Ecal Interface document

Mechanical part status

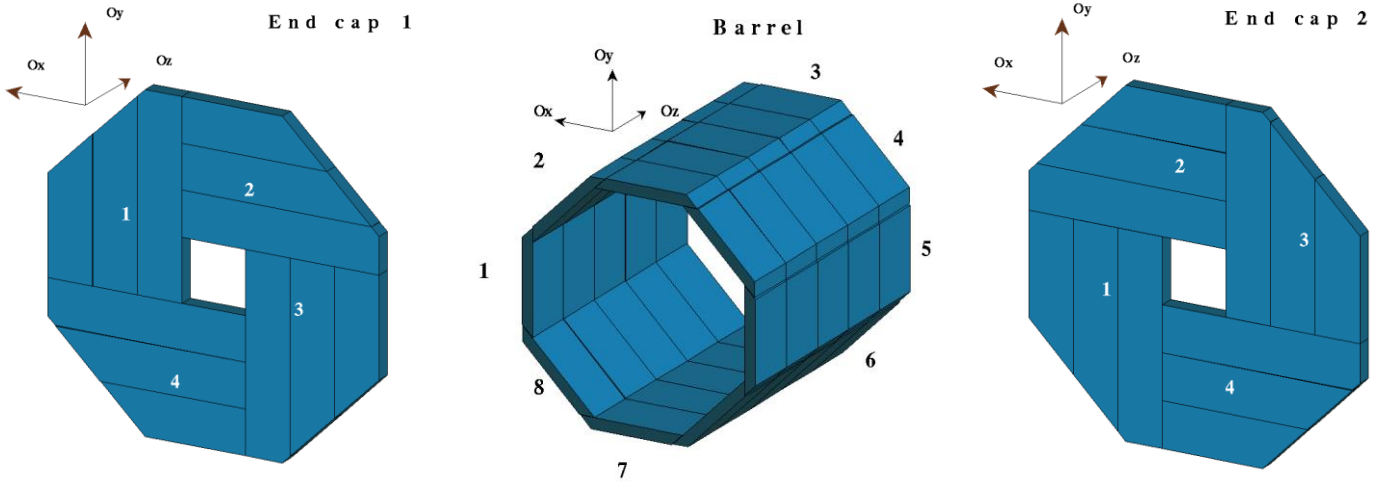
Henri Videau
LLR Ecole polytechnique / CNRS
Roman Poeschl
LAL UPS / CNRS

Power supplies, signal treatment patch panels presented in Roman Pöschl's slides

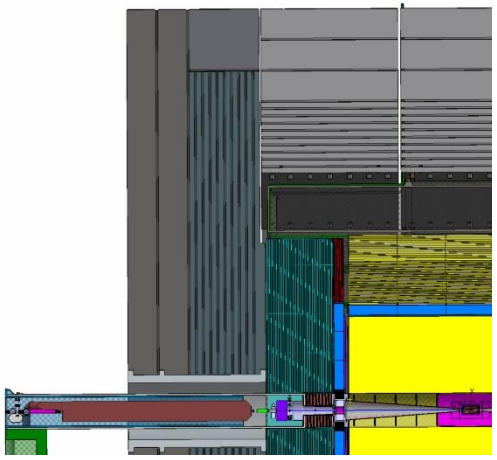
The interface document is not finished but well advanced,
The mechanical side is almost done since the problems are well defined
Roman slides will show you the rest but more developments are expected on electronics, power consumption … what has to be done?

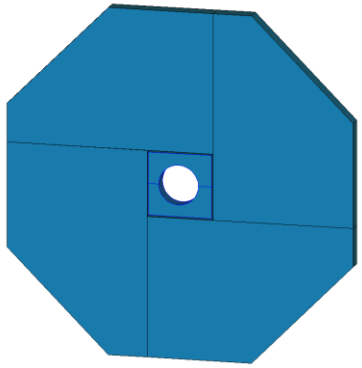
We should have in mind that it is not a static situation we have to describe
we study a detector made of sub-systems which have to be
built, tested on their own, assembled and connected.
The detector has to be put together, assembled, but also disassembled if needed.
The connections, patch panels, define the borders between the sub-detectors and the services.

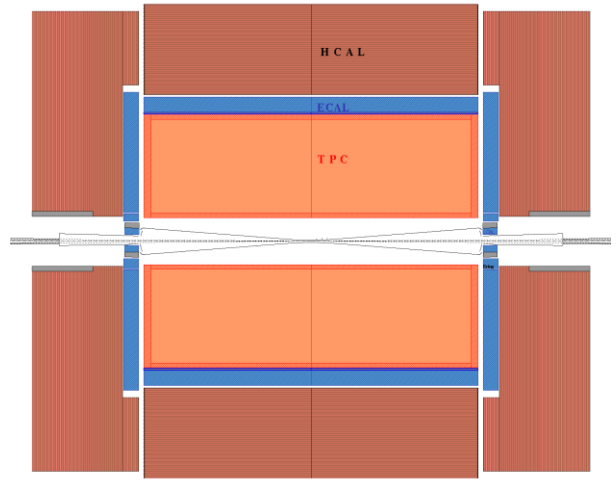
The ECal is composed of 3 parts: 1 barrel, 2 end caps, 2 end cap rings.
The end cap rings are mounted on the forward/backward beams and not considered here.



Large detector

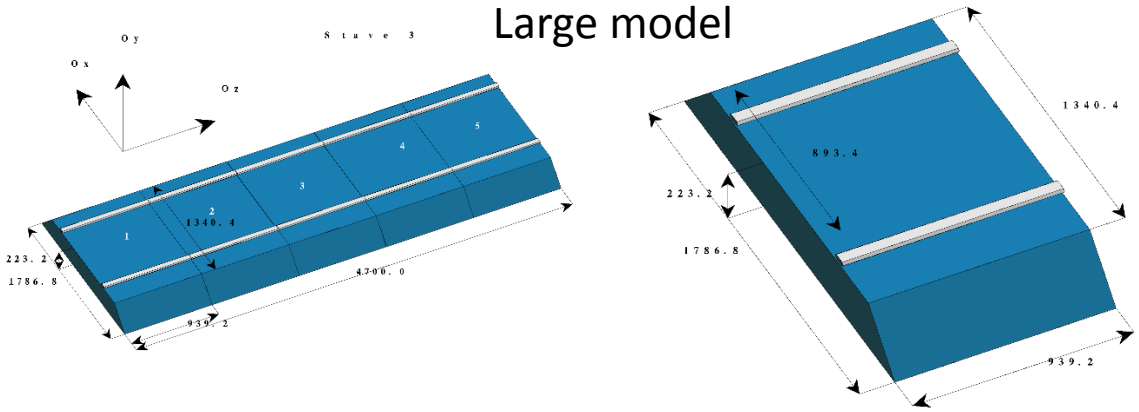


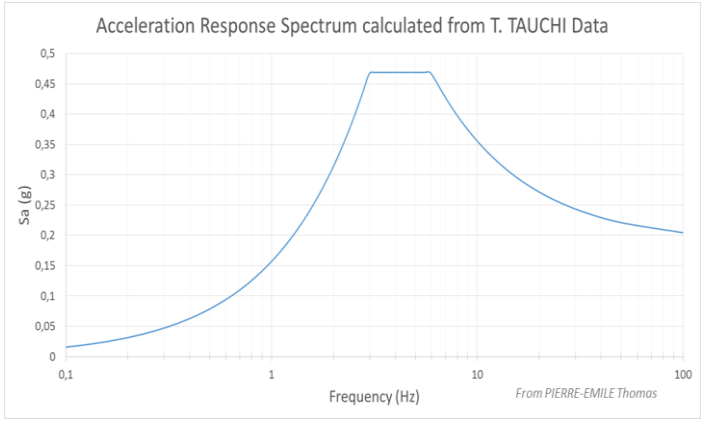




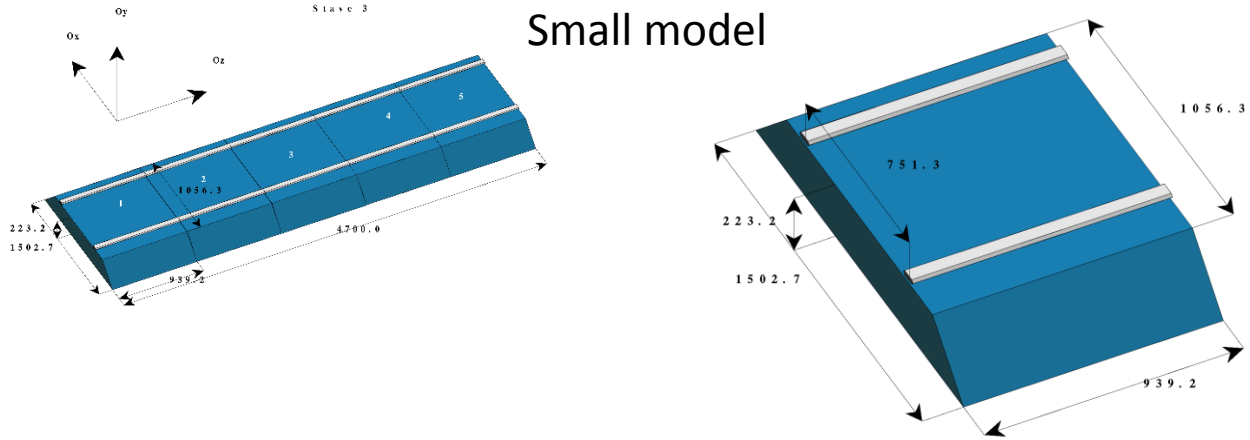
The ECal (light blue) environment:
It surrounds the tracker, SET, TPC, inner trackers
It is surrounded by the HCal

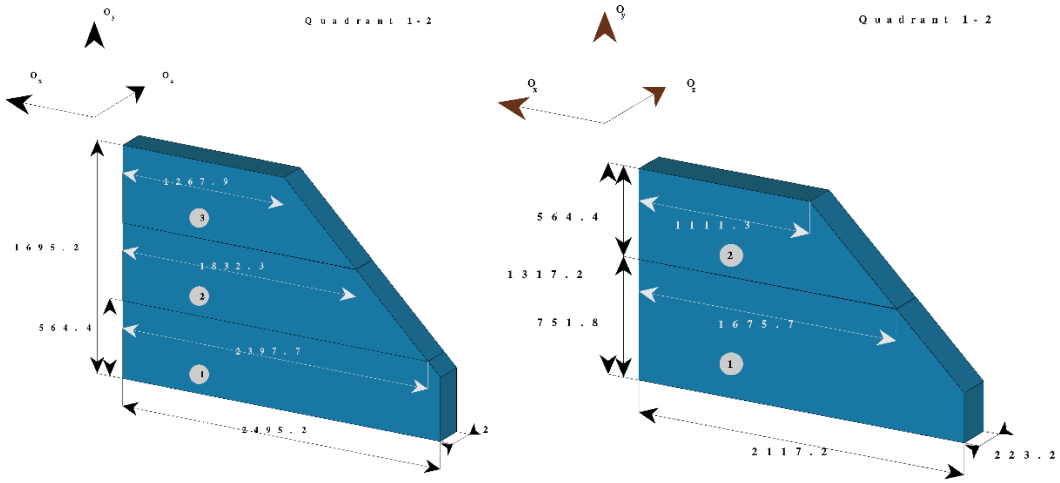
Large model





Small model





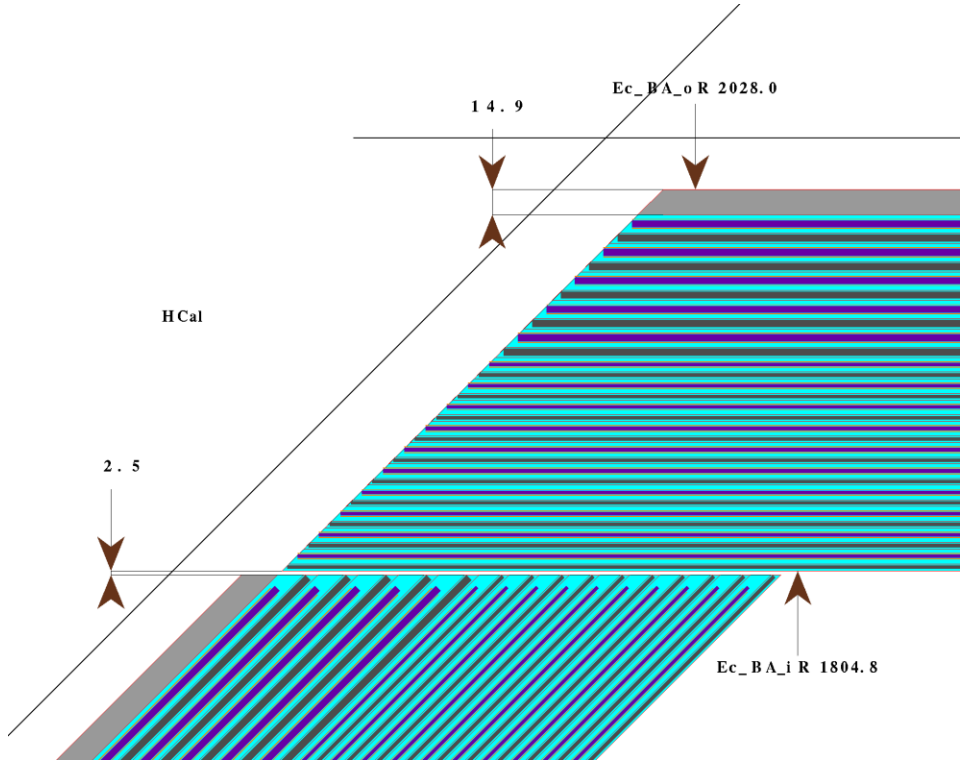
These structures have been tested for their vibration eigenmodes. The lowest frequency being above 30Hz they are not too sensitive to earthquakes and vibrations propagated from the Hcal.

Interface barrel: Hcal, fixation, vibrations, deformations SET&TPC.

Five modules are assembled to make a stave, they are fastened together by sharing the same two female rails either on the mounting stand or on the HCal.

The Hcal barrel deforms under its weight plus the Ecal weight, plus, maybe, TPC weight and ISS weight.
The clearance between staves (in phi) is currently at 2.5mm.
The distortions of the Hcal barrel under its weight
do not hamper this tolerance for any structure (T or V),
anyway the rail positions could be adjusted.
The Hcal vibrations on the cryostat are low frequency,
resonating well with earthquake frequencies.

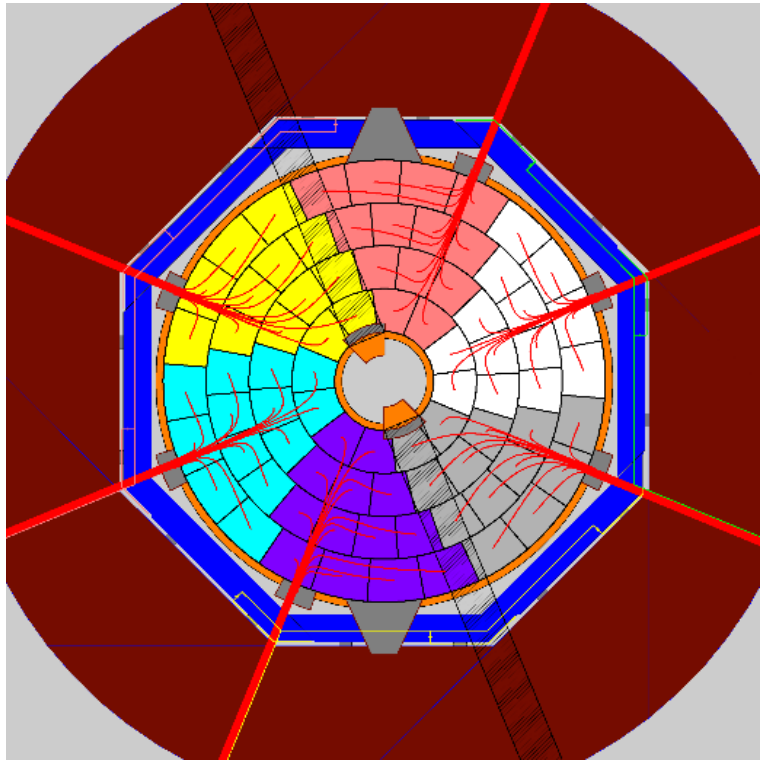
Damping may be (is) needed.



Interface barrel: Hcal, fixation, vibrations, deformations
SET&TPC.

Interface with the SET: the radial reservation made for the SET is currently 35mm for two planes of strip sensors.
There are no information on the structure, the power consumption, the cabling.
The SET can be an autonomous structure resting on the TPC endplates
or sensor planes fastened to the Ecal front face. This has an impact on the Ecal: to be known

The Ecal/Tpc interface concerns the passage of the Tpc “ribbons”
and the services between end cap and barrel as well as patch-panels.



Notice the path of the leak-less cooling. It interferes with the TPC ribbons and services from TPC and inner detectors. All that has to be clarified.
To simplify, the cooling is considered to be on one end of the barrel,
the other barrel services being at the other end.

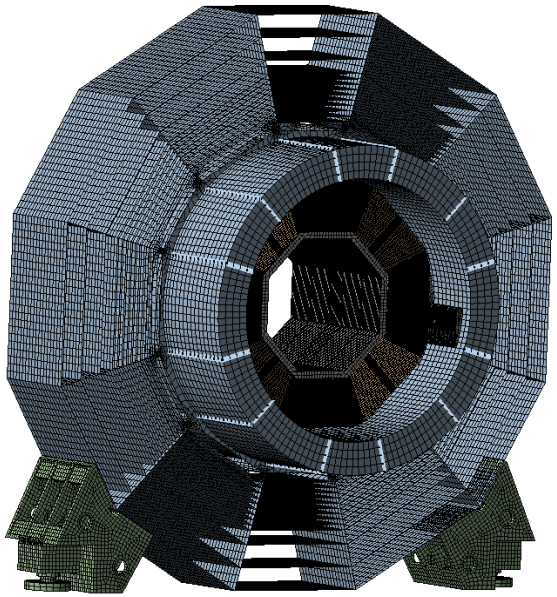
Such an interface exists also with the inner detectors.

Patch panels for the Ecal barrel in Roman’s slides

The study of the Ecal clearances when the detector is loaded and moved by earthquakes

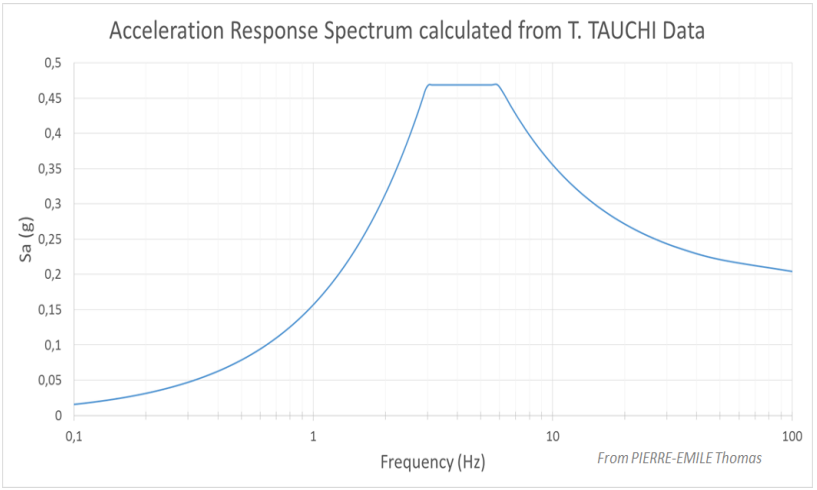
(Marc Anduze, Thomas Pierre-Emile, September 2017)

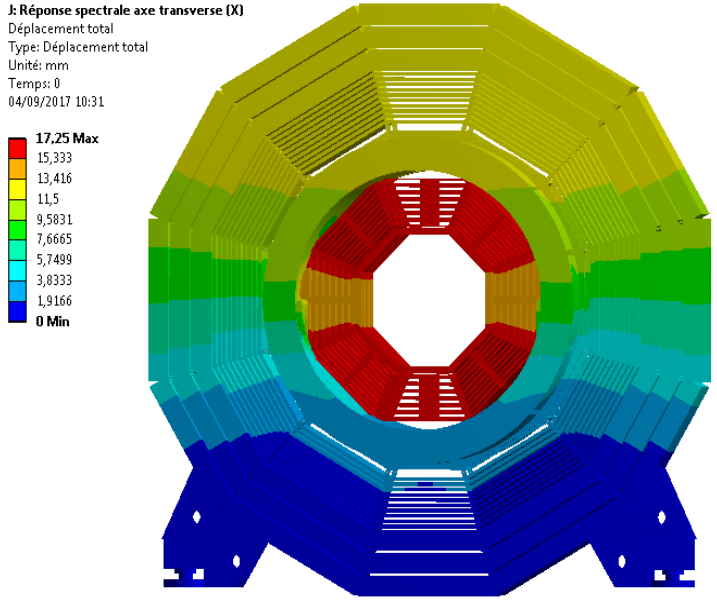
has shown, on top of the Ecal behaviour, that the transverse efforts may destroy the detector.



DESY central ILD model

Hcal TESLA model



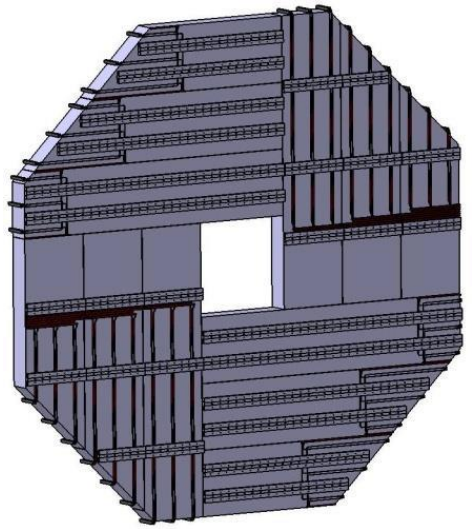


Maximum displacement:
17,3 mm Nominal 1mm -> 0.5

Smallest gap between ECAL rings along z:
0,98 mm Nominal 2.5mm

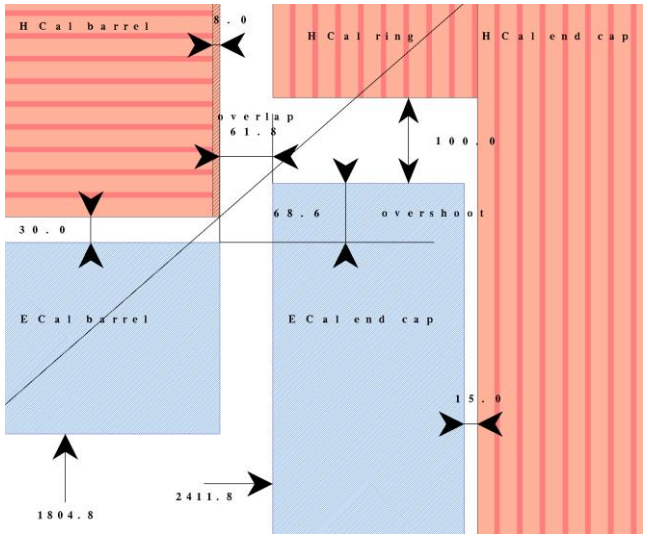
Smallest gap between ECAL module along phi: **1,89mm**

The Ecal end caps are fastened on the Hcal end caps through rails, see figure by D. Grondin.
Notice that for the small model the drawing of page 4 and this one disagree.



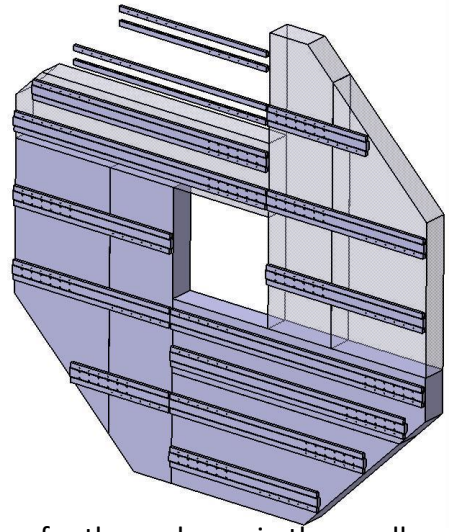
Fastening system for the end caps in the large model

15mm had been reserved between Ecal and Hcal for the fastening system.
30mm seem necessary.

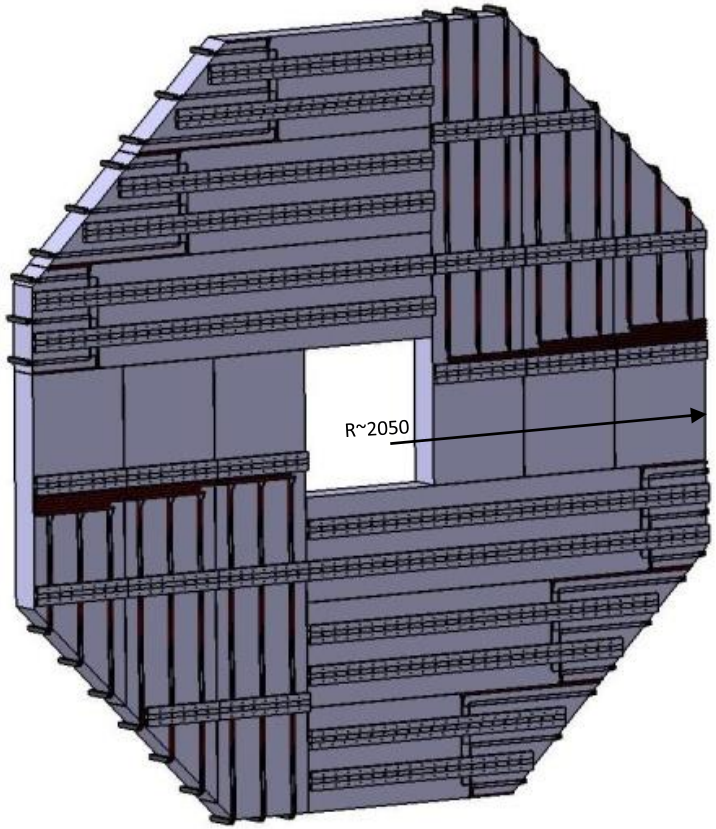


The clearance between barrel and end cap (overlap) has been reduced,
That may be a problem for the AHCal electronics space in the Tesla structure,
since the overshoot precludes the easy solution of thinning the Hcal ring.
In any case this clearance is the most critical dimension since it has to cope with the end cap barrel clearance plus the services and patch panels. Being worked upon.

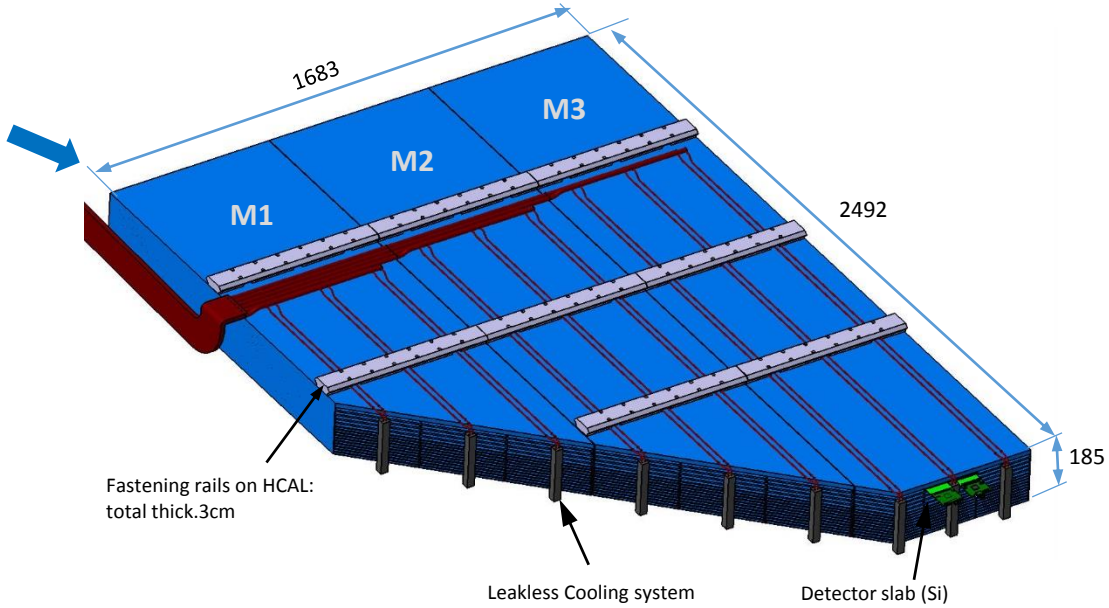
This problem does not exist really in the small model.



Fastening system for the end caps in the small model



End caps cooling (D. Grondin)



This was done with the DBD model not the actual one

	W mass	Si mass	Cu mass	Module mass	Stave mass	Barrel mass
Large model	2356	54	158	2617	13083	104666
Small model	1924	44	129	2138	10691	85527

Masses in the barrel of ECal (in kg).

	W mass	Si mass	Cu mass	Module mass	Quadrant mass	End caps mass
Large model module 1	2254	52	198	2504	6193	49545
Large model module 2	1917	44	169	2129		
Large model module 3	1404	32	123	1559		
Small model module 1	2402	55	212	2669	4071	32570
Small model module 2	1262	29	111	1402		

Masses in the end caps of ECal (in kg).

Alignment constraints
At the level of the mm. The targets should be surveyed at the level of 0.1mm

The end

Please read the interface document!
And have also a look at https://edmsdirect.desy.de/treebrowser/ildtdr/
then Si-ECAL