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406: Jet Production in DIS at NLO Including Z and W Exchange

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Abstract. Next-to-leading order QCD predictions for 1-jet and 2-jet cross sections in deep inelastic scattering with complete neutral current (γ^* and Z) and charged current ($W^\pm$) exchange are presented.

Electroweak effects in DIS n-jet production are known to become important for $Q^2 \gtrsim 2500$ GeV^2. These effects can be studied with the fully differential $ep \to n$ jets event generator MEPJET [1, 2] which allows to analyze any 1- or 2-jet like observable in NLO in terms of parton 4-momenta. Numerical results for 1- and 2-jet cross sections in $e^\pm p$ scattering are shown in Fig. 1.

Jets are defined in a cone scheme (in the laboratory frame) with $R = 1$ and $p_T^{\rm lab}(j) > 5$ GeV. In addition, we require $0.04 < y < 1$, an energy cut of $E(e') > 10$ GeV on the scattered lepton (in NC scattering) and a cut on the pseudo-rapidity η of the scattered lepton and jets of $|\eta| < 3.5$.

The Q^2 distribution of the NC 2-jet cross section (including γ^* and Z exchange) is compared to the CC 2-jet cross section in Fig. 1a. The difference between the e^+p and e^-p results in the NC case is entirely due to the additional Z exchange, which increases (decreases) the 1-photon result in the e^-p (e^+p) case by more than a factor of two for very high Q^2. The Q^2-dependence of the 2-jet rate, defined as the ratio of the 2-jet to the 1-jet cross section, is shown in Fig. 1b for e^+p scattering in NC (solid) and CC (dashed) exchange.

The QCD corrections to the electroweak cross sections are investigated in Figs. 1c-f where the Q^2 dependence of the K-factors for NC and CC 1- and 2-jet cross sections are shown. While NC and CC effects differ markedly for e^+p and e^-p scattering, the QCD K-factors are largely independent of the initial state lepton. We find very similar K-factors for jets defined in the k_T scheme with $E_T^2 = 40$ GeV^2. More results can be found in [2].

References

[1] E. Mirkes and D. Zeppenfeld, *Phys. Lett.* **B380** (1996) 105, [hep-ph/9511448]; *Acta Phys. Pol.* **B27** (1996) 1393, [hep-ph/9604281].
[2] E. Mirkes, [hep-ph/9711224].
[3] M. Glück, E. Reya and A. Vogt, *Zeit. Phys.* **C67** (1995) 433.
[4] A.D. Martin, R.G. Roberts, W.J. Stirling, *Phys. Lett.* **B387** (1996) 419.

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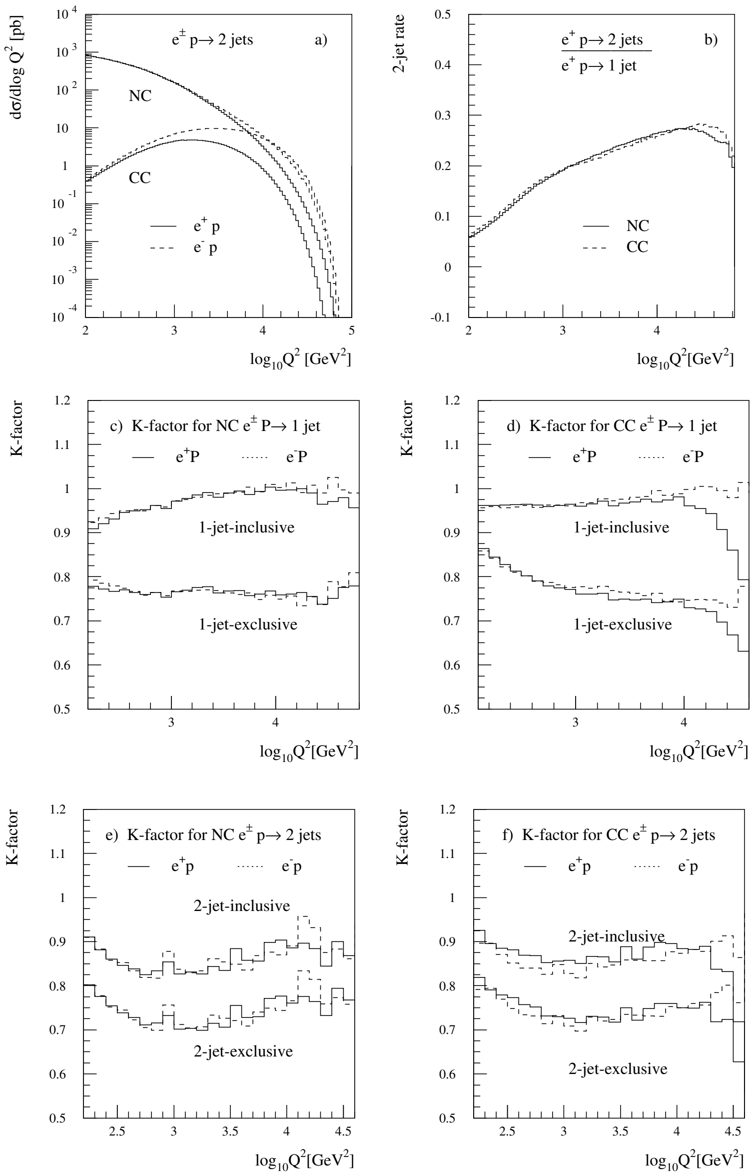

Fig. 1. a) Q^2 dependence of the CC and NC 2-jet cross section for e^+p (solid) and e^-p (dashed) scattering. b) 2-jet rate σ(2-jet)$[Q^2]/\sigma$(1-jet)$[Q^2]$ for NC (solid) and CC (dashed) exchange. The results in a,b are shown in LO with MRS Set (R1) [4] parton distributions and the two-loop formula for the strong coupling constant.
c,d) Q^2 dependence of the K-factor for NC and CC 1-jet inclusive and exclusive cross sections in e^+p (solid) and e^-p (dashed) scattering. The (LO) NLO cross section, which enter the K-factor, are calculated with LO (NLO) GRV parton distributions [3] together with the 1-loop (2-loop) formula for the strong coupling constant. e,f) same as c,d) for 2-jet cross sections.