Contribution ID: **531** Type: **Parallel Talk**

Particle identification with the cluster counting technique for the IDEA drift chamber

Friday, 8 July 2022 09:45 (15 minutes)

The IDEA drift chamber is designed to provide efficient tracking, a high precision momentum measurement, and excellent particle identification by exploiting the cluster counting technique. The ionization process by charged particles is the primary mechanism used for particle identification (dE/dx). However, the significant uncertainties in the total energy deposition represent a limit to the particle separation capabilities. The cluster counting technique (dN/dx) takes advantage of the Poisson nature of the primary ionization process and offers a more statistically robust method to infer mass information. A simulation of the ionization clusters generation is needed to investigate the potential of the cluster counting techniques on physics events. For this purpose, an algorithm, which uses the energy deposit information provided by the Geant4 software tools, has been developed to reproduce the cluster size and the cluster density distributions in a fast and convenient way. The results obtained confirm that the cluster counting technique allows reaching a resolution two times better than the traditional dE/dx method. To validate the simulations results, a first beam test, using a 165 GeV/c muon beam on a setup made of different size drift tubes, equipped with different diameter sense wires, has been performed at CERN by collecting data with two gas mixtures (90% He - 10% iC4H10 and 80% He - 20% iC4H10) at different gas gains and angles between wire direction and ionizing tracks. The main goal of the beam test is: to ascertain the Poisson nature of the cluster counting technique, to establish the most efficient cluster counting and electrons clustering algorithms among the various ones proposed, and to define the limiting effects for a fully efficient cluster counting, like the cluster dimensions, the space charge density around the sense wire and the dependence of the counting efficiency versus the impact parameter. The ionization clustering simulation algorithms and the experimental beam test results will be presented in this talk.

In-person participation

No

Primary author: CUNA, Federica (Istituto Nazionale di Fisica Nucleare)

Co-authors: CORVAGLIA, Alessandro (Istituto Nazionale di Fisica Nucleare); CAPUTO, Claudio (UCLouvain); CHIARELLO, Gianluigi (INFN); DE FILIPPIS, Nicola (BA); GORINI, Edoardo (Istituto Nazionale di Fisica Nucleare); GRANCAGNOLO, Francesco (Istituto Nazionale di Fisica Nucleare); GRECO, Matteo (Istituto Nazionale di Fisica Nucleare); PANAREO, Marco (Istituto Nazionale di Fisica Nucleare); PRIMAVERA, Margherita (Istituto Nazionale di Fisica Nucleare); TASSIELLI, Giovanni Francesco (Istituto Nazionale di Fisica Nucleare); VENTURA, Andrea (Istituto Nazionale di Fisica Nucleare); MONGELLI, Maurizio (BA); PASTORE, Cosimo (Istituto Nazionale di Fisica Nucleare); JOHNSON, Kurtis (Florida State University); MICCOLI, Alessandro (LE); TALIERCIO, Angela (UCLouvain); D'ANZI, Brunella (Istituto Nazionale di Fisica Nucleare); ELMETENAWEE, Walaa (Istituto Nazionale di Fisica Nucleare)

Presenter: CUNA, Federica (Istituto Nazionale di Fisica Nucleare)

Session Classification: Detectors for Future Facilities, R&D, novel techniques

Track Classification: Detectors for Future Facilities, R&D, novel techniques