Update of the MC-geometry of the RICH detector*

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The Monte-Carlo model of the RICH detector has been updated according to the optimized RICH geometry [1]. In the new model details down to single pixels are implemented, and the volume hierarchy has significantly changed following the evolution of the engineering design.

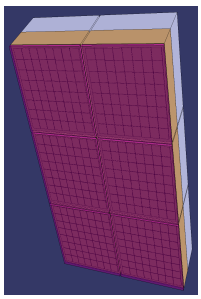

Figure 1: One block of 6 PMTs without FEBs in MC geometry.

Most changes are related to the photosensitive camera. The basic unit for camera building is called block and consists of 2 by 3 PMTs with partial common FEE for HV distribution and data collection. This is a common development with HADES RICH upgrade [2]. Figure 1 shows the ROOT-compatible geometry of one block without FEBs inside CATIA. As the MAPMTs to be used for the CBM RICH have already been ordered [3], information from PMT specification is used to model details like single pixels and glass window.

There are two different configurations of the photosensitive camera under consideration - ”two wings” and ”cylindrical”.

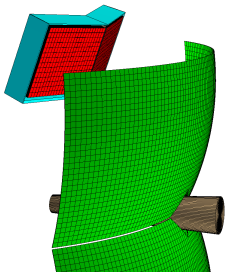

Figure 2: Detailed ”two wings” camera geometry in CbmRoot.

The full camera consists of two halves - top and bottom. In the ”two wings” configuration one half consists of two planes; we call them quarters. In the basic configuration one quarter is 7 by 7 blocks - 1112mm by 741mm. On half would thus give room for 21x14=294 PMTs, however the upper two rows and one row on each of the outer sides would not be equipped with PMTs but offer space for cabling, cooling and more. We thus have only 19x13=247 PMTs per quarter which makes 988 in total. Figure 2 shows the ”full camera” configuration in CbmRoot. The position and rotation of the sensitive planes are optimized for high ring quality [1].

In order to minimize the gap between the quarters and approximate the ideal focal surface with smaller error the usage of a cylindrical camera is investigated [4]. One cylinder of the camera is formed by 14 vertical columns of blocks. The angle between the columns is approx. 5° while the angle between the ”wings” is 20° (see figure 3). The cylindrical configuration thus requires no extra space between the modules, however needs more complicated implementation in the RICH software (ongoing work).

Shape of the mirrors has been updated. The new shape covers full geometrical acceptance and has no gaps between the top and the bottom halves.

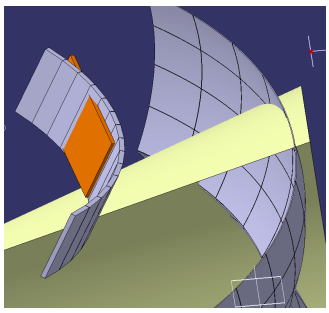

Figure 3: Cylindrical camera overlayed with one quarter of ”two wings” camera. Yellow cone shows an opening angle of 25° from the target point.

Both versions of geometry, with ”two wings” and cylindrical camera, are available in two configurations - with perfect spherical mirror and with separate mirror tiles with the possibility to introduce individual misalignments. This specific geometry is used to study techniques for the correction of possible mirror misalignment [5]. All geometries include aluminum support structures in order to have realistic material budget of the detector. New geometry requires significant changes in software. This changes are discussed in [6].

The MC-geometry of the CBM RICH detector was created and maintained using the ”CATIA-GDML geometry builder” inside CATIA [7].

References

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