

# Advancing Particle Identification in Helium-Based Drift Chambers: A Cluster Counting Technique Study through Beam Tests

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While the ionization process by charged particles ( $dE/dx$ ) is commonly used for particle identification, uncertainties in total energy deposition limit particle separation capabilities. To overcome this limitation, the cluster counting technique ( $dN/dx$ ) takes advantage of the Poisson nature of primary ionization, providing a statistically robust method for inferring mass information. This presentation introduces state-of-the-art algorithms and modern computing tools for electron peak identification and ionization cluster recognition in experimental data. Three beam tests conducted at CERN, involving different helium gas mixtures, varying gas gains, and various wire orientations relative to ionizing tracks. The tests employ a muon beam ranging from 1 GeV/c to 180 GeV/c, with drift tubes of different sizes and diameter sense wires. The discussion will include the data analysis results regarding the confirmation of the Poisson nature of the cluster counting technique.

## Alternate track

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Yes

**Primary authors:** ELMETENAWEE, Walaa (Universita e INFN, Bari (IT)); D'ANZI, Brunella (Universita e INFN, Bari (IT)); DE FILIPPIS, Nicola (Politecnico/INFN Bari (IT)); GRANCAGNOLO, Francesco (INFN - Lecce); LOUKA, Magdy (Universita e INFN, Bari (IT))

**Co-authors:** CHIARELLO, gianluigi (INFN); CORVAGLIA, Alessandro (INFN Lecce and Salento U.); DE SANTIS, Francesco (INFN Lecce e Universita del Salento (IT)); GORINI, Edoardo (INFN Lecce e Universita del Salento (IT)); MAGGI, Marcello (Universita e INFN, Bari (IT)); MICCOLI, Alessandro (INFN Lecce e Universita del Salento (IT)); PANAREO, Marco (INFN Lecce e Universita del Salento (IT)); PRIMAVERA, Margherita (INFN Lecce e Universita del Salento (IT)); PROCACCI, Francesco (Universita e INFN, Bari (IT)); VENTURA, Andrea (INFN Lecce e Universita del Salento (IT)); XIN, Shuiting (Chinese Academy of Sciences (CN)); GUO, Fangyi (Chinese Academy of Sciences (CN)); LIU, Shuaiyi (Chinese Academy of Sciences (CN))

**Presenter:** ELMETENAWEE, Walaa (Universita e INFN, Bari (IT))

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