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Performance of MPGD-based TPC Prototypes for the Linear Collider Experiment

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Time projection chamber (TPC) is considered as a strong candidate for the central tracker at the future linear collider experiment because of its large volume coverage and high three-dimensional granularity. Since the performance of TPC depends on its readout scheme we have conducted a series of experiments in order to compare the performance of prototype TPCs equipped with different readout planes: a conventional multi-wire proportional chamber (MWPC) or micro pattern gas detectors (GEM and MicroMEGAS), using common field cage and readout pad plane. The prototypes, filled with an argon-based gas mixture at the normal pressure, were subjected to a test beam at KEK under an axial magnetic field of up to 1 tesla. All the prototypes operated stably and provided us with valuable information. It was found that the obtained spatial resolution was reproduced both by an analytic formula and a MonteCarlo simulation with appropriate assumptions on the pad response function and the relative variance of avalanche fluctuation for a single drift electron. We report here the results obtained with MPGDs along with experimental details. Also included are the comparison between GEM and MicroMEGAS, interpretation of the results and extrapolation to the real TPC.

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