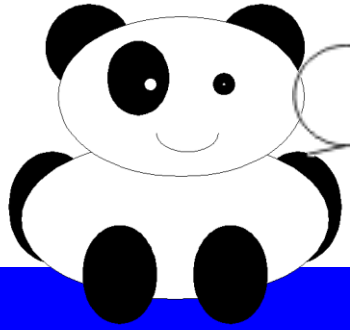


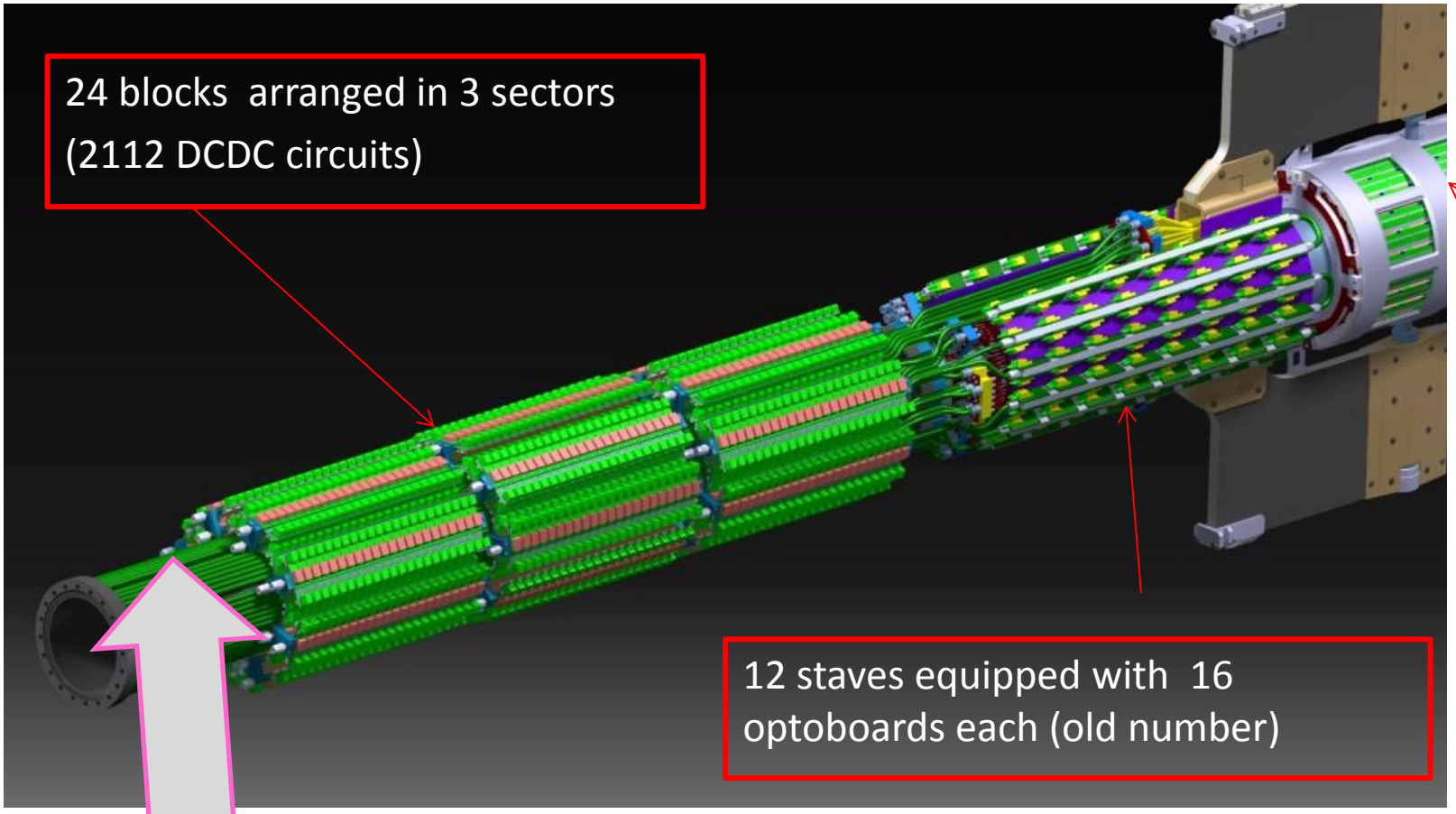
MVD services and requests

- MVD services
- DCDC circuits
- Optoelectronic (GBTx + VTRX) boards
- Cooling plant
- Services on platform in front of the magnet

Daniela Calvo

MVD services

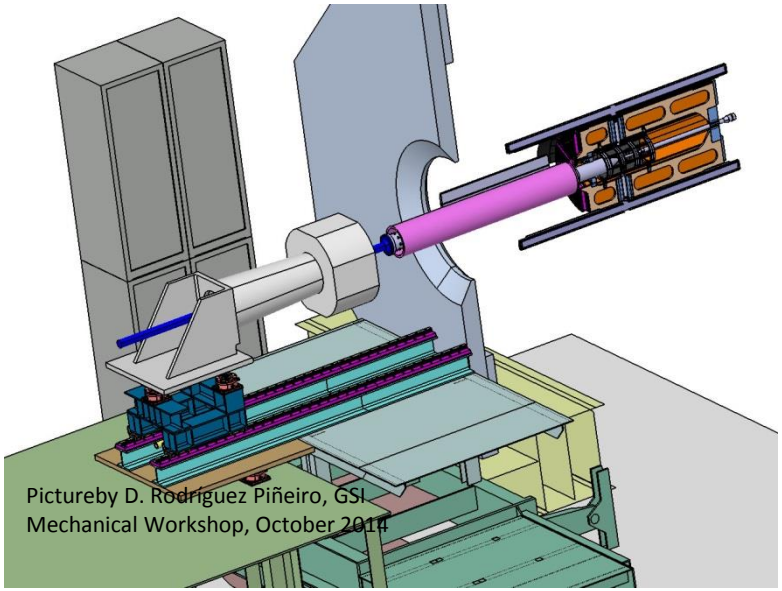
MVD services

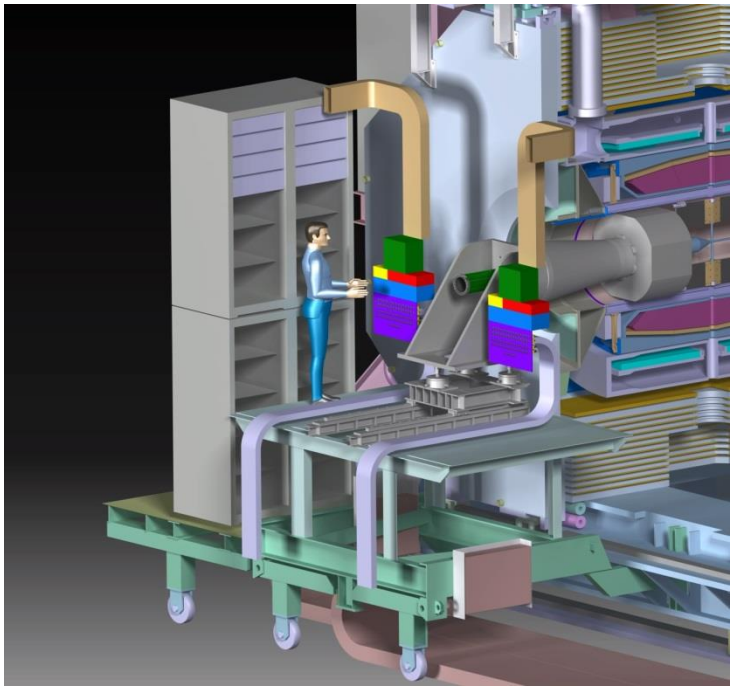


- Space for intermediate connectors
- Space for cooling manifolds

Shift backward of the pump
20 cm already requested
? answer

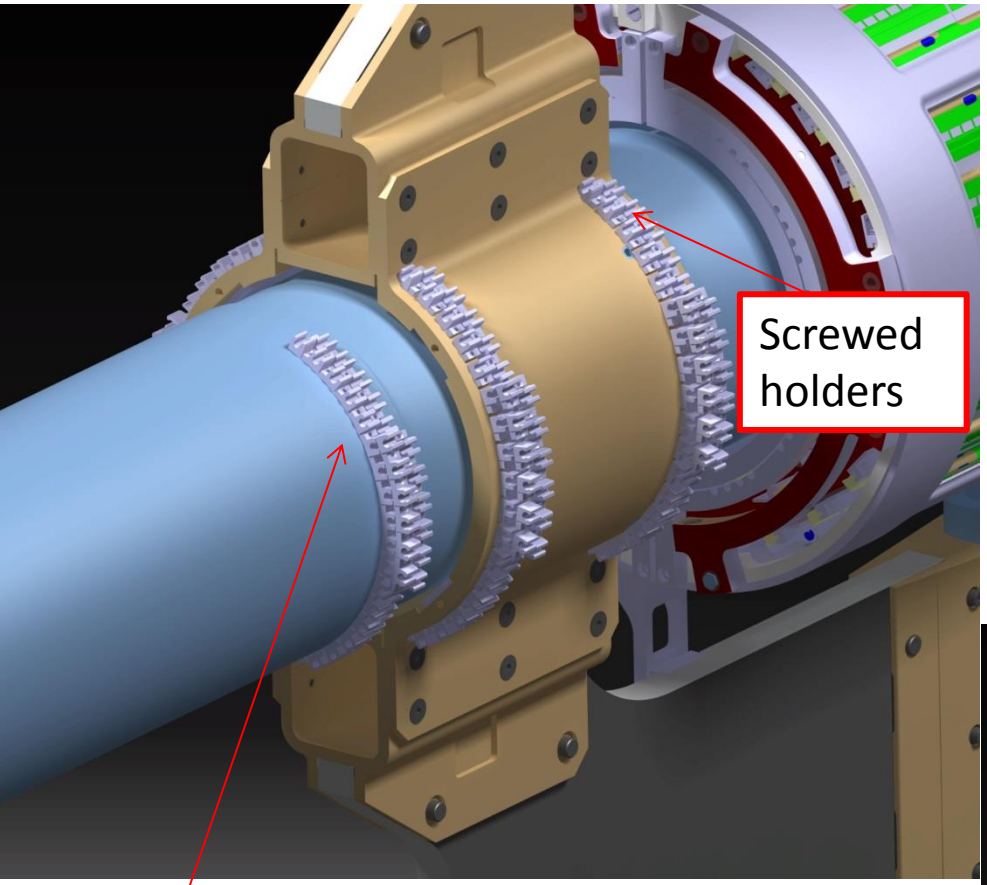
Interaction with BEMC during the installation





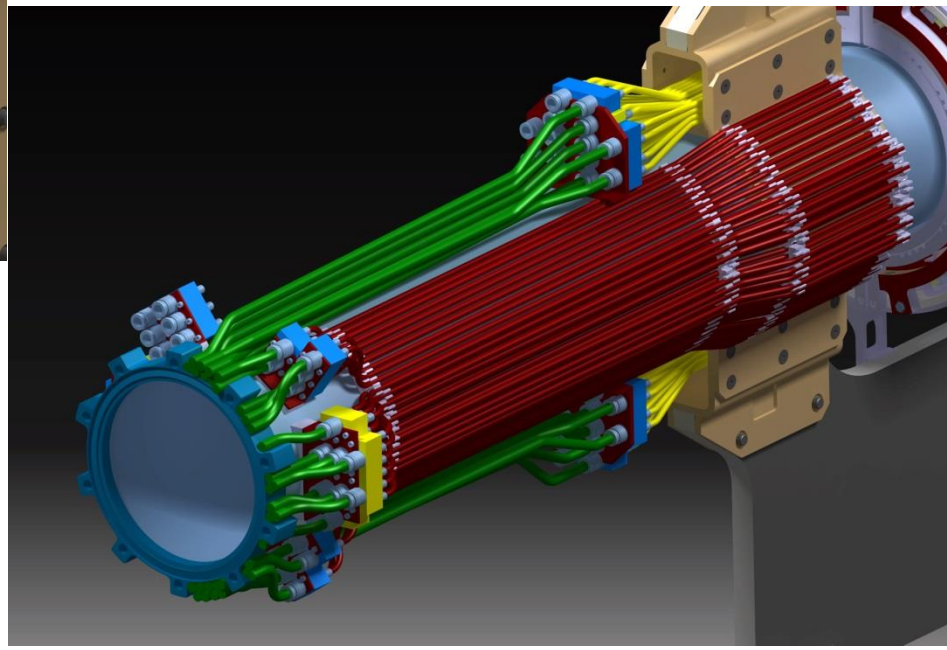
- BEMC slides on the MVD services
- All cables, connectors, etc. must fit into the hole of the BEMC
- Long cables directly connected from MVD services to the racks are possible , but have to be supported for several meters. The connectors can be a issue.
- Patch panels for MVD, as close as possible to entry port of MVD services

MVD services



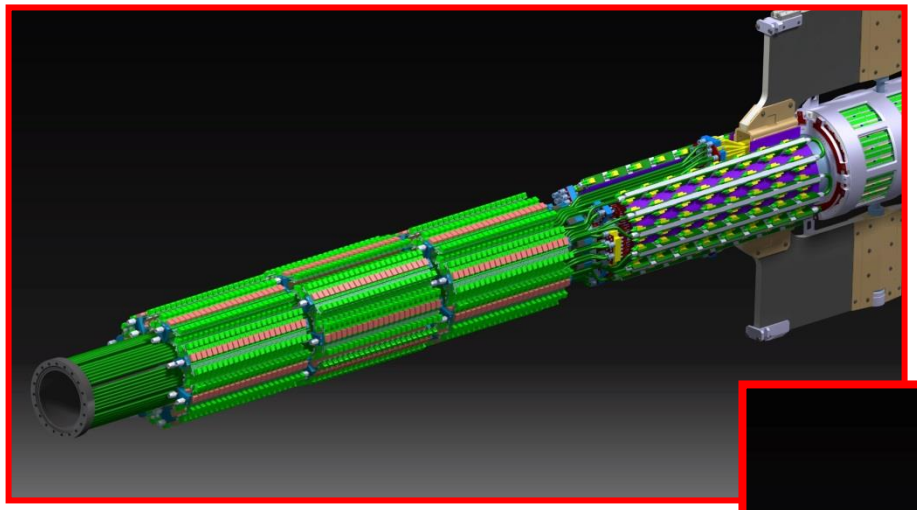
Pipe holders

- Glued
- Fixed on welded boss



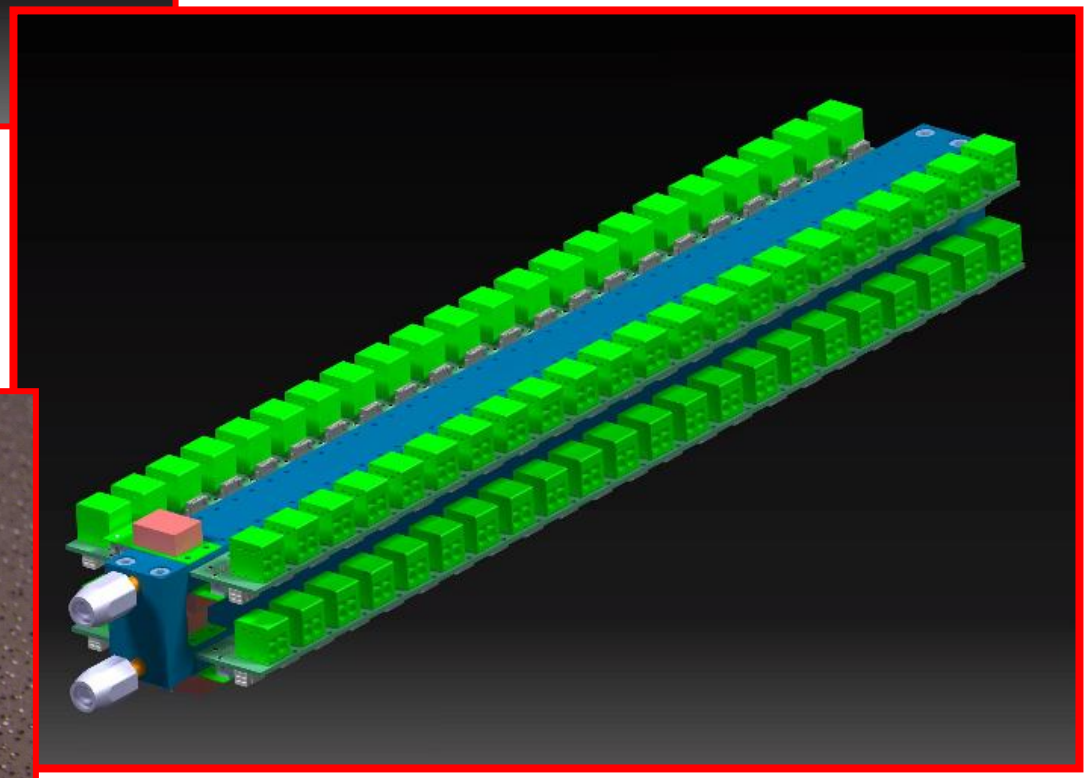
MVD services - DCDC circuits

MVD service - DCDC circuits

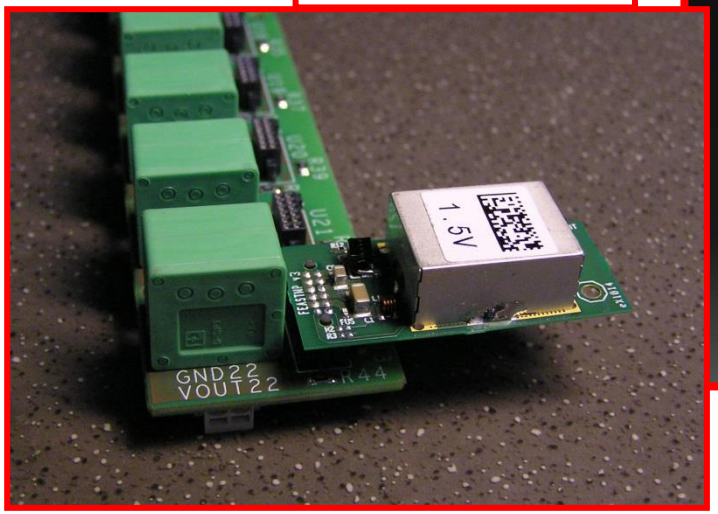


24 blocks arranged in 3 sectors
(2112 DCDC circuits)

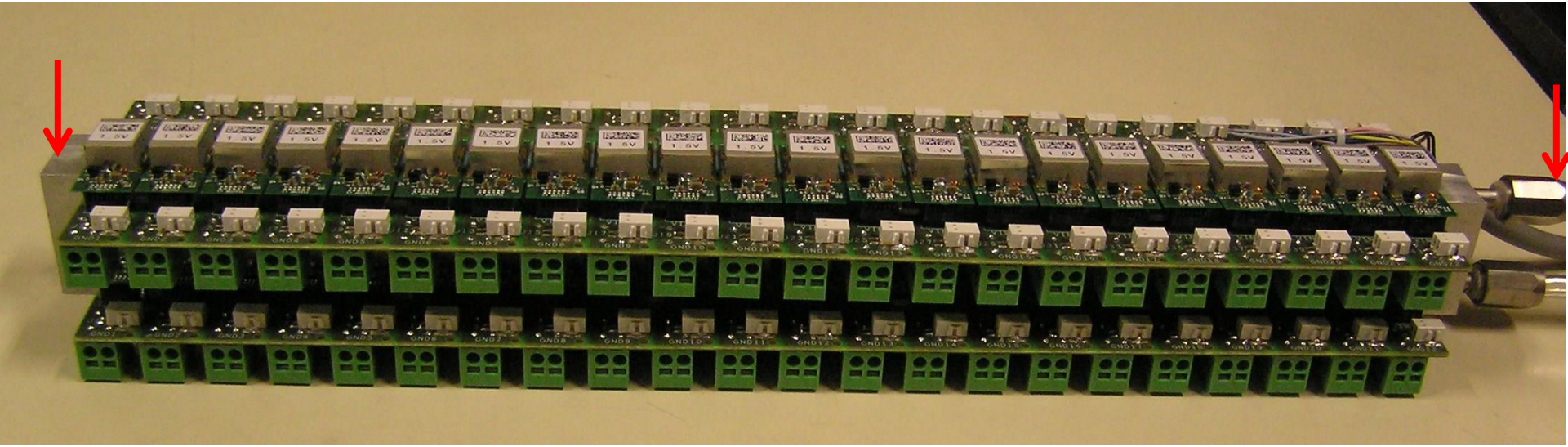
4 PCBs (left and right difference)
housing 22 DCDC circuits each



First prototype



MVD services – first prototype

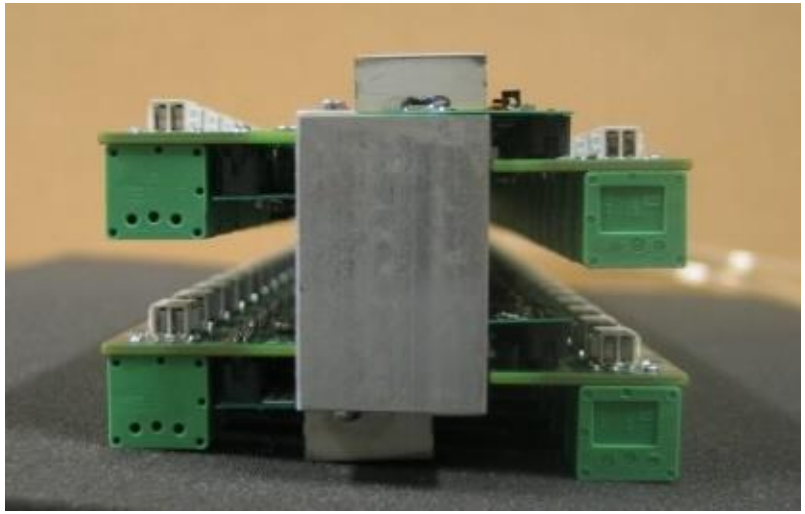


88 DCDC circuits (22 DCDC circuits each row)

Weight (without cables): ~ 1.3 Kg

Dimension (without cables):

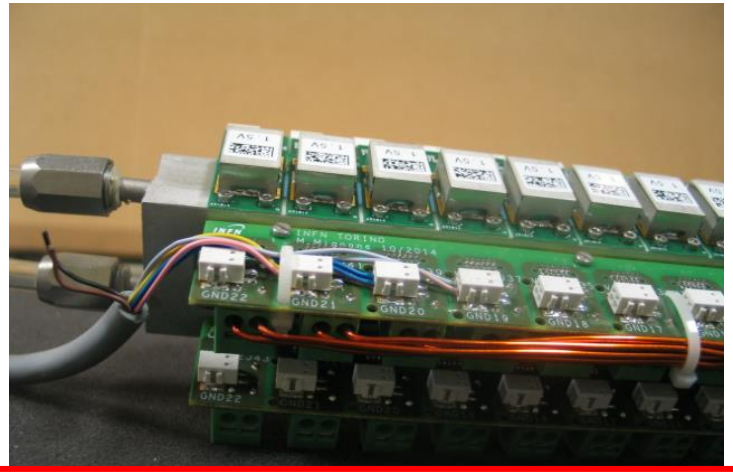
455 mm (with cooling connectors) x 85 mm x 63 mm

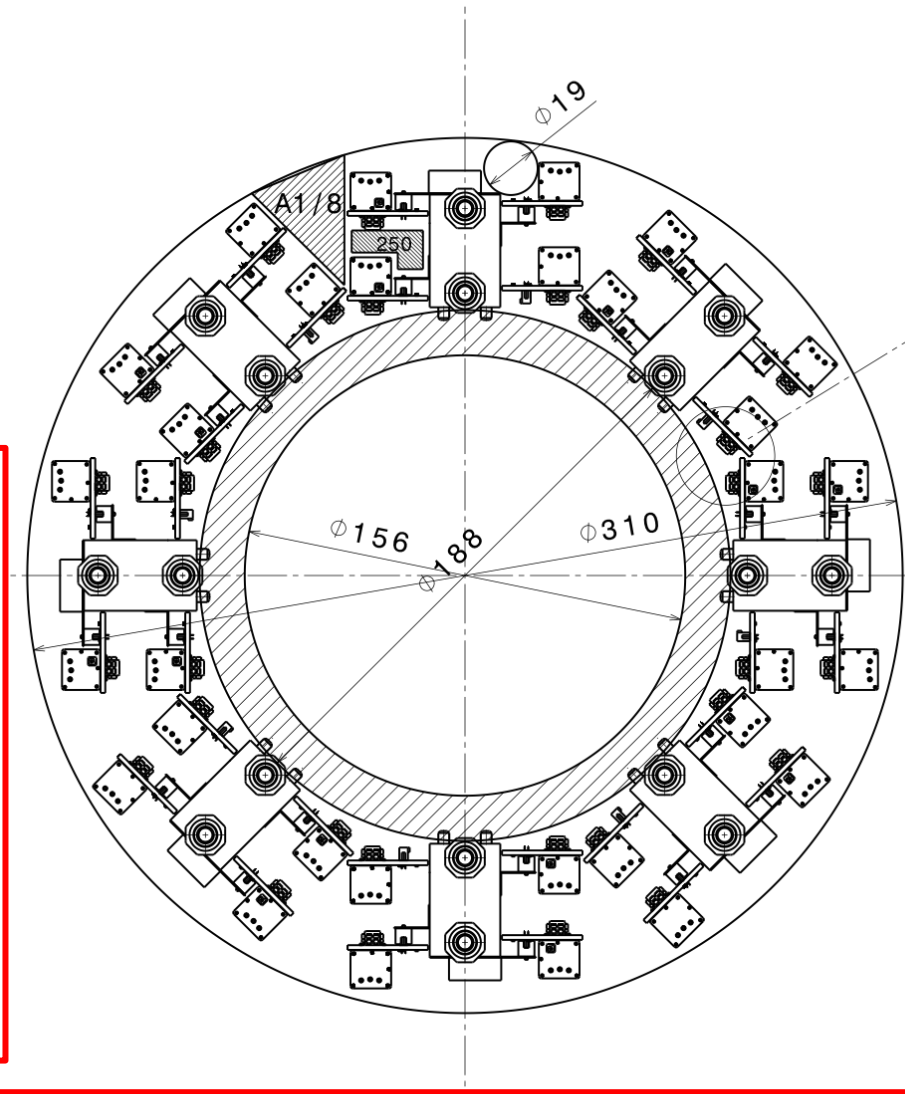


The total weight (without cables) of all the 24 blocks is ~ 32 Kg

By adding the optoelectronic boards staves the total weight is ~ 55 Kg, without cables.

MVD services - Request





Available cross section: 56000 mm^2

(between beam pipe and inner BEMC diameter)

Cooling pipes and supports: 9000 mm^2

(dashed ring – challenge solution!)

DCDC circuits leave only ~ half of cross section for cables (needed cross section: 23500 mm^2

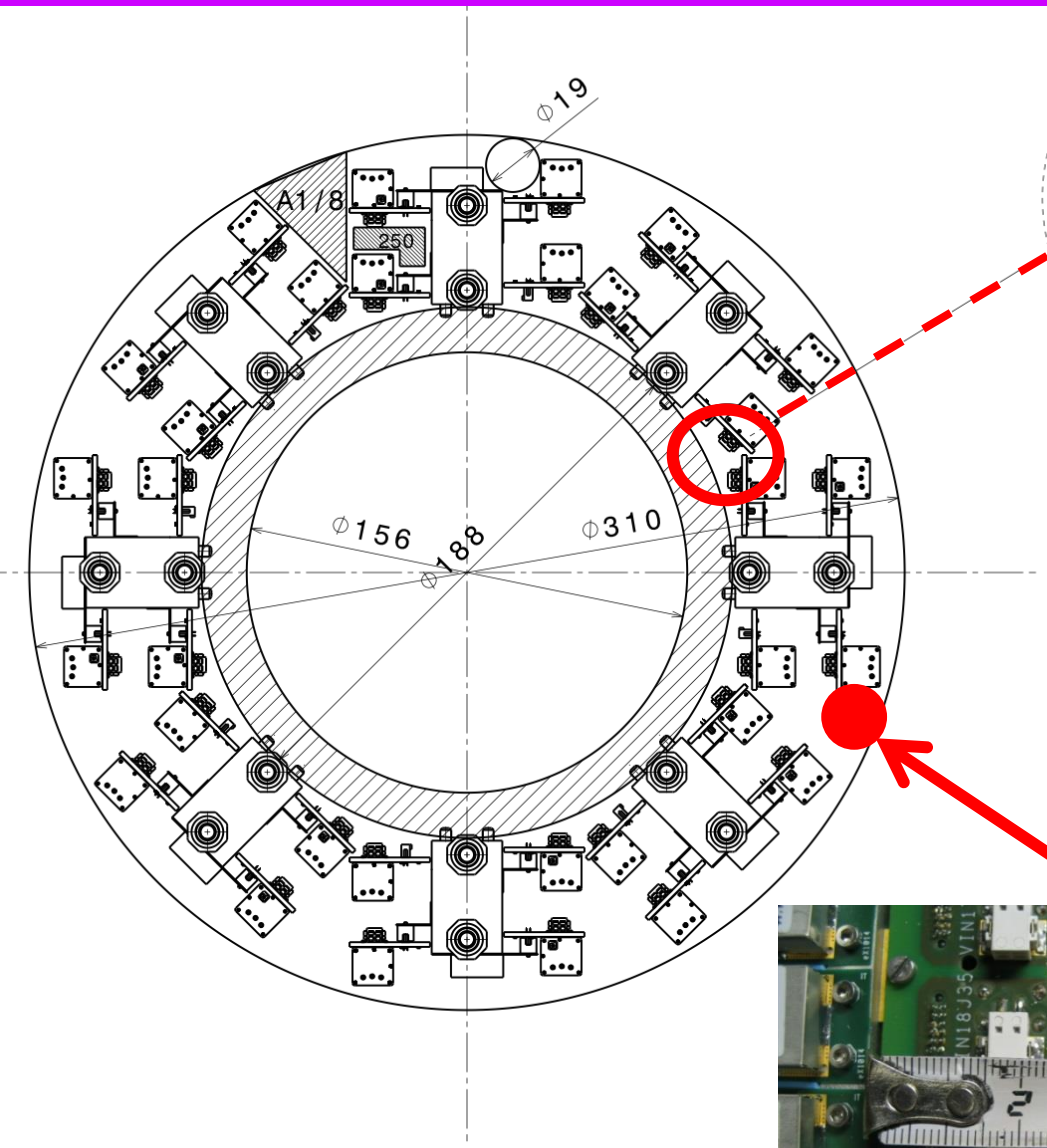
) and they will fill the empty parts between the circuits anyway.

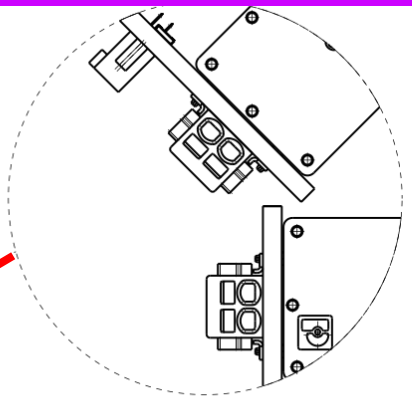
(not recommended!)

About ONLY HALF of the needed CROSS SECTION is AVAILABLE for cables (too segmented space!)

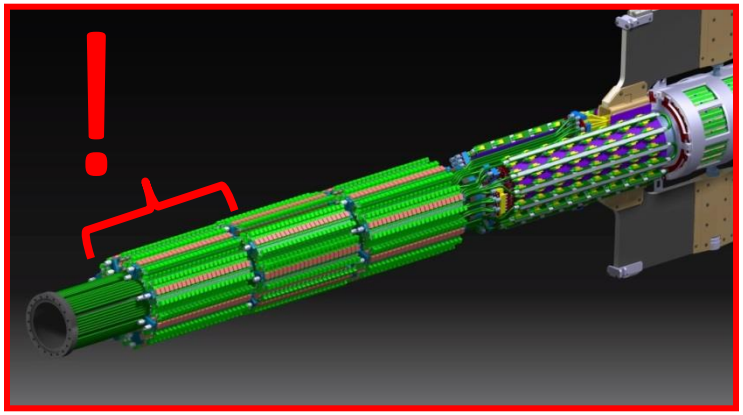
IT IS NECESSARY MORE SPACE around the beam pipe for the MVD

First DCDC stave prototype

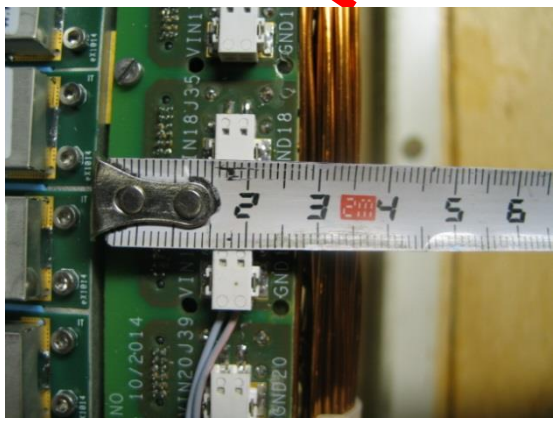


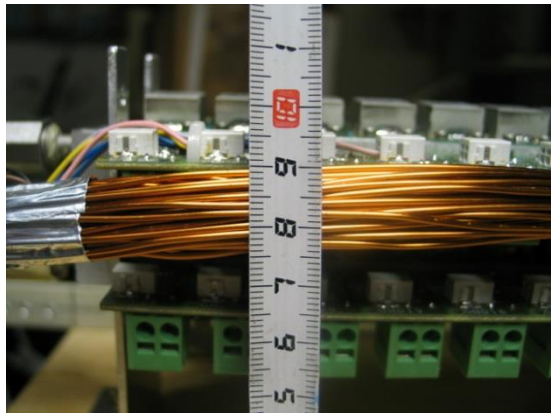


?

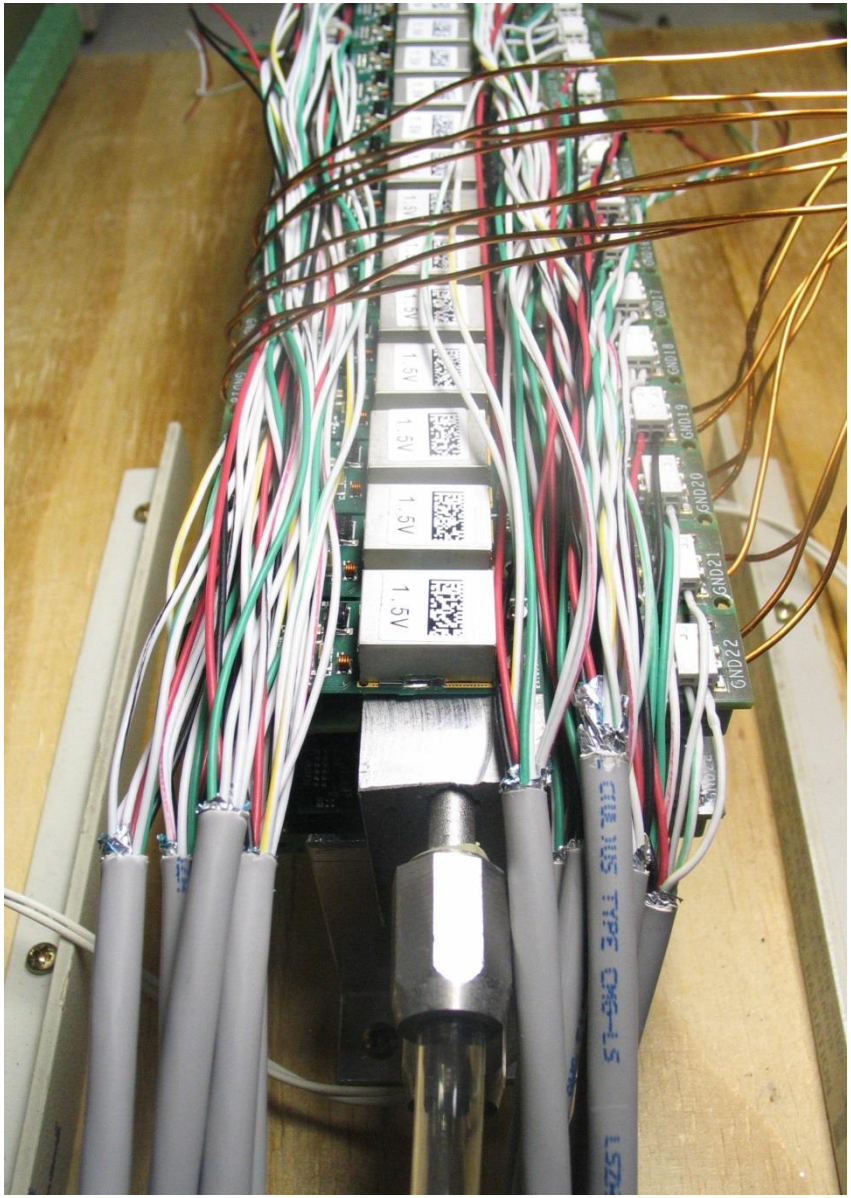


!





First DCDC stave prototype



Cables from power supplies – max diameter: complex handling of all the wires on the top of the DCDC circuits. The bottom part has to be still tested.

Cables to the readout - max diameter : ok

Tested power : ~ 7,6 W/ch

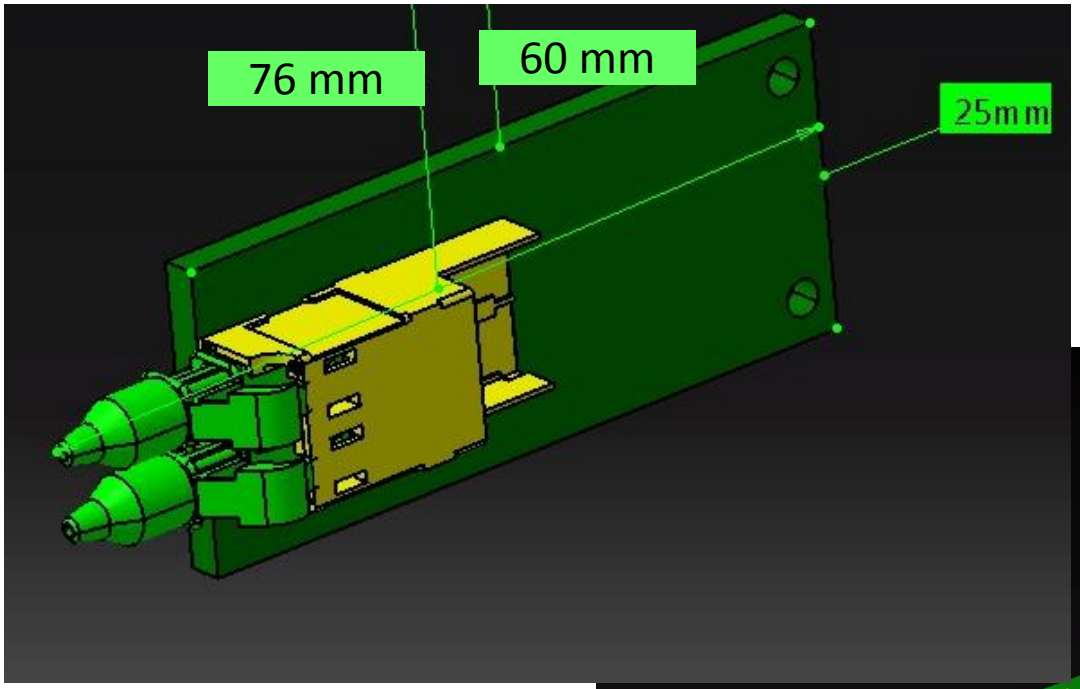
DCDC circuit efficiency (measured): ~ 63%

Expected T on the DCDC circuit (with ideal contact and T of input water of 18C): ~ 32 °C

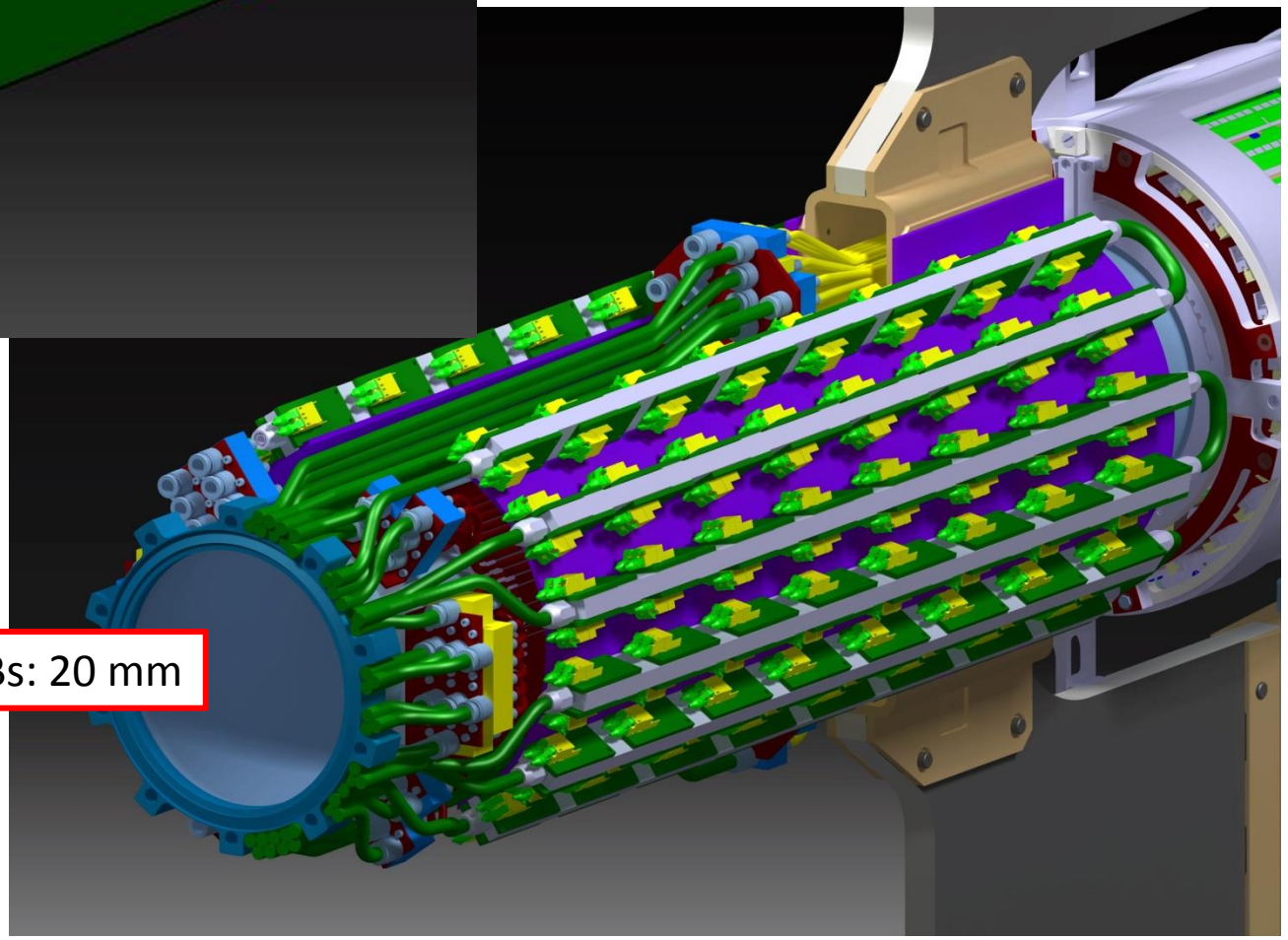
Measured T on the DCDC circuit (with thermal pad and T of input water of 16 C, and only a part of the dcdc circuits powered): up to 34 °C

MVD services – Optoelectronic boards

Optoelectronics board, old version

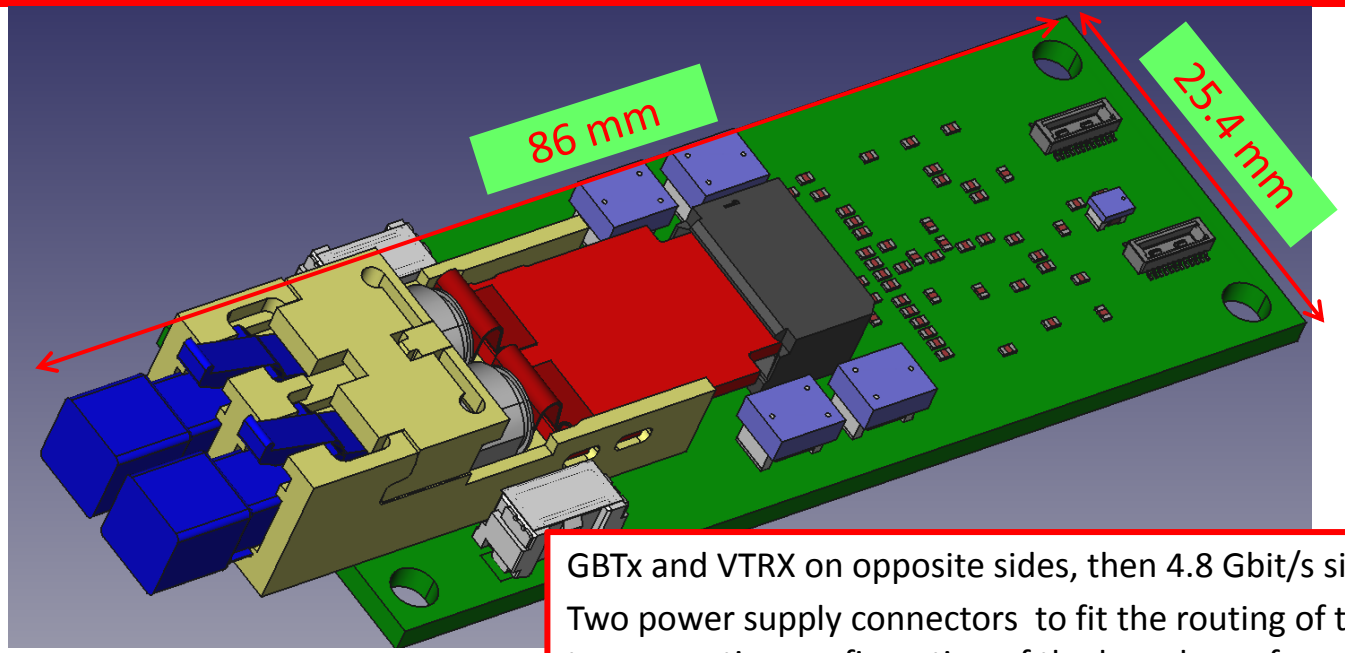


12 staves with 16 GBT boards each (192 circuits)



Interspace between PCBs: 20 mm

Optoelectronic board, new version – GBTx + VTRX



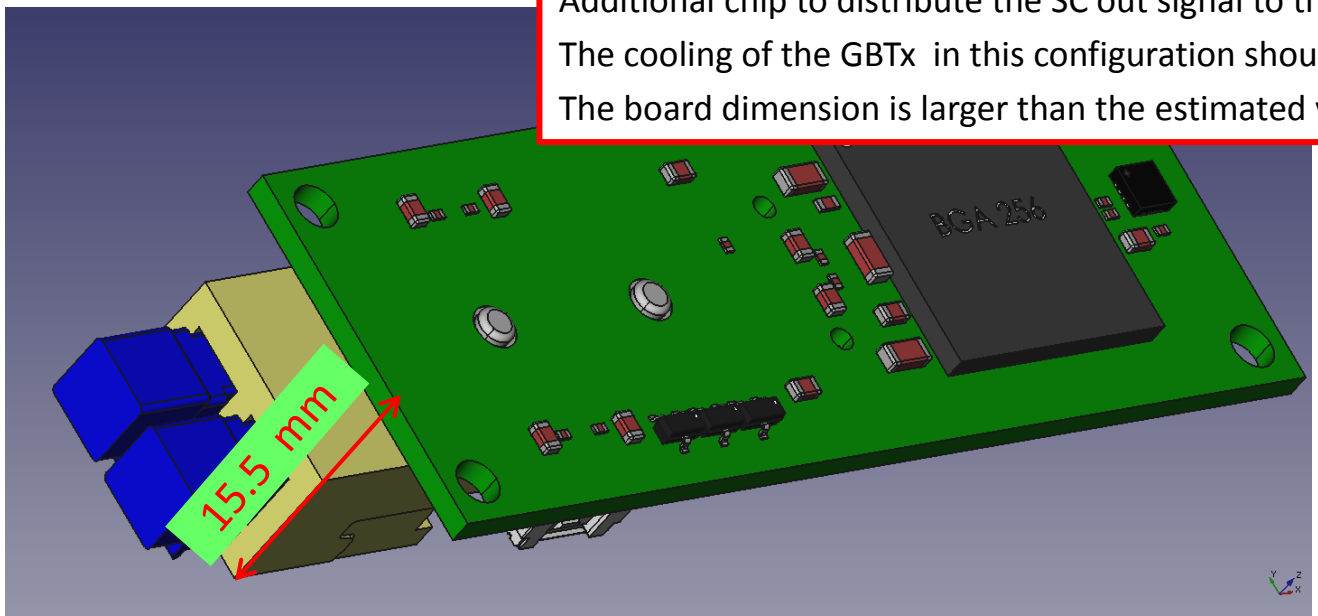
GBTx and VTRX on opposite sides, then 4.8 Gbit/s signals routed using vias

Two power supply connectors to fit the routing of the power supply cables, in fact two mounting configuration of the boards are foreseen.

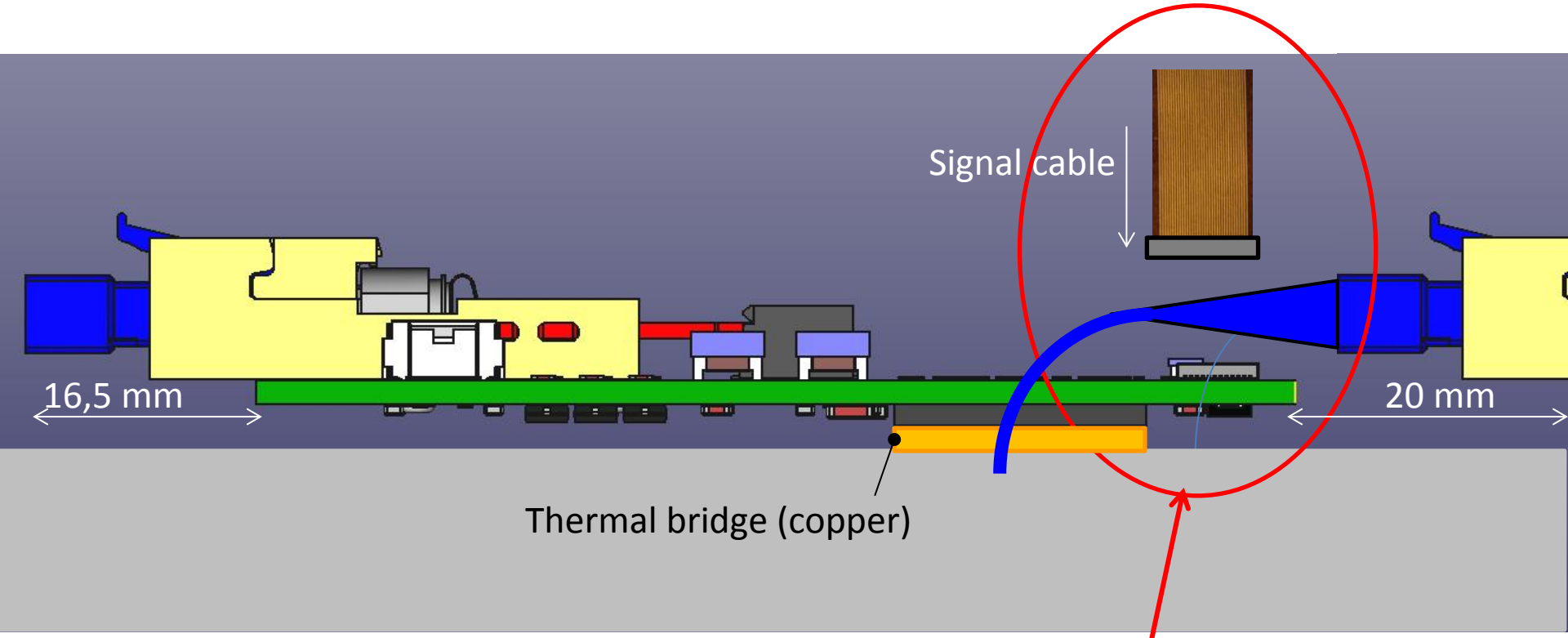
Additional chip to distribute the SC out signal to the two connectors towards the FEE.

The cooling of the GBTx in this configuration should be easier (to be verified!).

The board dimension is larger than the estimated values (3 years ago) anyway.

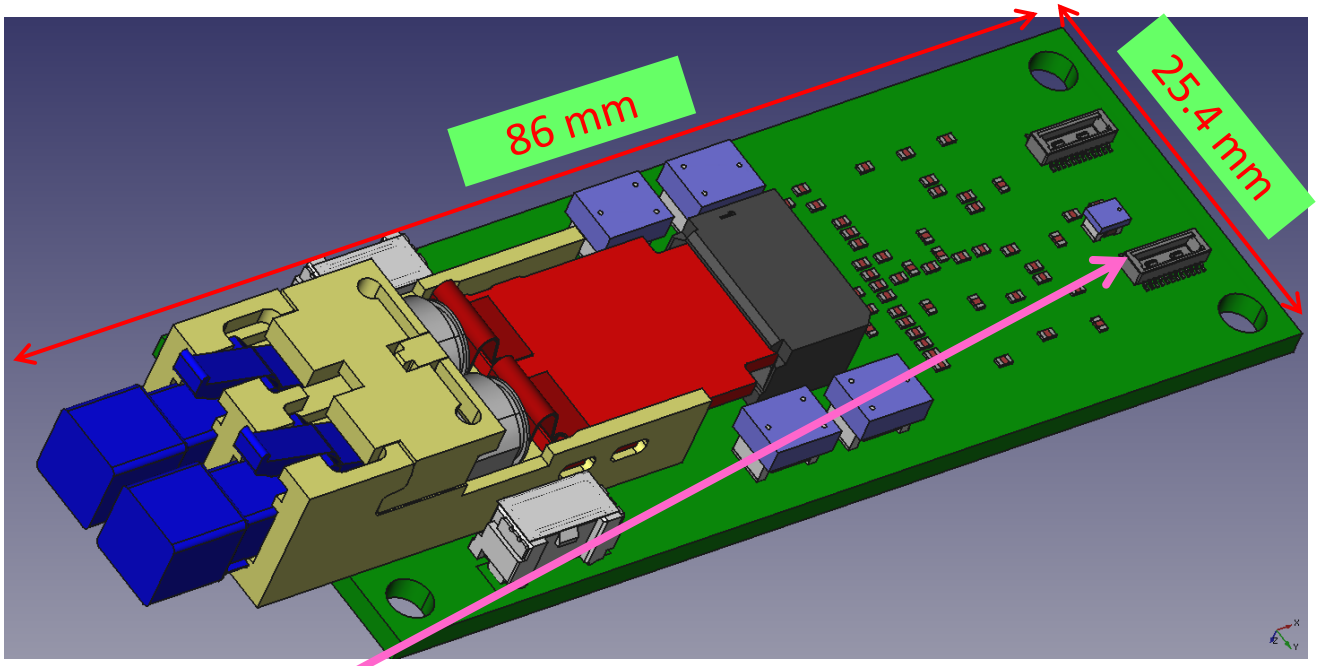


Opto. board, new version – board routing



Interference between optical fiber connectors and signal cables !!

Opto. board, new version – board number



Each connector includes : 5 e-links + SC signal

22 additional boards

- to maintain the symmetry left– right during the routing of the semi disks and semi cylinders of the barrel part
- to be able to send the SC signal to each pixel or strip module without connection between different modules

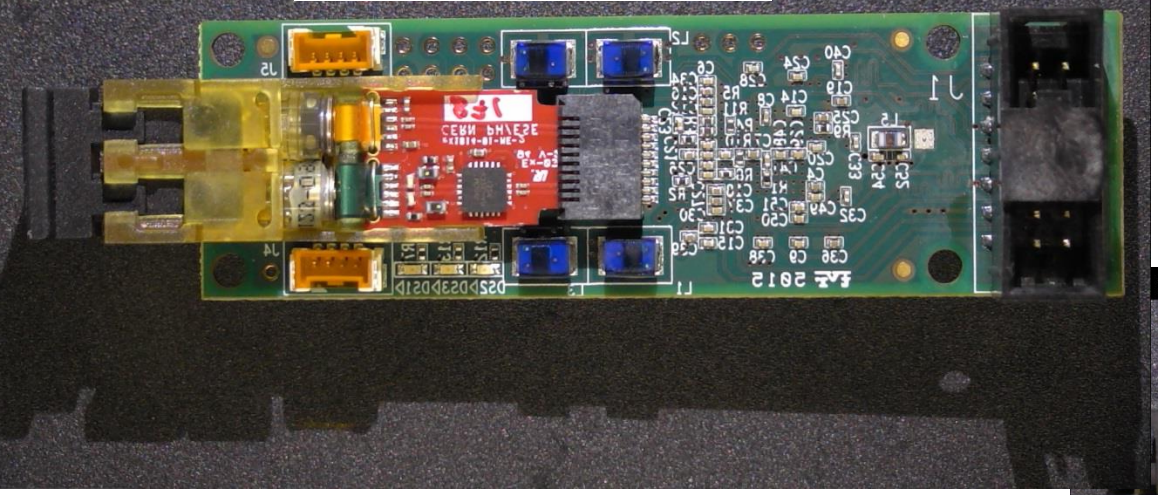
It is necessary to increase the GBT board number from 192 to 214.

It means 2 additional optoelectronic boards each bar, one each side (solution?)

Opto. board, new version – adapted to ToPix4

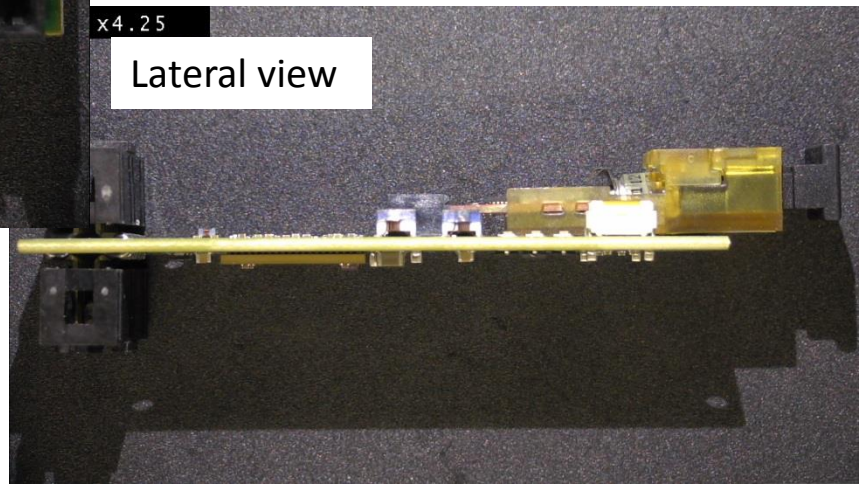
View from the GBTx side

View from the VTRX side



First prototype of the optoelectronic board

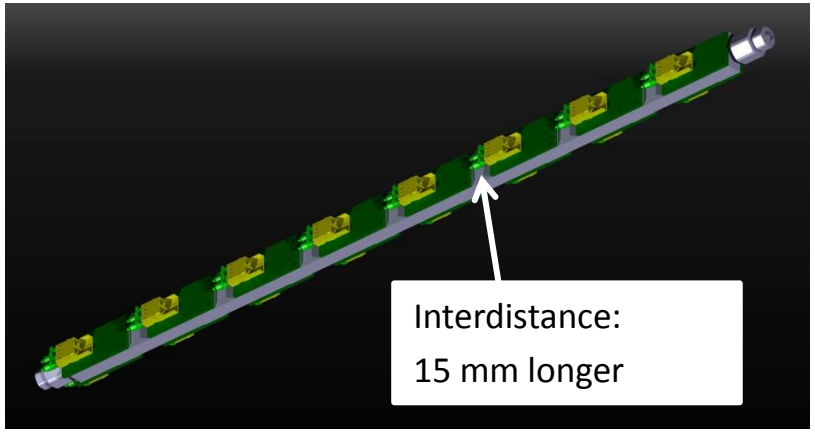
The two connectors for the e-links and SC signal of the final version have been adapted in this case to work with ToPix4

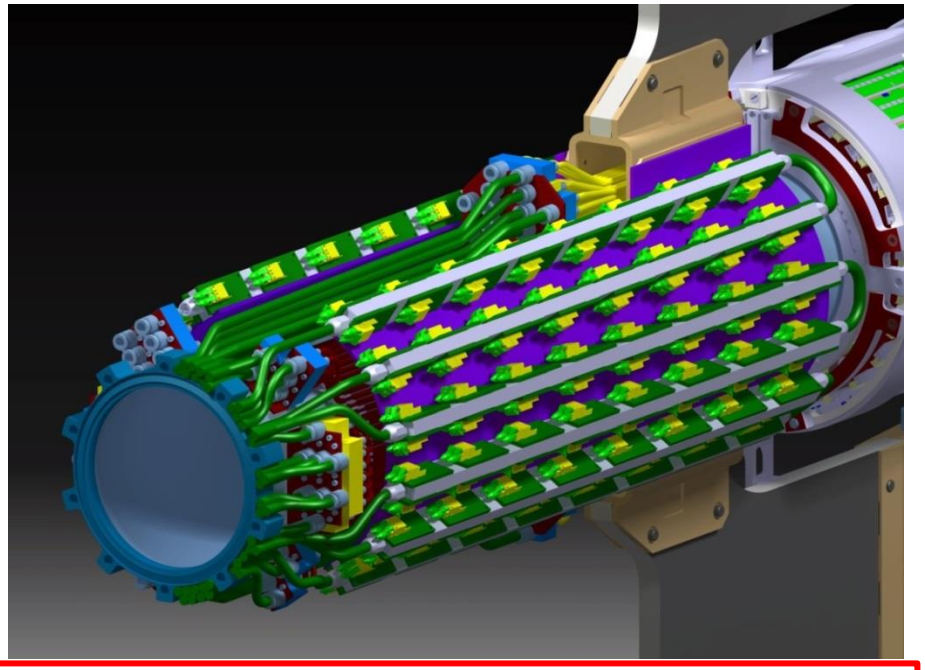


Lateral view

A possible solution and drawbacks

- Additional 80 mm to arrange the 192 longer optoelectronics boards
- Additional 120 mm to avoid interference between optical fibers and signal cables
- Additional 86 mm to arrange an additional board along the rod





Possible solution ?: to shift upstream the beam pipe flange

A DCDC block (or partial block) has to be cut out, anyway!, if we follow this solution…

but the distance from the module readout (up to ~ 30 cm) is too much for the aluminum cables and the cooling manifolds

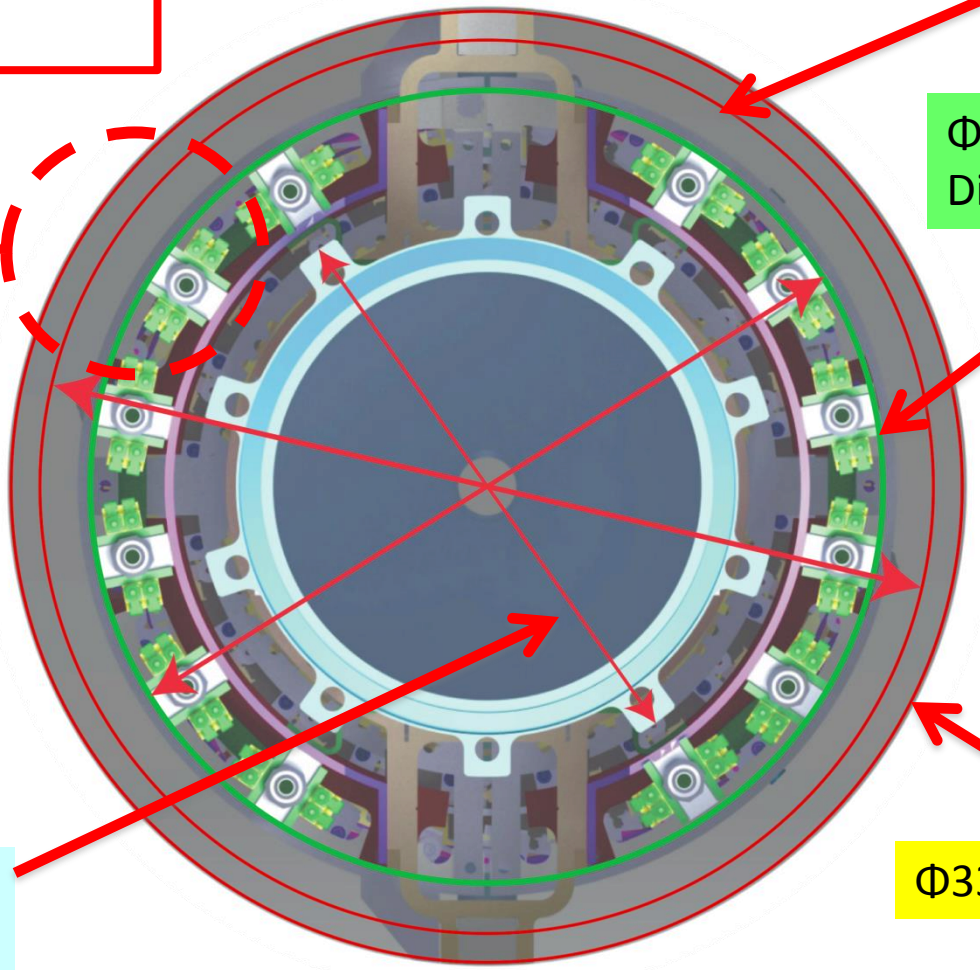
IT IS NECESSARY MORE SPACE around the beam pipe for the MVD

Alternative solutions !

Add optoelectronic boards on the top of existing staves

Φ310 MVD Services Limit

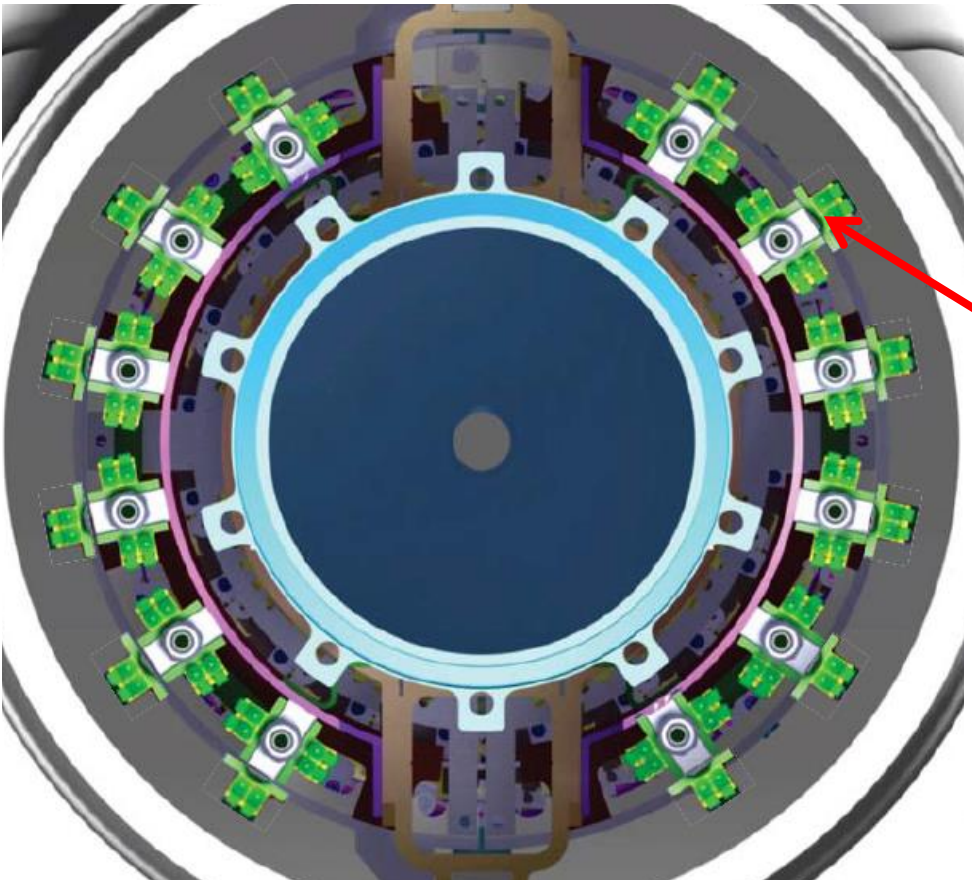
Φ275 GBT Outer Diameter



Φ202 Flange Diameter

Φ330 BWEC Limit

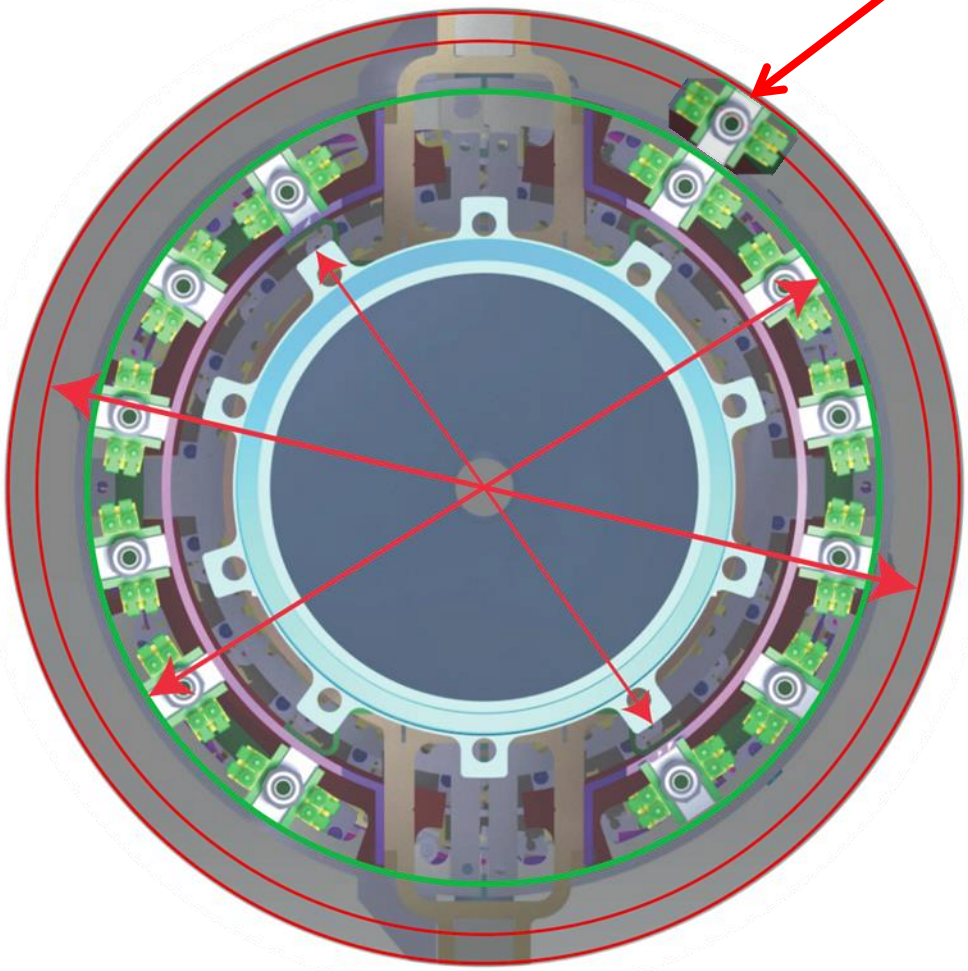
First solution



First solution

- Additional boards on the top of the staves, in a staggered configuration
- Use of all the space between the existing stave and the MVD services limit (~ 17.5 mm)
- Routing of this part not easy anyway
- Cable cross section available at this level is reduced.
- Additional cooling request. To be investigated

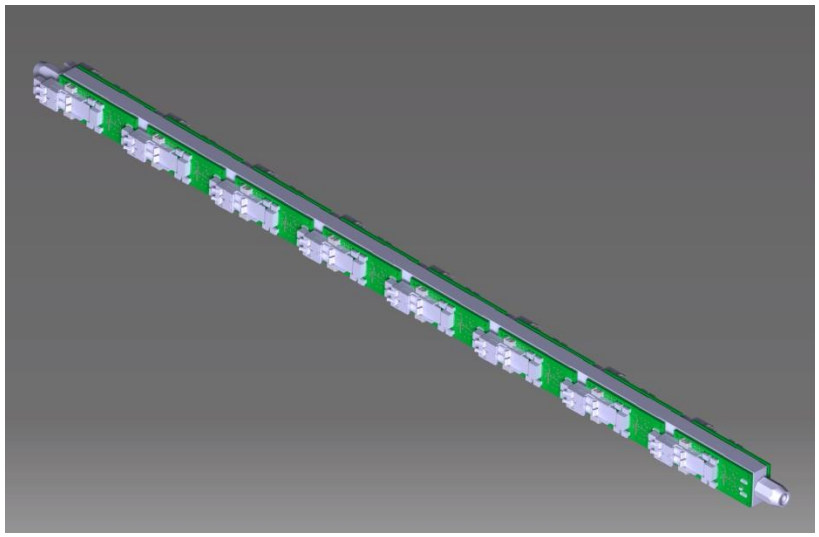
Second solution

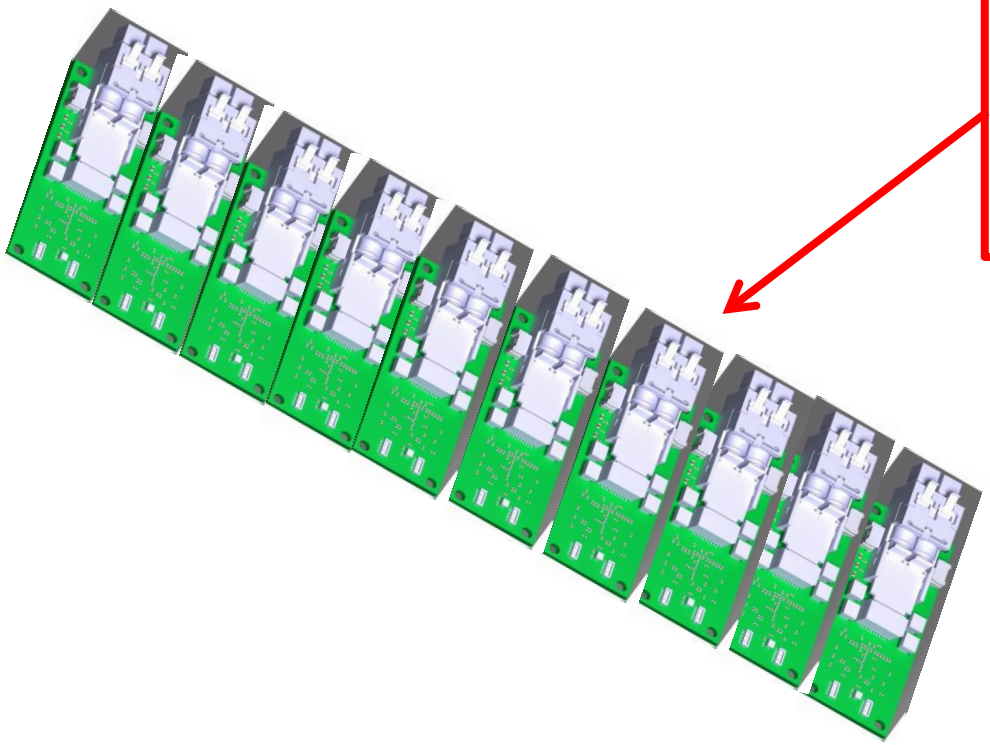


Second solution

- Additional staves on the top of the existing staves
- Large overhang in the clearance MVD-BEMC
- Routing of this part not easy anyway
- Cable cross section available at this level is strongly reduced.
- Additional cooling request and pipes.

Alternative solution

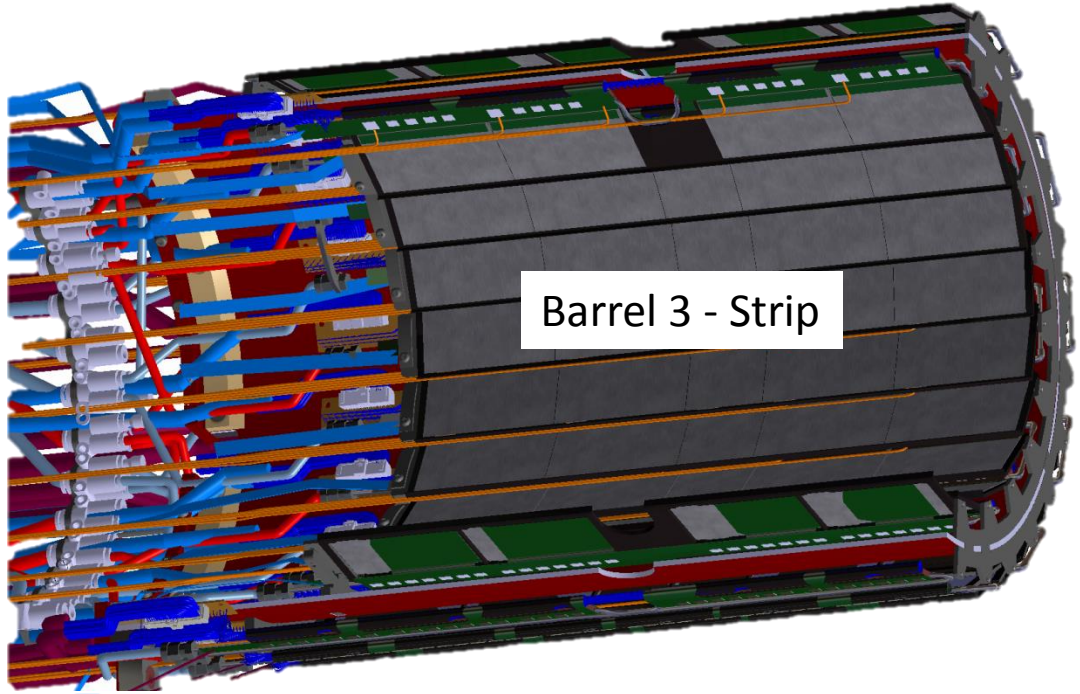


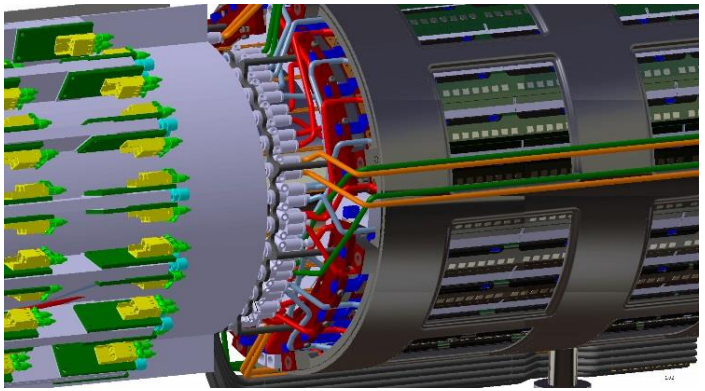


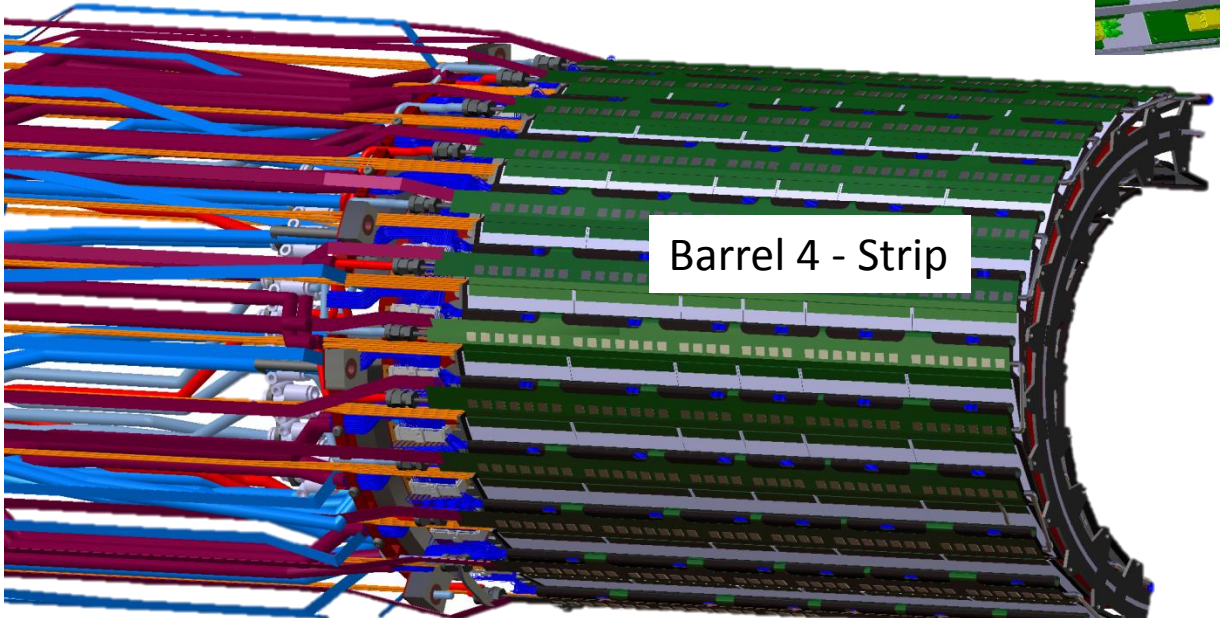
Third solution

- Rotate the optoboards on the staves (perpendicular)
- Routing of this part not easy anyway
- Available cable cross section reduced, at this level.
- Additional cooling request. To be investigated

Interferences upstream the MVD

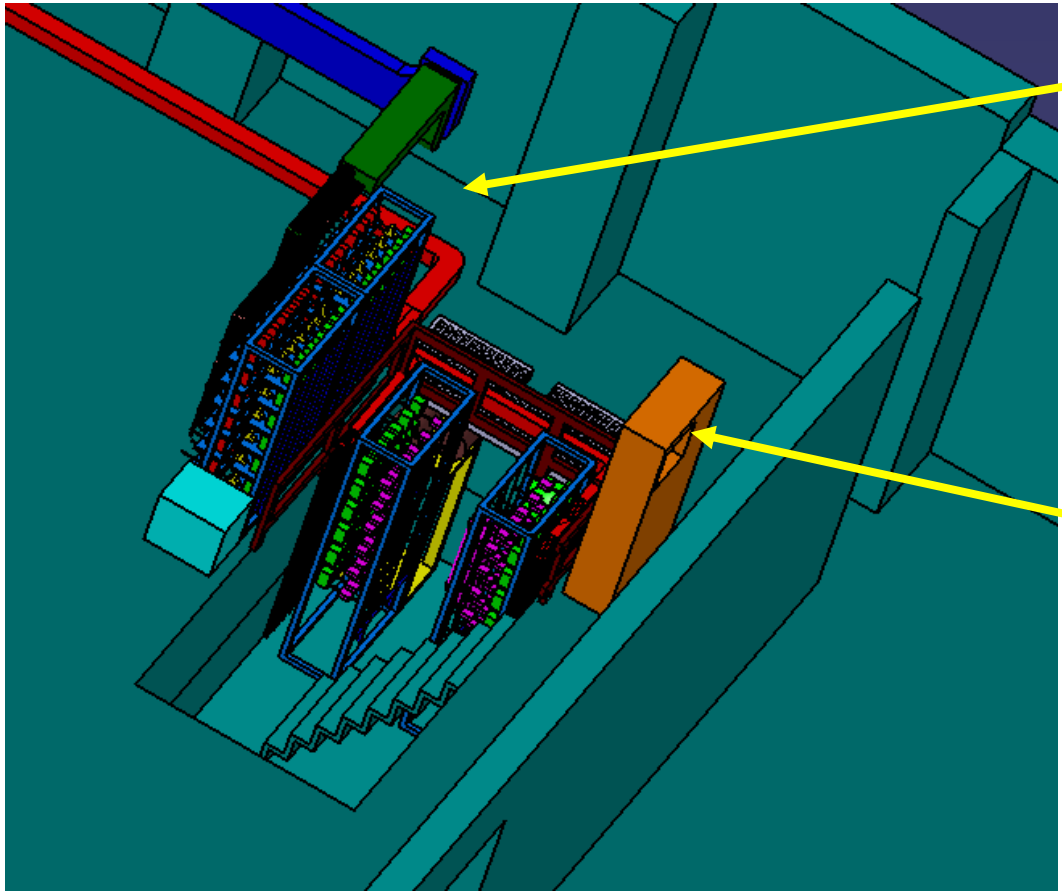




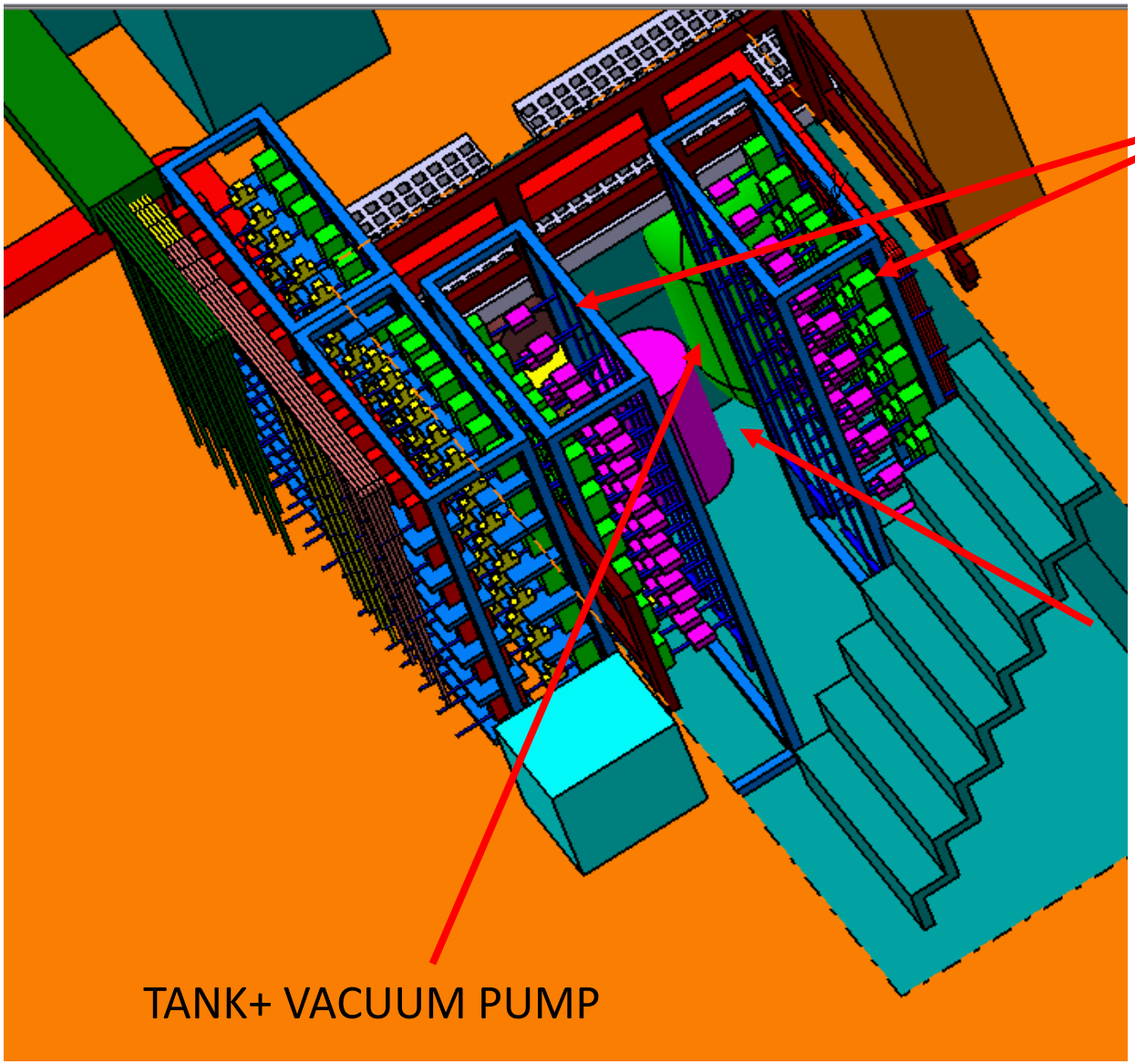


MVD services – Cooling plant

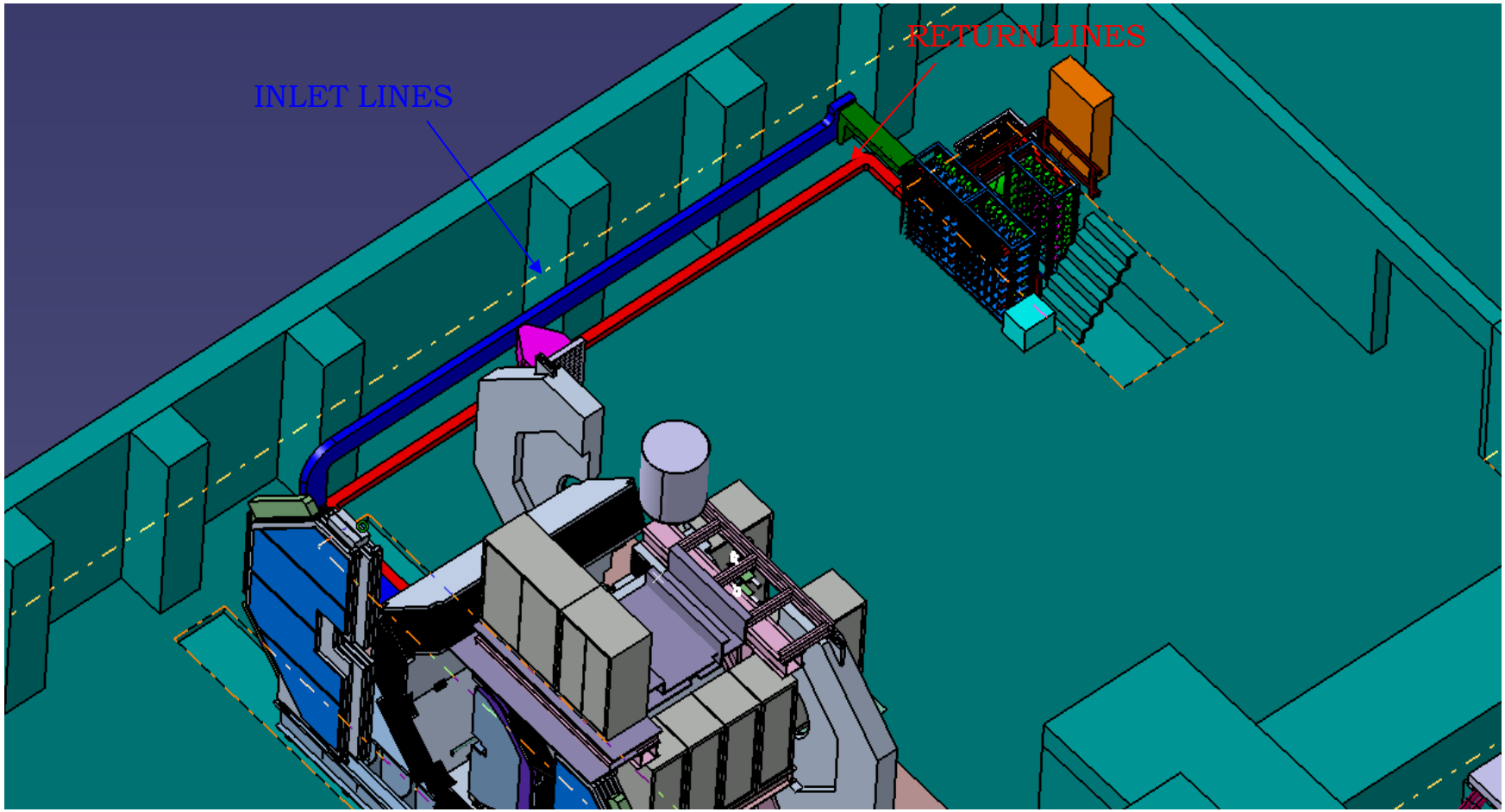
Cooling plant ouside the pit



Cooling plant inside the pit



Cooling plant - line paths inside PANDA Hall



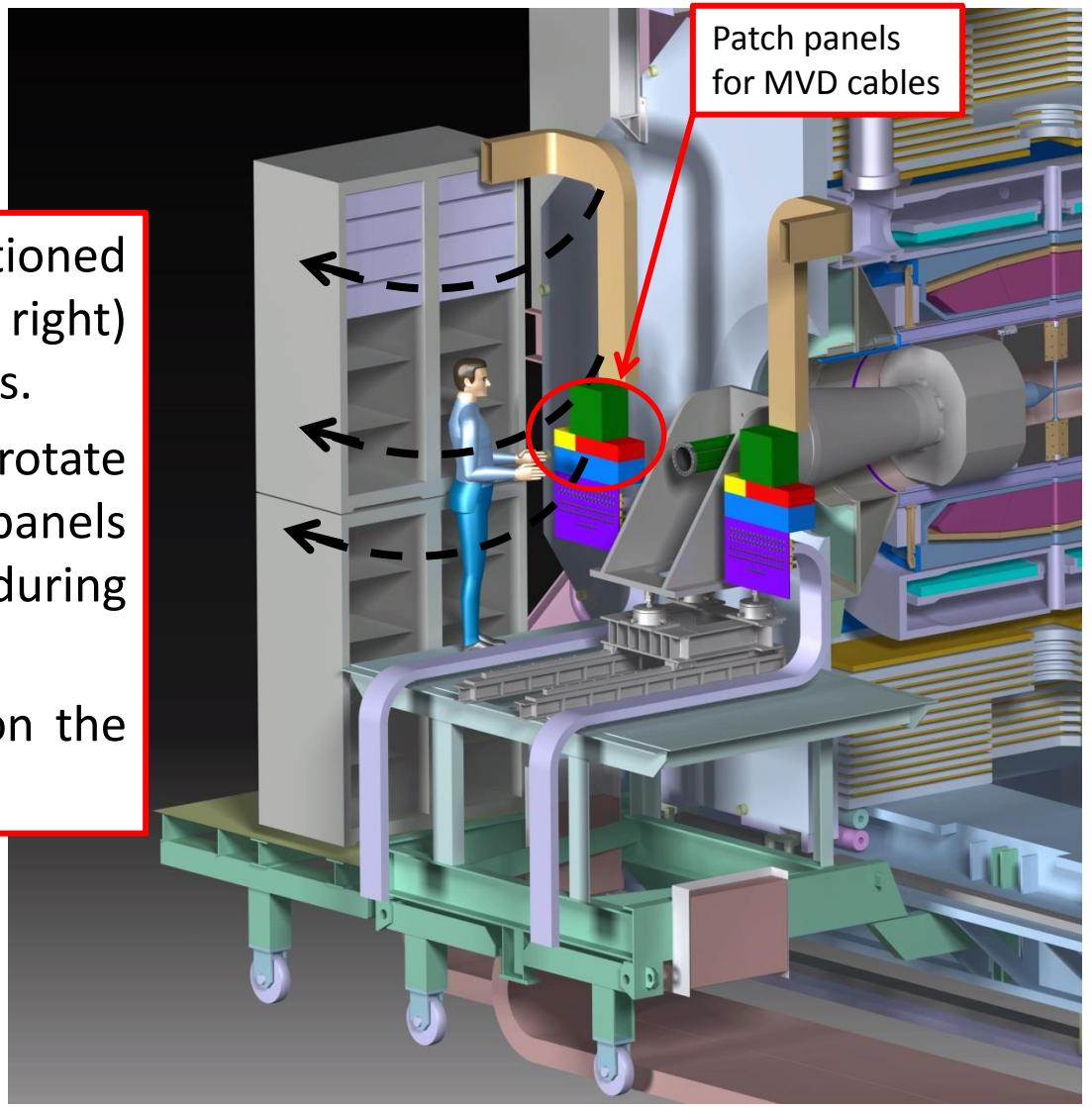
MVD services in front of the magnet

Patch panels for cables - request

Patch panels for MVD cables positioned close the BEMC support (left and right) with duct to route cables from racks.

A specific system could move and rotate the duct for positioning the patch panels at the external side of the racks, during the installation of detectors.

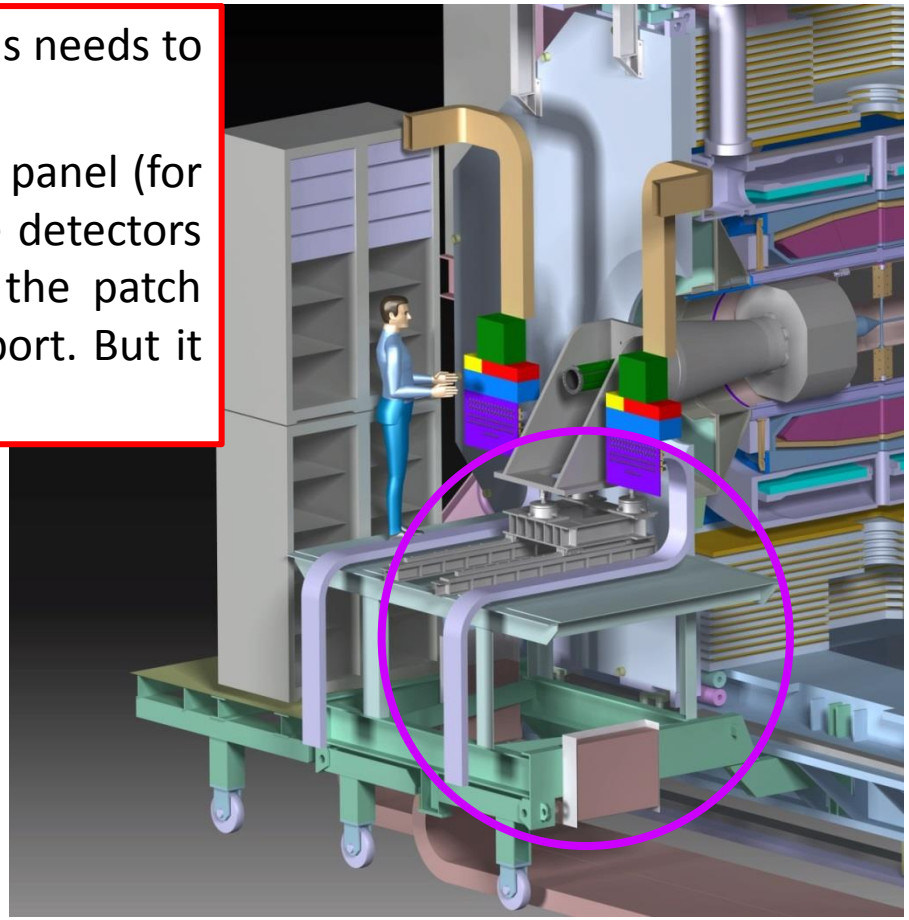
The system could be positioned on the top of the racks

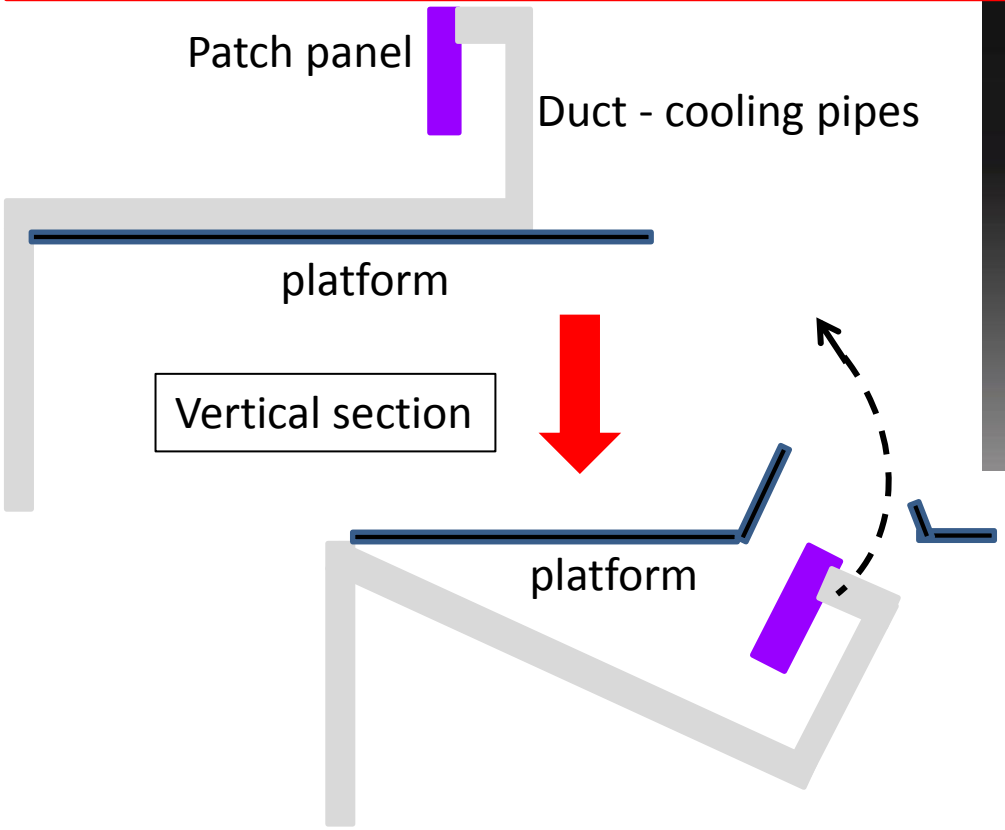


Routing of the cooling pipes and patch panel - request

The duct for the cooling pipes to the patch panels needs to be positioned under the platform floor

It should be a solution to foresee also the patch panel (for the cooling part) under the platform during the detectors installation. A system could move and rotate the patch panel to the final position, near the BEMC support. But it is necessary to go trough the platform floor.





Input about the electronic system in the racks close the appparatus

- Channels to be powered
- Boards, controllers, power supplies
- Power and cooling requirements
- Place requirements
- Cable cross sections, connector types, …

Daniela Calvo (INFN-Torino)
on behalf of the MVD group

Environment

- TID: O(1 Gy) (from PANDA. From hall/ beam:?)
- NIEL: ?
- Residual magnetic field: O(10-100 mT)
- EM interferences: ?

Numbers

RACKS near PANDA									
		channel n.	module	V,I (max.)	module n.	mainframe type	mainframe n.	power/mainf. [kW]	U/crate
PIXEL part	Low Voltage-readout (A&D)	608	CAENa2519a	15V,5A	76	SY4527	5	3	8
	High Voltage	176	CAENa1520p	500V, 15 mA	15	SY4527	2	3	8
	Optoelectronic boards (1.5&2.5)	368	CAENa2519a	15V,5A	46	SY4527	3	3	8
	LV & HV safety factor				14 LV e 1 HV	SY4527	1	3	8
STRIP Part									
	Low Voltage	676	8016i	15V, 5A	85	Wiener MPOD	9	3	9
	High Voltage	296	ECH_...	500V, 5 mA	20	ISEG ECH_44A	2	1,2	8
General part									
	pressure sensors(power &readout& transmission)	170	to be defined	NSCSANN006BAUNV, 12V,2A			4	1	3
	on detector/interlocks	25	custom				1	1,2	8

Numbers

mainframe type	mainframe n.	power/mainf. [kW]	U/crate	rack space [U]		Total power [kW]	Notes
SY4527	5	3	8	40		15	2 U per air cooling/each Mainf.: 10U
SY4527	2	3	8	16		6	2 U per air cooling/each Mainf.: 4U
SY4527	3	3	8	24		9	2 U per air cooling/each Mainf.: 6U
SY4527	1	3	8	8		3	2 U per air cooling/each Mainf.: 2U
							24 U
Wiener MPOD	9	3	9	81		27	
ISEG ECH_44A	2	1,2	8	16		2,4	2 U per air cooling/each Mainf.:2U
to be defined	4	1	3	12		3	estimated values for the power
custom	1	1,2	8	8		1,2	estimated values for the power
				205	Total U crates	66,6	
				24	Total U for cooling		
				229	TOTAL U Racks		
						TOTAL POWER	

Inside the rack – PS CAEN SY4527 - example

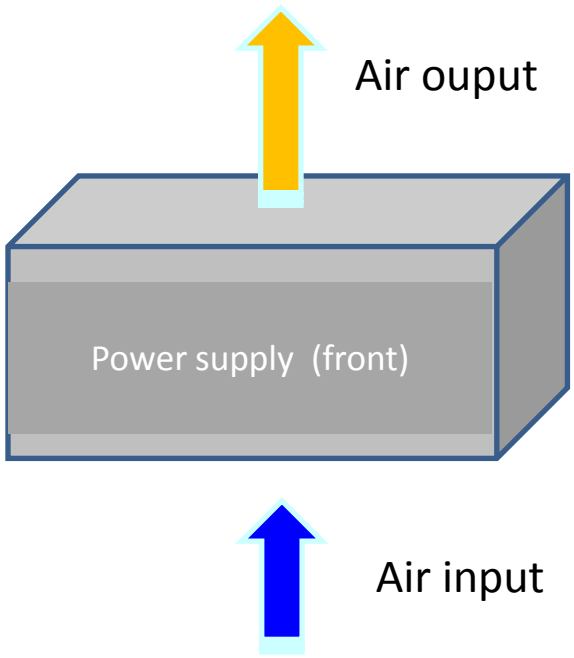
Empty

Power supply - CAEN type

Power supply - CAEN type

Power supply - CAEN type

Power supply - CAEN type

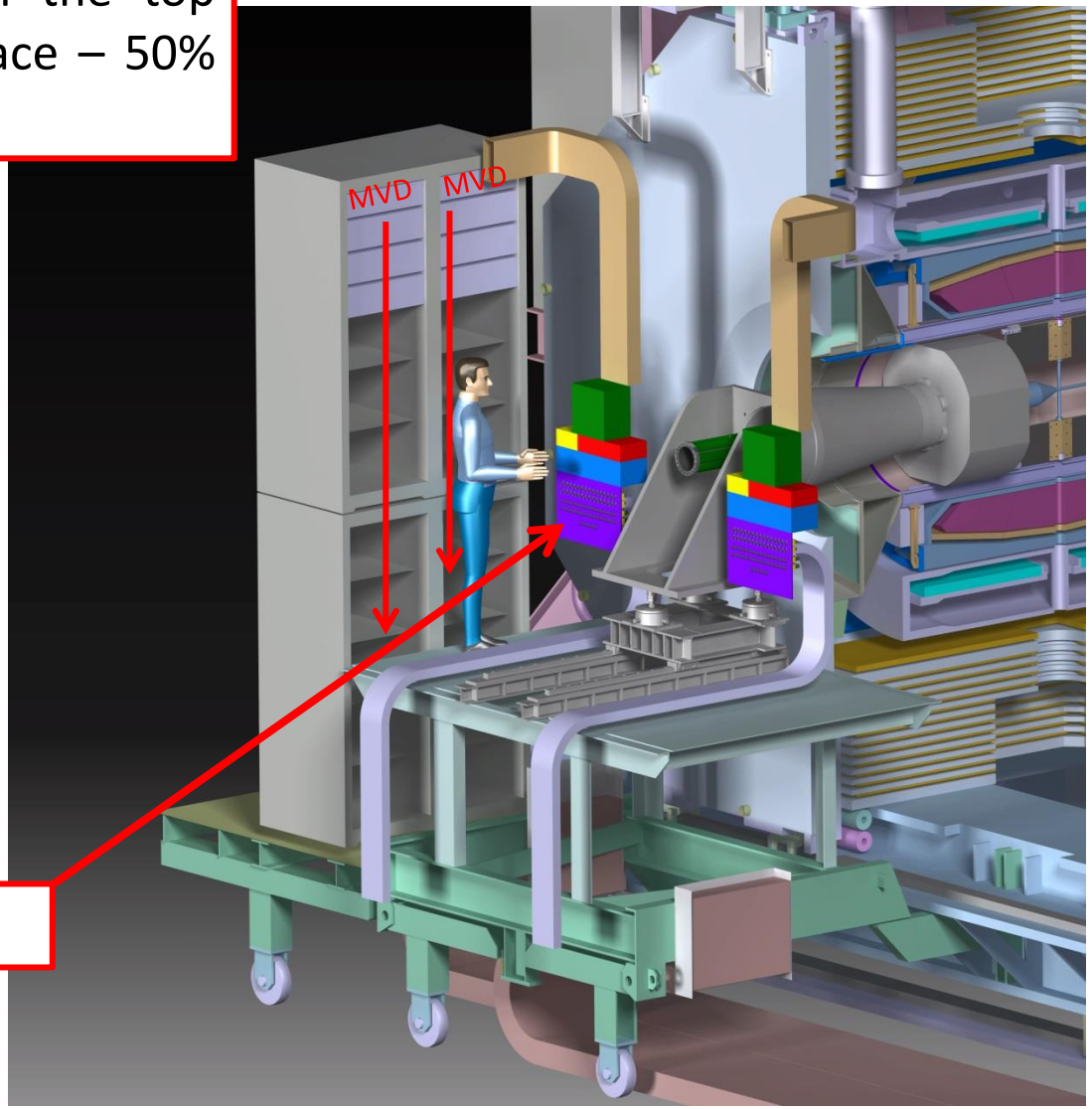


Front – Controller, display, Primary PS, boosters

Rear – LV or/and HV boards

Racks - request

Use the racks starting from the top (229 U (including cooling space – 50% left and 50% right).



MVD patch panels

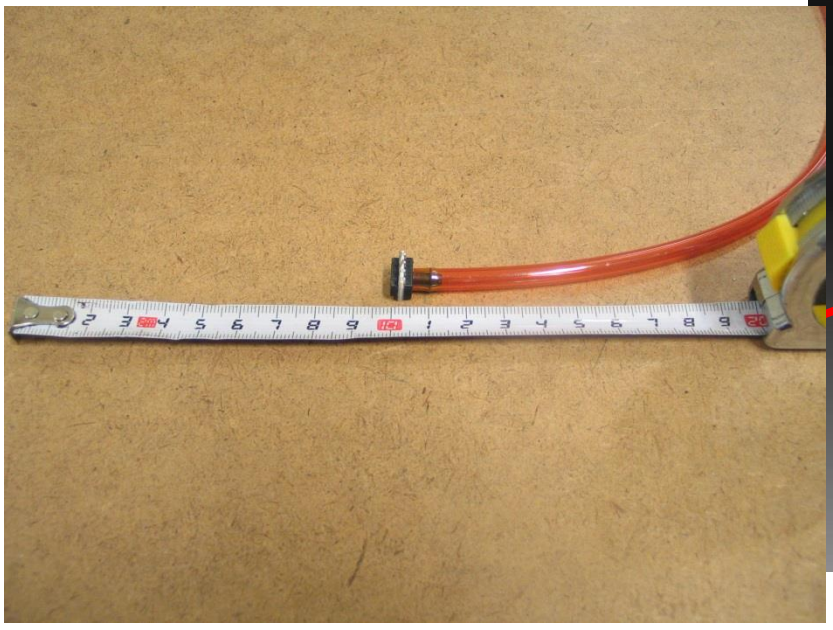
Racks - request

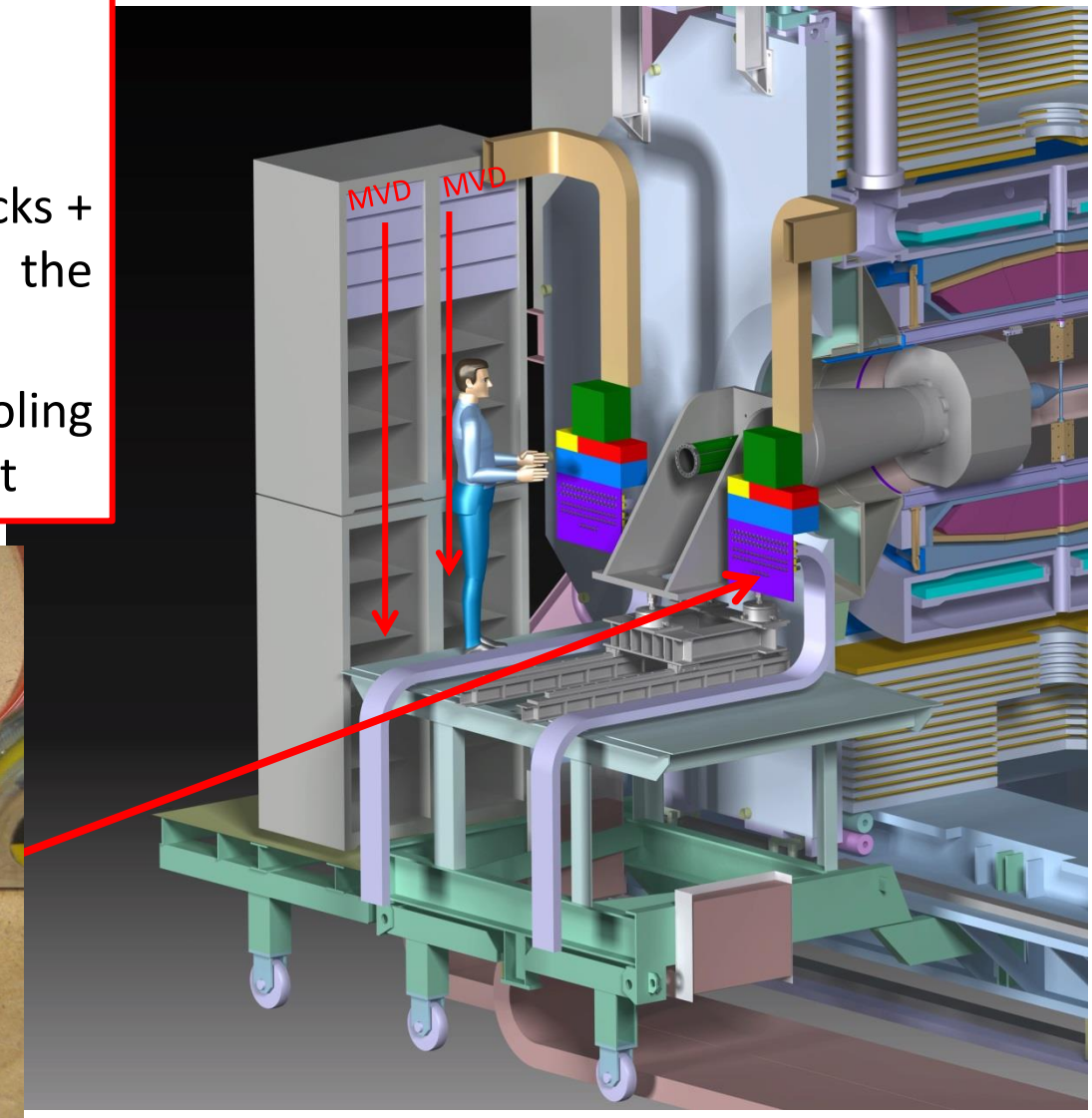
170 Pressure sensors to be

- powered
- read-out

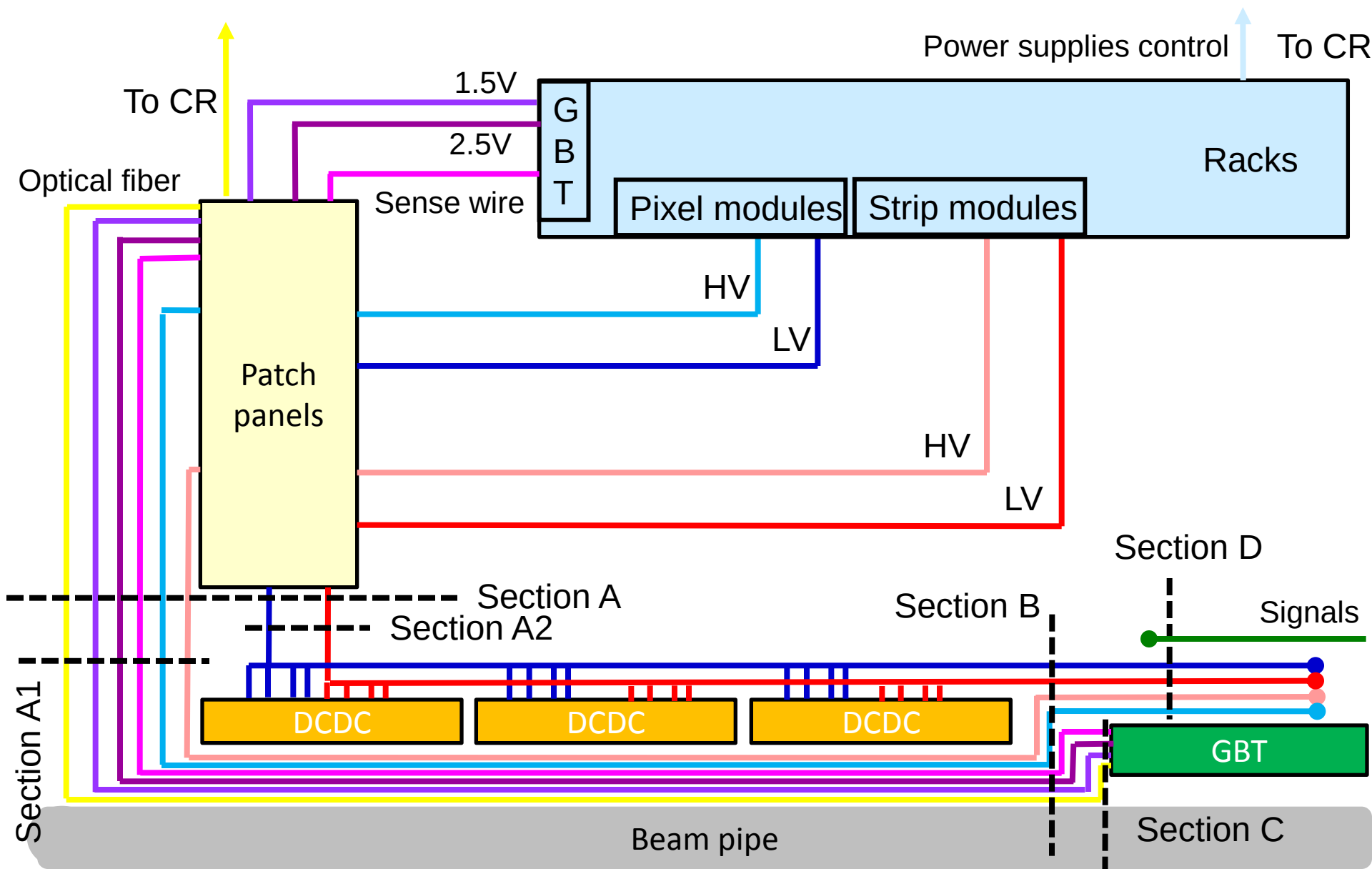
With, alternatively:

1. Boards to be arranged in the racks + local PLC to be connected with the MVD cooling plant
2. Cables along all the MVD cooling pipe duct up to the cooling plant





Racks – patch panels – MVd service - MVD



Cross sections – summary 2016

Section name	HV	Optical fibers	LV GBT		LV FEE	Total
A1	477 1.3 633 809	440 1 346 440	56 8.5 3176 4044	28 7 1077 1372		**1001** **5232** **6665**
A2					300 7.5 13226 16840	**300** **13226** **16840**
A (A1 + A2)						**1301** **18458** **23505**

Cable number
Cable diameter [mm]
Total cable section [mm^2]
Total cable section x $4/\pi$ [mm^2]