FEB Form Factor constraints for BOT

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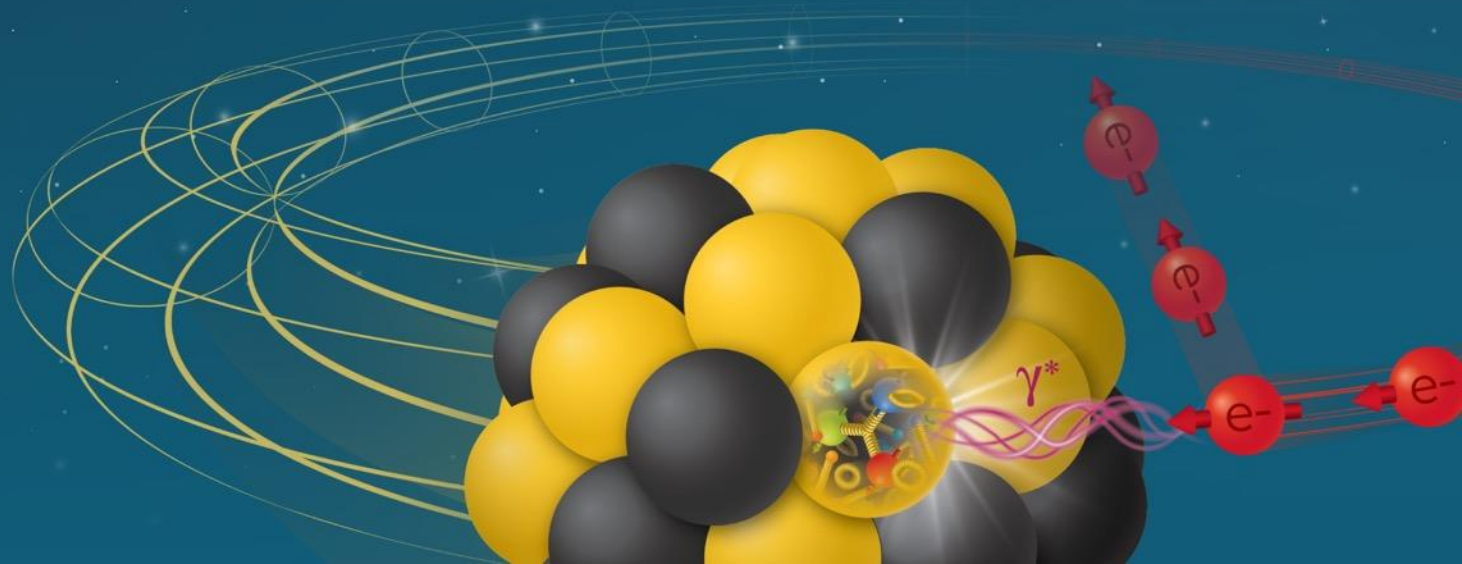
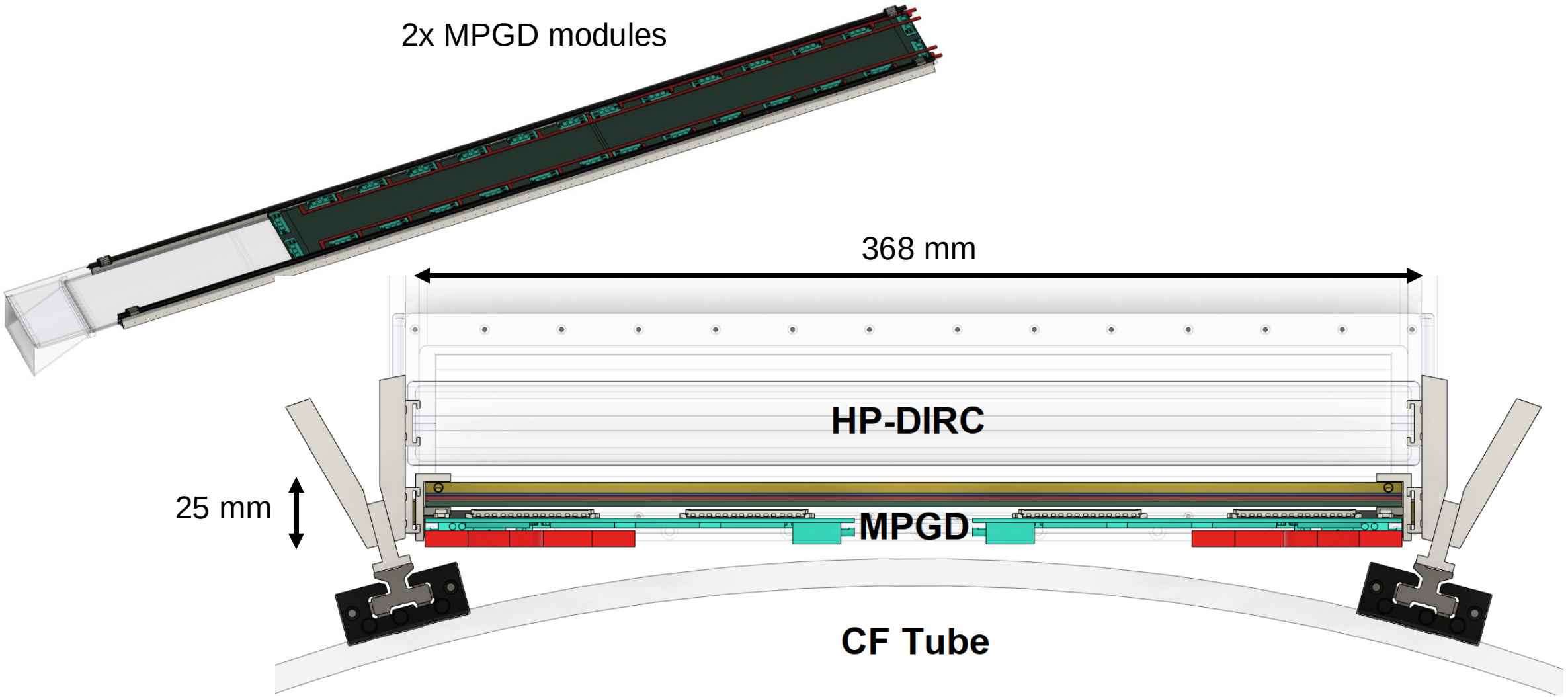


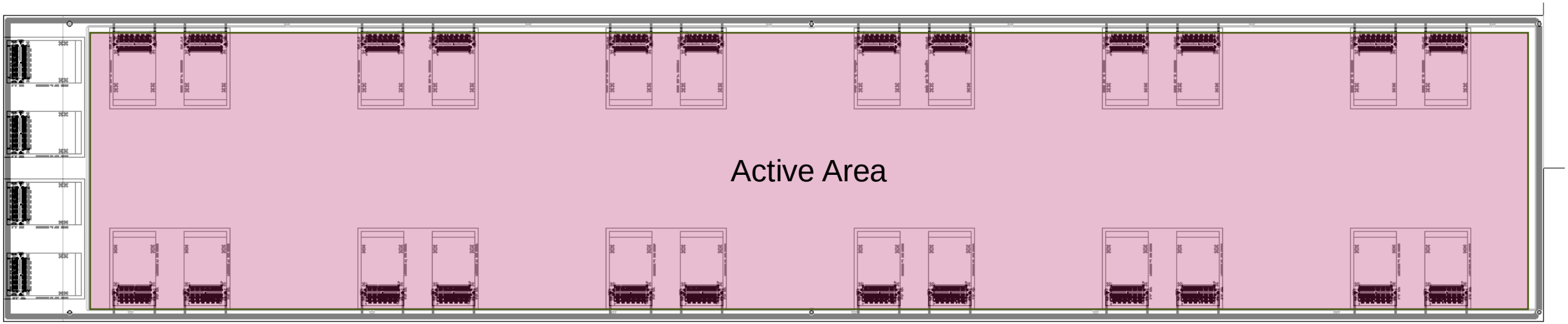
ePIC Collaboration Meeting
Frascati, Italy
Jan 20-24, 2025

Electron-Ion Collider

BOT overview



BOT FEB layout (test article)

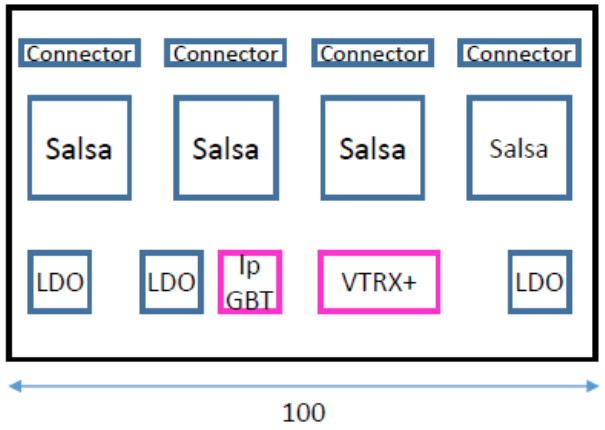


- uRWell PCB size: 36 cm x 180 cm
- Active Area: 33 cm x 170 cm (~15 mm frame width)
- 14 FEBs
- Each FEB has 2 x 144 Hirose FX10 connector (total 256 Channel, 4 x Salsa)
- Each FEB requires 1x Power for DC/DC converter, 1x VTRX board
- Each FEB requires 1xOptical Fiber Connector, 1x Power cable, and Cooling

Update from Salsa - CyMBaL

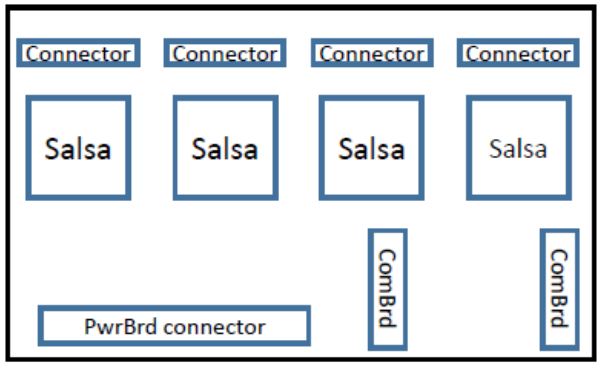
Illustration of CyMBaL lpGBT-based FEB organization options

- Single board

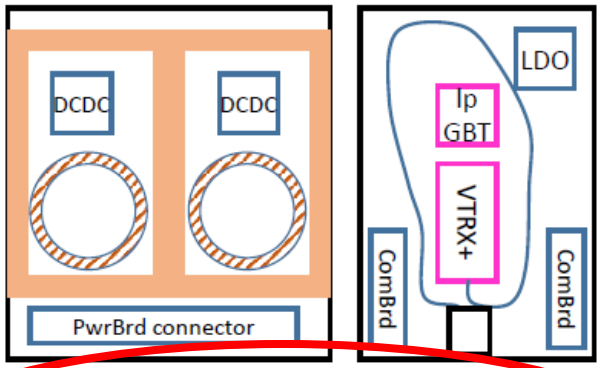


→ Complex high density high speed
→ MPGD-specific form factor

Mezzanine approach

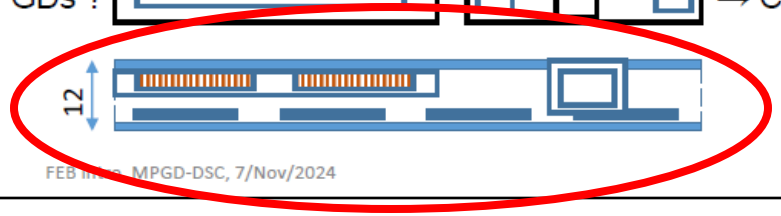


→ FEB mother-board
→ Low density low speed
→ MPGD-specific form factor



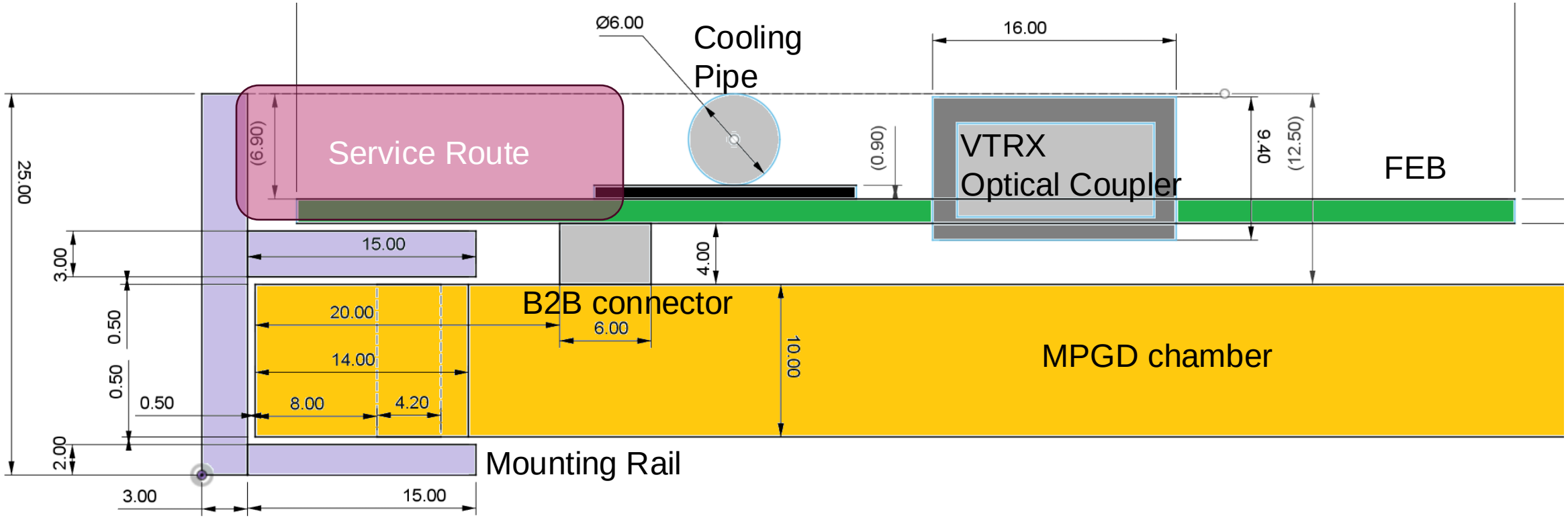
→ DC/DC mezzanine
→ 2 T tolerant low EMI
→ Common to all MPGDs ?

→ Communication mezzanine
→ high density high speed
→ Common to all MPGDs ?

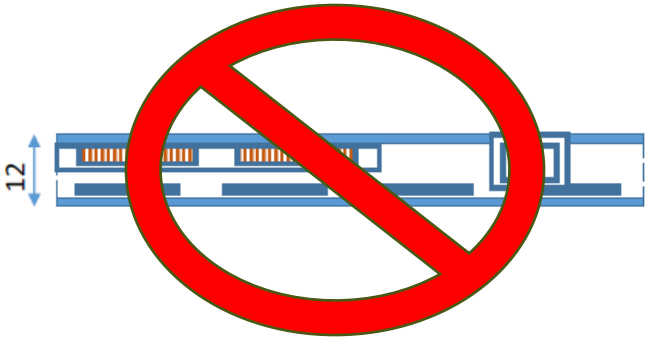


Can We?

BOT side view



- Only 12 mm space for FEBs and Services
- Stacking multiple boards is not feasible at this point



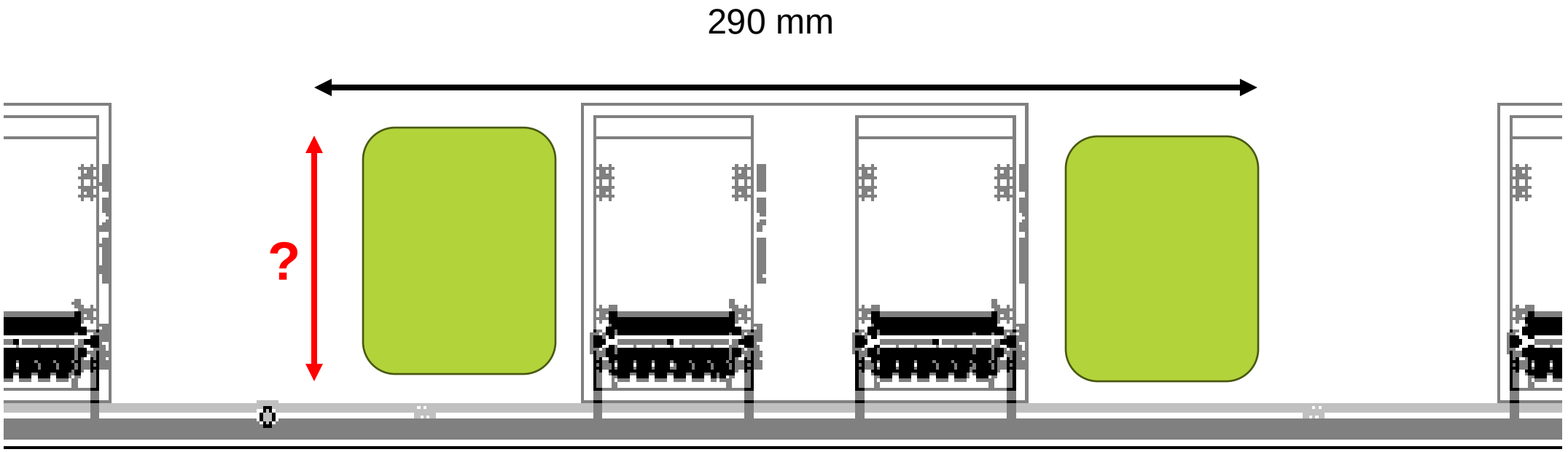
Decision factor

1. Fit in the detector envelope (25 mm height)

2. Meet requirements
- Each FEB has 2 x 144 Hirose FX10 connector (total 256 Channel, 4 x Salsa)
- Each FEB requires 1x Power for DC/DC converter, 1x VTRX board
- Each FEB requires 1xOptical Fiber Connector, 1x Power cable, and Cooling

3. Move everything toward side mount rail
- minimize material in active area
- minimize mechanical stress on MPGD chamber

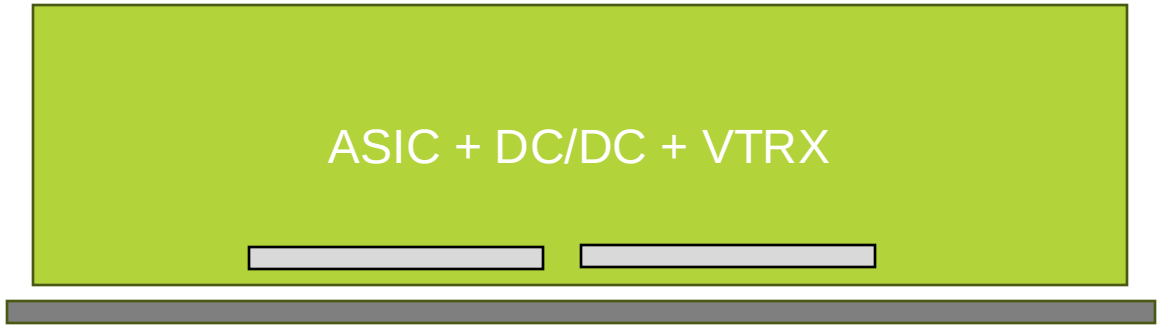
FEB size & location



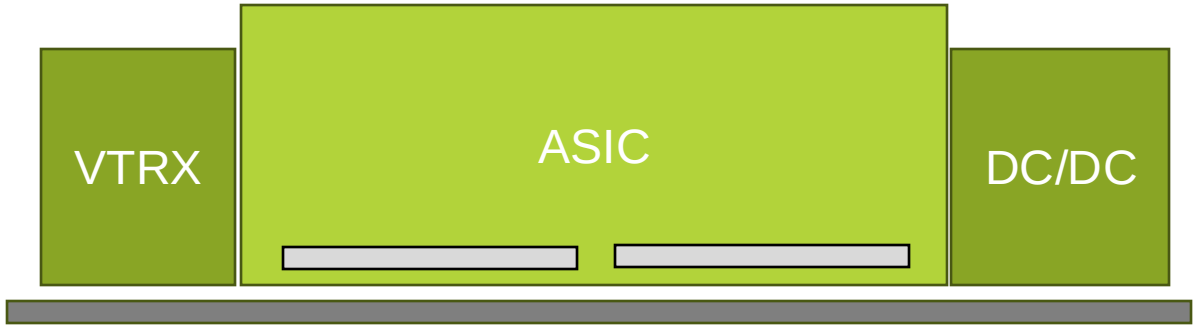
- BOT has space on each side of FEBs
- Maximum width of FEB (with DC/DC and VTRX) can be 290 mm
- Minimize height for material in the Active Area (? < 40 mm)

FEB option

All-in-one



Modular



- Everything in a singe board
- Mechanically more stable
- Efficient spacing (less connectors)
- Hard to modify later
- Replacement is not efficient

- Modular design: sidecars
- Mechanically less stable
- More B2B connectors
- Can be modified individually
- Can be replaced individually

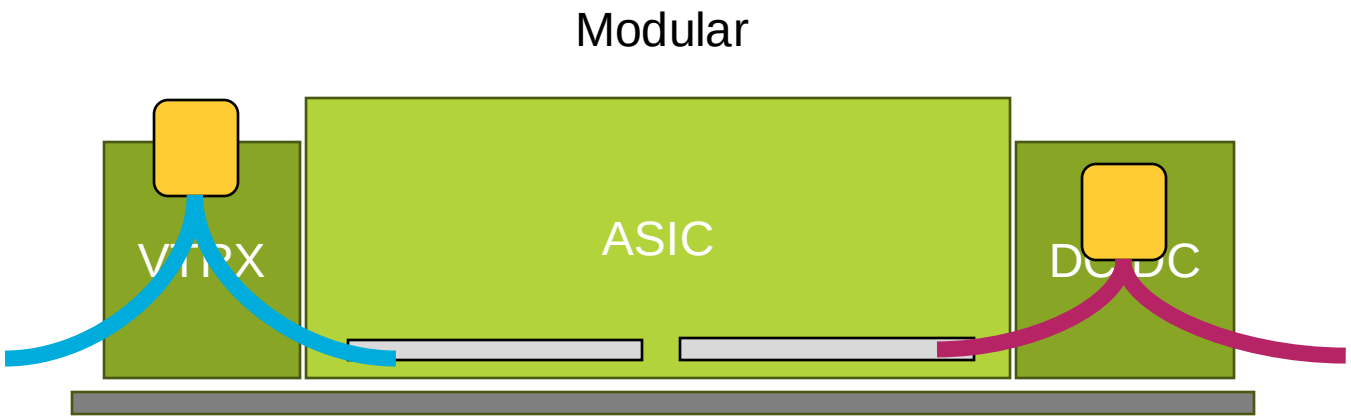
Decision is not made yet

Summary

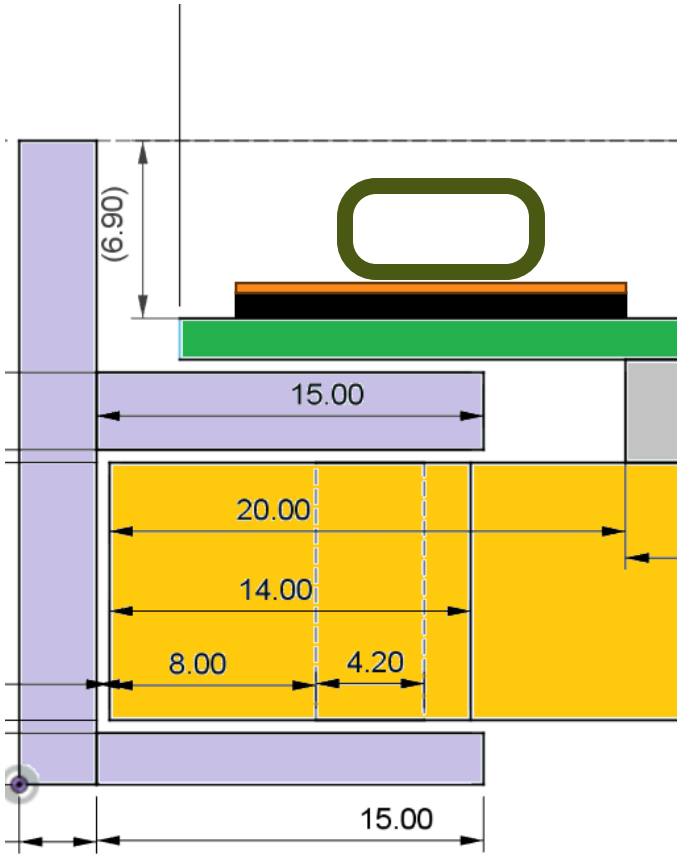
- FEB design is required to have single layer
- FEB design is required to have long and narrow shape
- All-in-one / Modular design will be decided later
- More details will be discussed along with Salsa development

? Question ?

Backups

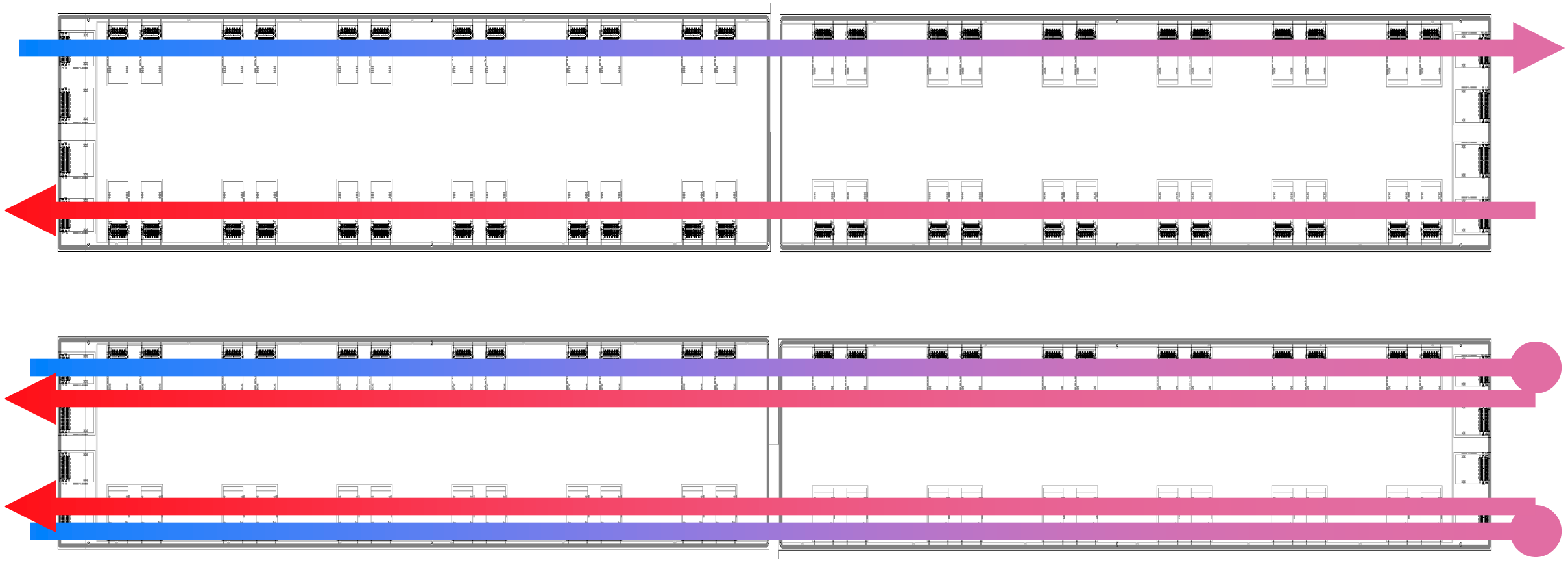


Design for bi-directional service

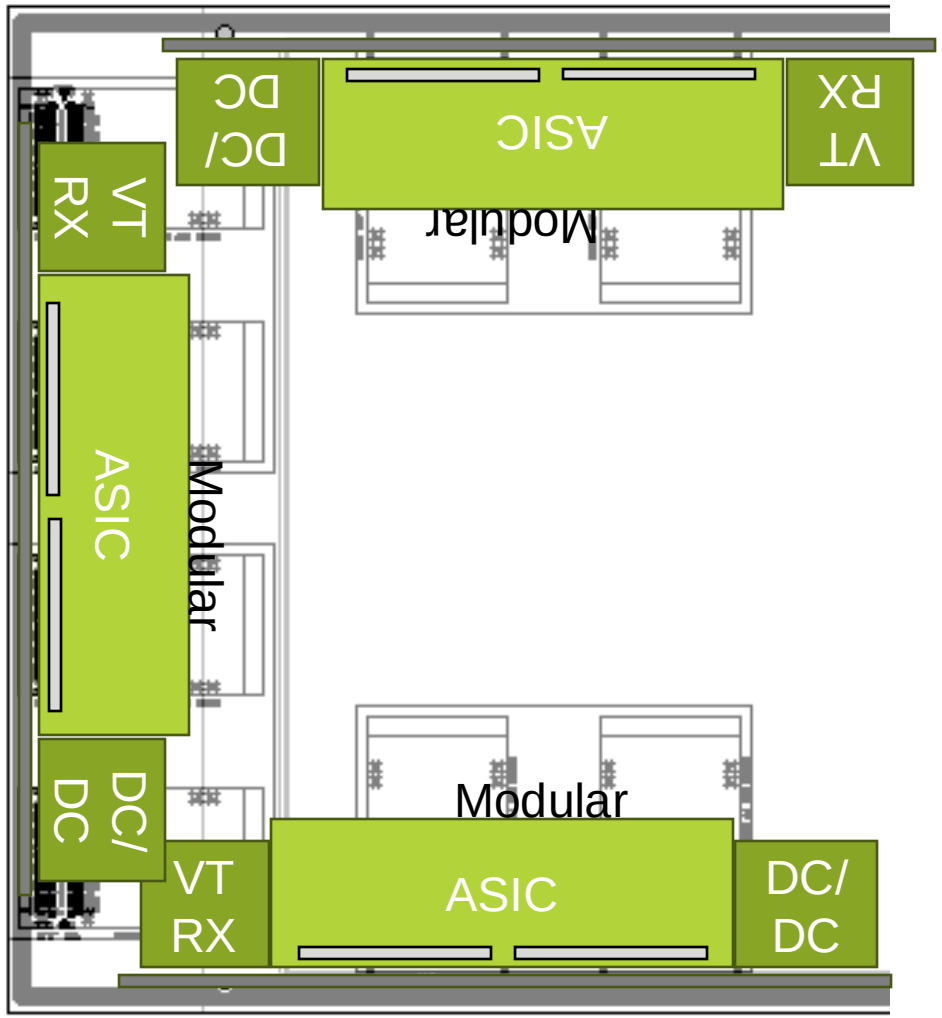


- Rectangular pipe?

Cooling line



Service area



- If space is limited on the MPGD service area…
- Reduced x-y strip for end-side
- 2x FEB => 1x FEB