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## Helium-Based Drift Chamber for Central Tracking in the IDEA Detector

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The IDEA detector concept for a future e+e- collider incorporates an ultra-low-mass helium-based drift chamber as the central tracking system. This chamber is designed to deliver high- efficiency tracking, precise momentum measurements, and excellent particle identification through the cluster counting technique. Simulations using Garfield++ demonstrate that this technique achieves twice the resolution of the traditional dE/dx method for charged particles. Experimental validation has been conducted through beam tests at CERN, using various helium gas mixtures, wire orientations, and gas gains. These tests confirm the Poisson nature of ionization clusters and highlight the effectiveness of advanced algorithms for identifying electron peaks and clusters despite challenges like signal overlap in the time domain. This talk will discuss the expected tracking and particle identification performance based on detailed simulated physics events and test beam analyses. Additionally, key aspects of the drift chamber's construction will be explored, including the evaluation of new wire materials, advanced wire soldering techniques and the optimization of the drift cell design. The latest mechanical simulation studies will also be covered.

### Primary experiment

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