Status of Cable Paths and Patch Panels studies

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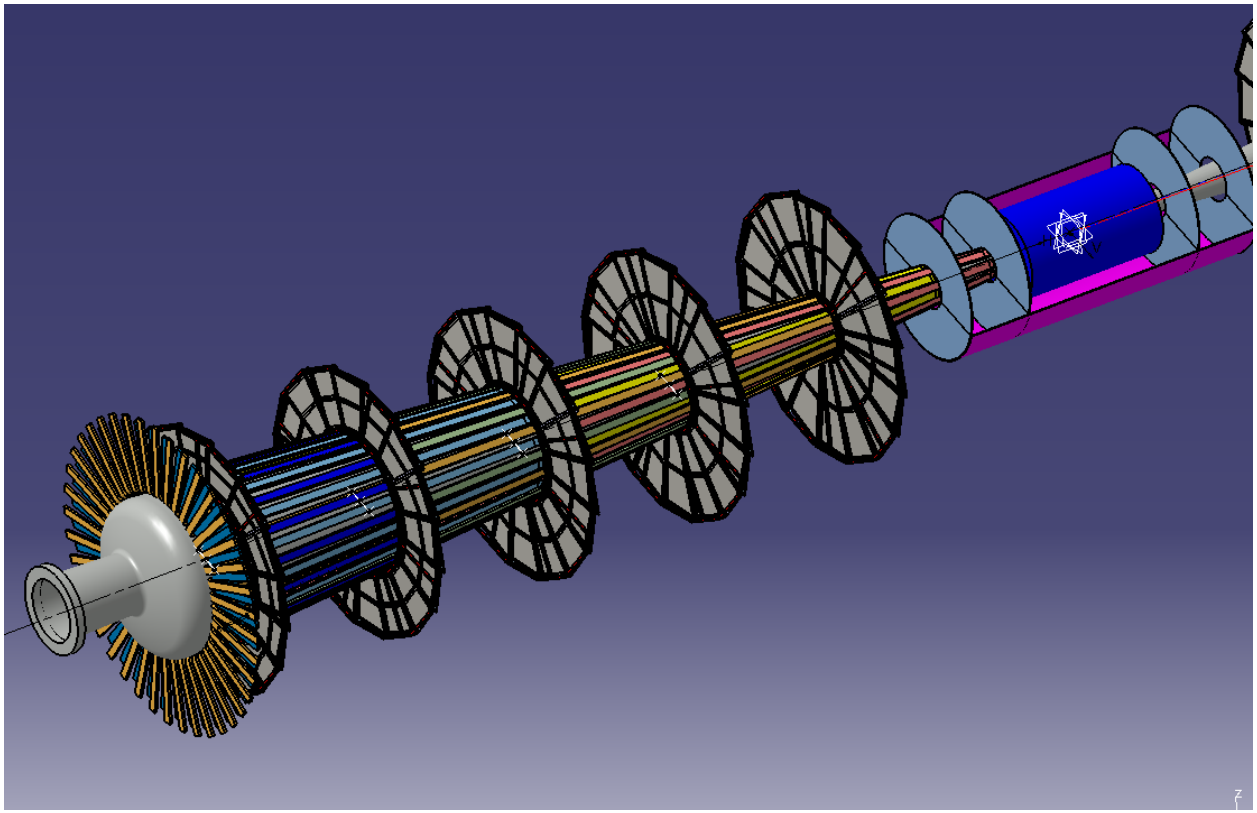

In april , in Orsay….

Thanks to D.Moya, F.Ateche, I.Alvarez, A.Ruiz Jimeno IFCA Cantabria

Modularity 1/4 OF DISK

Copper		Component	Nº Cables	CABLE NEEDED	Voltage drop (V/m)	Max. current. per cable (A)	Cu Section Per Cable (mm^2)
DC-DC solution	1/4 DISK	4 X 12v-1.25 V DC-DC	2	AWG 15	0,031	3	1,65
		2 X 12V-2.5V DC-CD					
		High voltage cable	2	AWG 24	0,001	very low(<0,01)	0,2
		TOTAL	4				
	All DISK	DC-DC-s	8	AWG15		3	1,65
		High voltage cable	8	AWG24		very low(<0,01)	0,2
		TOTAL	16				
Super Capacitors solution	1/4 DISK	2 supercapacitors	2	AWG 16	0,026	2	1,309
		High voltage cable	2	AWG 24	0,001	very low(<0,01)	0,2
		TOTAL	4				
	All DISK	Supercapacitors	8	AWG 16		2	1,309
		High voltage cable	8	AWG24		very low(<0,01)	0,2
		TOTAL	16				

Modularity 1/4 OF DISK

Aluminum		Component	Nº Cables	CABLE NEEDED	Voltage drop (V/m)	Max. current. per cable (A)	Al Section Per Cable (mm^2)
DC-DC solution	1/4 DISK	4 X 12v-1.25 V DC-DC	2	AWG 13	0,032	3	2,62
		2 X 12V-2.5V DC-CD					
		High voltage cable	2	AWG 24	0,001	very low(<0,01)	0,2
		TOTAL	4				
	All DISK	DC-DC-s	8	AWG15		3	2,62
		High voltage cable	8	AWG24		very low(<0,01)	0,2
		TOTAL	16				
Super Capacitors solution	1/4 DISK	2 supercapacitors	2	AWG 14	0,027	2	2,08
		High voltage cable	2	AWG 24	0,001	very low(<0,01)	0,2
		TOTAL	4				
	All DISK	Supercapacitors	8	AWG 14		2	2,08
		High voltage cable	8	AWG24		very low(<0,01)	0,2
		TOTAL	16				

- *Reduction of the amount of cables per FTD from 98 to 16 ….*
- *Conductor section per FTD from 158 to 14.8 mm² in Cu….*

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Following slides :
Update of inner cables according to these datas + security margin of 2 (very low number…)

SIT : same extrapolation with ratio of surface

FTD 1 & 2 : datas extrapolated from VXD , no changes

FTD strips : 4 ¼ disks, 4 cables par ¼ disks (4 HV & 4 LV) , ref AGW15 (1.65 mm² de Cu) and AGW24 (0.2 mm² Cu)

Then per FTD strips : 29.6 mm² de Cu

148 mm² Cu for the 5 FTD one side 32 cables

SIT : same techno than FTD strips with less channels (½)

- Per side : FTD 1.2 Mch & SIT 0.5 Mch

Conductor section: 148 mm²/2 = **74 mm² de Cu**

- SIT subdivided in 33 supermodules (22 for SIT2 & 11 for SIT 1)

If the power is distributed the same way than for FTD strips , then 4 cables (AGW17 ;AGW24 (0.2 mm² Cu)) per super modules :

total of 132cables full SIT.

FTD pixels :

- Same techno than VTX ? But Surface 0.67 m² against 0.17 m² for VTX (≈ 4)

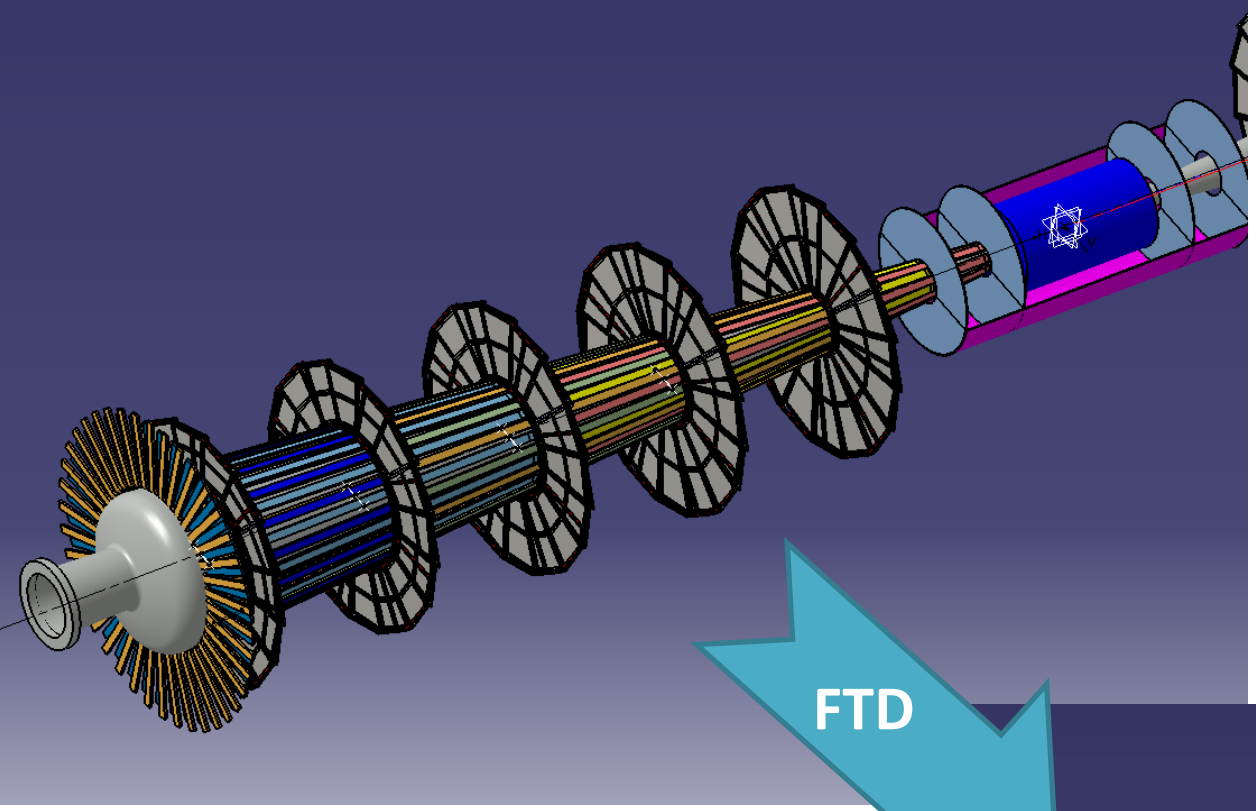
VTX CMOS : 62 mm² of Cu, then 85*4= **340 mm² Cu for FTD pixels**

- Same segmentation than FTD strips :16 petals, 6 cables per petals, 96 cables per FTD

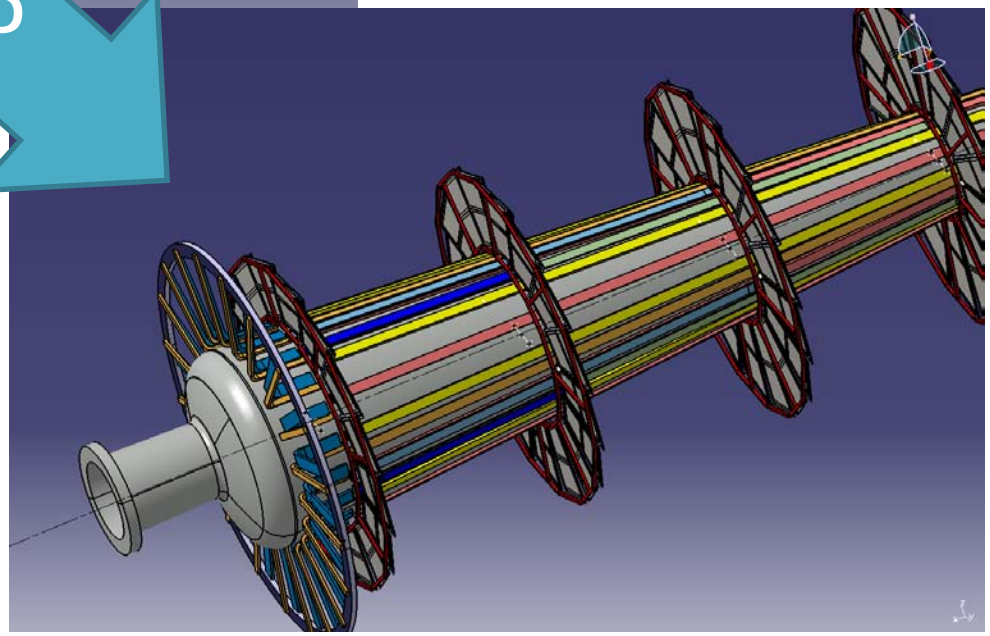
No changes

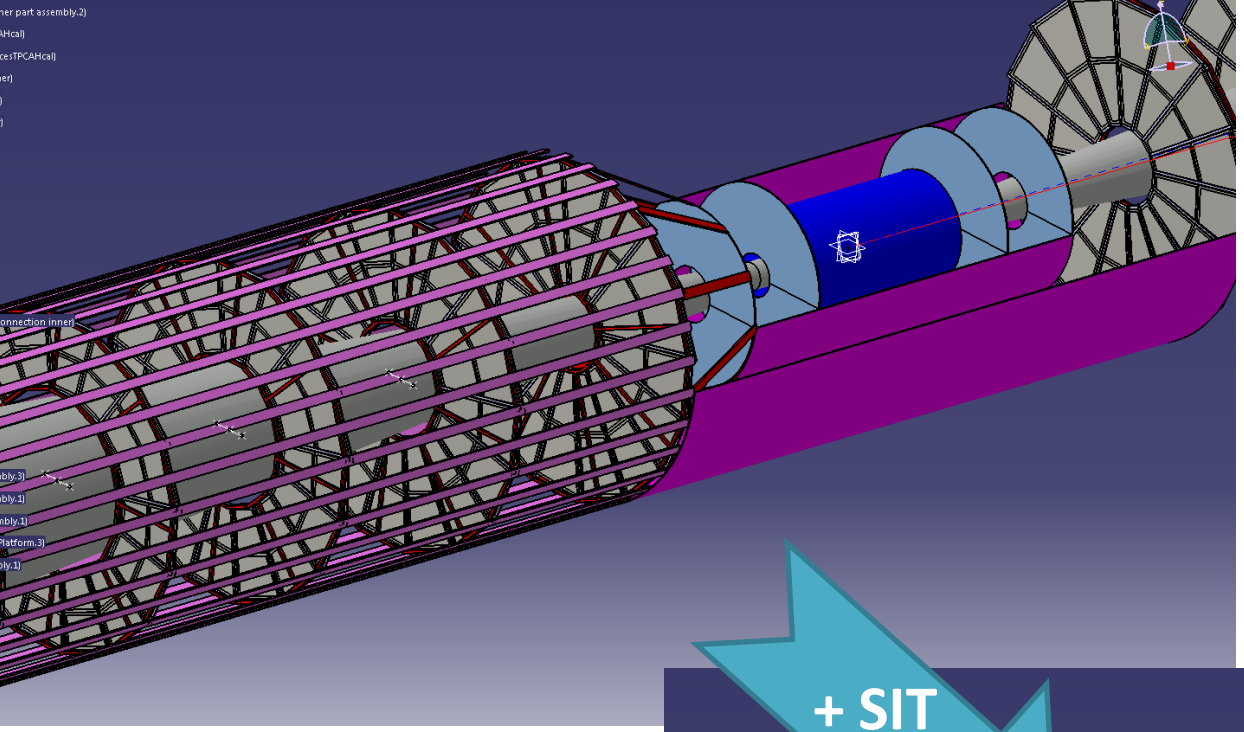
So,……

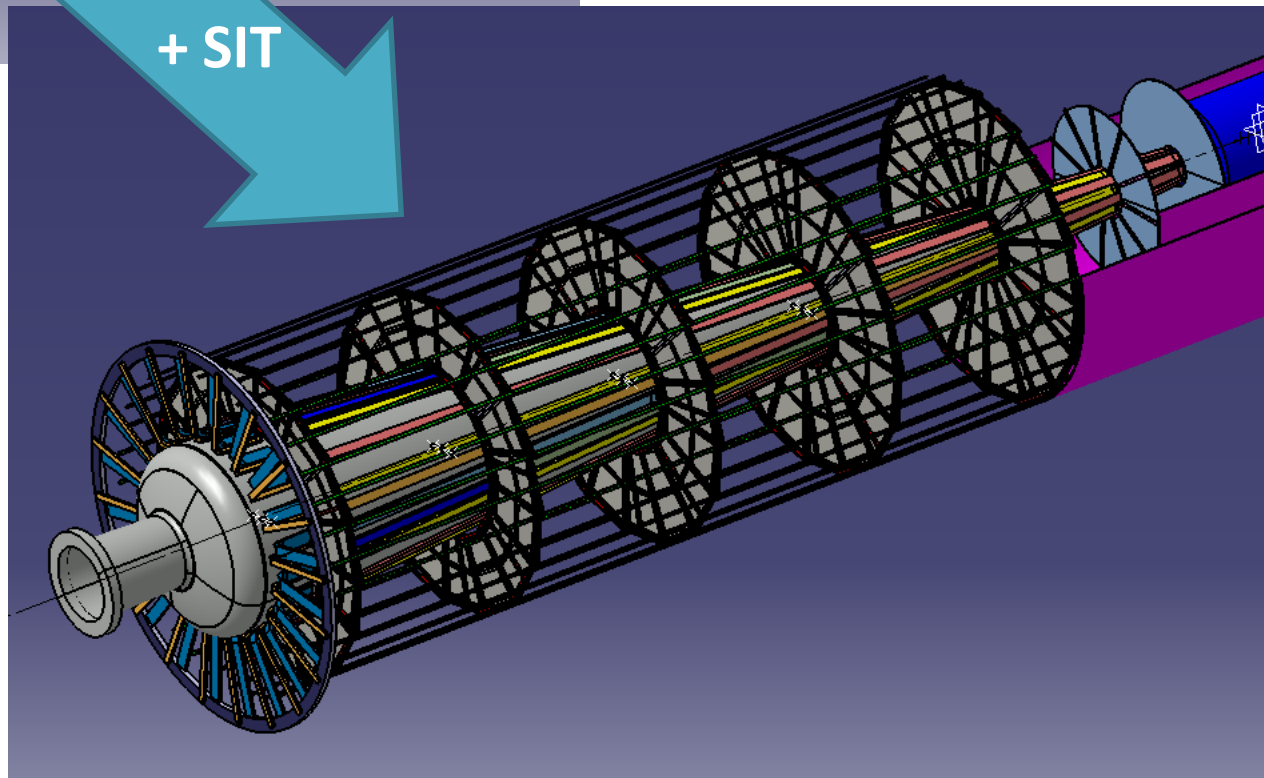
	Cu	with SIT & FTD1&2							
	position	FTD7	FTD6	FTD5	FTD4	FTD3	FTD 2	FTD 1	VTX
new values	eq Th of Cu	0,52	0,61	0,75	0,95	1,34	1,70	1,23	0,41
	X0% FCCPD	3,66%	4,27%	5,24%	6,62%	9,38%	11,88%	8,61%	2,88%
old values	eq Th of Cu	1,33	1,47	1,69	1,97	2,53	2,12	1,23	0,41
	X0% FCCPD	9,30%	10,27%	11,79%	13,77%	17,72%	14,83%	8,61%	2,88%
	Aluminum								
	position	FTD7	FTD6	FTD5	FTD4	FTD3	FTD 2	FTD 1	VTX
new values	eq Th of Al r	0,85	0,99	1,22	1,54	2,18	2,76	2,00	0,67
	X0% FCPPD	0,95%	1,11%	1,37%	1,73%	2,45%	3,10%	2,25%	0,75%
old values	eq Th of Al r	2,16	2,39	2,74	3,20	4,12	3,45	2,00	0,67
	X0% FCPPD	2,43%	2,68%	3,08%	3,60%	4,63%	3,87%	2,25%	0,75%
	Nbre of Cables								
	position	FTD7	FTD6	FTD5	FTD4	FTD3	FTD 2	FTD 1	VTX
new values	total	514,00	482,00	450,00	418,00	386,00	266,00	126,00	30,00
old values	total	900,00	804,00	708,00	612,00	516,00	288,00	126,00	30,00

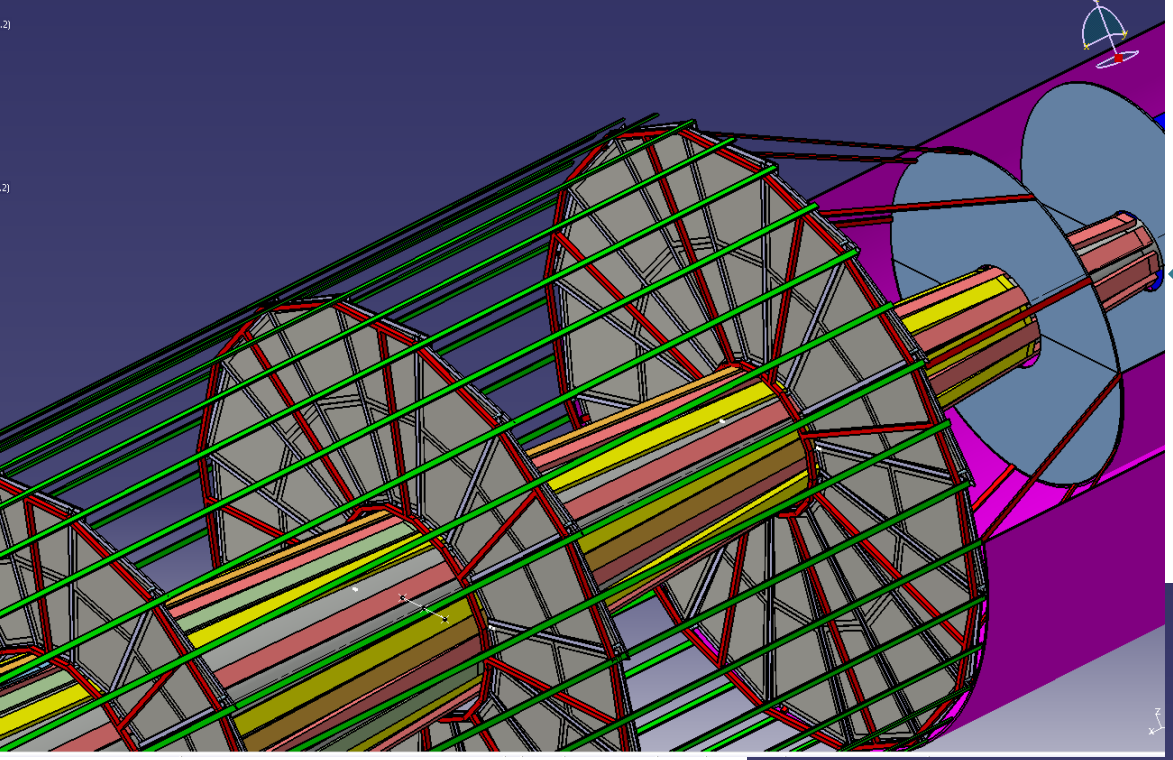


FTD



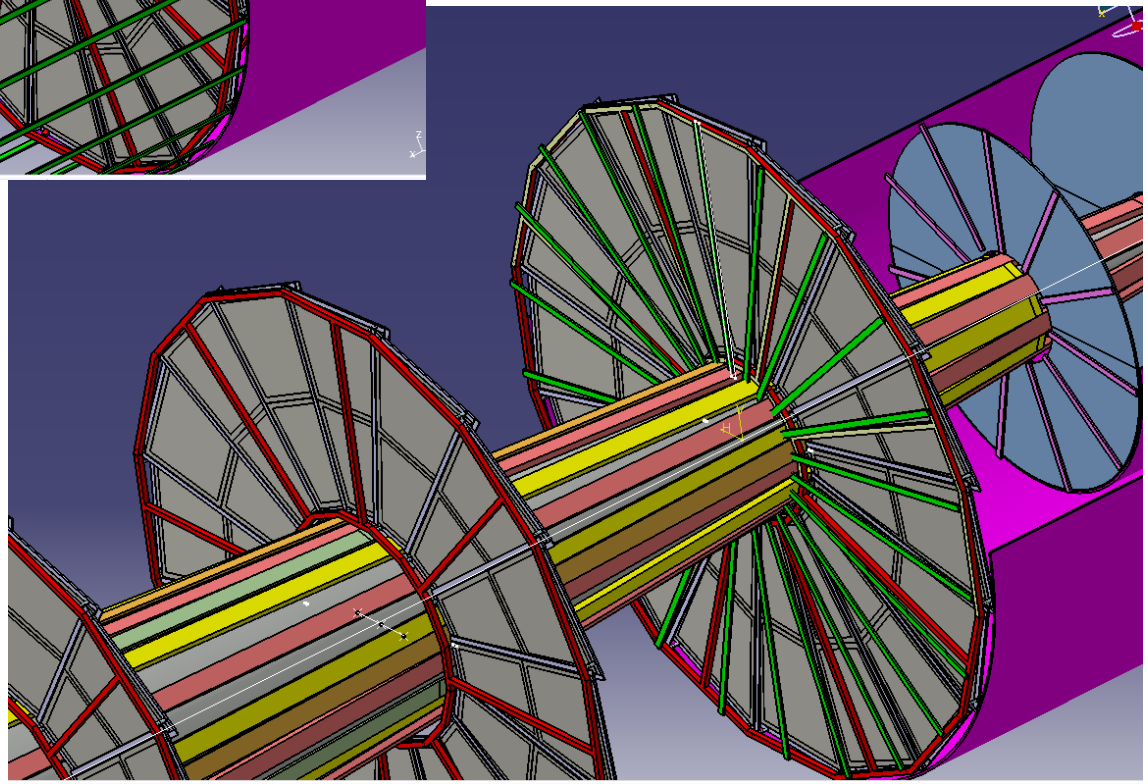


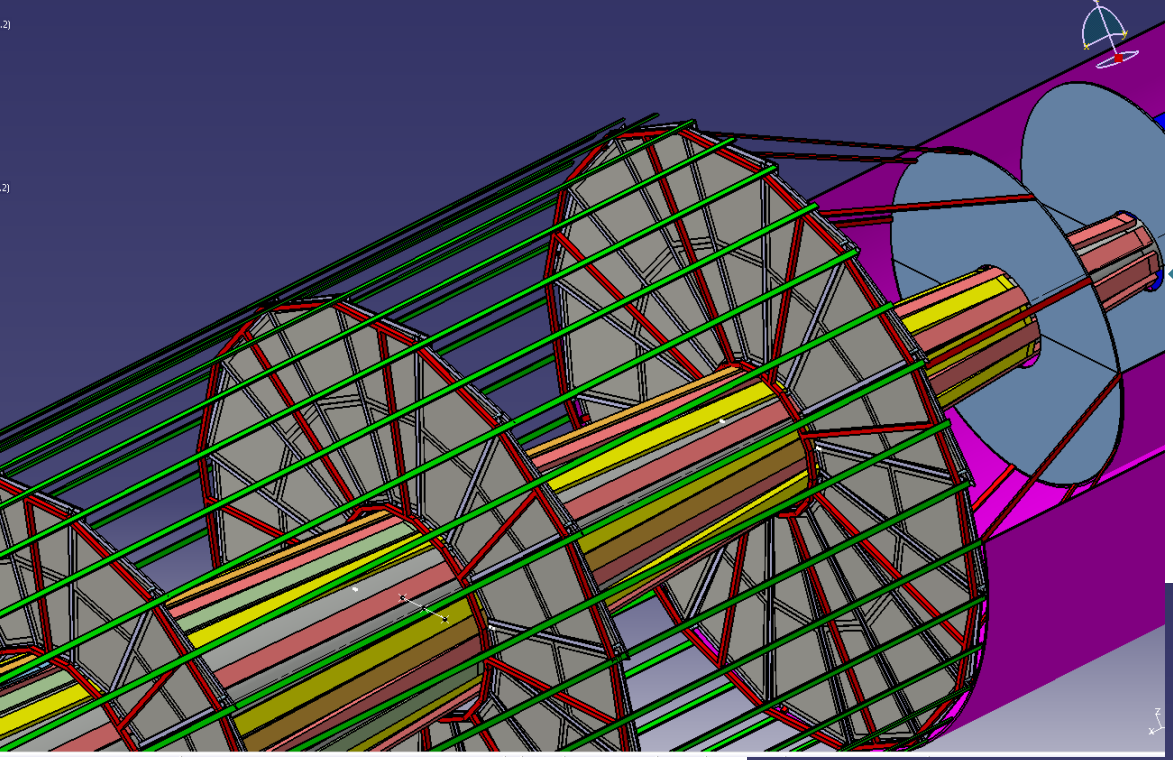

+ SIT



SIT cables at inner radius TPC

SIT cables along BP





SIT cables at inner radius TPC

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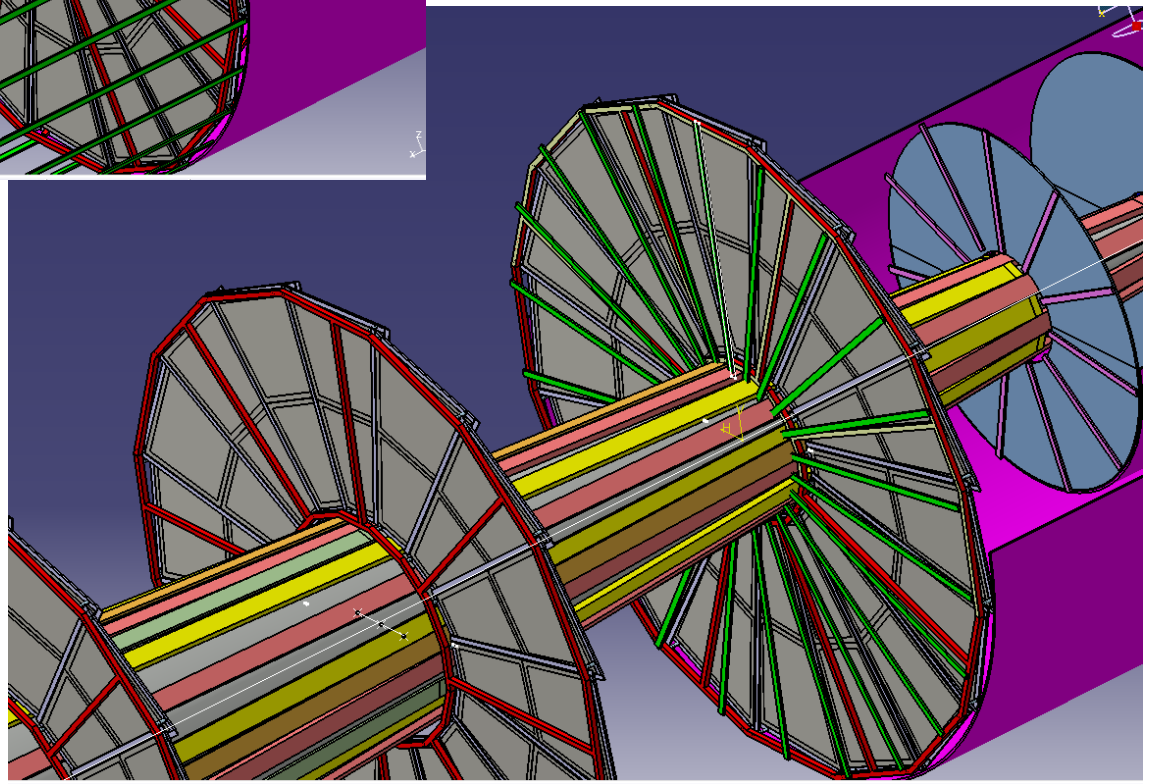


Depends also on integration scenario possibilities,

See C.Bourgeois ‘s talk

Patch panels positions : Inner radius of TPC endplates, what for ? :

1) needed for integration

If not : for inner integration , cables of at least 4 meters to reach the inner radius of the coil *: not easy for insertion of the inner part in the TPC*

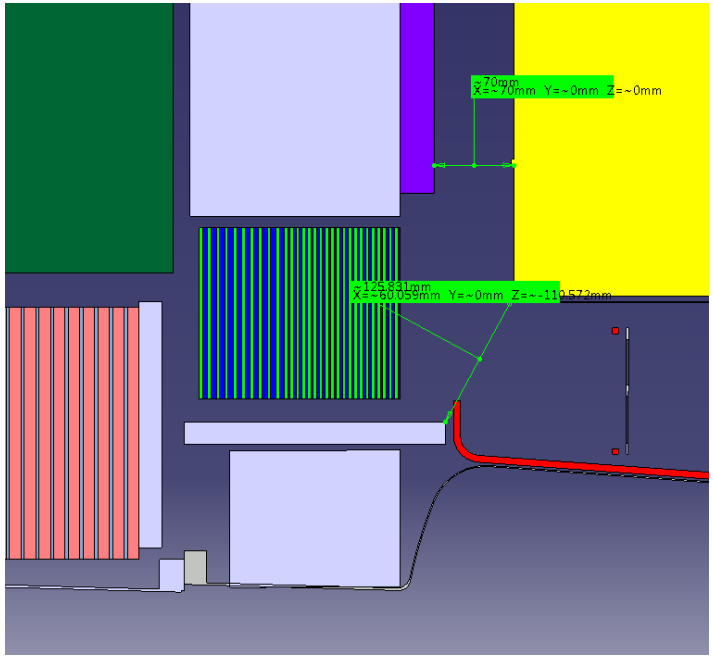
+if not : the next patch panel might be on the coil : the total length of the cables will be of about 7 meter (voltage drop about 2 %)

2) The actual number of cables is just for power distribution :

Signal transmission : not yet estimated in the previous tables (at least 16 lignes per FTD…) ,

i.e ≈ 200 more lines for full inner part

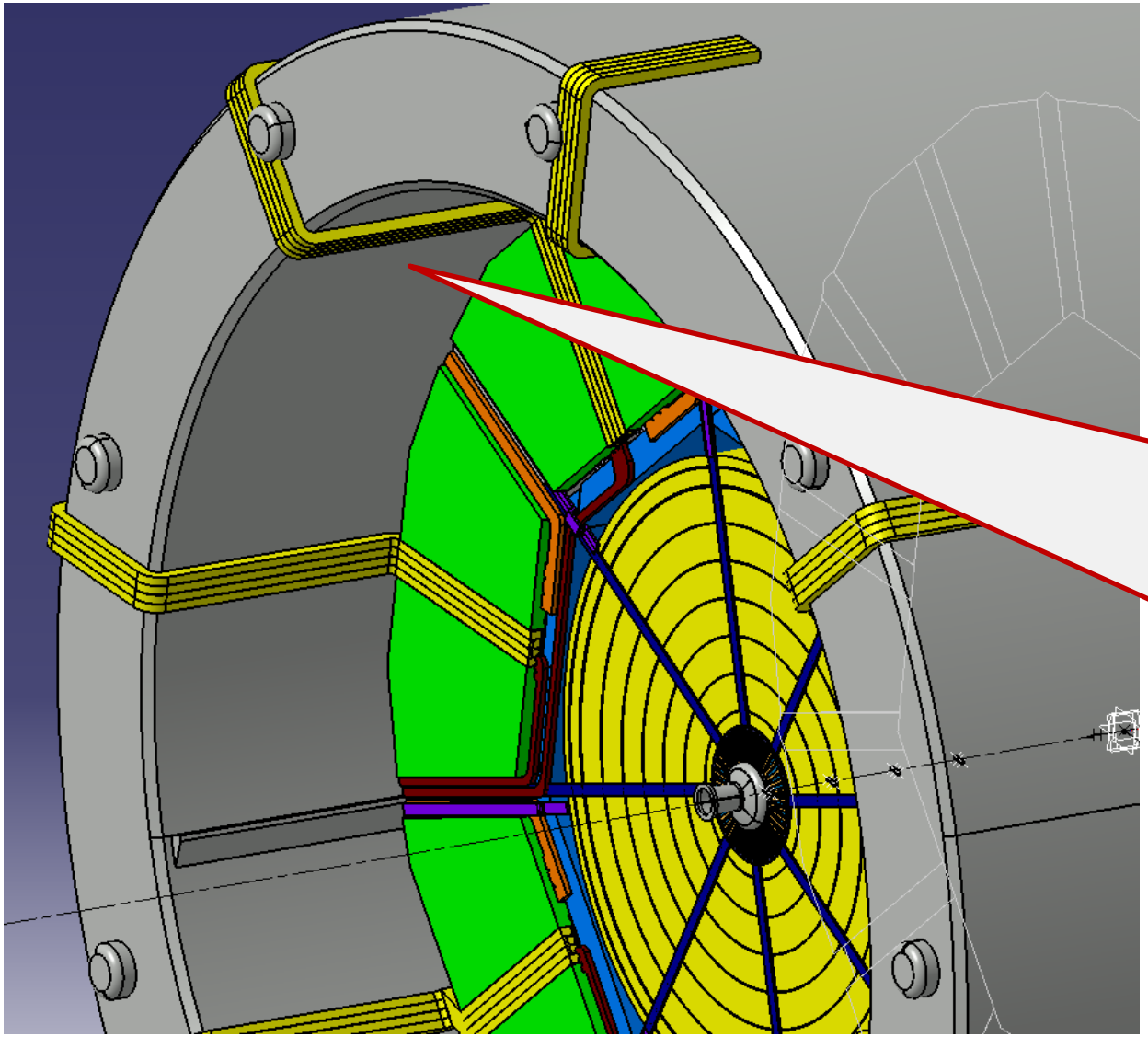
After this patchpanel : possiblity to reduce the cable by gathering at least some power lines distributions (HV??)



3) Position of the optical conversion ?

At the petal edge or at the position of this first patchpanel (remember that optic fiber have high bending radius and lost in transmission within bend)

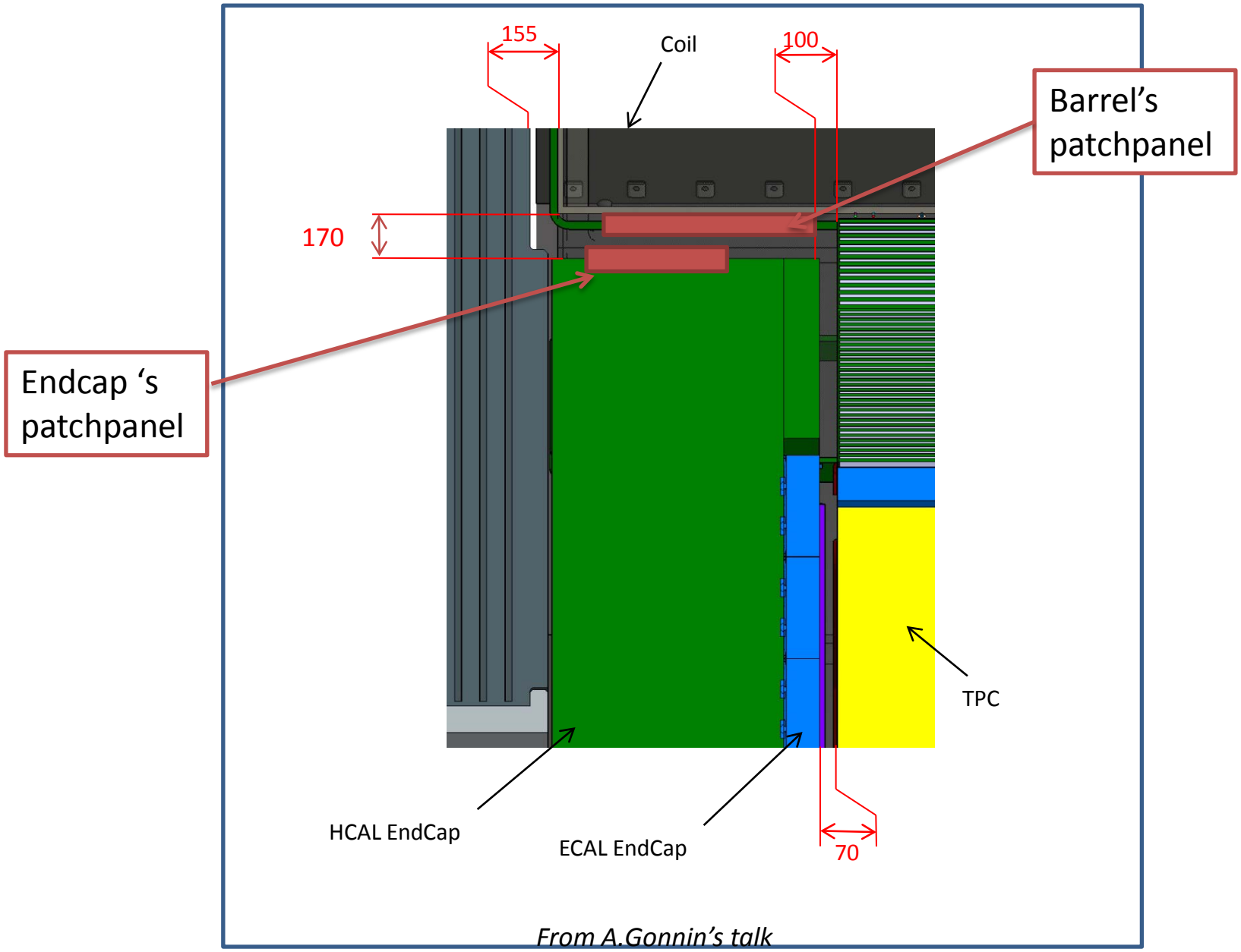
Patch panels positions : Inner radius of the coil:



Proposition :
Use the inner radius of the coil .

For Hcal
Ecal
TPC
Inner ?

Rin coil = 3440 mm Circ= 21 m



From A.Gonnin's talk

Ecal

Per 2/3 stave

LDA		1 per column	5 per module			
			cable ∅	mm²	Nbre	S total cm²
LV to DC/DC 48>3,3 V	48V/2A	2*1,5mm²of Cu	8	50,24	15	7,536
HT depletion Wafers 250 V/50µA par layer	250V/1,5mA		8	50,24	15	7,536
Signal/CC	flat multiwire cable 2,54 mm	0,05cm²*10wires		50,67	15	7,6
Ground line		1 per module ?		210	3	6,3
			Total			28,972

Where is the optical conversion of signal ?

33 cables per 3/5 staves per even ways out

AHcal

For one half octant

pe+A34r layer	(48 par 1/2 module)		cable ∅	mm²	Nbre	S total cm²
1Power	50v 0,3 µA per channel 276 ch/layer	2*5pins SAMTEC IPL1	10*2,54 mm	50,67	48	24,3216
1 HDMI			8	50,24	48	24,1152
Ground line		1 per Half octant		210	1	2,1
			Total			50,5368

98 cables per uneven ways out

TPC

per way-out — 80 modules per endplate to be shared into 8 way-out

			cable ∅	mm²	Nbre	S total cm²
central Cathode	70 KV		15	176,625	1	1,76625
µmégas/Gem's power supply	o,4-1KV multibrins 14	14*0,14 mm²		1,96	10	0,196
1 double optical fibre					10	0
1 low voltage 32 A	Assuming Conversion 48V/2A ???	2*1,5mm²of Cu	8	50,24	10	5,024
Ground line				210	1	2,1
						9,08625

32 cables Per even ways out

+ for inner detectors : 65 per even way out

Uneven way 1 to 15 = 98 cables / Even way 2 to 16 = 130cables

As much connectors….

Previous slide : 2000 cables per side full detector ….

But:

Endcaps ? The patch panel won't be fixed at the same position (Coil inner radius) but the cabling will follow the same way out

Signal transmission : not yet considered and may strongly increase the needed space

Optical conversion

Cooling : the volume occupancy of the cooling distribution is quickly to be considered.