

FD2 BDE Installation and Cabling

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FD2 Bottom Drift Electronics Preliminary Design Review

April 25, 2022

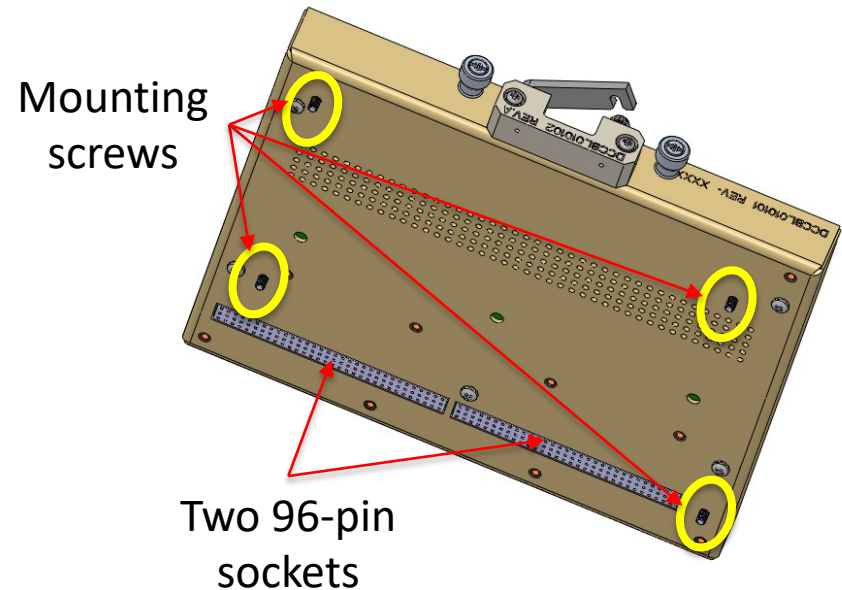
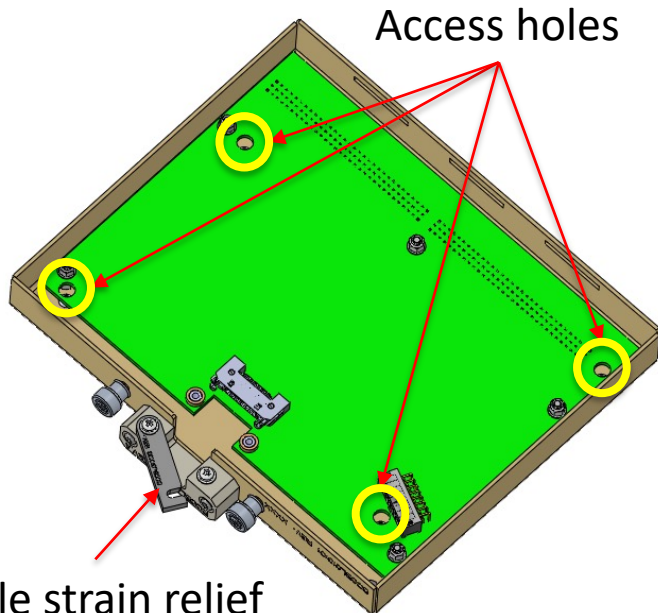
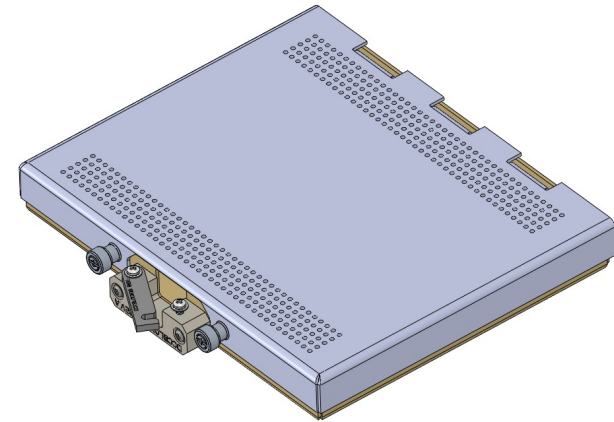
Outline

- CE box and installation
- Bottom CRP patch panel and cabling
- Cryostat Penetration and Cryostat cabling

CE Box and Installation

Bottom CRPs are read out by FEMBs. Each FEMB is enclosed in a metallic CE box for electromagnetic shielding and mechanical support. The CE box also provides a strain relief mechanism to secure the cable connection.

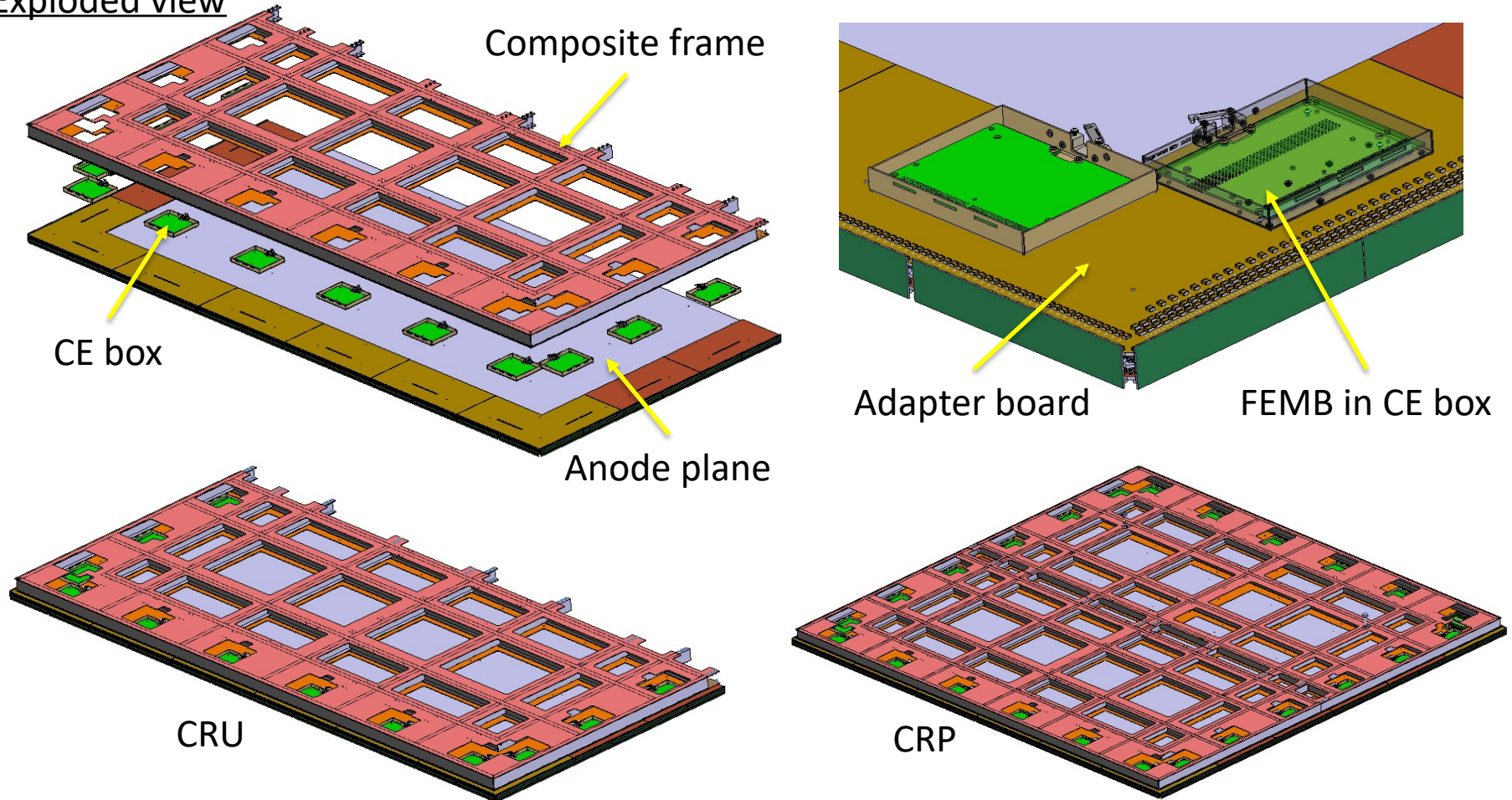
Each CE box is installed on a CRP with four mounting screws. Four access holes on the FEMB facilitates installing and removing CE box on/from CRP.



CE Box and Installation

A bottom CRP consists of two CRUs. Each CRU is readout by 12 CE boxes. In total, 24 CE boxes per CRP. The FEMBs are plugged into the CRP adapter boards via two 96-pin sockets.

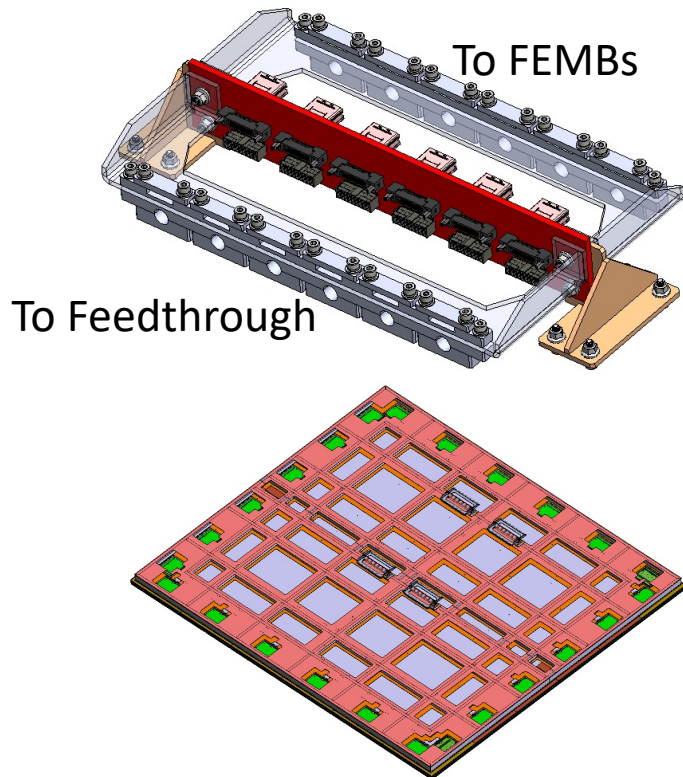
Exploded view



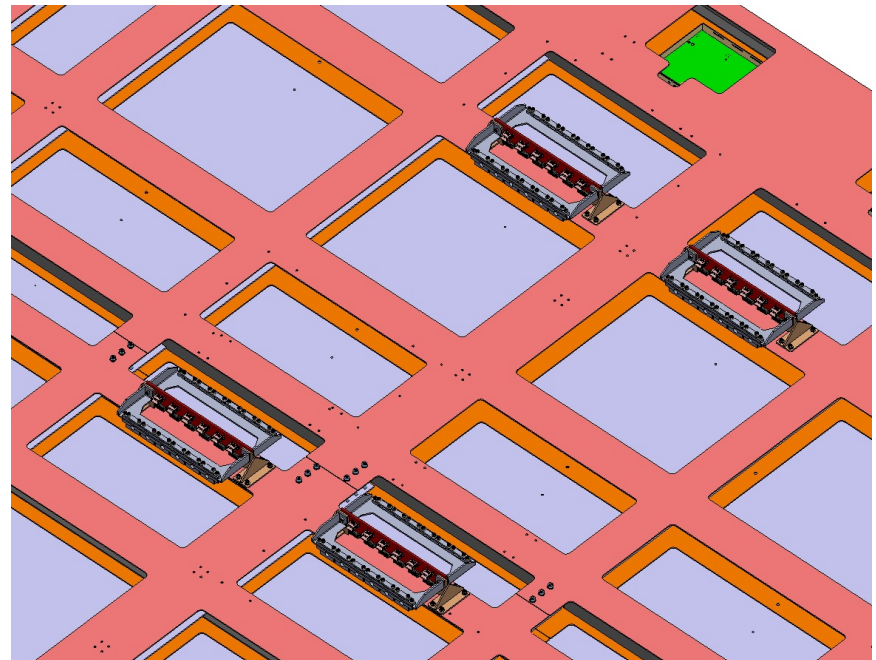
Bottom CRP Patch Panel and Cabling

Patch panels are mounted on the CRP composite frame. A patch panel provides an interface between the CRP cabling and the cryostat cabling. One side of the patch panel receives Mini-SAS cables from the CE boxes. The other side of the patch panel receives Samtec cables from cryostat cabling.

Patch panel assembly



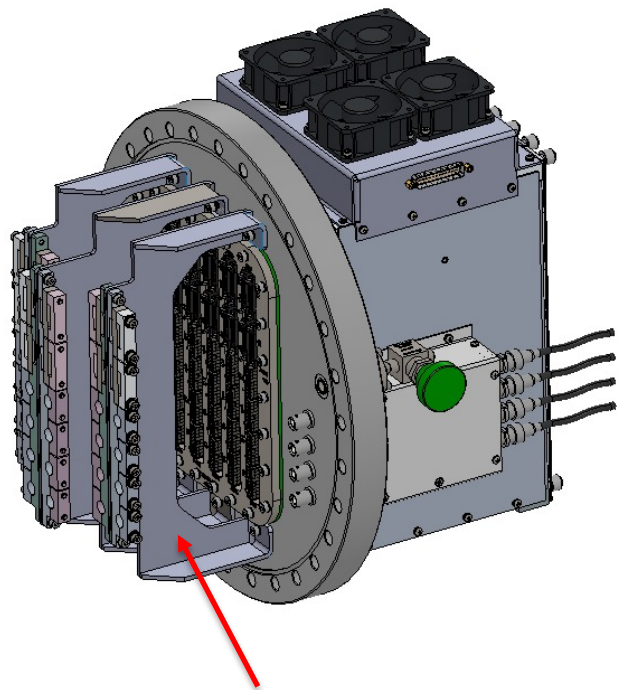
Patch panels installed on CRP composite frame



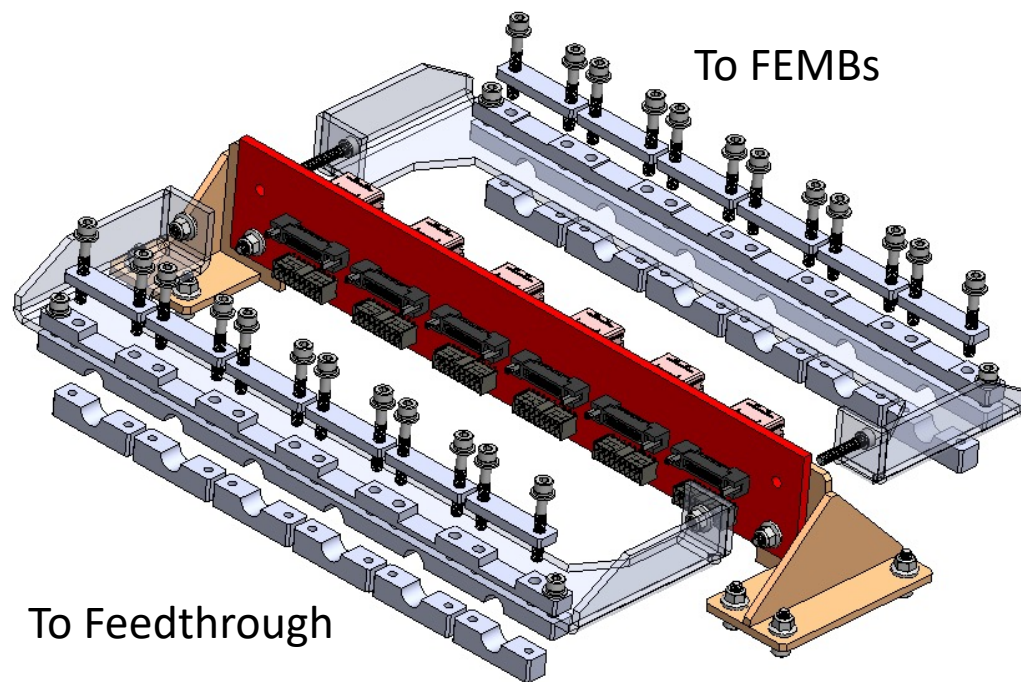
Bottom CRP Patch Panel and Cabling

Cable strain relief brackets of the patch panel adopt a proven design of CE flange brackets in protoDUNE-I.

CE flange assembly



Cable strain relief brackets of a patch panel

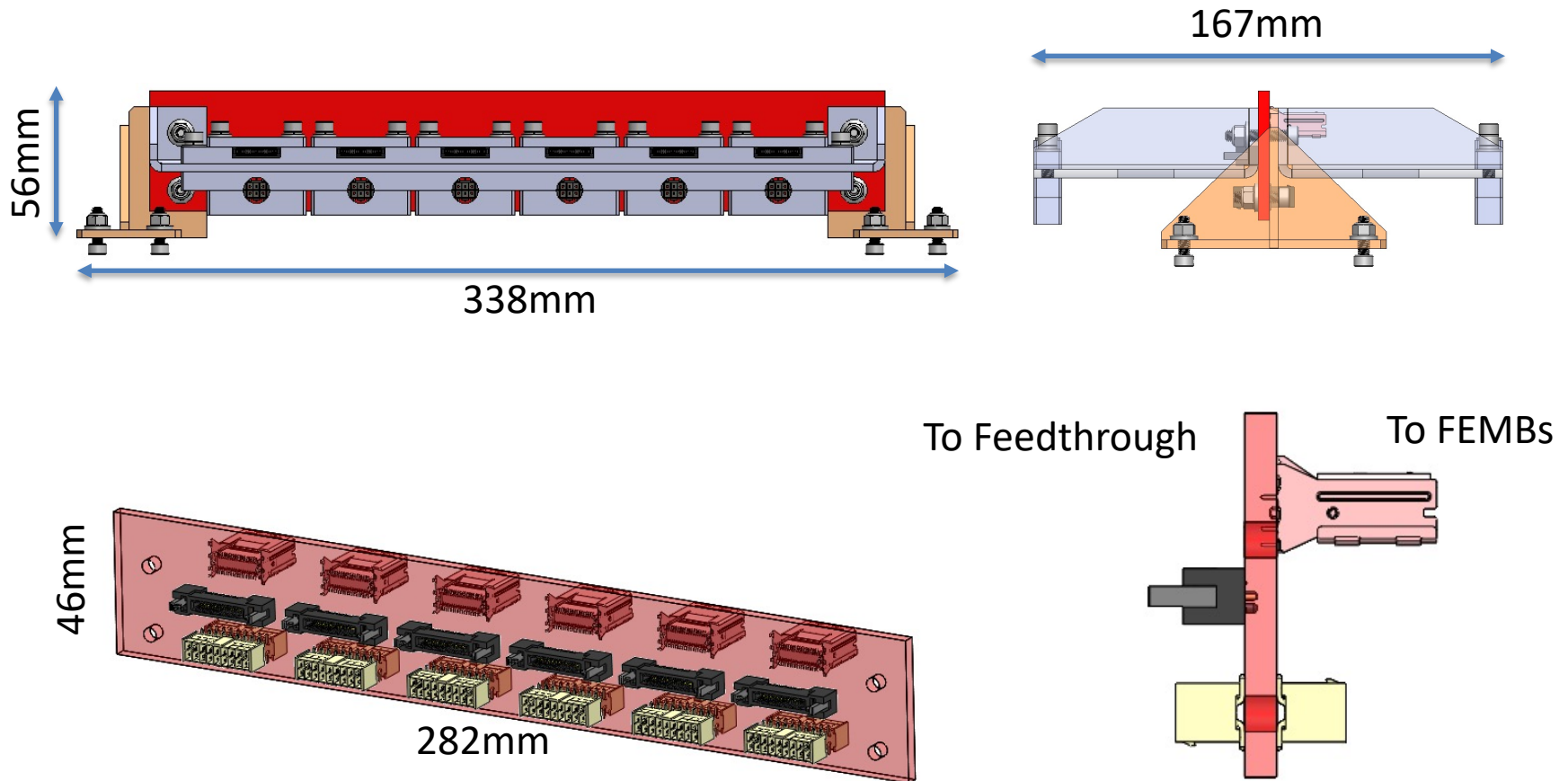


Cable strain relief brackets

Exploded View

Bottom CRP Patch Panel and Cabling

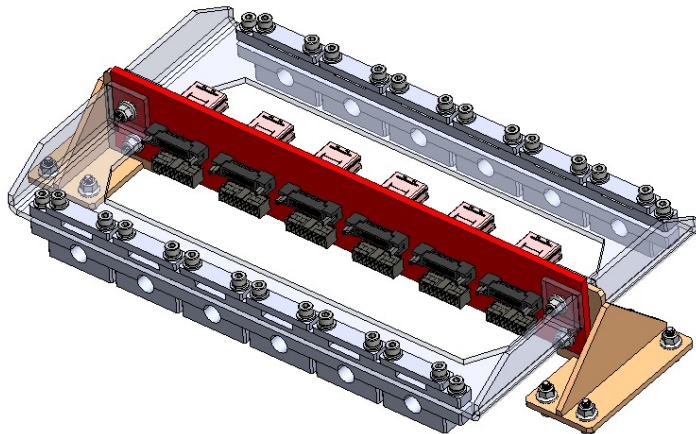
Low profile design of the patch panel can easily fit in the space between the CRP and the cryostat corrugation floor.



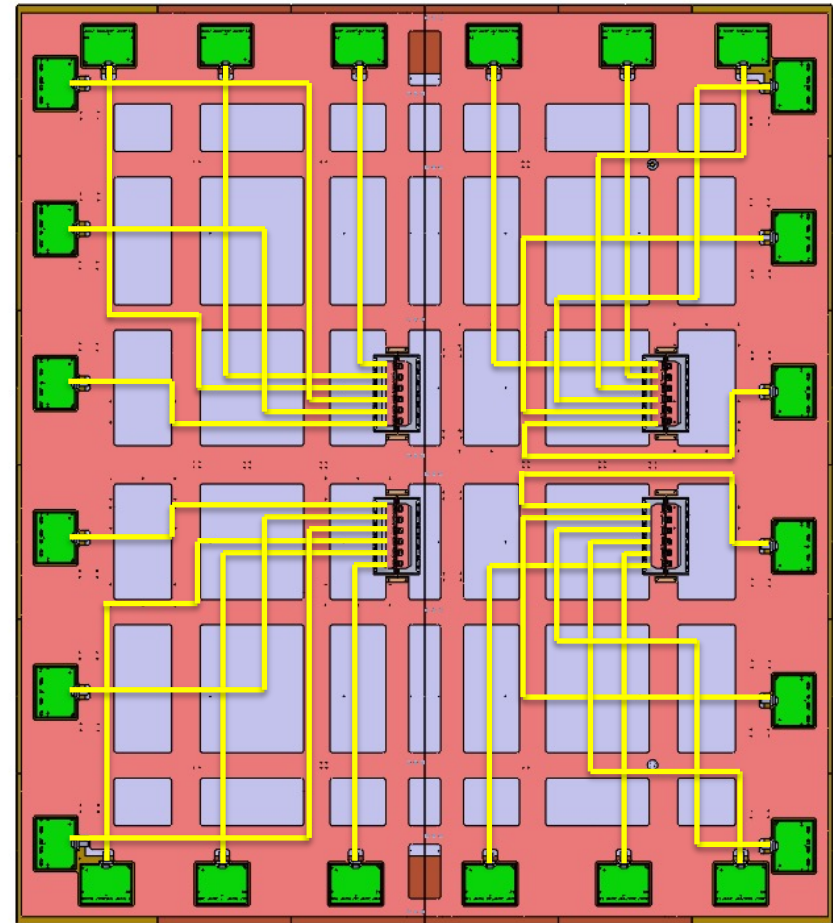
Bottom CRP Patch Panel and Cabling

Four patch panels are needed for one CRP. Each patch panel receives cables from six FEMBs.

Max cable length required to connect the FEMBs to the patch panel is 2m ~ 2.5m.



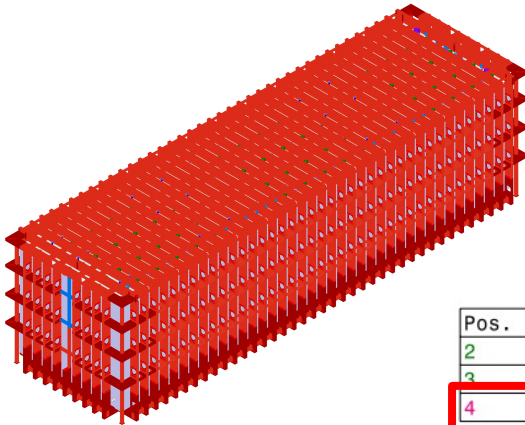
Patch panel and cable layout*



*It doesn't show the actual cable length or exact location. It only schematically shows the connections between CE boxes and patch panels.

Cryostat Penetration and Cryostat Cabling

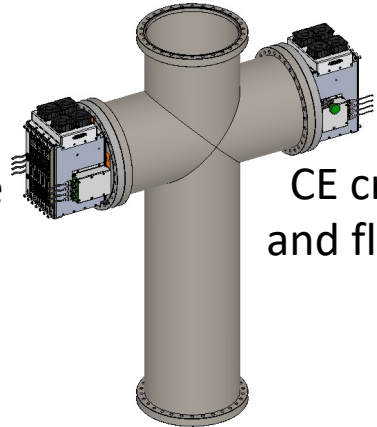
40 penetrations on the VD cryostat are provided for bottom CRP cables and PDS. A cross tube is installed on each penetration, with two side ports for bottom CRP cables and the top port for PDS.



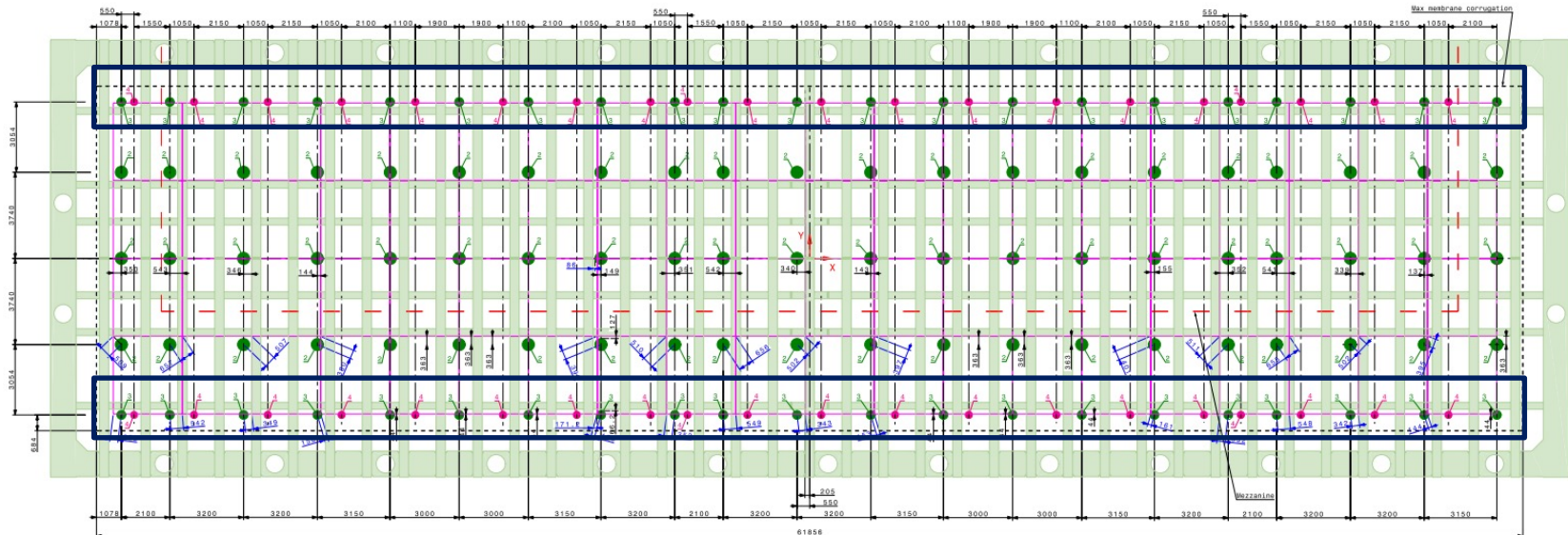
Pos.	Diameter [mm]	Quantity	Description
2	Ø526	63	Top Center CRP Cables
3	Ø381	42	Top Side CRP Cables & ECSS
4	Ø304.8	40	Bottom CRP Cables + PDS

Top port for PDS flange

CE crate and flange

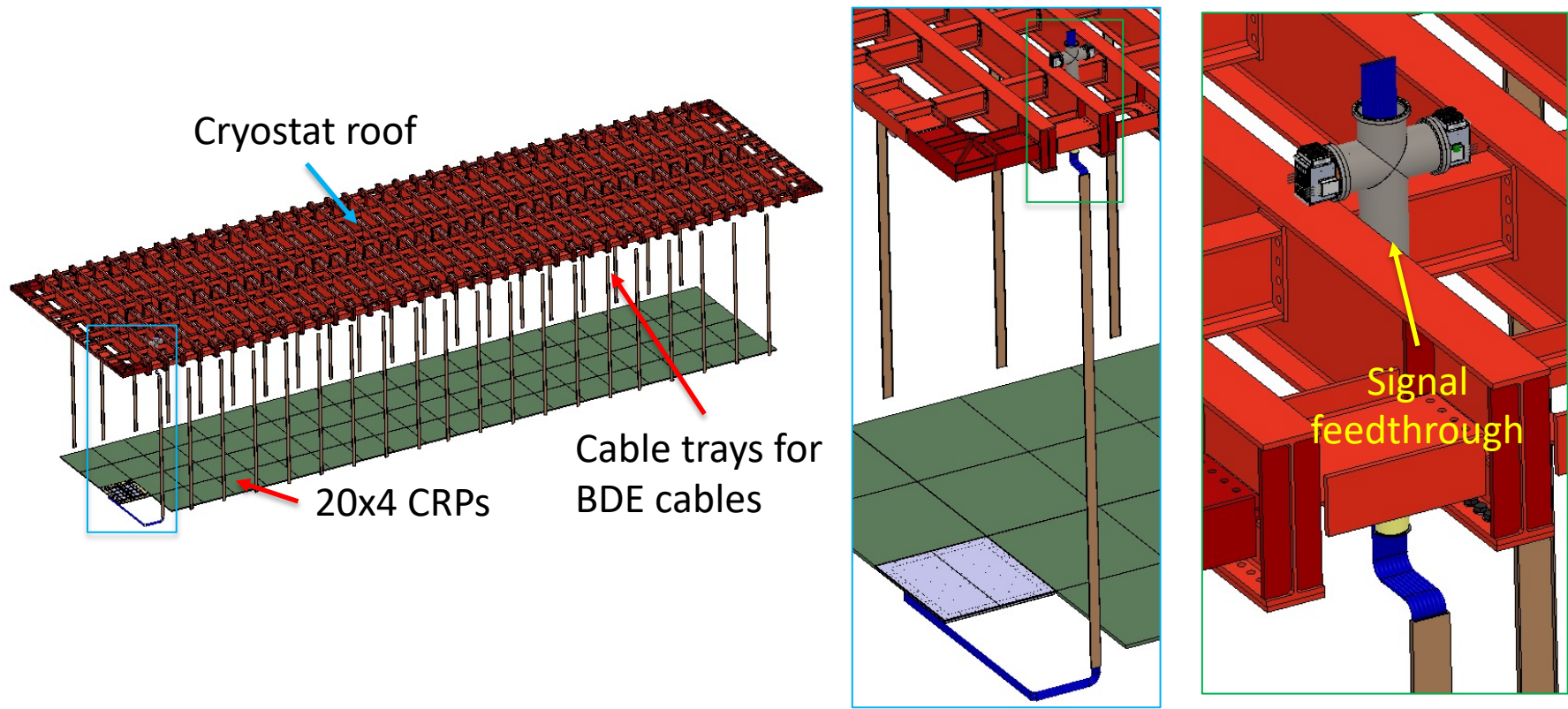


CE crate and flange



Cryostat Penetration and Cryostat Cabling

SAMTEC CE cables run from CE flanges to CRP patch panels. The cables are tied to the cable trays along the cryostat wall and laid down on the cryostat floor. When installing the bottom CRPs, the cables are then connected to CRP patch panels.

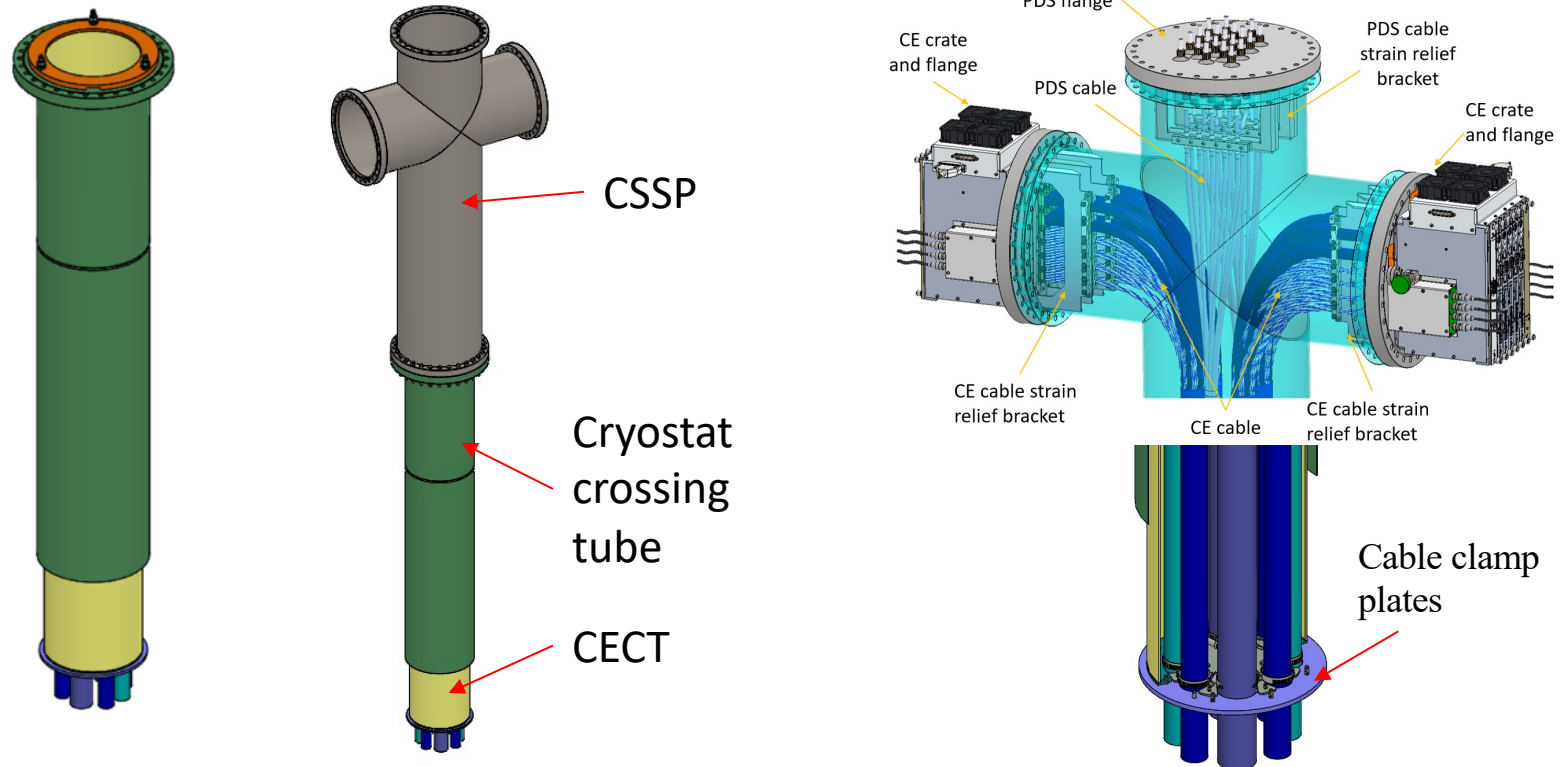


Cryostat Penetration and Cryostat Cabling

The cables from bottom CRP are connected to the CE flanges and strain relieved on the CE cable brackets.

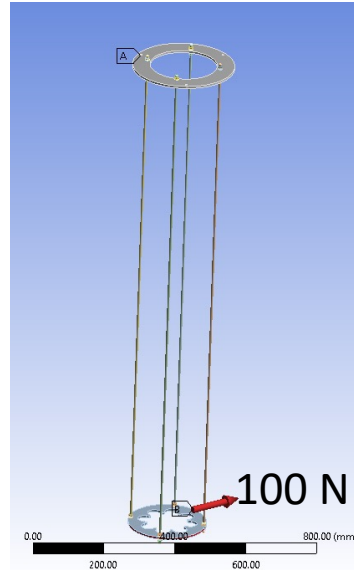
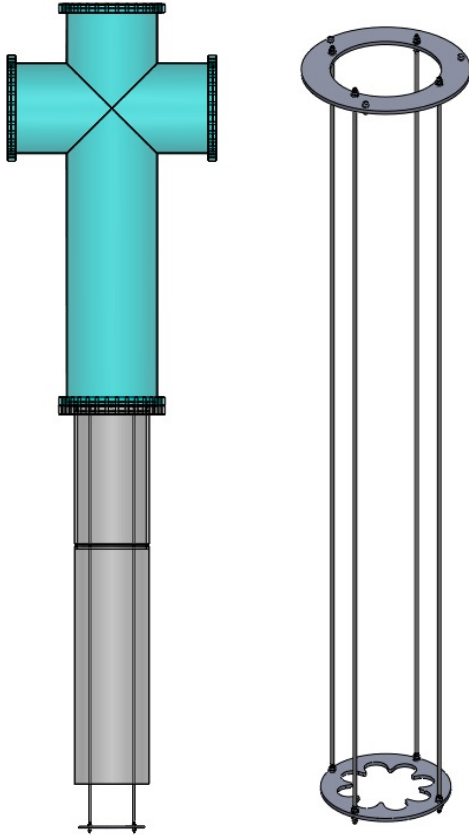
In HD FD1, a cable clamp plate is mounted on the bottom flange of the CECT to provide secondary cable support.

Several alternative designs of secondary cable strain relief are being evaluated.

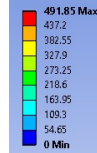


Cryostat Penetration and Cryostat Cabling

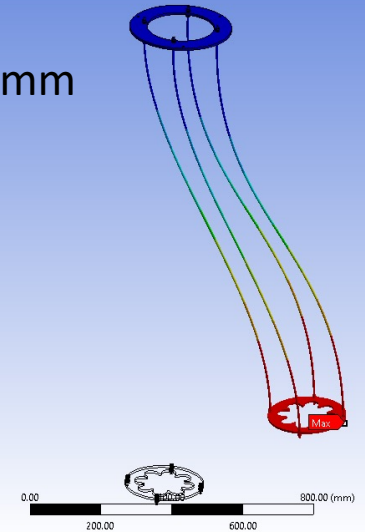
Alternative design of secondary cable strain relief (1A)



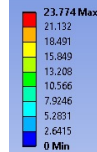
B: Static Structural
Total Deformation
Type: Total Deformation
Unit: mm
Time: 1



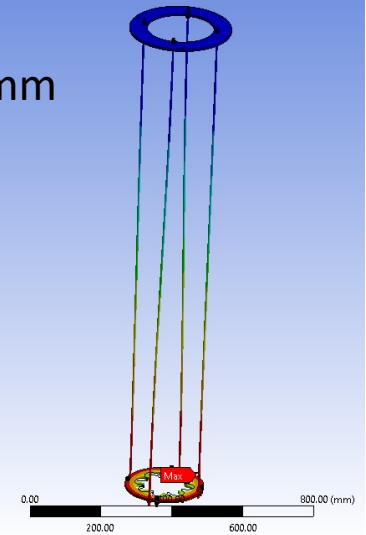
491.9 mm



C: Static Structural
Total Deformation
Type: Total Deformation
Unit: mm
Time: 1

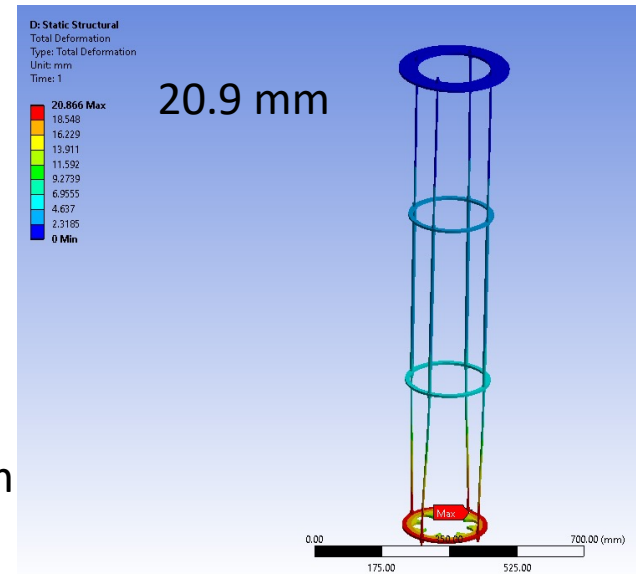
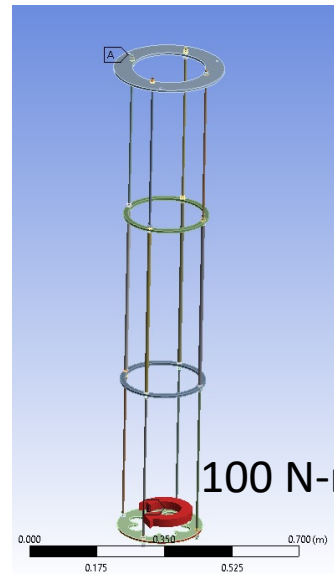
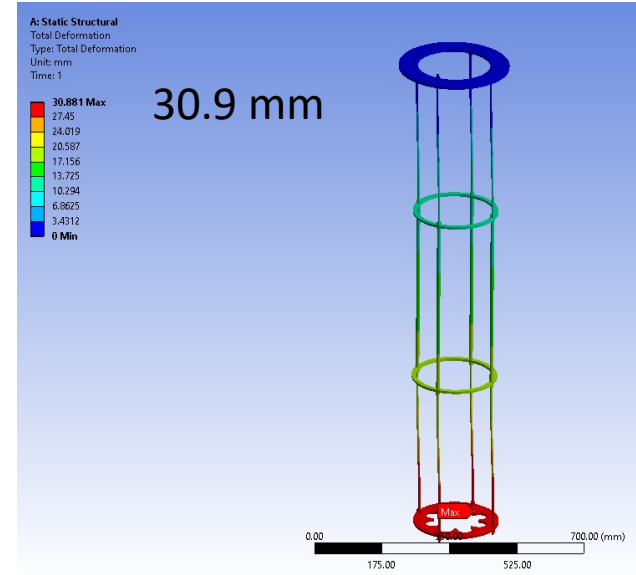
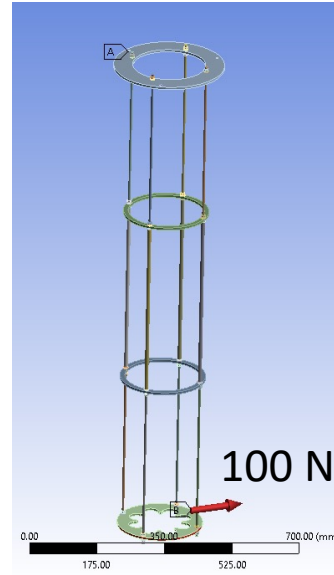
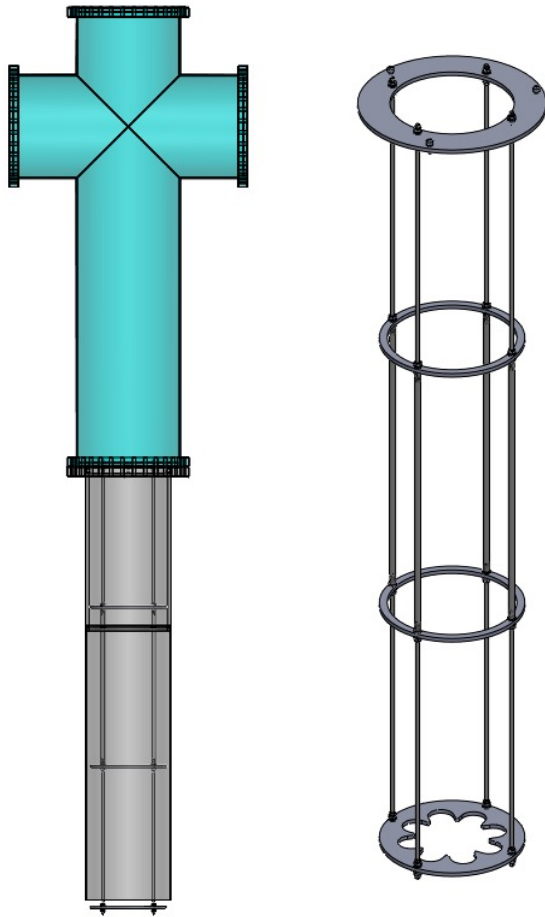


23.8 mm



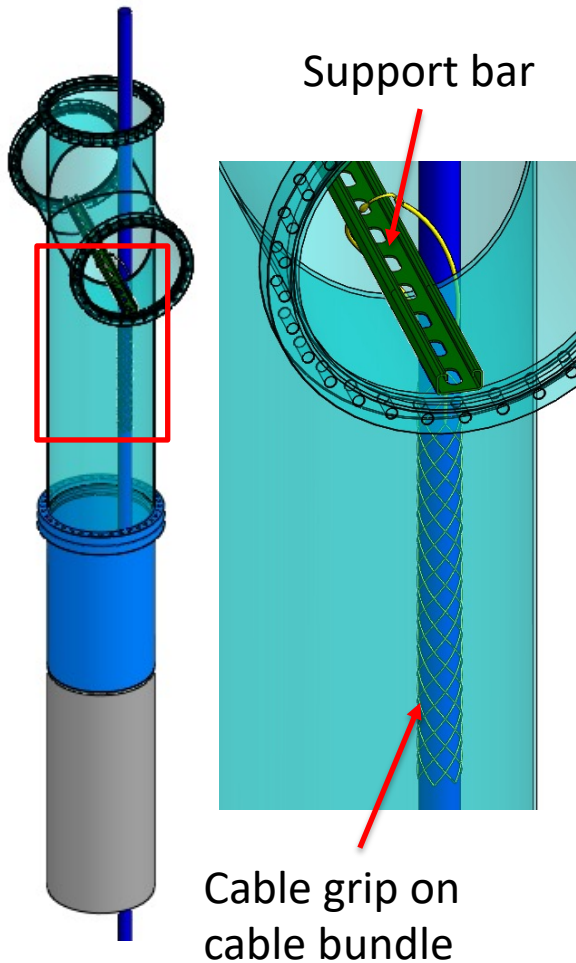
Cryostat Penetration and Cryostat Cabling

Alternative design of secondary cable strain relief (1B)

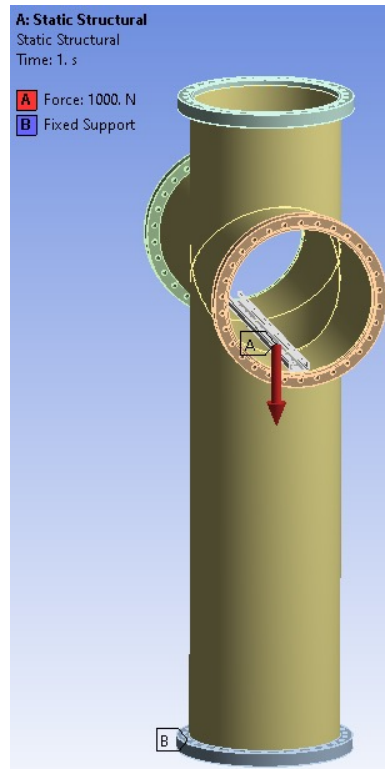


Cryostat Penetration and Cryostat Cabling

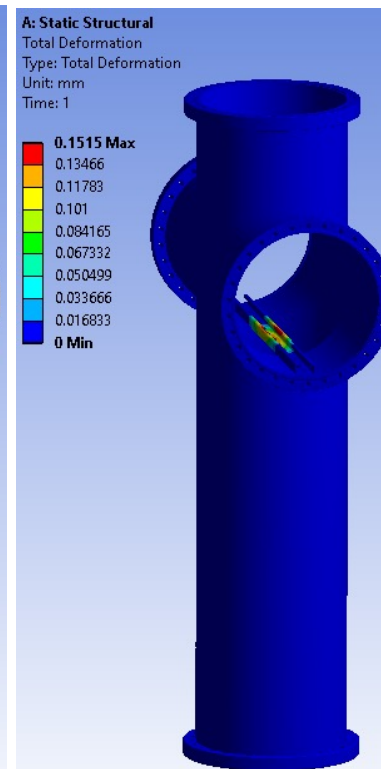
Alternative design of secondary cable strain relief (2)



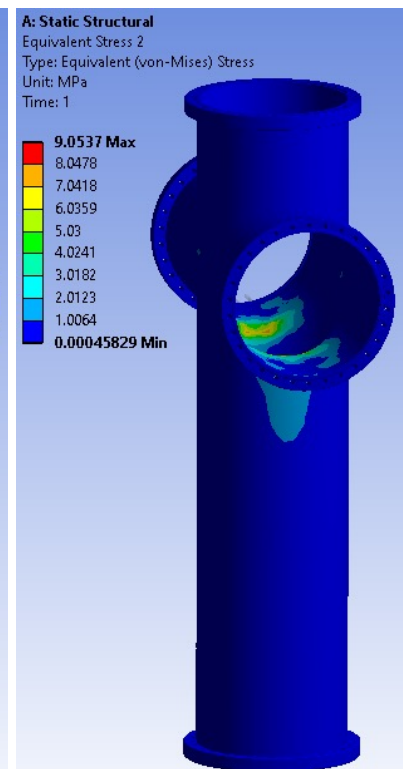
1000 N
cable weight



Max deflection:
0.2 mm



Max Stress:
9 MPa



Conclusion

- CE boxes provide electromagnetic shielding and mechanical support to FEMBs. A strain relief mechanism secure cable connection to FEMB.
- CE box is installed on CRP adapter board. Screw access holes facilitate CE box installation.
- Patch panel provides interface between the CRP cabling and the cryostat cabling.
- Signal feedthrough on cryostat roof provides CE flanges for cable connection.
- SAMTEC CE cables connect CE flanges and CRP patch panels.