



Jet Physics at HERA

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Isolated-photon+jet production in ep collisions at a centre-of-mass energy of 318 GeV has been measured with the ZEUS detector at HERA using an integrated luminosity of up to 300 pb⁻¹. Measurements of prompt-photon+jet cross sections are presented as functions of the photon transverse energy and pseudorapidity in a wide range of exchanged-photon virtuality. In addition, differential gamma+jet cross sections are presented as functions of the jet transverse energy and pseudorapidity. Leading-logarithm parton-shower Monte Carlo predictions and perturbative QCD calculations were compared to the data.

Differential inclusive-jet cross sections have been measured in photoproduction for boson virtualities $Q^2 < 1 \text{ GeV}^2$ with the ZEUS detector at HERA using an integrated luminosity of 300 pb⁻¹. Jets were identified in the laboratory using the kt cluster algorithm in the longitudinally inclusive mode. Cross sections are presented as functions of the jet pseudorapidity, η_{jet} , and the jet transverse energy, E_{tjet} . In addition, measurements of double-differential inclusive-jet cross sections are presented as functions of E_{tjet} in different regions of η_{jet} . These cross sections have the potential to constrain the gluon density in the proton and the photon when included as input to fits to extract the proton parton distribution functions. Next-to-leading-order QCD calculations give a good description of the measurements. A value of $\alpha_s(M_Z)$ has been extracted from the measurements. The energy-scale dependence of the coupling has also been determined.

Signals of QCD instanton-induced processes are searched for in deep-inelastic scattering (DIS) at the electron-proton collider HERA in the kinematic region defined by the Bjorken-scaling variable $x > 10^{-3}$, the inelasticity $0.2 < y < 0.7$ and the photon virtuality $150 < Q^2 < 15000 \text{ GeV}^2$. The search is performed using H1 data corresponding to an integrated luminosity of $\sim 350 \text{ pb}^{-1}$. Several observables of the hadronic final state of the events are exploited to identify a potentially instanton-enriched domain. Two Monte Carlo models, RAPGAP and ARIADNE, are used to estimate the background from the standard DIS processes, and the instanton-induced scattering processes are modeled by the program QCDINS. In order to extract the expected signal a multivariate data analysis technique is used.

New results on normalised inclusive jet, di-jet and trijet differential cross sections in neutral current deep-inelastic ep scattering (DIS) based on a regularised unfolding procedure are presented. Detector effects like acceptance and migrations as well as statistical correlations between the multi-jets and the inclusive DIS events are taken into account in this procedure. The DIS phase space of this measurement with the H1 detector is given by the virtuality of the exchanged boson (γ^*, Z^0) $150 < Q^2 < 15000 \text{ GeV}^2$ and the inelasticity of the interaction $0.2 < y < 0.7$. The jets are reconstructed in the Breit frame of reference using the k_{T} jet algorithm. In all cases the jet pseudorapidities in the laboratory frame are required to be in the range $-1.0 < \eta_{\text{lab}} < 2.5$. For inclusive jets the transverse momenta in the Breit frame are $7 < P_{\text{T}} < 50 \text{ GeV}$. The di-jet and tri-jet phase space are defined by requiring $5 < P_{\text{T},i} < 50 \text{ GeV}$, and the invariant mass of the two leading jets $M_{1,2} > 16 \text{ GeV}$. Compared to a previously published result on normalised multi-jet cross sections, the new features are an extended range in jet pseudorapidity, an improved hadronic energy scale uncertainty of 1% and the adoption of a regularised unfolding procedure. The unfolded normalised jet cross sections are compared to QCD calculations at NLO and values for the strong coupling $\alpha_s(M_Z)$ are extracted.

Track Classification: Track 6. QCD, Jets, Parton Distributions