

Time Projection Chamber with Triple GEM and Highly Granulated Pixel Readout

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Future experiments in high energy physics, e. g. at the International Linear Collider, put stringent requirements on all detector subsystems. In particular the tracking detectors should allow not only precise track reconstruction but also good multi-track resolution, excellent efficiency and a reliable particle identification. Micro Pattern Gas Detectors (MPGDs) such as Gas Electron Multipliers (GEMs) have many favorable properties for fulfilling these requirements. Especially the high granularity, intrinsic suppression of ion backflow, high rate capability and almost no distortions due to $E \times B$ effects make the use of MPGDs in Time Projection Chambers (TPCs) very attractive. To fully exploit the small structure size of the gas amplification stage, it is advantageous to use the metalized pads of a highly granulated pixel readout chip such as the Timepix ASIC to pick up the charge released by the gas amplification stage.

We have constructed two test chambers with a triple GEM and Timepix readout. On the one hand a small prototype with a maximum drift distance of 26 cm and a single ASIC readout was used to study the performance of this concept with cosmic rays, with an electron test beam and in high magnetic fields. In a second project we have designed and constructed a readout module for the Large Prototype (LP) of the LCTPC-Collaboration. The LP was constructed in the EUDET framework and is set up at the electron test beam facility at DESY. The test facility is composed of a fieldcage with up to 60 cm drift distance, a magnetic field of 1 T, an up to 6 GeV electrons test beam and the infrastructure necessary to operate the detector. Our readout module was equipped with 8 ASICs featuring a total of 0.525 million readout channels and placed in the endcap. Typical operation parameters such as beam energy, gas gain and incident angle were varied. First results will be presented.

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