

# HERA data on azimuthal decorrelation and charged particle multiplicity spectra probing QCD dynamics and quantum entanglement effects

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The azimuthal decorrelation angle between the leading jet and scattered lepton in deep inelastic scattering is studied with the ZEUS detector at HERA. The data was taken in the HERA II data-taking period and corresponds to an integrated luminosity of  $330 \text{ pb}^{-1}$ . Azimuthal angular decorrelation has been proposed to study the

$Q^2$  dependence of the evolution of the transverse momentum distributions (TMDs) and understand the small- $x$  region, providing unique insight to nucleon structure. Previous decorrelation measurements of two jets have been performed in proton-proton collisions at very high transverse momentum; these measurements are well described by perturbative QCD at next-to-leading order. The azimuthal decorrelation angle obtained in these

studies shows good agreement with predictions from Monte Carlo models including leading order matrix elements and parton showers.

New experimental data on charged particle multiplicity distributions are presented, covering the kinematic ranges in momentum transfer  $5 < Q^2 < 100 \text{ GeV}^2$  and inelasticity  $0.0375 < y < 0.6$ . The data were recorded with the H1 experiment at the HERA collider in positron-proton collisions at a centre-of-mass energy of 320 GeV. Charged particles are counted with transverse momenta  $P_T > 150 \text{ MeV}$  and pseudorapidity  $-1.6 < \eta_{lab} < 1.6$  in the laboratory frame, corresponding to high acceptance in the current hemisphere of the hadronic centre-of-mass frame. Charged particle multiplicities are reported on a two-dimensional grid of  $Q^2$ ,  $y$  and on a three-dimensional grid of  $Q^2$ ,  $y$ ,  $\eta$ . The observable is the probability  $P(N)$  to observe  $N$  particles in the given  $\eta$  region. The data are confronted with predictions from Monte Carlo generators, and with a simplistic model based on quantum entanglement and strict parton-hadron duality.

## Secondary track (number)

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