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Contribution ID : 2

Type : **Contributed Oral**

The new Cylindrical GEM Inner Tracker of the BESIII experiment: test beam results of two prototypes.

Thursday, 2 March 2017 09:00 (0:20)

Content

A cylindrical GEM detector is under development, to serve as an upgraded inner tracker at the BESIII spectrometer. It will consist of three layers of cylindrically-shaped triple GEMs surrounding the interaction point. The experiment is taking data at the e^+e^- collider BEPCII in Beijing (China) and the GEM tracker will be installed in 2018. Tests on the performances of triple GEMs in strong magnetic field have been run by means of the muon beam available in the H4 line of SPS (CERN) with both planar chambers and the first cylindrical prototype. Efficiencies and resolutions have been evaluated using different gains, gas mixtures, with and without magnetic field. The obtained efficiency is larger than 95%, in many operational arrangements. The spatial resolution for planar GEMs has been evaluated with two different algorithms for the position determination: the charge centroid and the micro time projection chamber (TPC) methods. The two modes are complementary and are able to cope with the asymmetry of the electron avalanche when running in magnetic field, and with non-orthogonal incident tracks. With the charge centroid, a resolution lower than 100 microns has been reached without magnetic field and lower than 200 microns with a magnetic field up to 1 T. The micro TPC mode showed to be able to improve those results. In the first beam test with the cylindrical prototype, the detector had a very good stability under different voltage configurations and particle intensities. The resolution evaluation is in progress.

Summary

Primary author(s) : Dr. LAVEZZI, Lia (INFN and IHEP)

Presenter(s) : Dr. LAVEZZI, Lia (INFN and IHEP)

Session Classification : Micropattern gas detectors

Track Classification : Micropattern gas detectors