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J/ψ photoproduction at HERA with ZEUS

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In this article, the status of J/ψ photoproduction at HERA using the ZEUS detector is summarized. The J/ψ mesons were identified through their decay into muon pairs. The proton-dissociative diffractive photoproduction of J/ψ mesons has been studied in ep collisions with the ZEUS detector at HERA using an integrated luminosity of 112 pb^{-1}. The cross section is presented as a function of the photon-proton centre-of-mass energy, W, and of the squared four-momentum transfer at the proton vertex, $|t|$. The results are compared to perturbative QCD calculations. The double differential inelastic J/ψ photoproduction cross section as function of the squared transverse momentum of the J/ψ, p_t^2, in bins of the inelasticity z has been measured. An integrated luminosity of 468 pb^{-1} was used corresponding to the full data sample collected by the ZEUS experiment. The events were required to have $0.1 < z < 0.9$, $p_t > 1$ GeV and $60 < W <$240 GeV. The double differential cross section measurements are compared to the most recent theoretical predictions.

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1. Proton-dissociative diffractive photoproduction of J/ψ mesons

Photoproduction of J/ψ mesons is thought of as a process where the photon fluctuates into a $q\bar{q}$ state, which then interacts with the proton and becomes a J/ψ. The $q\bar{q}$ is squeezed into a small configuration and perturbative QCD (pQCD) can be applied. In exclusive photoproduction of J/ψ, $\gamma\, p \to J/\psi\, p$, the mass of the J/$\psi$ provides a hard scale at the photon vertex, while the four-momentum-transfer squared at the proton vertex is small, $|t| \lesssim 1$ GeV^2. For $|t| > 1$ GeV^2, the dominant process is that where the proton dissociates into a low-mass nucleon Y: $\gamma\, p \to J/\psi\, Y$. This is a two-scale process. ZEUS has studied this process [1] for the kinematic range $30 < W < 160$ GeV and $2 < |t| < 20$ GeV^2 with an integrated luminosity of 112 pb^{-1}.

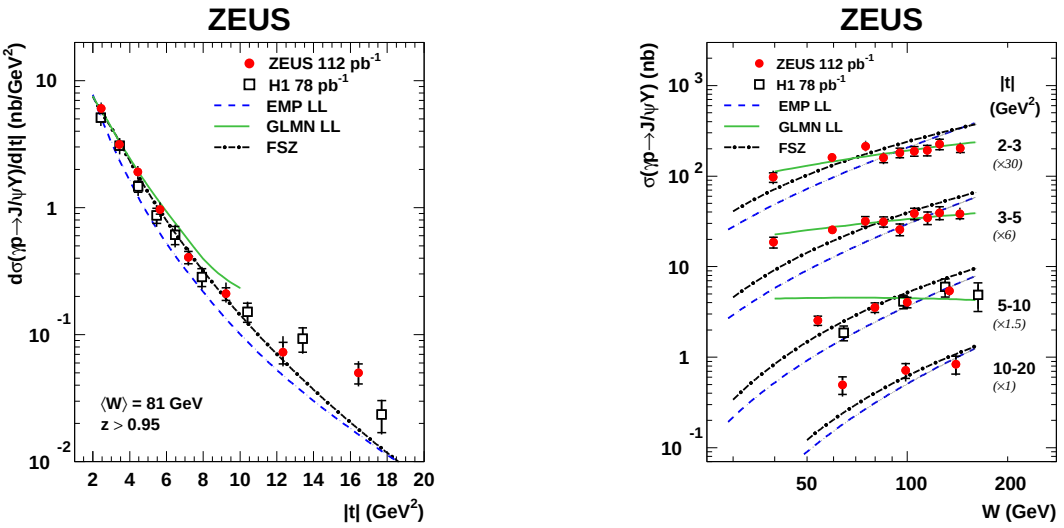

Figure 1: Plot on the left: the $|t|$ dependence of the differential cross-section $d\sigma/d|t|$ for the process $\gamma\, p \to J/\psi\, Y$ at $< W >$ = 81 GeV and $z > 0.95$. The H1 data, $50 < W < 150$ GeV, [5] are also shown. Plot on the right: The W dependence for the process $\gamma\, p \to J/\psi\, Y$ ($z > 0.95$) in four different $|t|$ bins. The H1 data, for the |t| bins of 5 to 10 GeV^2, [5] are also shown. In both plots the inner bars correspond to the statistical uncertainties and the outer to the statistical and systematic uncertainties added in quadrature, the lines show the predictions of several theoretical calculations.

On the left of Fig. 1 the $d\sigma/d|t|$ as function of $|t|$, and on the right the cross section as function of W in four different $|t|$ bins are shown. The data are compared with different leading logarithmic (LL) calculations: GLMN [2], EMP [3] and FSZ [4]. Even if these pQCD calculations are able to catch the overall behaviour of the data, no one gives a fair description of the ZEUS data.

2. Inelastic photoproduction of J/ψ mesons

ZEUS has measured the double differential inelastic J/ψ photoproduction cross section [6] as

function of the squared transverse momentum, p_t^2, of the J/ψ in bins of the inelasticity variable z, for the W range $60 < W < 240$ GeV and using an integrated luminosity of 468 pb^{-1} (see Fig.2).

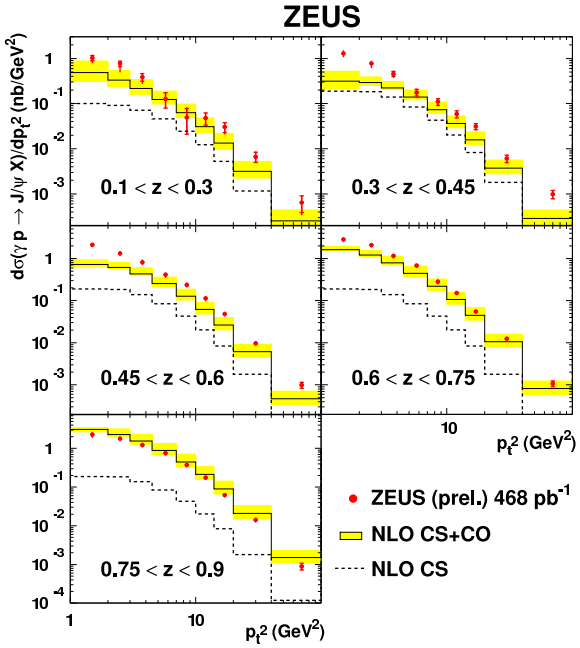

Figure 2: Differential cross section as function of p_t^2 in different z intervals for inelastic J/ψ photoproduction in the W range $60 < W < 240$ GeV. The inner bars of the data points correspond to the statistical uncertainties and the outer to the statistical and systematics uncertainties added in quadrature. The yellow band corresponds to a NLO calculation which takes into account both CS and CO contributions, the dashed line shows the NLO CS contribution only.

The data are compared with a NLO calculation [7] containing both color singlet (CS) and color octet (CO) terms. The calculation gives a satisfactory description of the data both as shape and as normalisation. The CS terms only can't explain the data yield.

References

[1] ZEUS Coll., S. Chekanov et al., JHEP **5**, 1 (2010).

[2] E. Gotsman et al., Phys. Lett. **B 532**, 37 (2002).

[3] R. Enberg, L. Motyka and G. Poludniowski, Eur. Phys. J. **C 26**, 219 (2003).

[4] L. Frankfurt, M. Strikman and M. Zhalov, Phys. Lett. **B 670**, 32 (2008).

[5] H1 Coll., A. Atkas et al., Phys. Lett. **B 296**, 205 (2003).

[6] ZEUS Coll., S. Chekanov et al., ZEUS-prel-11-006.

[7] Butenschoen M., Kniehl B. A., Phys. Rev. **D 84**, 051501 (2011);
Butenschoen M., Kniehl B. A., Phys. Rev. Lett. **106**, 022003 (2011);
Butenschoen M., Kniehl B. A., Phys. Rev. Lett. **104**, 072001 (2010).