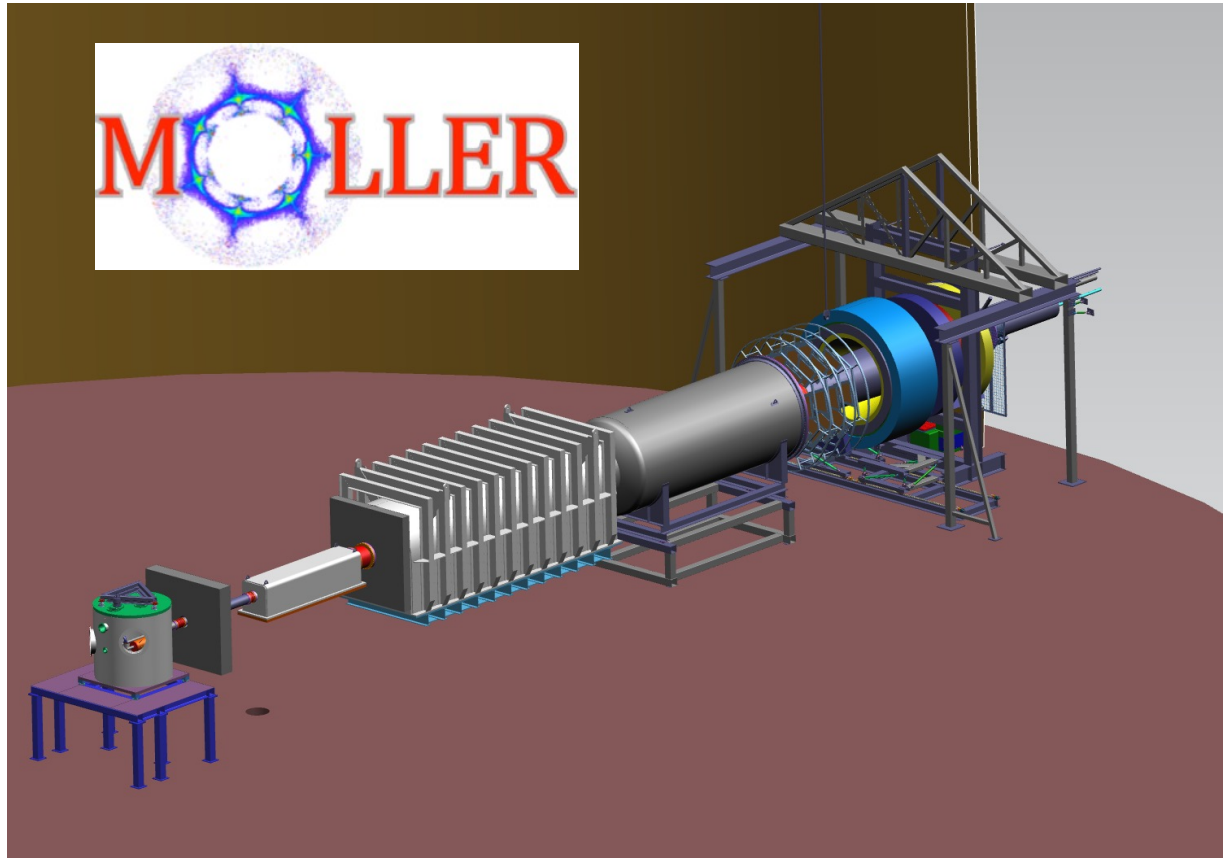
Main Detector cabling

Dustin McNulty – Idaho State University



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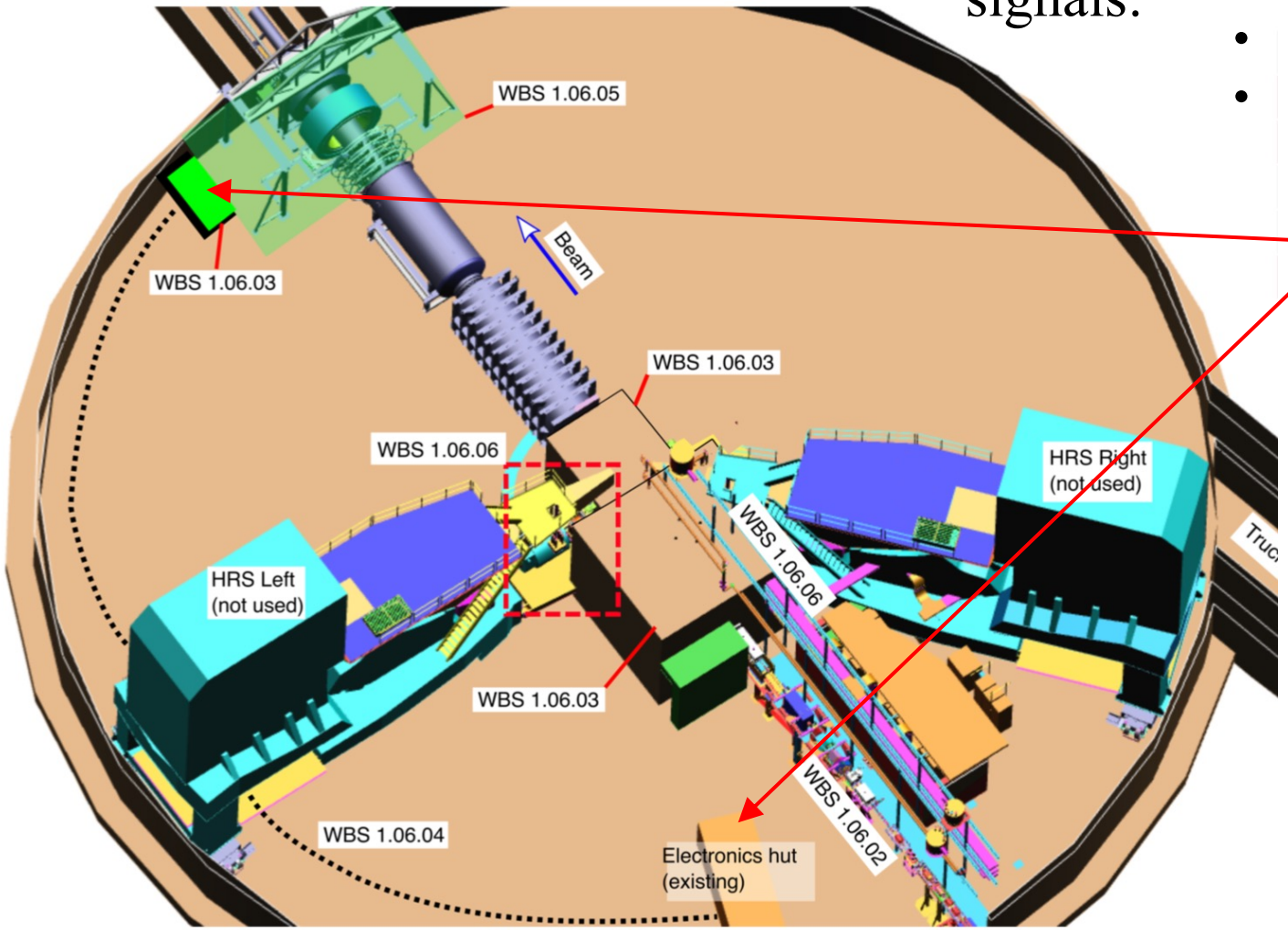
Detector Cabling

MOLLER Hall Layout



--400 (300) channels integration (counting) mode signals:

- 224 main detector channels
- 28 SM channels, 14 pion, 8 SAM, LAMs, DBMs, US and DS scanners

- Two electronics huts – one downstream and one upstream; we only use US hut
- ~50+(?) ft runs from detector patch panels to floor patch panels
  --All signals go to electronics or power supplies in the US hut
- 320 ft runs between floor PP and US hut

--HV (Radiall BB's) and LV(18 AWG)

- For powering PMT, divider relay, and pre-amplifier
- And for switching between dividers (high and low gain) and preamp settings

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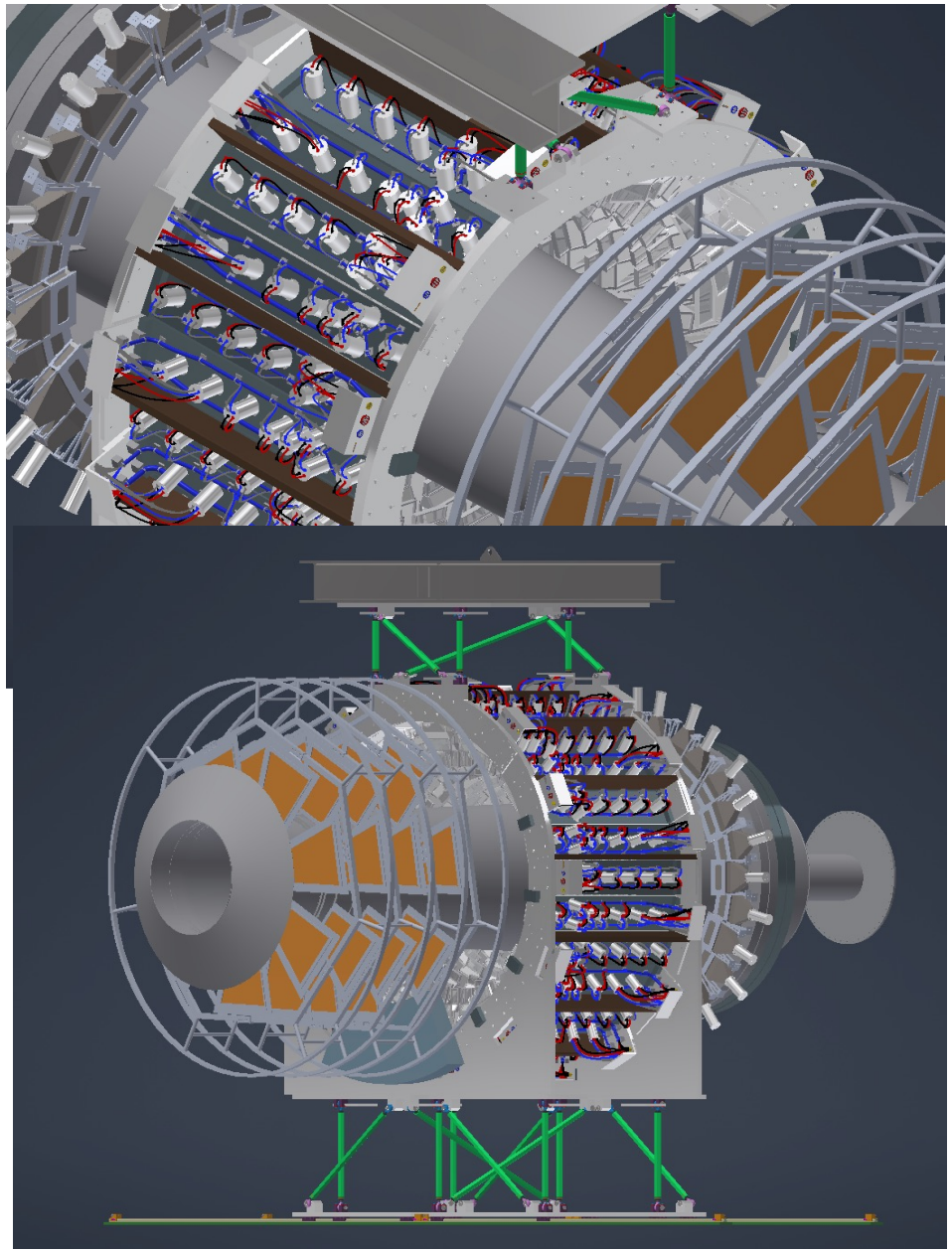
Signal breaks/patch panels



Integration mode signals

--Two patch panels for 400 det channels: one near detectors and other in US hut

If pre-amp is integrated into PMT enclosure (for main dets):

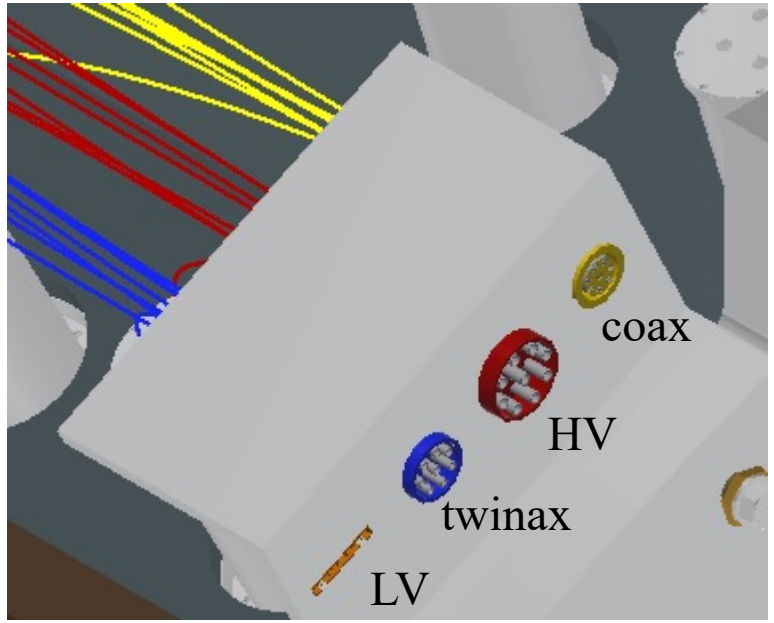
--25 m long, 9 ch high density twinax cable from each 1/28 segment patch panel to patch panels on floor near the detectors
--then use 100 m cables from here to US hut patch panels (RG-108 twinax)
--15 m cable from US hut patch panel to integrating ADC (twinax)

Counting mode signals

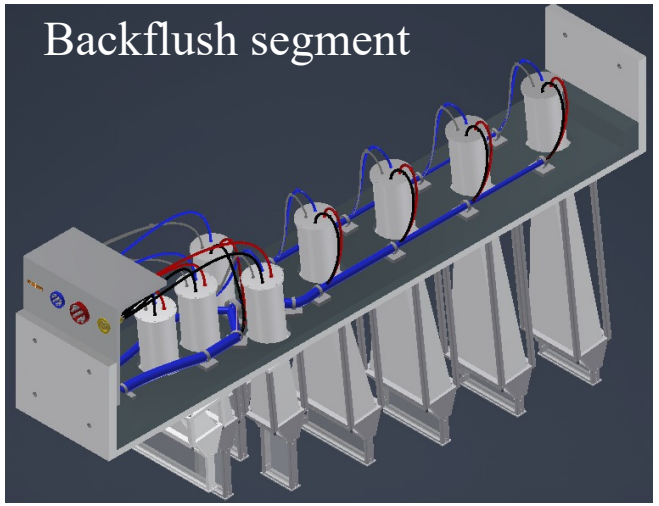
--Two patch panels for 302 det channels: one near detectors and other in US bunker

--25 m long, 9 ch high density coax cable from each 1/28 segment patch panel to the patch panel on floor near the detectors
--then use 100 m cables (RG58) between floor and US hut patch panels
--15 m cables from US hut patch panel to fastAmp and then from fastAmp to flash ADC (RG-58)

1/28 Segment Patch Panel



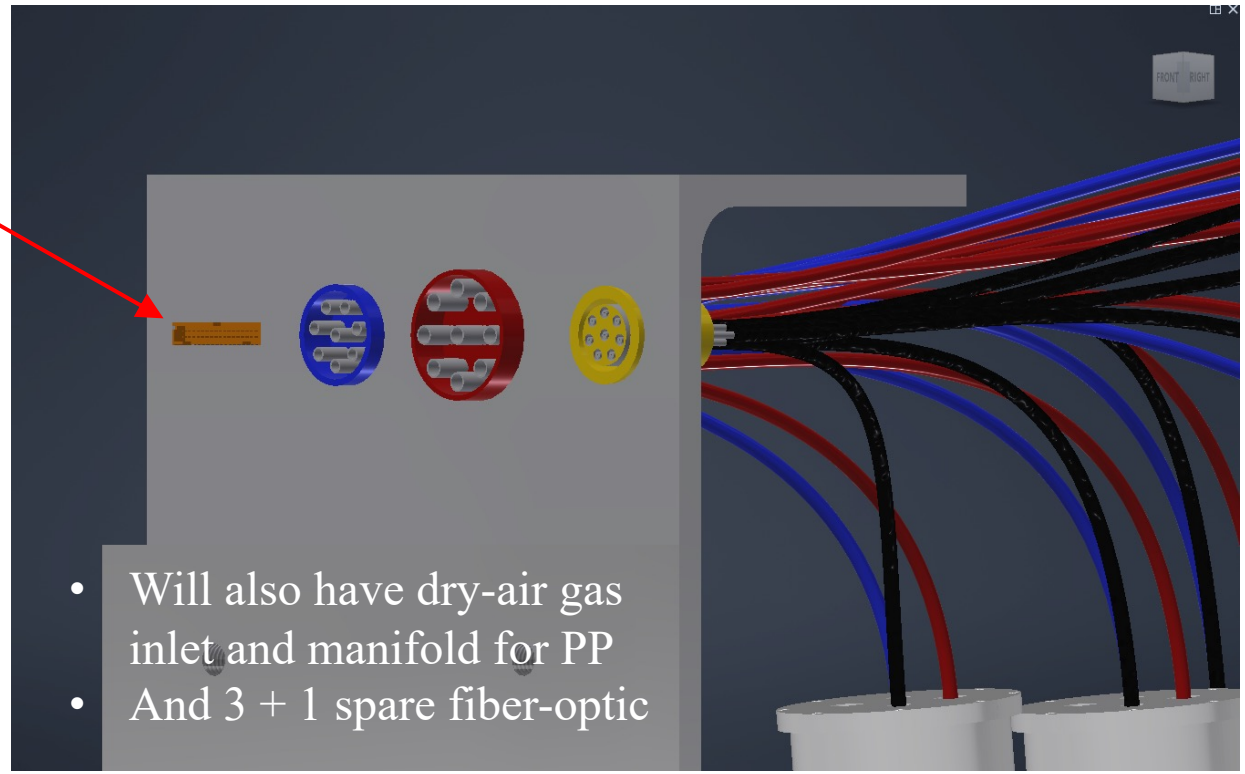
There are 8 detectors per segment



Each segment's patch panel is essentially an aluminum angle bracket with 4 high density connectors for passing signals

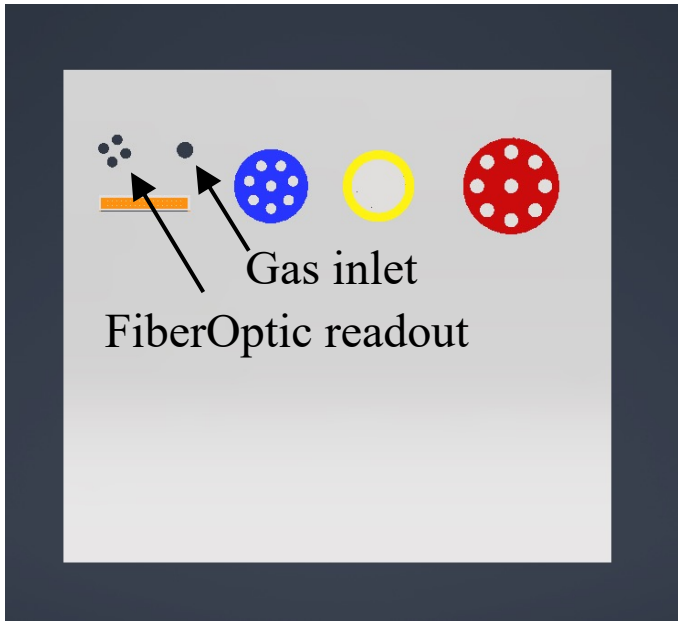
Patch panels are installed on alternating, up- and down-stream faces

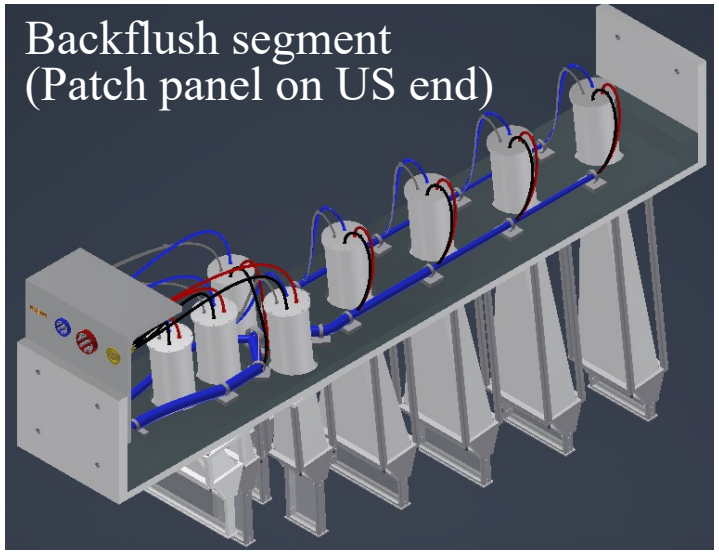
LV 32 ch ribbon cable connector in process of being replaced with larger connector for 18 AWG wires



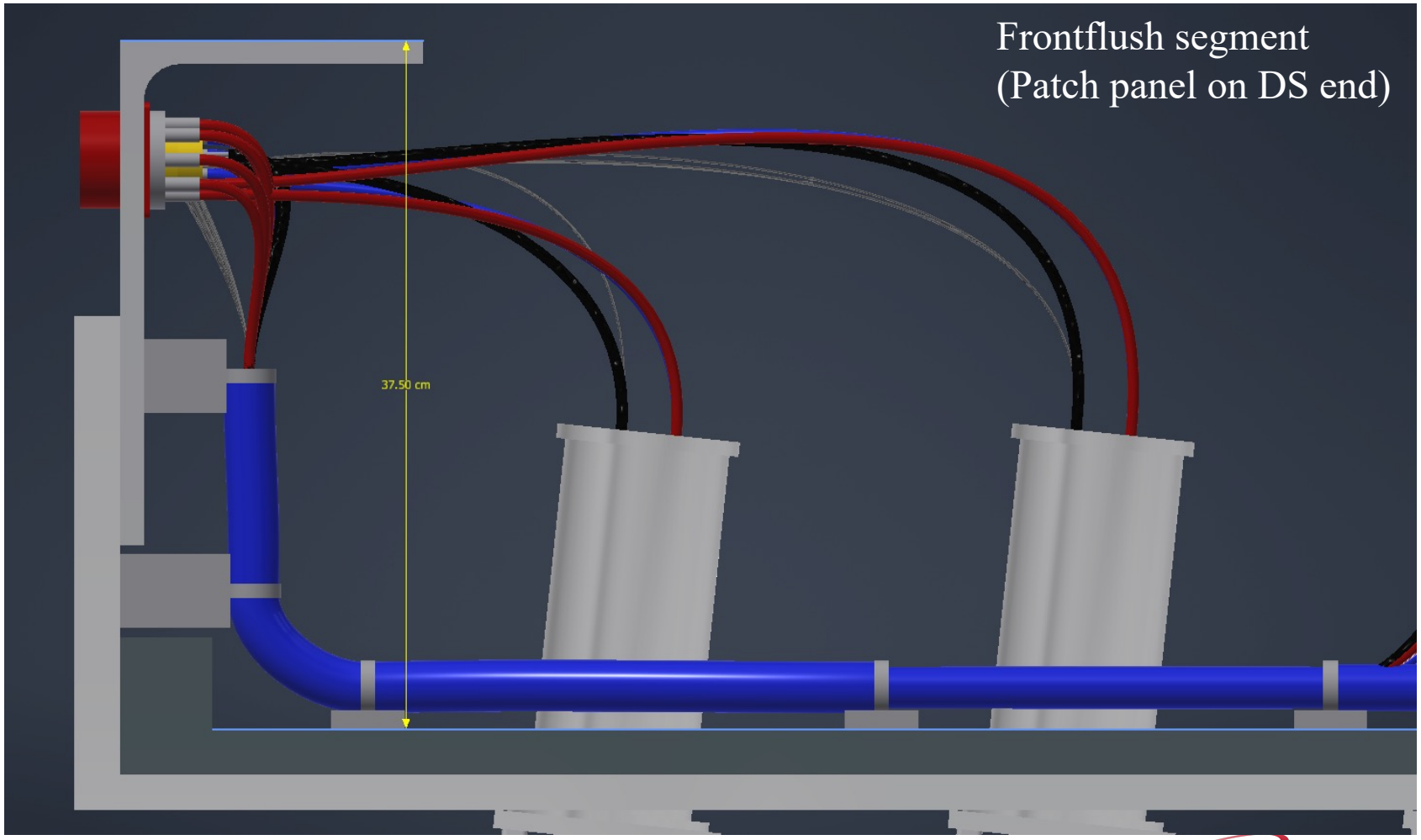
Each det requires:
1 HV cable
2 coax signal cables
4 LV and control wires

1/28 Segment Patch Panel





Each segment's patch panel is essentially an aluminum angle bracket with 4 high density connectors for passing signals



High Density connectors (candidates)

Twinax: (Smithsinterconnect.com)

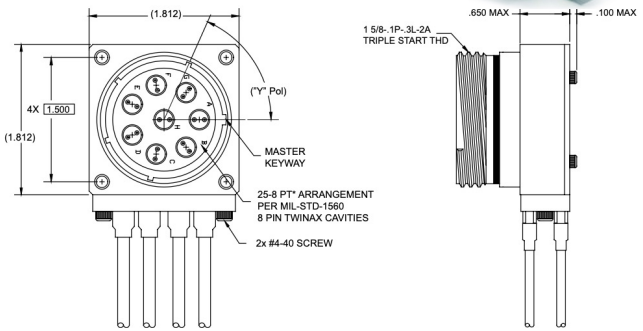
Box Mount Receptacle Pin Insert 25-8 PT* to 8 R/A Twinax Cables to Open Lead

Y	Polarization
1	N
2	A
3	B
4	C
5	D
6	E

Part Number	Cable Type	Cable
02370Y-1XXX	Differential Twinax	540-1099-000

Y = Connector Polarization
XXX = Cable Length in Inches
Please specify cable length when ordering

- Connector Receptacle is supplied fully loaded with Twinax pin contacts terminated to Differential Pair Twinax cable to open lead (all cavities included).



Coax: MHC Contacts (Smithsinterconnect.com)

Features

- Fits Size 8 and 12 cavities for MIL-DTL-38999, ARINC 404 and ARINC 600
- Fits Size 8 cavity for MIL-DTL-24308 D-Sub
- Spring loaded for optimum contact mating force
- High frequency performance
- Low VSWR:
  - Size 8: 1.15:1 Typ Mated Pair (DC to 26.5 GHz)
  - Size 12: 1.25:1 Typ Mated Pair (DC to 26.5 GHz)
    1.5:1 Typ Mated Pair (26.5 - 40 GHz)
- Insertion Loss:
  - 0.15 dB to 26.5 GHz Typ (Size 8)
  - 0.2 dB to 40 GHz Typ (Size 12)
- Socket contacts are spring loaded float mount for superior RF performance and reliability

Electrical Specifications

(MIL-DTL-38999 / ARINC 404 / ARINC 600)

Impedance	50 Ohms
Frequency Range	DC to 26.5 GHz (Size 8) DC to 40 GHz (Size 12)
VSWR	1.15:1 Typ (Size 8) to 26.5 GHz 1.25:1 Typ (Size 12) to 26.5 GHz 1.50:1 Typ (Size 12) to 40 GHz (mated pair)
DWV	500 VRMS @ Sea Level (Size 8) 325 VRMS @ Sea Level (Size 12)
Temperature Range	-65°C to +165°C

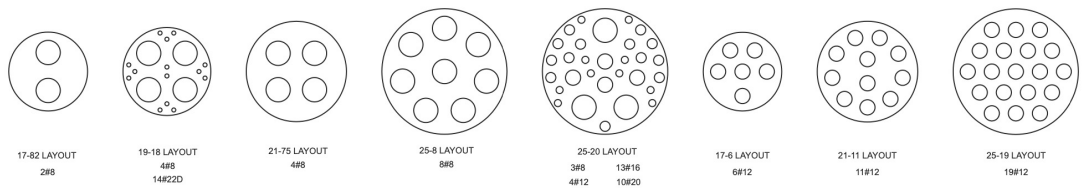
Materials & Finishes

Center & Outer Spring Contacts	Brass per ASTM-B16, alloy UNS C36000 or BeCu per ASTM-B196, alloy UNS C17200, C17300 Gold plate per MIL-DTL-45204, Type II, Class 1
Shell	Brass per ASTM-B16, alloy UNS C36000 Gold plate per MIL-DTL-45204, Type II, Class 1
Hood	305 CRES per ASTM-A240, passivated per ASTM-A967
Insulators	PTFE per ASTM D-170

MHC Sample Insert Arrangements

Consult Factory For:
- Custom or Special Insert Arrangements
- Connector Ordering Informatioin
- PC Tail Versions of Contacts

MIL-DTL-38999



High Density connectors (candidates)

HV: (ges-highvoltage.com)

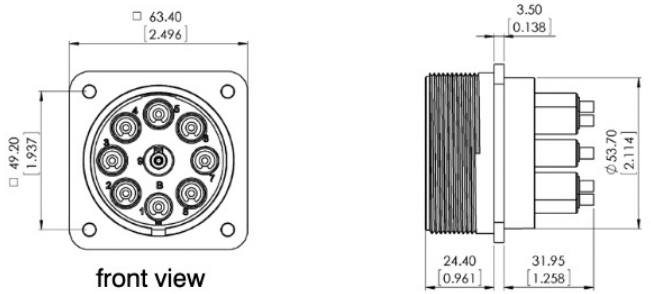
M Series

Type M915/1E 8(+1) Pole 12 kVDC

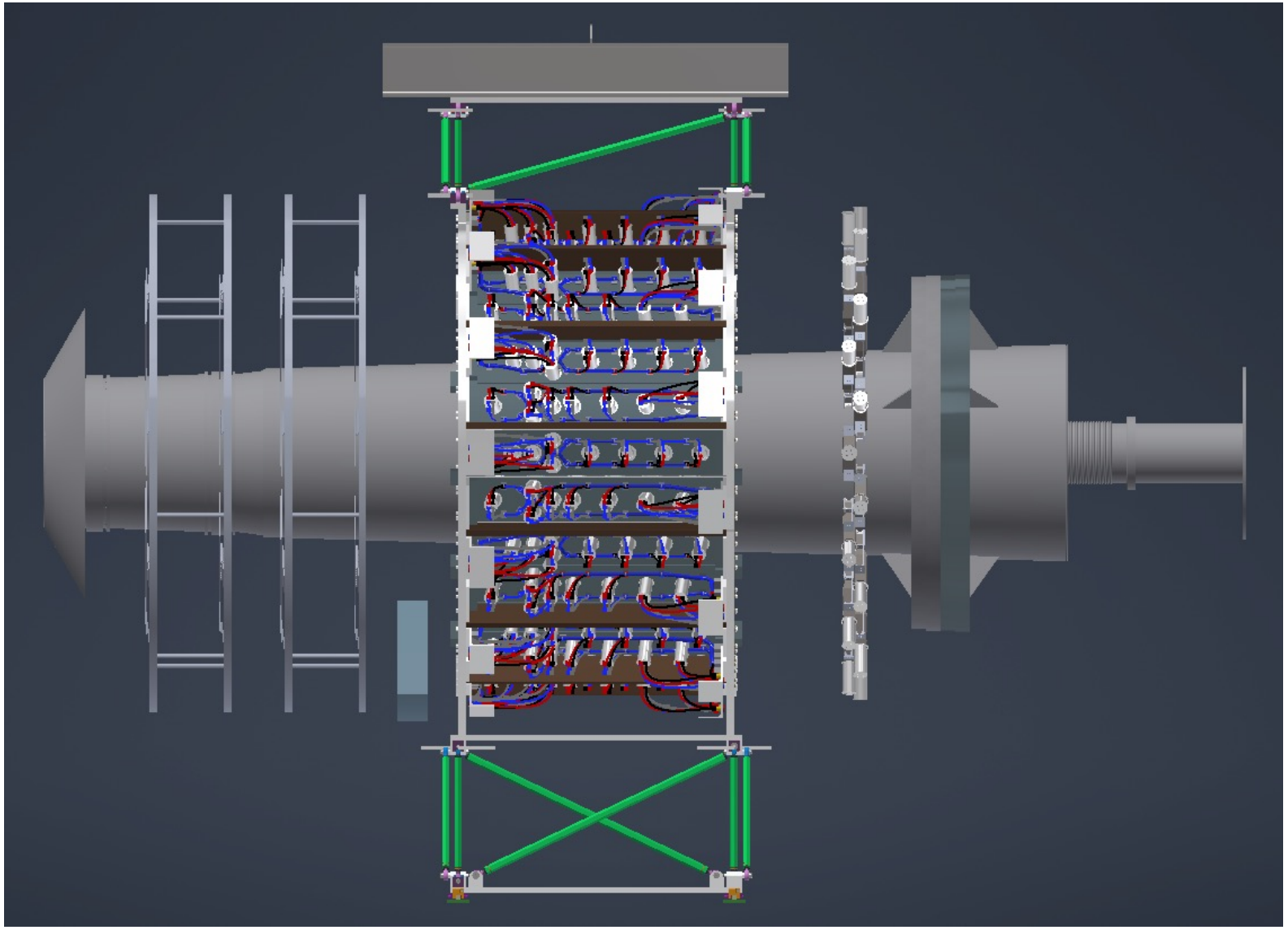
Electrical values	
Operating voltage (DC)	12 kV
Test voltage (DC)	18 kV
Rated current	30 A

Characteristics	
Number of pins high voltage (HV)	8
Number of pins E-contact 2.5 mm (LV)	1
Number of pins I-contact 1.5 mm (LV)	-
Insulation material	PTFE

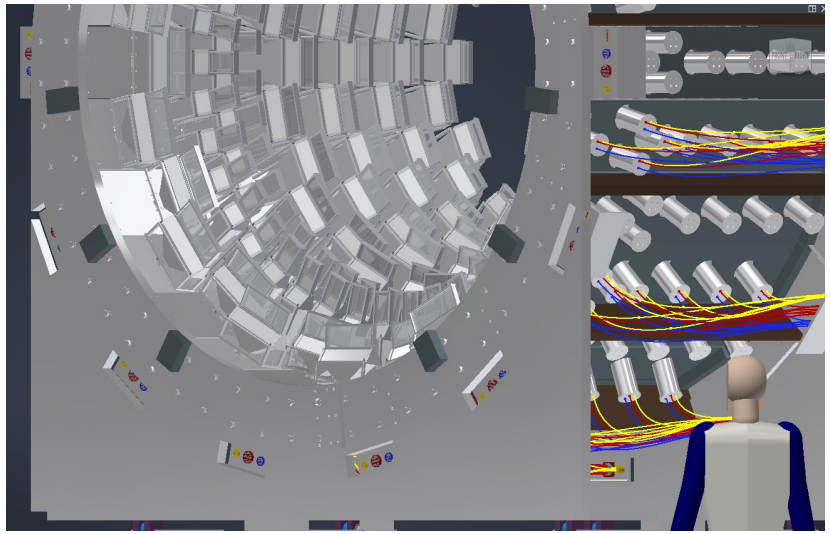
Layout

Type / Version / Part number	Picture / Drawing
Type: receptacle, panel mount **Version: GB 915/1E/PTFE** **Part no. 7749011**	 

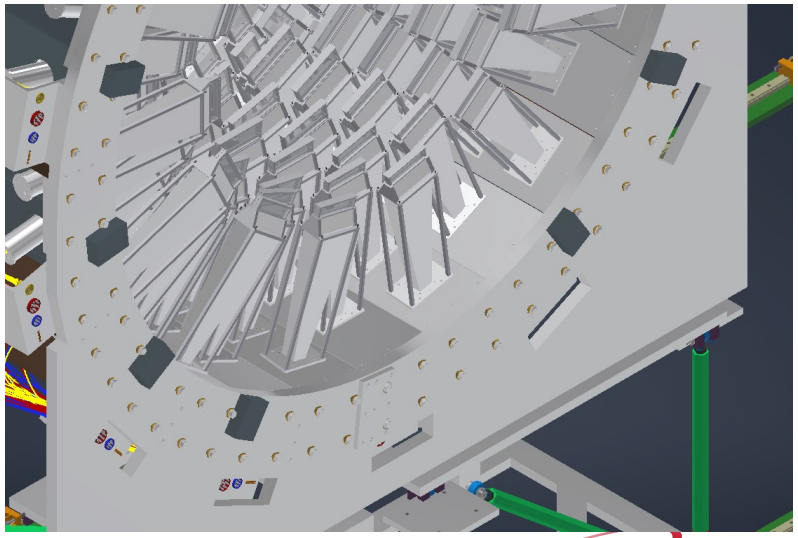
More views



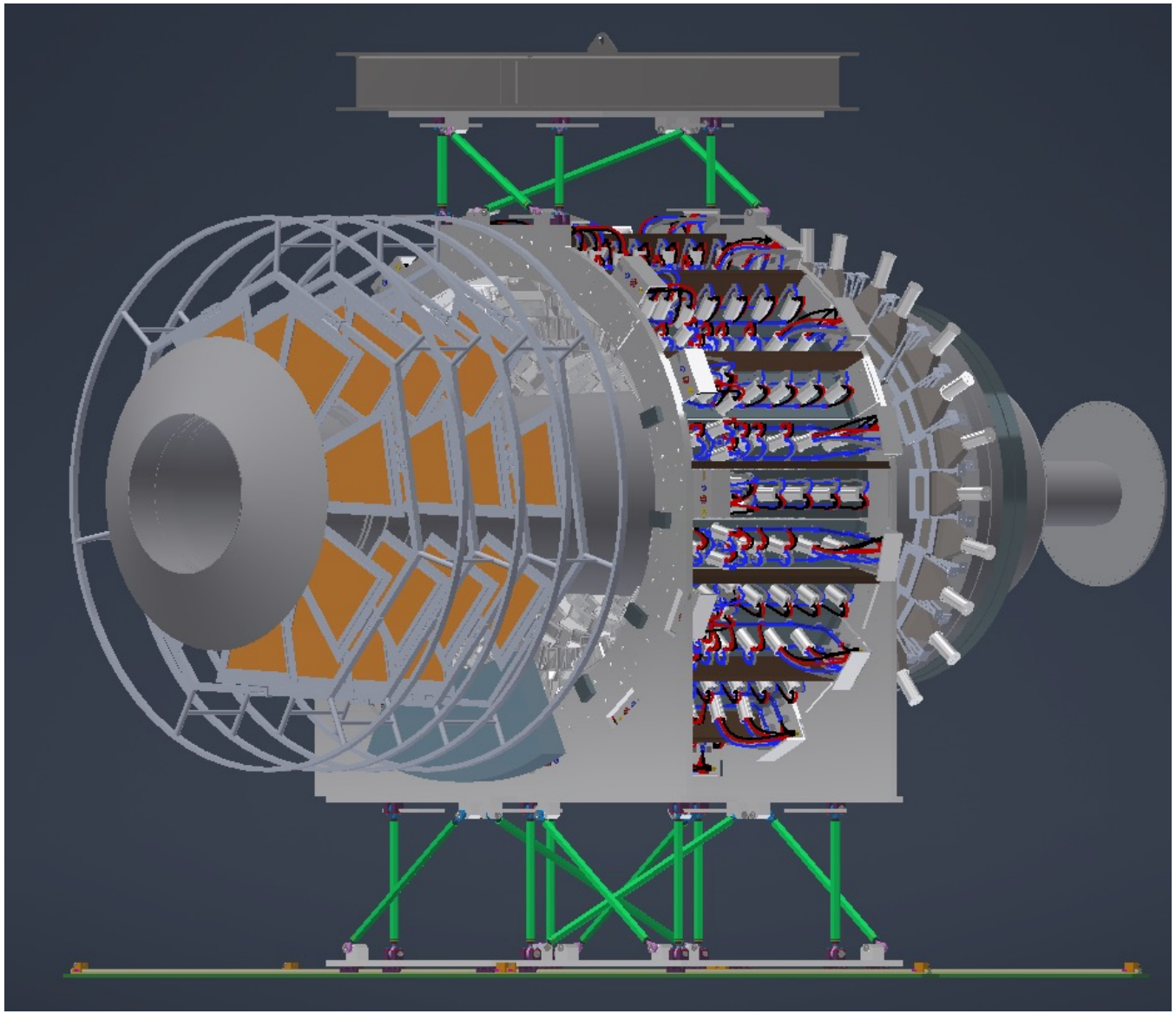
Upstream Face View

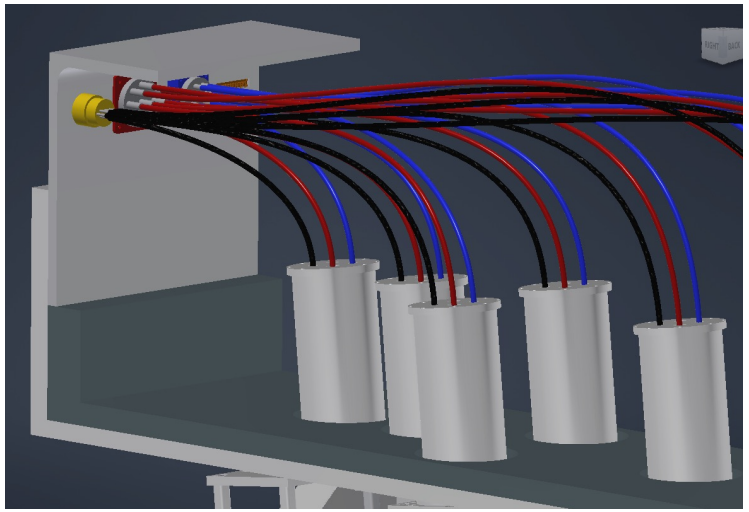


Downstream Face View

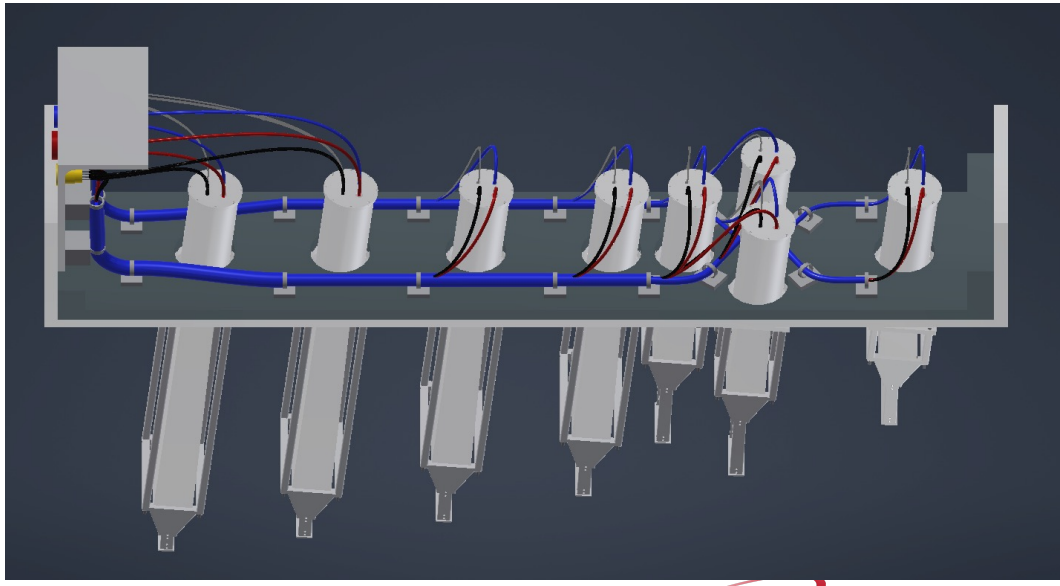


More Views

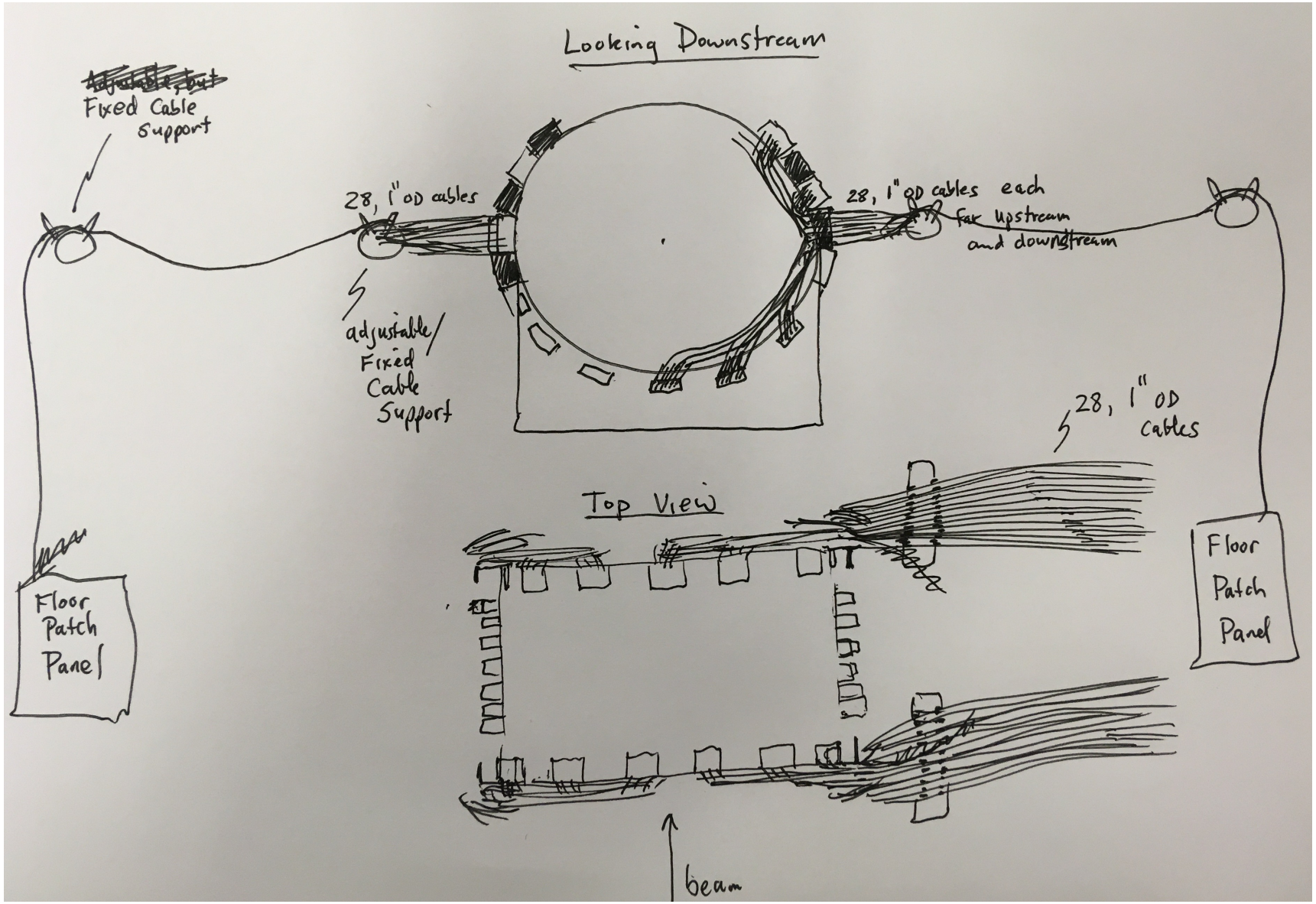




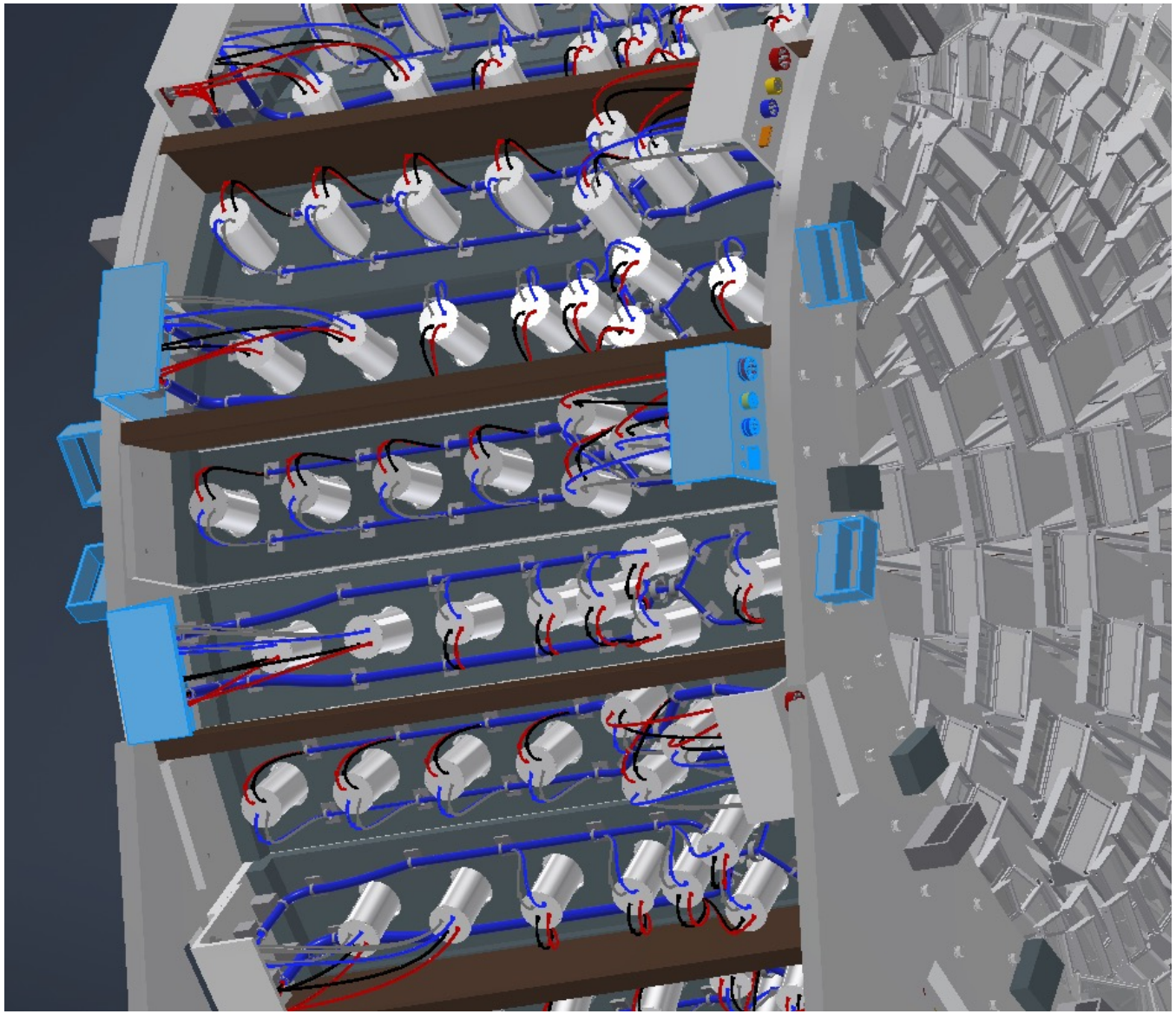
Front-flush segment



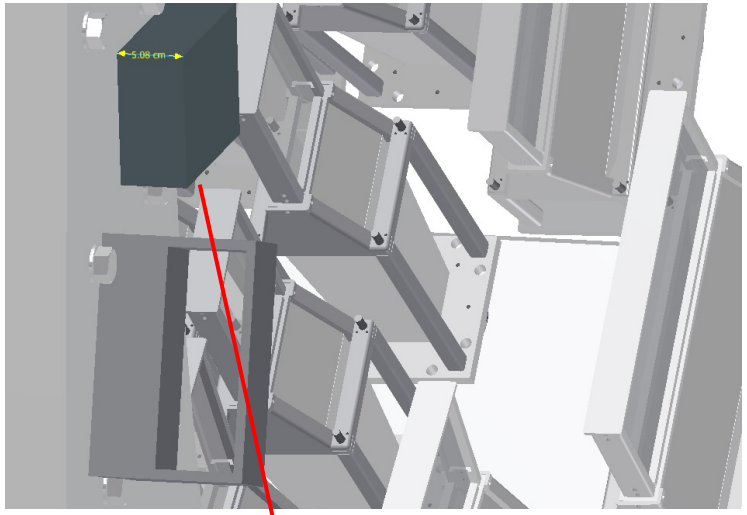
Outer cabling plan/sketch

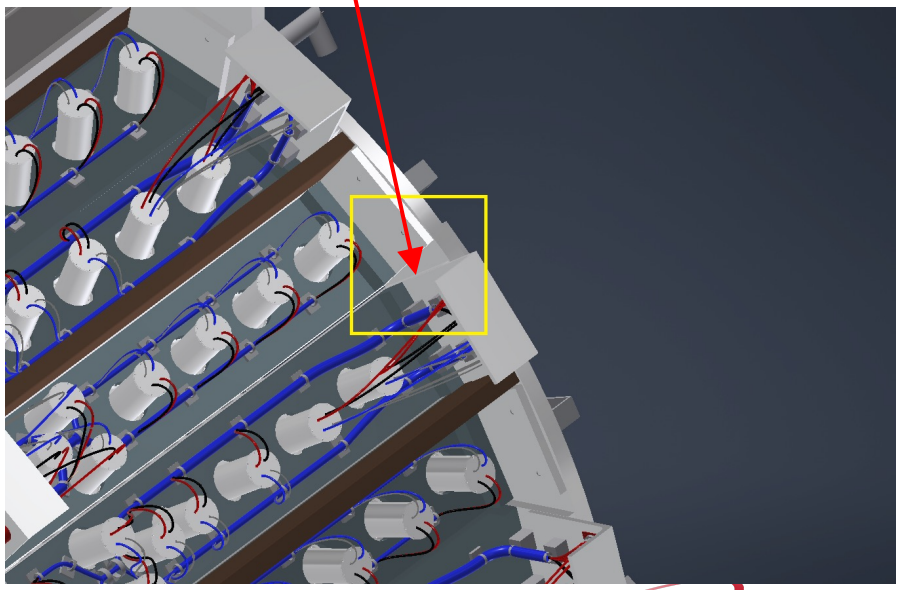


Outside Cabling: beam-left cable exit locations with temporary guides



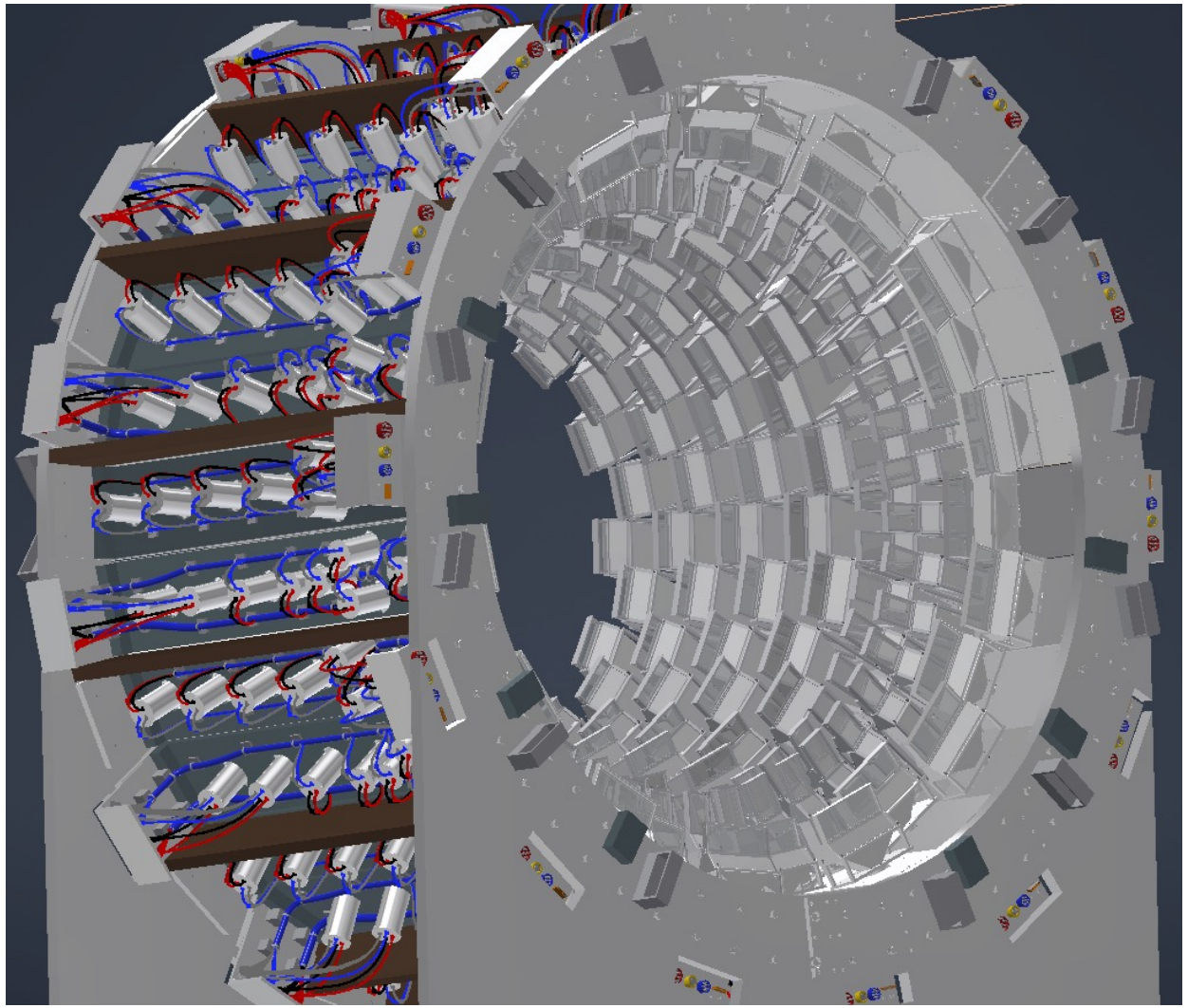
Lead brick clearance: move from outside to inside



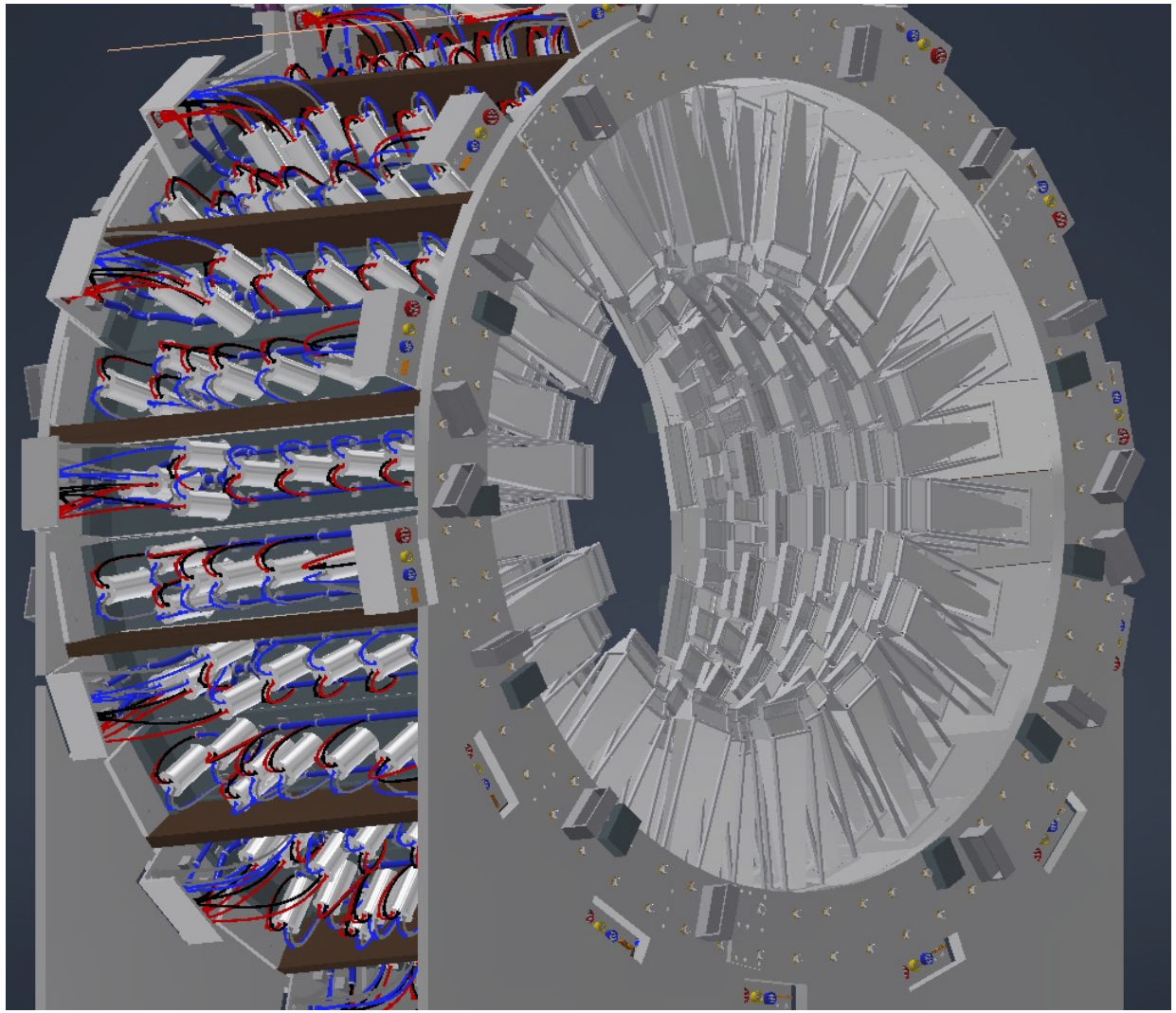


More Views

Looking Downstream

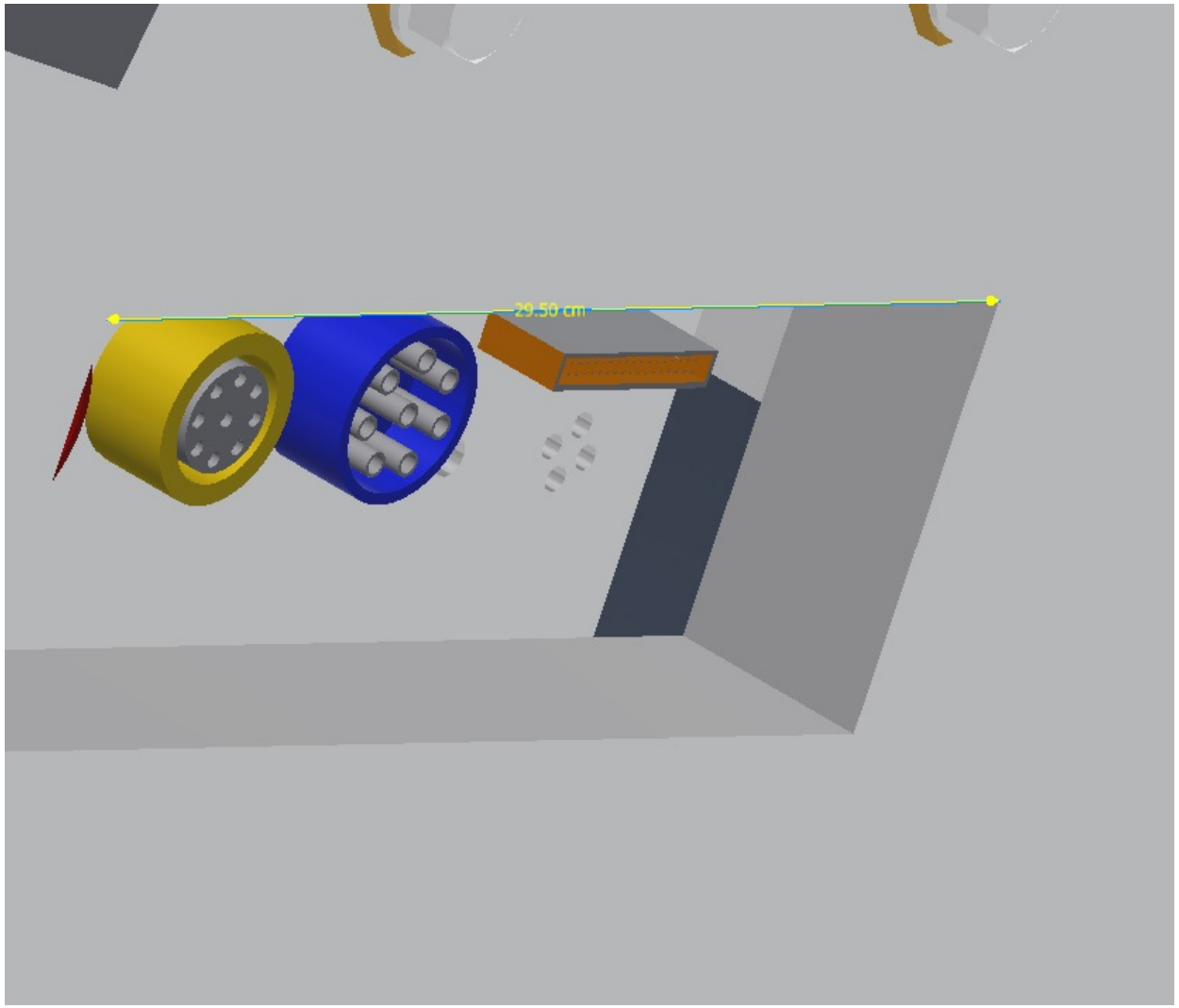


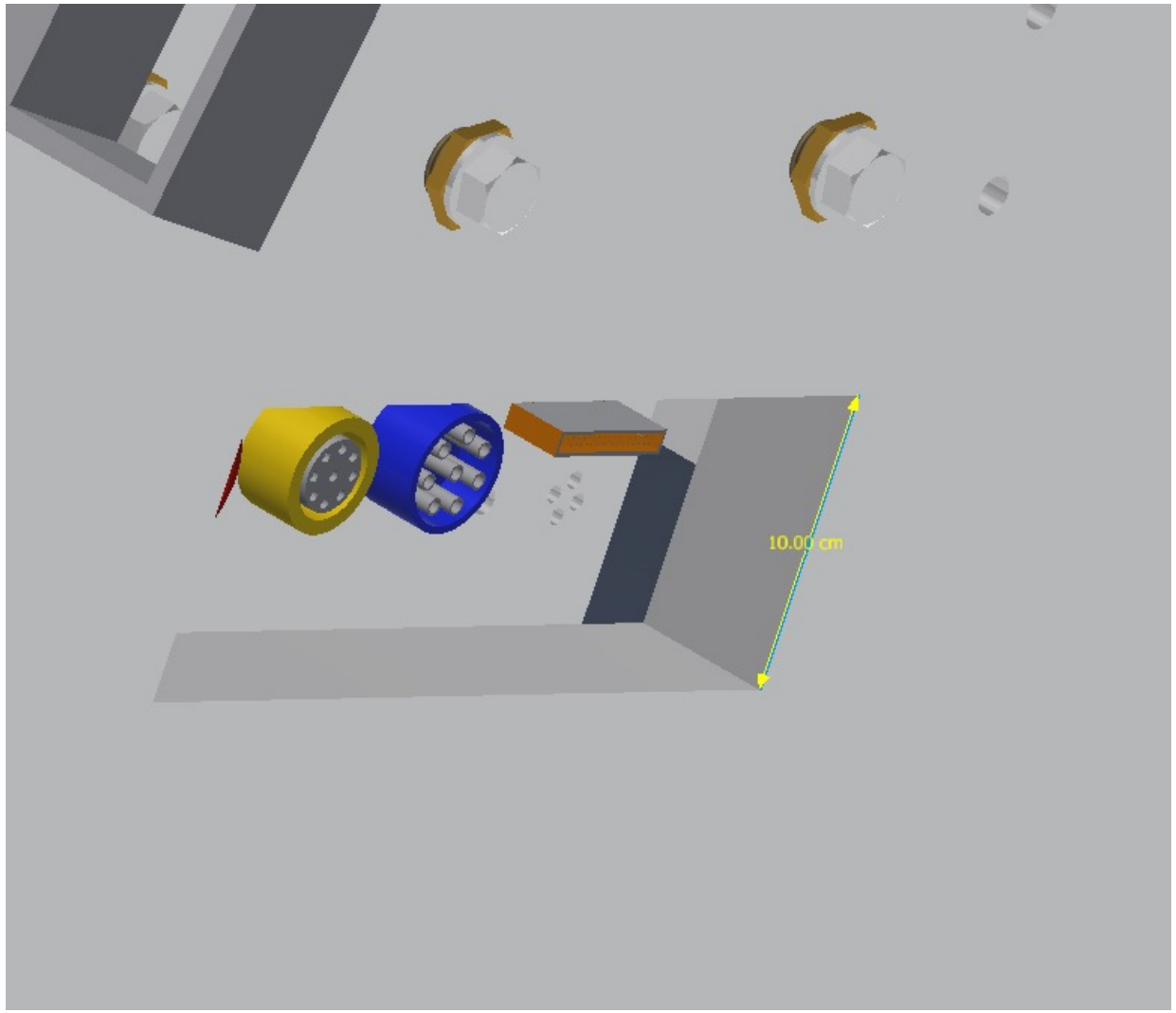
Looking Upstream



Patch panel frame cutouts

- These are the absolute minimum size of the cutouts. We think we will need larger holes, but not sure yet how big





Cabling Summary and future work

- There are many details still evolving: keep-out areas and potential interferences that are not shown in these drawings
  --Multi-level scaffolding around the main detector barrel that can move in and out
  --A large robot arm centered at the z-location of the barrel just on either side: beam-right or beam-left
- Need to find HD connectors we can purchase and build a patch panel prototype (and eventually test on bench with a parity setup, such as our PMT non-linearity system)
- A suitable and available HD coax connector has been found; we are looking into LV now
- Next steps are to start developing outer barrel HD cable routing and strain-relief mechanics

Questions and interference with top supports