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Diffractive cross sections at HERA

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A combination of the inclusive diffractive cross section measurements made by the H1 and ZEUS Collaborations at HERA is presented. The analysis uses diffractive deep inelastic scattering data measured by means of proton spectrometers. Correlations of systematic uncertainties are taken into account by the combination method, resulting in improved precision. The combined data cover the range 2.5 < Q2 < 200 GeV2 in photon virtualities, 0.00035 < xIP < 0.09 in fractional momentum losses, 0.09 < |t| < 0.55 GeV2 in four momentum transfer at the proton vertex and 0.0018 < beta < 0.56 in beta = x/xIP, where x is the Bjorken scaling variable.

The reduced cross section in diffractive deep inelastic scattering ep events was measured with the ZEUS detector at HERA, using two different centre-of-mass energies, 318 and 225 GeV. The diffractive events, gamma* p-> Xp, were selected requiring a large rapidity gap between the hadronic system X and the outgoing proton. The measurement covers an unexplored range of y, the inelasticity of the interaction.

The diffractive process ep → eXY , where Y denotes a proton or its low mass excitation with MY < 1.6 GeV, is studied with the H1 experiment at HERA. The analysis is restricted to the phase space region of the photon virtuality 3 ≤ Q2 ≤ 1600 GeV2, the square of the four-momentum transfer at the proton vertex |t| < 1.0 GeV2 and the longitudinal momentum fraction of the incident proton carried by the colourless exchange xIP < 0.05. Triple differential cross sections are measured as a function of xIP , Q2 and β = x/xIP where x is the Bjorken scaling variable. These measurements are made after selecting diffractive events by demanding a large empty rapidity interval separating the final state hadronic systems X and Y . High statistics measurements covering the data taking periods 1999-2000 and 2004-2007 are combined with previously published results in order to provide a single set of diffractive cross sections from the H1 experiment using the large rapidity gap selection method. The combined data represent a factor between three and thirty increase in statistics with respect to the previously published results. The mea- surements are compared with predictions from NLO QCD calculations based on diffractive parton densities and from a dipole model. The proton vertex factorisation hypothesis is tested.

First measurements are presented of the diffractive cross section σ_ep⟶eXY at centre-of-mass energies √s of 225 and 252 GeV, together with a precise new measurement at √s of 319 GeV, using data taken with the H1 detector in the years 2006 and 2007. Together with previous H1 data at √s of 301 GeV, the measurements are used to extract the diffractive longitudinal structure function FLD in the range of photon virtualities 4.0 ≤ Q2 ≤ 44.0 GeV2 and fractional proton longitudinal momentum loss 5 ·10−4 ≤ x_IP ≤ 3 ·10−3. The measured FLD is compared with leading twist predictions based on diffractive parton densities extracted in NLO QCD fits to previous measurements of diffractive Deep-Inelastic Scattering and with a model which additionally includes a higher twist contribution derived from a colour dipole approach. The ratio of the diffractive cross section induced by longitudinally polarised photons to that for transversely polarised photons is extracted and compared with the analogous quantity for inclusive Deep-Inelastic Scattering.

The cross section for the diffractive deep-inelastic scattering process ep → eXp is measured, with the leading final state proton detected in the H1 Forward Proton Spectrometer. The data sample covers the range x_IP<0.1 in fractional proton longitudinal momentum loss, 0.1 < |t| < 0.7 GeV2 in squared four-momentum transfer at the proton vertex and 4 < Q2 < 700 GeV2 in photon virtuality. The cross section is measured four-fold differentially in t, x_IP , Q2 and β = x/x_IP , where x is the Bjorken scaling variable. The t and x_IP dependences are interpreted in terms of an effective pomeron trajectory and a sub-leading exchange. The data are compared to perturbative QCD predictions at next-to-leading order based on diffractive parton distribution functions previously extracted from complementary measurements of inclusive diffractive deep-inelastic scattering. The ratio of the diffractive to the inclusive ep cross section is studied as a function of Q2, β and xIP .

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