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The CBM Time-of-Flight wall

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The Compressed Baryonic Matter spectrometer (CBM) is expected to be operational in year 2015 at the Facility for Anti-proton and Ion Research (FAIR) in Darmstadt, Germany. The spectrometer aims at systematically studying rare and bulk probes stemming from heavy ion reactions in the energy regime 2-90GeV, in order to precisely characterize the phase diagram of nuclear matter and eventual first or second order phase-transitions. The key element providing hadron identification is a Time-of-Flight wall placed at 10m, with a polar angular coverage [2.5-25deg] and full azimuth. The necessary particle Id capabilities require of 80ps system resolution at high efficiency.

For the time being, the most promising technological solution consists on a 150m2 carpet based on Resistive Plate Chambers. The existing conceptual design foresees two well defined regions: while the outer-most part can be probably covered with standard float glass RPCs in multi-strip fashion, the central region will consist of densely packed read-out cells (either strips or pads) made of low resistive electrodes. The CBM-TOF wall will therefore consist of the largest multi-strip RPC system used for timing world-wide and, simultaneously, the one with the highest rate capability so far (20 kHz/cm2).

We will present comprehensively the behavior as a function of the rate for various prototypes, where we have observed an approximate 1/(rho d) scaling of their rate capability, as arises from a simple DC modeling of the counter. Additionally, a large number of multi-strip designs, with lengths ranging from 0.25-1m have been tested with optimized designs under realistic conditions. We will show how cross-talk can be minimized and multi-hit performance ensured by convenient design choices.

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