26pZB-5 Subleading-twist effects in single-spin asymmetries in semi-inclusive DIS on a longitudinally polarized hydrogen target

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Single-spin asymmetries in the distribution of lepto-produced hadrons in the azimuthal angle around the virtual photon direction are a valuable tool for the exploration of transverse spin and transverse momentum degrees of freedom in nucleon structure. Such asymmetries have been observed in semi-inclusive deep-inelastic scattering with unpolarized beam and with targets polarized both longitudinally and transversely with respect to the beam direction. Since the virtual-gamma direction and the beam direction do not coincide the nucleon polarization has a transverse component with respect to the virtual-photon direction when the nucleon is polarized along the beam direction. In analogy there is a non-vanishing longitudinal component when the target is polarized transversely to the beam direction. Only a combined analysis of data from transversely and longitudinally polarized targets allows a separation of the terms associated with nucleon polarizations transverse or longitudinal to the virtual-photon direction. The transverse asymmetries can be interpreted as the so-called Sivers and Collins asymmetries. The longitudinal asymmetries are of subleading twist that means they are $1/Q$ suppressed in the cross section where Q is the four-momentum transfer from beam to target. The longitudinal asymmetries are therefore of particular interest as they constitute one of the few instances where subleading-twist contributions do not have to "compete" with leading-twist contributions. Hence they are a clear manifestation of subleading twist – a long debated issue in the description of the nucleon. The HERMES data from targets polarized both longitudinally and transversely with respect to the beam direction are combined to extract the subleading-twist contribution. For the π^+ this contribution is significantly positive and it dominates the asymmetries from a target polarized longitudinal to the beam direction. The π^- asymmetry is consistent with zero.