

ProtoDUNE membrane cryostats

M.Nessi 7-12-2016

2015

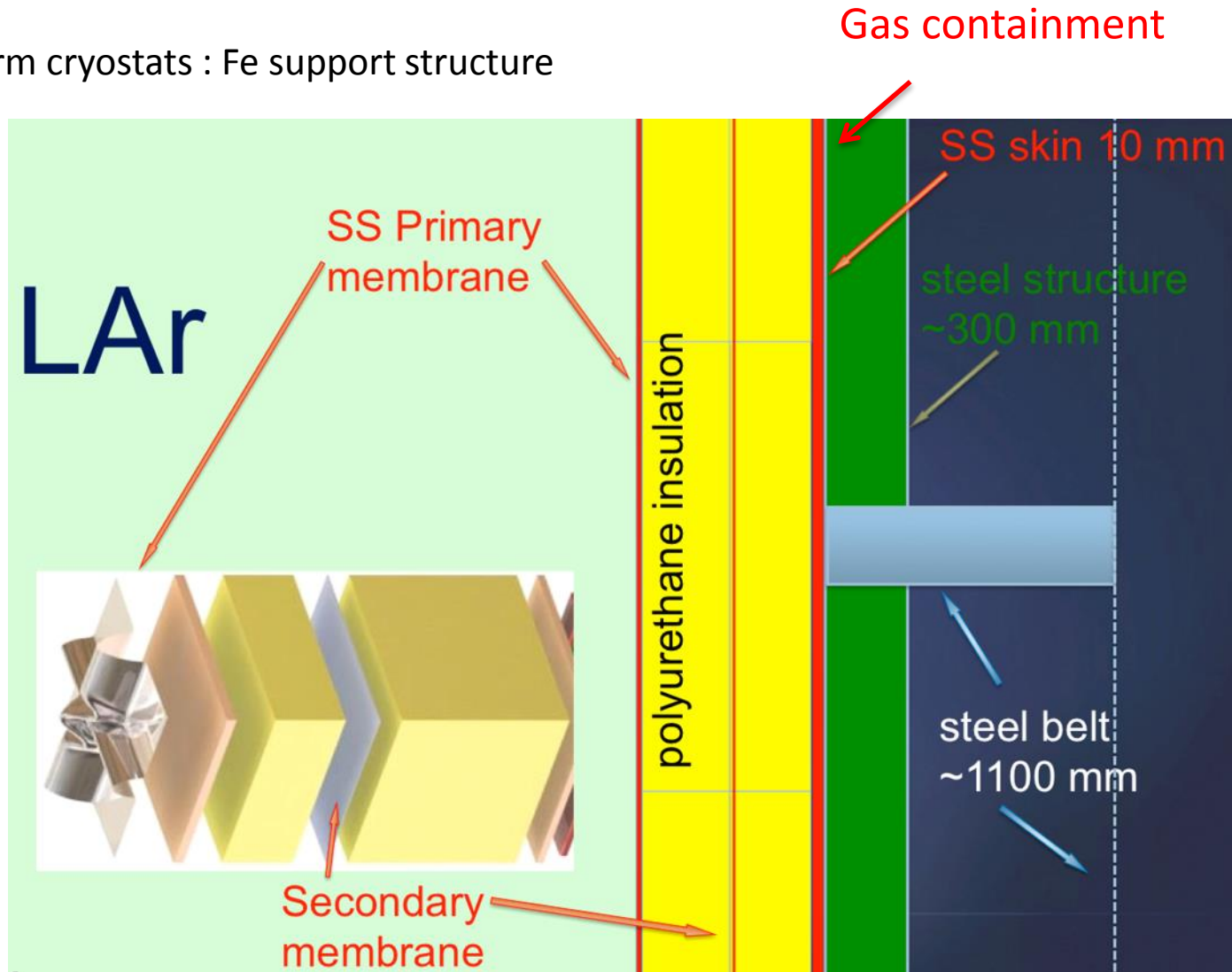
- First discussions with LBNE February 2016
- Some preliminary discussion for ICARUS and WA105 started in 2014
- Main concept : Fe support structure outside, GTT technology inside
- LBNF decision in 2015 to have a unique design for all cryostats based on this concept

The Cold Membrane Vessel (LNG industry technology)

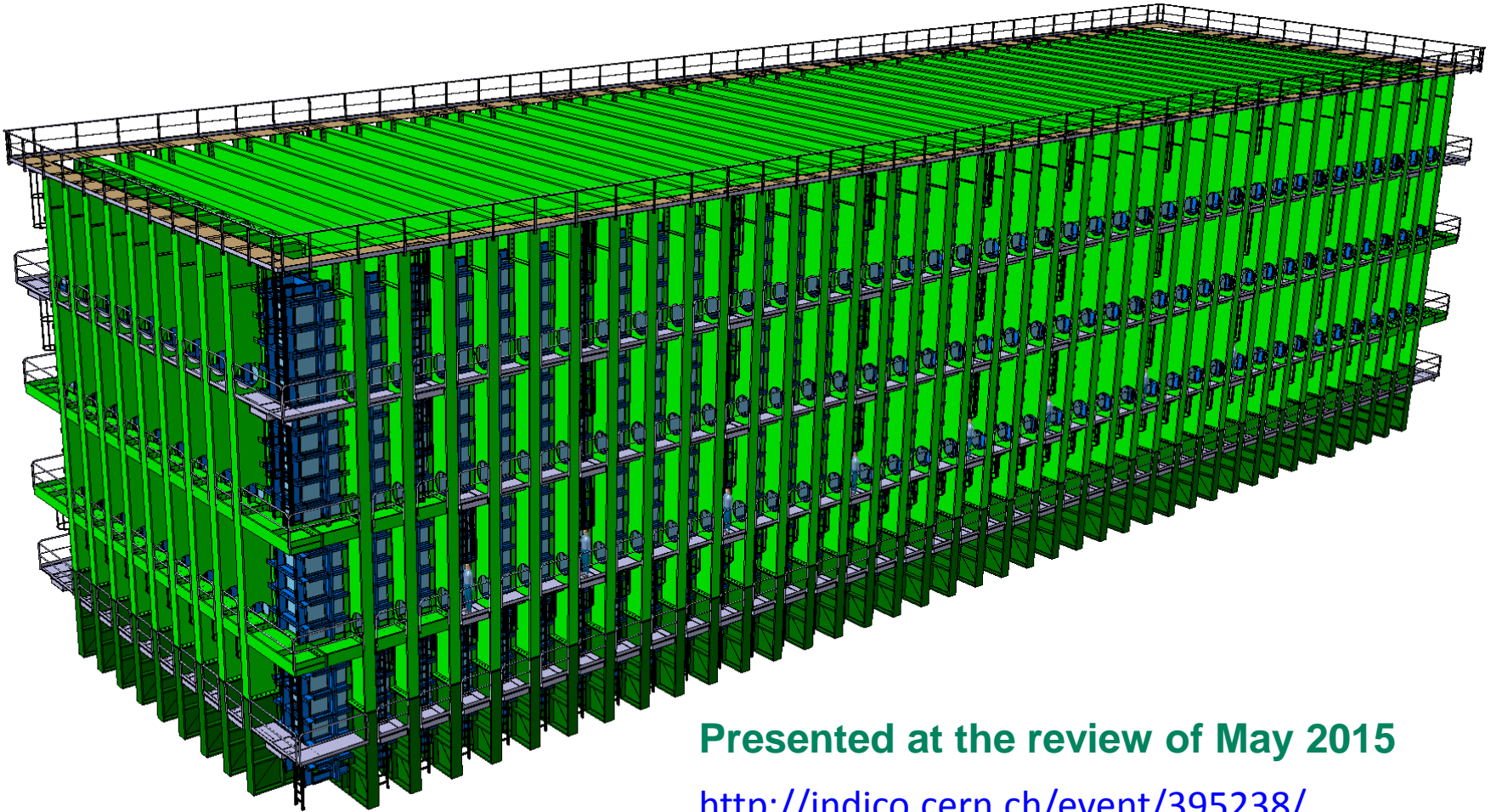


Cryostats Design Requirements

- Warm cryostats : Fe support structure



Original Design Concept (version 1)

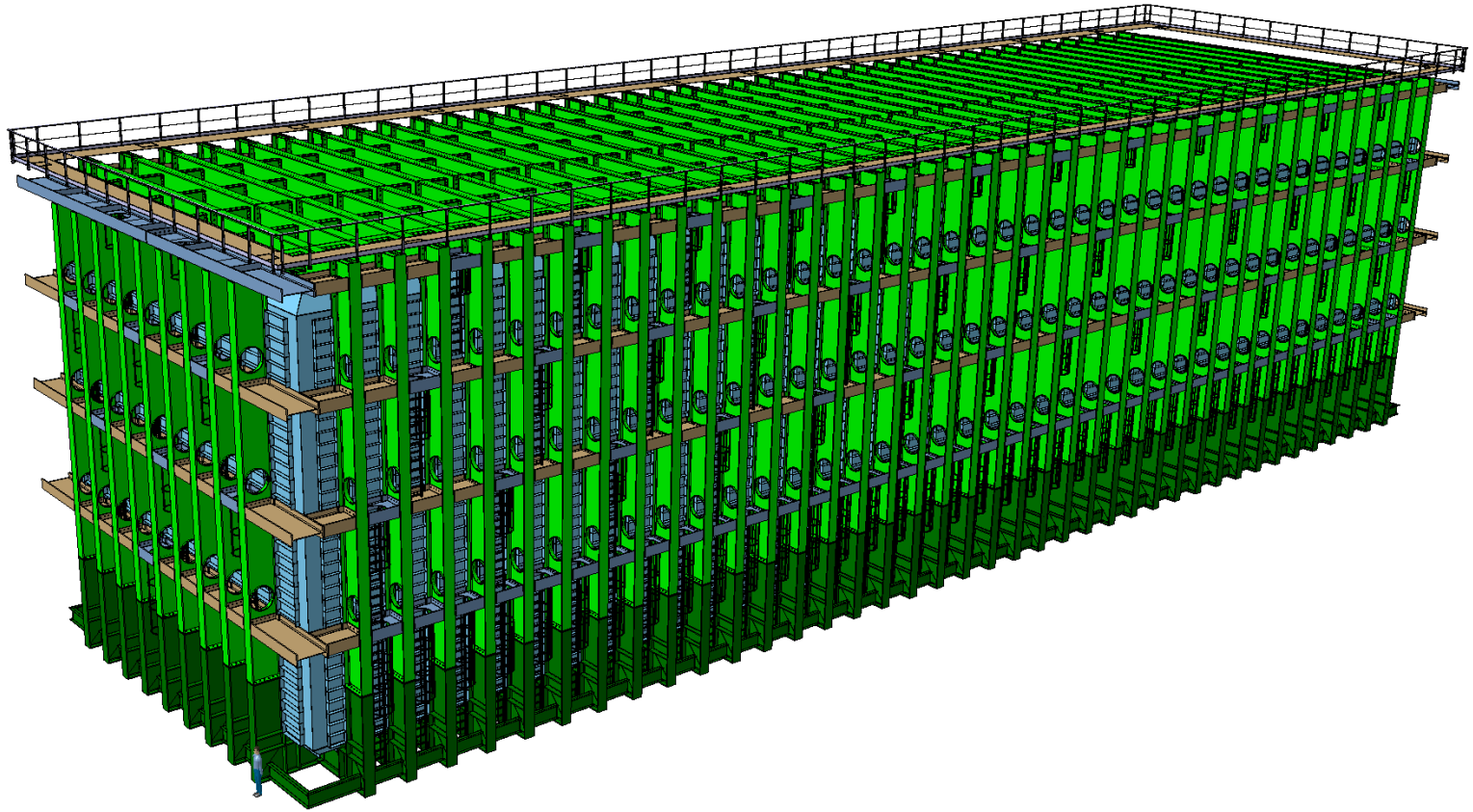


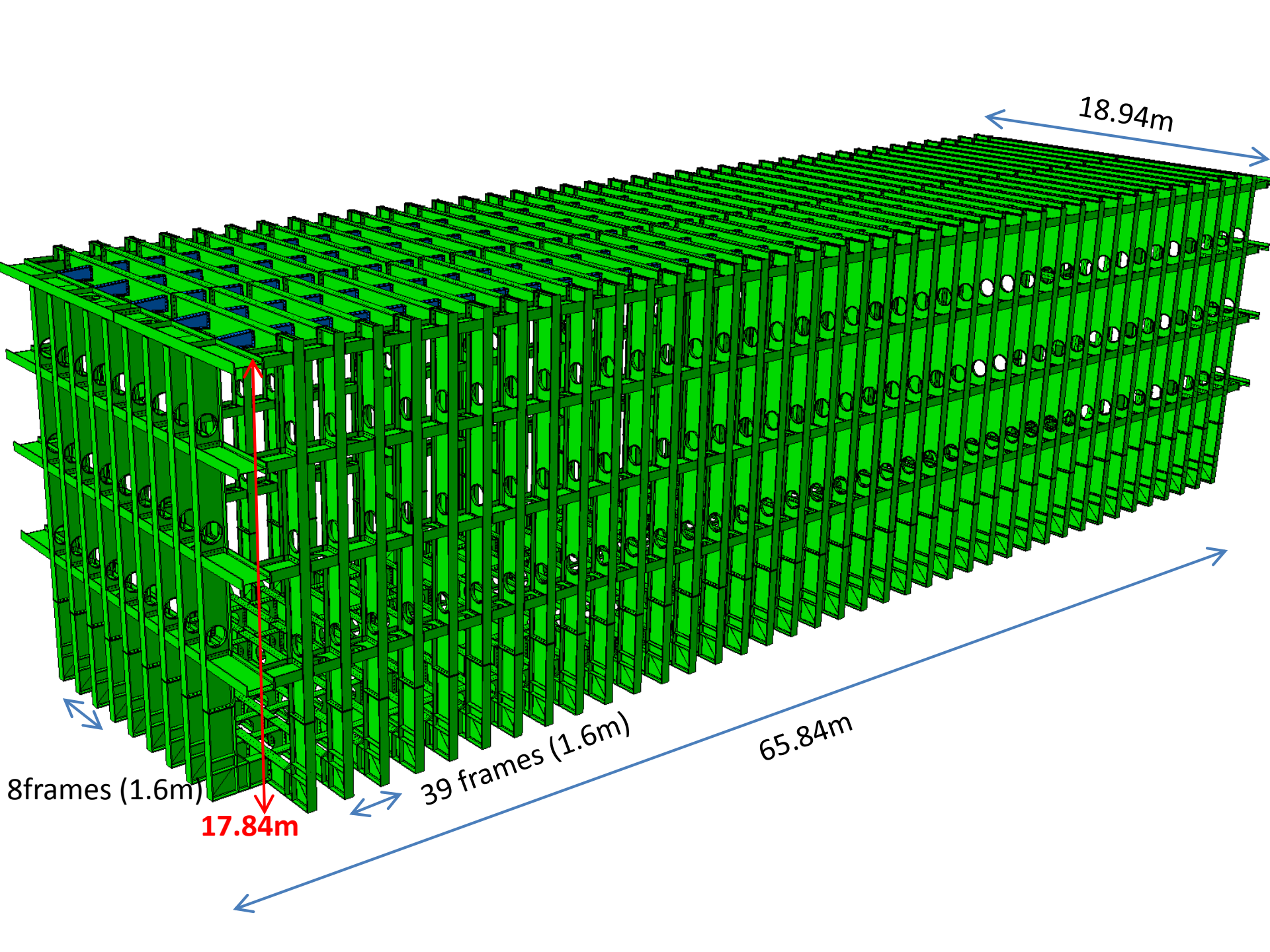
Presented at the review of May 2015

<http://indico.cern.ch/event/395238/>

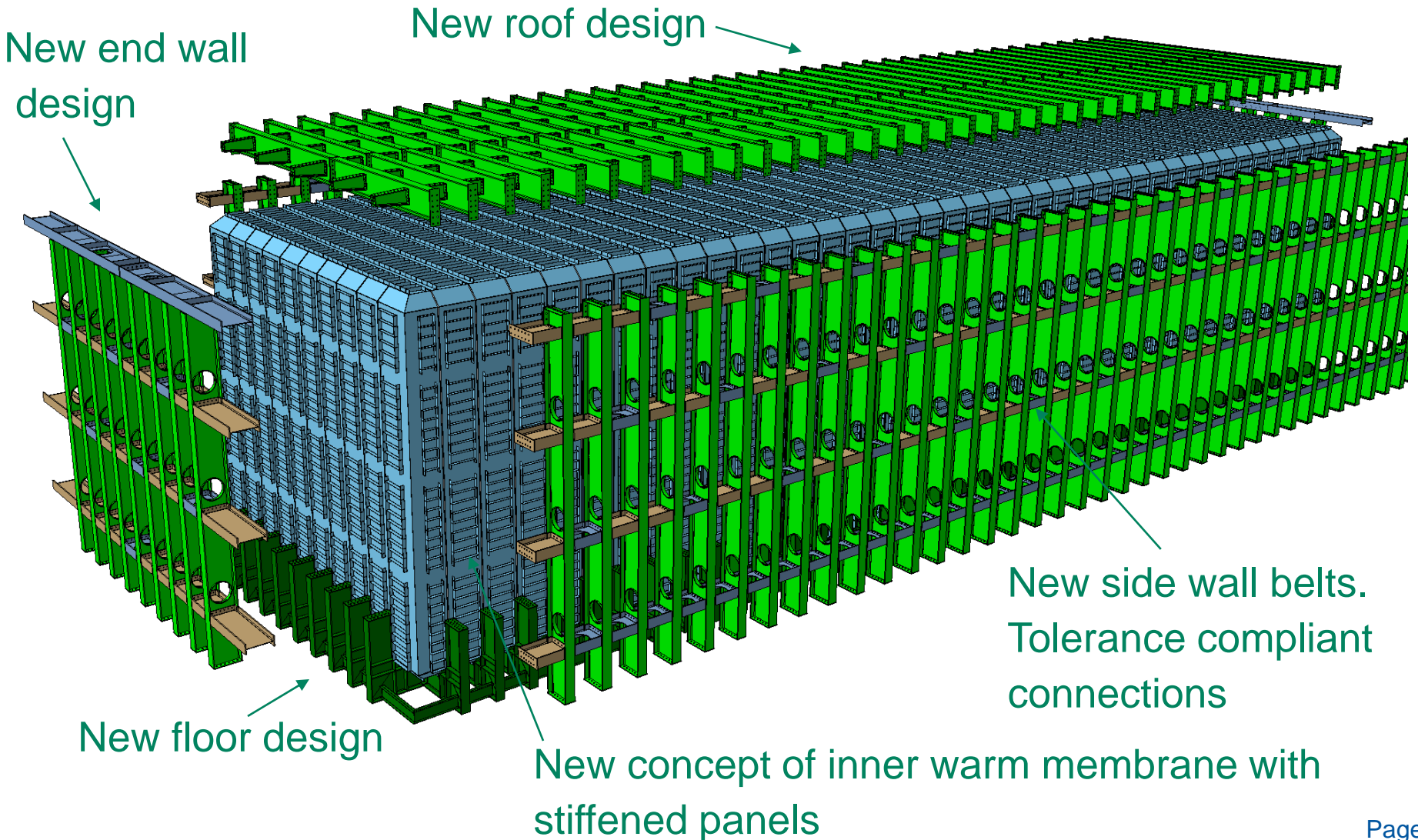
New design (version 2)

Stp files available: <https://edms.cern.ch/document/1738513>

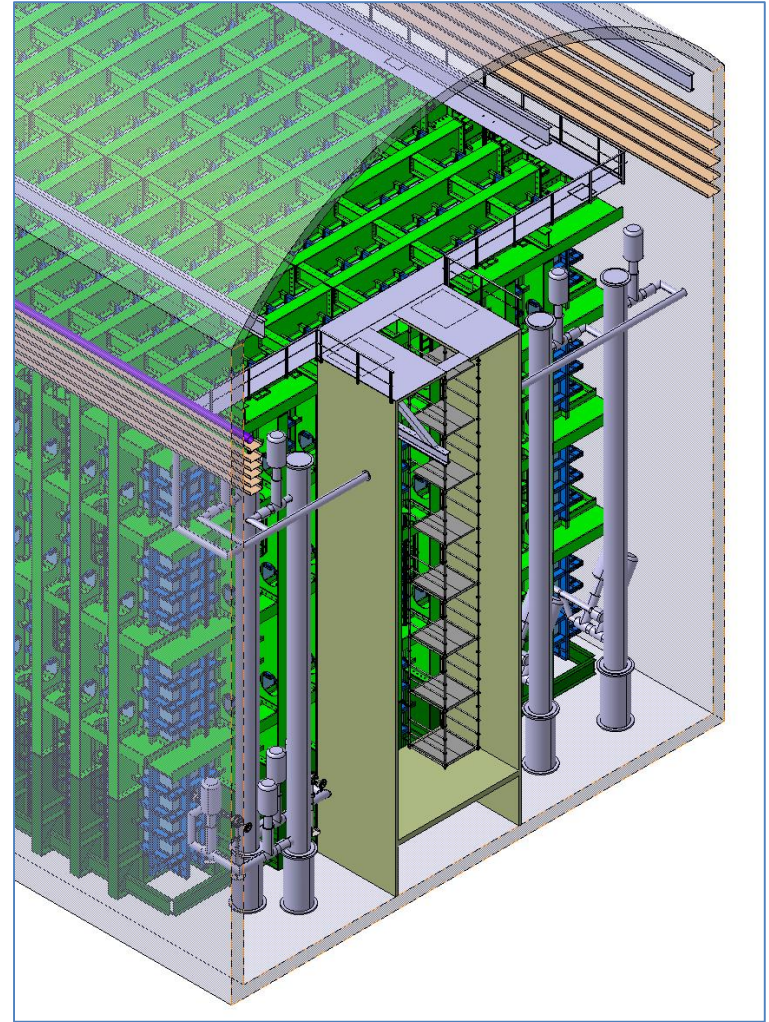
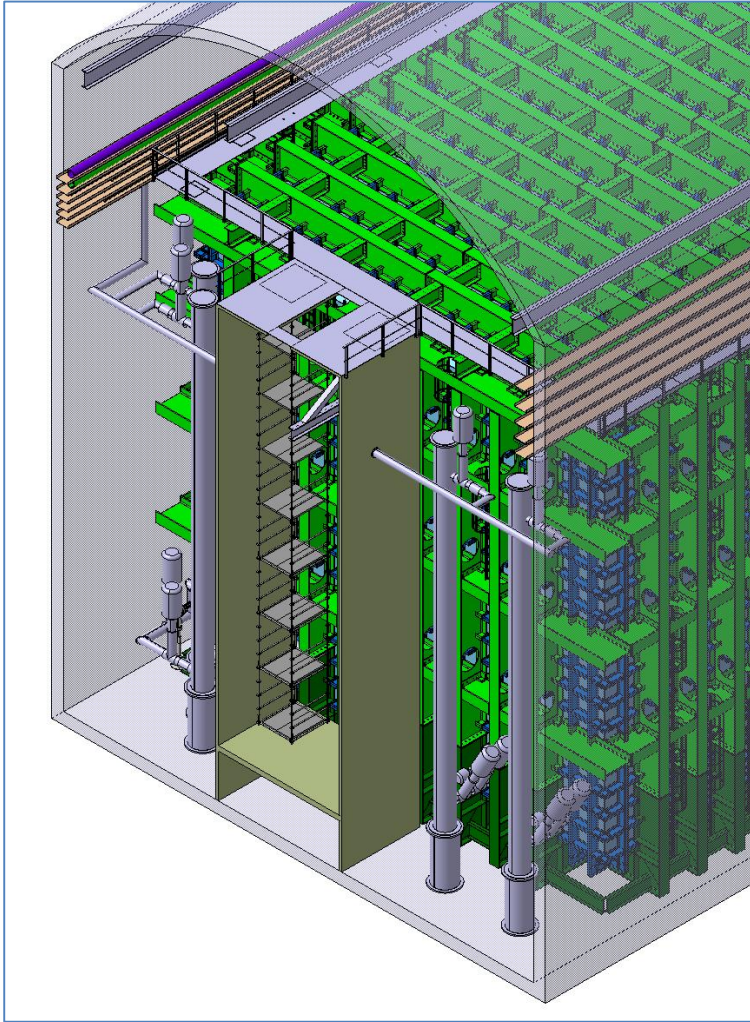




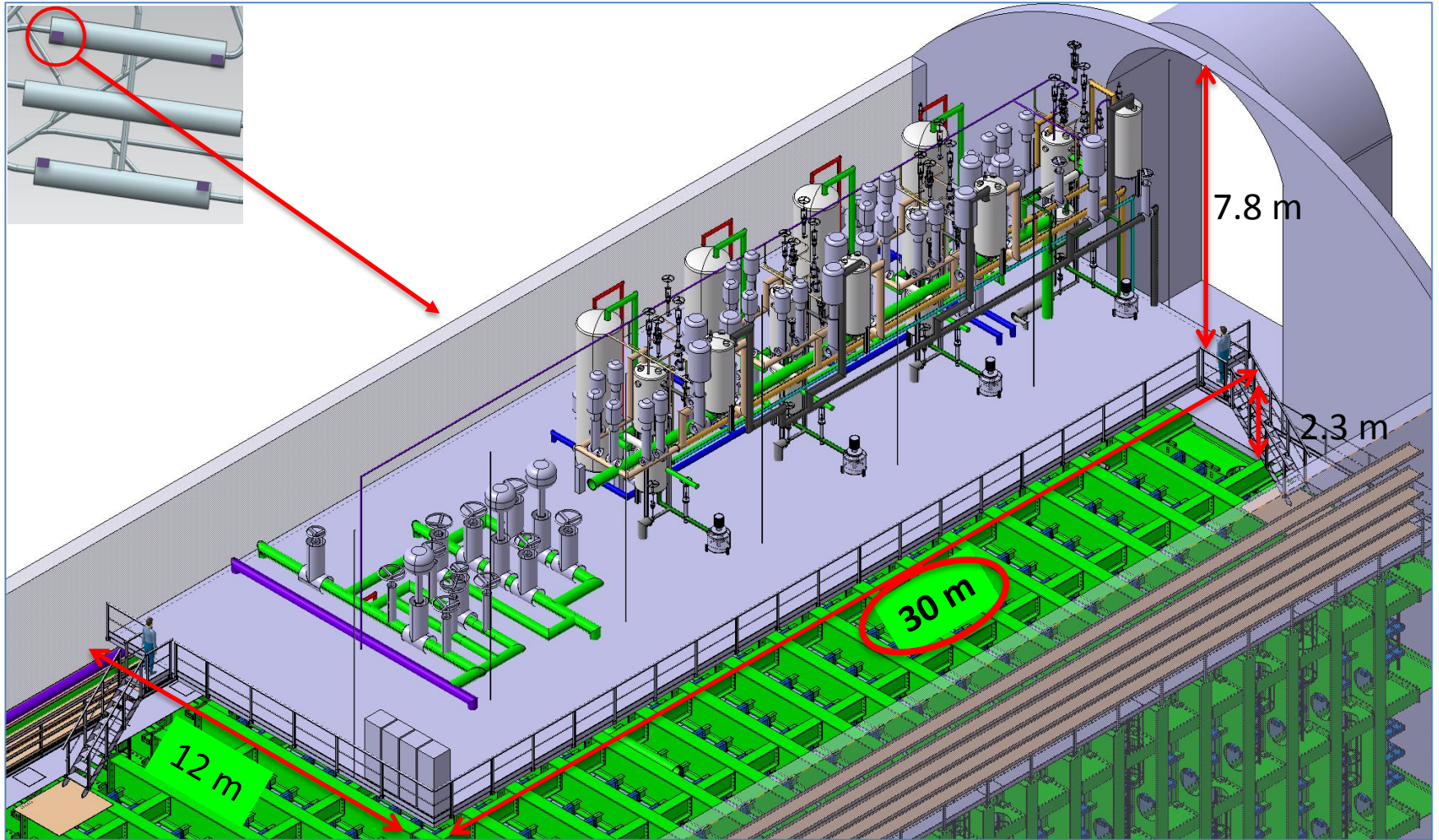
Design revisions of the warm structure



LAr circulation pumps

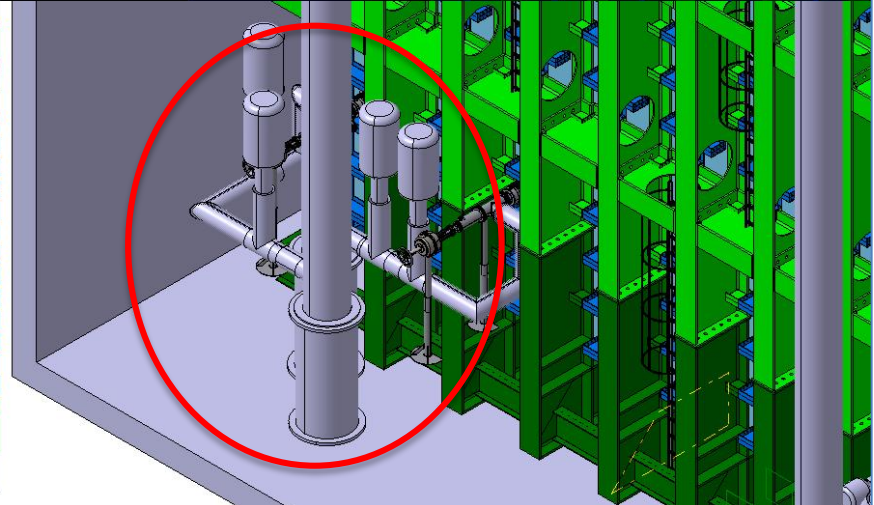
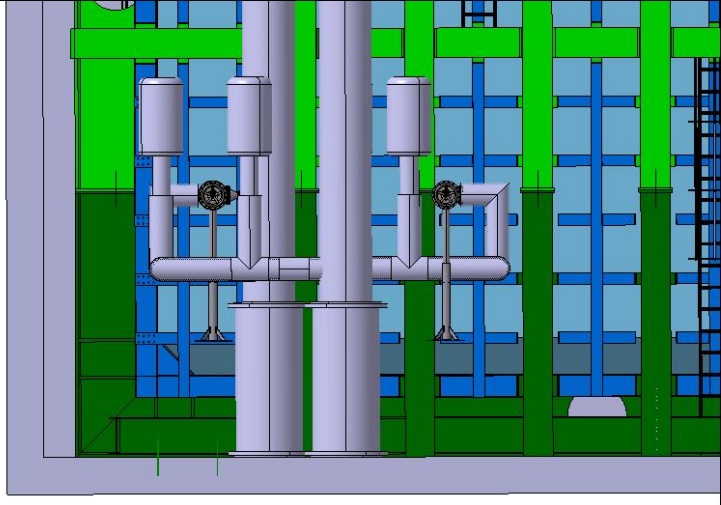
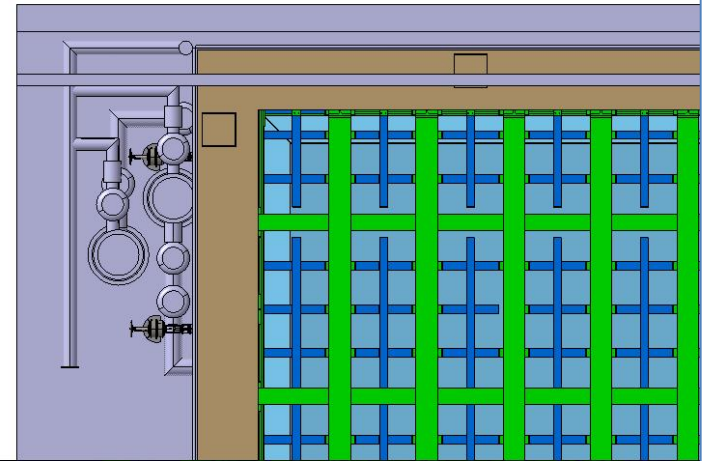
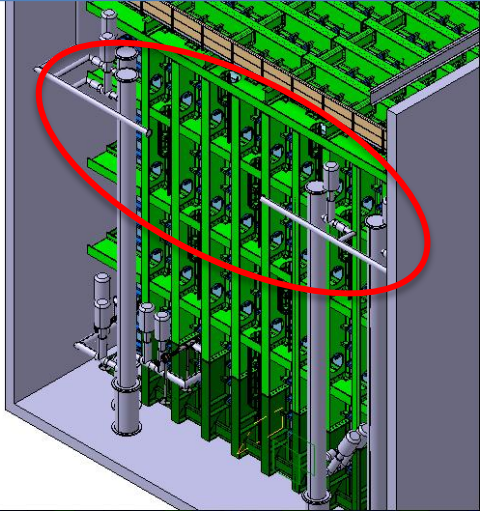


Cryo Mezzanine



LAr circulation pumps – Detailed view

Installation of cryo-piping sequenced to allow detector installation

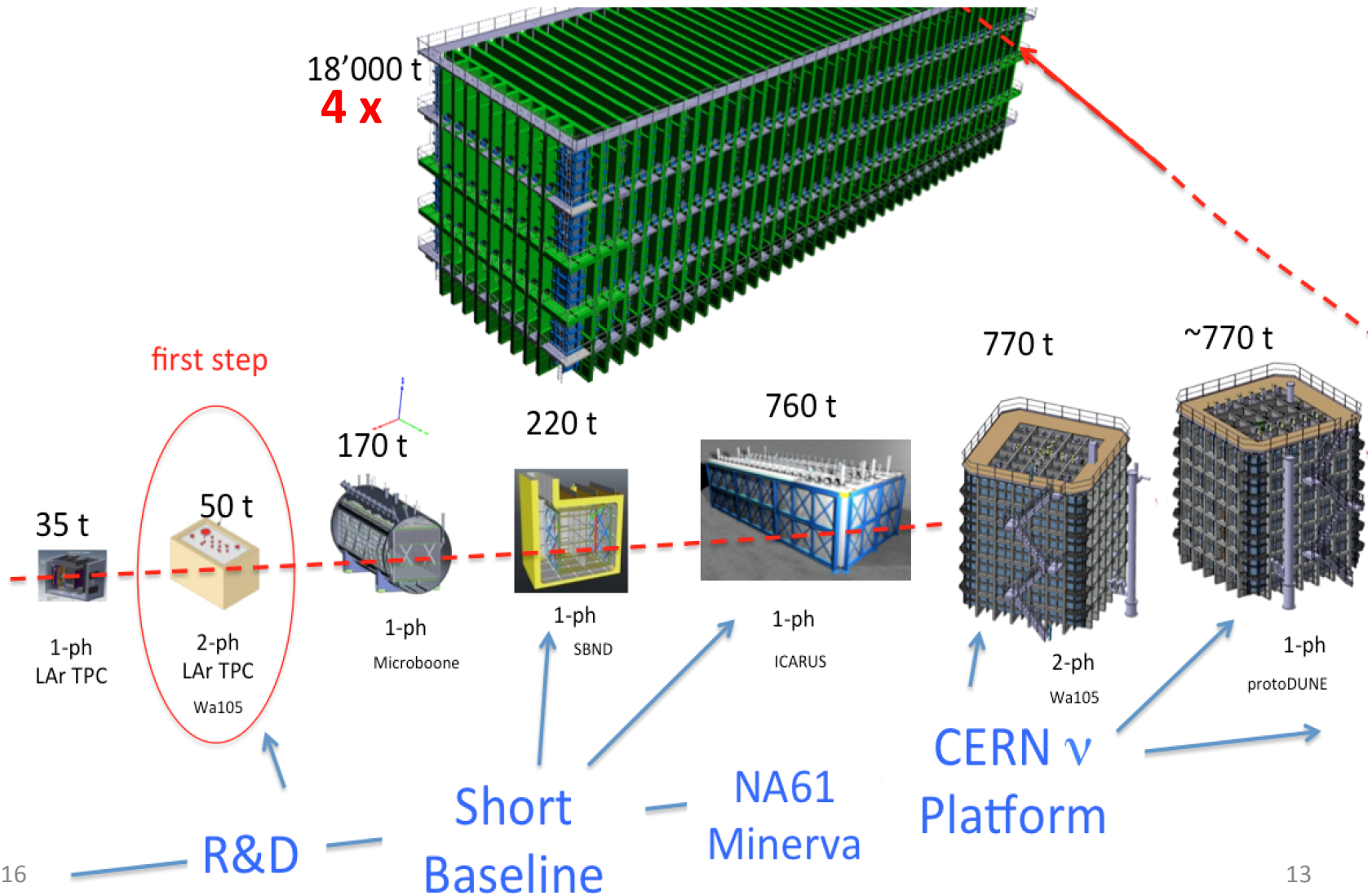


Structural analysis and design summary

<https://indico.cern.ch/event/571287/>

STEP BY STEP (LAr TPCs)

- the large scale is a big and new challenge



First Demonstrator (WA105)



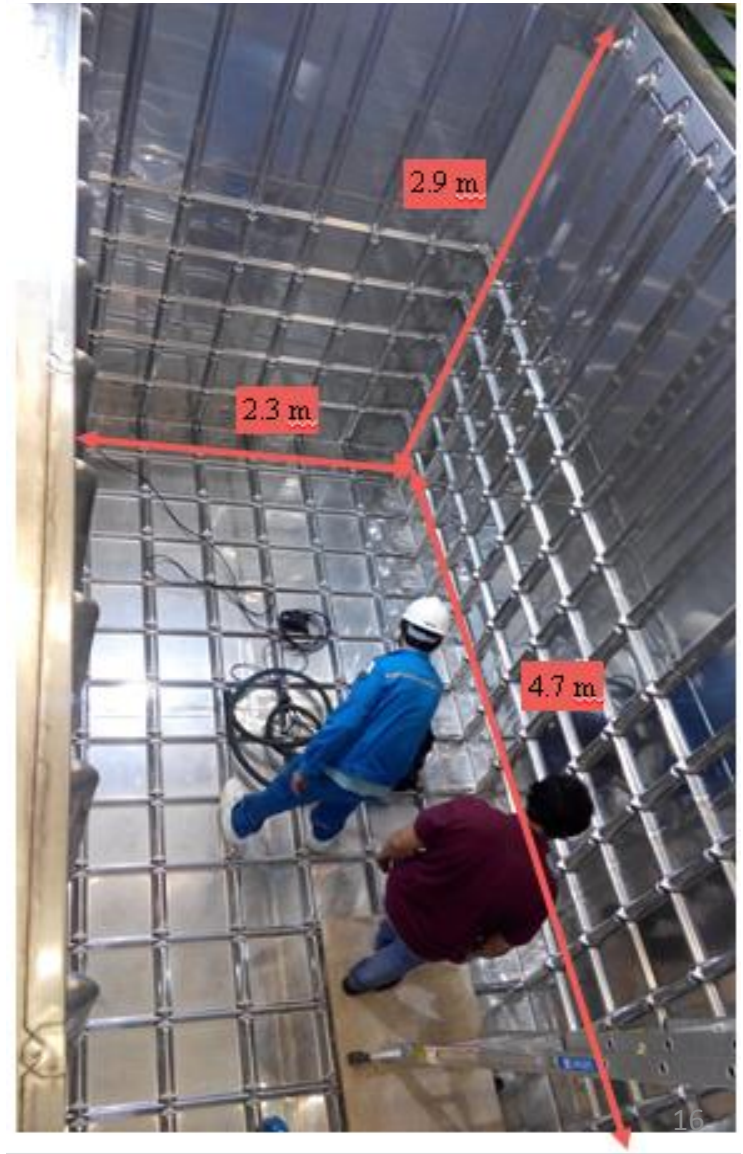
NP02 3X1X1 demonstrator experience



FIRST STEP IN O2 SXFI demonstrator

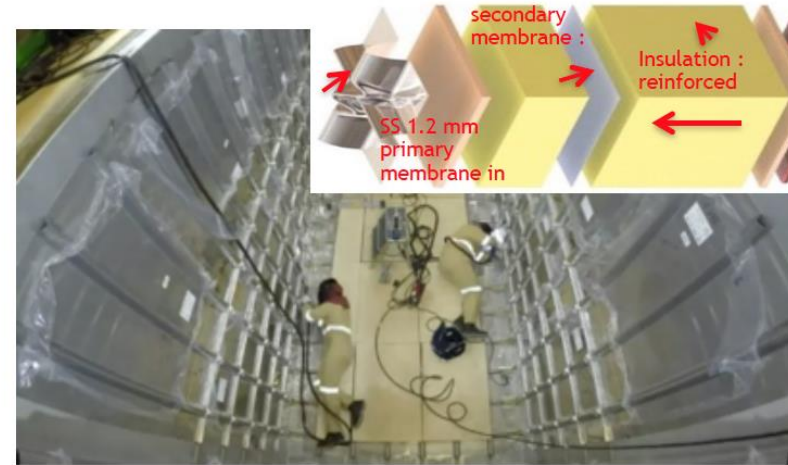


Leak tested at $2 \cdot 10^{-9}$ mbar/l*s level



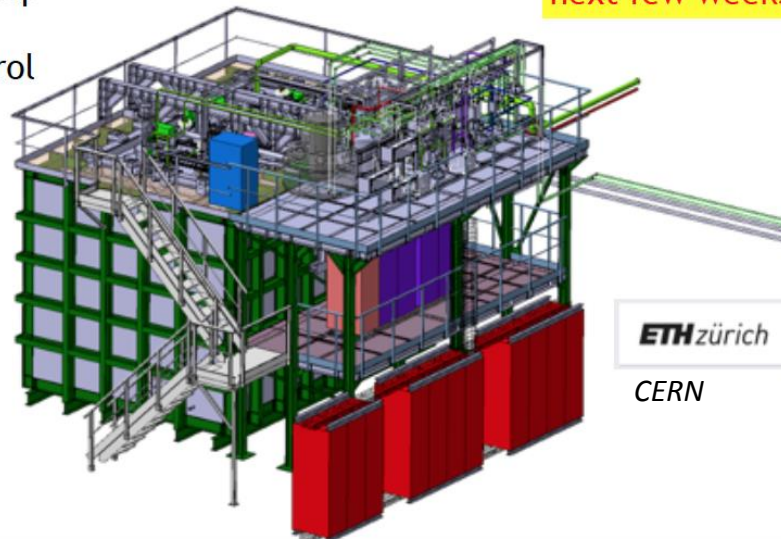
FIRST STEP : IN 02 SIXTIX demonstrator

- ▶ 3x3x1 demonstrator for dual-phase TPC technology
- ▶ first prototype of the cryostat membrane based on LNG technology
- ▶ New technology developments to adapt the detector to surface operation

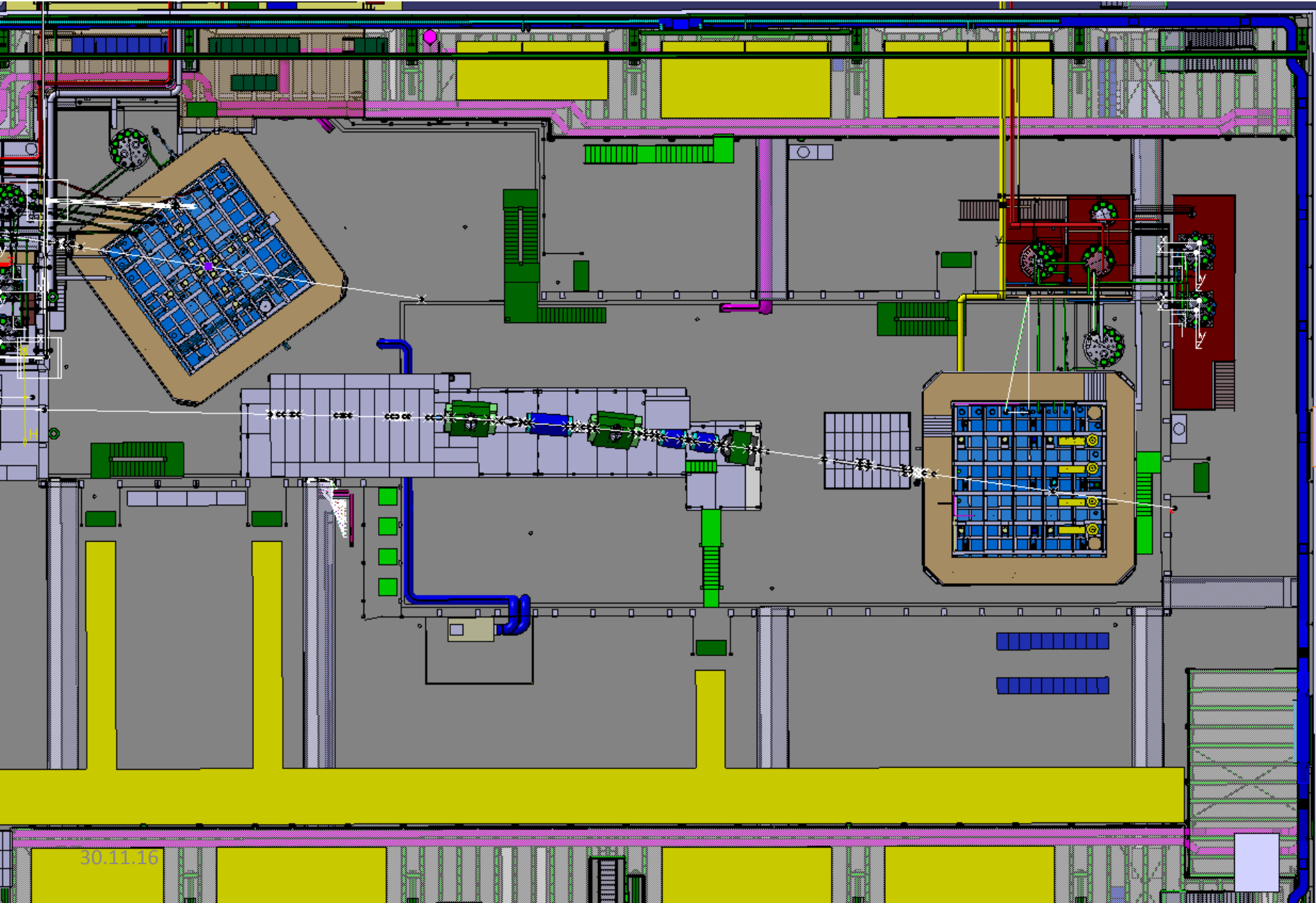


Ready to start cool down in the next few weeks!!

Experimental setup (cryostat, cryogenics, control system, DAQ)

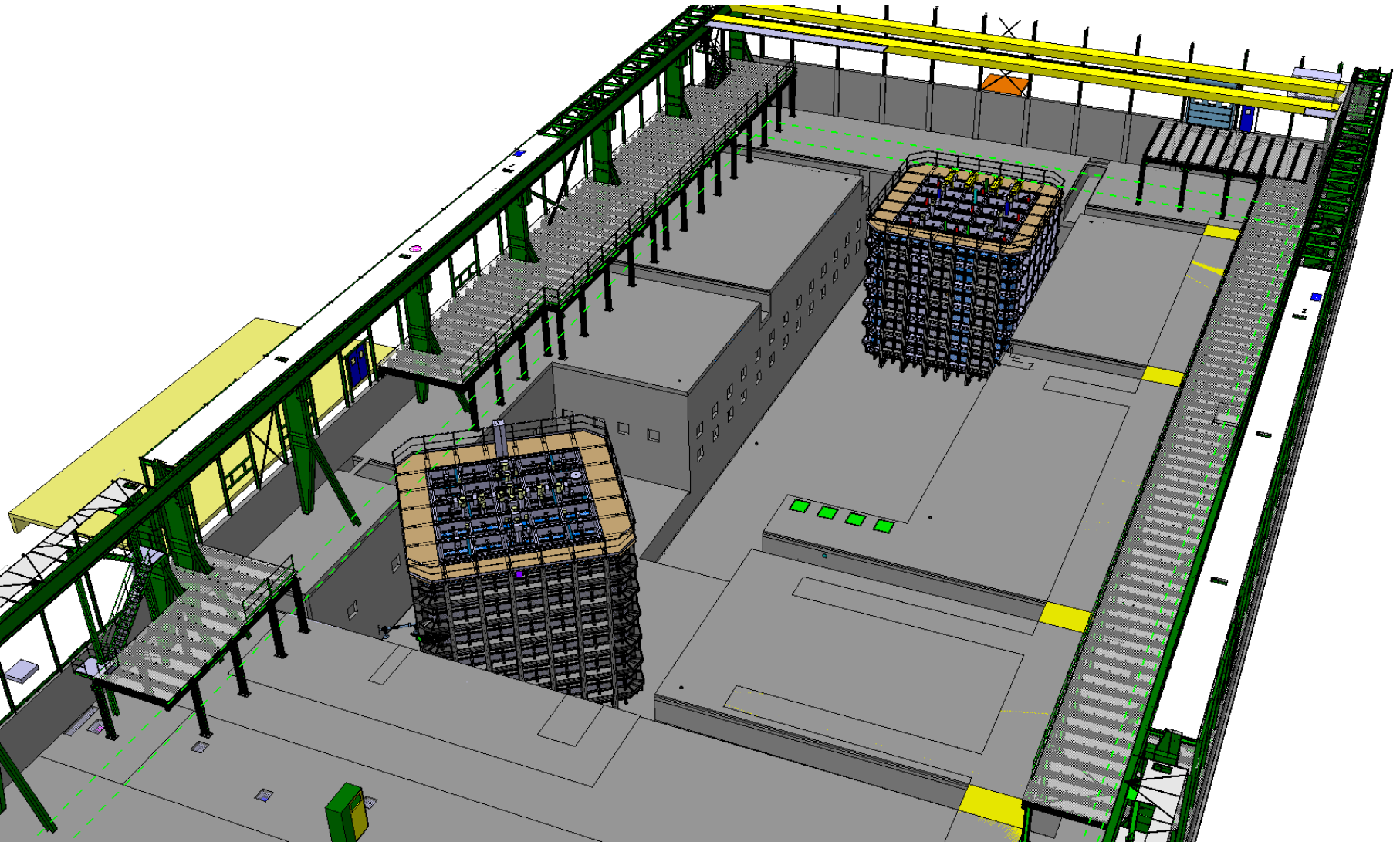


SECOND STEP

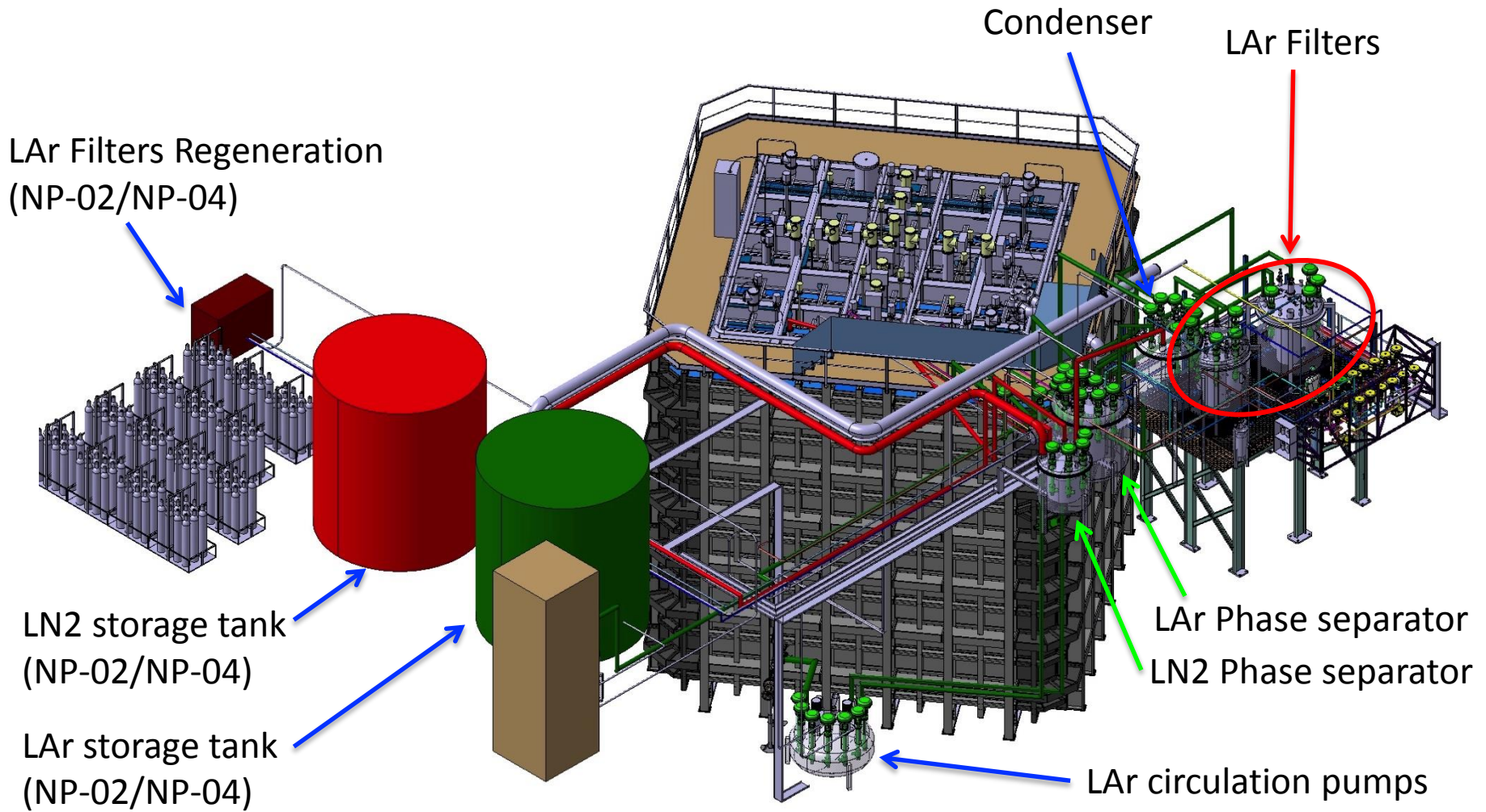


30.11.16

Two 770 tons LAr detectors

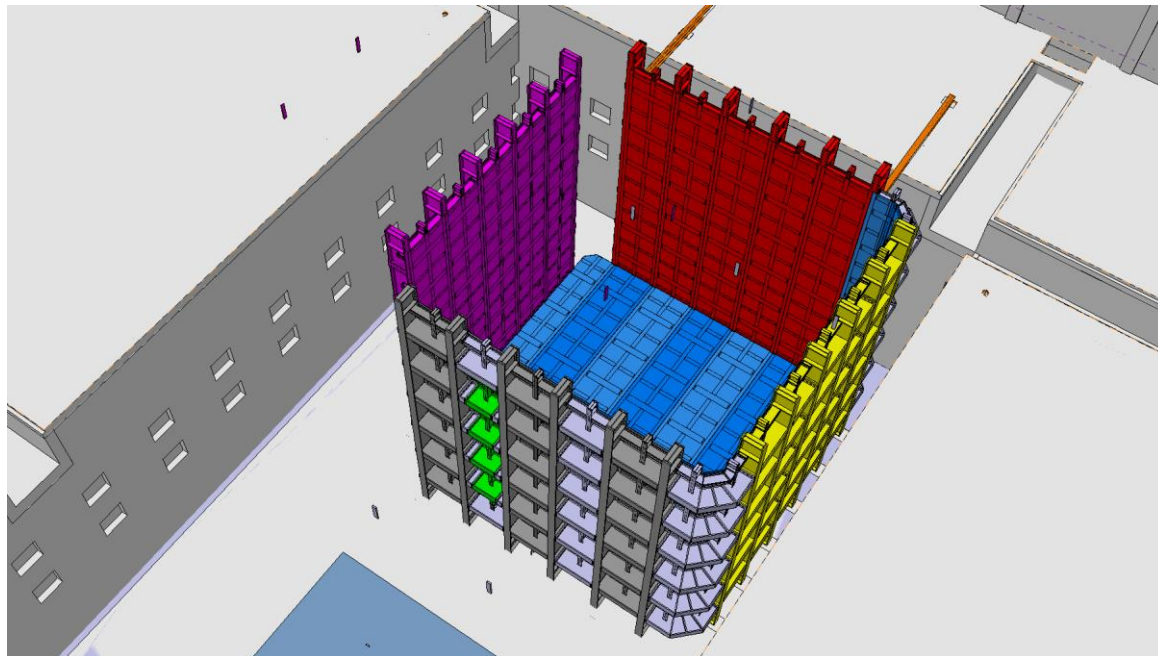
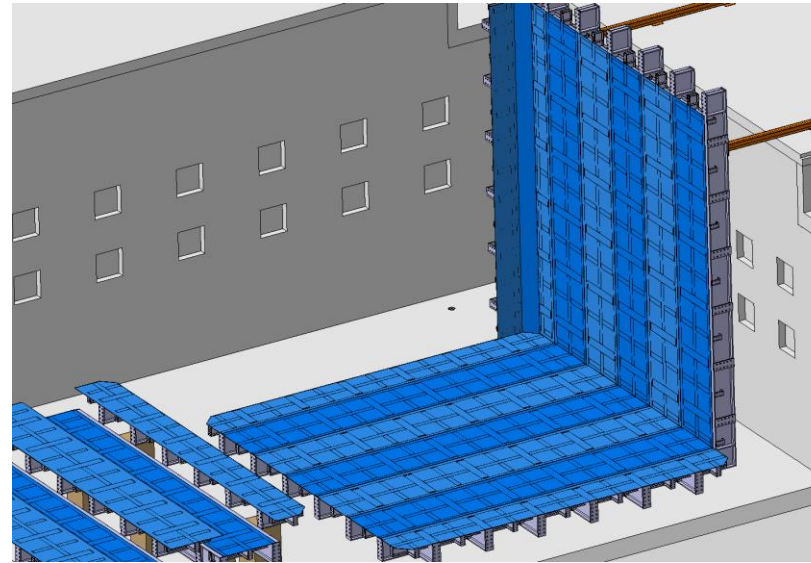
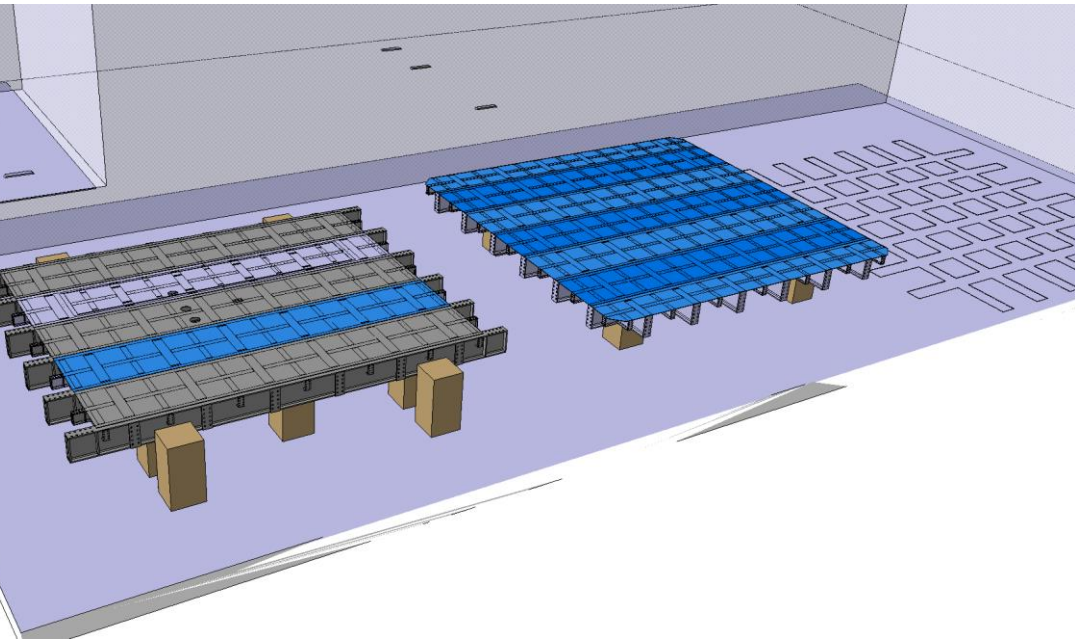


CRYOGENICS



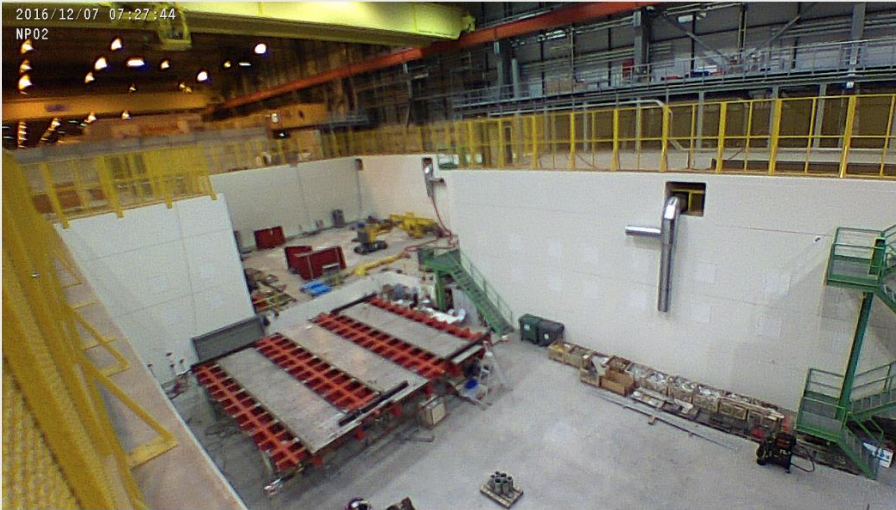
HOW DO WE OPERATE? (warm structure)

- Warm structure design and structural analysis done by CERN
- CERN public tender for steel raw material and delivery contracts
- CERN public tender for the preparing modules ready to be assembled of the warm structure + contract execution
- CERN assembles the structure + QA with its own manpower



<http://cenf-ehn1-np.web.cern.ch>

Camera NP02



*Images updated every 30 minutes.

Camera NP04



*Images updated every 30 minutes.

Welcome to EHN1-Neutrino Platform Facility

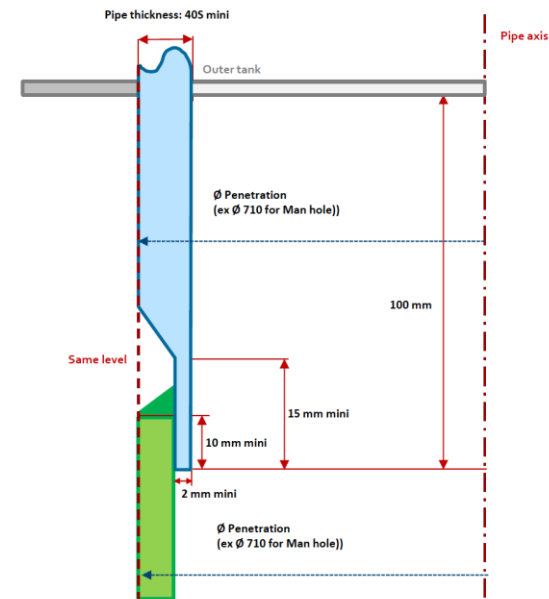
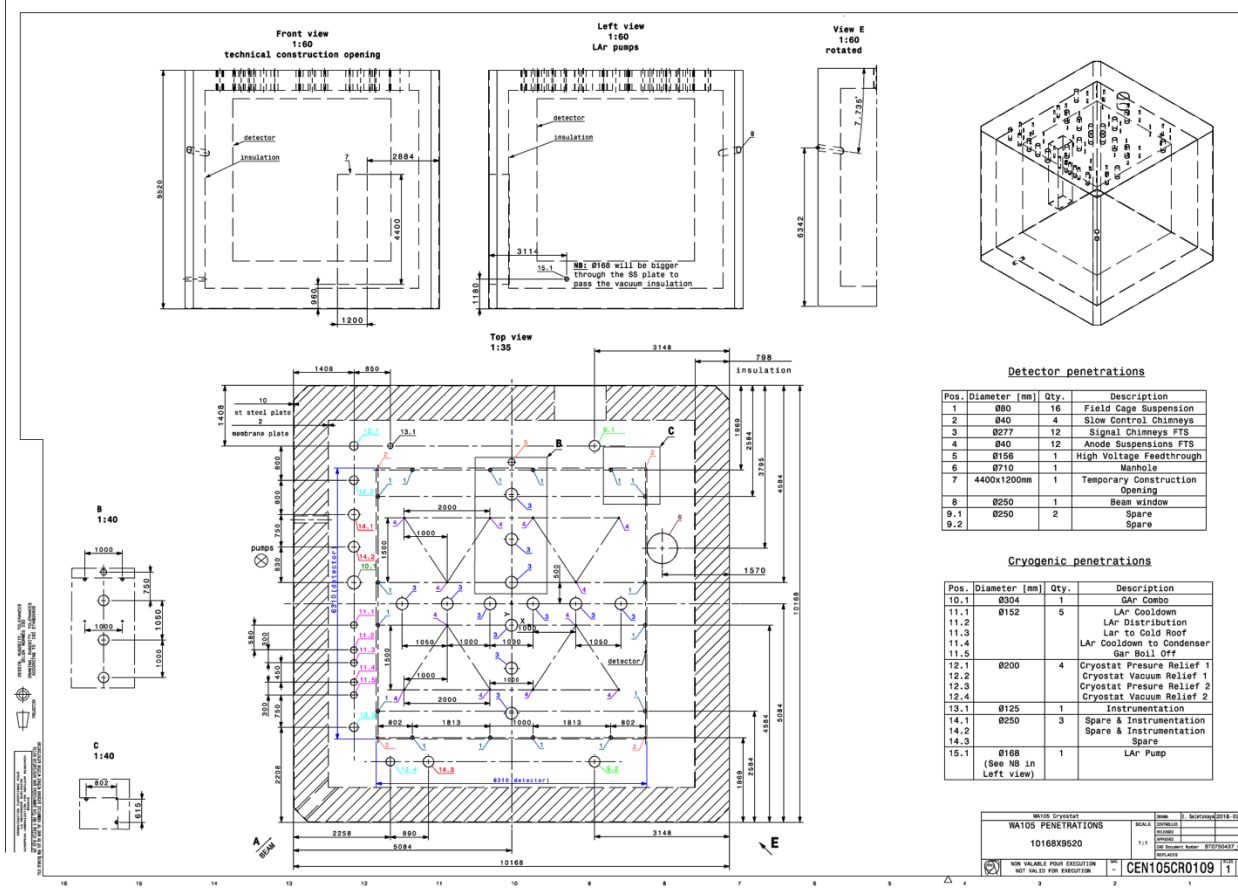


HOW DO WE OPERATE? (cold structure)

- CERN has a co-operation agreement with GTT
- CERN issues an engineering contract to GTT for the design of the cold vessel
 - Bill of material
 - Installation sequence and manual
 - Risk analysis and material optimization
 - All interface details with the detector and warm structure (penetrations, internal fixations, special materials,...)
- CERN public tender for steel membrane material (insulation, steels, small materials,...) and delivery contracts using prepared bill of material by GTT
- CERN public tender for membrane installation, including QA and GTT supervision + contract follow up. To GTT licensed firms!
- CERN will provide logistic support to the installation firm, will run its own leaks test on the membrane for final qualification
- CERN handles the cryogenics plants and the cool down process.

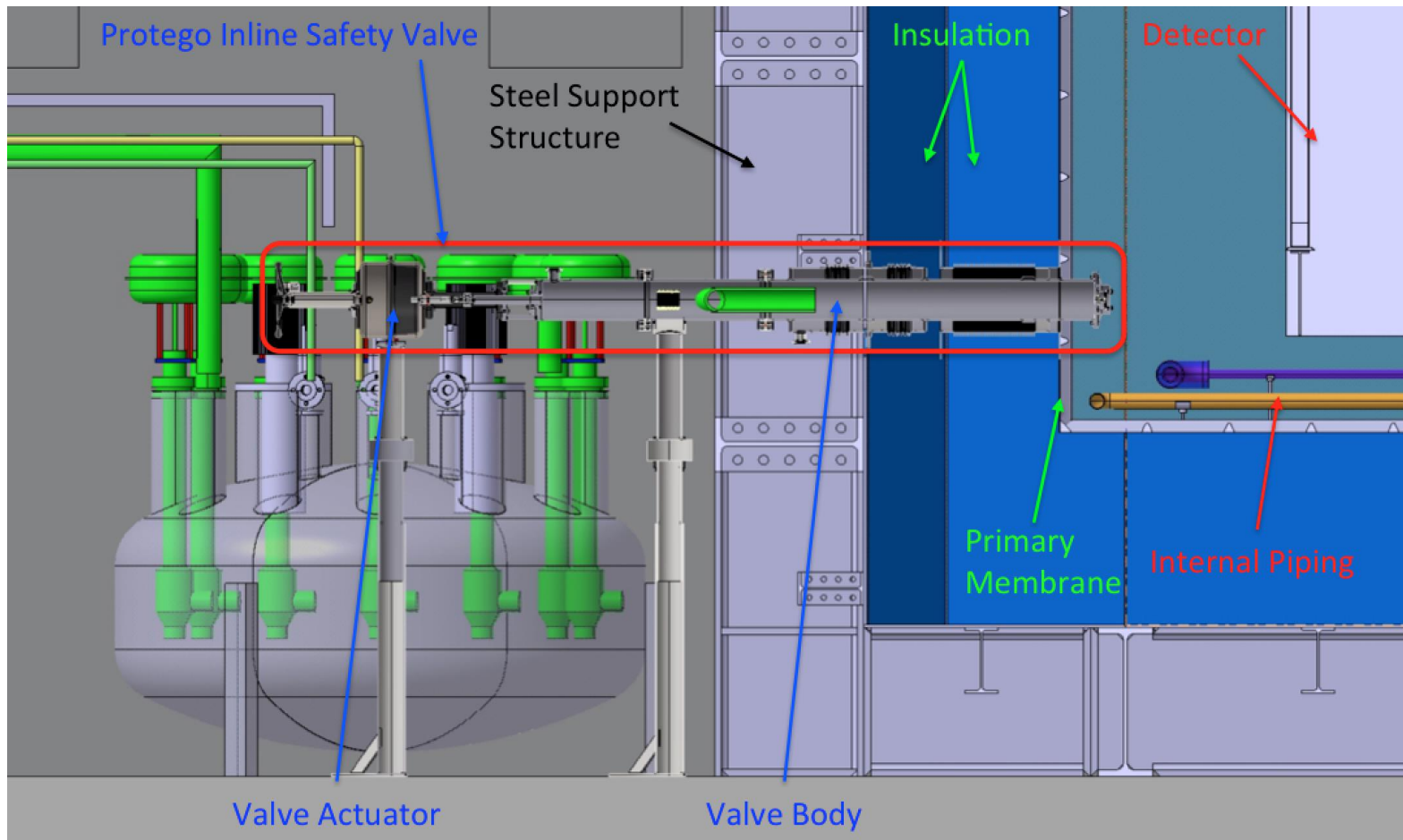
CRITICAL ITEMS

- ✓ The important amount of penetrations (mostly from the top, a few from the side)

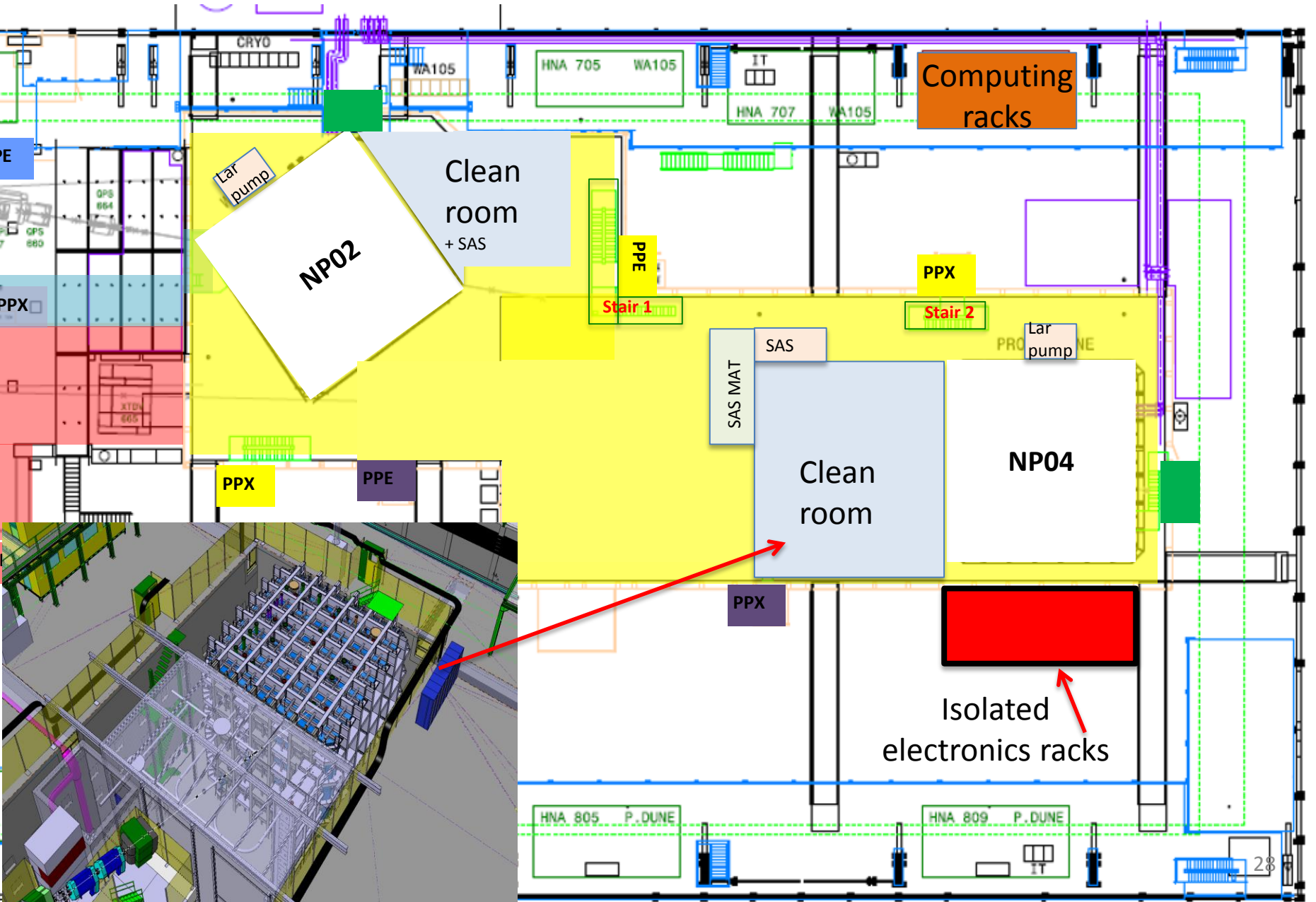


CRITICAL ITEMS

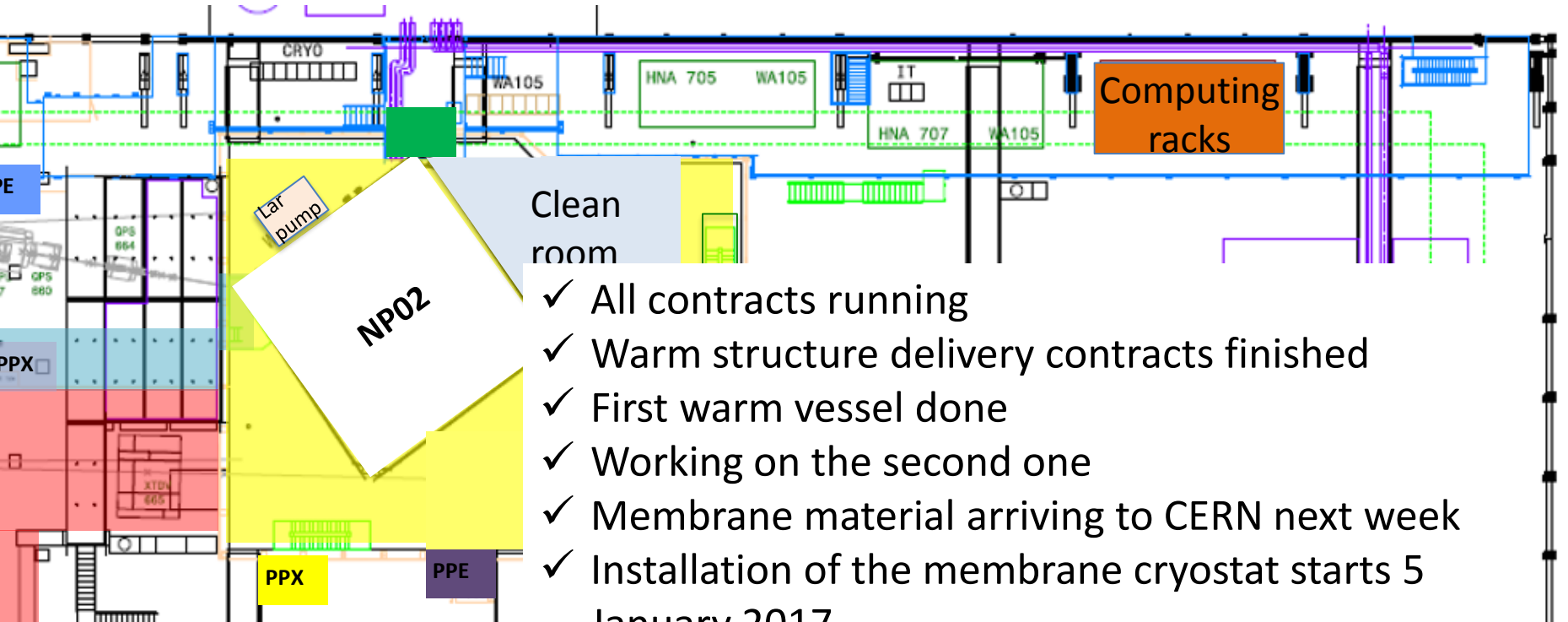
- ✓ LAr extraction from the side (low)



STATUS (next 5 months)



STATUS (next 5 months)



- ✓ All contracts running
- ✓ Warm structure delivery contracts finished
- ✓ First warm vessel done
- ✓ Working on the second one
- ✓ Membrane material arriving to CERN next week
- ✓ Installation of the membrane cryostat starts 5 January 2017
- ✓ In May 2017 the installation of the detectors starts
- ✓ Cool down in February 2018

