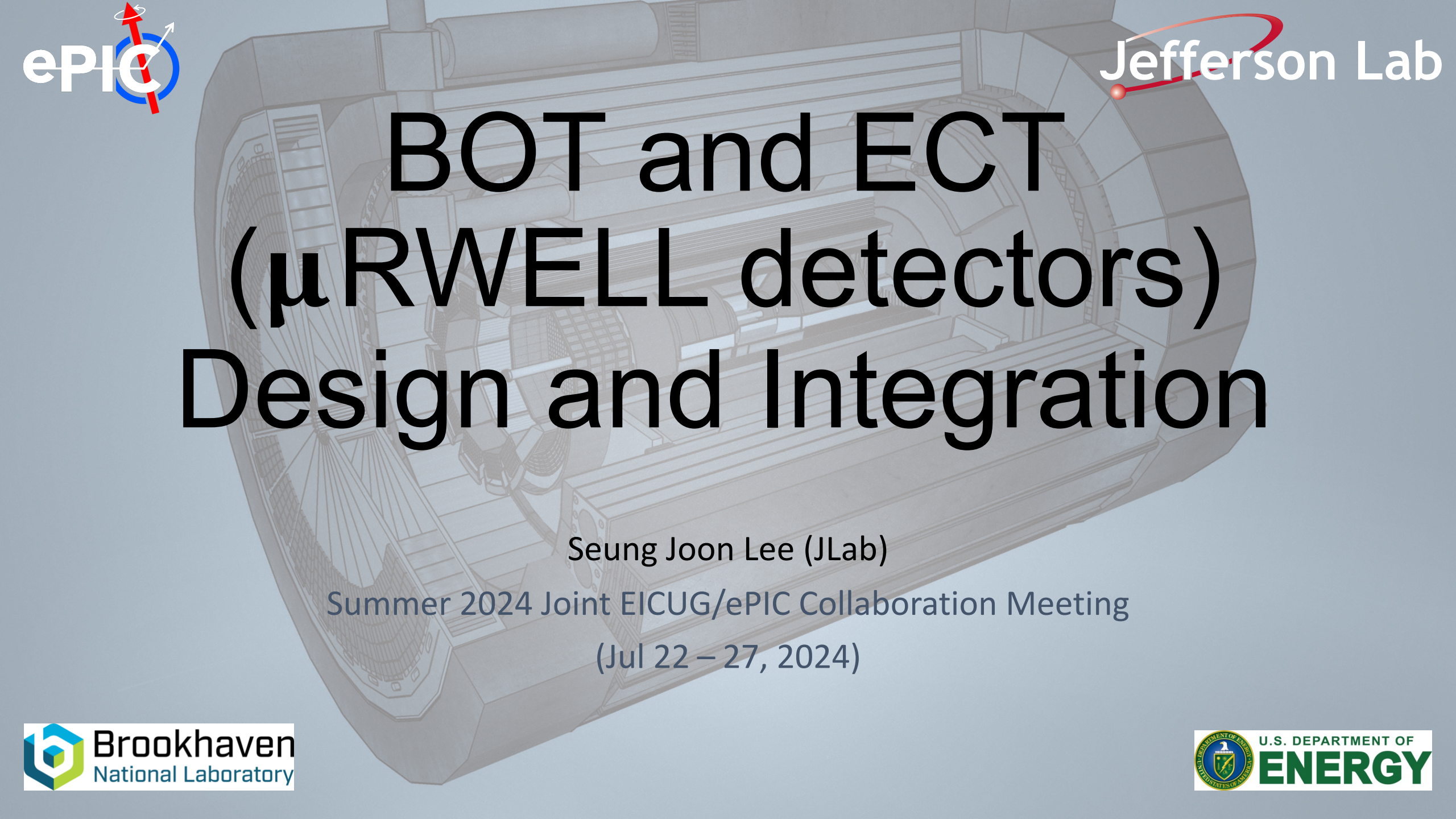


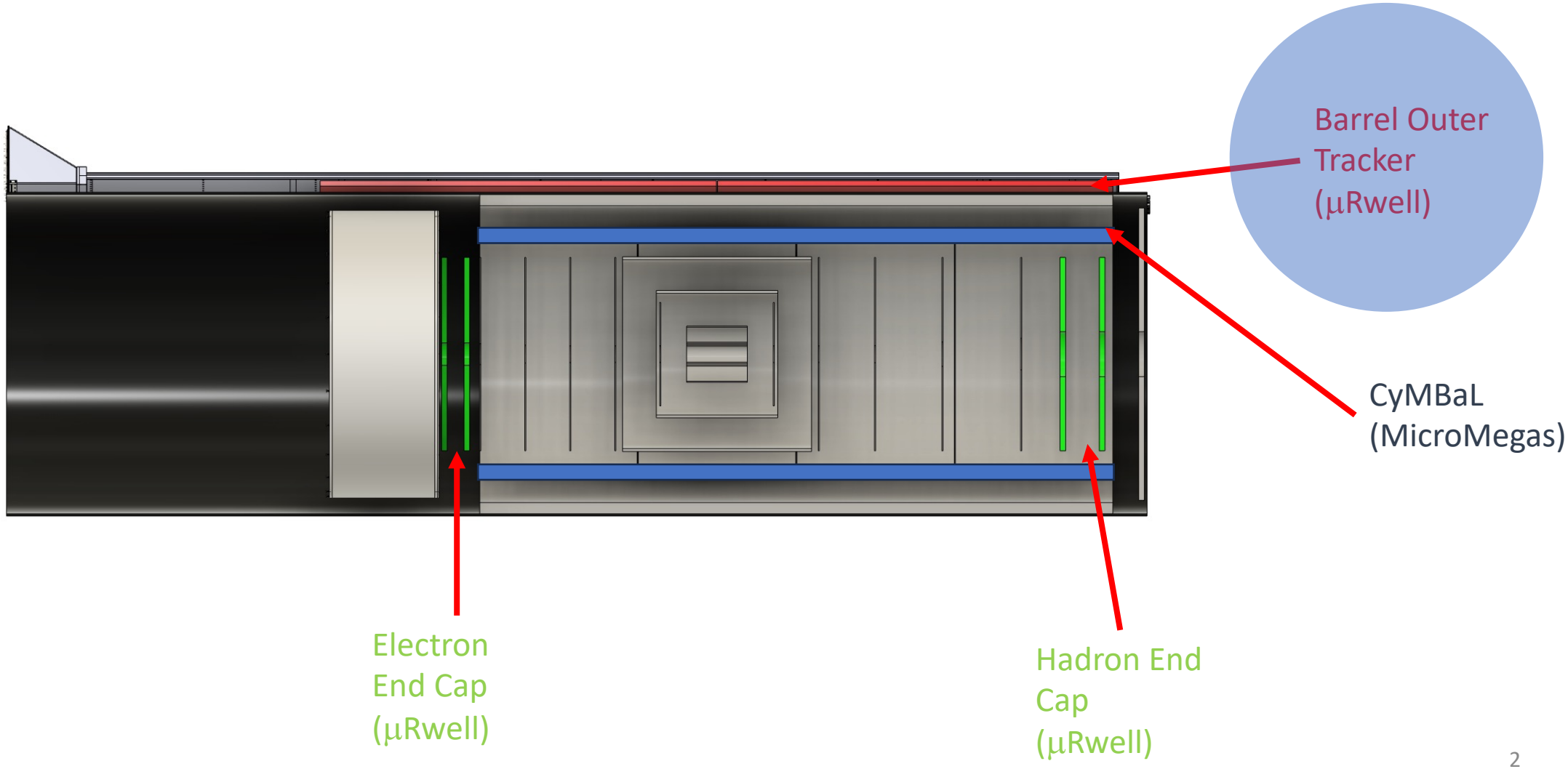
BOT and ECT (μRWELL detectors) Design and Integration

Seung Joon Lee (JLab)

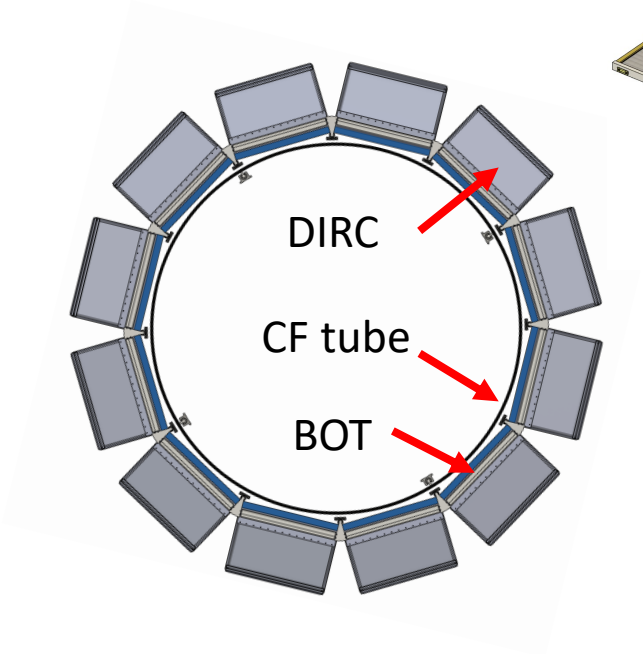
Summer 2024 Joint EICUG/ePIC Collaboration Meeting

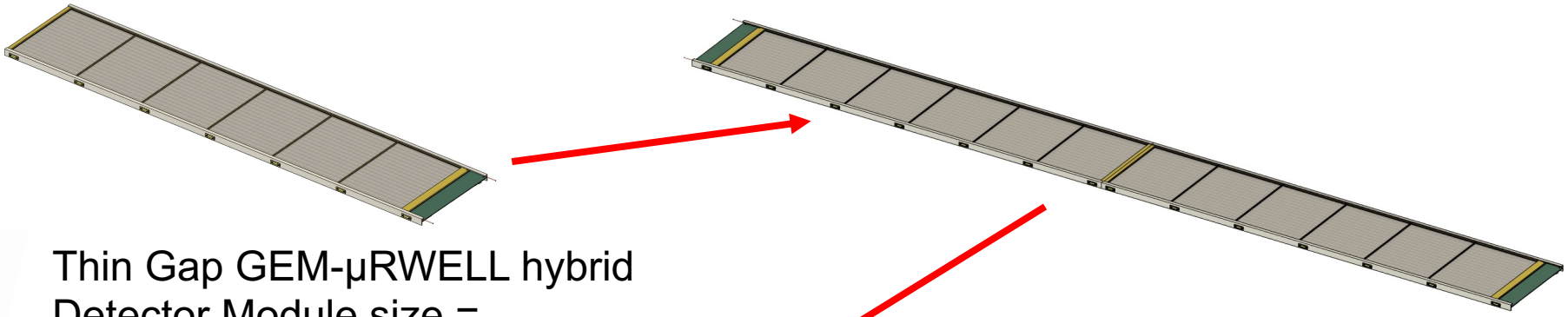
(Jul 22 – 27, 2024)

MPGD Detectors



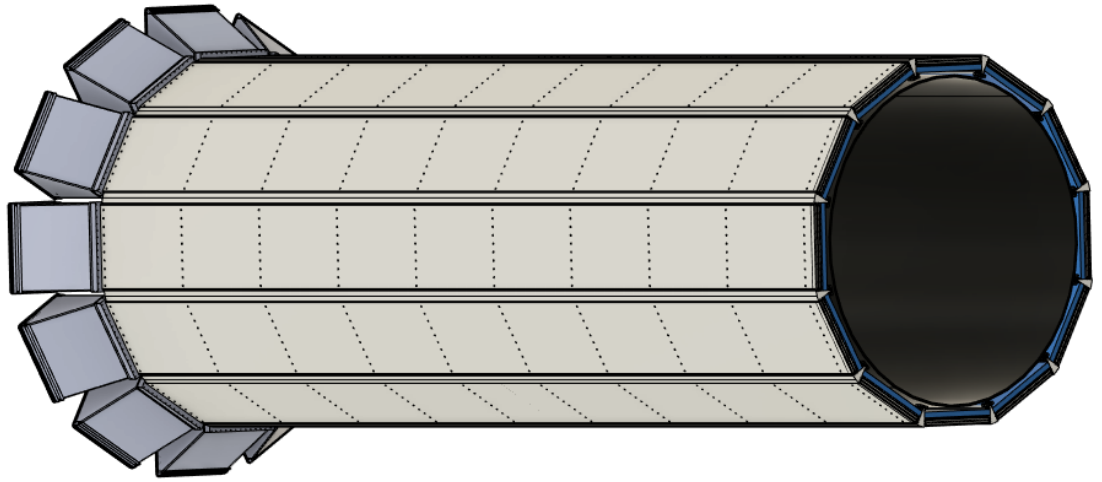
Barrel Outer Tracker (BOT)





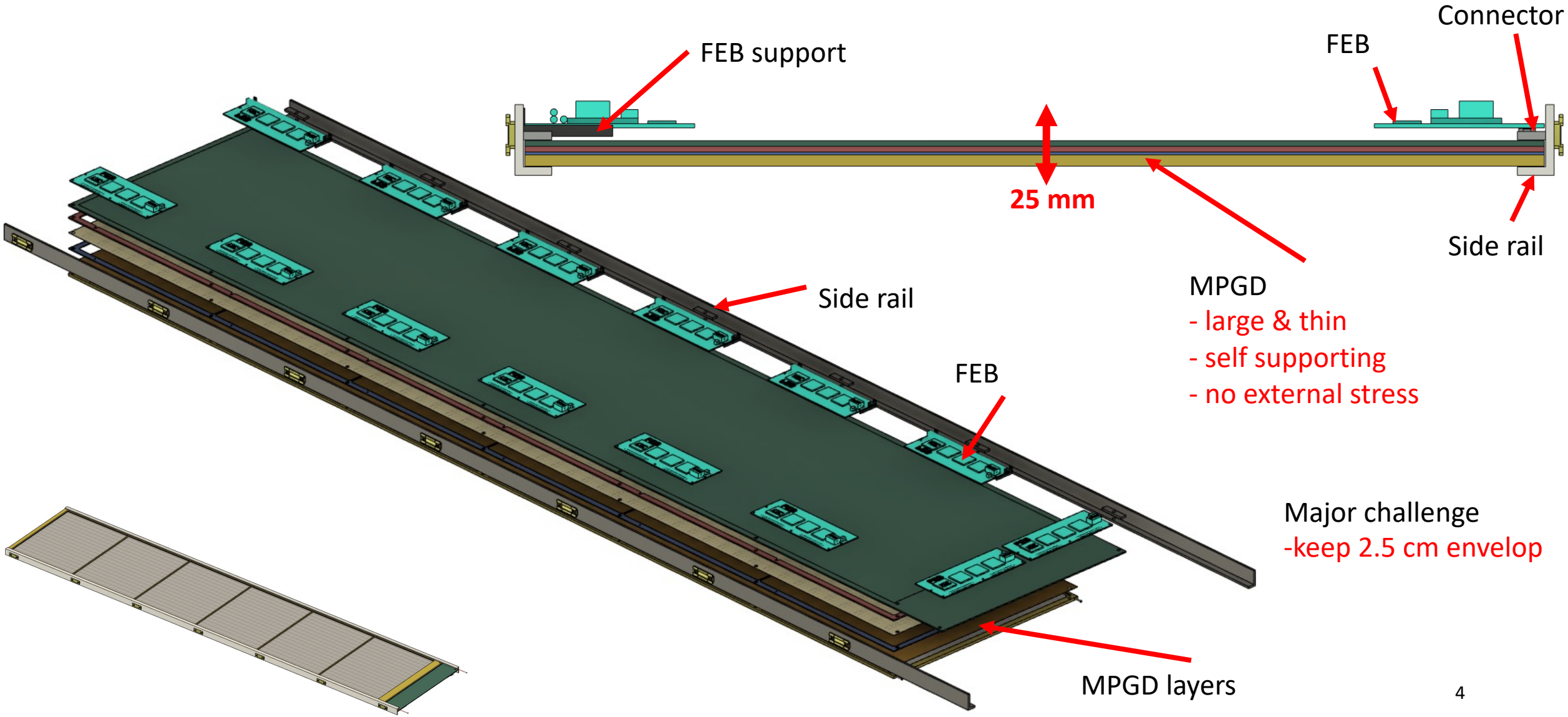
Thin Gap GEM-μRWELL hybrid
Detector Module size =
180 cm x 38 cm x 2.5 cm

2x Module for each sector
Mirroring position
Service area on each side

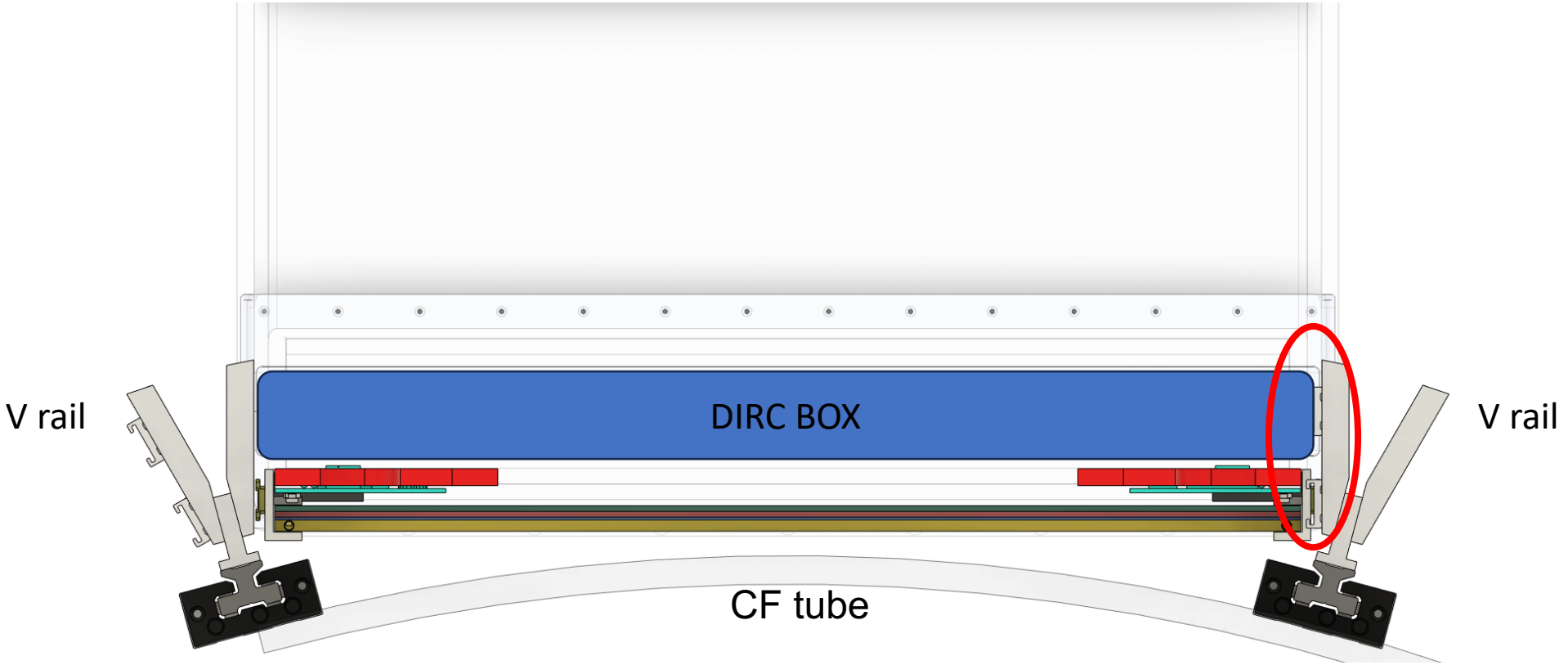


12x Sectors around the
CF tube with DIRC

Detector Structure



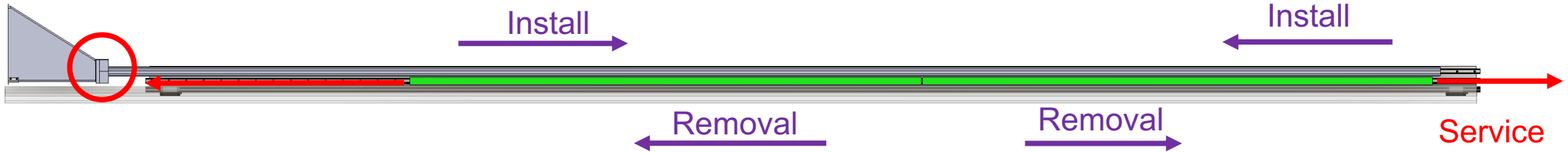
Integration (BOT)



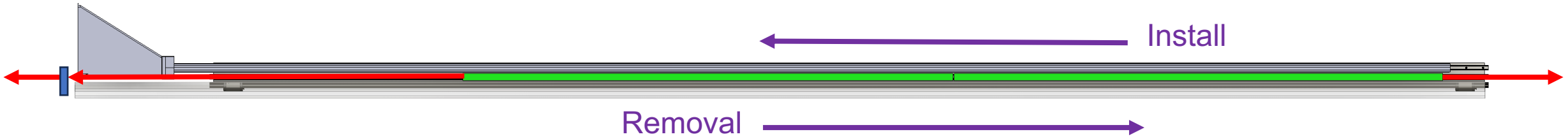
- V shape support has two Rails on each side for slide inserts from the DIRC and BOT
- BOT thickness is only 25 mm.
- 5 mm installation clearance on each side (DIRC, CF tube)
- Open box design: No space to make a box. Cooling may be required.

Service Issue (BOT)

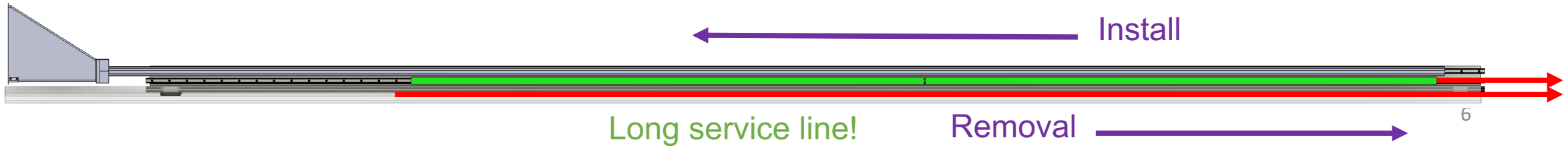
Initial Plan: Install/Removal/Service lines from Each Side - West side blocked by DIRC



Plan B: Service lines from Each Side / Install & Removal from East side – Patch panel on the west side

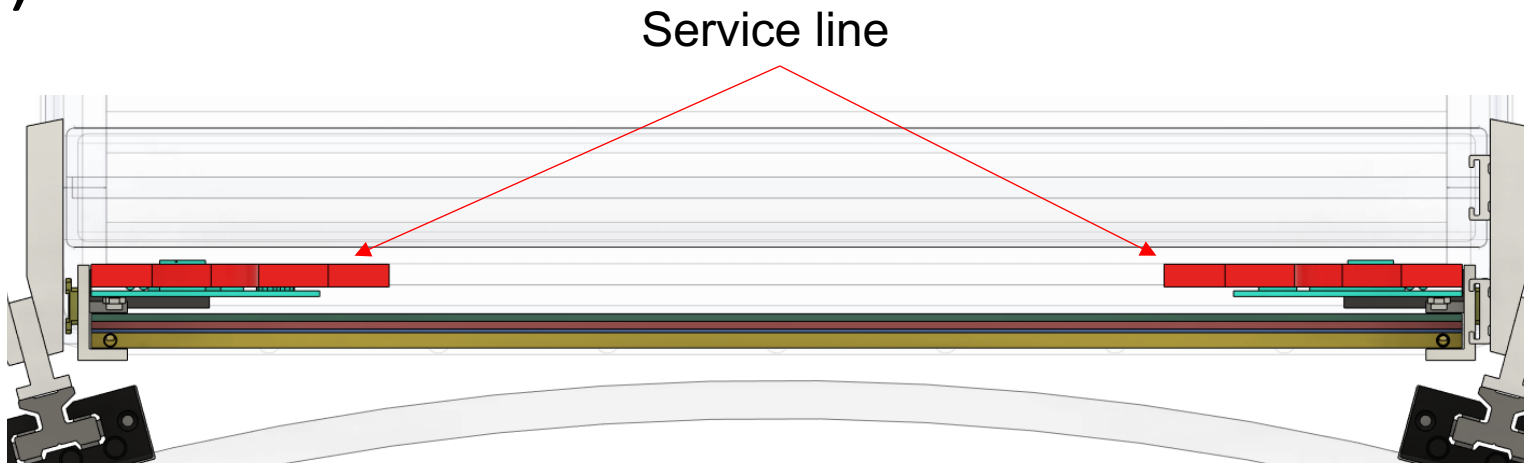


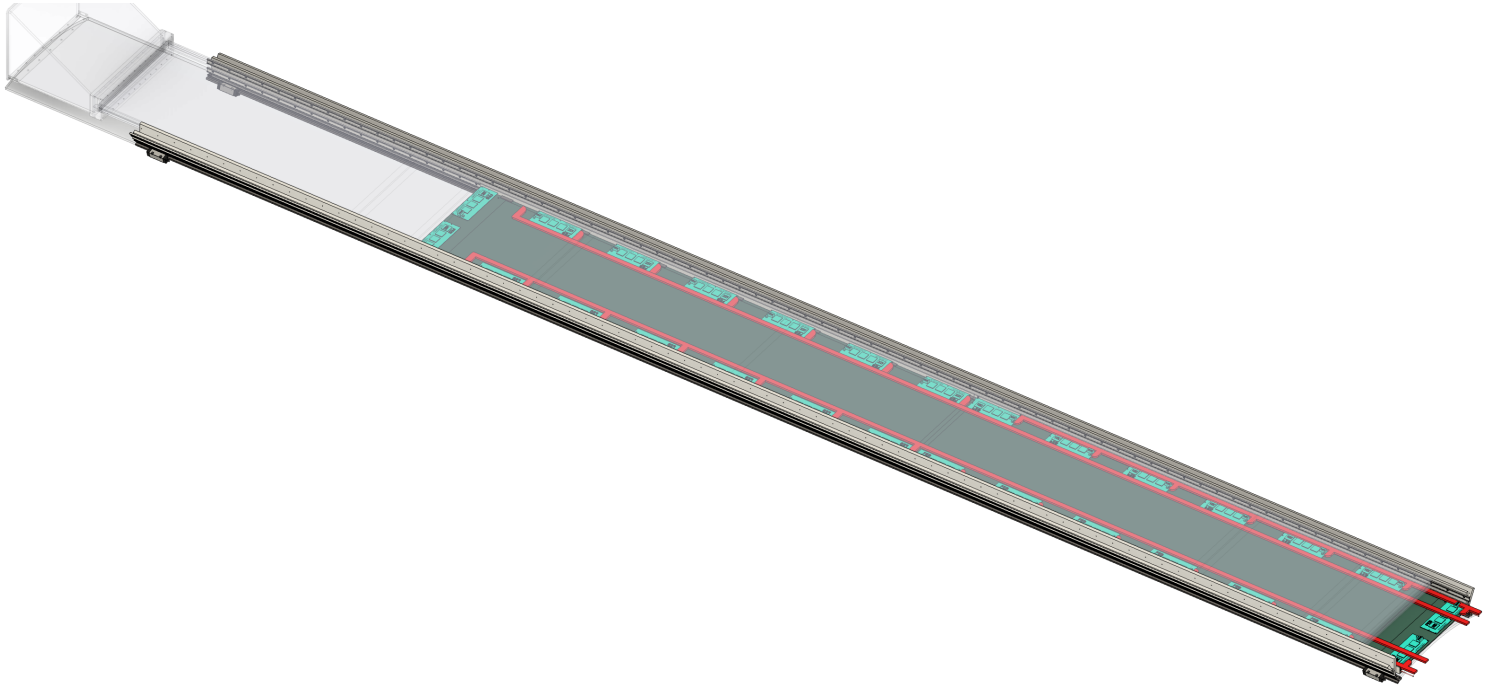
Current Plan: Service lines from East Side + Install & Removal from East side – Double up service line



Service Line (BOT)

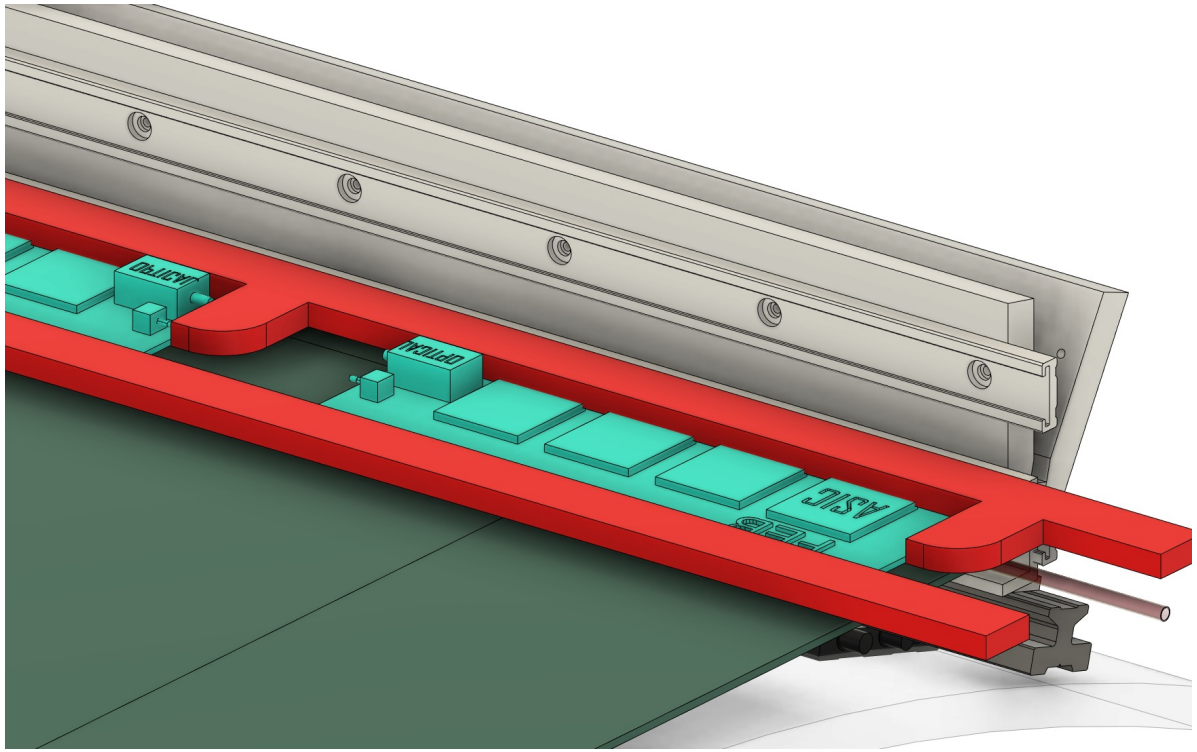
- Data Cable (optical)
- Low voltage
- High Voltage
- Gas (for MPGD)
- Gas/liquid (for cooling)
- Other sensors (temperature..)





- Liquid cooling is nearly impossible (space, weight)
- Service line should be supported by structure (no stress on MPGD)

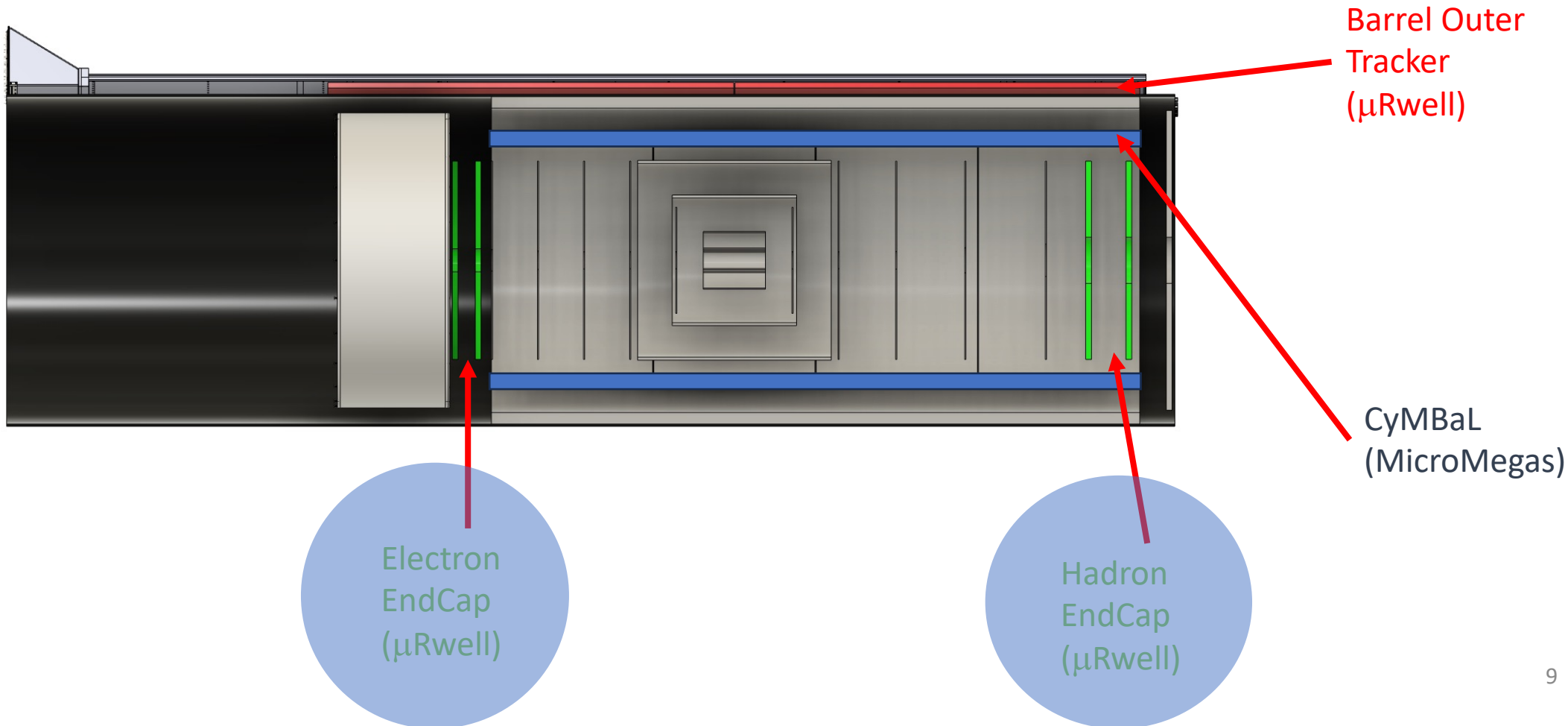
Service Line (BOT)



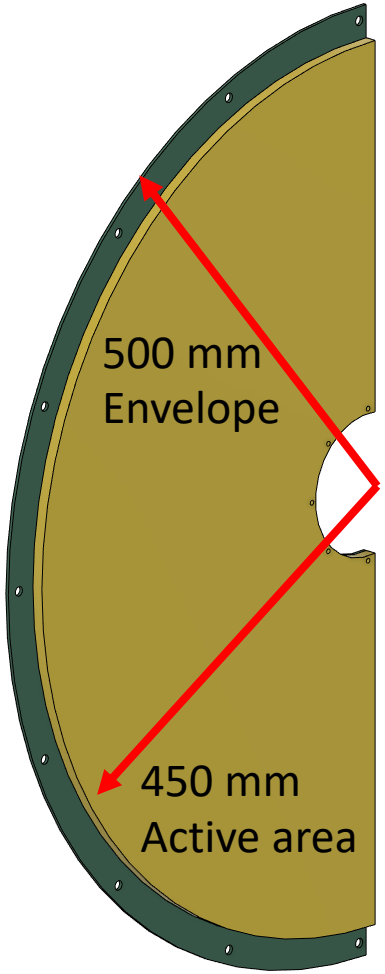
- Service line was doubled
- Not enough space for the 2nd service line on the side wall
- Extra support structure is required to support weight of 2nd service line
- Material budget increase
- Long data cable to RDO – copper may not be possible (current model: optical)
- Long cooling line (if required) -> open space air cooling

- No specification for FEB yet:
- size, weight, data cable, cooling
- modification expected as FEB comes out

MPGD Detectors - ECT

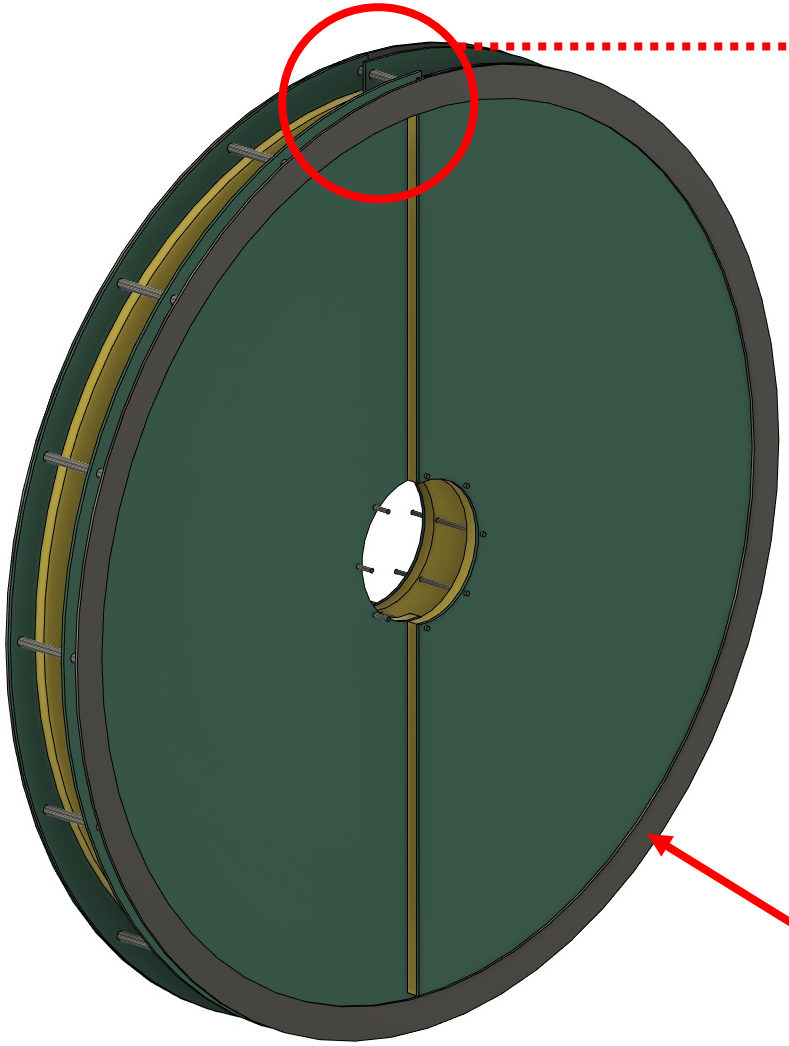


End Cap Tracker (ECT)



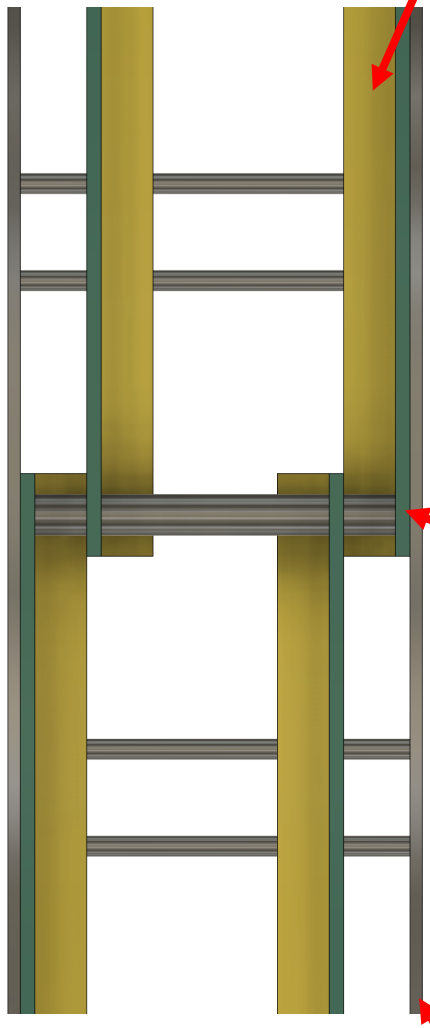
- Thin Gap μRWELL(BOT) or μTPC (1 ~ 3 cm thickness)
- Two full disc layers per ECT
- 2 half-disc modules for one layer
- 1 meter diameter
- **10 cm** spacing for Electron ECT
- 15 cm spacing for Hadron ECT
- ECT will be integrated into Inner Barrel rail

Current Design of ECT



Top view

Support
Frame



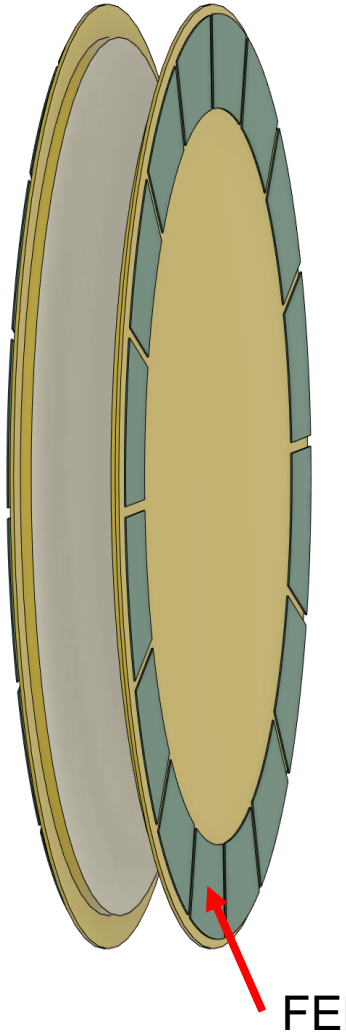
MPGD

Active Area Overlap
(10 mm)

10 cm for E-ECT

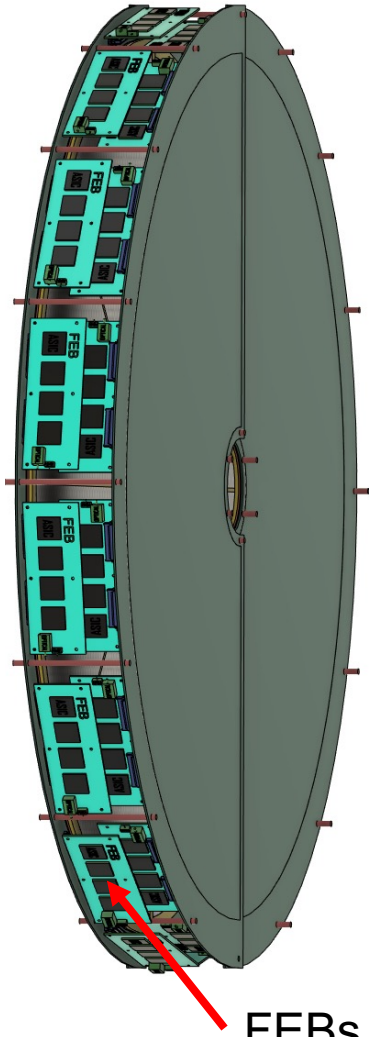
Support frame

FEB placement

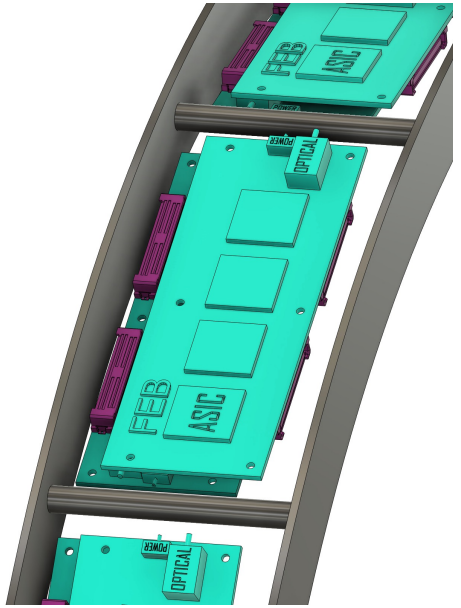


- FEBs are mounted back side of disc
- FEBs are in the active area
- 3~5 mm honeycomb structure in the disc to support weight
- Still requires connection between two full discs
- Disc spacing is not an issue

FEBs on the back side

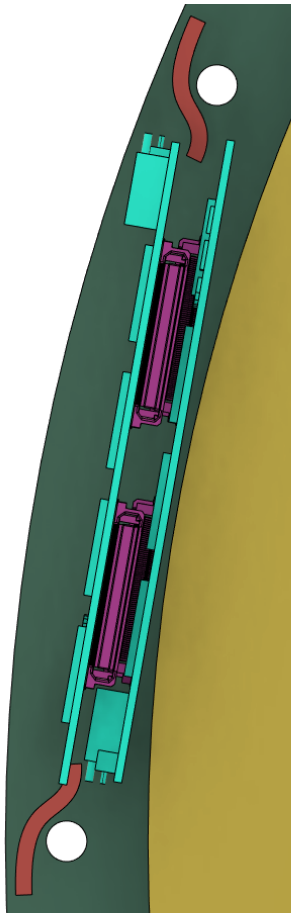


- FEBs are mounted 90^{o} to the detector
- FEBs are not in the active area
- Disc spacing is important to place many FEBs
- Requires external support frame

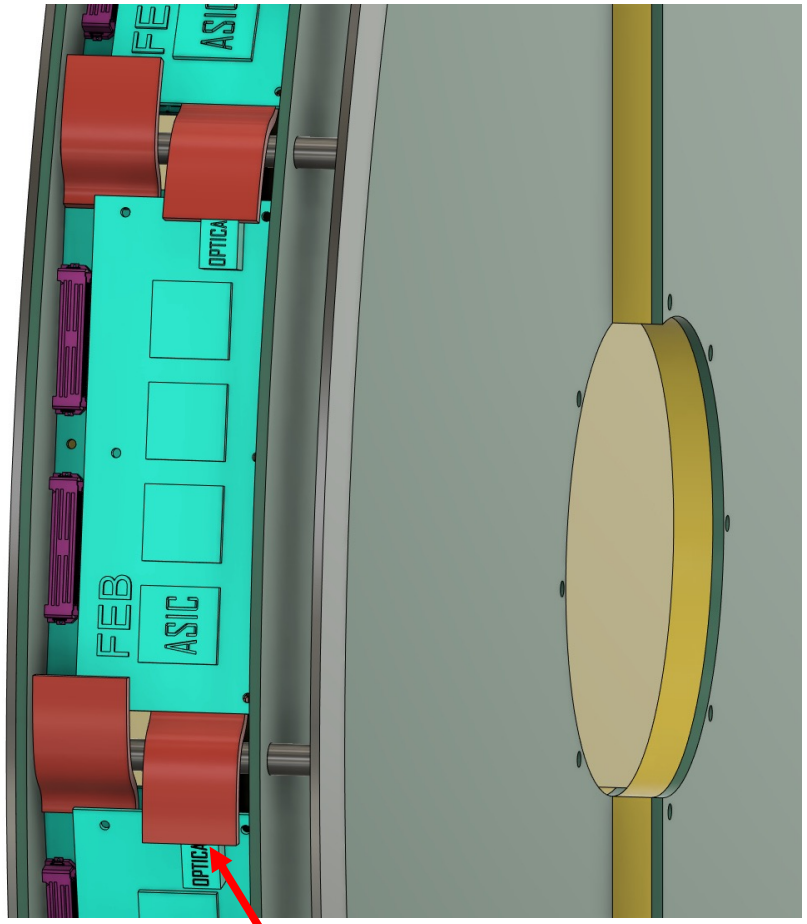


FEBs between discs

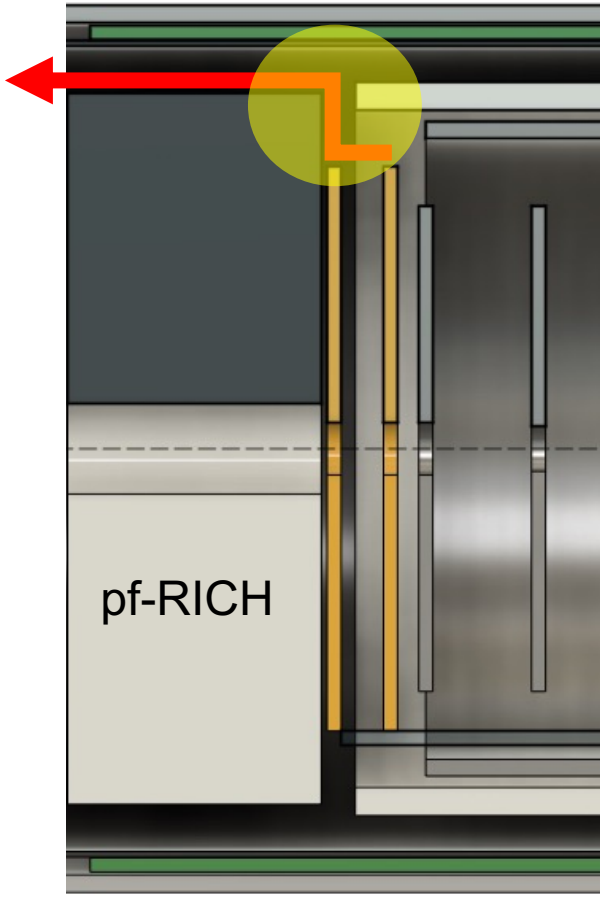
FEB and Service



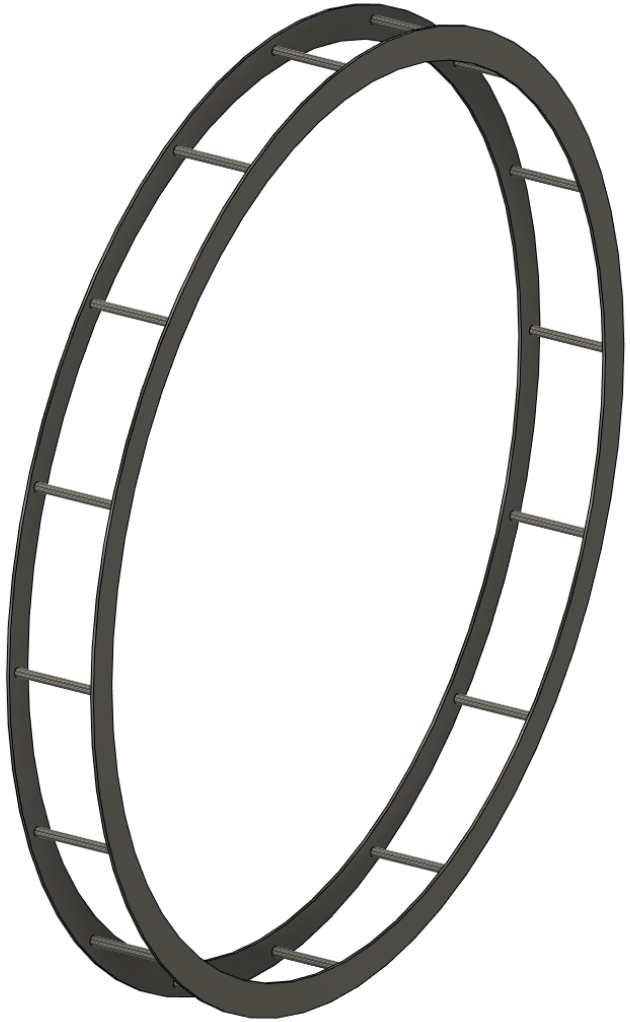
Front view without front disc
2 FEBs



Service line for FEBs, Gas, HV



Support Structure (ECT)



- Double rim structure
- Al or CF
- Outside of Active Area
- Support MPGD discs
- Support FEBs
- Support service line

- Easy to design/modify linkage to the IB rail

Summary

- Both BOT and ECT design is still underway

- BOT service plan requires extra support structure
- More modification is expected by FEB specification

- ECT has a tight space for FEB vertical mount
- ECT will use extra rim support that handles detector, services, and integration into IB

Backup Slides

Service Requirement (BOT & ECT)

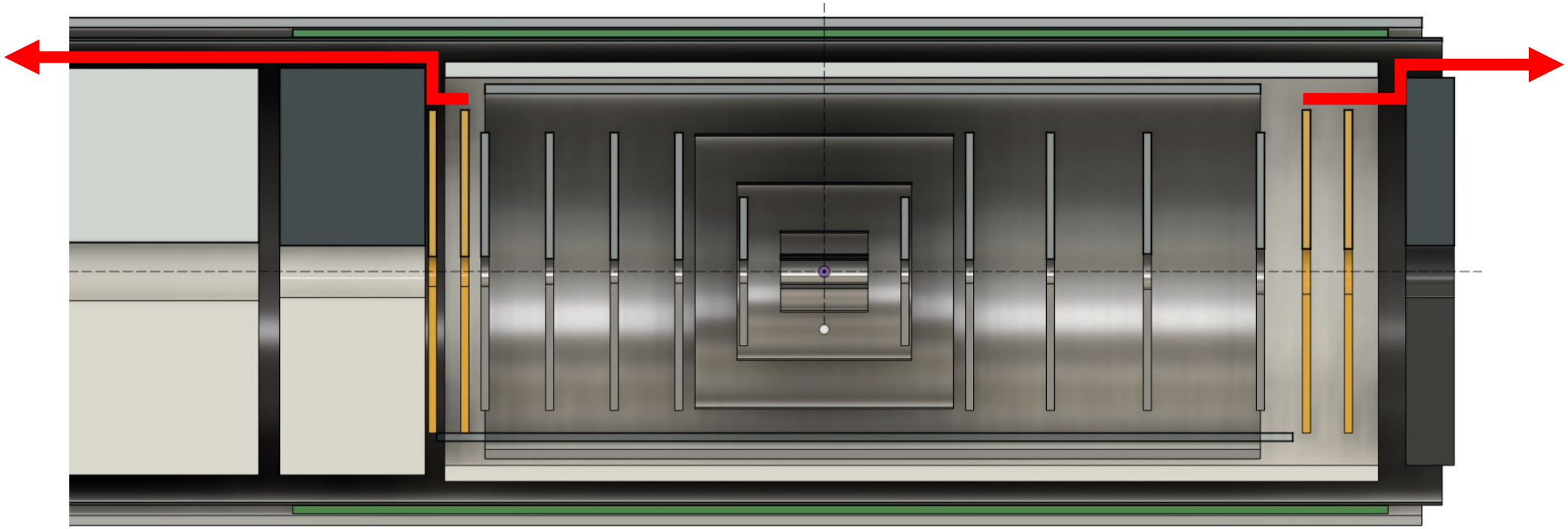
- BOT (minimum, per sector)
- Each Module has 7 FEBs on each side (14 FEBs per module)
- Each sector has 2 modules
- Total (28 FEBs) per sector :
- 28 Data cable (Optical Fiber)
- 28 Low voltage for FEB
- 2 High Voltages
- 4 Gas lines (for MPGD chamber)
- Cooling lines (liquid/gas)

- ECT (minimum, per ECT)
- Each 1/2-disc has 12 FEBs

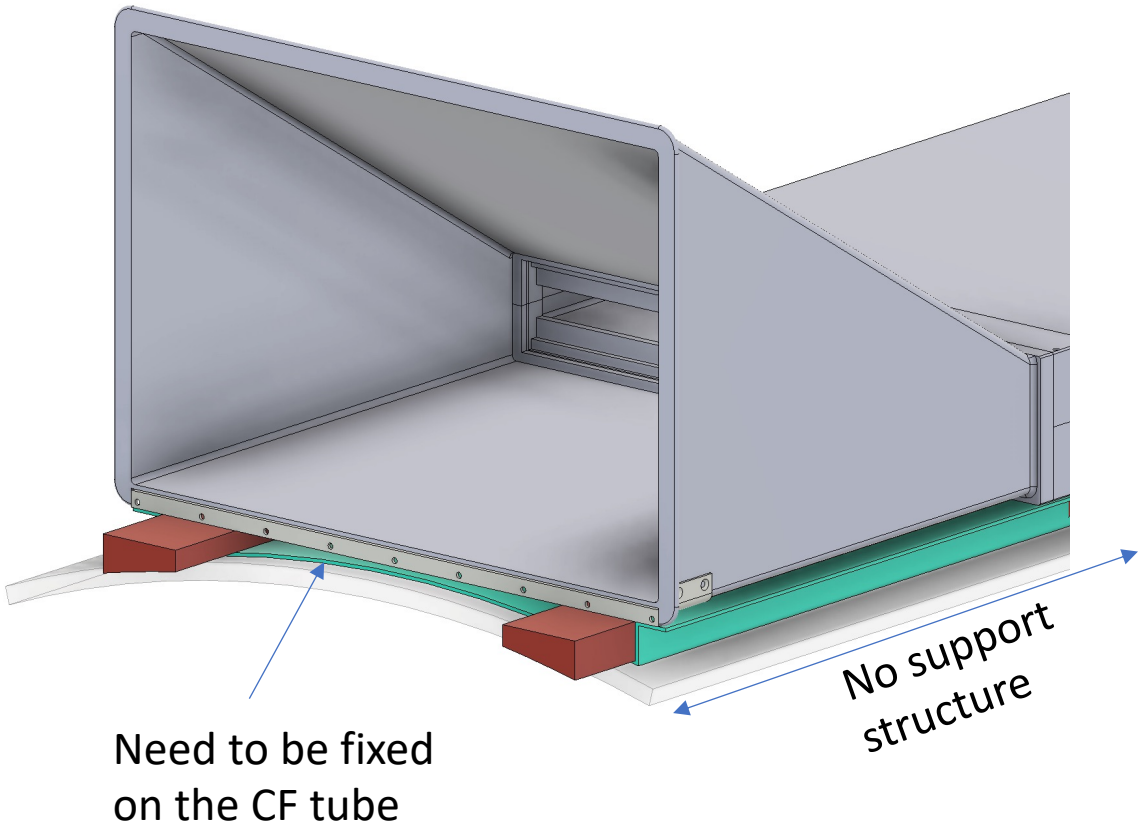
(48 FEBs per ECT)

- 48 Data cable (Optical Fiber)
- 48 Low voltage for FEB
- 4 High Voltages
- 8 Gas lines (for MPGD chamber)
- Cooling lines (liquid/gas)

Service line

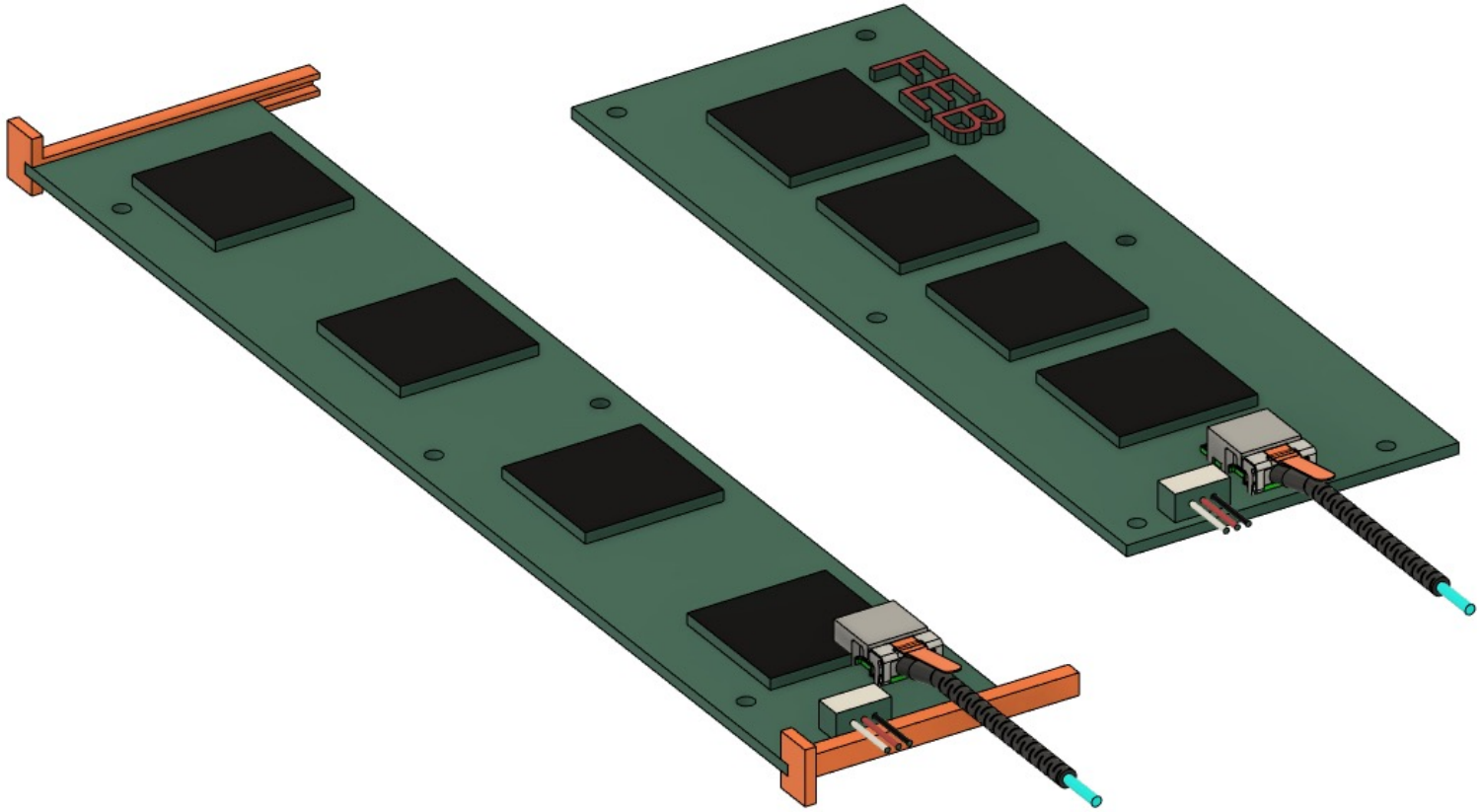


Service Tray- plan B

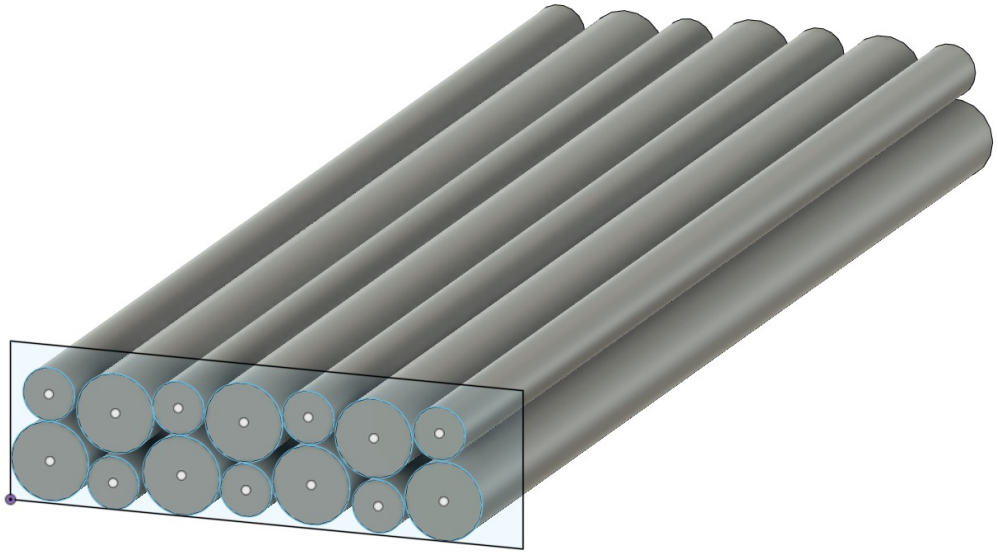


- Service tray will guide all service line to outside (to RDO) while not interfering with DIRC box.
- Service tray must be fixed onto CF tube since there is no support structure after the end of extension rail (will be discussed later)

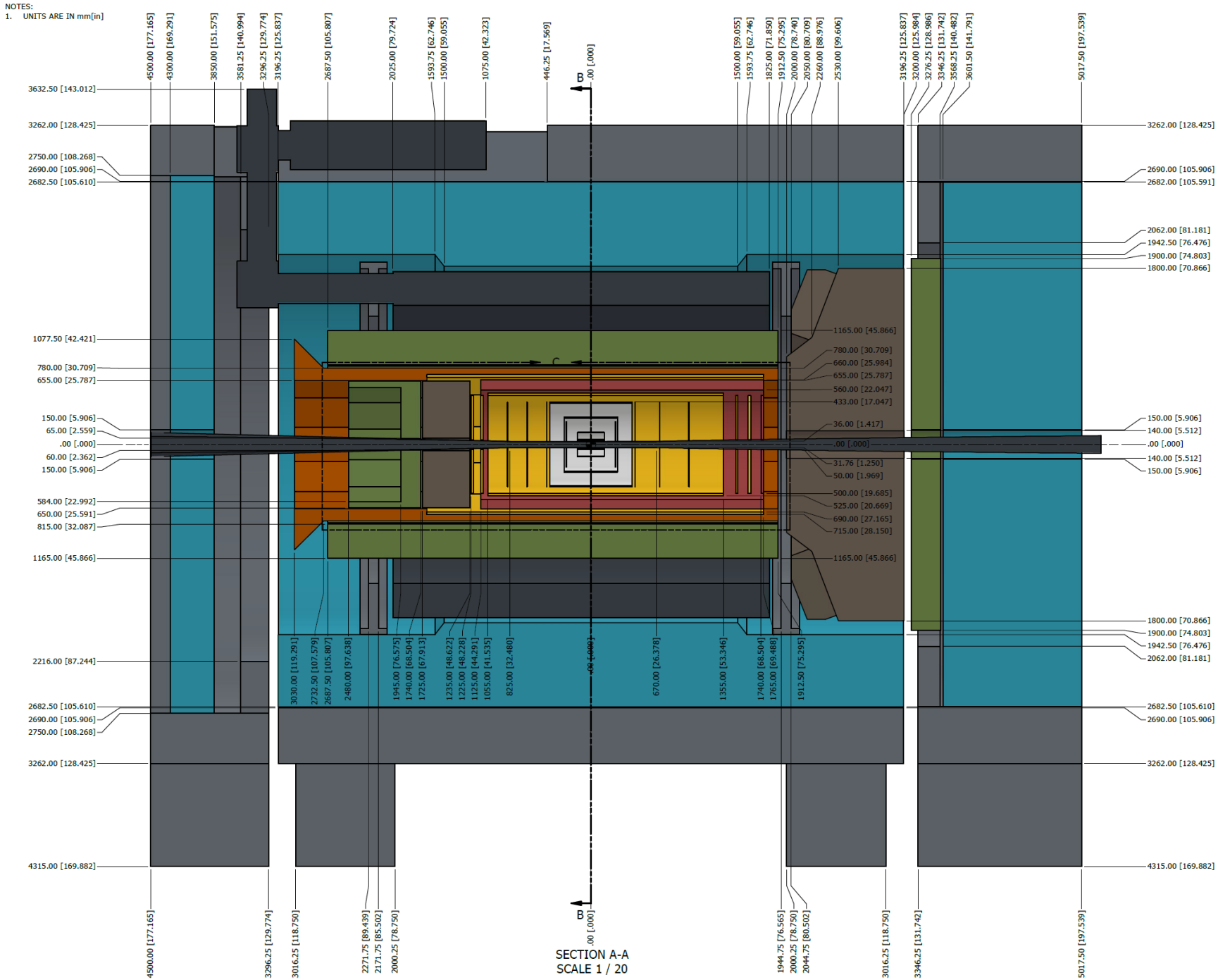
FEB comparison BOT



BOT service line (6 x 20 mm)



7 Optical
+ 7 LV


NOTES:
1. UNITS ARE IN mm[in]
SECTION A-A
SCALE 1 / 20