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A Cylindrical GEM Detector with Analog Readout for the BESIII Experiment

We are developing a low mass, cylindrical GEM detector with analog readout for the inner tracker upgrade of the BESIII experiment at the BEPC-II e+e- collider. The GEM detector will replace the current inner drift chamber that is suffering early aging due to the increase of the machine luminosity.

The new inner tracker is expected to match the momentum resolution (σpt/Pt˜0.5% at 1 GeV) and radial resolution (σxy˜100μm) of the drift chamber and to improve significantly the spatial resolution along the beam direction (σz ˜150μm) with very small material budget (about 1X0).

The inner tracker will be composed by three layers of triple cylindrical GEM with an angular coverage of 93% of the solid angle. Each layer is composed by five cylindrical structures: the cathode, three GEMs and the anode readout. To minimize the material, no support frames are used inside the active area and the GEM foils are mechanically stretched being glued to fiberglass rings at their ends.

The anode configuration is studied by means of Maxwell and Garfield simulations and with a small-scale planar prototype that is tested with cosmic rays. Preliminary R&D and simulation studies will be presented together with the mechanical design of the detector.

Due to the 1 T magnetic field of the experiment an analog readout is mandatory to achieve the desired spatial resolution; the charge will be measured with "time-over-threshold"technique. Our plan to develop a new ASIC chip based on UMC-110nm technology with limited power consumption will be also presented.

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