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Hybrid Gaseous Detector Module for CEPC-TPC at IHEP

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A study group was formed in Beijing in September 2013 to investigate the feasibility of a high energy Circular Electron Positron Collider (CEPC), the CEPC provides a much cleaner environment than the LHC, and it is ideally suited for studying the Higgs. For the preliminary Concept Design Report (CDR) initial study, the International Linear Detector (ILD) has been chosen as the starting point for the CEPC detector design. In the paper, some critical challenges of the CEPC Time Projection Chamber (TPC) detector's requirements were compared with the circular collider and the linear collider firstly. For the consequent frequency of the beam structure (approximately $4\mu\text{s}$ of the cycle time) in the circular collider without power-pulse mode, the detector baseline design would be operated without the gating device to reduce the more serious ions back flow in the longer working time. The CEPC preliminary design, for instance, has a significantly shorter focal length L^* of 1.5m than that of the ILC design, the position of the final focusing magnet (QD0) will be close to IP in the machine detector interface and will be inside of TPC's drift region. Therefore, the continuous mode will lead to the serious ion feed back without gating device and the more obvious effects of electromagnetic distortion needs to be considered. We estimated the momentum resolution with the different geometry of the TPC detector based on the ILD's size, and the new detector module's prototype was developed in IHEP. Finally, some results of the simulation and evaluation of the geometry, voxel occupancy, readout size, operation mixture gas and momentum resolution are be given, and the hybrid structure gaseous detector of the Micromegas with GEM preamplifier described. The preliminary performance shown that it could get the continuous ion suppression and more stable working time.

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