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Proposal of a new Hcal forward geometry without crack

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Abstract

This paper deals with a proposal of a new Hcal forward design.

The calorimeter described below is not projective with respect to the beam axis. Consequently there is no crack in the detection, and then no loss of information.

I. INTRODUCTION

The Hcal forward is an end cap of the Hcal barrel. The "classical" configuration consists (most of the time) in twelve identical trapezoidal modules (cf. Figure 1). Consequently each module is projective with respect to the beam axis: cracks exist in such a design.

A study concerning the geometry of a non projective Hcal barrel has been previously carried out [1]. As a follow up a second study for the Hcal forward to be non-projective as well is performed.

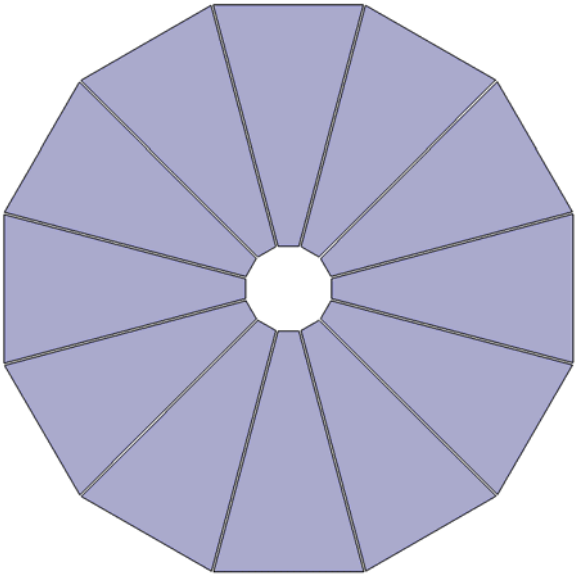

Figure 1: classical geometry

Note that for such a "classical" geometry, chambers must be inserted radially. Moreover, the shape of the latters can be more or less difficult to fabricate.

II. HCAL FORWARD GEOMETRY PROPOSAL

A. Absorbers.

The Hcal forward is a cantilever structure: fixed on the endcap Iron, free at the other extremity. The aim of the study was to develop a realistic design without cracks, that is to say neither in the absorbers, nor in the chambers.

A possible geometry could be to realize a stack of large absorber plates along Z-direction. Each layer could be made of only one plate, with a hole in the middle for the beam pipe. However it seems to be more realistic (and maybe easier for the assembly procedure) to divide each layer into two parts along the vertical axis. Figures 2 and 3 describe the layers, each of them composed of two plates.

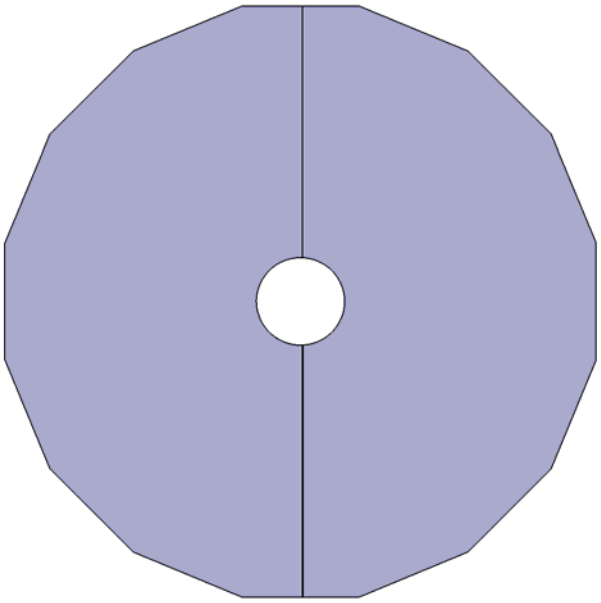

Figure 2: Face view of the Hcal forward proposal

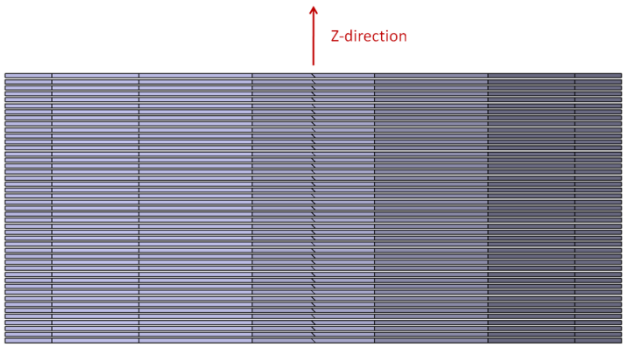

Figure 3: Top view of the Hcal forward proposal

Moreover in order not to have a crack between these two parts, it could be a interesting option to realize a bevel in the interface region of the 2 plates, and to position these parts a close as possible (See Figure 4).

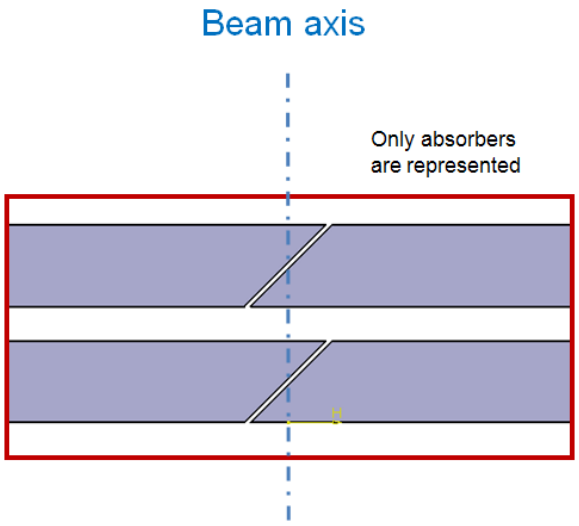

Figure 4: Zoom on the beveled plates of two layers (top view)

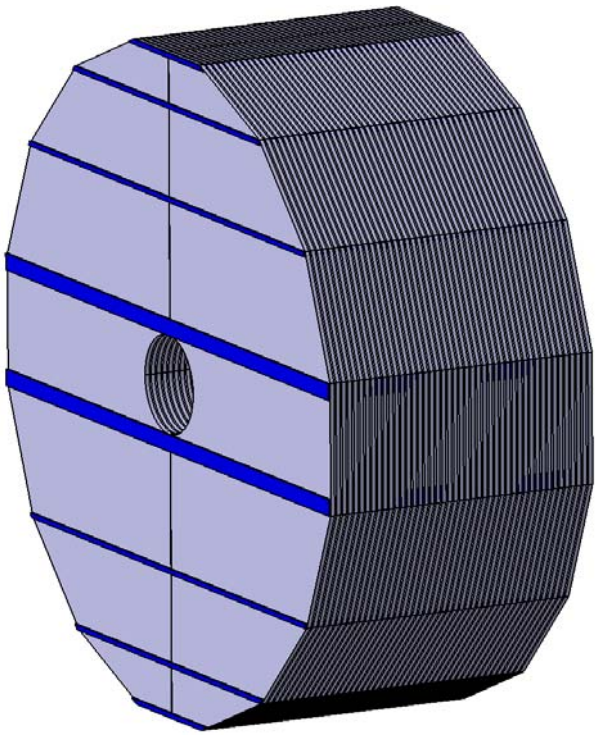

Figure 5: Horizontal beams (in blue) play the role of spacers

The Hcal forward being a cantilever structure, each layer must be firmly fixed on the previous one. The very first layer is fixed on the endcap Iron. The following ones are screwed via spacers, to ensure a constant distance between two consecutive absorbers (for the chambers to be inserted).

Thus, according to Figure 5, horizontal beams are used to play the role of spacers. The next plates, inside which counterbored holes (for fixing screws) are previously machined, can be then fastened.

B. Chambers

Unlike the "classical" geometry, for which the chambers must be inserted radially, this new design allows chambers to fit into the Hcal forward laterally (cf. Figure 6).

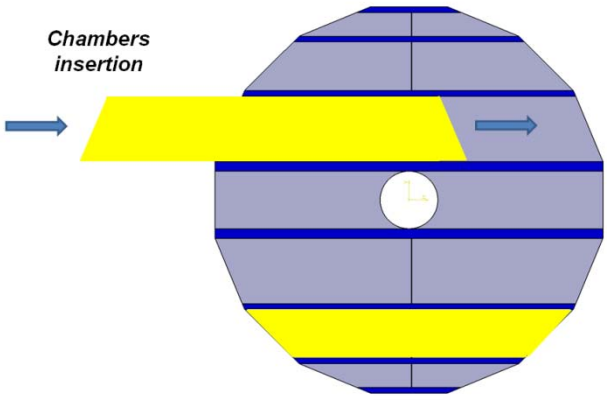

Figure 6: Chambers are inserted laterally along spacers

Moreover, given that every spacers are in a horizontal position (with respect to the gravity), these chambers are maintained without any other device.

Note that the different planes (perpendicular to the layers) defined by the spacers are not projective. There is consequently no crack in the Hcal endcap.

Moreover, the shape of the Hcal forward is a polygon with sixteen edges (cf. Figure 7). Indeed, with such a polygon, the size of one edge is very close to the internal diameter of the endcap. Then an external boundary with 16 edges is very useful and consistent for the chambers to fit the beam axis region

Finally, according to Figures 7 and 8, chambers can be inserted either from the left, or from the right.

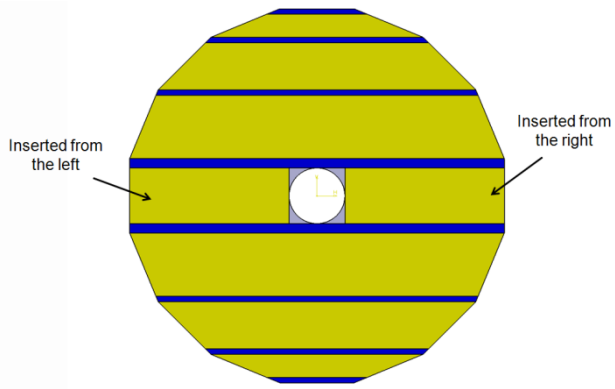

Figure 7: Chambers fit well the beam region

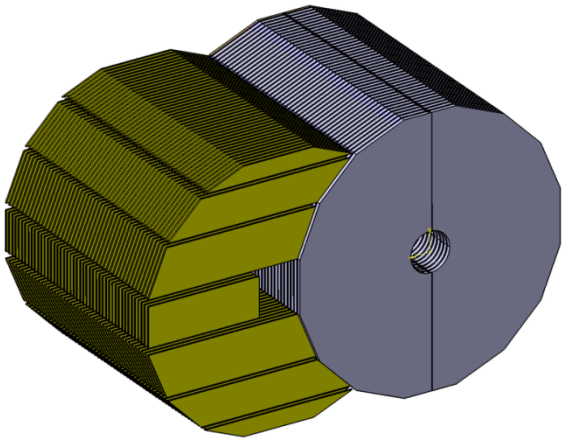

Figure 8: 3D View of the Hcal forward during chambers insertion

III. CONCLUSION

A new Hcal forward design, avoiding cracks, has been studied. To associate such geometry with the design of the Hcal barrel (cf. Figure 9) could be a good option to cancel cracks.

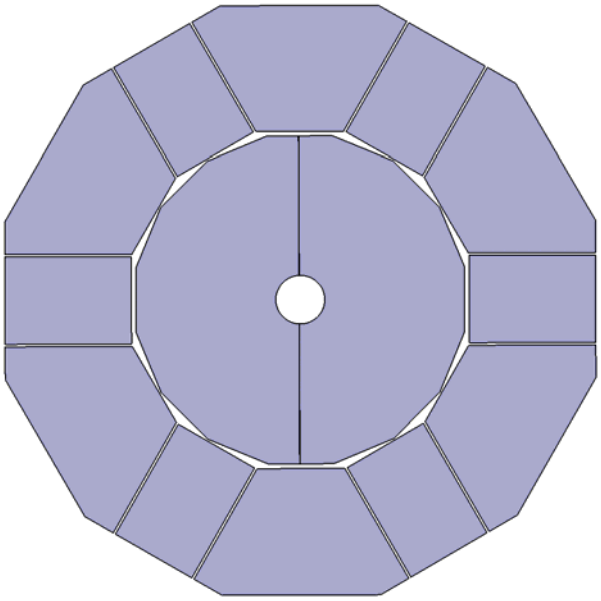

Figure 9: Hcal barrel and Hcal forward (Face view – Z-direction)

IV. REFERENCES

[1] N.Geffroy et al, “Proposition of a new Hcal geometry avoiding cracks in the calorimeter”, LAPP technical note September 2008:

http://hal.in2p3.fr/in2p3-00324823/fr/