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Three- and Four-jet Production at Low x at HERA

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Three- and four-jet production is measured in deep-inelastic ep scattering at low x and Qˆ2 with the H1 detector using an integrated luminosity of 44.2 pbˆ-1. Several phase space regions are selected for the three-jet analysis in order to study the underlying parton dynamics from global topologies to the more restrictive regions of forward jets close to the proton direction. The measurements of cross sections for events with at least three jets are compared to fixed order QCD predictions of $\mathcal{O}(\alpha_s^2)$ and $\mathcal{O}(\alpha_s^3)$ and with Monte Carlo simulation programs where higher order effects are approximated by parton showers. A good overall description is provided by the $\mathcal{O}(\alpha_s^3)$ calculation. Too few events are predicted at the lowest $x \sim 10^{-4}$, especially for topologies with two forward jets. This hints to large contributions at low x from initial state radiation of gluons close to the proton direction and unordered in transverse momentum. The Monte Carlo program in which gluon radiation is generated by the colour dipole model gives a good description of both the three- and the four-jet data in absolute normalisation and shape.

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