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High spatial resolution pad and pixelated TPC technology R&D for the e+e- collider

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Time Projection Chamber (TPC) could be used as a central high spatial resolution tracking detector at future electron-positron colliders such as ILC, CEPC or FCC-ee. A large worldwide community of physicists is working to realize EWK precision physics program at the future e+e- Higgs Factory. In the ILD detector concept, a large volume TPC is embedded in a magnetic field of $B=3.5\text{T}$, the requirements for the TPC are a continuous tracking with very high efficiency and a single hit resolution of better than $100\mu\text{m}$ in the transverse direction. The TPC performance of the spatial resolution and dE/dx have been measured using three different readout modules (GEMs, Resistive Micromegas and GridPix) in a magnetic field of $B=1.0\text{T}$ at DESY. In the conventional readout the pad size is $\sim 1\text{mm} \times 6\text{mm}$ and in the pixelated readout it is about $55\mu\text{m} \times 55\mu\text{m}$. During Tera-Z operation at the high luminosity, the pixelated readout can reach better spatial resolutions with higher detection efficiency. To improve the particle identification using dE/dx and dN/dx , the cluster counting method shows significant potential, but a high readout granularity is needed. In this talk, we will present the updated results and plans of TPC technology potential extending to other e+e- colliders.

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