Engineering studies on calorimeter structures

A status

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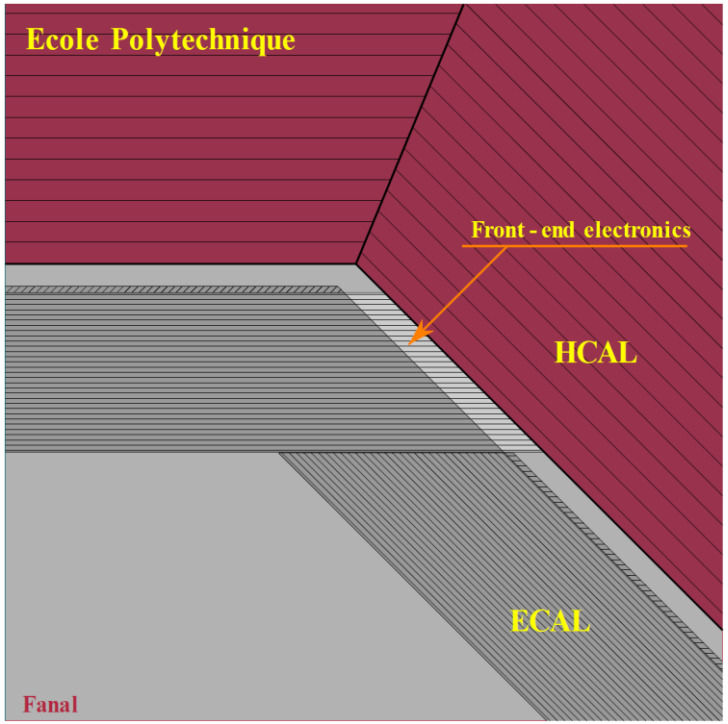
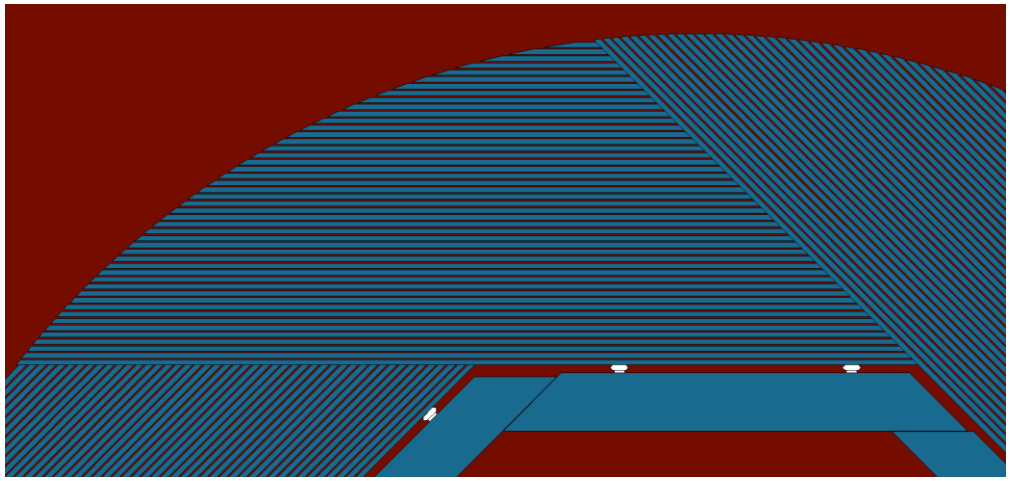
There exist two technologies proposed for the HCal,
the scintillators and the RPC's.
They have developed using different mechanical designs referred to as
Tesla (this design was invented for the Tesla project 2000) and
Videau (because one day your "serviteur" proposed it)
but there are no strong correlations between sensors technology and mechanics.

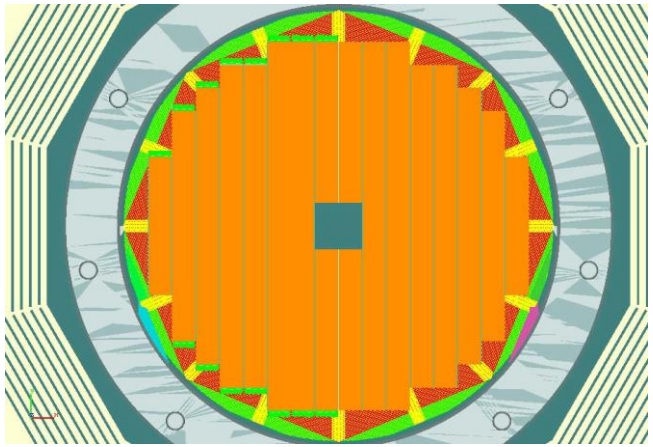
This is true for barrel and for end caps in a totally independent way.

Notice that, following the eightfoldway, the Ecal barrel existed
with its actual structure chosen only to get signals and services out
directly in the back of the Ecal in the gap left between Ecal and Hcal

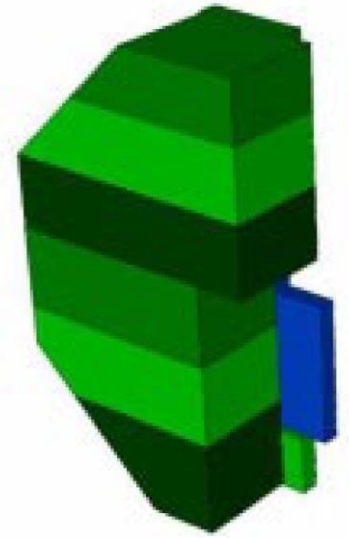


TESLA TDR





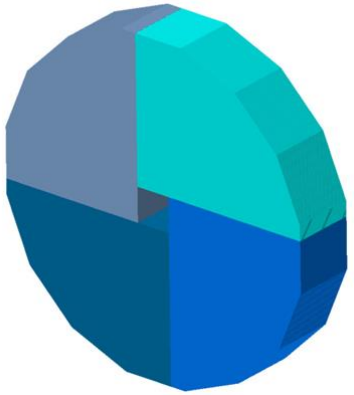
DBD



TESLA TDR

A sketchy history of the two designs for barrel and end caps according to me:
For the barrel the TESLA model gets back to the beginning of the TESLA project (TDR in 2000)
At a time, long ago, it was considered to get fibres from the calorimeter out of the yoke.
The model V was introduced much later to follow the same idea as the Ecal and get the services out in the back of the Hcal, in front of the coil.

For the end caps the earlier solution was “à la V”, made of four quadrants for an easy fastening to an FSP likely to bulge slightly when the field is turned on.
The T structure was proposed by Karsten Gadow later (DBD) for the simplicity of the fastening I guess.



Icd sDHCal

If really there is no strong correlation between technology and mechanical structure
why not solve first the mechanical structure choice which should be easier, and this independently for barrel and endcaps?

Answer:

Create a TV task force

DONE

The first approach was to look at the structure from a mechanical point of view: what is more stable against static load, under earthquake conditions? Is any structure better for its partners like Ecal or services?

Then we can also discuss cracks, cooling etc.

Only the first point has started to be looked at.

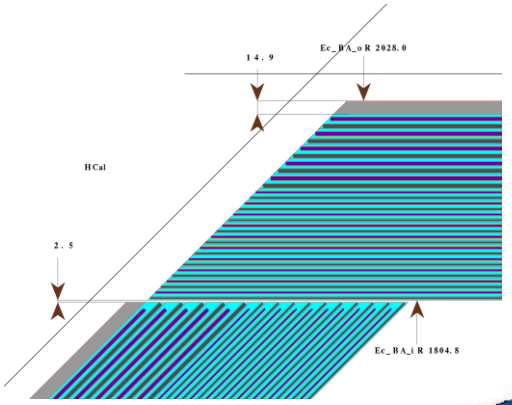
Here is the status.

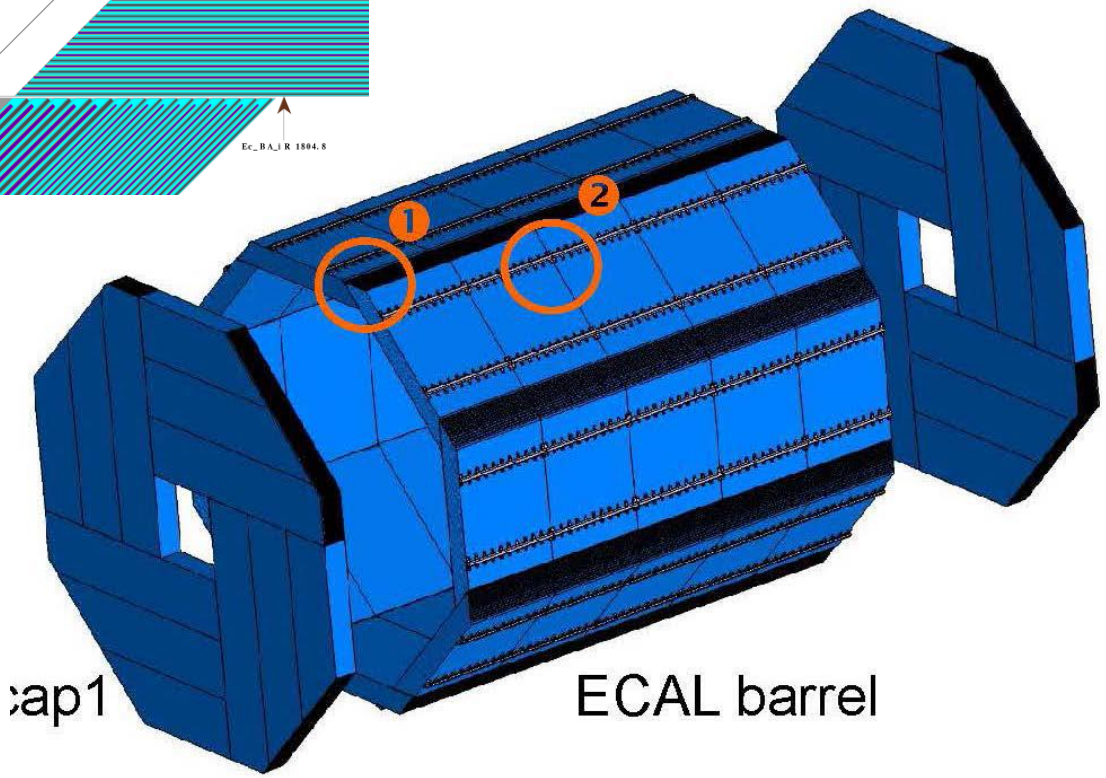
The ongoing study concerns the barrel and its way to behave under weight and earthquakes.

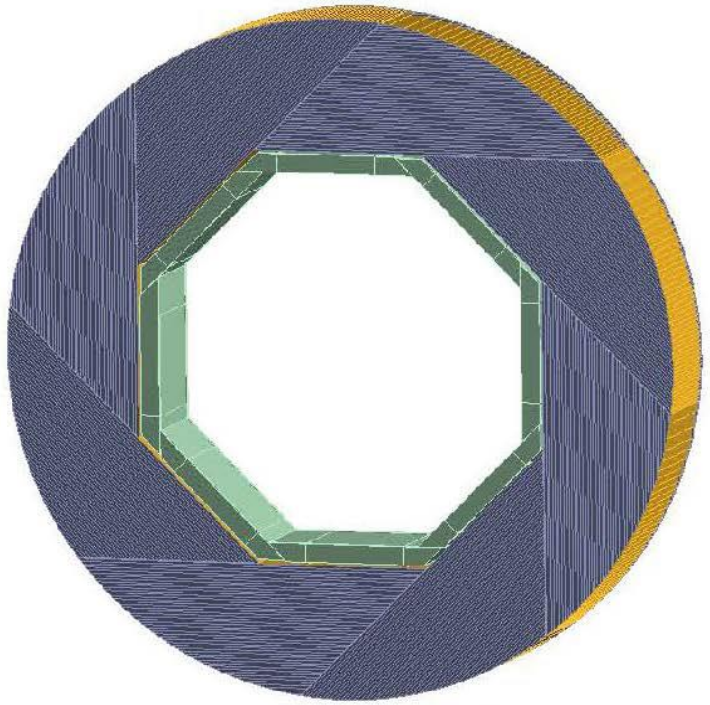
I take back the slides Claude had presented to summarise the status

GLOBAL DESIGN: calorimeter mechanical simulations (LLR)

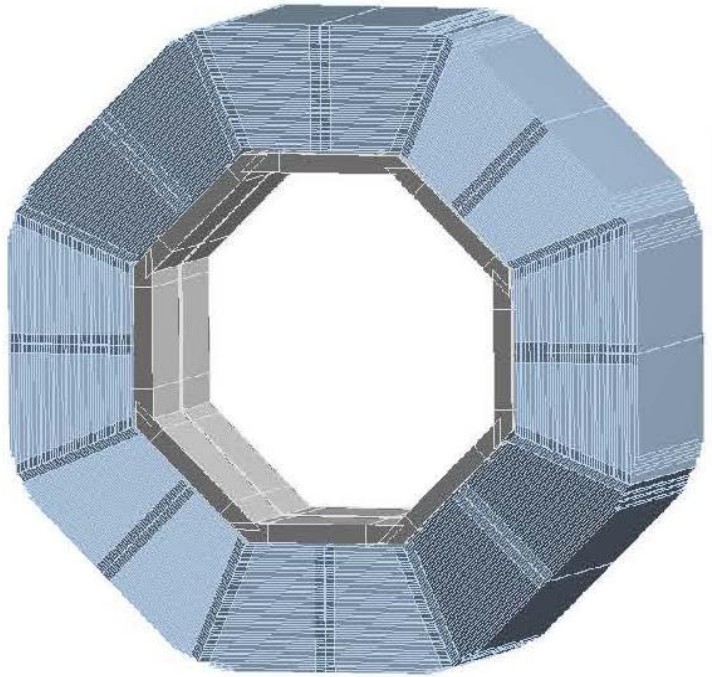
Address issue of tolerances at ECAL boundaries







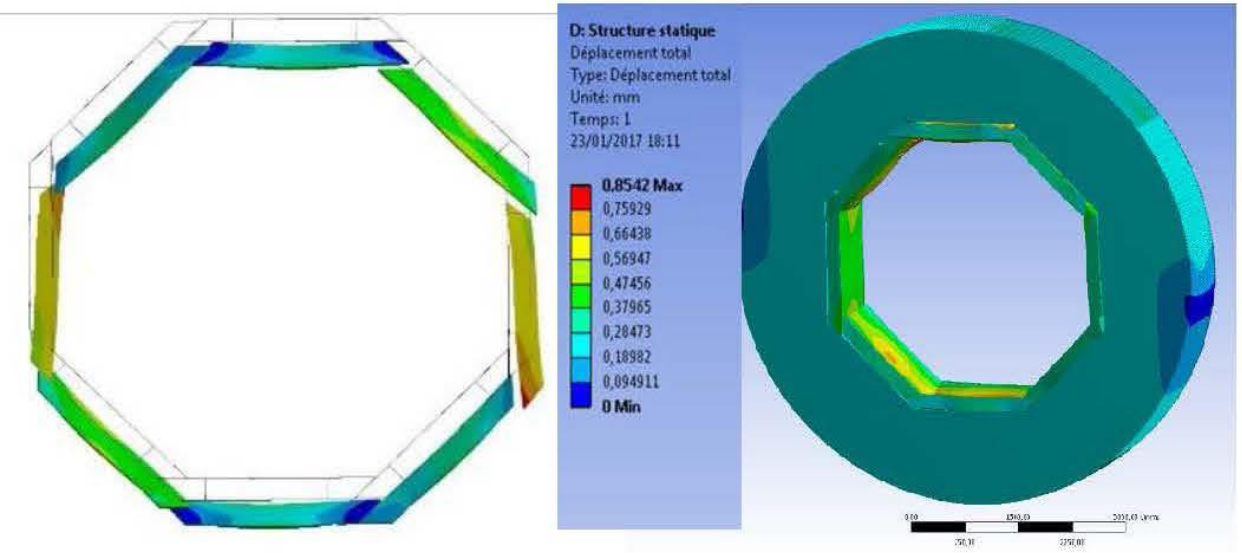
VIDEAU

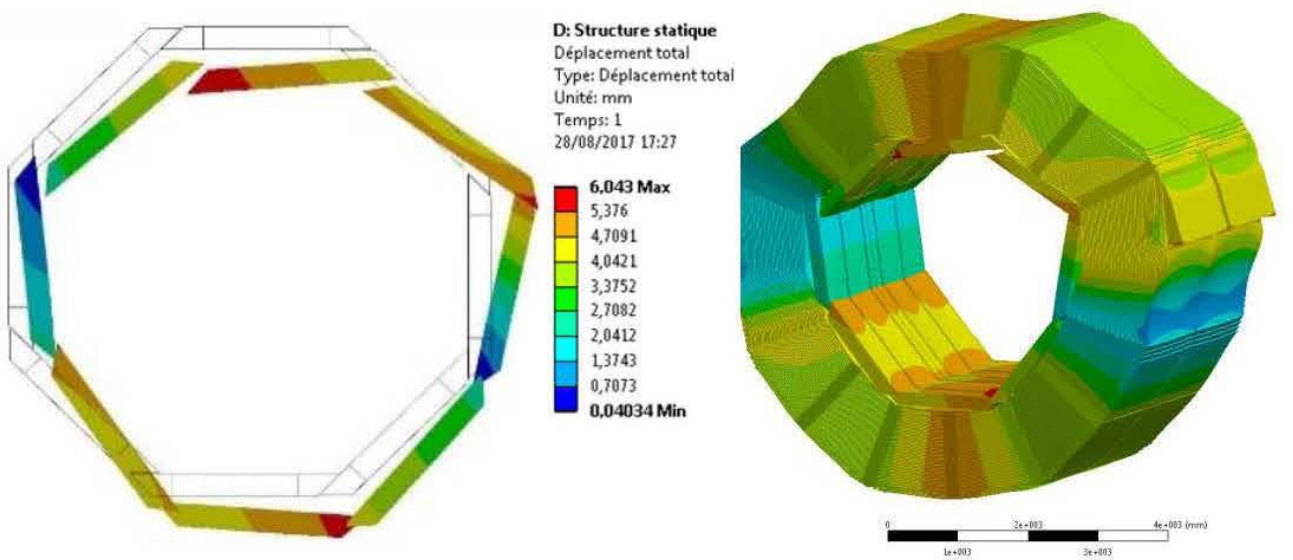


TESLA

NB: old model Not corresponding to the actual (DBD) dimensions, The Ecal has then been adapted by LLR for these computations

EM STACK BOUNDARIES: static simulation (LLR)





For a nominal gap of 2.5mm

VIDEAU model :

Total displacement 0,9 mm
Smallest gap between ECAL modules in phi : 2,31mm

Roman TESLA model :

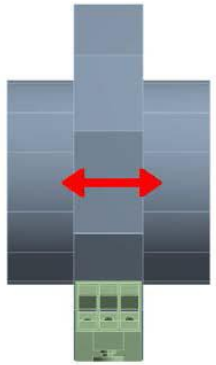
Total displacement 6 mm
Smallest gap between ECAL modules in phi : 0,95 mm

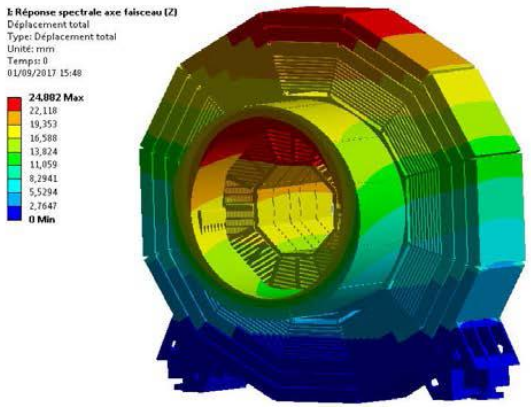
Both models within specifications *VIDEAU more rigid, allows for tighter stack adjustment*

The smallest gap is the clearance left for sliding in the staves.

COMPONENT INTERFACES: dynamic simulation of TESLA option (LLR)

Since V is more rigid

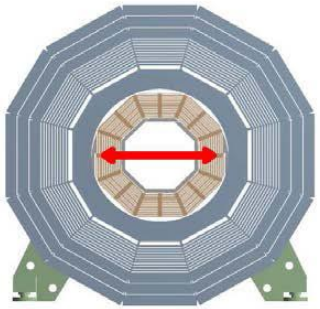


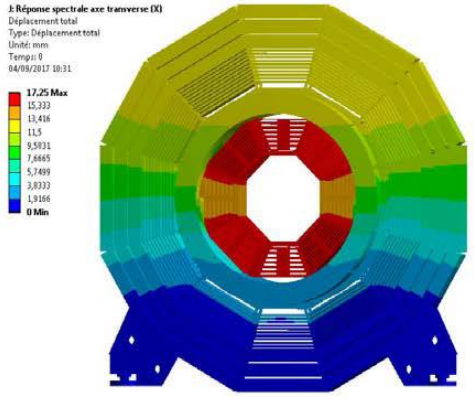


Maximum displacement:
24,9 mm

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

Smallest gap between ECAL module along phi: **2,29mm**





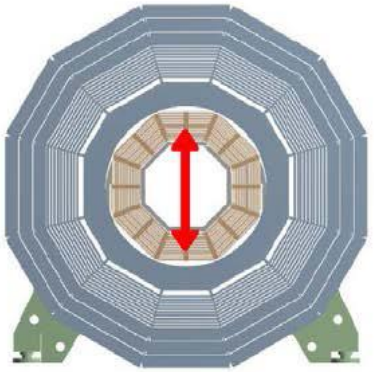
Maximum displacement:
17,3 mm

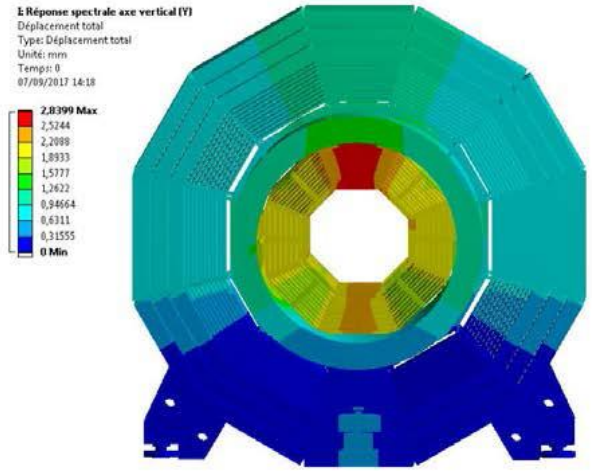
Smallest gap between ECAL rings along z: **0,98 mm**

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

Along the axis -> TPC -> ISS!!!

Horizontal transverse





Maximum displacement:
2,9 mm

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

Smallest gap between ECAL module along phi: **2,05 mm**

Input: spectrum provided by Tauchi-san

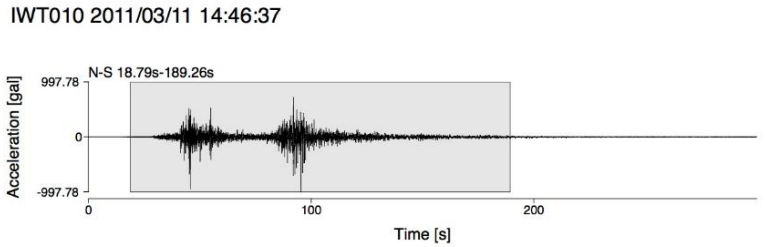
Vertical

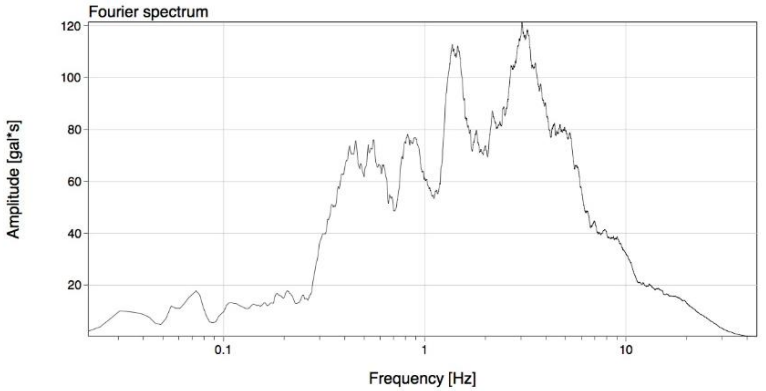
Overall ILD reacts as a ~stiff block
But breakable
to dynamical stimulations ??

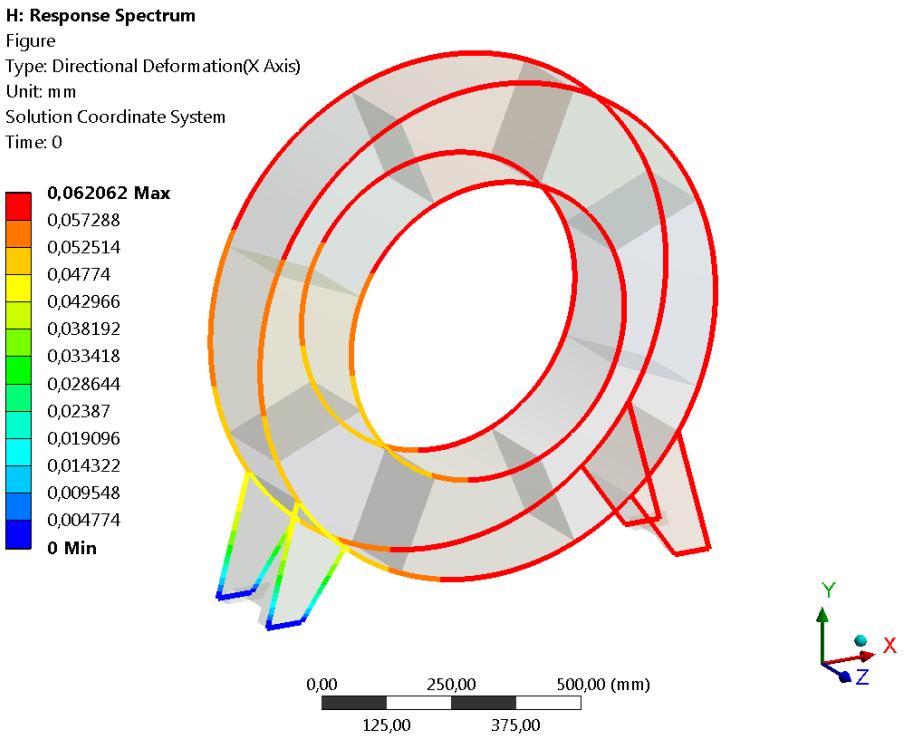
Dynamic simulation of TESLA option (DESY)

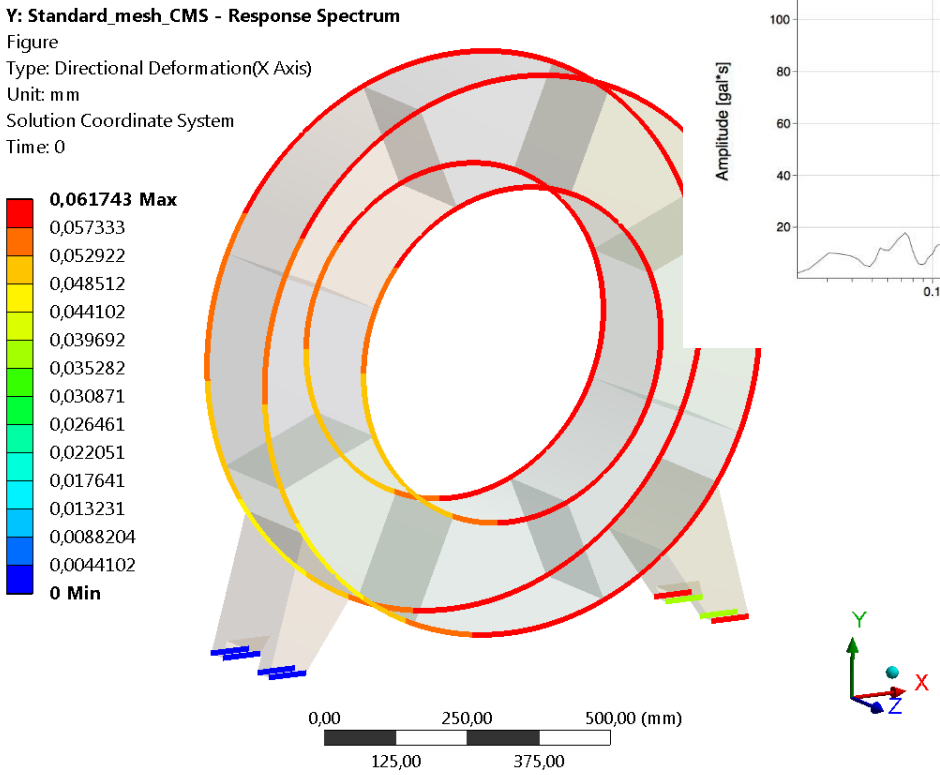
Fast simulation method "Component Mode Synthesis" validated on simplified wheel model with real earthquakes

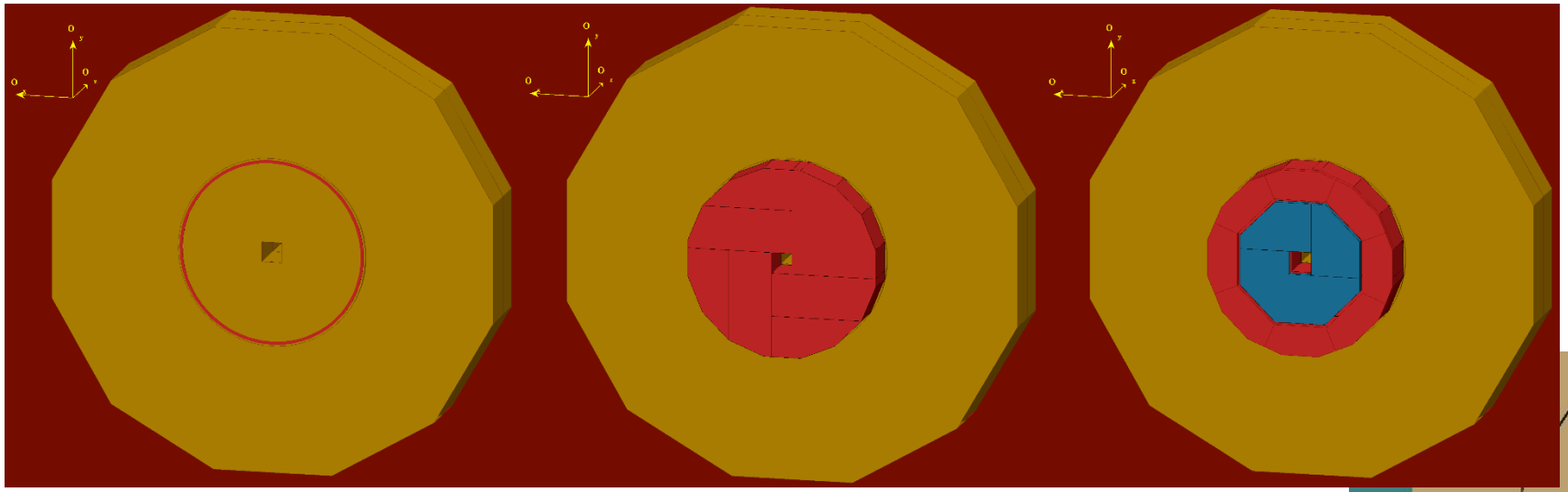
Updated TESLA model needed from DESY to allow cross-comparison and check of both static and dynamic simulations between DESY and LLR





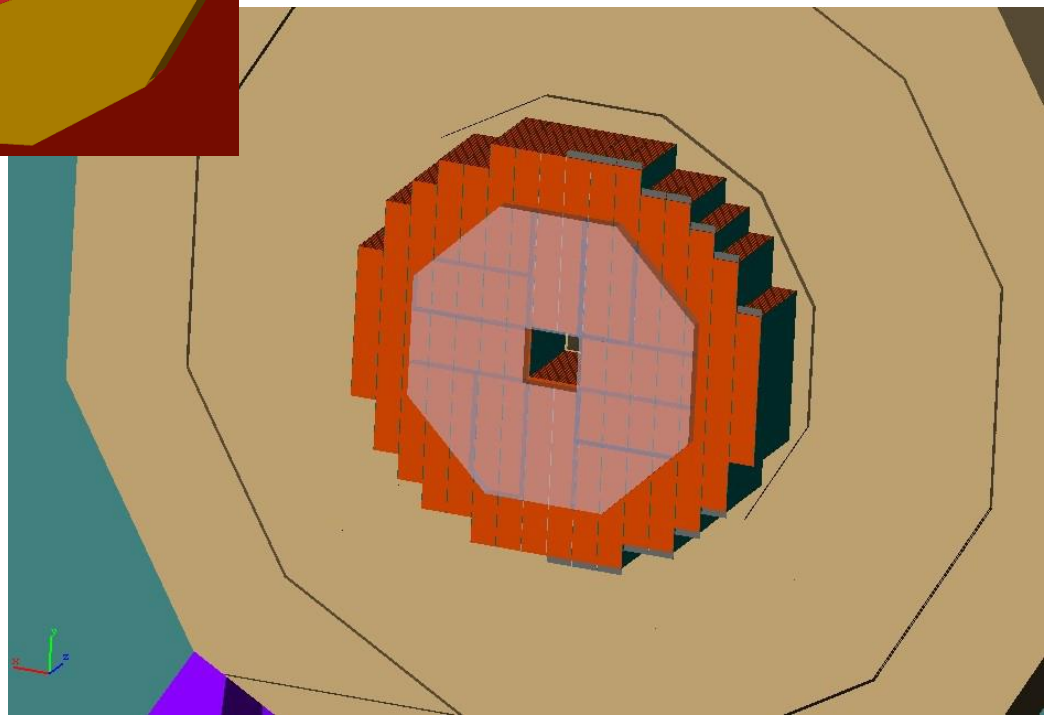






Plot de la version V (but from TESLA):
yoke and FSP with a fastening ring
Hcal end cap mounted in a two modules version
Ecal and Hcal ring installed

From Felix presentation
The bookshelf according
to Karsten Gadow



To follow up

The comparison needs to be done with an updated model, dimensions, thicknesses, but

what more studies have to be done to choose a structure for the barrel

A structure for the end caps?

The interference with the services path, therefore with the other sub-detectors

The interference with the TPC (support)

Etc.

End caps

The question on hanging on a slightly bulging FSP

The question of the dead zones.

Do really both technologies accept these two models?

Still not so much done but little drawings.

To be really started by the task-force

We have started the work

We have to move on as quickly as possible