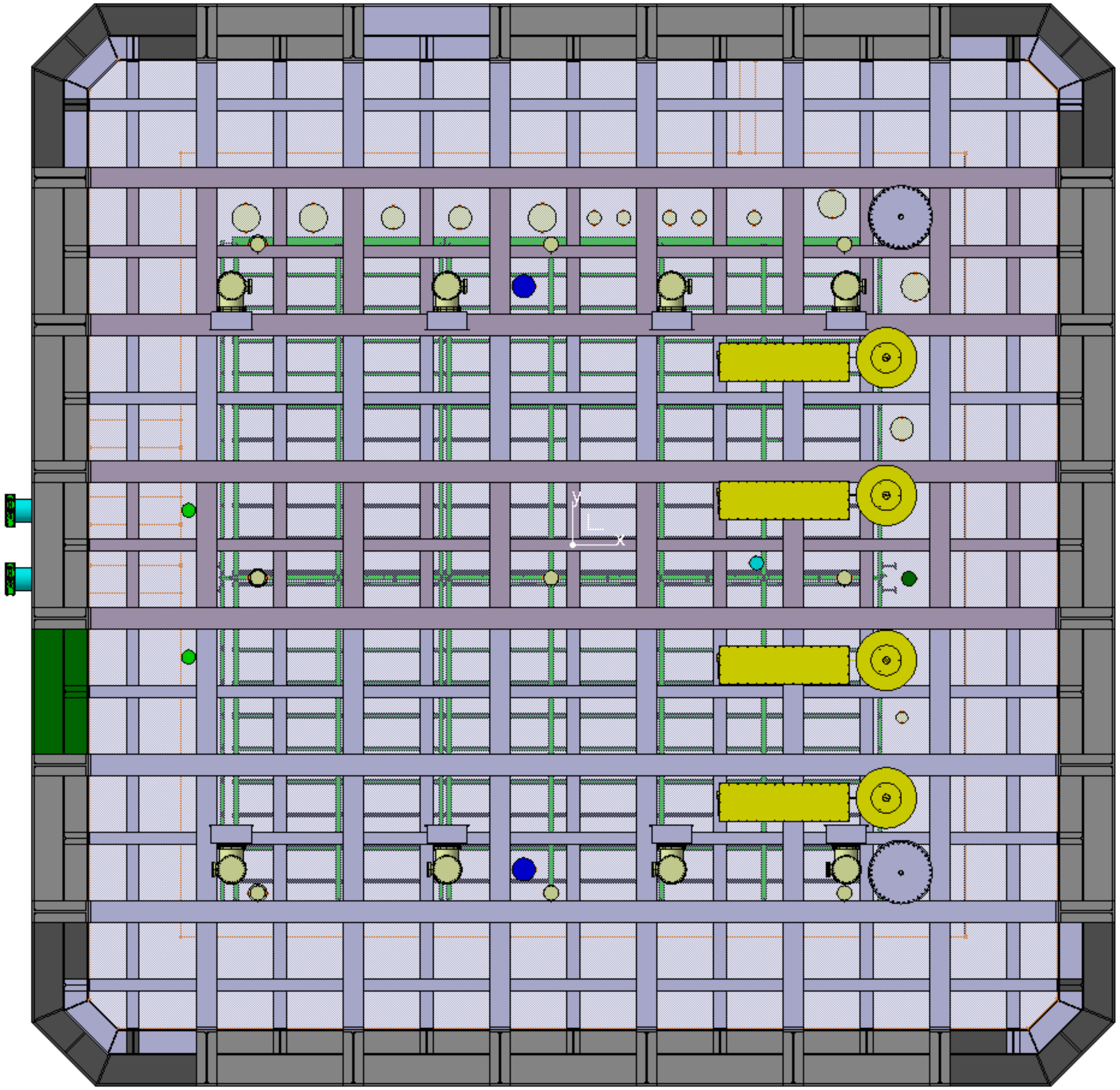
Outline

- Review CERN engineering meeting
  - Finalize mechanical interfaces between TPC and cryostat. Define TPC location and cryostat penetrations (size and locations).
  - Define beam windows.
  - Review materials for CPA assembly.
- EHN1 information from Anne Laure Perrot
- Show early conceptual sketches of ProtoDUNE installation.

Plan view ProtoDUNE cryostat



Details of cryostat from requirements document

- Document found at https://edms.cern.ch/document/1543254/1
- Some details.

	Length [mm]	Width [mm]	Height [mm]
Membrane Flat Internal dimensions	8548	8548	7900
SS Plate Internal Dimensions	10552	10552	9904
External Dimensions of the Structure	11808	11808	11160

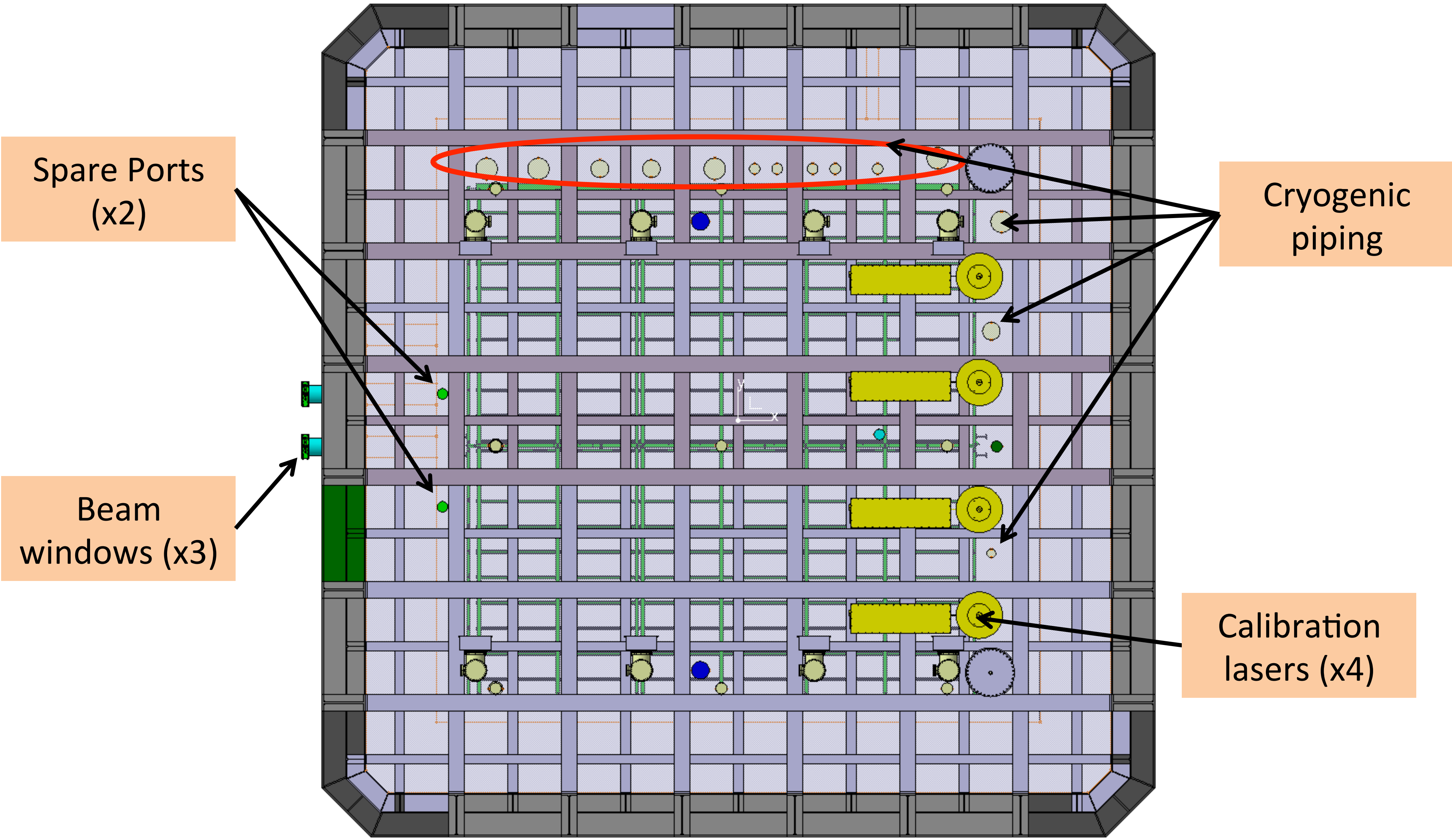
- *The final inner volume is 7900 mm * 8548 mm * 8548 mm (height*length*width): ~580 m^3.*
- *Tank capacity (liquid volume = ~0.96%): ~557 m^3*
- *Residual Heat Input (RHI): 5 W/m^2*
- *Insulation density: 70 kg/m^3 (PU Aged HFC245)*
- *Insulation thickness (all included): <=1 m (to be computed by GTT in order to fulfil the required RHI)*
- *Design pressure: Max 1350 mBar / Min 950 mBar. And 1350 mBar for the case of a cryogenics accidental condition.*
- *Operating temperature: 86K-89K*

Detailed list of penetrations

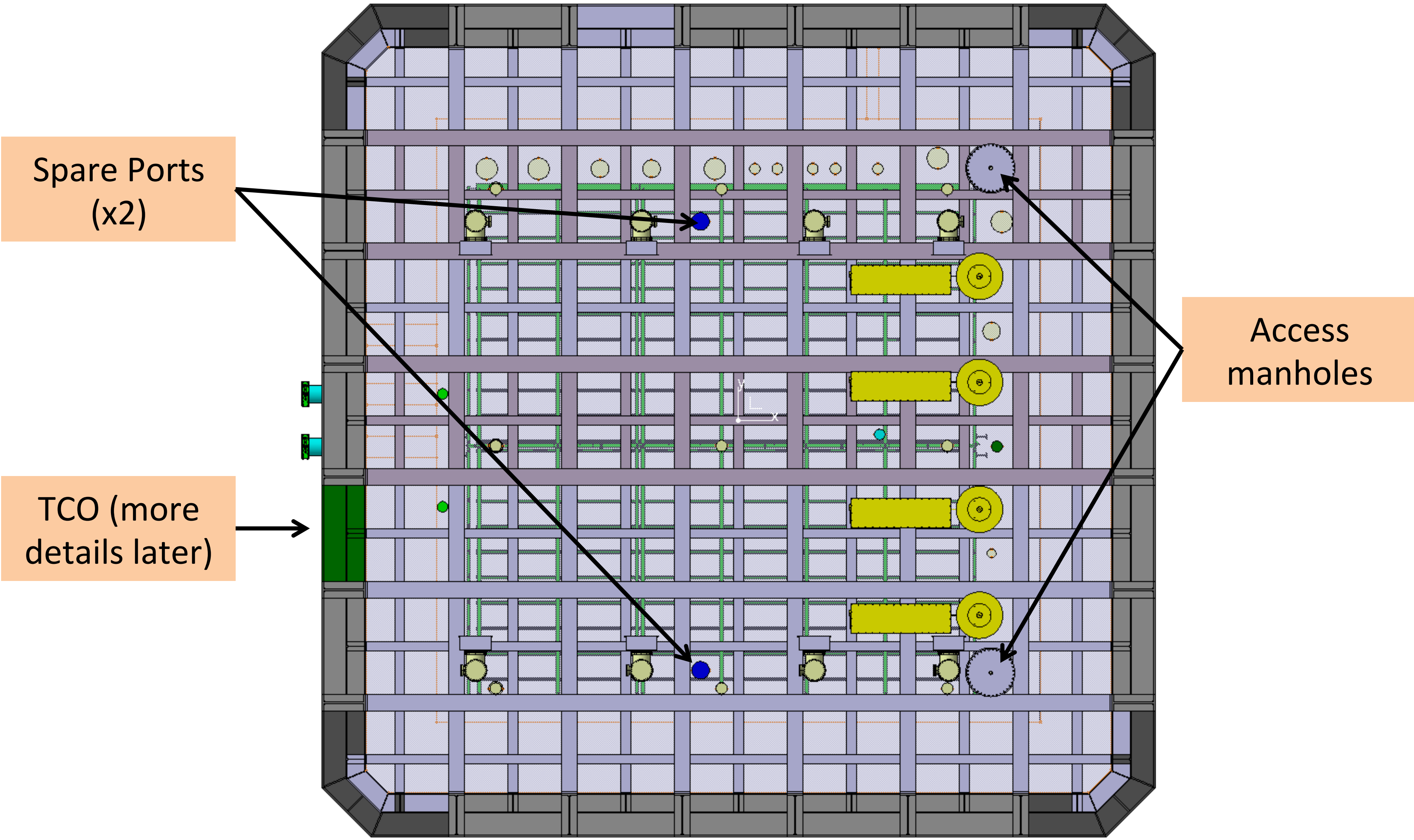
Detector Penetrations - **roof**:

West TPC translation suspension:	N. 3,	crossing tube diameter	200 mm
Center TPC translation suspension:	N. 3,	crossing tube diameter	150 mm
East TPC translation suspension:	N. 3,	crossing tube diameter	150 mm
Signal cable chimney FTs:	N. 8,	crossing tube diameter	250 mm
Spare on Signal cable row FTs:	N. 2,	crossing tube diameter	250 mm
Laser FTs:	N. 4,	crossing tube diameter	100 mm
Calibration Fiber CPA FT:	N. 1,	crossing tube diameter	150 mm
Spare on CPA line FTs:	N. 2,	crossing tube diameter	150 mm
HV FT:	N. 1,	crossing tube diameter	156 mm
Manhole:	N. 2,	crossing tube diameter	609 mm
Angled beam windows – west **side**:	N. 3,	crossing tube diameter	300 mm
TCO – west **side**:			1372mm x 7900 mm
Cryogenic pipes - **roof**:			
	N. 5,	crossing tube diameter	304 mm
	N. 5,	crossing tube diameter	152 mm
	N. 1,	crossing tube diameter	125 mm
	N. 3,	crossing tube diameter	250 mm
Cryogenic pipes – north **side**:	N. 1,	crossing tube diameter	168 mm

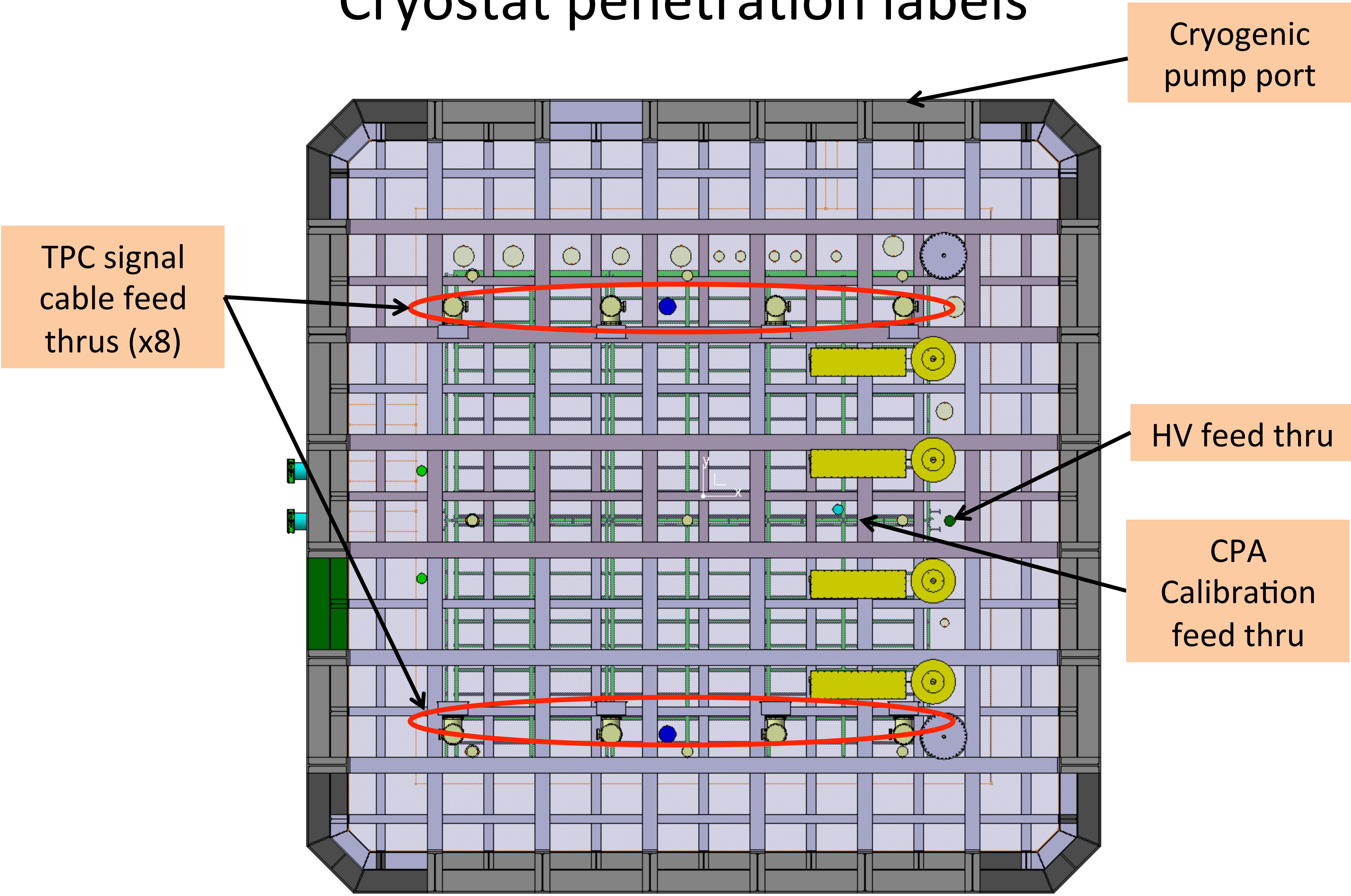
Cryostat penetration labels



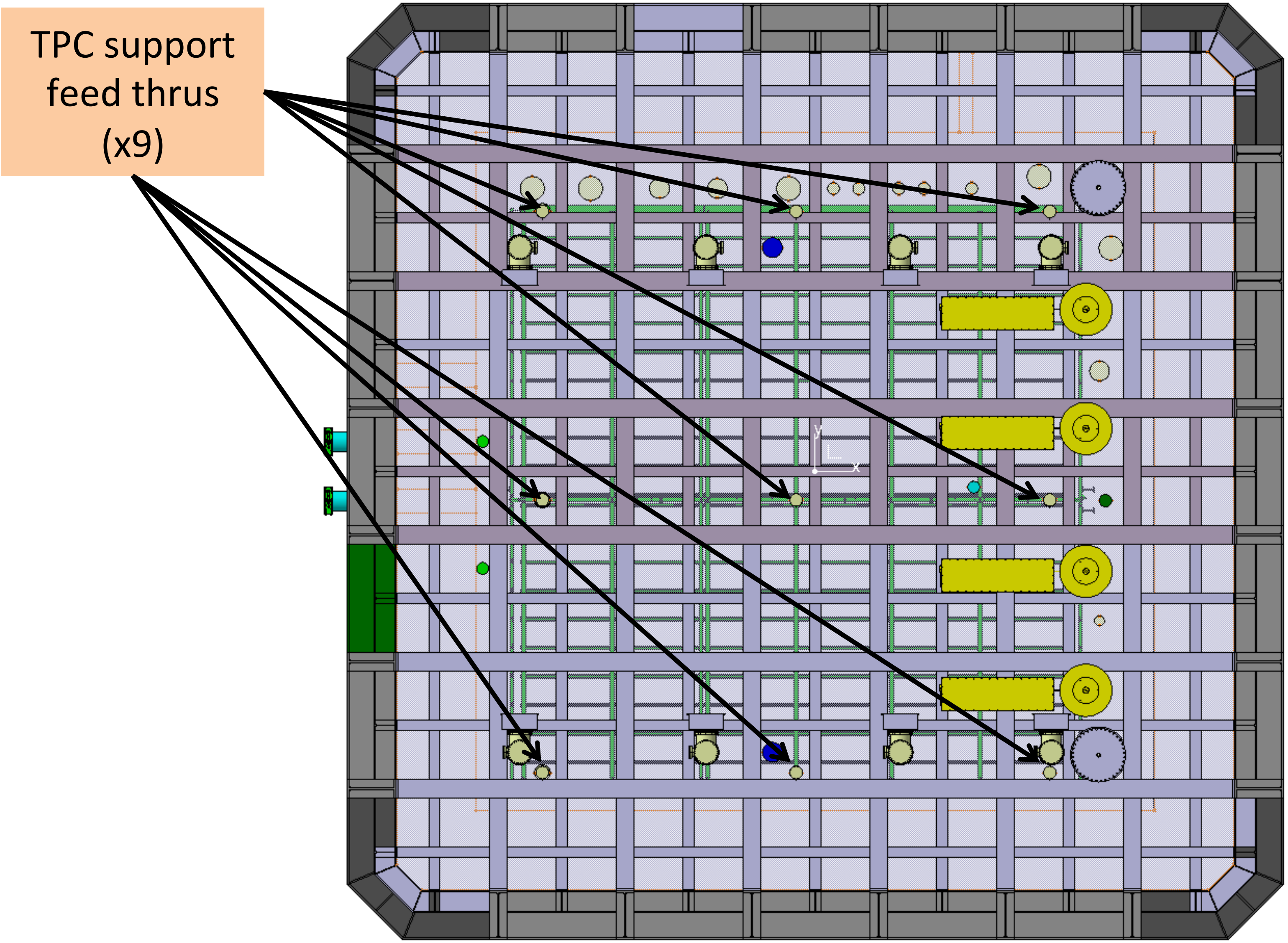
Cryostat penetration labels



Cryostat penetration labels



Cryostat penetration labels



Beam Window

- Final location of beam window ports were not fixed.
- We gave Illias the location of where the central beam should cross the cathode plane.
- He will configure the beam line, iterate with Diamanto to avoid critical steel work, then make a proposal for the penetration locations.
- We will iterate with him. This should happen in the next few days.

Beam Window

- What angles and over what angle ranges do we want the beam?
- Stated in mails that one wants to avoid angles less than 5 degrees as the detector performance degrades.
- Suggest we would like data in the 3-5 degree range to verify the detector performance.
  - We want ProtoDUNE to give data needed to make a technology comparison so we should not only measure where the performance is optimal.

Proposed baseline option for CPA

- Sandwich of thin G10 foils with resistive coating mounted on G10 bar frame:
  - Total thickness ~1 cm seems feasible.
  - Coating choice can be defined
  - Density larger that LAr eases suspension and planarity
- Resistive outer frame:
  - subject to the highest local fields
  - G10 round bars: resistive coating to be carefully studied.

Material choice for CPA Structural

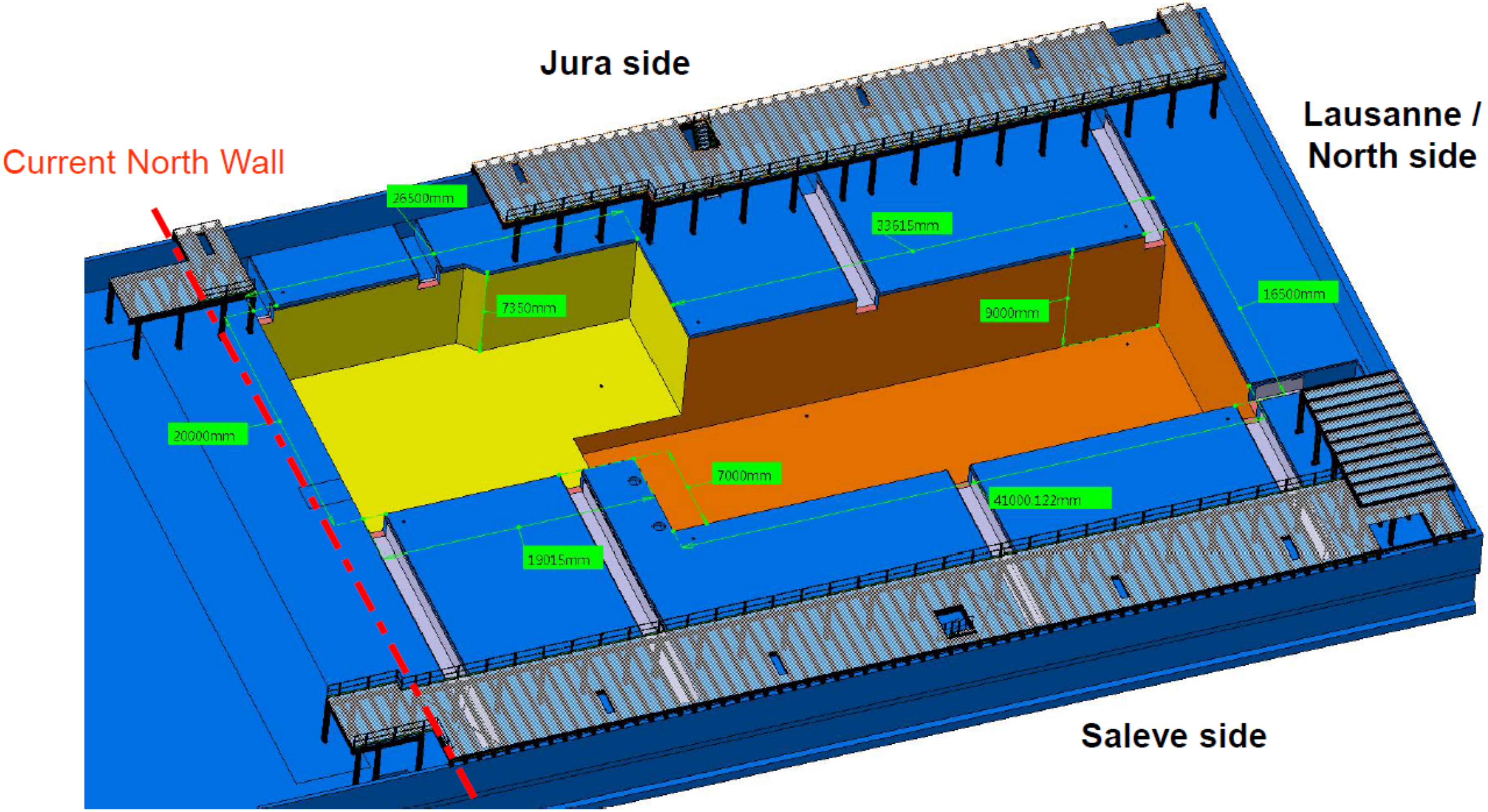
- G-10 preferred over MiCarta.
- Advantages:
  - Lower radiological
  - Denser than LAr (CPA will not float)
  - Stronger than MiCarta
  - Cheap
  - Cathode inner frame does not need to be resistive.

Cathode Issues

- Stability of coating on G10 support at LAr temperature
- Aging of resistive coating
- Electrical connection to HV distribution bus
- Panel-to-panel electrical connections

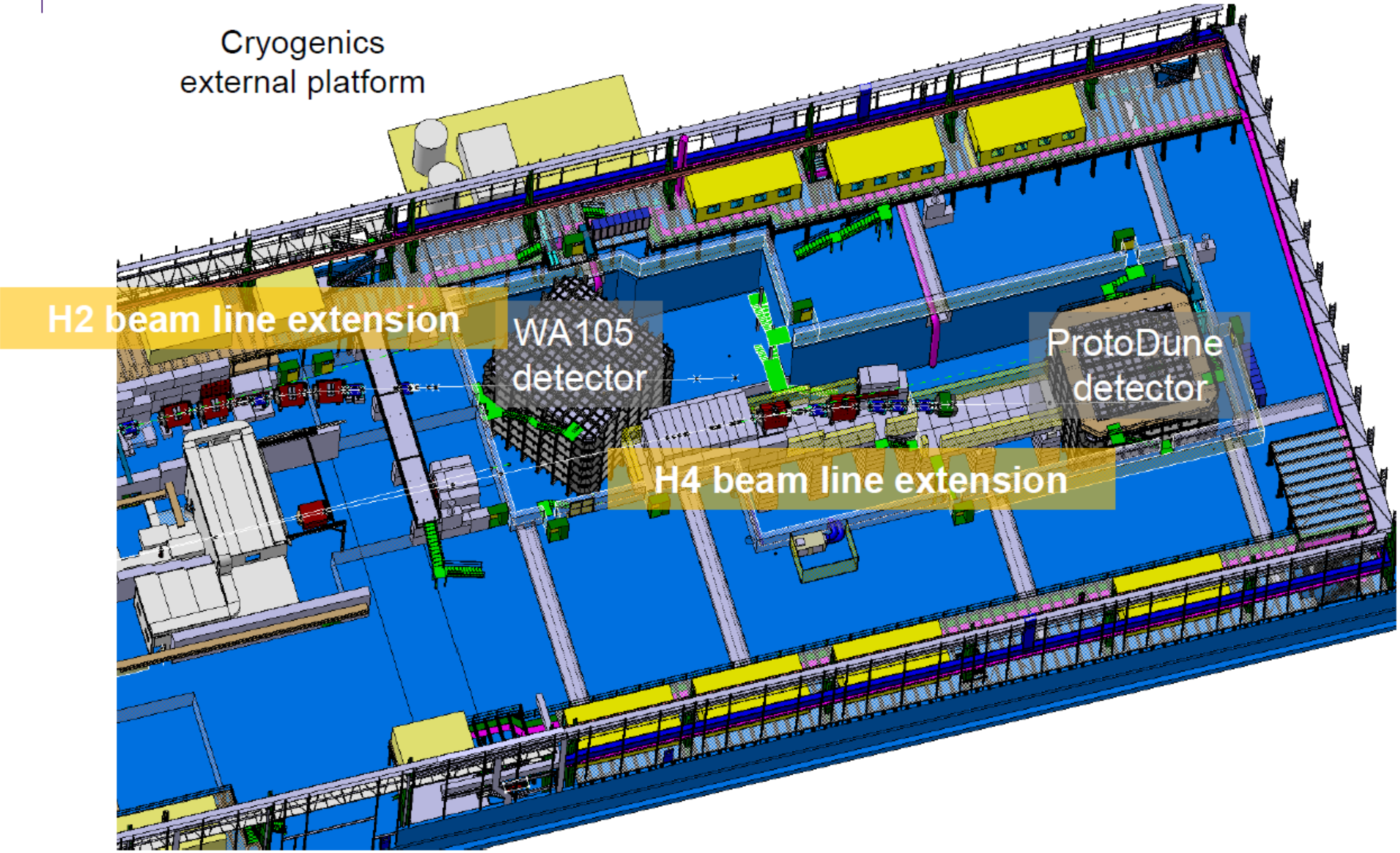
EHN1 extension integration

Building as delivered by the civil engineering at the handover

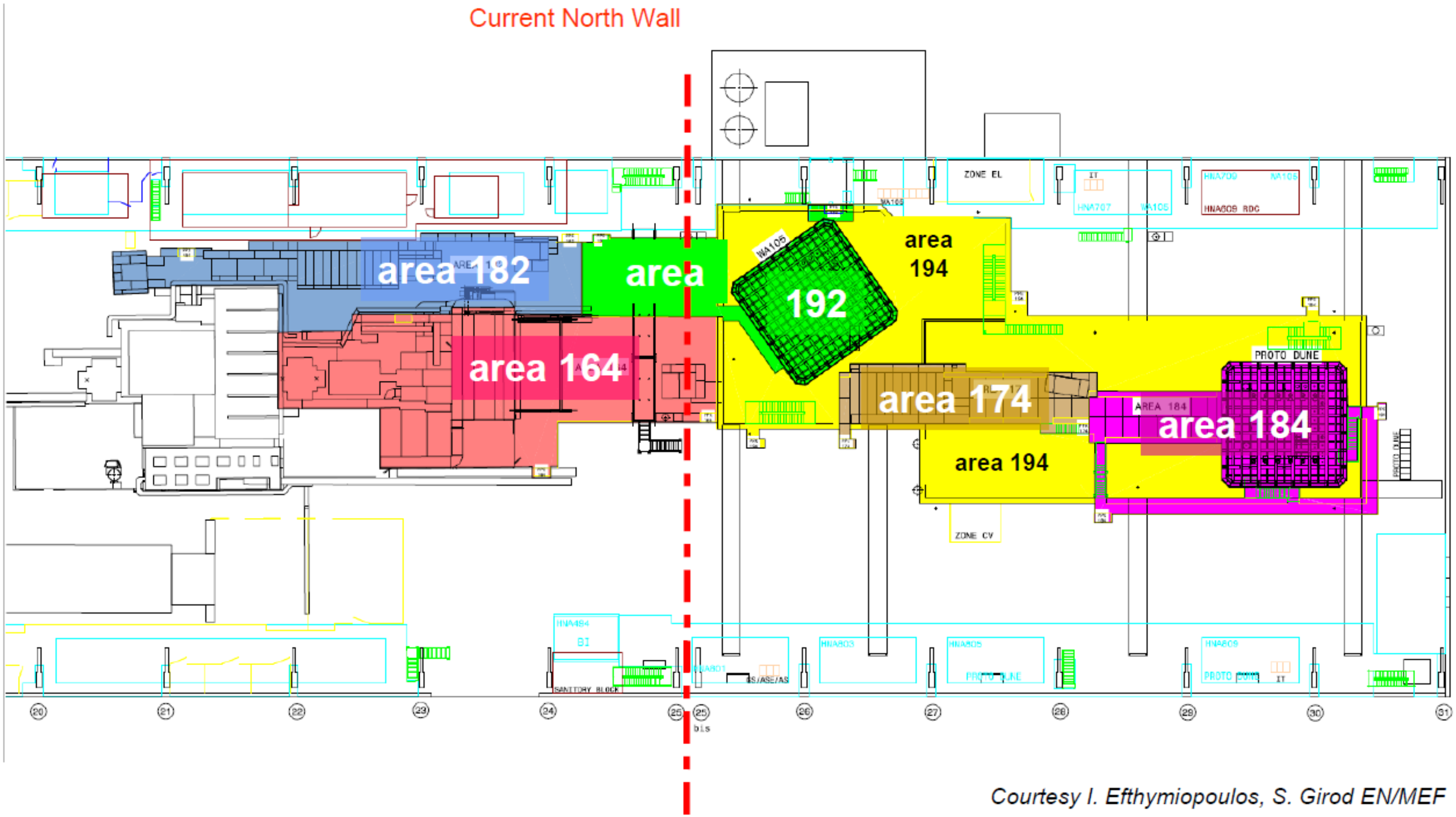


EHN1 extension integration

Courtesy V. Clerc, S. Girod EN/MEF

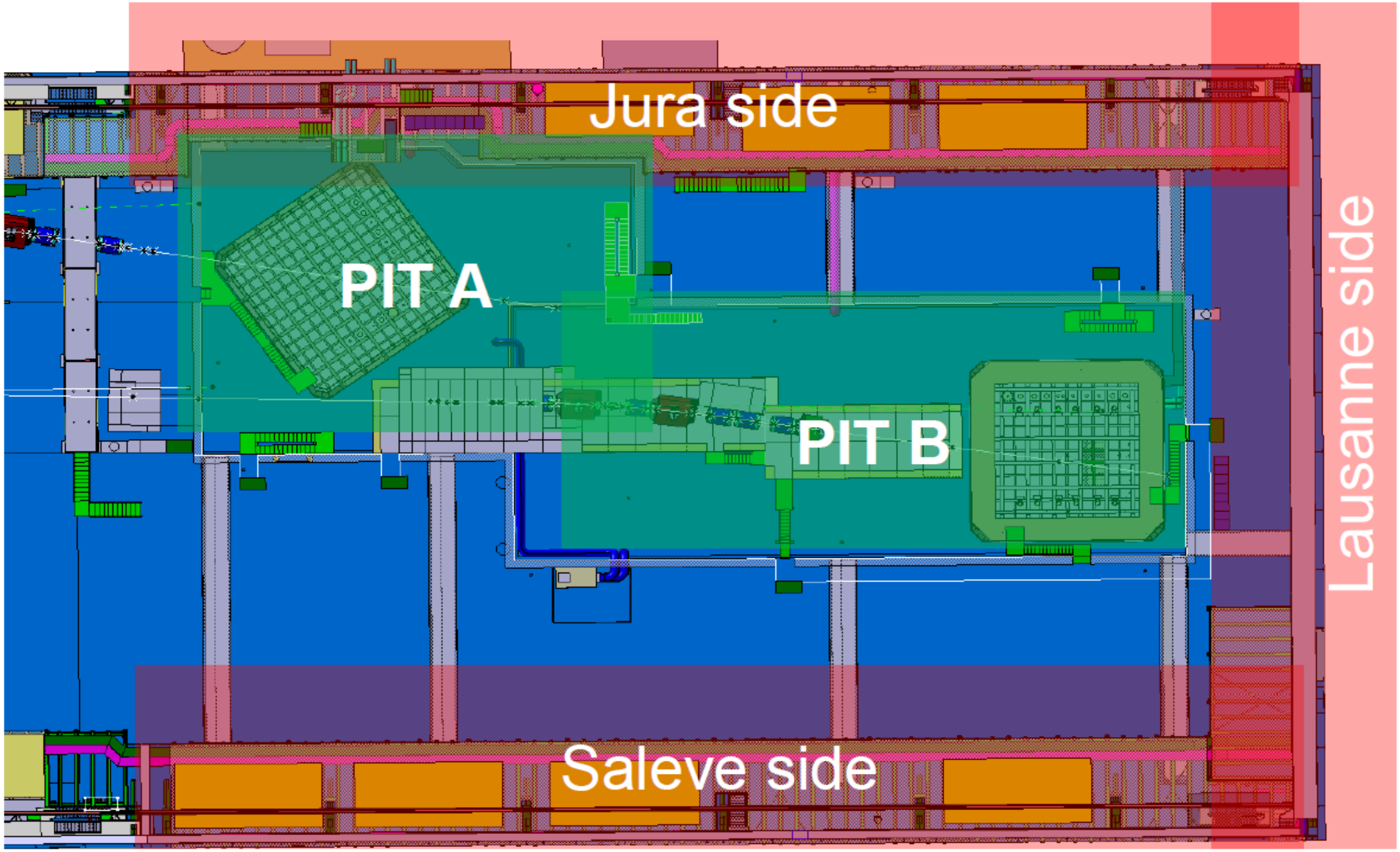


EHN1 extension – access layout

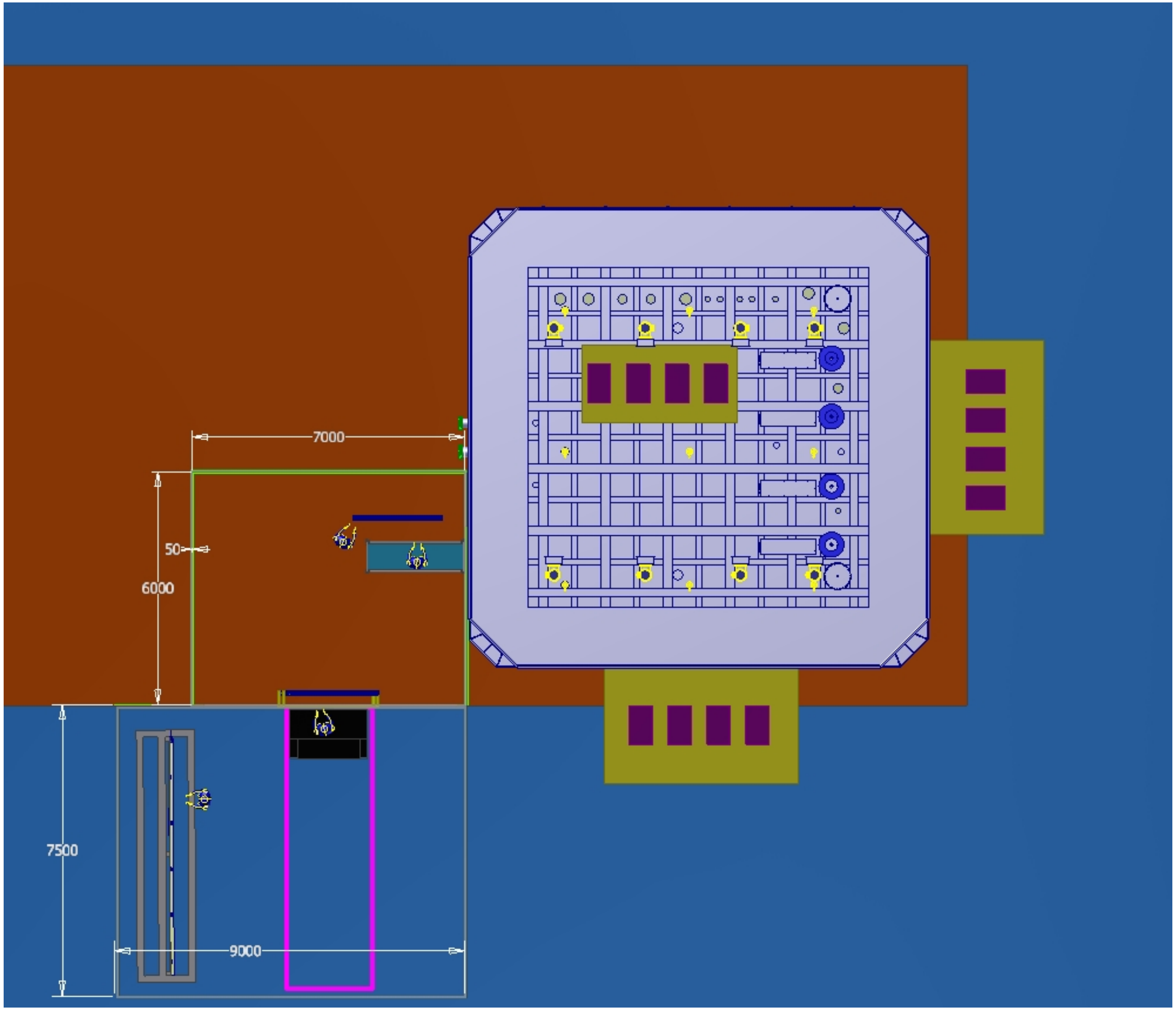


Courtesy I. Efthymiopoulos, S. Girod EN/MEF

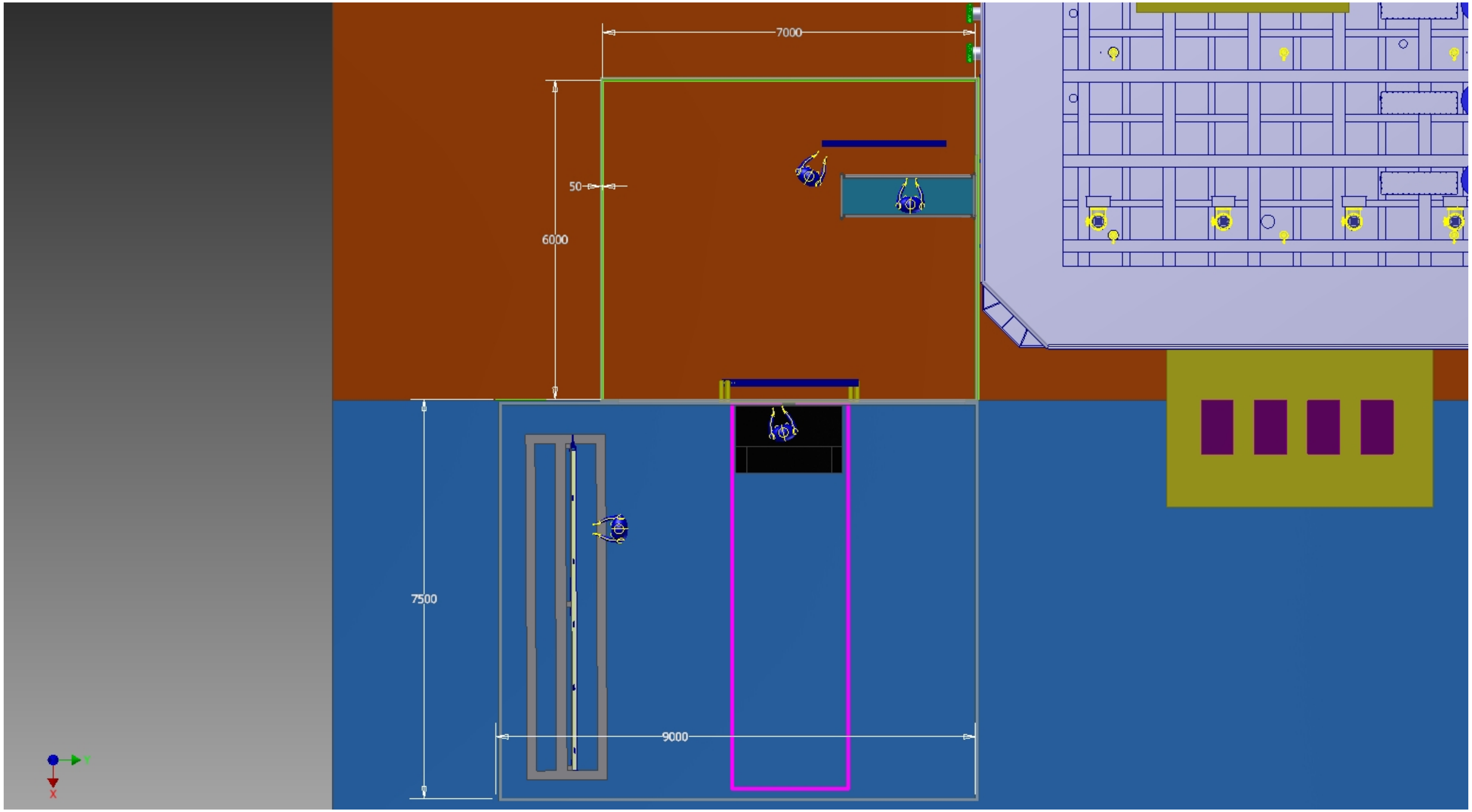
EHN1 extension – areas definition for planning



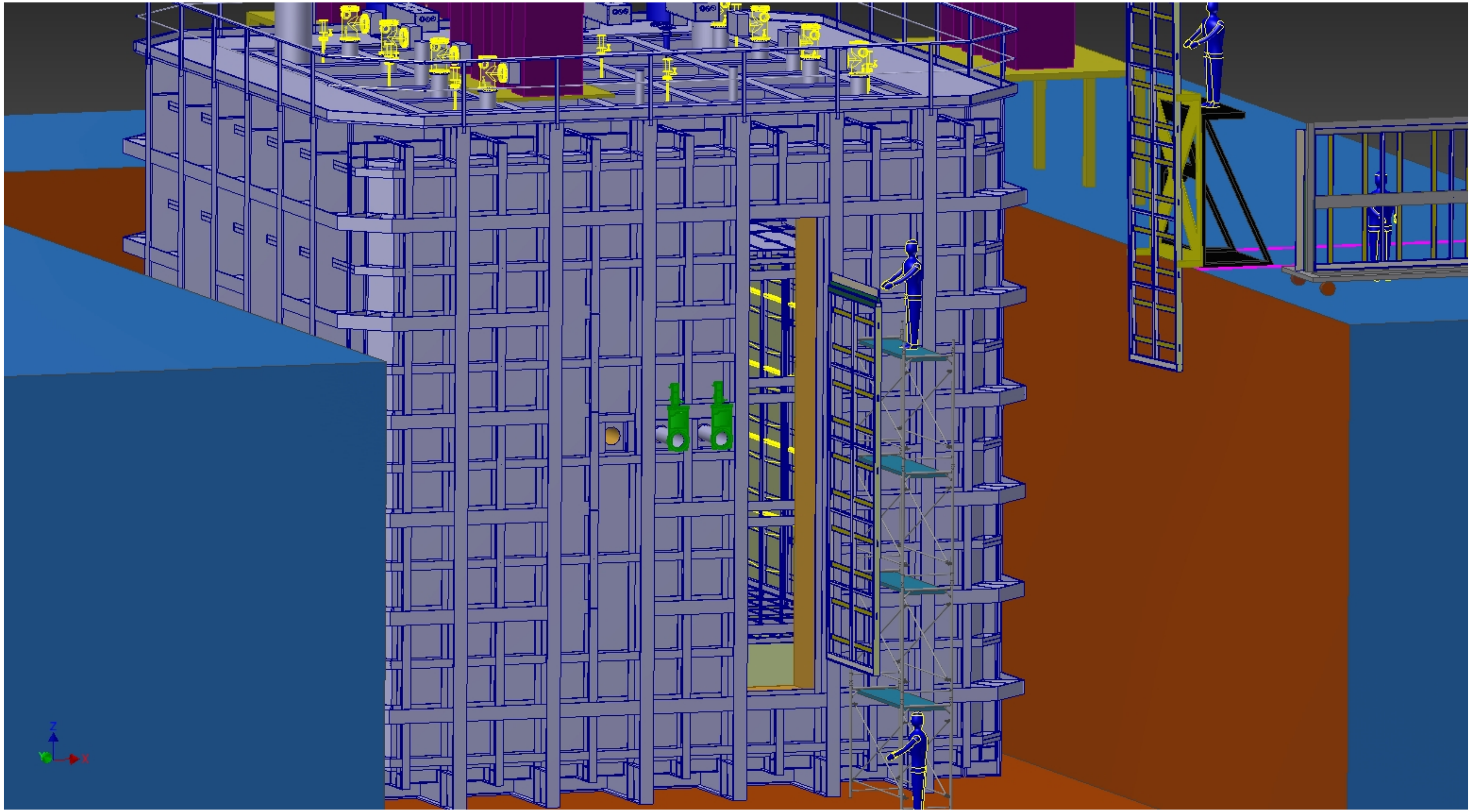
Pit B / ProtoDUNE plan view



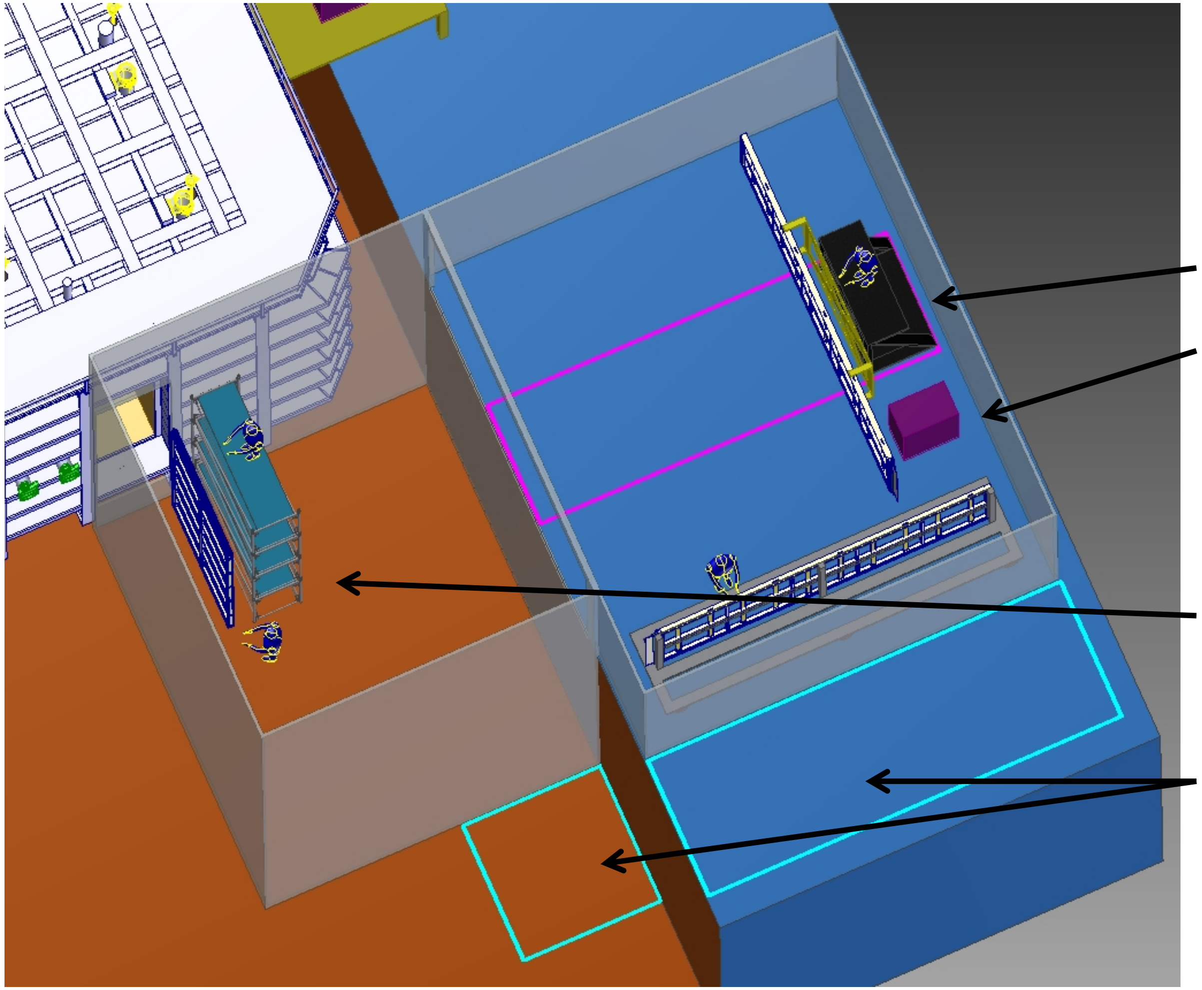
First attempt to estimate the clean spaces needed for installation



View of TCO

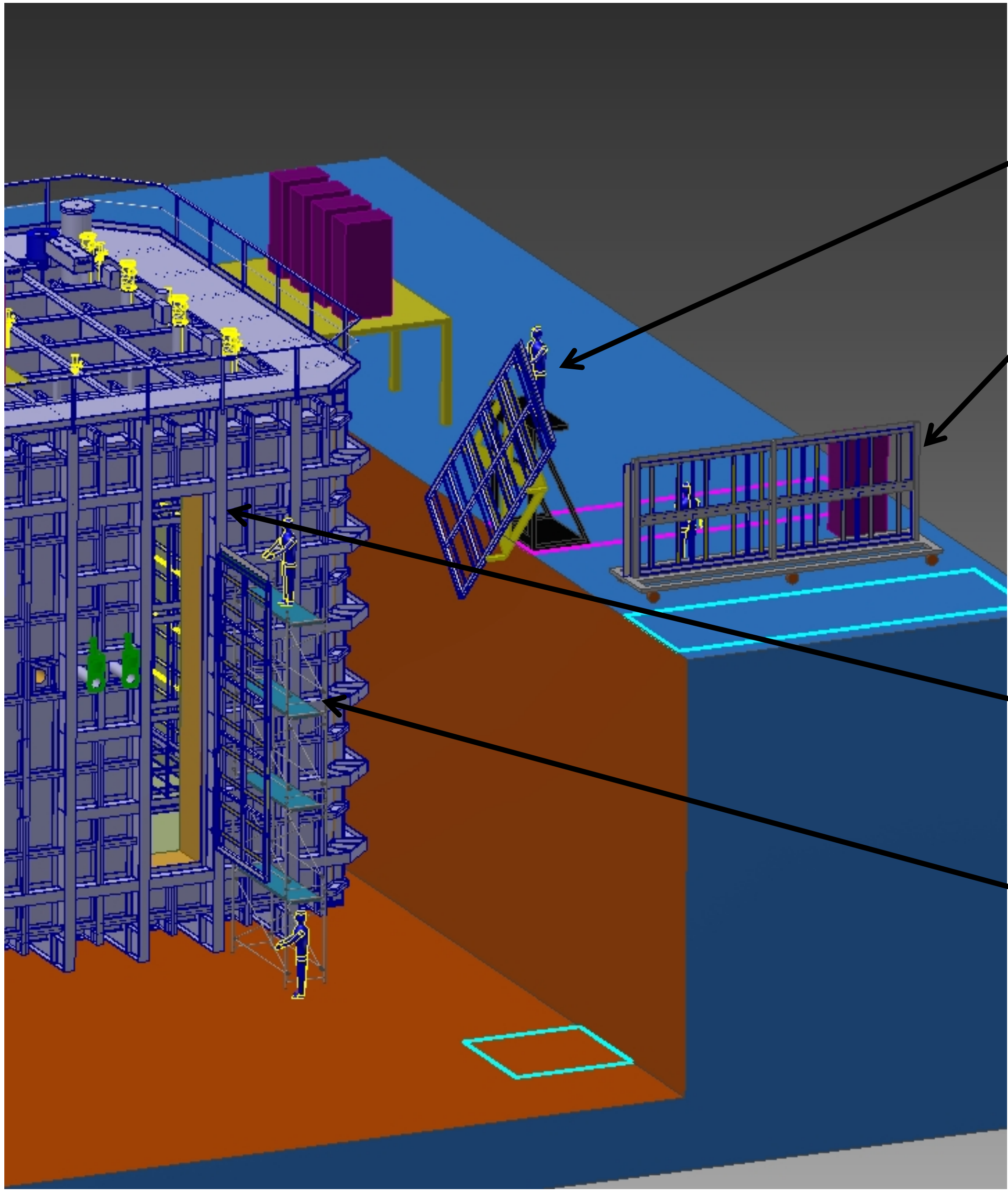


Clean spaces



Clean spaces will be required on each level on the TCO end of the cryostat.
The upper level will be used for staging the parts before installation and any final testing or pre assembly needed before parts are moved inside the cryostat.
The lower level will be used to transfer the parts to the extended installation rail (not shown) and move them inside the cryostat.
Entrance vestibules will be needed on each level to bring parts and personnel into the spaces.

Tooling for development



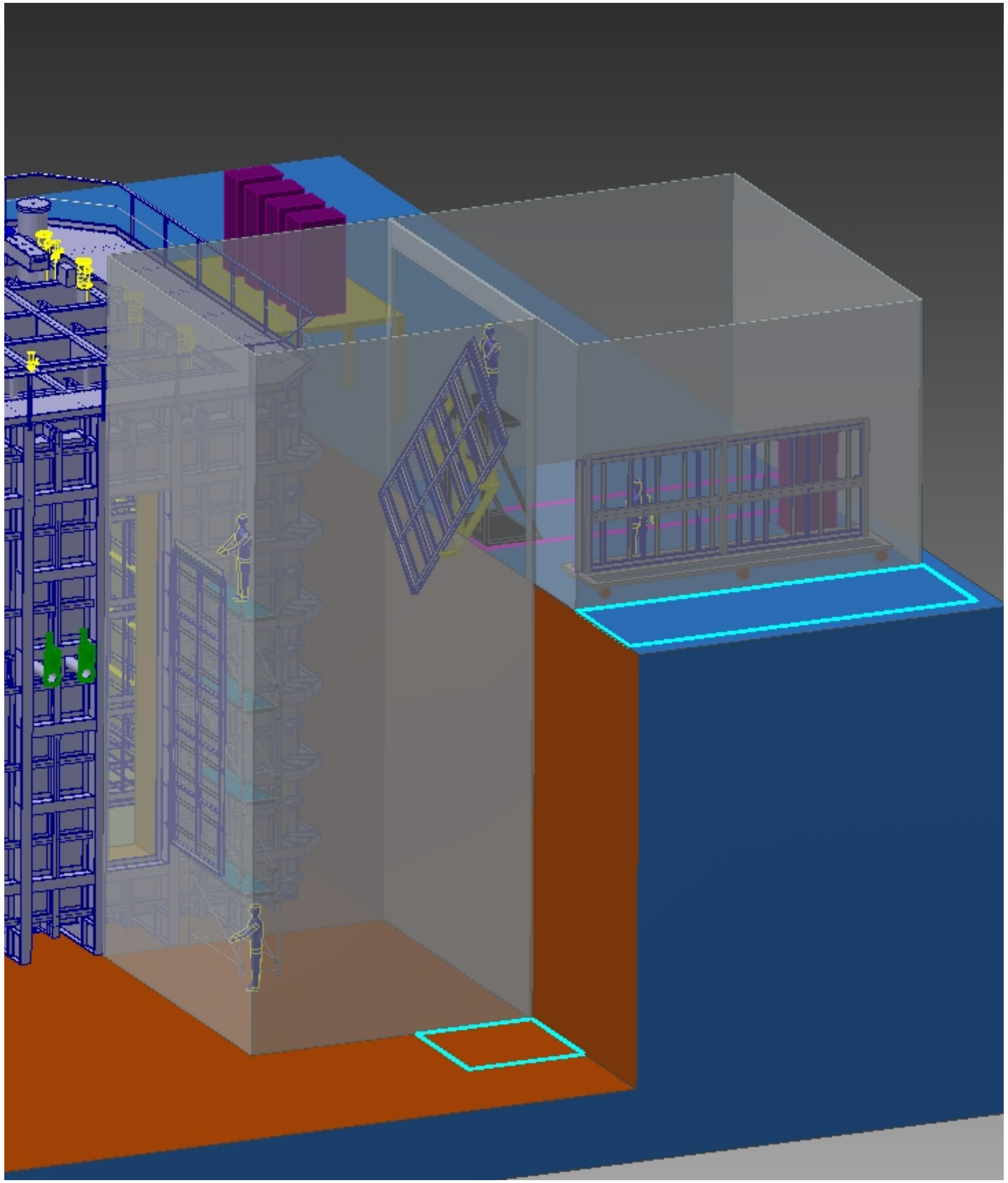
Rotation fixture for APAs and potentially CPAs with access platform.

Inspection / transport cart.

Installation rail and transport trolleys (currently be developed at PSL).

Access scaffolding.

More development



The actual clean space enclosure needs to be designed and supported. Most probably a tent like structure similar to what was used in MicroBoone.

How the ceiling of the clean space interfaces with the building crane that will be needed to translate and move the items inside the clean space.
Or we develop a stand alone crane system to use inside the clean spaces.

What other tasks need to be done inside these spaces?
- A specific list of testing, assembly tasks, etc.

Summary

- The mechanical interfaces between the TPC and cryostat have been established.
- We are trying to integrate our installation needs with the CERN EHN1 integration group. A preliminary list is needed in December.
- Initial concepts are being modeled for installation using a TCO as opposed to a roof opening.
- Layouts for racks and electronics are being added to the models.
- A concept for how the TPC is assembled/installed inside the cryostat will be shown at the next working group meeting.