Phi Asymmetries in Dijet Production in Deep-inelastic Scattering at HERA

H1 Collaboration
DESY, Hamburg, Germany

The helicity dependent azimuthal asymmetries in (2+1) jet events in deep-inelastic scattering at HERA have been measured. The data sample has been taken in the years 1996 – 1997 and corresponds to an integrated luminosity of $\mathcal{L}_{int} \simeq 20$ pb^{-1}. For semi-inclusive measurements of neutral current DIS processes with unpolarized beams , the cross-section can be written as a function of 4 structure-functions, $d^5\sigma = (1+(1-y)^2)\,F_2+2(1-y)\,F_L-(2-y)\sqrt{1-y}\,F_4\cos\phi^* + 2(1-y)\,F_6\cos 2\phi^*$, where ϕ^* is defined in the Breit system as the angle between the lepton-plane and the hadron-plane. The ratios $R = F_{L,4,6}/F_2$ all go like $k_\perp^2/Q^2$ for $Q^2 >> k_\perp^2$. The fact that the intrinsic $p_\perp$ of the proton is contributing in a non-trivial manner motivated an exclusive jet measurement to establish the scaling properties of the structure-functions and the size and shape of the effects from the intrinsic $p_\perp$. Systematic effects stemming from QED-radiation on the lepton-side and the acceptance of the detector are thoroughly discussed. The sensitivity to the helicity is checked with a toy-model,where the gluons have spin-0. The effects stemming from the intrinsic $p_\perp$ of the proton is incorporated in a Monte-Carlo model and, using this, the intrinsic $p_\perp$ in our data is estimated to be below $300\,MeV$. The measurement is in very good agreement with both analytical predictions concerning scaling, and a detailed Monte-Carlo integration of leading order QCD.