



Contribution ID: 385

Type: **Oral Presentation**

Development of a TPC for an ILC Detector

Saturday, 11 June 2011 16:40 (20 minutes)

The ILD concept, one of two proposed detector concepts for the planned International Linear Collider (ILC), foresees a Time Projection Chamber (TPC) as the main tracking detector. Precision physics measurements at the ILC require a very accurate momentum resolution of $9 \times 10^{-5} \text{ GeV/c}$ in the TPC at a magnetic field of 3.5T and a very efficient pattern recognition. In addition, the TPC -barrel as well as endcaps- must be build with very low material to enable precise measurements in the highly granular calorimeter located behind the TPC allowing for an efficient usage of particle flow methods in the reconstruction.

The LCTPC (Linear Collider TPC) collaboration pursues R&D to develop such a TPC based on the best state-of-the-art technology. After tests with smaller prototypes, current studies focus on studies using a large prototype with a diameter of 750mm and a length of 600mm. This prototype can accommodate seven read-out modules of a size comparable to the ones that would be used in the final TPC. Several prototypes of modules using Micromegas or GEM structures as gas amplification exist. They have been tested with electron beam at the EUDET facility at DESY in a 1T magnet. Besides the traditional pad read-out, a pixel read-out based on the TimePix chip is studied in these tests with up to 8 TimePix chips on a board. The challenges range from the construction of very lightweight, but geometrically precise fieldcage and endcaps to the development of self-supporting gas amplification structures covering large areas with minimal dead space and minimal material budget. The current status and future plans of the R&D will be presented.

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Session Classification: Gaseous Detectors

Track Classification: Gaseous Detectors