



Contribution ID: 24

Type: **Parallel Talk**

TPC Development by the LCTPC Collaboration for the ILD Detector at ILC

Friday, 8 July 2022 11:30 (15 minutes)

A large, worldwide community of physicists is working to realise an exceptional physics program of energy-frontier, electron-positron collisions with the International Linear Collider (ILC). The International Large Detector (ILD) is one of the proposed detector concepts at the ILC. The ILD tracking system consists of a Si vertex detector, forward tracking disks and a large volume Time Projection Chamber (TPC) embedded in a 3.5 T solenoidal field. The TPC is designed to provide up to 220 three dimensional points for continuous tracking with a single-hit resolution better than 100 μm in $r\phi$, and about 1 mm in z . An extensive research and development program for a TPC has been carried out within the framework of the LCTPC collaboration. A Large Prototype TPC in a 1 T magnetic field, which allows to accommodate up to seven identical Micropattern Gaseous Detector (MPGD) readout modules of the near-final proposed design for ILD, has been built as a demonstrator at the 5 GeV electron test-beam at DESY. Three MPGD concepts are being developed for the TPC: Gas Electron Multiplier, Micromegas and GridPix. Successful test beam campaigns with different technologies have been carried out in 2018-2021. Fundamental parameters such as transverse and longitudinal spatial resolution and drift velocity have been measured. In parallel, a new gating device based on large-aperture GEMs have been produced and studied in the laboratory. Recent R&D also led to a design of a Micromegas module with monolithic cooling plate in 3D printing and 2-phase CO₂ cooling. In this talk, we will review the track reconstruction performance results and summarize the next steps towards the TPC construction for the ILD detector.

In-person participation

Yes

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