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## Exclusive Processes at HERA

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Diffractive cross sections of electroproduction of  $\rho$  and  $\phi$  mesons is measured at HERA with the H1 detector in the elastic and proton dissociative channels. The data correspond to an integrated luminosity of  $51 \text{ pb}^{-1}$ . Based on data collected with the H1 detector at HERA in 2005, cross sections or elastic  $\rho$  photoproduction have been measured at momentum transfer  $|t| < 0.58 \text{ GeV}^2$  and photon-proton center-of-mass energies  $20 < W < 90 \text{ GeV}$ . This data has been combined with cross sections published previously by the Omega and ZEUS collaborations in a global fit to determine the pomeron trajectory  $\alpha(t)$  in 13 bins of  $t$  by from the  $W$ -dependence of the elastic  $\rho$  production cross section. Exclusive diffractive photoproduction of  $J/\psi$  mesons is measured with the H1 detector at the electron-proton collider HERA. At the end of the HERA operation in 2007 the nominal proton beam energy was reduced from 920 GeV to 575 and 460 GeV, respectively. The reduced proton beam energy allows diffractive  $J/\psi$  measurements in an extended phase space towards lower photon-proton centre of mass energies  $W_{\text{gamma}p}$ . Differential cross sections are presented as a function of  $t$ , the squared four-momentum transfer at the proton vertex, and of  $W_{\text{gamma}p}$  in the kinematical range of low photon virtualities of  $Q^2 < 2.5 \text{ GeV}^2$ . The exclusive photoproduction reaction  $\gamma p \rightarrow \text{Upsilon} p$  has been studied with the ZEUS detector in ep collisions at HERA using an integrated luminosity of  $468 \text{ pb}^{-1}$ . The measurement covers the kinematic range  $60 < W < 220 \text{ GeV}$  and  $Q^2 < 1 \text{ GeV}^2$ , where  $W$  is the photon-proton centre-of-mass energy and  $Q^2$  is the photon virtuality. The  $\gamma$ - $p$  cross section for  $\text{Upsilon}$  photoproduction is presented as a function of  $W$  and  $|t|$ , where  $t$  is negative transverse momentum square at the proton vertex. These results, which represent the analysis of the full ZEUS data sample for dimuon decay channel, are compared to predictions based on perturbative QCD. The proton-dissociative diffractive photoproduction of  $J/\psi$  mesons has been studied in ep collisions with the ZEUS detector at HERA using an integrated luminosity of  $112 \text{ pb}$ . The cross section is presented as a function of the photon-proton centre-of-mass energy and of the squared four-momentum transfer at the proton vertex. The results are compared to perturbative QCD calculations. The  $J/\psi$  decay angular distributions have been measured in inelastic photoproduction in ep collisions with the ZEUS detector at HERA, using an integrated luminosity of  $468 \text{ pb}^{-1}$ . The range in photon-proton centre-of-mass energy,  $W$ , was  $50 < W < 180 \text{ GeV}$ . The  $J/\psi$  mesons were identified through their decays into muon pairs. The polar and azimuthal angles of the muon+ were measured in the  $J/\psi$  rest frame and compared to theoretical predictions at leading and next-to-leading order in QCD.

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