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Measurement of Jet Cross Sections in Deep Inelastic Scattering

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Jet cross sections in deep-inelastic scattering have been measured with the H1 detector at the positron proton collider HERA. The jets were defined using the inclusive $k_\perp$ clustering algorithm. A large kinematical range of four momentum transfers $5 < Q^2 < 5000$ GeV^2, transverse jet energies $70 < E^2_{t,jet,Breit} < 3600$ GeV^2 and invariant dijet masses $100 < M^2_{jj} < 8000$ GeV^2 is covered. The data sample covering $5 < Q^2 < 70$ GeV^2 was taken in the years 1996 – 1997 and corresponds to an integrated luminosity of $\mathcal{L}_{int} \simeq 20$ pb^{-1}. For the higher Q^2 sample all available positron data (1994 – 1997) are included resulting in an integrated luminosity of $\mathcal{L}_{int} \simeq 36$ pb^{-1}. Double differential dijet cross sections have been measured for several sets of variables $(Q^2, E_{t,jet,Breit}, M_{jj}, \xi, x_{Bj})$. The results are compared to perturbative QCD calculations in next-to-leading order (NLO) of the strong coupling constant. Over the whole phase space the next-to-leading predictions give a very good description of the data. For the low Q^2 sample the dependence on the different choices of the renormalisation scale are discussed. For $Q^2 > 100$ GeV^2, the gluon density in the proton is determined in a NLO QCD fit to the dijet cross sections for $0.01 < x < 0.1$ at a scale $\mu^2 = 200$ GeV^2. The result is in good agreement with the gluon density from a QCD analysis of the H1 structure function data and extends the determination to larger x.