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Pixelated readout gas detector for PID

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Future circular electron-positron collider has been proposed as both Higgs factories and high-luminosity Z factories. The conceptual design of the updated detector includes a tracking system, with the Time Projection Chamber (TPC) serving as the primary tracking detector. The TPC offers high spatial resolution (approximately 100 μm over the entire drift length in a 3T magnetic field) in a large 3D volume, which is particularly important for operations at the high-luminosity Z pole (Tera-Z at a 2T magnetic field).

In this talk, we will present the feasibility and current status of using a high-precision TPC as the main tracking detector for electron-positron colliders. The TPC is designed to achieve good separation power, utilizing cluster counting, and we will discuss simulation results for both pad and pixelated TPC technologies for electron-positron colliders. Compared to pad readout in simulations, the high-granularity readout option for the TPC demonstrates better spatial resolution for single electrons, very high detection efficiency, excellent tracking, and superior PID performance (with a resolution of less than 3σ).

We will present the results of track reconstruction performance and dE/dx measurements, review the overall track reconstruction performance, and summarize the next steps toward TPC construction for CEPC physics and the detector Technical Design Report (TDR).

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