Main detector segment cabling discussion

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Students working on this:

Edwin Sosa
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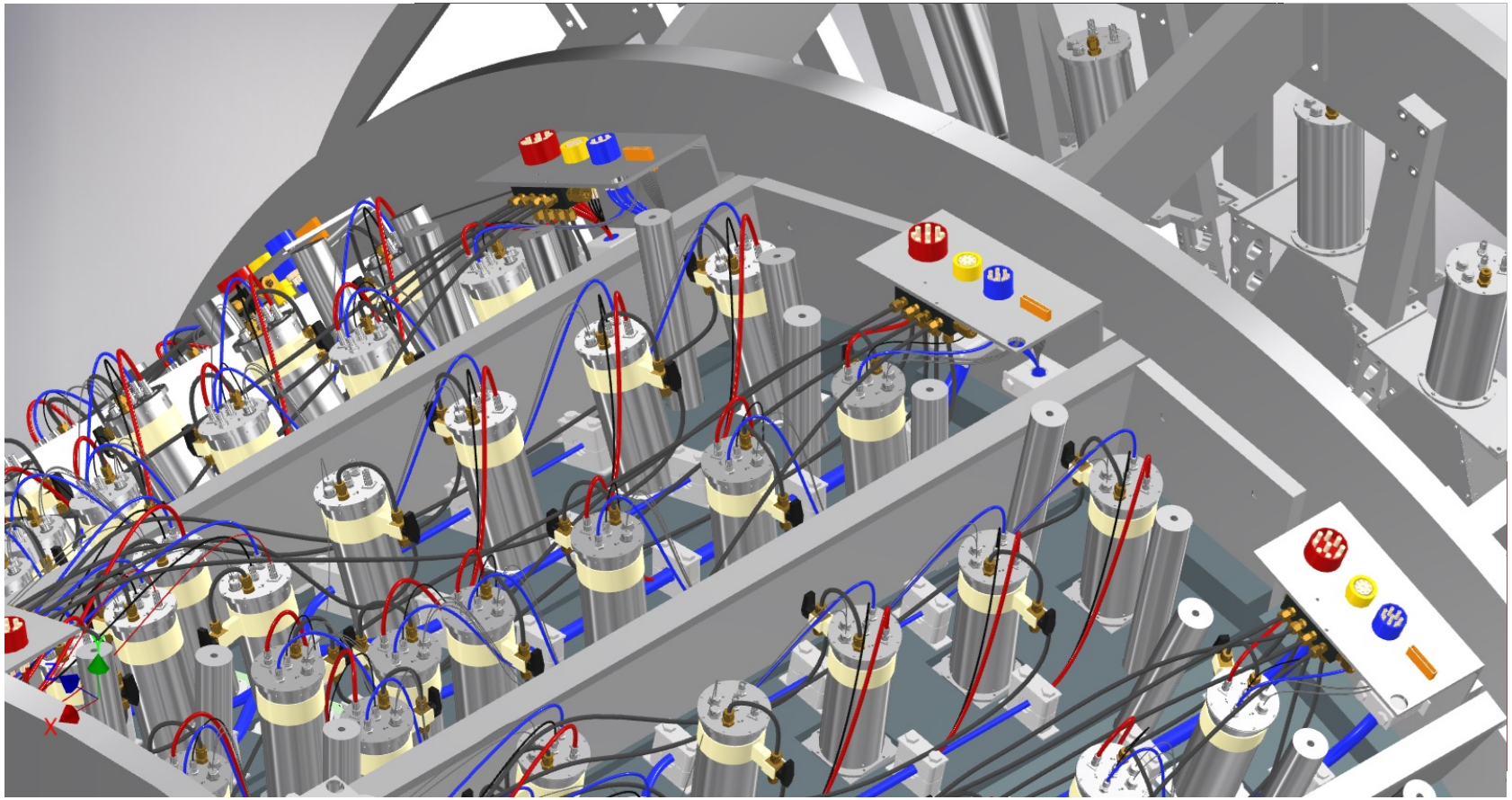

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Main detector barrel logistics

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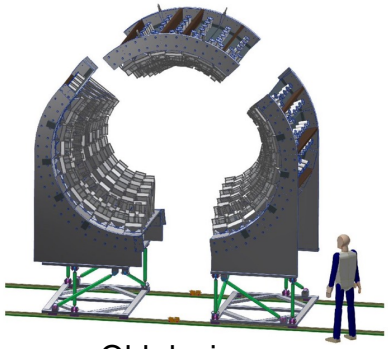
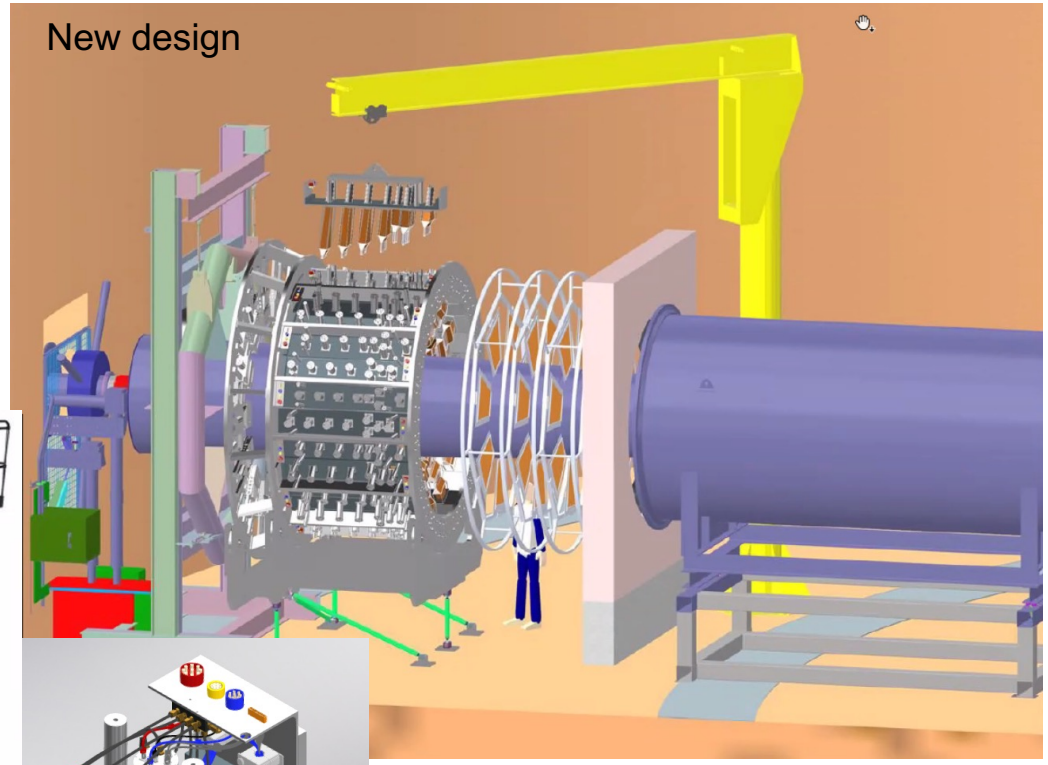
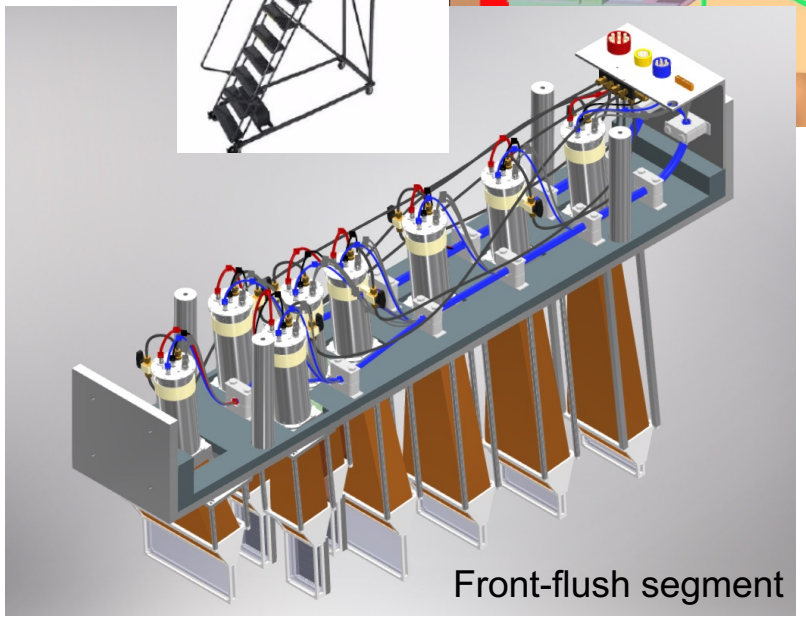
- We moved away from 3 piece design that opens to a “single” support barrel in 2 pieces that bolt around beampipe and can rotate
- Shower-max ring now attached to main detector barrel and all detectors rotate together
- Assembly rests on a 6 roller bearing system with cart; cart sits on 6 rod attachment support and alignment system
- Main detector lead trays with fully instrumented detector assemblies are lowered into barrel vertically from above one at a time (no robot arm)
- Main detector patch panels modified to route cables radially (not along z as before)
- Cabling harness adapted to new lead tray hole pattern and new patch panel; model for gas distribution system developed
- We are now quoting/sourcing HD plugs and receptacles for a patch panel and cabling harness prototype

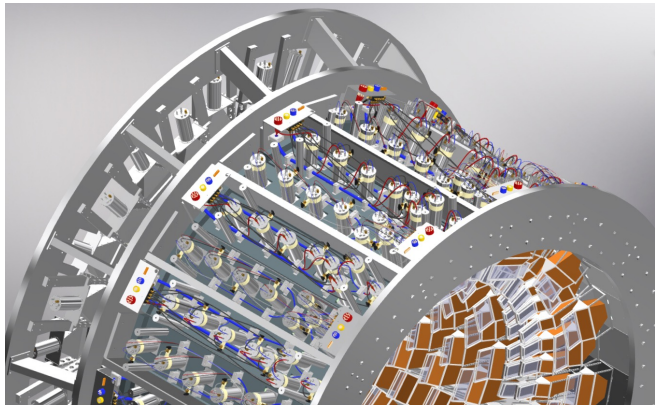


Old design





Front-flush segment



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Snapshot of Technical Progress (detector cabling)

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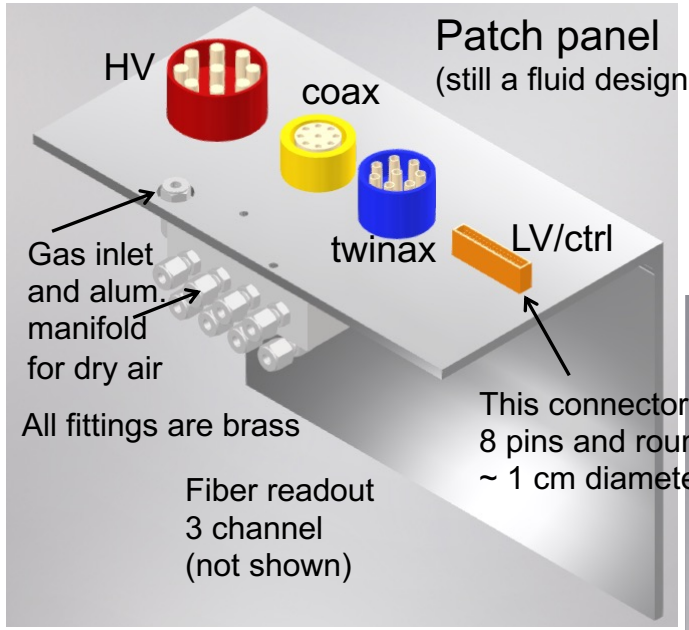
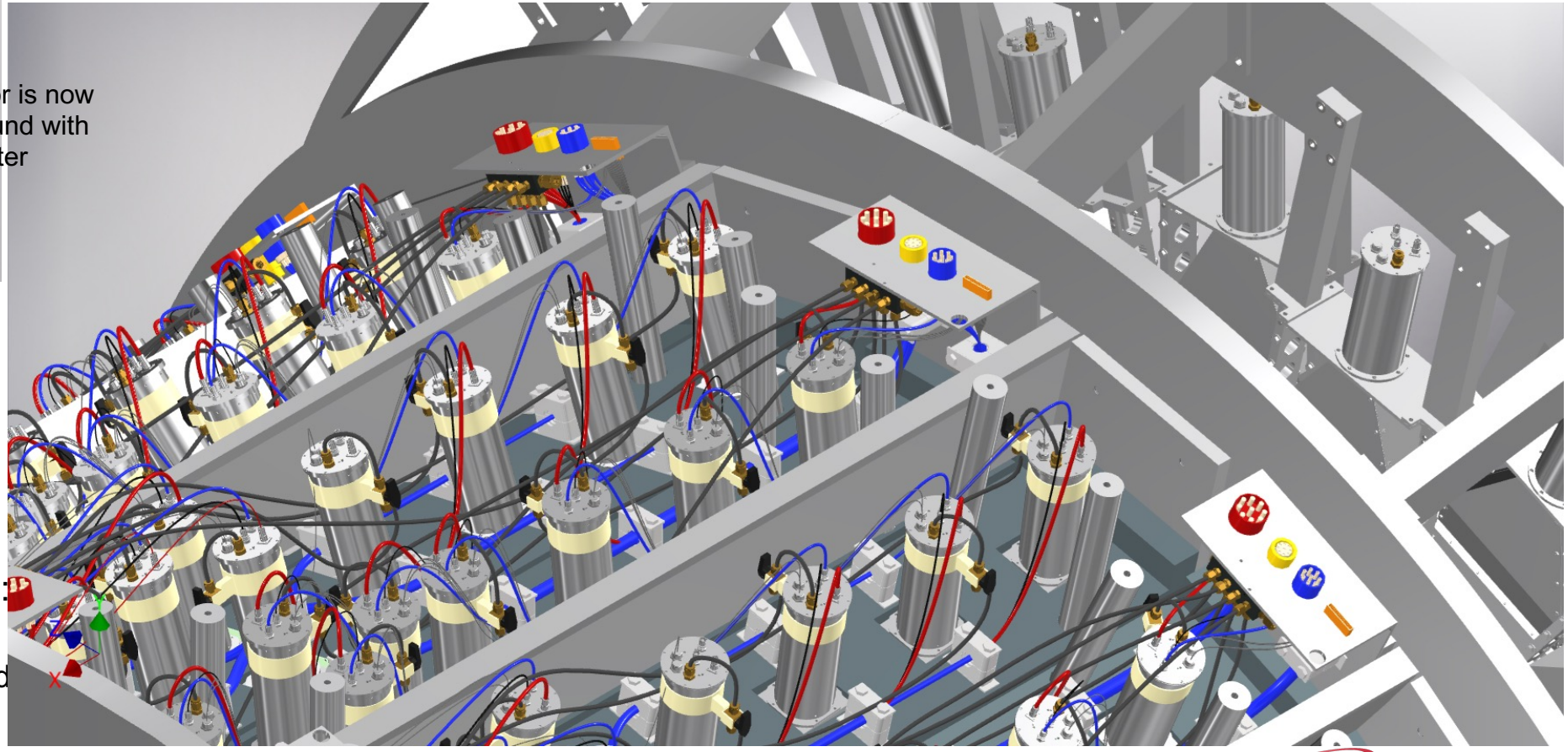


Main detector cabling (CAD work by Edwin Sosa)

- Connector CAD models are place holders, but match dimensionally our candidates
- New LV/control HD connector found; we are moving away from ribbon style
- Gas distribution system design (manifold, tubing size, etc.) is very preliminary



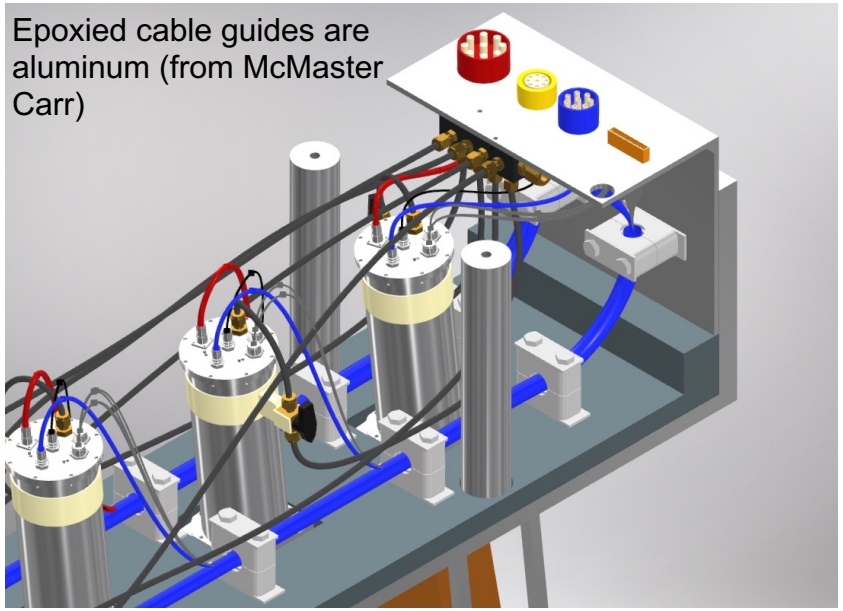
- 8 detectors per tray, each detector requires:

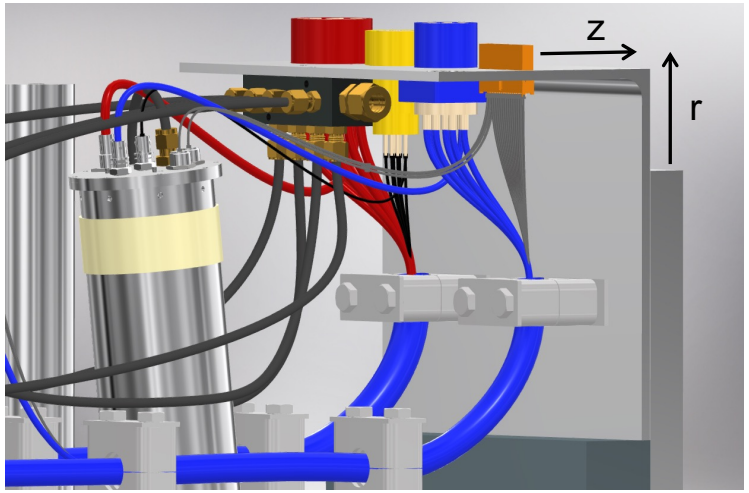
-1 HV cable
-2 signal cables (coax and twinax)
-1(2) LV control wire(s)
-1 gas inlet

- 3 HVMAPs per tray, each needs:

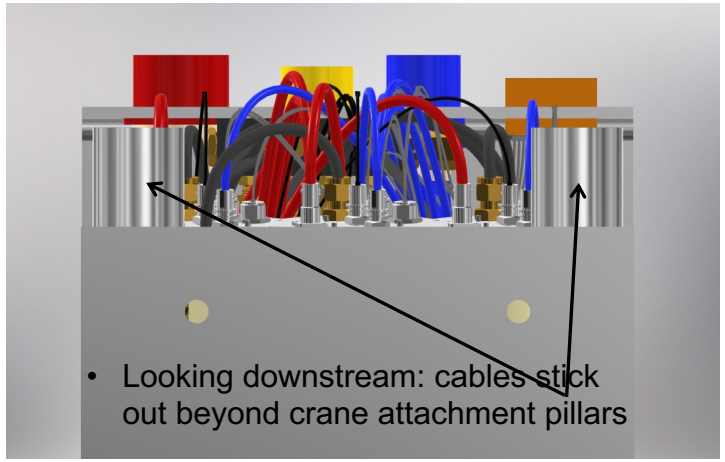
-1 Fiber Optic readout cable
-1 gas inlet (could use separate manifold
-28 LV power wires (not shown)

Patch Panel and harness views

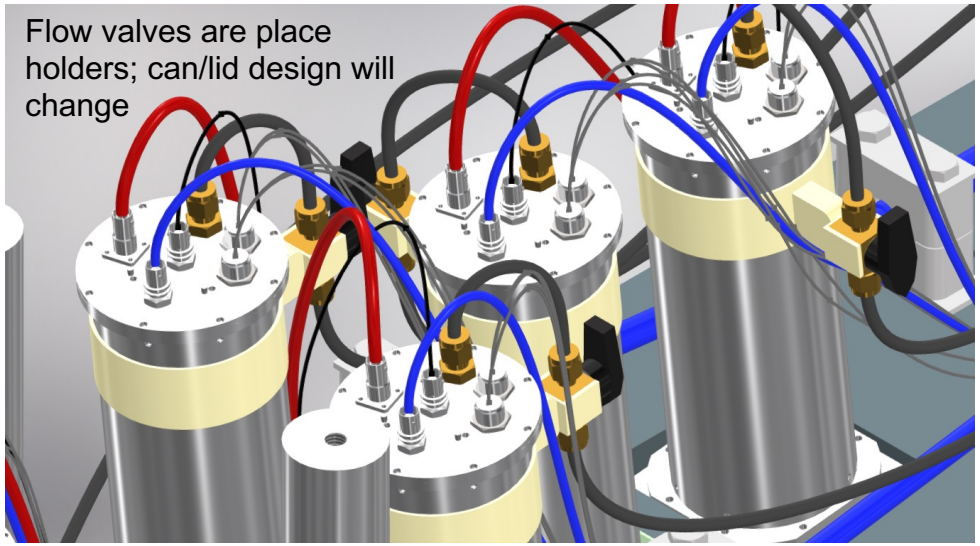


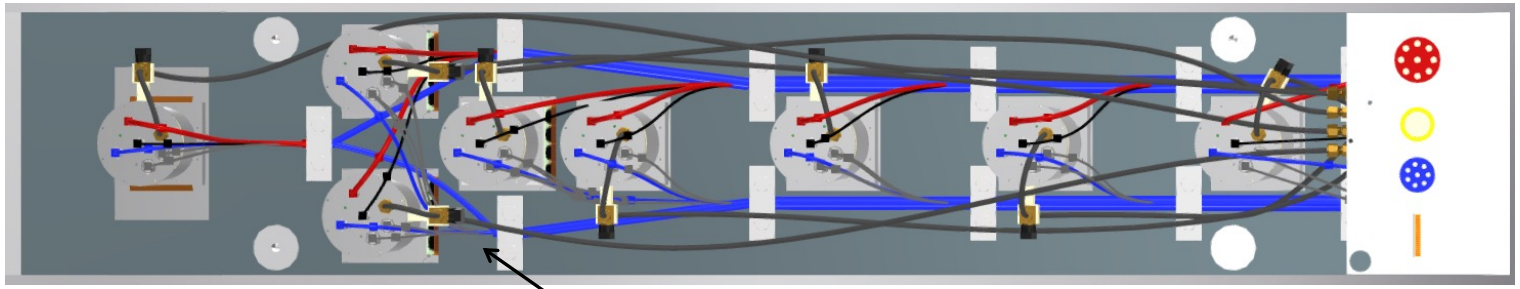


- Patch panel “L” bracket size was increased along both r and z to allow needed space



- Looking downstream: cables stick out beyond crane attachment pillars

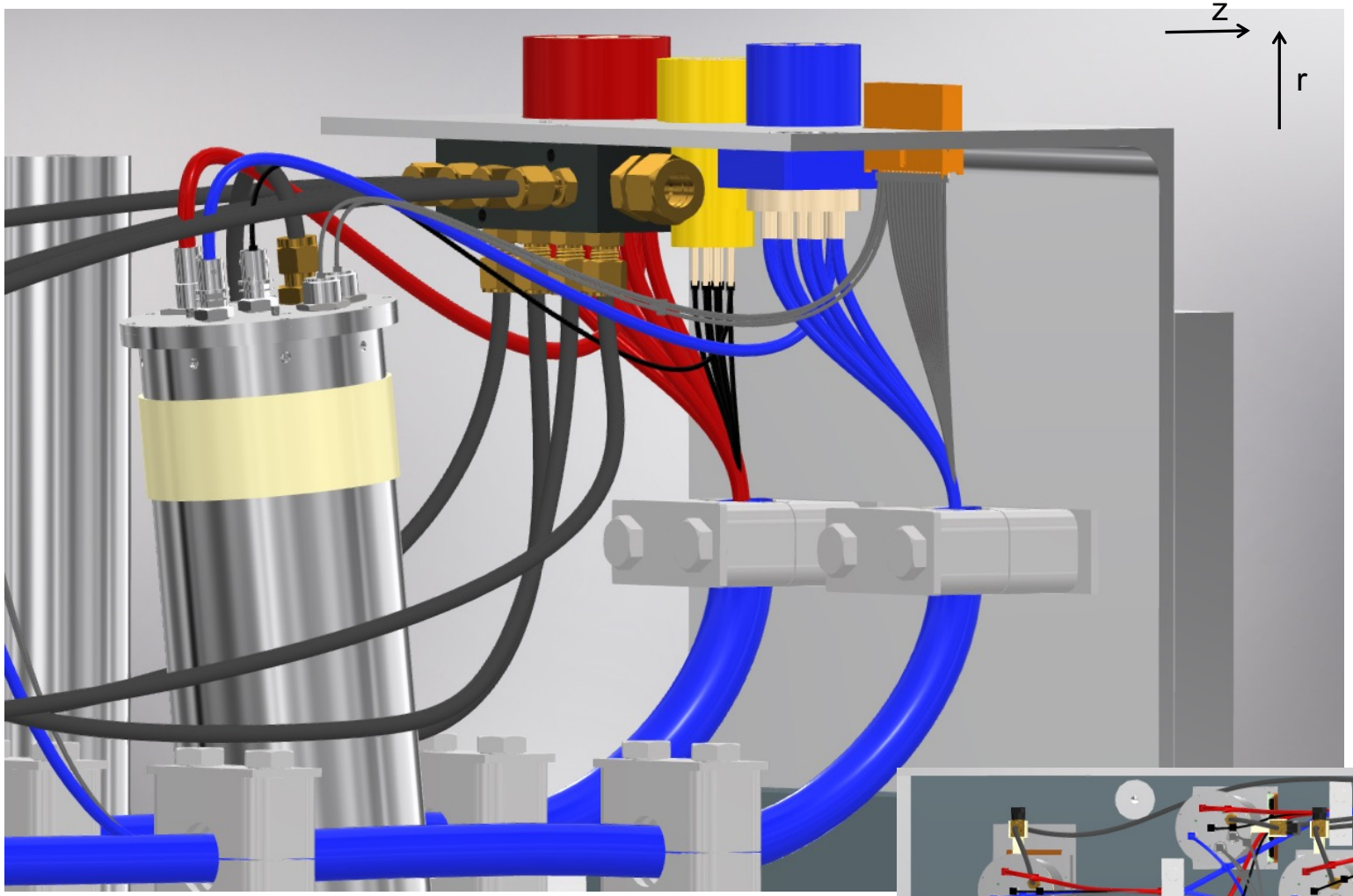




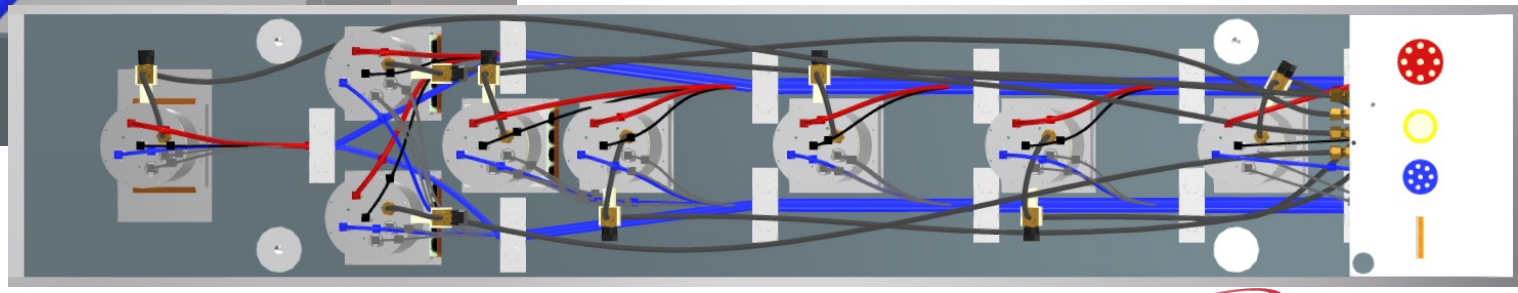
- Most challenging or space constrained area is here (especially for back-flush segments)

- Manifold and tubing sizes are not set. We’re showing ¼” OD nylon 12 tubing with the smaller manifold which can have 3/8” or ½” OD input tubing
- We need to determine what gas flow rates we need for the detectors and Hvmaps

Patch Panel and harness views



- Patch panel “L” bracket size was increased along both r and z to allow needed space
- Issue here: If we want to have all signal cables (coax and twinax) for all 8 detectors to be the same length inside the segments, then we’ll need to coil the extra cable lengths under the patch panel—shown here (It’s pretty tight)



PMT lid design

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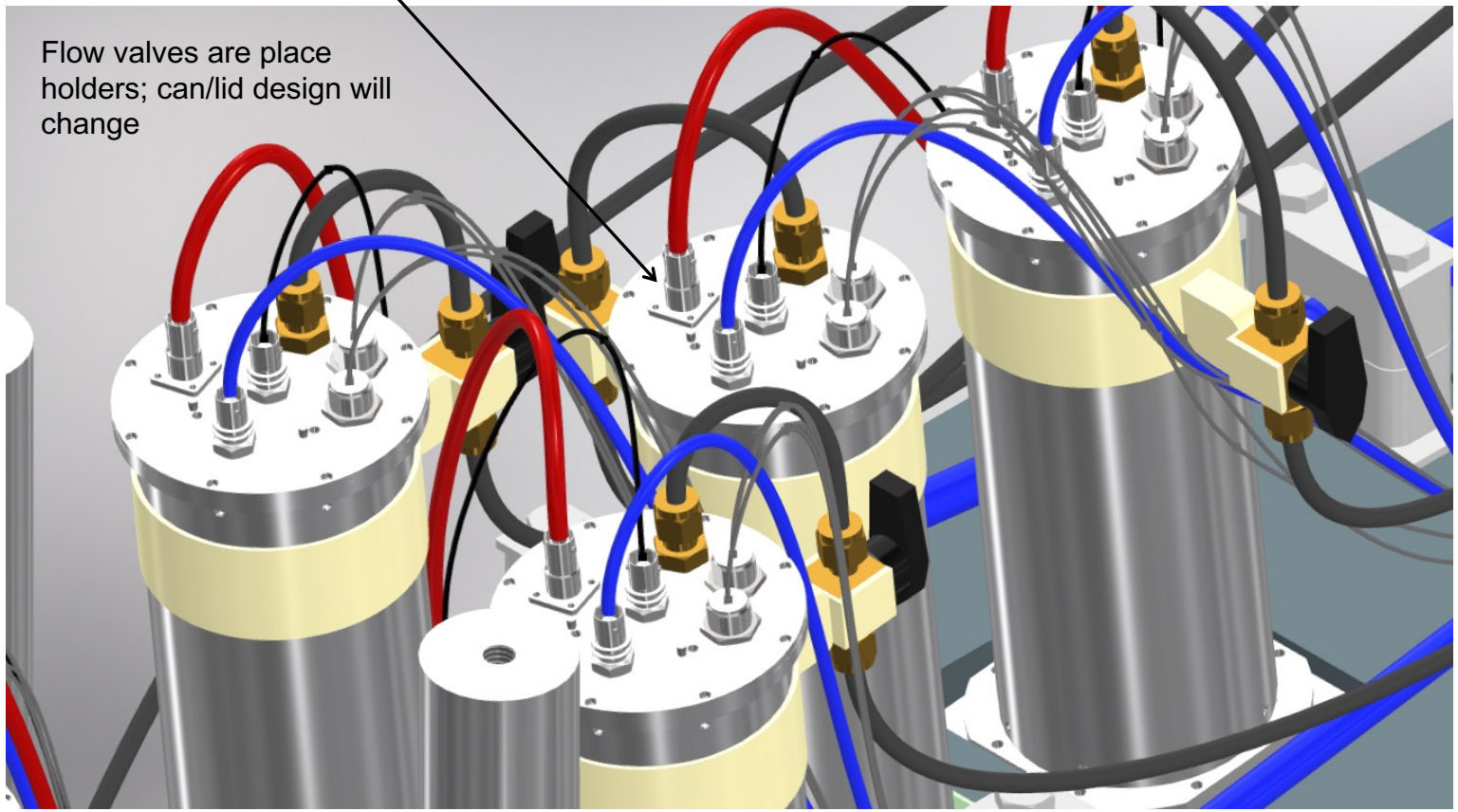
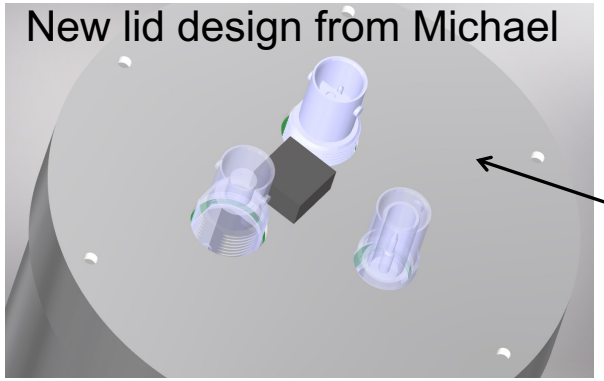
These are the old lids with 2 low voltage connectors; there is now only 1 LV connector

The connector placements on the lid were just placeholders

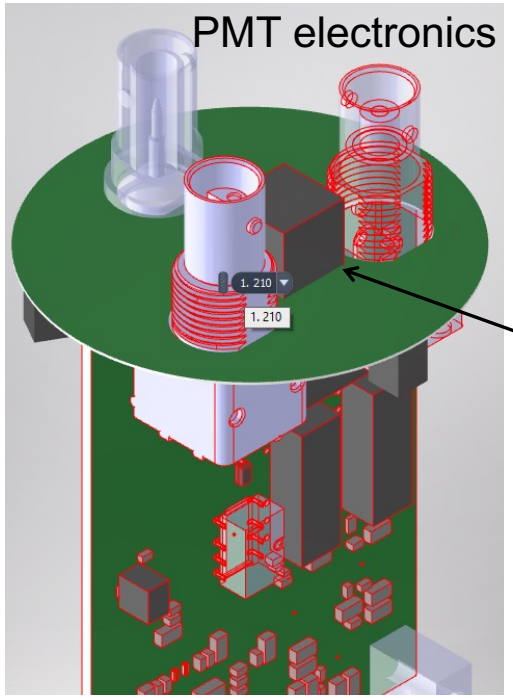


New lid design from Michael



Missing a gas inlet

PMT electronics



LV connector ?

Gas system

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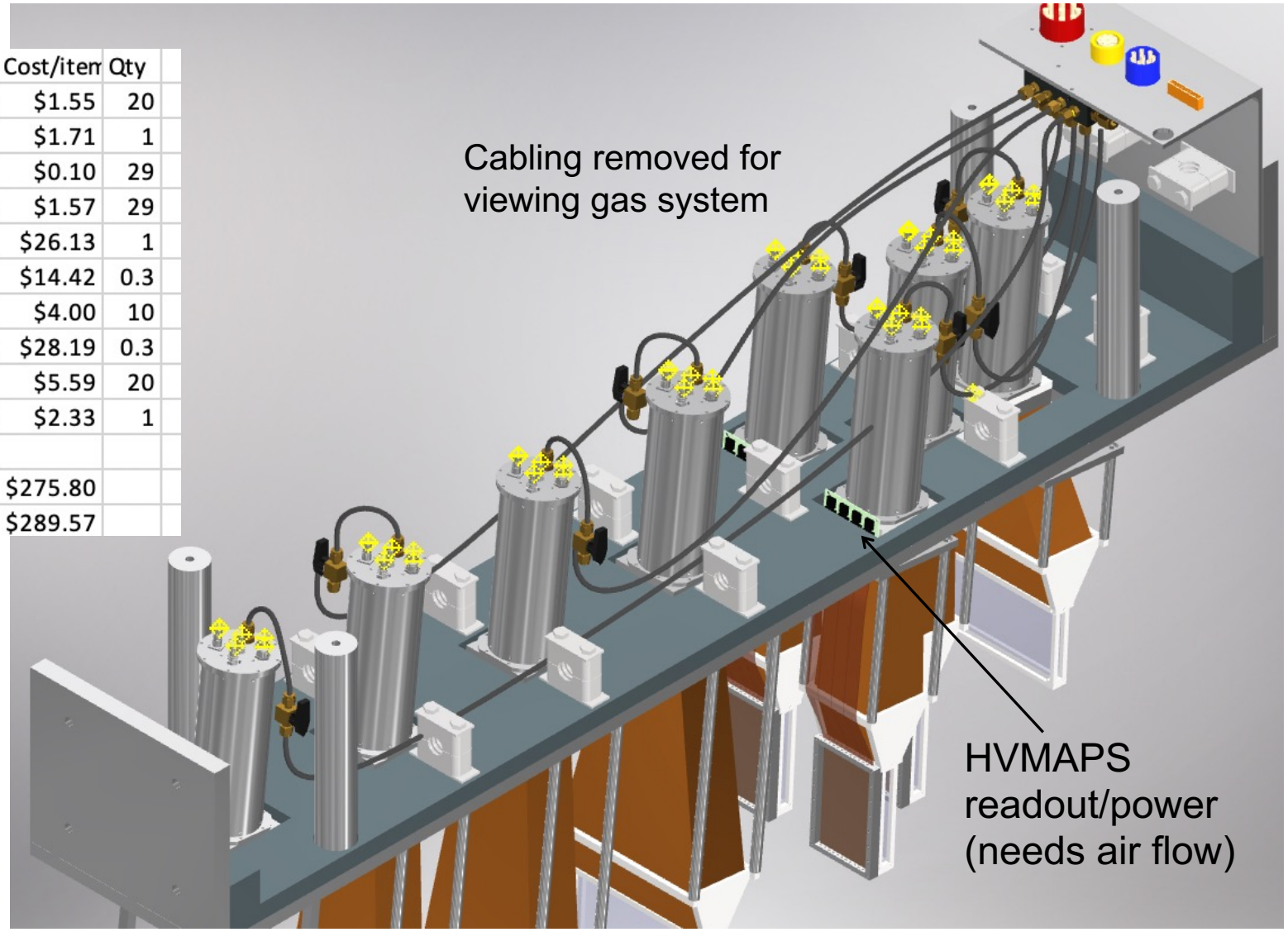
Gas system components and $ per segment

BRASS FITTNGS/TUBING/MANIFOLD	VENDOR	Cost/item	Qty
Straight Adapter 1/4 in NPT by 1/4 in tube OD	Buyfittingsonline.com	$1.55	20
Dixon Brass Solid plug 1/4in NPT For Manifold	Jmesales.com	$1.71	1
Nylon compression sleeve (ferrule) 1/4 in	Jacobseninc.com	$0.10	29
Brass insert sleeve 1/4 in	Buyfittingsonline.com	$1.57	29
Black Adonized 6061-T6 Aluminimu Manifold	a1manifolds.com	$26.13	1
1/4 OD Nylon 12 Tubing ($0.479/foot)	Amazon.com	$14.42	0.3
Air compressor ball drain valve NPT 1/4in for 1/4in T	Amazon.com	$4.00	10
1/4 OD Nylon 12 Tubing ($0.9363/foot)	Buyfittingsonline.com	$28.19	0.3
Swivel Adapter Fitting 1/4in NPT For 1/4in tube OD	Mcmastercarr.com	$5.59	20
Straight Adapter 3/8 in NPT by 1/4in tube OD	Buyfittingsonline.com	$2.33	1
Total Cost Using ($0.479/foot) tubing		$275.80	
Total Cost Using ($0.9363/foot) tubing		$289.57	



- The design does not include any filters yet
- There is worry about flowing air over exposed electronics which could outgas
- Preamp/amp electronics will need air flow for cooling
- HVMAPS cooling flow requirements – will need higher flow than detectors

High Density connectors (some candidates not available)

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High Density connectors (candidates)

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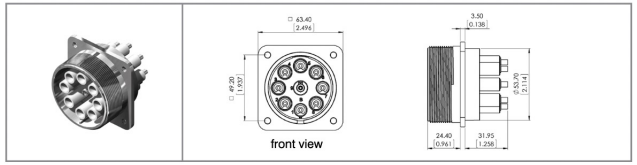
HV: (ges-highvoltage.com)

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	 front view

- The HV connector is available and we have a quote for receptacle and plug (we've inquired about insertion test data)

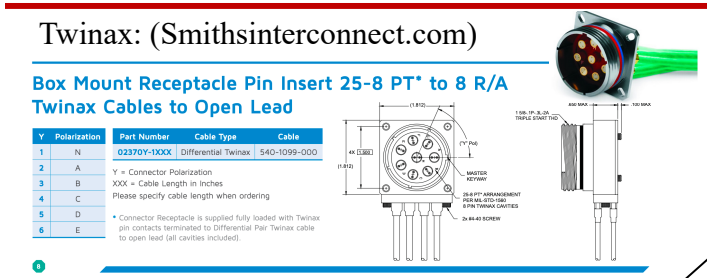
Line	Part No	Description	Qty.	Unit Price	Total
1.	7749011	GB 915/1E PTFE receptacle, panel mount, 9-pole 8x HV pins, female contacts 2.7mm silver plated 1x earthing pin, female contact 2.5mm silver plated	2 ea	$275.55	$551.10
2.	7490417	KS 915/1E PTFE Sym KV plug, cable mount, 9-pole, symetric cable gland 8x HV pins, male contacts 2.7mm silver plated	2 ea	$316.03	$632.06
					$1,183.16
					$1,183.16

- There is also an 8 conductor HD HV cable you can get for these which we are investigating (for routing HV inside trays)

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

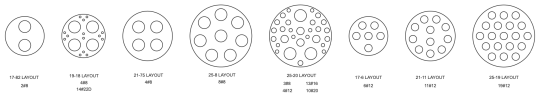
Materials & Finishes

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 Information
- PC Tail Versions of Contacts

MIL-DTL-38999



- The twinax connector is no longer actively supported by Smiths Interconnect, but they pointed us to comparable part and supplier (TTI inc.) which we are investigating
- Still waiting to hear about the coax rec. and plug availability

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summary and future work

Idaho State University

- Patch panels and cabling harness adapted to new barrel and lead tray design
- Patch panel will be updated with new connectors; cabling is being adapted to Michael's new tray design
- We have a first-pass modeling of the gas distribution system for the main detectors; engineer advice welcome
- HD connector vendors have been contacted; some quotes in hand; developing prototyping plan for building a full scale patch panel and cabling harness
- HVMAPS detectors each require 28 LV wires, 14 guage; so there are 3 of these per patch panel; we are starting to look into this—patch panel may have to increase in size
- Adjustments to the cabling harness will be made following final tweak to the lead tray design; also need to finalize all needed cables, gas lines, and especially LV wiring for each 1/28 segment and then try to make it all fit
- We are ready to start modeling the external barrel cabling, but feel we need some input from engineers related to keep out zones and cable tray location(s)/height, etc.; we could use a brain storming meeting to get going
- There are potential complications (but not interferences) with routing the cables in/out of the patch panels that are near or in between the roller bearings