TAGGING THE COLLINS FRAGMENTATION FUNCTION AT HERMES

Pasquale Di Nezza (on behalf of the HERMES Collaboration)
I.N.F.N. Laboratori Nazionali di Frascati, via E.Fermi 40 I-00044 Frascati - Italy
e-mail: Pasquale.DiNezza@lnf.infn.it

Transversity and related spin-distribution functions are still unmeasured because their unusual chiral-odd structure implies that they are not directly observable in inclusive lepton-nucleon scattering experiments. Recently, HERMES has observed the occurrence of a single-spin asymmetries, where only the target is longitudinally polarized. This may offer access to transversity through the so-called Collins effect. The latter involves a chiral-odd fragmentation function that, together with the transverse distribution function, preserves the chirality in the interaction. This model describes how the probability for producing a hadron (a pion in this case) depends on its direction with respect to the direction of transverse polarization of the struck quark. In HERMES, the target has a longitudinal polarization in the laboratory frame but, due to a finite beam energy, in the virtual gamma both a transverse and a longitudinal component of the target polarization can be found. A robust target-spin asymmetry of the distribution in the azimuthal angle ϕ of the pion relative to the lepton scattering plane was observed for π^+ and π^0 while it is compatible with zero for the π^-. The analyzing power (A_{UL}) for $sin\phi$ has been calculated as a function of different kinematical variables. The increase with increasing x suggests that single-spin asymmetry are associated with valence quark contributions. The P_T dependence can be related to the dominant kinematical role of the intrinsic transverse momentum of the quark for P_T below the typical hadronic mass of 1 GeV, as predicted in the Collins parameterization. The z dependence of the π^0 asymmetry is consistent with the monotonic increase of the π^+ asymmetry, but these asymmetries becomes one order of magnitude more when the semi-exclusive kinematical region ($z \simeq 1$) is reached. The analyzing power for $sin2\phi$ has been calculated and found compatible with zero. A fair agreement of the experimental data has been found with some theoretical models. In conclusion, the appearance of this single-spin asymmetry suggests that the effect of chiral-odd spin distribution function coupled with a Collins fragmentation function, offers a means to measure transversity in 2001 when HERMES will start collecting data using a transversely polarized target.