Flavour Separation of Polarized Parton Distributions at HERMES

The HERMES collaboration

We present new results from the HERMES experiment on the polarized quark distributions of the nucleon. The HERMES experiment at DESY has been studied the spin structure of the nucleon using the longitudinally polarized 27.6 GeV electron/positron beam from HERA and different longitudinally polarized internal gas targets: ^{3}He (1995), hydrogen (1996−1997), deuterium (1998−2000). The results of early analyses based on the limited statistics were reported [1-3].

In the successful year 2000, due to the high target and detector performance about 7 times more data were taken in comparison to the first two deuterium runs. Based on 10 M deep inelastic scattering events in total, the quark contributions to the nucleon spin could be determined with an improved statistical accuracy. The five components, $u(x)$, $\bar{u}(x)$, $d(x)$, $\bar{d}(x)$, and $s(x)(=\bar{s}(x))$, were separated for the first time using in addition double spin asymmetries for $\pi^{\pm}$ and $K^{\pm}$ identified by the Ring Imaging CHêrenkov counter (RICH).

The average lepton identification efficiency of 99% at a hadron contamination of less than 0.5% were achieved by the combination of the HERMES particle identification detectors. Hadron type identification has been performed using the RICH which was designed to identify π, K, and p in the momentum range from 2 to 15 GeV/c. Installed in 1998, it replaced the previous threshold type Chêrenkov counter. Detecting hadrons in coincidence with the scattered beam lepton, double spin asymmetries of positively and negatively charged hadrons (1996 and 1997), and $\pi^{\pm}$ and $K^{\pm}$ using the RICH (1998-2000) have been determined.

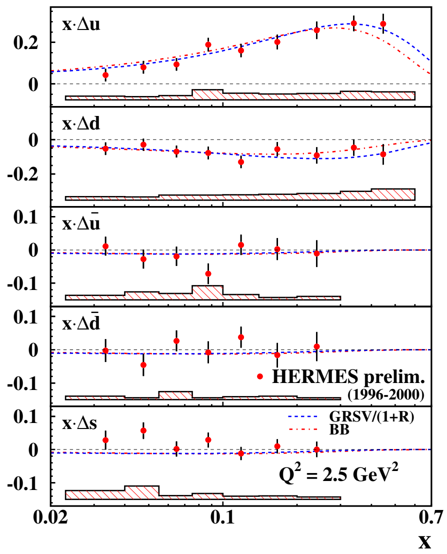

Figure 1: The x-weighted polarized quark densities at $Q^2 = 2.5$ GeV^2. The systematic uncertainties are shown as bands. Also shown are pQCD parameterizations (dashed lines).

The inclusive and semi-inclusive asymmetries measured on the p and d targets were used in the flavor decomposition analysis. Using a Monte Carlo simulation based on the LUND string fragmentation model and the unpolarized parton distribution functions (CTEQ5 LO), the spin dependent quark distributions were extracted in LO pQCD as shown in Figure 1. The results for the first moments of the polarized parton densities and the Bjorken sumrule will be presented and discussed.

References

[1] K. Ackerstaff et al, Phys. Lett. **B404** (1997) 383-389.
[2] A. Airapetian et al, Phys. Lett. **B442** (1998) 484-492.
[3] K. Ackerstaff et al, Phys. Lett. **B464** (1999) 123-134.