CALICE Si-W ECAL (& ILD)
power pulsing
(cabling)

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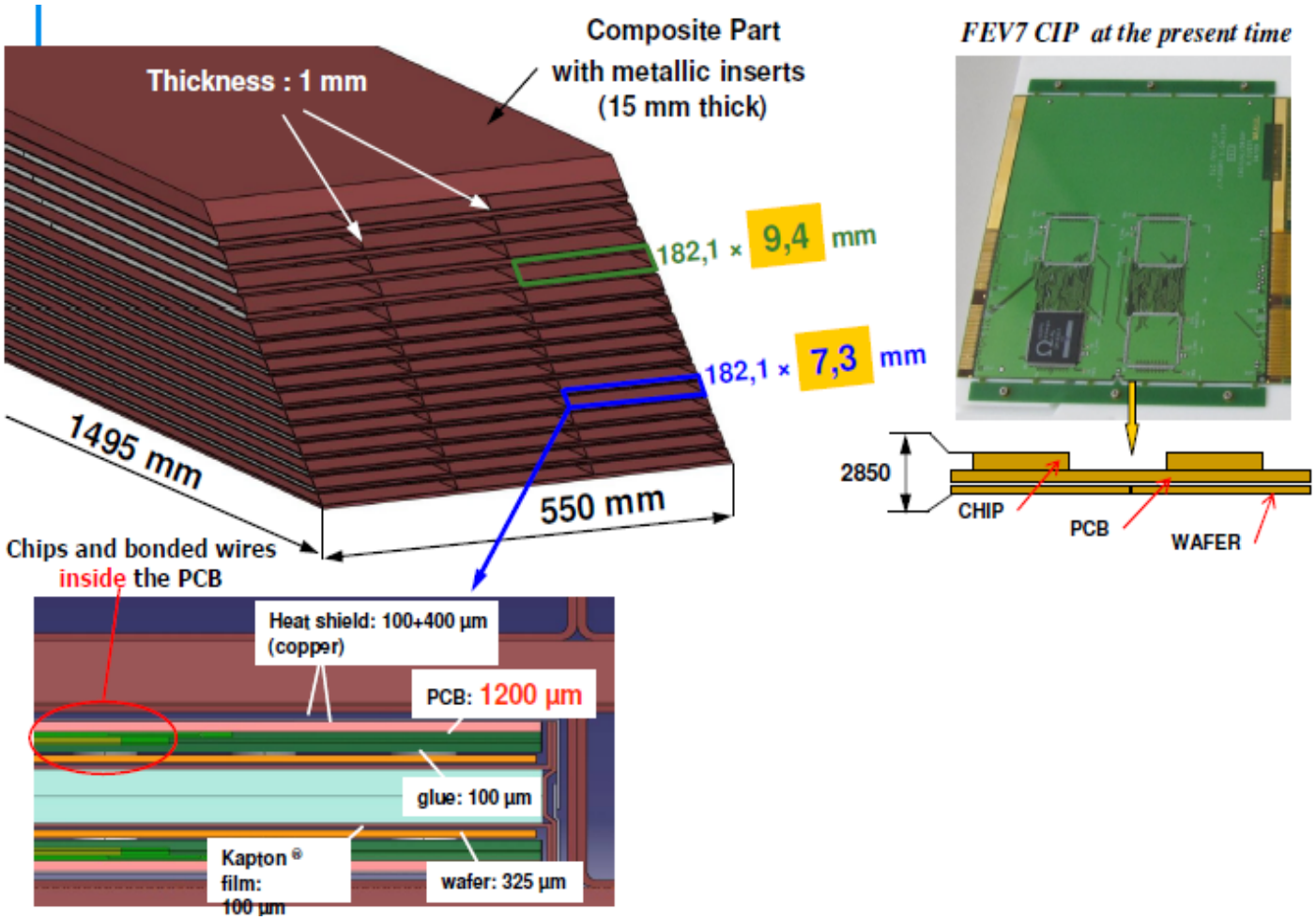
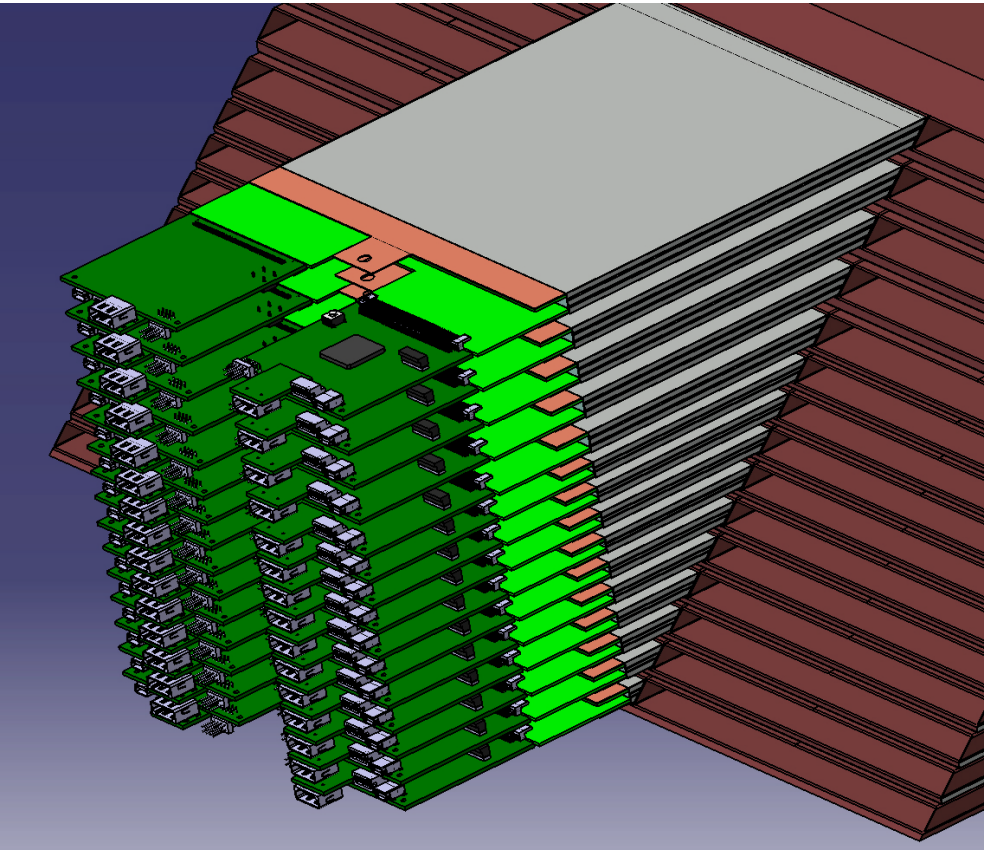
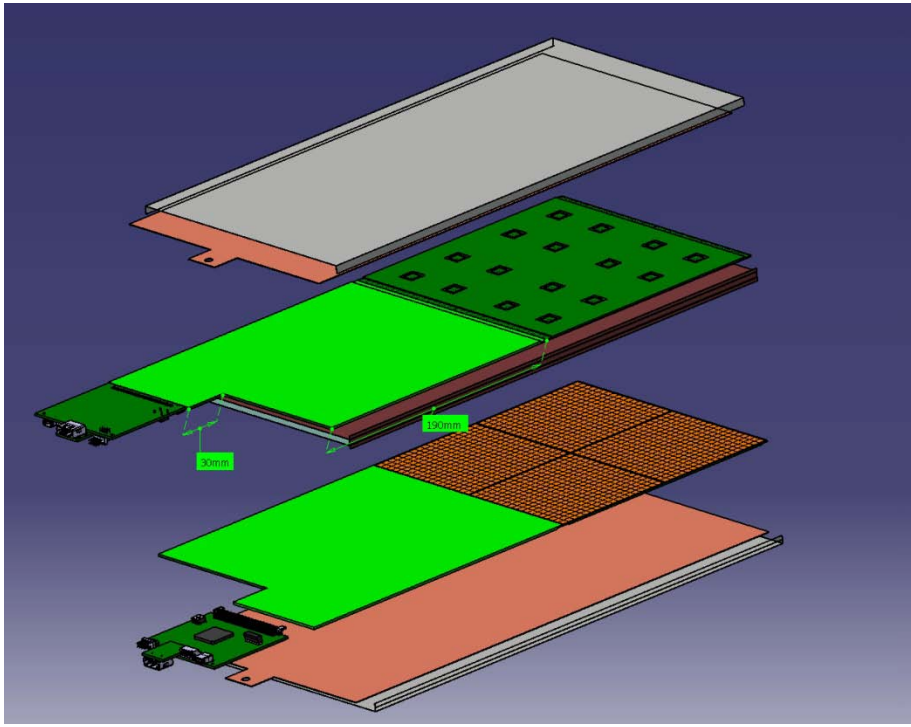
ECAL prototype

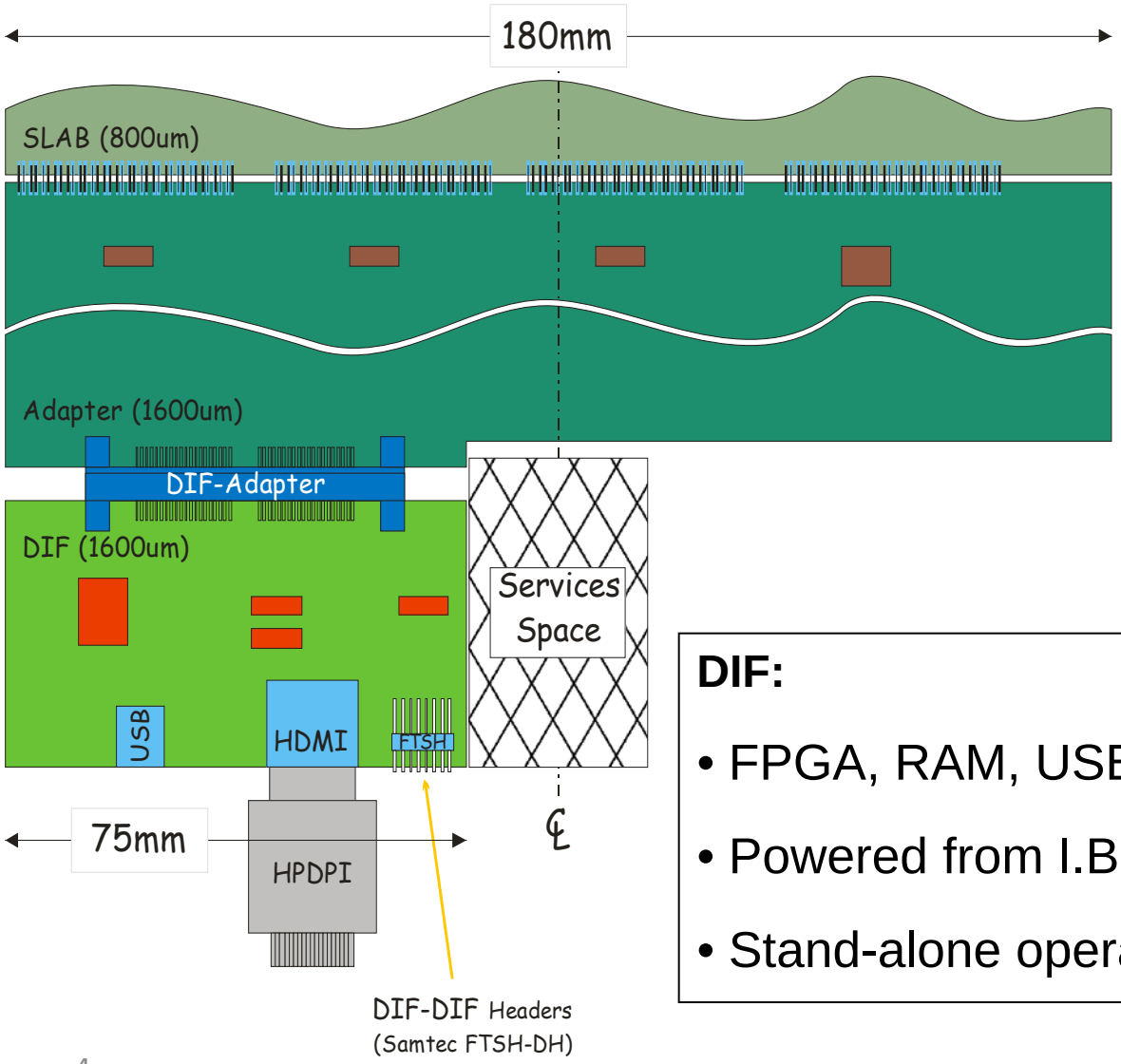


ECAL prototype





DIF & intermediate board



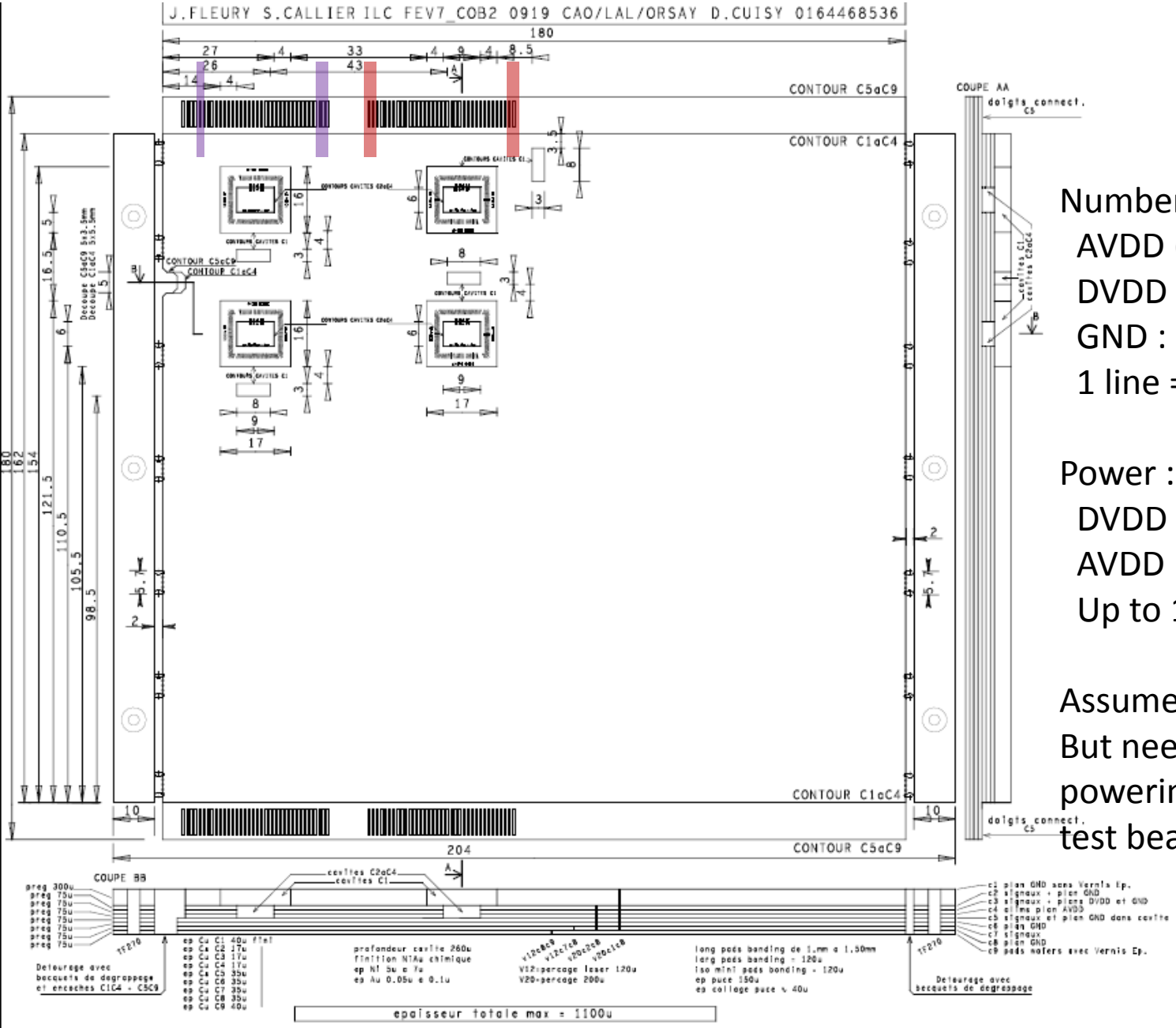
Intermediate board:

- Power distribution
  (& pulsing?!)
- Clock fanout
- Level conversion
- Sensors for T, V, I, etc.

DIF:

- FPGA, RAM, USB, DIF and LDA links, etc.
- Powered from I.B.
- Stand-alone operation

Power lines on detector



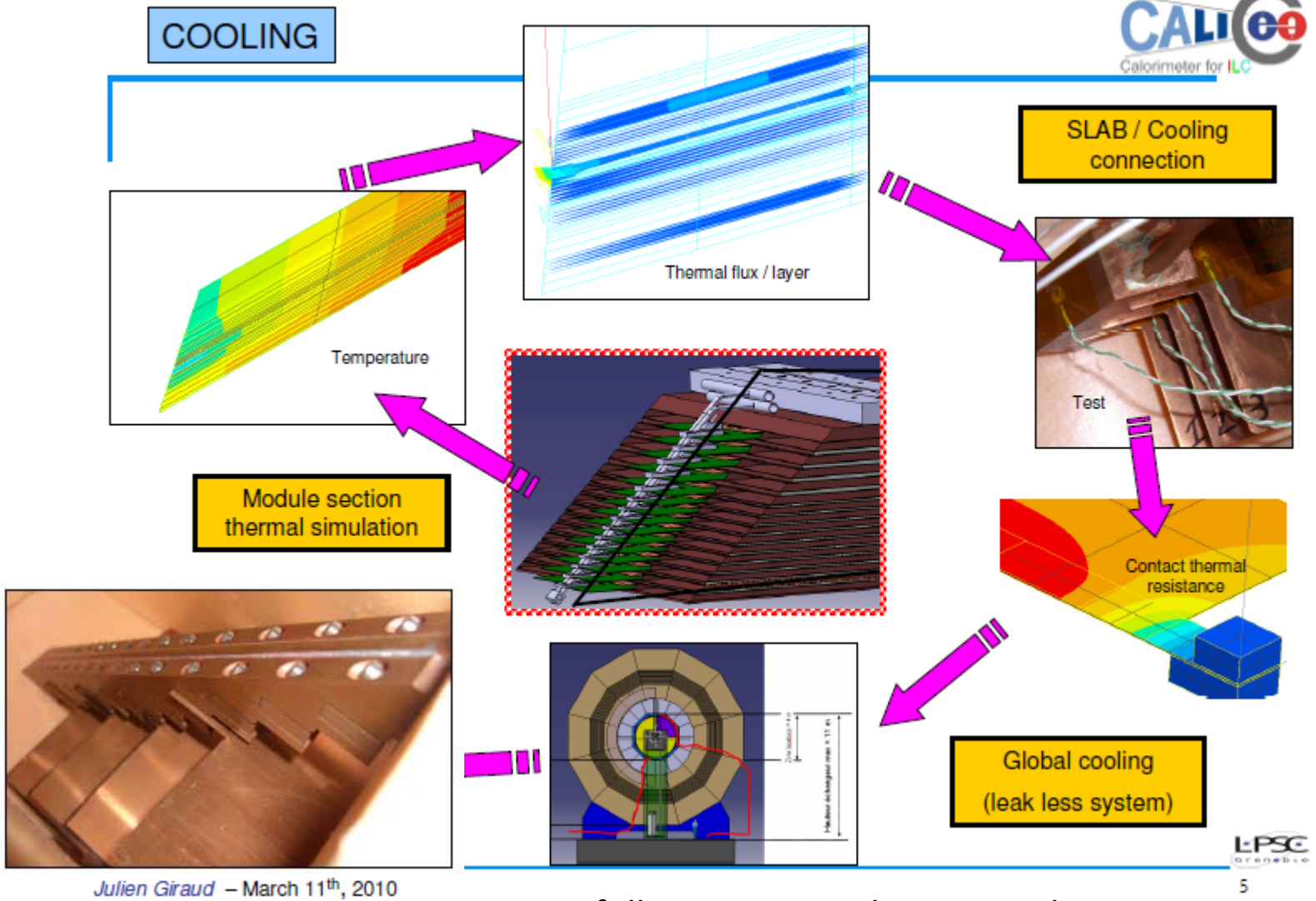
Number of lines
- AVDD (3.3 V) : 4
- DVDD (3.3 V) : 3
- GND : 19
- 1 line = 0.017 mm^2

Power :
- DVDD : 200 mA/ASU
- AVDD : 1.5 A/ASU
- Up to 10 ASU

Assume duty 1% cycle
But need constant powering for tests at lab, test beams, …

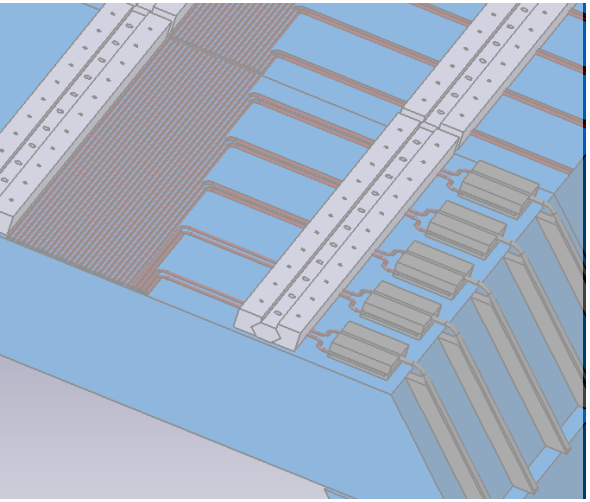
Cooling system, cable trays (LPSC)

A huge effort has been done on the cooling system and its validation with tests



See a full presentation by J. Giraud

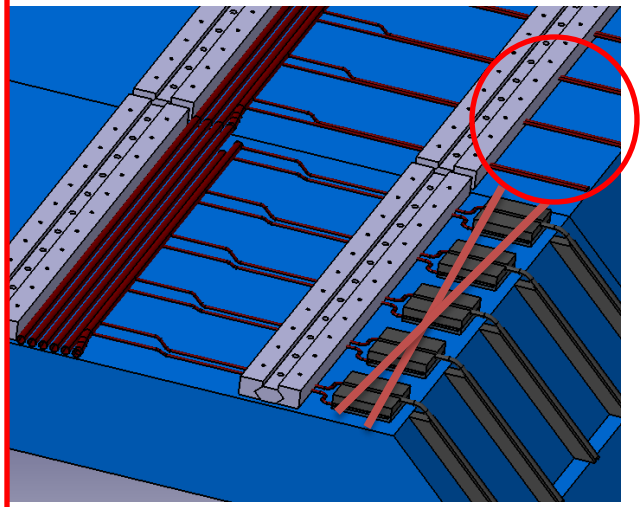
COOLING ECAL Barrel, 3 possibilities, leak less system with heat pipes .
(*J.Giraud & al, LPSC)*



(1)
Small Cu pipes distributing each columns

400 tubes full barrel

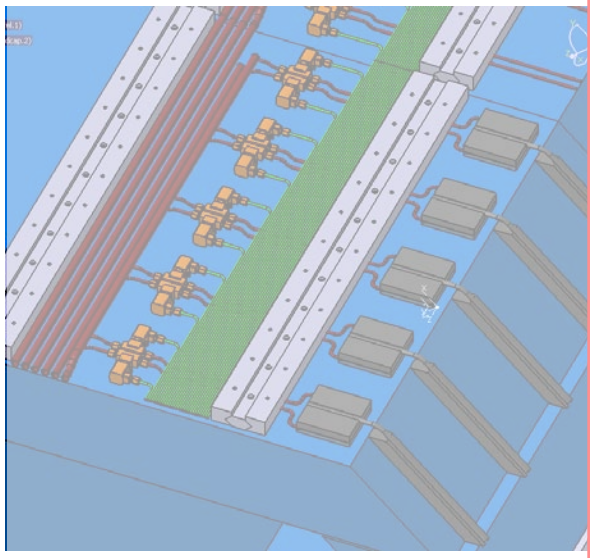
15 W max



(2)
2 bigger pipes per modules

80 tubes full barrel

150 W



(3)
Same as (2) + pneumatic valves

80 (water) + 400 (air)

150 W

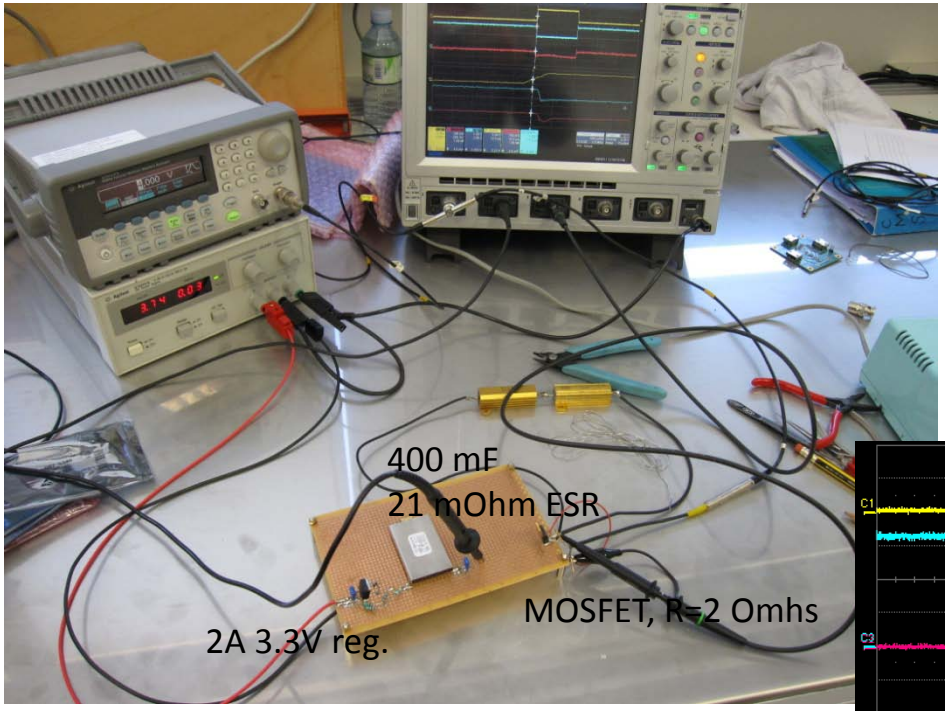
Power Issue

- Current pulses from few 100 mA to several A (~10 A), Voltage remains constant (hopefuly)
  - Battery or huge capacitance : few mF to few 100 mF, according to assumptions & optimizations (next talk)
    - After regulator (as low current battery charger)
    - “Small” size (eg. AVX bestcap BZ01 case)
  - Need low serial resistance
  - Dynamic behavior ?
- 4T B field : 5-10 g/wire at 5 Hz

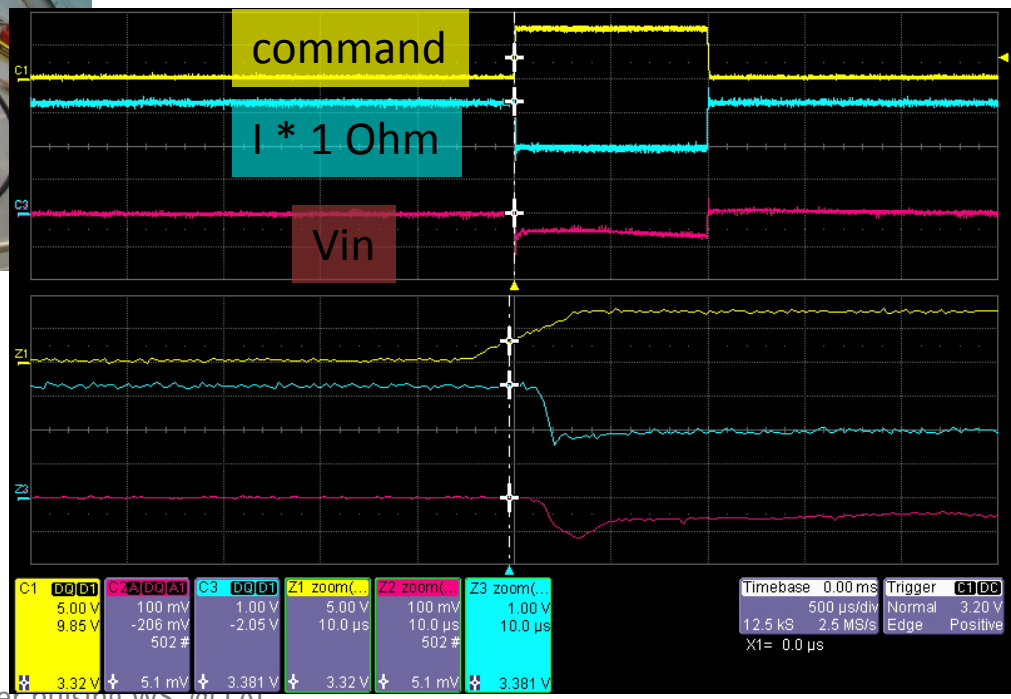
BestCap® Ultra-low ESR
High Power Pulse Supercapacitors

	BODY DIMENSIONS		
Case Size	L±0.5 (0.020) mm (inches)	W ±0.2 (0.008) mm (inches)	H nom mm (inches)
BZ01	28 (1.102)	17 (0.669)	2.3 (0.091) – 6.5 (0.256)
BZ02	48 (1.890)	30 (1.181)	2.9 (0.114) – 6.8 (0.268)
BZ05	20 (0.787)	15 (0.590)	2.3 (0.091) – 6.5 (0.256)
BZ09	17 (0.669)	15 (0.590)	2.3 (0.091)

Test setup (today!)



Command : 1% duty cycle
Vin= 3.3 V
Load : 1 A on 1 Ohm, 1 ms, rise=1 us
Vin undershoot : 100 mV



To be continued with other settings…
(0.1 – 2 Ohms loads and Imax up to 10 A)

What about ILD ?
&
Backup slides

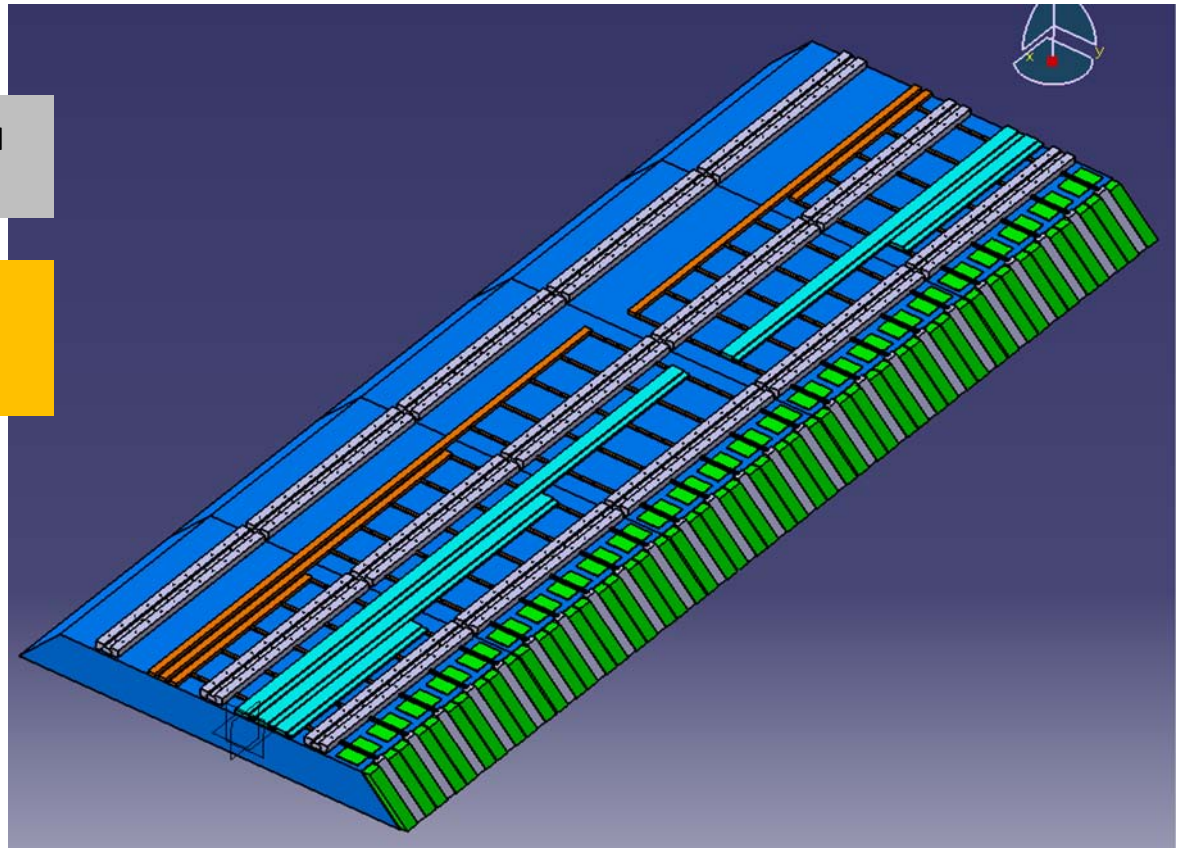
C.Clerc
ILD integration meeting,CERN
18/10/2010

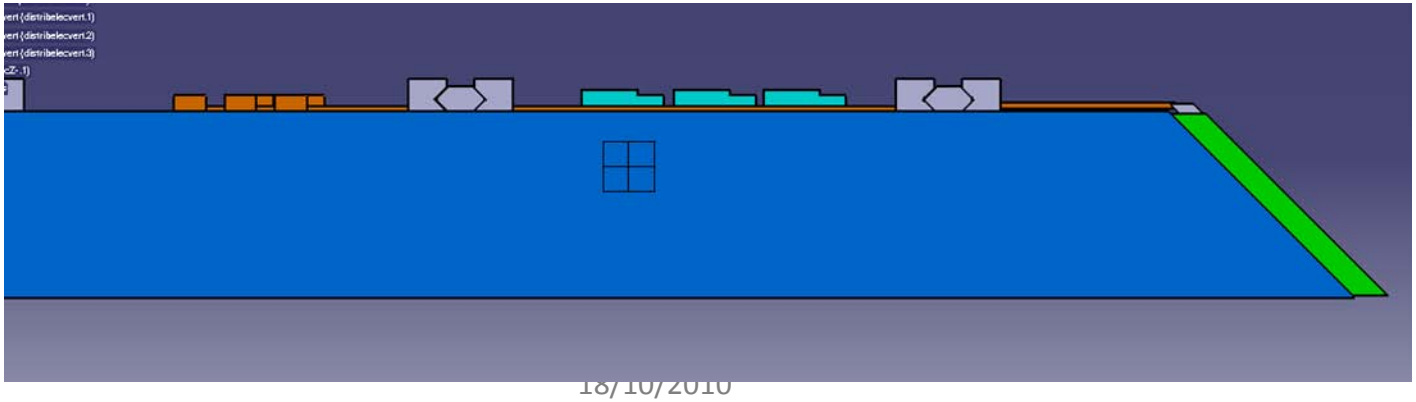
Fixing system :3 rails Alu
10.3x3.5 cm² each

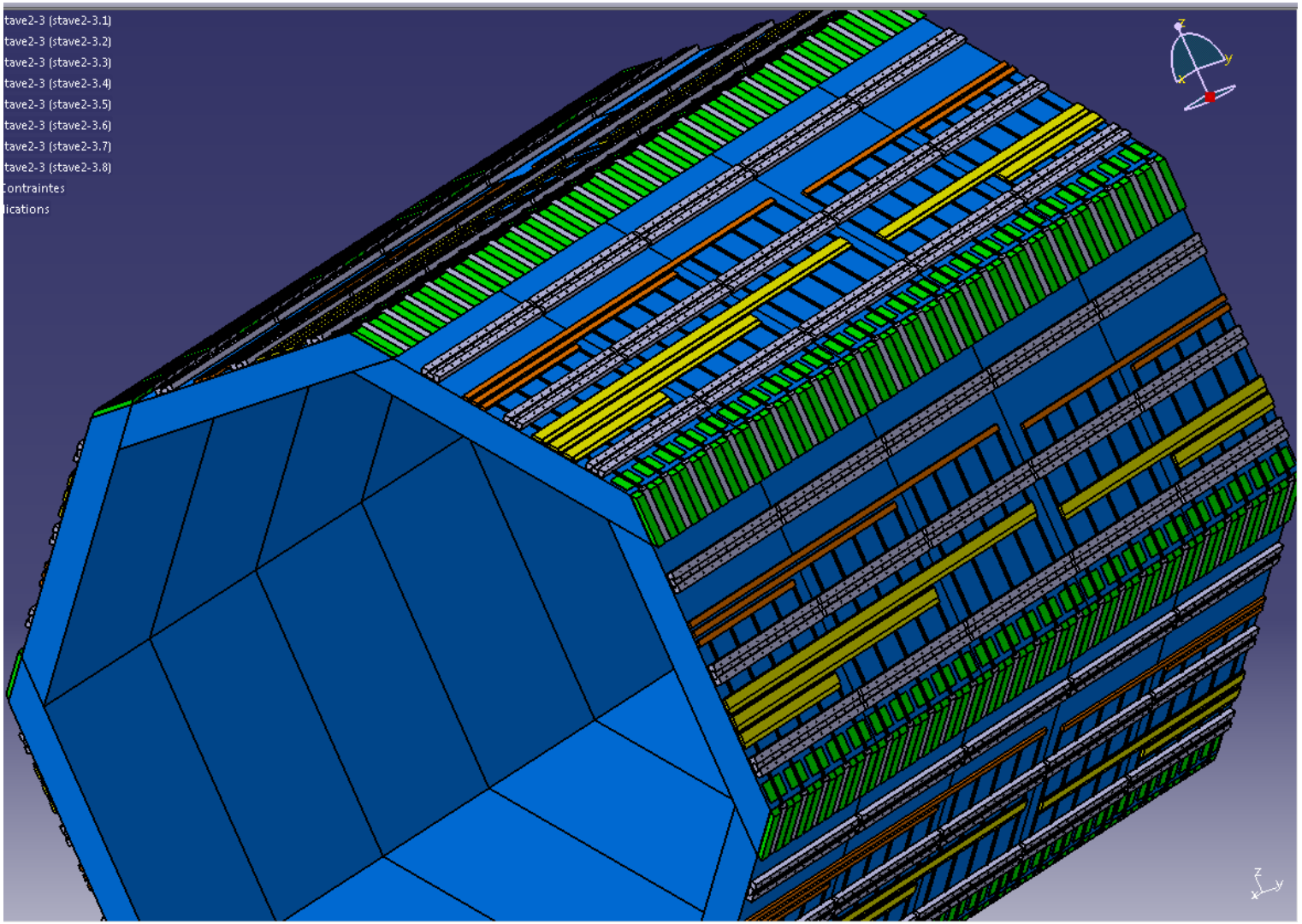
Cooling :
2 lignes in/out ∅16 per module
then 2 lignes in/out ∅6 par column

Cables
10 cm² per module

LDA & Front-end






tave2-3 (stave2-3.1)
tave2-3 (stave2-3.2)
tave2-3 (stave2-3.3)
tave2-3 (stave2-3.4)
tave2-3 (stave2-3.5)
tave2-3 (stave2-3.6)
tave2-3 (stave2-3.7)
tave2-3 (stave2-3.8)
Contraintes
lications

Gap Barrel-Endcap :

Services of the Barrel ; 16 ways-out (170 cm²each)

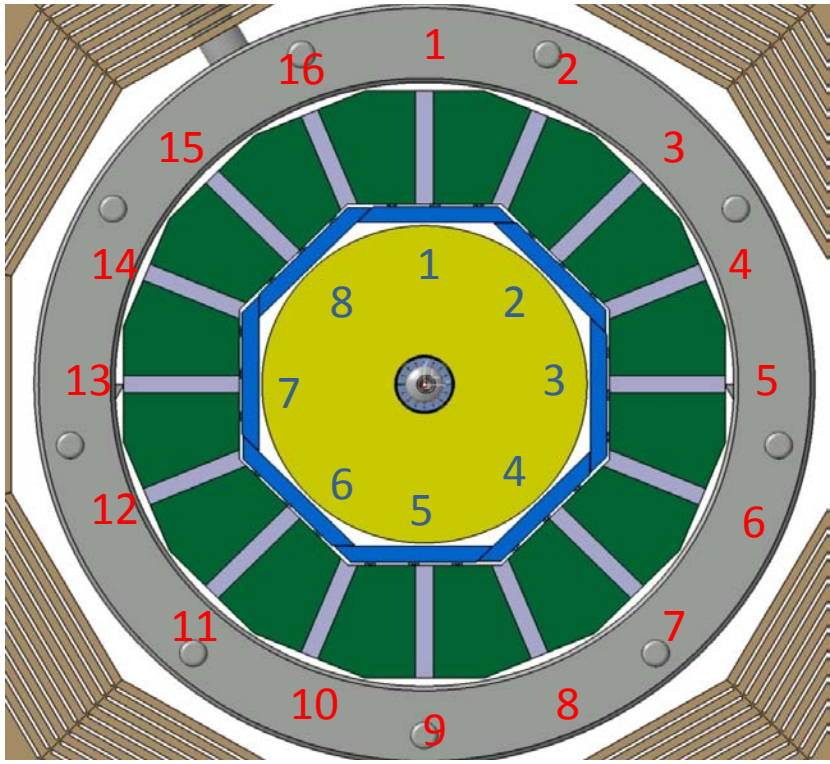
- •TPC 80 cm²
- •AHCAL 800 cm²
- •ECAL 352 cm² (cooling case (2))
- •SET

But Also

In case AHCAL electronic in the gap (10cm long)

Services of the Endcaps in 16 ways out

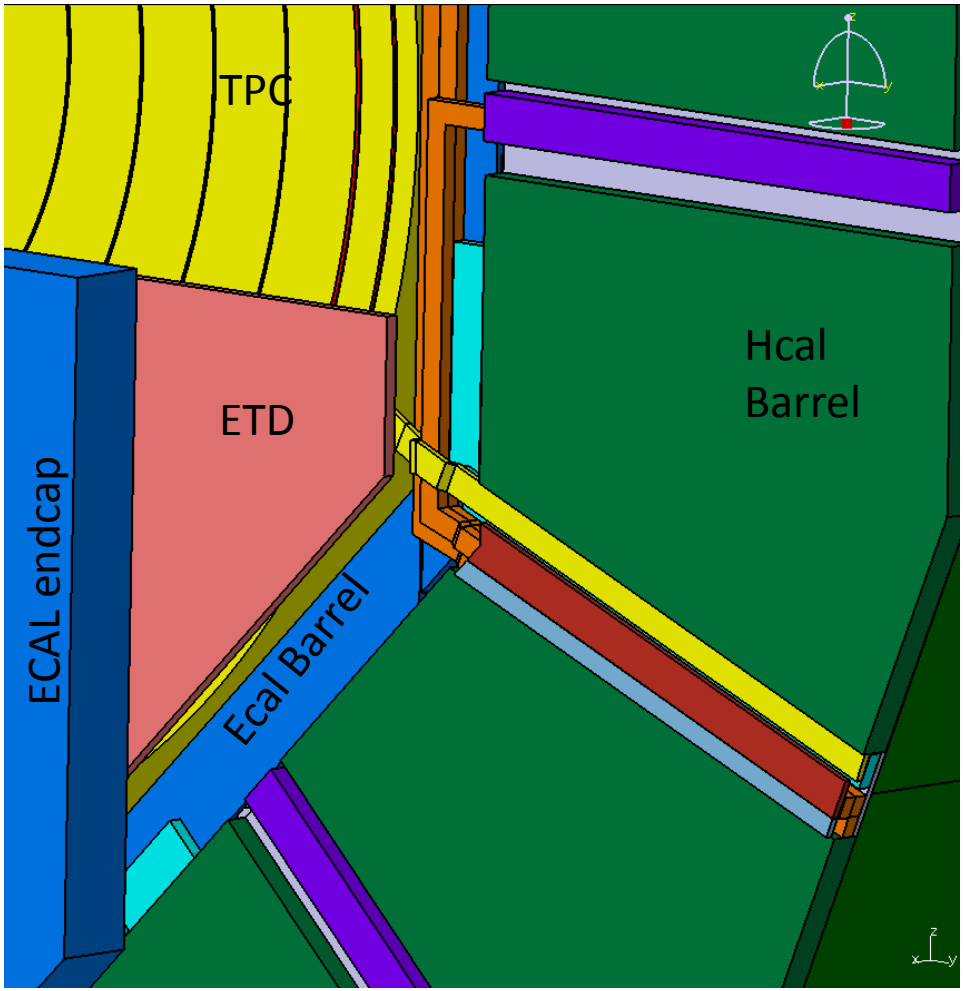
- •Ecal endcaps
- •ETD



Cables and services from the endcaps in the gap Barrel/endcaps:

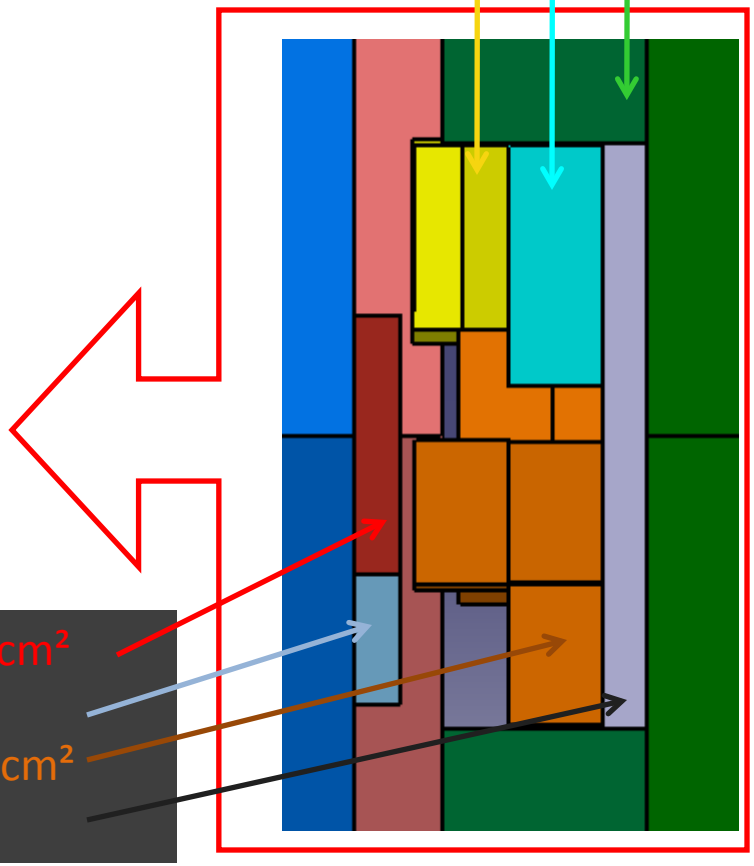
Ecal :

- ➢ Cooling = 56 cm² (minimal thickness 1.5 cm) Only 4 ways-out
- ➢ Cables (?)= 15Mch ≈ 53 cm² (i.e : 7 cm² in 8 paths) for each endcap



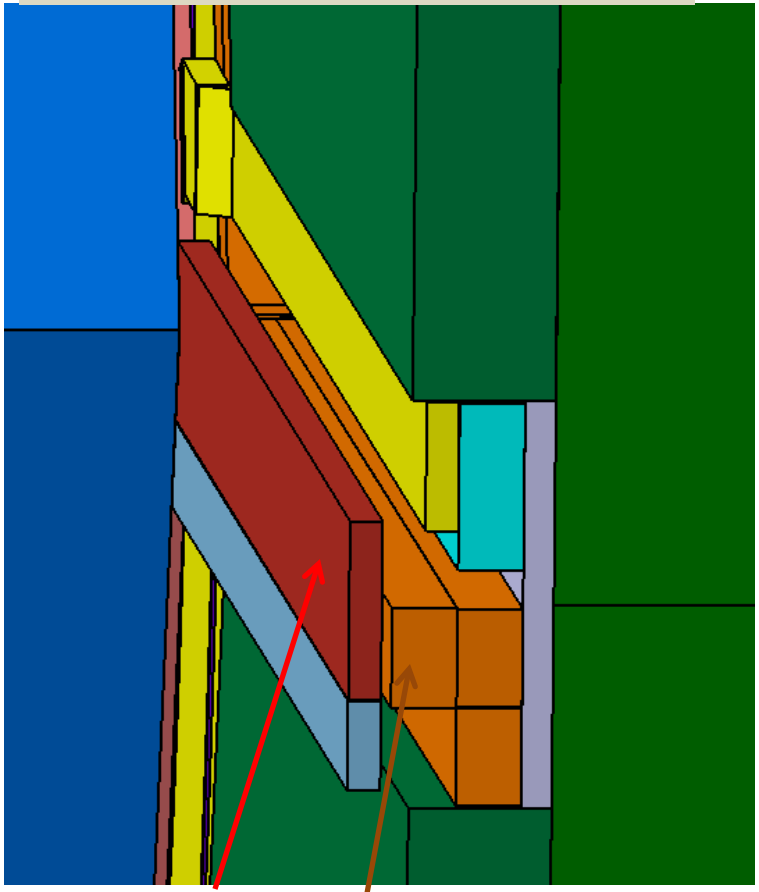
Hcal= 100 cm²
8 ways

TPC cables = 10 cm²
Ecal Barrel cables= 30 cm²
Ahcal Elec. Board (7 cm)



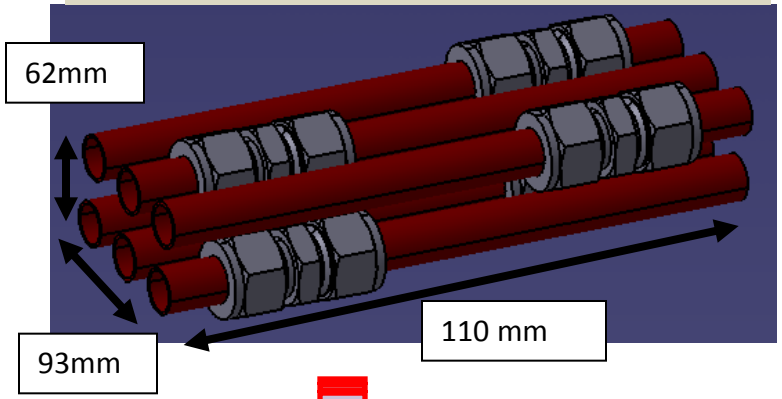
Ecal cooling (Endcaps) = 14 cm²
Ecal Endcaps cables = 7 cm²
Ecal cooling (Barrel) = 3* 14cm²
Mechanical support

Each Ecal cooling lines 14 cm²
(for 3 modules in length)



Ecal cooling (Endcaps)
Ecal cooling (Barrel)

But if connections in gaps
S = 58 cm²



Way 6 :
S = 58 cm² X3 > 170 cm² availables
Already too much

Données de base pour les calculs

Ecal

Per 2/3 stave

LDA		1 per column	5 per module						
			cable ∅	mm²	Nbre	S total cm²	Cu cm²/cable	Cu total	
LV to DC/DC 48>3,3 V	48V/2A	2*1,5mm²of Cu	8	50,24	15	7,536	0,03	0,45	5,97%
HT depletion Wafers 250 V/50µA par layer	250V/1,5mA		8	50,24	15	7,536	0,03	0,45	5,97%
Signal/CC	flat multiwire cable 2,54 mm	0,05cm²*10wires		50,67	15	7,6		0	0,00%
Ground line		1 per module ?		210	3	6,3		6,3	100,00%
			Total			28,972		7,2	24,85%

Where is the optical conversion of signal ?

AHcal

For one half octant

per layer	(48 per 1/2 module)		cable ∅	mm²	Nbre	S total cm²	Cu cm²/cable	Cu total	
1Power	50v 0,3 µA per channel 276 ch/layer	2*5pins SAMTEC IPL1 0,64mm	10*2,54 mm	50,67	48	24,3216	0,032	1,536	6,32%
1 HDMI			8	50,24	48	24,1152	0,03	1,44	5,97%
Ground line		1 per Half octant		210	1	2,1	2,1	2,1	100,00%
			Total			50,5368			
								5,076	10,04%

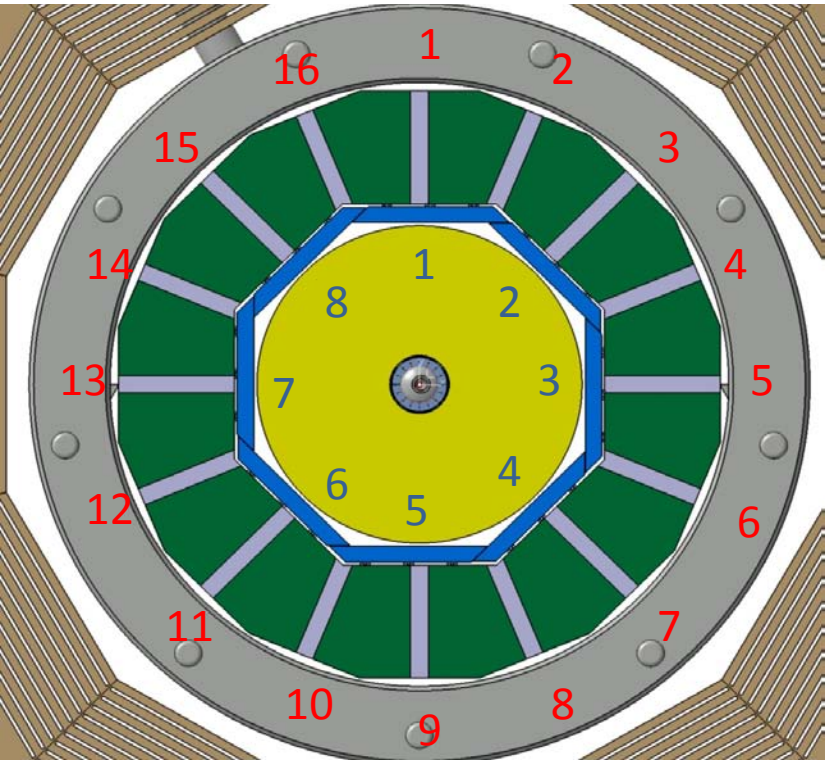
TPC

per way-out — 136 modules per endplate to be shared into 8 way-out

			cable ∅	mm²	Nbre	S total cm²	Cu cm²/cable	Cu total	
central Cathode	70 KV		15	176,625	1	1,76625		0	0,00%
µmégas/Gem's power supply	o,4-1KV multibrins 14	14*0,14 mm²		1,96	10	0,196	0,02	0,2	102,04%
1 double optical fibre					10	0		0	0,00%
1 low voltage 32 A	Assuming Conversion 48V/2A ???	2*1,5mm²of Cu	8	50,24	10	5,024	0,03	0,3	5,97%
Ground line				210	1	2,1	2,1	2,1	100,00%
						9,08625		2,6	28,61%
									21,17%

Services section vs way-out

Missing : TPC cooling
Liquid supply line = 5 mm ID; 7 OD
Vapor return = 8 mm ID; 10 OD



FACE Z-

	Cables				Ecal cooling		
Way in	Hcal	TPC	Ecal Barrel	Ecal Endcaps	Water Barrel Water Endcaps	Endcaps	Total cm²
1	100	0					100
2	0	10	30	7		0	47
3	100	0					100
4	0	10	30	7		0	47
5	100	0					100
6	0	10	30	7	42	14	103
7	100	0					100
8	0	10	30	7	28	14	89
9	100	0					100
10	0	10	30	7	14	14	75
11	100	0					100
12	0	10	30	7	28	14	89
13	100	0					100
14	0	10	30	7		0	47
15	100	0					100
16	0	10	30	7		0	47

Worse case : path (6), 103 cm²