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Development and operation of the CGEM Inner Tracker for the BESIII experiment

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The extension of data acquisition for the Beijing Electron Spectrometer (BESIII) experiment until at least 2030 has resulted in upgrades to both the accelerator and the detector.
An innovative Cylindrical Gas Electron Multiplier (CGEM) is under construction to upgrade the inner tracker, which is suffering from aging. The CGEM Inner Tracker (CGEM -IT) was designed to restore efficiency and enhance the reconstruction of the secondary vertexes position with a resolution of 130 μm in the xy-plane and 350 μm along the beam direction. For the reconstruction in the magnetic field of 1 T, an analog readout, and an electronic contribution to the time resolution better than 5 ns are required. The entire system consists of about 10,000 electronic channels and must maintain a peak rate of 14 kHz/strip of signal hits for the innermost layer of the CGEM-IT. The CGEM readout system is based on the innovative TIGER ASIC, which is manufactured using 110 nm CMOS technology. A special readout chain consisting of GEM Read Out Cards (GEMROC) was developed for data acquisition.
Two out of three layers, instrumented with final electronics, have been operating in Beijing since January 2020 and are being remotely controlled by Italian groups due to the pandemic situation.
In July 2020, a test beam was conducted at CERN with the final electronics configuration on a small prototype consisting of four GEM planar detectors. About 250M triggers have been acquired. Both muon (@80 GeV) and pion (@150 GeV) beams were used, with the beam incidence angle varying from 0° to 45°.
In this presentation, the general status of the project CGEM-IT will be presented, with particular emphasis on the results of the test beam data collection.

Collaboration

BESIII Italian Collaboration

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