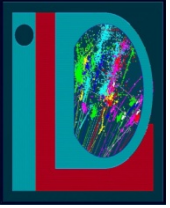


ILD integration studies toward simulation model:

Dead materials
Gaps

How to estimate them?

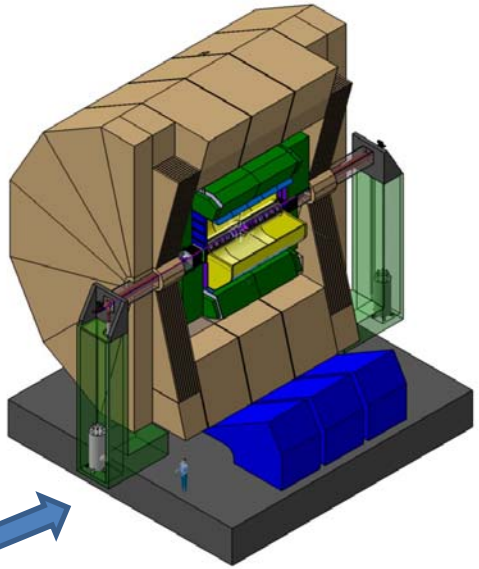
Case of the Barrel

C.Clerc **LLR, Ecole polytechnique, Palaiseau**

P.Cornebise *LAL, Orsay*
M.Jore *LAL, Orsay*

Overall dimensions

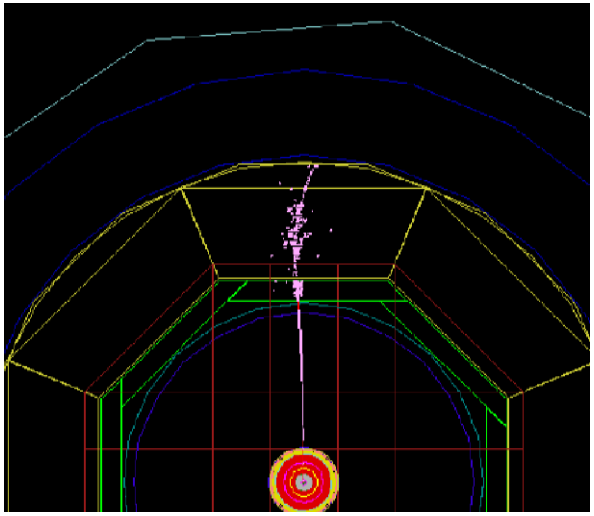
http://www.ilcild.org/groups/mdi/ILD0dimensions-weigth130209.xls



technical design of subdetectors

- All the detailed mechanical design studies were done to stick to those limits

- These are the dimensions currently used in the simulation and corresponding to the overall detector's envelope



Overall dimensions

technical designs of subdetectors → In simulation models

See A.Miyamoto's presentation

Needed for simulation models

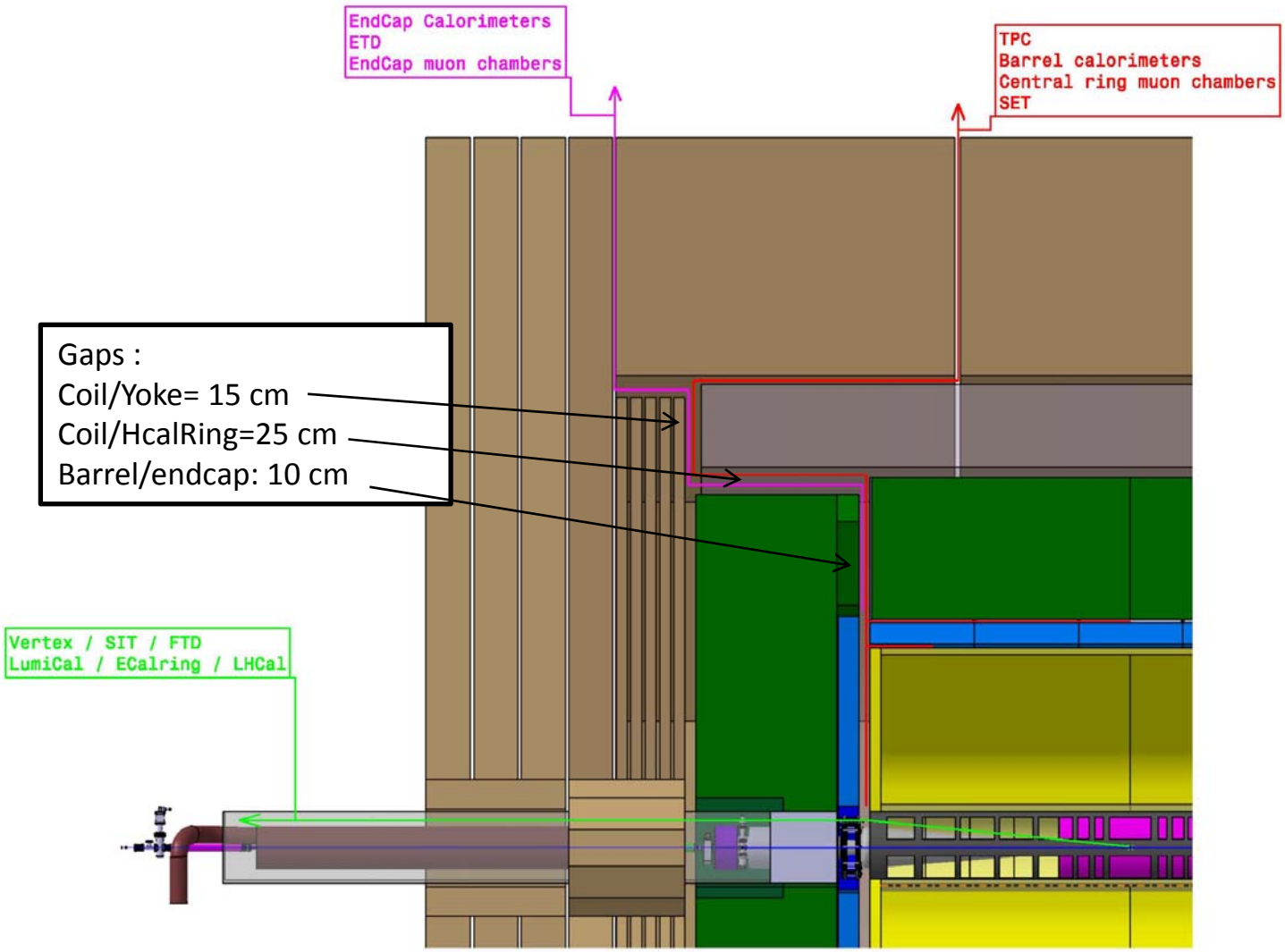
Dead material

- Services :
  - cables,
  - Cooling pipes
  - Including their support and screening
- Front end electronic card going overboard the mechanical structure
- Fastening system
- Patch panels for integration and maintenance

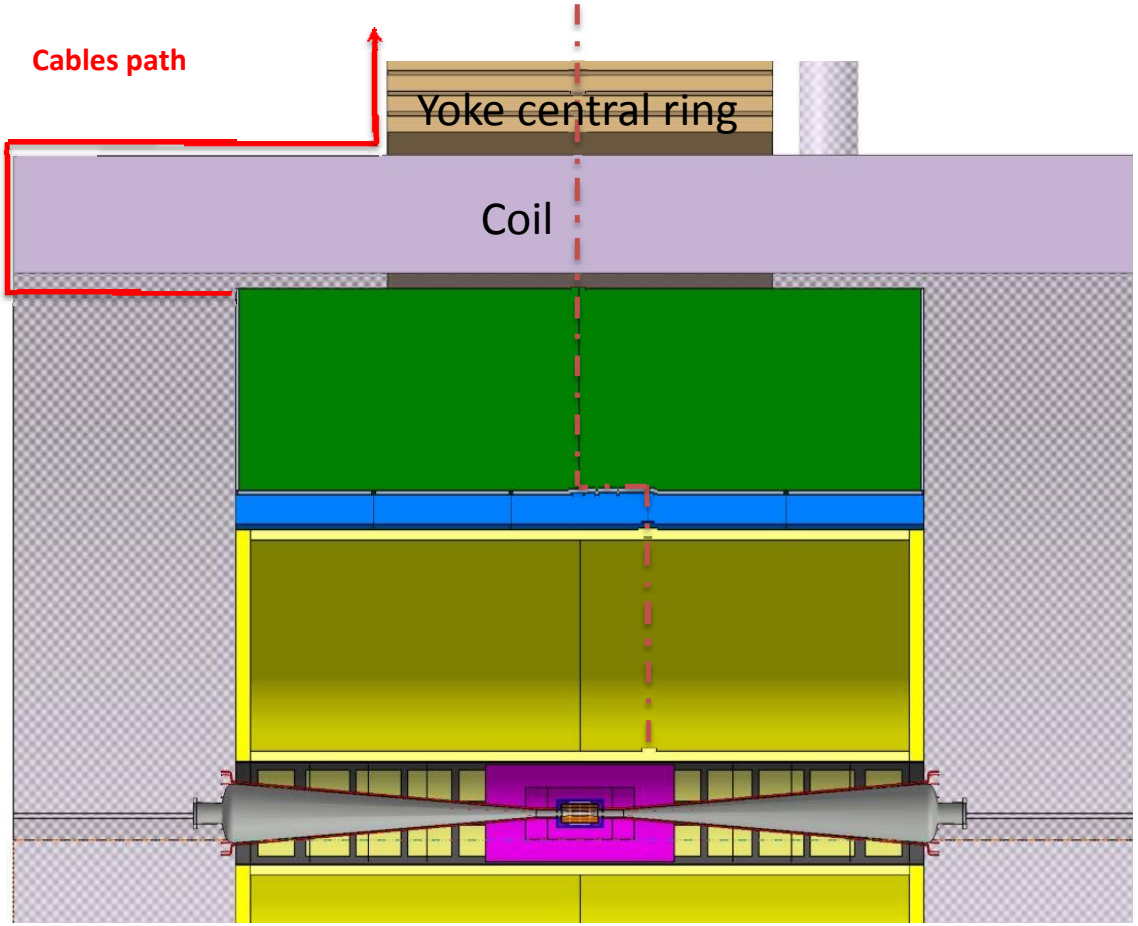
Gaps

- Room for services, screening & patch panels
- Room fro integration tooling
- Tolerances :
  - ✓ for alignment,
  - ✓ mechanical deformation
  - ✓ Construction tolerances

Actual strategy for cables/services from detector integration steps



Dead materials :Cables



Z-

Z+

AHCAL :
1 ring of 8 modules

Ecal : 3 modules per stave; 8 staves

TPC : 1 endplate
HV Cathode

AHCAL :
1 ring of 8 modules

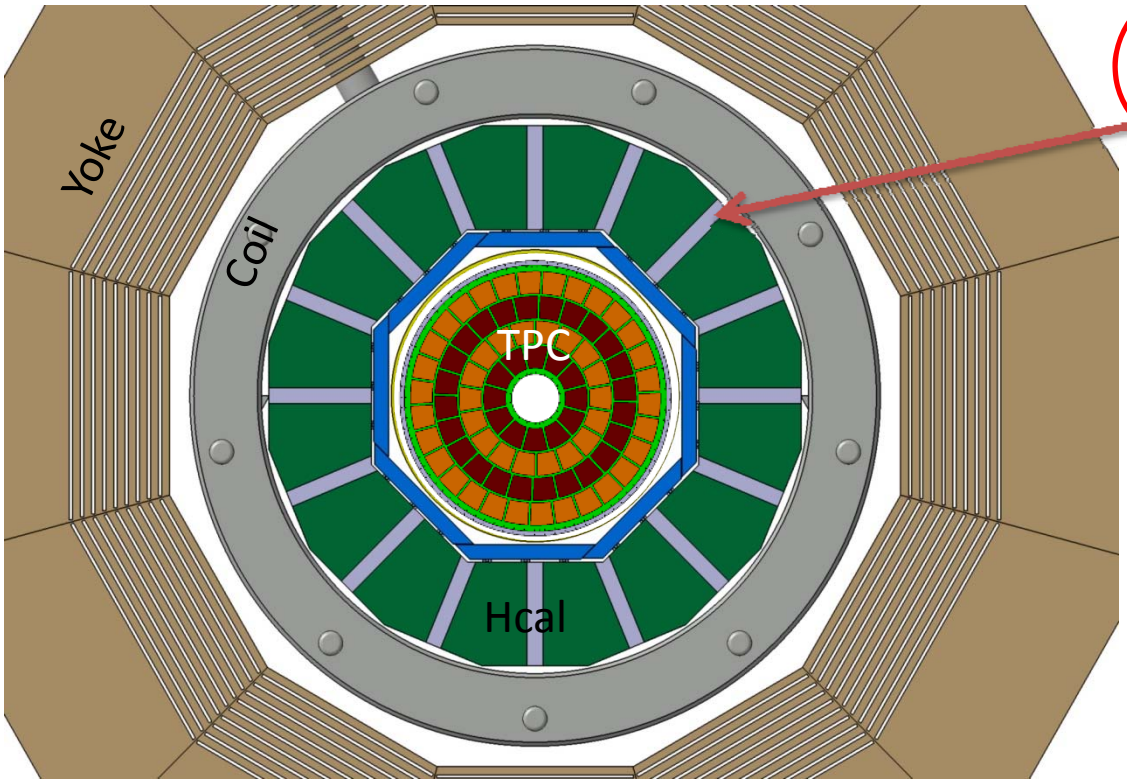
Ecal : 2 modules per stave; 8 staves

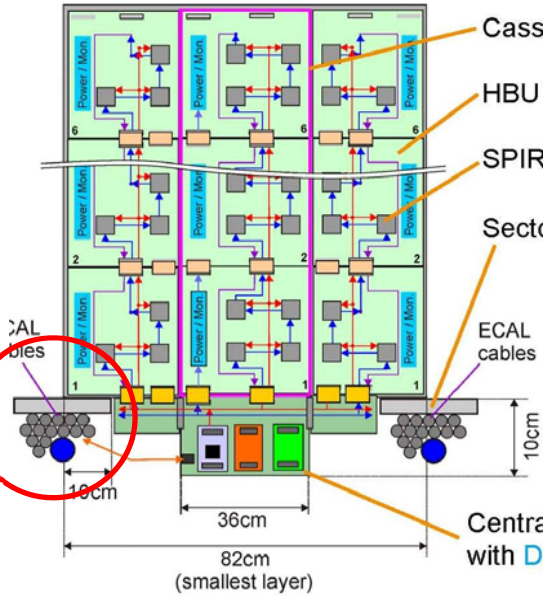
TPC : 1 endplate

+ SET

For each side :

16 way-out zones for barrel cables
(Hcal/Ecal/TPC)
20 cm large each; gap 10 cm; thickness support 1.5 cm
170 cm²





AHCal : Electronic representation of 1 layer ; From K.Gadow

Cables

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 ?

From R.Cornat

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	8	24,3216
1 HDMI			8			24,1152
Ground line		1 per Half octant				2,1
						50,5368

From P.Goettlicher & K.Gadow's presentations

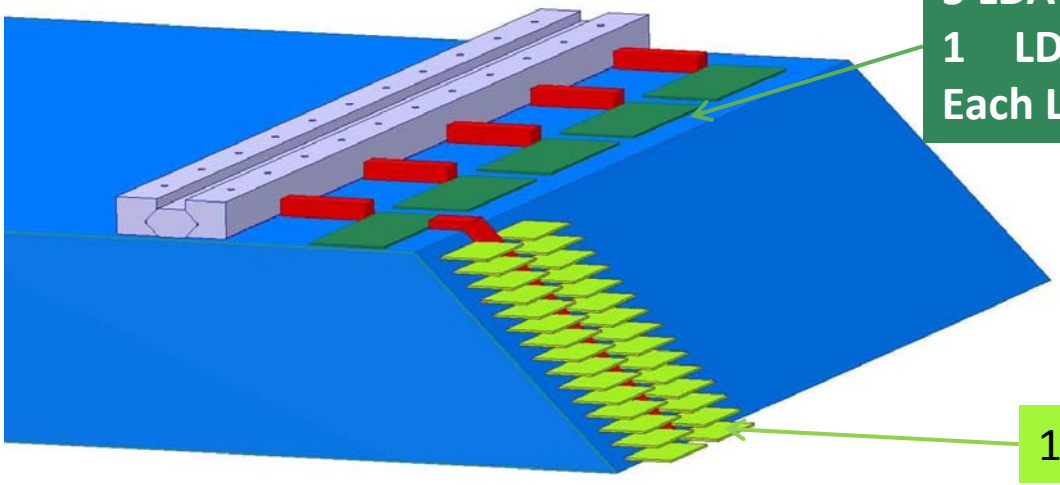
TPC

per way-out | 80 modules per endplate to be sh

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

From P.Colas & D.Attié's presentations

Cables dimensioning, case of Ecal



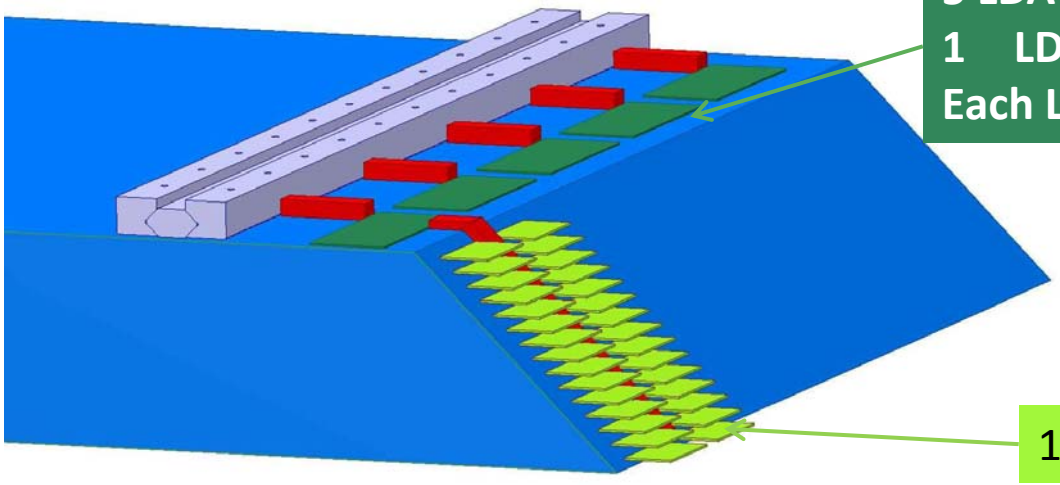
5 LDA per module
1 LDA per raw i.e. per 30 DIF
Each LDA supply power on 30 layers

1 slab= 2DIF

1 layer : 2 FPGA on DIF , 500 mW each
+ 13 kch, 25 µW each
≈40W/raw; 3.3V/12A
Safety margin*2 = 24 A/3.3V

**DIF:Detector Interface Board (FE); LDA:*Link/Data Aggregator*

Cables dimensioning, case of Ecal



5 LDA per module
1 LDA per raw i.e. per 30 DIF
Each LDA supply power on 30 layers

1 slab= 2DIF

24 A/3.3V

Section of conductor > 6mm² , Cable ∅>13mm

Problems of :

- tension drop in the 35m minimal length between LDA-Power supply
- Bending Radius,
- heating ….

But

DC/DC converter foreseen on LDA :

3.3V/24A ⇨ ≈ 48V/2A

Conductor section in the cable is reduced to reasonable size:

Nominal section in mm²	Copper diameter in mm	Câble diameter 2wires CERN in mm	Radius curvature in mm
0,5	0,79	7	42
0,75	0,97	6,8	40,8
1	1,12		
1,5	1,38	8	48
2,5	1,78		
4	2,25	10,8	64,8
6	2,76	13,2	79,2

This optimisation of the voltage supply should be considered by each subdetector

+ new idea : see S.Dhawan's presentation

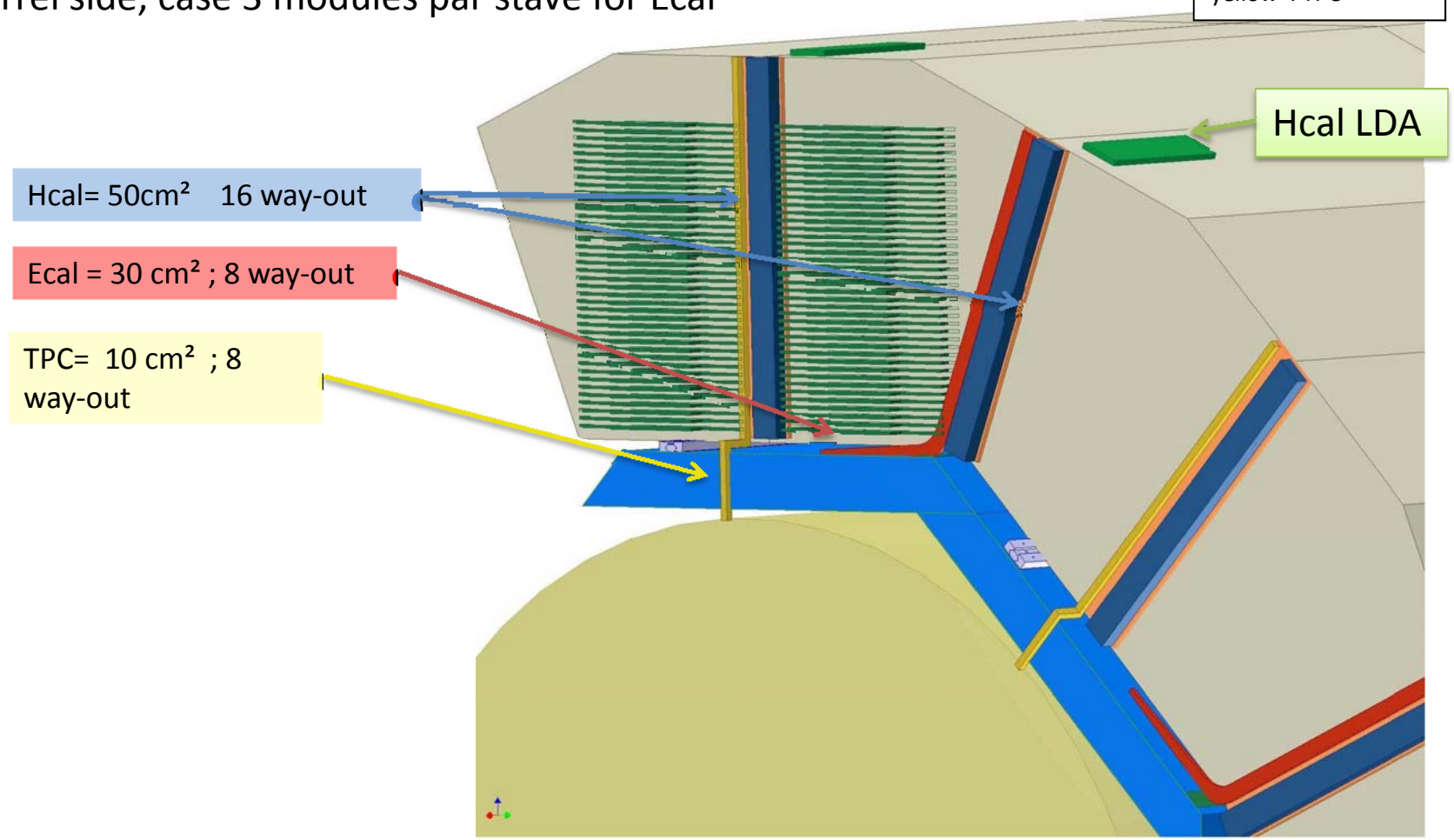
On Hcal modules faces :

Per barrel side, case 3 modules par stave for Ecal

Red : Ecal cables

Blue : Hcal cables

yellow : TPC



After LDA-Hcal, number of Hcal cables migth be reduced by factor 48 but increase of diameter.

Those cables volumes may be refined for simulation:

- ✓part of conductor (Cu) versus insulator

Missing or not yet considered :

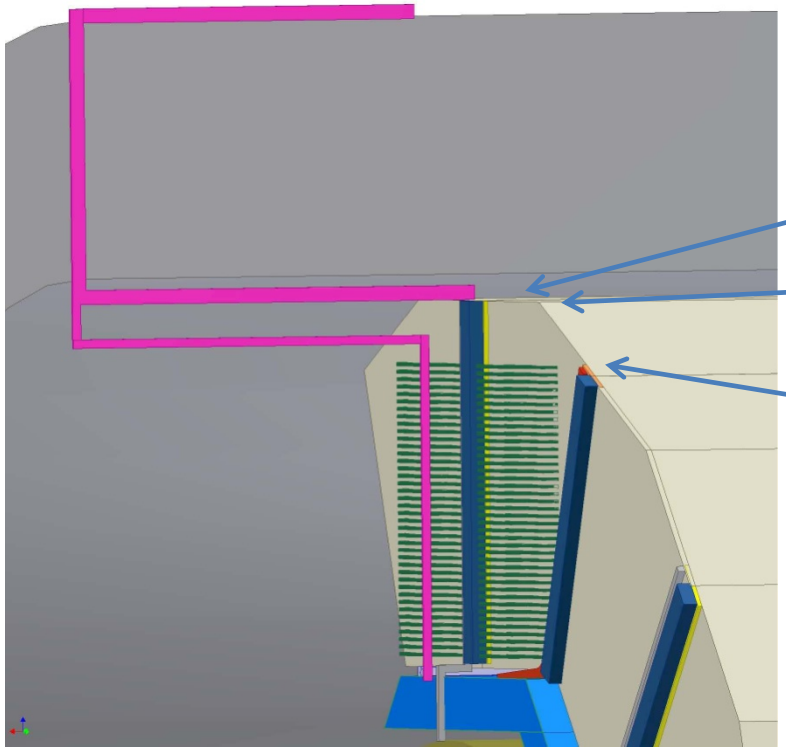
- ✓Cables screening
- ✓Bending radius of cables
- ✓SET cables & services (no information up to now)
- ✓Optical fibres : position of convertors , number of fibres in cables (bending radius about 10 X ∅ of cable)

Dead materials ,

What else ?

- Connecting boxes
- Electronic in gaps
- Fastening system
- Cooling distribution

Position of patch panels from integration and maintenance scenarii.



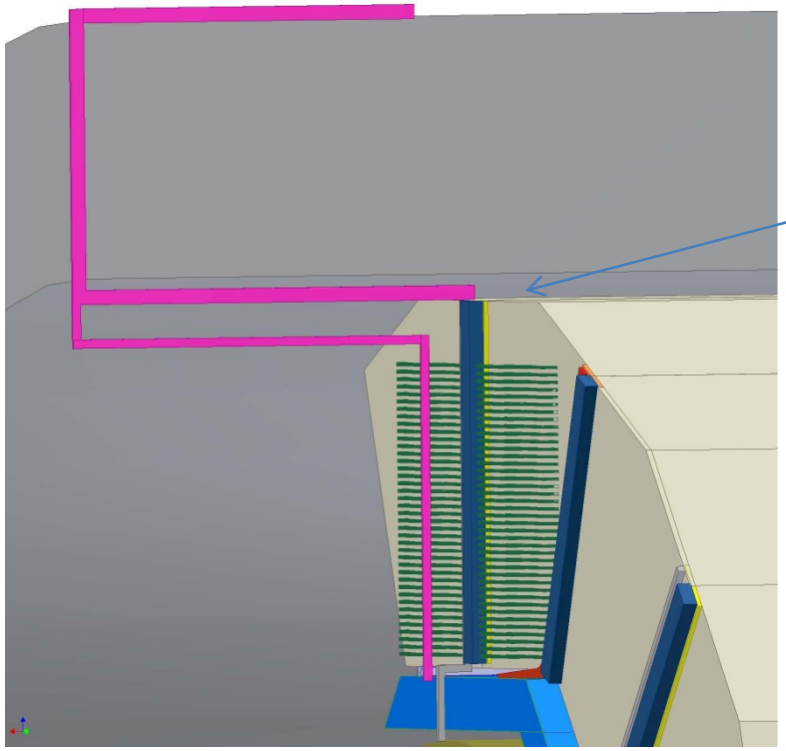
Positions of :
AHCAL LDA

TPC connecting box and/or on endplate face

Ecal connecting box for integration on Hcal or cryostat inner face ?

Size depends on number of cables, nature and size of connectors/header
It may be quite large

Position of patch panels from integration and maintenance scenarii.

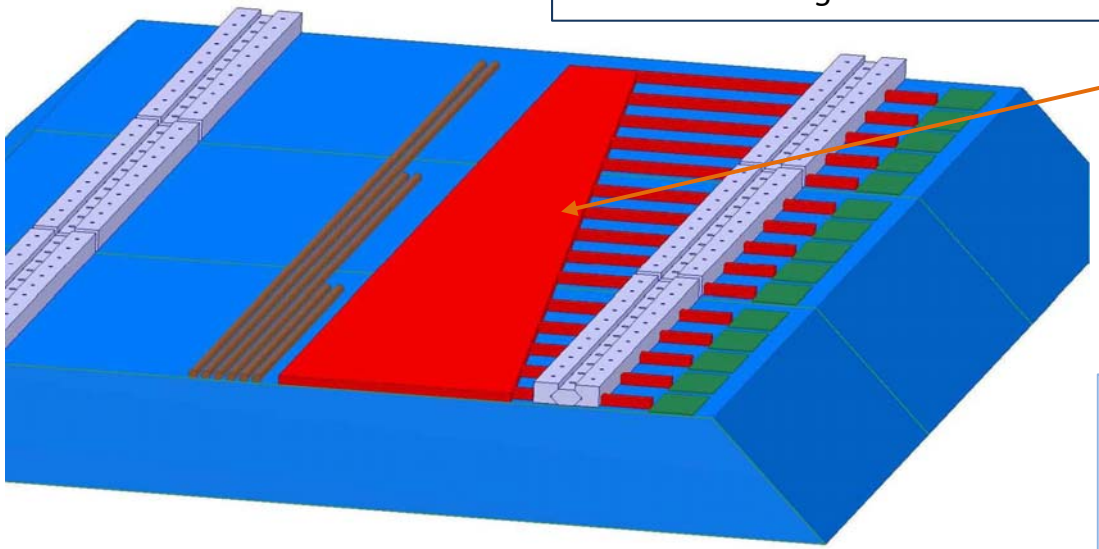


Patch panel HCAl at the top of each half octant :

LDA- AHCAl board:
dimension for 48 HMDI and Samtec cables coming from layers and for cable header?
Total length > 90 cm

Occupancy of the gap between Ecal & Hcal

- *Fastening system*
- *Cables & cooling*

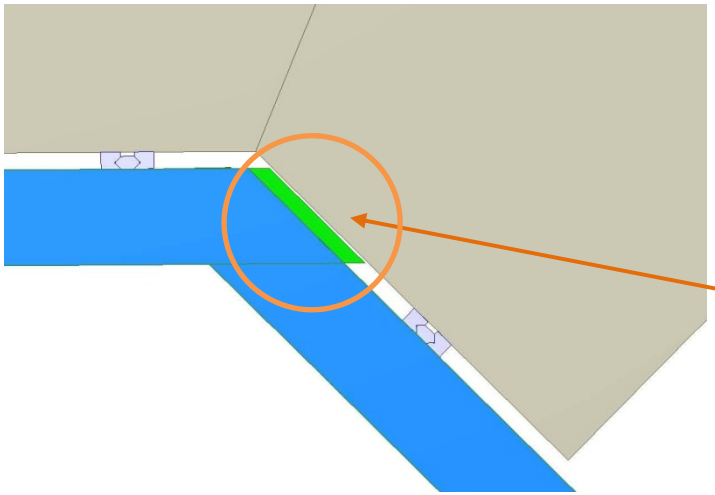


Cabling

Must not exceed 15 mm in thickness to accomodate overlap with cooling pipes

Fastening :

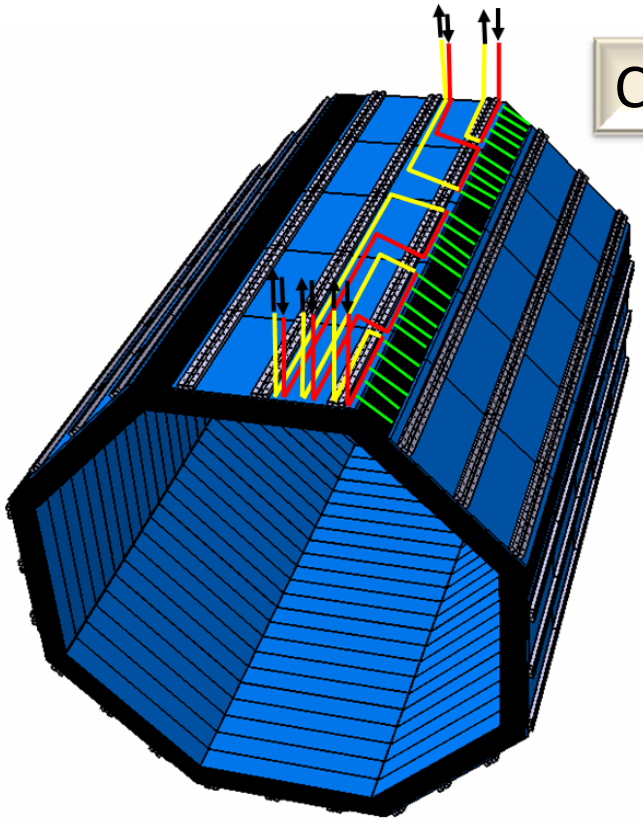
- 2/3 ? Rails, dimensions ?
- Actual design in Al, Carbon under study *(D.Grondin, LPSC)*

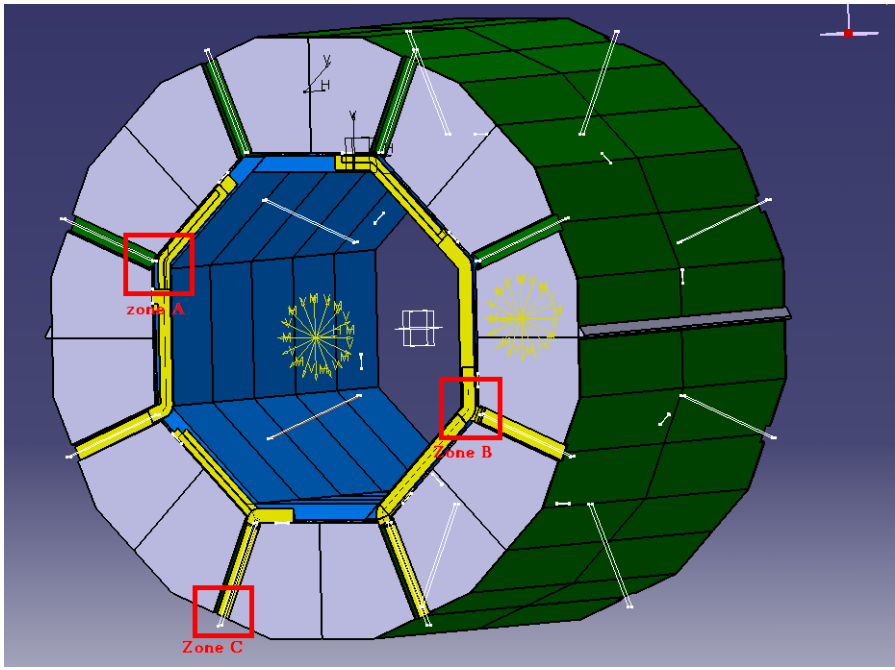


Front end board in gap :

Full space for DIF board and cooling distribution

Cooling, example of Ecal



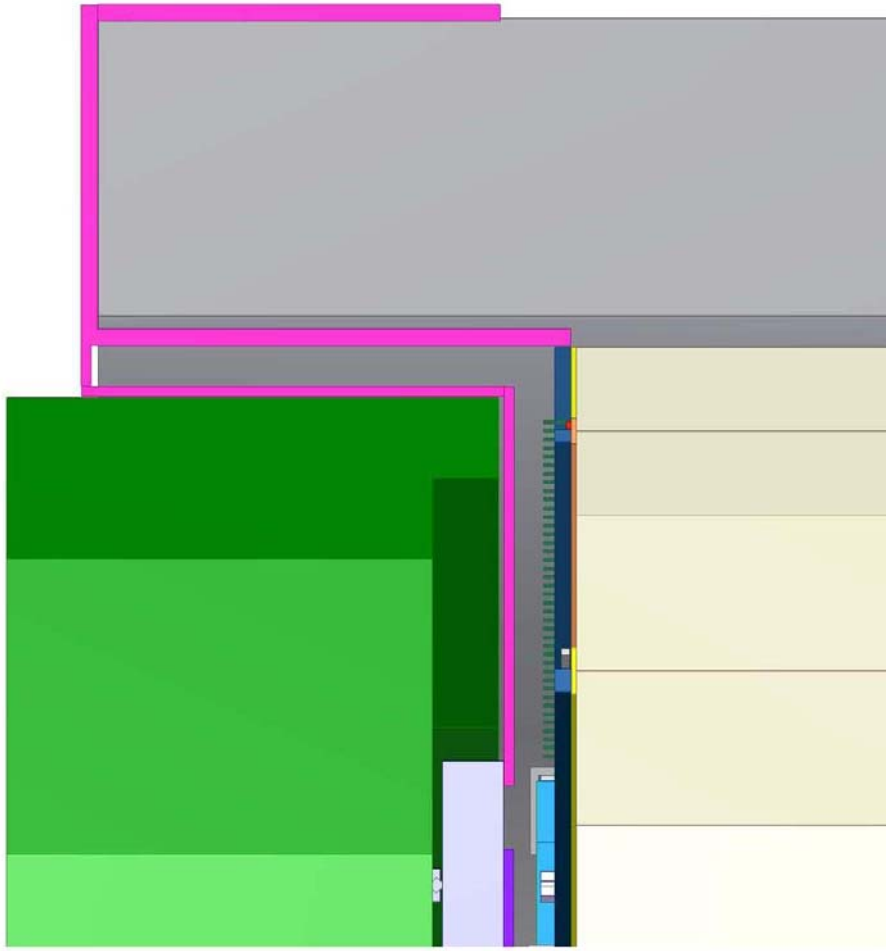


Global design

- Leakless mode.
- One line / module.
- Inlet water temp: 18°c / Outlet water temp : 23°c
- Maximum power / column : 100 W (EUDET)
- Pipe diameter : 13 mm.

Water distribution is not using all the way-out channels

From D.Grondin LPSC

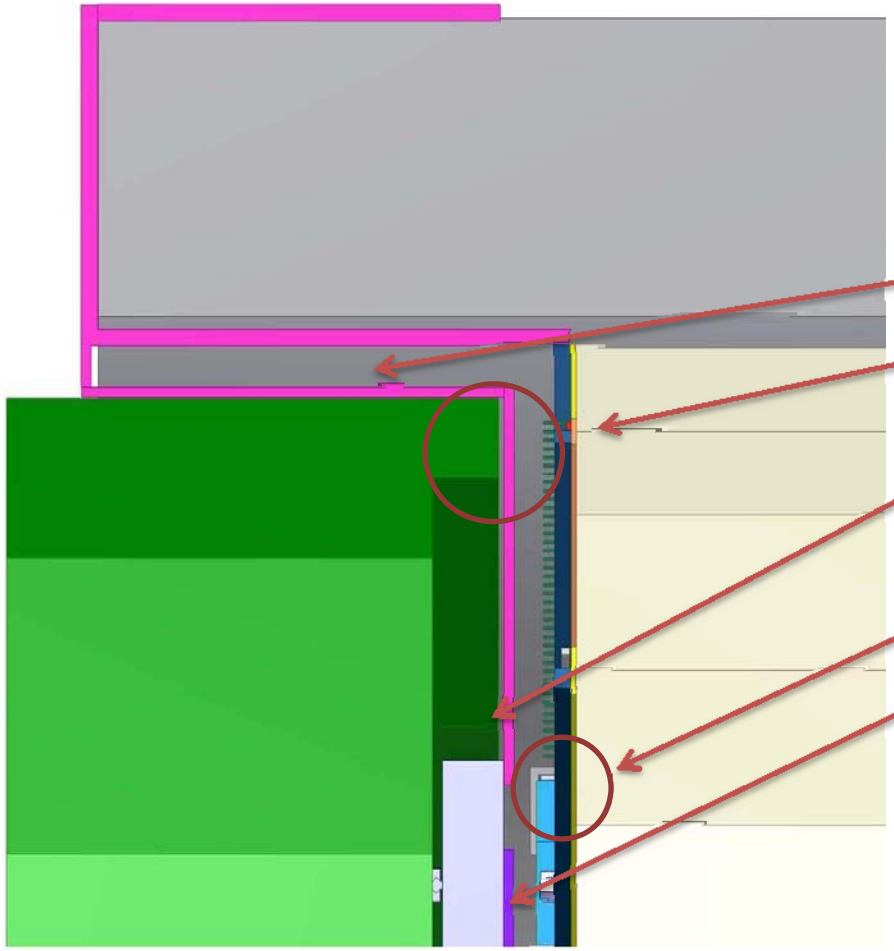


GAP between Barrel and endcaps

10 cm OK for barrel

But

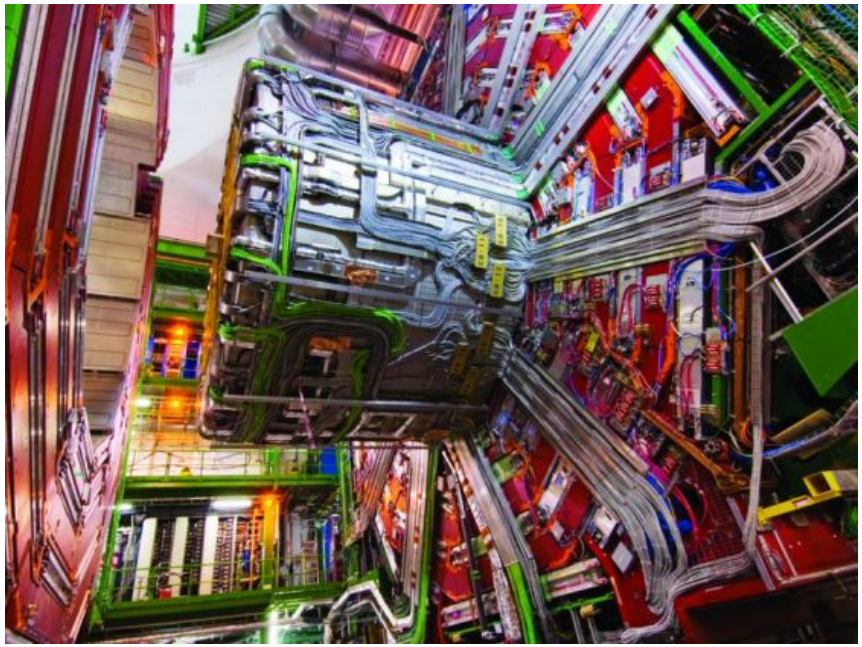
GAP between Barrel and endcaps



What from Endcaps ?

- Hcal endcap board & services
- Hcal ring board & services
- Ecal endcaps board & services
- Ecal LDA
- ETD ?

Some work in progress in case of Barrel,



Ok, this is CMS....

For realistic definition of dead materials & zones, so many information still missing !

- Need technical contact for each subdetectors

- What about **inner part**, certainly the most sensitive for simulation

What's coming next :

✓1st Integration meeting for « inner part « is foreseen.

With participations from VTX,SIT,FTD expected (April)

✓Some subdetectors « interface parameters « datasheets

partly filled out and ready for corrections

Questions :

- What level of detail is needed for simulation/reconstruction ?