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Measurement of Lepton-Jet Azimuthal Decorrelations and of the 1-Jetttiness event shape at High Q^2 using the H1 detector

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First measurements of the 1-jettiness event shape observable in the Breit Frame and of jet production in the laboratory frame, close to the Born-level configuration, are performed in neutral-current deep-inelastic scattering at HERA. The data were recorded with the H1 detector in the years 2003-2007 and are restricted to high momentum transfer $Q^2 > 150$ GeV^2. The 1-jettiness observable τ_{1b} is defined such that it is equivalent to the thrust observable defined in the Breit frame. Triple-differential cross sections are presented as a function of τ_{1b}, Q^2, and the inelasticity y. The data are compared to selected Monte Carlo predictions and to perturbative QCD calculations. The cross sections are sensitive to parton distribution functions of the proton, the strong coupling constant and to resummation and hadronisation effects. Jet production is measured differentially as functions of the jet transverse momentum, jet pseudorapidity, lepton-jet momentum imbalance, and lepton-jet azimuthal angle correlation. The jets are reconstructed in the laboratory frame with the k_T algorithm and a distance parameter of 1.0. The data are corrected for detector effects using the OMNIFOLD method, which incorporates a simultaneous and unbinned unfolding in four dimensions using machine learning. The results are compared with leading order Mont Carlo event generators and to higher order calculations performed within the context of collinear or transverse-momentum-dependent (TMD) factorization in Quantum Chromodynamics (QCD). The measurement probes a wide range of QCD phenomena, including TMD parton-distribution functions (PDFs) and their evolution with energy.

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