Mirror mount design for the CBM-RICH detector

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In the CBM-RICH detector, a spherical mirror of approximately 11.8 m^2 will be used for Cherenkov light projection onto the photodetector plane. In the current layout, the radius of curvature is 3 m, and mirrors with glass substrate of 6 mm thickness or less and reflective Al+MgF_2 coating are foreseen [1]. In order to cover a spherical mirror wall with this comparatively small radius, trapezoid mirror tiles of approximately 400×400 mm^2 will be used. A mirror mount design was developed in order to mount these tiles and allow for enough degrees of freedom for mirror adjustment [2]. Using ANSYS calculations based on a minimal deformation of the mirror tile (5-6 μm along the radius of a mirror surface), positions and degrees of freedom for the mount points were chosen for a 3-point mount attachment to the mirror tile as illustrated in Fig. 1.

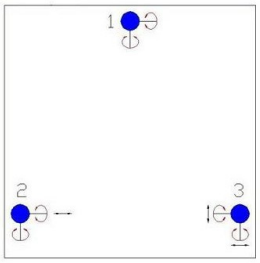

Figure 1: Layout of attachment points

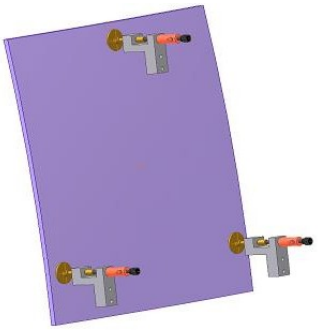

Figure 2: Three-point mirror mount attachment

The directions of possible shifts and rotations (degrees of freedom) are shown, except the rotations along the radius of the mirror tile. A three-dimensional model of the mirror mount (see Fig. 2) was designed using the Autodesk Inventor software.

The influence of the gravitational forces on the image of the reflected light spot (D_0) from a point light source was estimated by optical simulations. A value of 0.5 mm for such an image was obtained (see Fig. 3), which is negligible compared to the required reflected spot diameter of 3 mm.

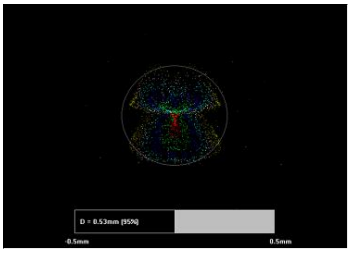

Figure 3: Optical simulation of the reflected light spot

The basic element of the mount is a cardan shaft allowing to implement all necessary degrees of freedom (shifts and rotations). A real mirror mount prototype with manual control was constructed (see Fig. 4) and preliminarily tested using a flat aluminium plate attached to the mounts.

Results of first tests show a good functionality of the developed mirror mount. More exhaustive and quantitative data can be obtained after optical tests with a spherical mirror prototype to be delivered and tested in 2011. Mirrors with these mounts will also be implemented in the CBM-RICH prototype [3].

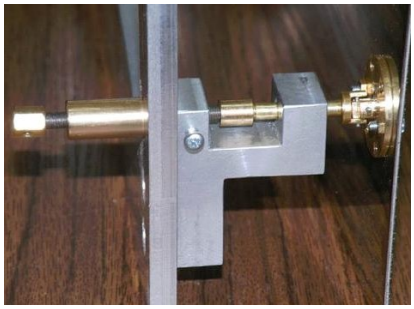

Figure 4: Prototype of the mirror mount

References

[1] M. Dürr, A. Braem and C. Höhne, *CBM Progress Report 2008*, Darmstadt 2009, p. 21

[2] V. Dobyrn *et al.*, *CBM Progress Report 2009*, Darmstadt 2010, p. 25

[3] D. Kresan and C. Höhne, *Design studies for a CBM-RICH prototype*, this report