

Study of jet production and subjet distributions in deep inelastic scattering at HERA

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Inclusive jet cross sections in charged current deep inelastic scattering (DIS) and three-jet production in DIS and photoproduction were studied with the ZEUS detector at HERA.

For the study of inclusive jet-production in charged current DIS, differential cross sections are presented as functions of Q^2 , Bjorken x and the jet transverse energy and pseudorapidity. The dijet invariant mass cross section is also presented. Observation of three- and four-jet events in charged-current $e\bar{p}$ processes is reported for the first time. The predictions of next-to-leading-order (NLO) QCD calculations are compared to the measurements. The data have the potential to constrain the u and d valence quark distributions in the proton if included as input to global fits.

For the study of three-jet production measurements of differential cross sections are presented as functions of angular correlations between the three jets in the final state and the proton-beam direction. These correlations provide a stringent test of perturbative QCD and show sensitivity to the contributions from different colour configurations. Fixed-order perturbative QCD calculations assuming the values of the colour factors C_F , C_A and T_F as derived from a variety of gauge groups were compared to the measurements to study the underlying gauge group symmetry. The measured angular correlations in the deep inelastic ep scattering and photoproduction regimes are consistent with the admixture of colour configurations as predicted by $SU(3)$ and disfavour other symmetry groups, such as $SU(N)$ in the limit of large N .

Subjet distributions were also measured in neutral current deep inelastic ep scattering with the ZEUS detector at HERA using an integrated luminosity up to 334 pb⁻¹. Jets were identified using the k_T cluster algorithm in the laboratory frame. Subjets were defined as jet-like substructures identified by a reapplication of the cluster algorithm at a smaller value of the resolution parameter y_{cut} . Measurements of subjet distributions for jets with exactly two or three subjets are presented as functions of observables sensitive to the pattern of parton radiation and to the colour coherence between the initial and final states. In the case of three subjets measurements are also presented as functions of angular correlations between the three subjets which provide a stringent test of perturbative QCD and show sensitivity to the contributions from different colour configurations. Perturbative QCD predictions give an adequate description of the data.

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