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## Enhancing Particle Identification for Future Circular Collider Experiments using Cluster Counting Technique

Particle Identification is a critical and challenging task in high-energy physics experiments, particularly for future collider facilities such as FCC-ee and CEPC. The dE/dx method is limited by significant uncertainties in the total energy deposition, which limit its particle separation capabilities. The cluster counting (dN/dx) technique exploits the Poisson distribution of primary ionisation, offering a statistically robust approach to infer particle mass. Simulation studies using Garfield++ and Geant4 show that dN/dx can achieve twice the resolution of dE/dx in helium-based drift chambers, at the cost of detecting electron peaks and identifying ionisation clusters, a challenging task due to signal overlap in the time domain. This presentation will introduce advanced algorithms and computational tools to enable the identification of electron peaks and ionisation clusters, validated in beam tests at CERN, using several drift tubes operating with different helium gas mixtures.

The analysis results will be reported and discussed, and a comparative study of the resolutions achieved using dN/dx and dE/dx methods will be presented.

## Secondary track

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Track Classification: T11 - Detectors