

CRP news

D.Duchesneau, S. Tufanli

- CRP and NP02 status
- Anode PCB development and status and next prototype
- Bottom CRP installation update
- PRRs time update

CRP meeting
October 30th 2024

CRP status in NP02 cryostat: plan prior to NP02 purge and fill

- ❑ The before purge checklist was presented at the last TB meeting of Oct 23rd
- ❑ Several controls and checks were already done in July before TCO closure
- ❑ No major problem discovered from the CRP system; only minor facts:
- ❑ The 4 CRPs were functional and in good state
- ❑ Top CRP and Bottom CRP are being verified since October before purge can start (see next slides)



The CRP signoff document will be uploaded on EDMS this week

Checklist for top CRP:

- Verify entire SHV biasing circuit from top cryostat flange to the anode strips/adapter boards:
 - put 20-30V and measure at the CRP (CRU with the secondary filter HV box)
 - CRP2 done on Oct 8th: ✓
 - CRP3 done on Oct 14th ✓
- Alignment and relative positions of CRP2 and CRP3: ✓
- Close and seal the top CRP HV + CRP2 level meter flange
- Close and seal the CRP3 level meter flange
- Check the CRP with TDE

By Nov 14th 2024



Checklist for Bottom CRP:

- Remove the white covers on the CRP5 and CRP4
- Remove the ESD protection sheets on CRP4 and CRP5
- Visual inspection of the exposed shield surface and removal of any visible dust
- Verify entire SHV biasing circuit from cryostat roof flange to the anode strips/adapter boards:
 - put 20-30V and measure at the CRP level (CRU side with the secondary filter HV box)
 - CRP4 to be done
 - CRP5 to be done
- Continue to check CRP with BDE

Foreseen on Nov 12th 2024

CRP commissioning activities

Before purge and final closure if possible

- ⇒ Track possible external sources of significant measured coherent noise
- ⇒ Reserve a few days to run with TDE to chase the noise by applying systematic checks
 - it may require disconnecting , reconnecting cables of different systems

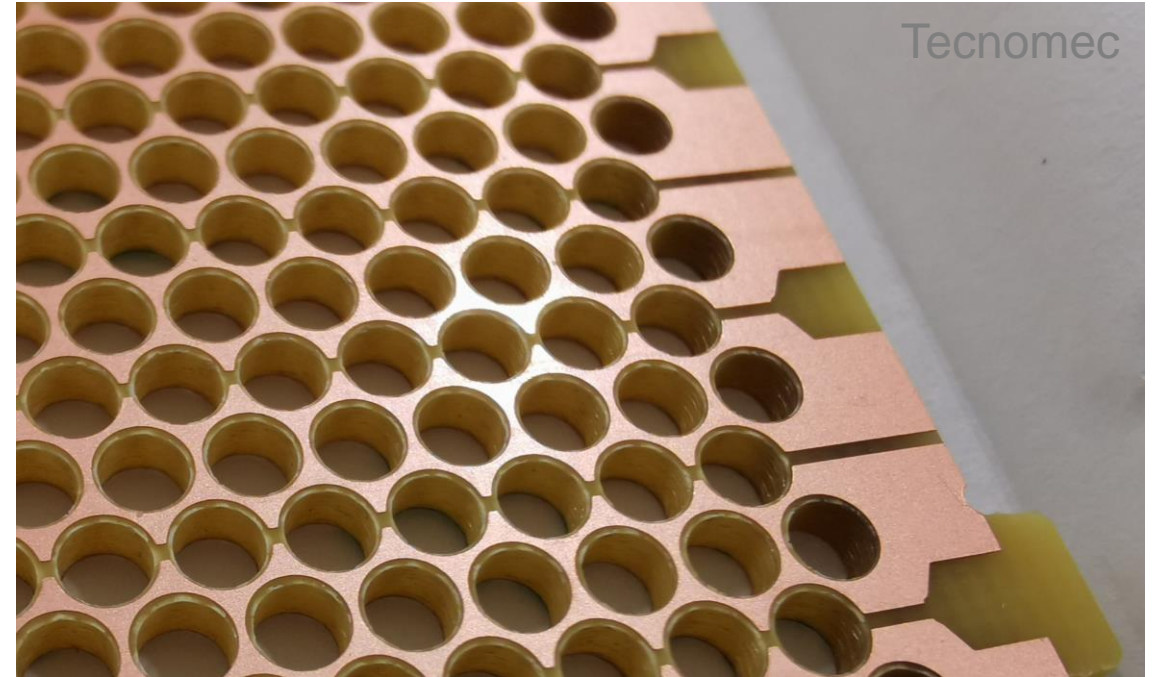
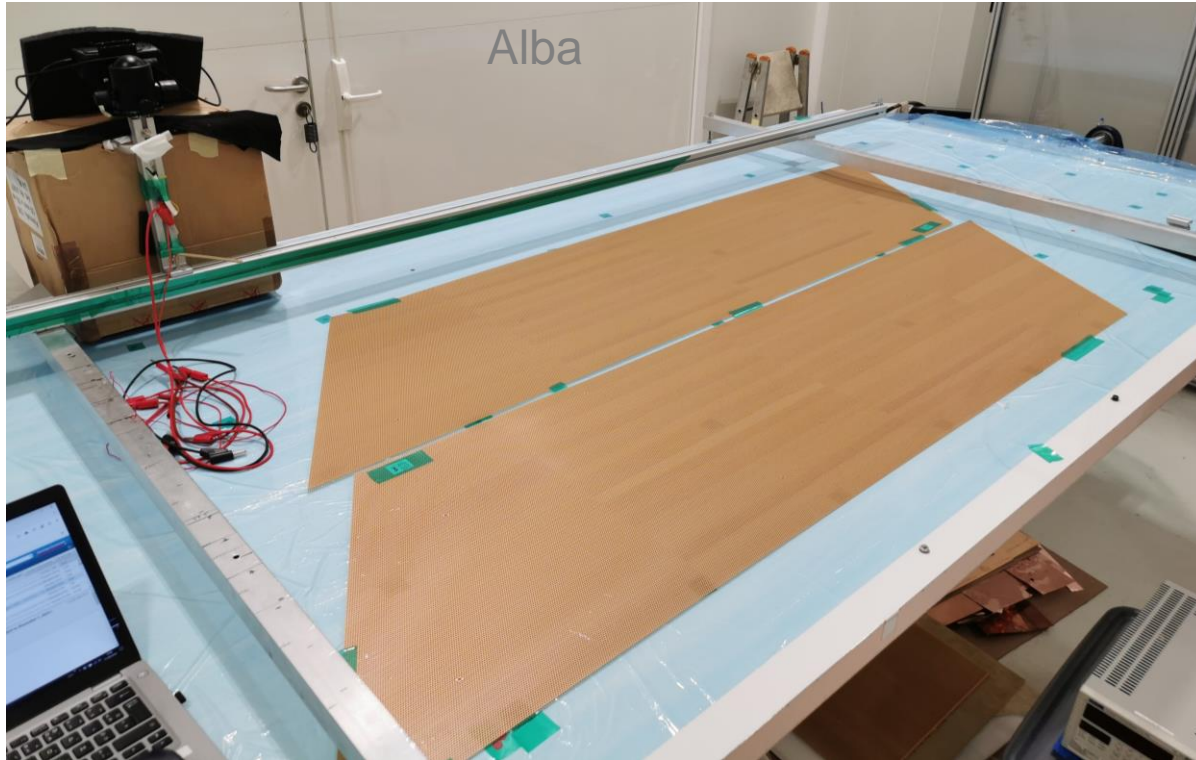
LAr transfer from NP04 : end of November: it takes about ~1-2 weeks to complete the transfer
The filling will be partial (60%)

⇒ should monitor continuously the noise behavior of Top and Bottom CRPs

⇒ As soon as the temperature goes down significantly:

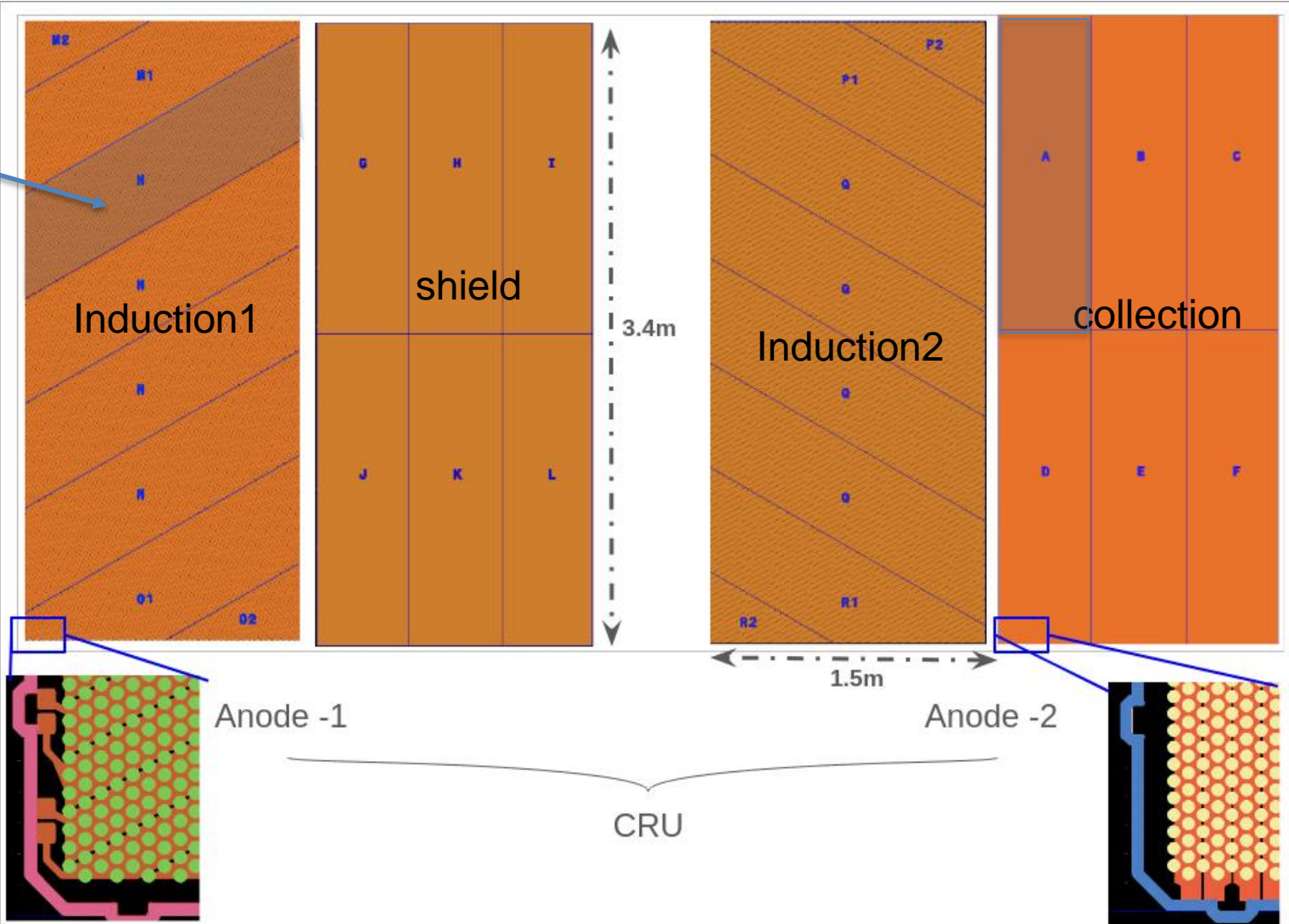
- ⇒ test from time to time the HV biasing to 100 Volts and check current on both the top and bottom
- ⇒ When liquid reaches the shield layer of Bottom CRPs: go to nominal HV bias to validate

Anode PCB development and status



22 different types of PCB panels

Shaded types are the ones produced and received for QC



Sketch by Serhan

Status of new anode PCBs

⇒ 2 companies (Alba and Tecnomec) are involved in the process of producing PCB anodes (samples and full set for CRP prototypes)

Unfortunately we had large delays from these producers to have new panel samples

❑ Expect to receive new Tecnomec samples (6 pieces) at around Nov 10th (2 months later than foreseen)

❑ Alba company sent PCB samples from 2 factories end of summer => QC checks done at CERN and feedbacks given to Alba in September => still waiting new samples after 2 months

In parallel we are investigating a very interesting opportunity proposal by Yi Wang from IHEP

❑ with a different producer (Chaosheng) able to produce with large machine the PCBs doing milling and drilling without moving the PCBs for the 2 processes

❑ Developing also measurement system and QC before shipping to CERN

❑ The manufacturer (Chaosheng) is preparing samples (one A and one N)

❑ => foresee to receive them end of next week (Nov 8th)

From end of next week we may have a dense period of checks and controls of PCBs from Tecnomec and Chaosheng to give a very fast feedback

Status of new anode PCBs

In the mean time the technical specification are being written to be able to start the PCB market survey as soon as possible and in parallel to the last step of prototyping

Market Survey

Technical Description

Supply of Perforated Anodes for the DUNE Experiment Vertical Drift Far Detector

Abstract

This Technical Description concerns the supply of around 9000 printed circuit boards for the DUNE experiment vertical drift far detector charge readout planes. The boards have 1.6 mm thickness and come in 18 variants with dimensions of maximum ~50 cm × ~200 cm. This Market Survey will be followed by an Invitations to Tender that are planned to be issued in Q1 2025. Delivery is foreseen in batches over at most 12 months in 2025 and 2026. The first delivery is expected to take place in the first quarter of 2025. CERN may consider to split the volumes indicated in this Market Survey across two Contractors.

□

3.2 Technical Requirements

The Supply shall comply with the following parameters and conditions:

| Segment Mechanical Requirements | |
|----------------------------------|---------------------|
| Typical External sizes (mm) | 475/520 × 1700/2015 |
| Tolerance on external sizes (mm) | [+0/-0.1] |
| Thickness (mm) | 1.6 ± 0.1 |
| Number of layers | 1 |

| Finished copper thickness requirements | |
|--|--------------|
| External layers | 35 µm |
| Hole (via) walls | No via walls |

| Board finish requirements | |
|---------------------------|----------------------------------|
| Silkscreen on top | No |
| Silkscreen on bottom | No |
| Silkscreen colour | Free |
| Solder-mask on top | No |
| Solder mask on bottom | No |
| Solder mask colour | Free |
| Surface finish | OSP (organic surface protection) |

| Perforated anode segment specific requirements | |
|--|---------------|
| Milling tolerances | +0/-100 µm |
| 3M laminate on shield and collection segments | 3M 9460PC VHB |
| Hole diameter accuracy | ±25µm |
| Absolute hole position accuracy after the drilling | < 50µm |
| Hole to neighbouring hole position accuracy | < 10µm |

And more in the draft in the document being finalized

Important : to get the specifications right to prevent to get the problems we have identified up to now.

Prepared by Serhan with the inputs from Bo, Rui.

Foresee to start the market survey in the coming weeks

Next coldbox test and prototype

- ❑ Initial goal (from June) was to produce 2 CRU equivalent panels by September after anode QC confirmation
 - ❑ But this goal has shifted since then 1 month every month !!
- ❑ Difficult to envisage the next step but the companies were required to give a quote and proposal to produce 1 CRU as soon as possible

⇒ Such that a new bottom CRP prototype (CRP8) could be built and tested in December (reusing the composite the adapter boards and the edge cards) but replacing all anodes

In the meantime and without any delay: the new ground plane for the second CRU of CRP6 has been produced at CERN and ready to be picked up




Bottom CRU installation: ongoing work to revisit the design and procedures

Since October 17th: regular weekly meetings organised to review :

- the CRP support system design (adapter plates, feet)
- the installation procedure (operation, positioning)
- cabling procedure (to patch panels and the anode biasing HV)
- issues and changes to foresee on the interfaces (example: patch panels)

With the Wisconsin team + BDE + CRP + TC + I&I people

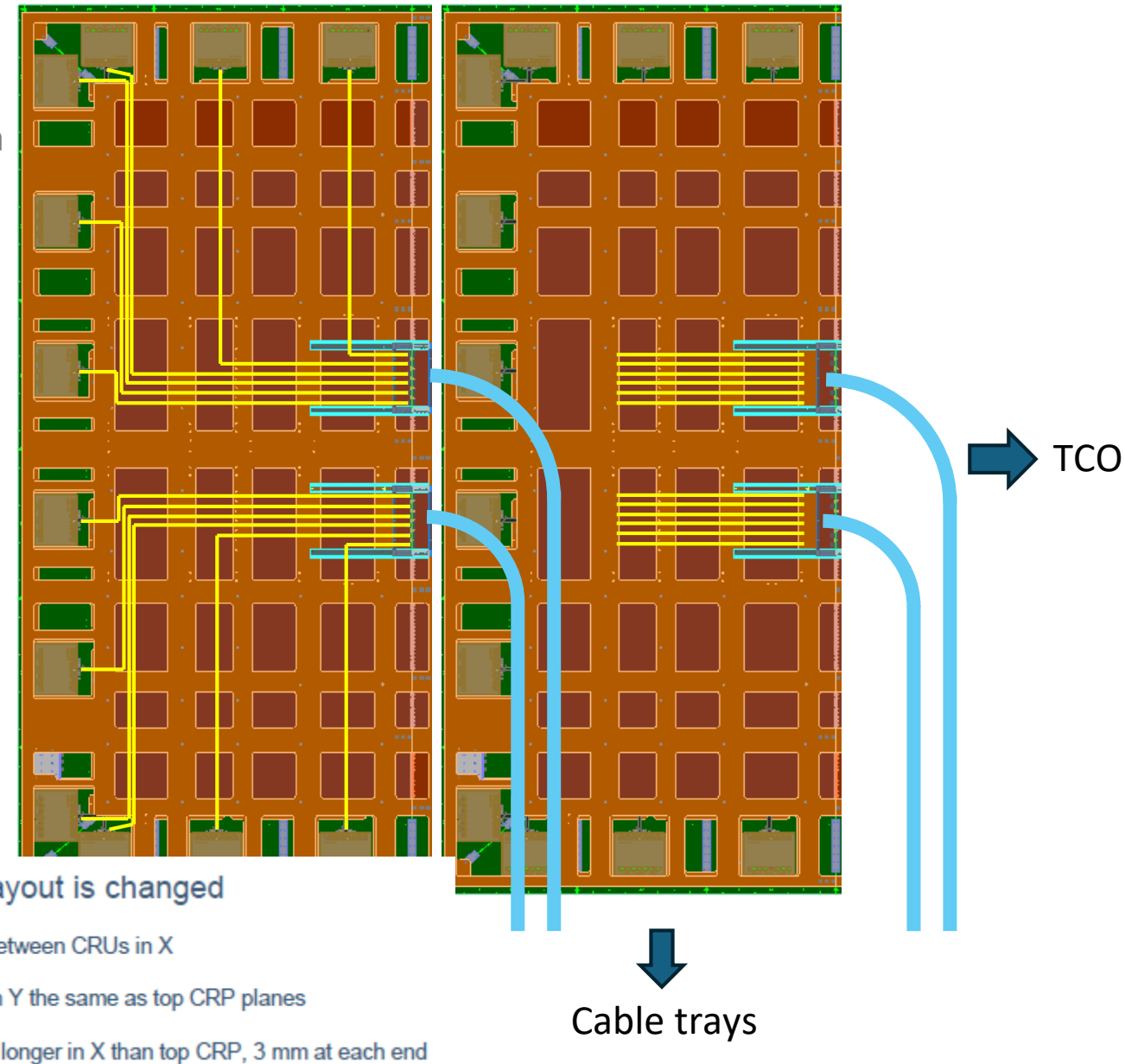
Previous meetings:

| | | | | |
|--|--------|--|------------|---|
|  | Oct 30 | Bottom CRP installation meeting, Oct 30th 2024 | NEW | https://indico.fnal.gov/event/66669/ |
|  | Oct 24 | Bottom CRP installation meeting, Oct 24th 2024 | | https://indico.fnal.gov/event/66825/ |
|  | Oct 17 | Bottom CRP installation meeting, Oct 17th 2024 | | https://indico.fnal.gov/event/66617/ |

=> System definition takes shape: need a few weeks to get to a complete plan and design option choice.

Requirements and agreed aspects for the Bottom CRP installation

- Install CRUs instead of CRP:
- Increase the height of bottom CRP wrt membrane by 20 mm
- CRU will be installed in symmetric orientation:
 - Edge cards opposite to TCO
- grounding may be not necessary between 2 CRUs if we have symmetric orientation
 - => test in the coldbox foreseen beginning of 2025
- Preference is to ground the feet to the membrane
- Foot should always be in contact with the membrane
- 1 foot fixed and 3 sliding
- Distribute the gap between CRU:
- Each gap should be controlled at warm



- **Bottom CRU layout is changed**
 - 4mm spacing between CRUs in X
 - Keep spacing in Y the same as top CRP planes
 - Layout is 6 mm longer in X than top CRP, 3 mm at each end

CRU layout and placement order defined:

FD Layout of Bottom CRUs

Placement order:

| | | | | | | | | | | | | | | | | | | | |
|----|----|----|------|----|----|------|------|----|----|----|----|----|----|----|------|------|----|----|----|
| 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| BA | BA | BA | BABA | BA | BA | BABA | BABA | BA | BA | BA | BA | BA | BA | BA | BABA | BABA | BA | BA | BA |

... To last row by TCO ← Install from back row. ...

- CRUs are lifted and lowered using Tines
- CRUs are installed in rows
 - Rows 1-19, with CRU broken into A and B rows: **order**: Left to right keeps access to PHV cable
 - Row 20: outside CRPs first, then last 2 CRPs installed as 4 separate CRUs
- Adapter plates, coded by CRP number, CRU, and position
 - e.g. 01AL is CRP 1, CRU A, left side

Note orientation of row B CRUs is rotated 180 deg

1,0 x 190,5 mm

10/24/2024

I. Jentz, Y. Pandiscas | Bottom CRU Installation : UW Update

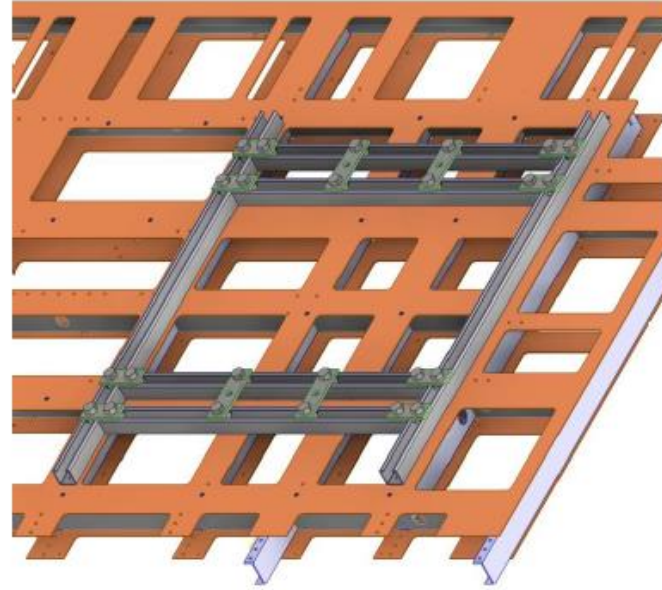


Feet support:

- 2 options carefully studied (material properties, mechanical behaviour) and compared;

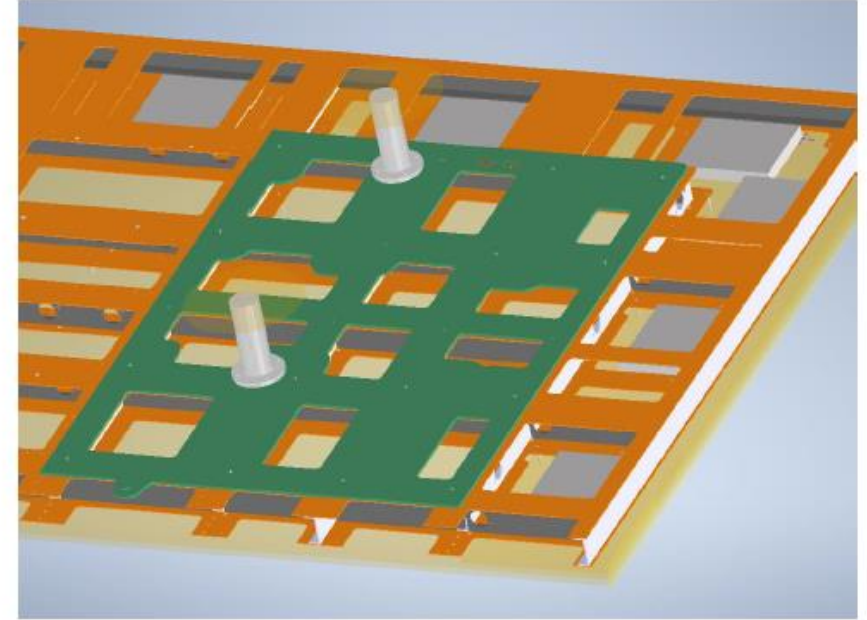
FEA calculations on going with the latest CRU design

Investigation into Support Mounting



Framing System

- Eliminated fiberglass pultrusion Unistrut frame members as option. Relative thermal contraction to CRU too high.
- Stainless steel, SS304, construction chosen. As better thermal contraction match.



Adapter Plates

- Update adapter plates to accommodate CRU install foot positions.
- Redesign with more open flow area.
- Considering stainless steel construction

Reminder: presented at the SURF meeting

Bottom CRP Installation : items to cover

goal: to come with viable installation and cabling solution for the Bottom CRP

I - CRU Installation procedure steps and points of caution:

where and how to flip the CRUs?: tooling to develop

how to install with a 4mm distance from previously installed CRU? Spacer or survey

How to level the CRUs?

....

Specific points to discuss:

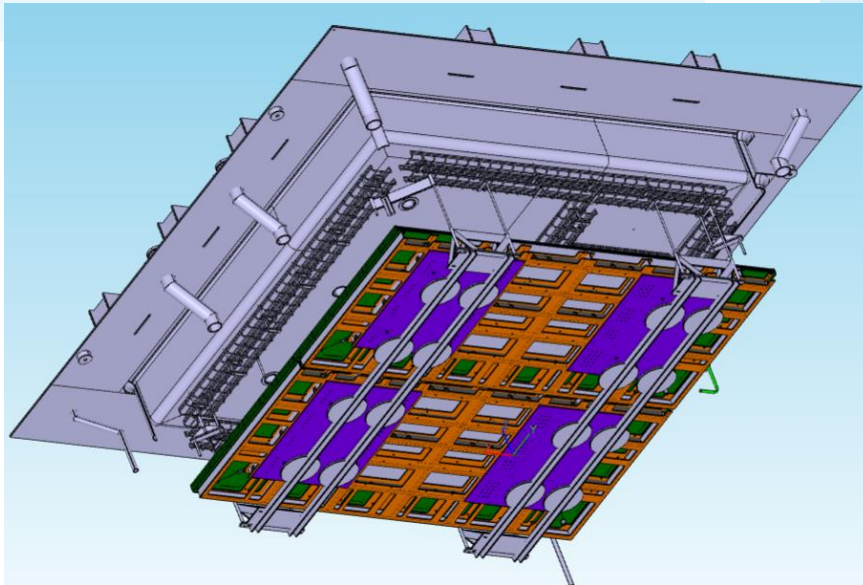
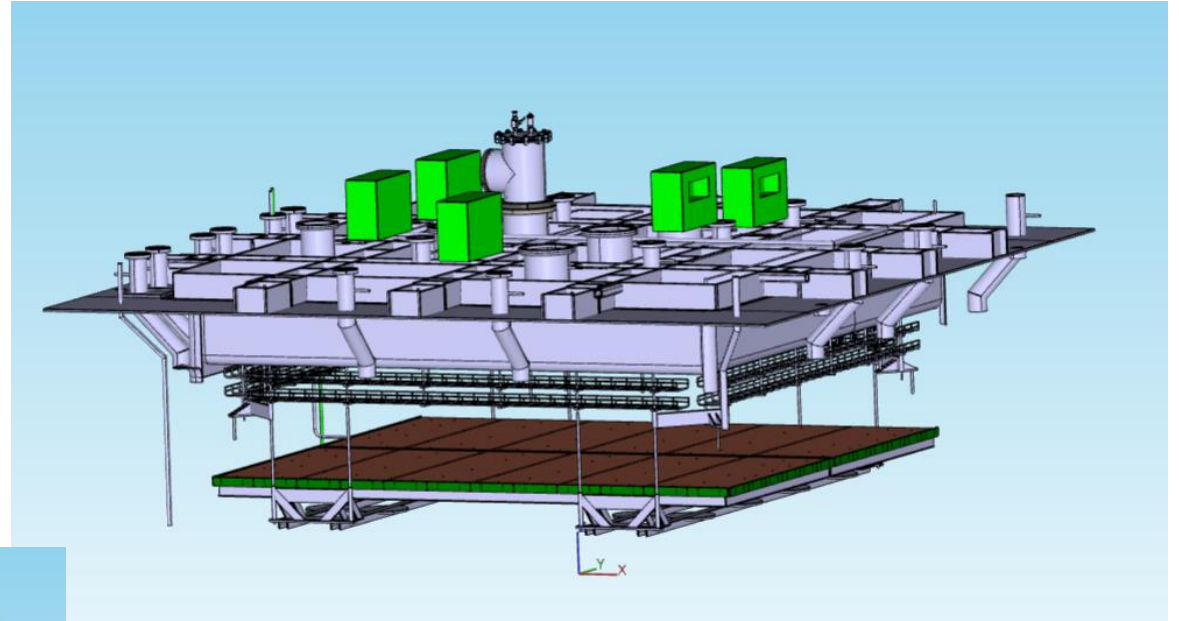
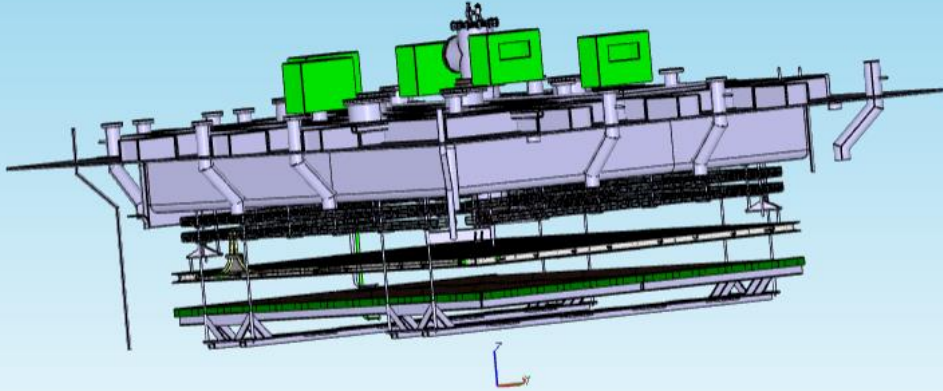
- adapter plates: which concept?
- Feet design status
- Lifting a CRU with tine system, how to lower very smoothly and precisely?
- Ground connection of 2 CRUs
- Connecting the HV filter boxes
- Patch panel design and positions,
- Cabling methods when on the floor
- Height CRP-Membrane: is it giving enough clearance for all the operations?

II) - Test program for this new installation procedure

- Mockup installation test
- Coldbox test

Future coldbox test with a bottom CRP installed on feet and anodes up
=> modification of the coldbox lid: design ongoing and discussed with BDE, CRP

B. Lacarelle



This test will happen in 2025 but it requires tooling development, modification of composite structure etc...

Update: PRR schedule for CRP components

CRP items and sub-component PRR list:

- **Composite frame:** Oct 10 2024
- **PCB anodes and panels:** Feb 2025
- **Adapter boards and edge cards :** Jan-Feb 2025
- **QC test setup and assembly site:** Jan-Feb 2025
- **Bottom CRP ground plane** Jan 2025



Postponed to beg of 2025

CRP Factories: (Main factory PRR and follow-up later for the second site)

- Grenoble and CERN Factories: first in March 2025 (TBC)
- US factories: Yale and 2nd site TBD: first in Jul 2025, second in Sep 2025
- **Bottom CRP support:** adapter plates + feet : Sept 2025
- **Top SST :** March 2025
- **Top cable trays:** March 2025
- **suspensions + decoupling system:** June 2025

END