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High-granularity readout Time Projection Chamber technology R&D for future e^+e^- colliders

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The Circular Electron Positron Collider (CEPC) was proposed as a Higgs and Z operation in Chinese High Energy Physics community, and the accelerator Technology Design Report (TDR) has been released in the end of 2023. The baseline detector design features a high-precision (approximately $100\ \mu\text{m}$) spatial resolution Time Projection Chamber (TPC) as the main tracking device surround a 3.0T solenoid field, even operated at the low luminosity Z. The TPC is required to provide a standalone momentum resolution of $10^{-4}\ (\text{GeV}/c)^{-1}$, and the physics requirement of Particle Identification (PID) resolution should be reached to $< 3\%$.

In this talk, the feasibility and update progress of high precision TPC as the main track detector for e^+e^- collider will be presented. TPC detection aims the good separation power with the cluster counting to be considered and the simulation results of the pad/pixelated TPC technology for e^+e^- collider will be given. Compared with the pad readout using the simulation, the high granularity readout TPC option ($500\ \mu\text{m} \times 500\ \mu\text{m}$) will obtain the better spatial resolution of single electrons, the very high detection efficiency in excellent tracking and good PID performance (less than 3σ). The track reconstruction performance and dE/dx results are presented. We review these findings and outline the next steps toward TPC construction for the ongoing physics and detector TDR document.

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