



Contribution ID: 772

Type: Poster

Large area triple GEM chambers for muon tracking at CBM experiment at FAIR

Tuesday, May 15, 2018 7:10 PM (30 minutes)

A Muon Chamber (MUCH) system comprising of alternating layers of segmented absorbers and detector triplets will perform the task of dimuon detection at CBM experiment at FAIR. Unprecedented interaction rates (~ 10 MHz) of Au+Au collisions and a high radiation environment in CBM impose severe constraints on the detector design. For the first two stations of MUCH where the particle rates reach more than 140 kHz/sq. cm. for minimum bias events, large area, Gas Electron Multiplier(GEM) based detectors with self-triggered readout will be used for muon tracking. Triple-GEM prototypes of both small and large sizes have been tested with particle beams. Design criteria such as a high charged particle detection efficiency, high-rate capability have been validated. Real-size trapezoidal shaped detectors (~ 2000 sq.cm area) have been fabricated and tested with Pb+Pb collisions at CERN SPS. Single-mask GEM foils consisting of 24 segments each, were stretched using "ns²"no-glue technique. Data was acquired in a free-streaming mode, using realistic CBM DAQ involving AFCK boards coupled to a self-triggered electronics and time synchronizing modules for the first time. Events were reconstructed offline by grouping the hits on the basis of their timestamps. Detailed response of the detectors in terms of time correlations, hit-multiplicity, their dependence on varying detector parameters have been studied and track reconstruction carried out. A cost-effective opto-coupler based, novel HV-biasing design for controlling individual segments will be presented. Low voltage distribution system(LVDS) with requisite radiation hardness have also been designed and tested. The detailed layout of the GEM stations, detector fabrication and the test results along with pre-production readiness plans for the upcoming mini-CBM experiment at GSI will be presented and discussed.

Content type

Experiment

Collaboration

CBM

Centralised submission by Collaboration

Presenter name will be specified later

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Session Classification: Poster Session

Track Classification: Future facilities, upgrades and instrumentation