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The RICH detector for the CBM experiment at FAIR

The CBM fixed-target experiment at FAIR will investigate highly compressed baryonic matter at moderate temperatures in heavy-ion collisions with 2-11 AGeV beam energy for heaviest nuclei at the SIS100 accelerator at FAIR starting in 2022. The CBM experiment aims at understanding and characterizing nuclear matter at high net-baryon densities but moderate temperatures focussing on the investigation of rare probes as for example electromagnetic radiation. Electromagnetic radiation, if measured with high precision, is particularly promising as is carries information on the temperature and evolution of the fireball, in-medium properties of vector-mesons and on the coupling to baryonic resonances. No measurements are available in this energy range so far, thus CBM has a high discovery potential due to the unprecedented reaction rates.

The major detector for clean electron identification in the CBM experiment at SIS 100 will be a RICH detector using CO_2 as radiator gas, spherical glass mirrors with reflective Al+MgF_2 coating as focusing elements and a photodetector plane consisting of an array of H12700 MAPMTs from Hamamatsu. This detector concept has been tested extensively with a real-size RICH prototype in testbeams and proven to show a high performance. The testbeam evaluations included a detailed study of layers of wavelength-shifting films for enhanced UV sensitivity and the development of MAPMT readout. Several MAPMT sensors were tested in this setup but also for radiation hardness in separate experimental campaigns with thermal neutron and gamma irradiation. As result the H12700 sensor was ordered from Hamamatsu in spring 2015, until now 500 MAPMTs have been measured and tested. The readout electronics is based on the TRB3 developments and focusses on good time resolution while offering moderate amplitude infromation via time-over-threshold. The close to final readout electronics is available and will be tested in testbeams at COSY and in the lab.

In order to make use of the early delivery of the photosensors with respect to the CBM time scales and to recuperate performance losses of the HADES RICH detector, the HADES RICH detector will be upgraded with these photosensors and readout electronics as developed for CBM. This upgrade program will be finished for the next HADES data taking period starting 2018.

In this contribution we will report on the design and development status of the CBM RICH detector including details from the MAPMT radiation hardness tests, MAPMT series measurements, readout electronics and the HADES RICH upgrade. Feasibility studies of di-electron measurements in CBM will be discussed.

Preferred Track

Future Experimental Facilities, Upgrades, and Instrumentation

Collaboration

Other

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