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High rate, high granularity, timing Multi-Strip Multi-Gap Resistive Plate Counter

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The Compressed Baryonic Matter fixed target experiment at the SIS100-FAIR/Darmstadt future accelerating facility is dedicated to study the properties and dynamics of highly compressed baryonic matter, looking for rare probes accessed at unprecedented high interaction rates. Therefore, at the low polar angles, the CBM detectors will be exposed to challenging high counting rates and track densities.
Two Multi-Strip Multi-Gap Resistive Plate Counters (MSMGRPC) designed with a high granularity for the inner zone of the CBM-TOF sub-detector were assembled using a low resistivity glass. The prototypes were successfully tested in the laboratory with cosmic rays, proving a very good efficiency (97%) and time resolution (60 ps). In-beam tests were performed in 2021 in the mCBM experimental setup installed at SIS18/GSI Darmstadt facility (FAIR Phase-0). At low counting rate the efficiency plateau was confirmed while a very good 40 ps time resolution was obtained. A scan with the beam intensity was converted in the particle flux incident on the chambers. At the highest beam intensity a corresponding 25 kHz/cm^2 counting rate, landmark value for the CBM-TOF, was reached exposing the whole active area of the chambers, while the measured time resolution and efficiency still maintain very good.
In parallel, detailed ageing tests of a MSMGRPC foreseen to be used for the inner zone of CBM-TOF sub-detector were performed at the IRASM multipurpose irradiation facility of IFIN-HH/Bucharest, based on a high intensity ^{60}Co source.
For the mitigation of the observed gas pollution ageing effects, we proposed a new detector architecture which assures a directed gas flow through the gas gaps. The designed prototype was tested in-beam in July 2021 in the mCBM setup. The obtained performances, similar with the results obtained for the prototype with gas exchange via diffusion will be reported.

Collaboration

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