Plans for HERMES Run 2

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on behalf of the HERMES Collaboration

The primary goal of the HERMES experiment located at the DESY Laboratory in Hamburg, Germany is the detailed study of the spin structure of the nucleon. Since 1995, HERMES has been collecting deep-inelastic scattering data on a variety of polarized targets (^{3}He, H, and D) and high density unpolarized targets in an attempt to elucidate how the constituents of the nucleon combine to produce its spin. The HERMES experiment is in a position to make a first determination of the spin structure of the nucleon to leading twist by measuring both the quark helicity and quark transversity distributions.

The HERMES data-taking period known as Run 1 was completed in August of 2000. With the existing data from longitudinally polarized targets, a detailed determination of the Bjorken-x dependence of quark helicities is possible including, for the first time, a full decomposition of the polarized quark sea. These same data in combination with the unpolarized deep-inelastic scattering data, have also provided a first glimpse into previously unmeasured quantities such the gluon polarization, and a quite unexpected first access to the quark transversity and to Skewed Parton Distributions (SPD). These first measurements provide an enriched motivation for the physics program of HERMES Run 2 (2001-2006). Capitalizing on the large acceptance and good particle identification of the HERMES spectrometer, its pure polarized and unpolarized targets, and the flexibility of the HERA accelerator to run with either electron or positrons as well as to routinely flip the beam helicity, HERMES wishes to deepen its understanding of the remarkable results from Run 1. Several physics investigations are planned for Run 2.

The high density unpolarized physics program from Run 1 will be continued in Run 2.

The quark helicity measurements could be improved significantly (especially the polarization of the $\overline{u}$ sea) with one additional year of running with longitudinally polarized hydrogen targets.

The quark transversity measurements can be obtained with good precision by running with a transversely polarized target. Projections of the statistical precision have been made using a realistic scenario of running conditions. Both the x and z dependence can be measured providing first detailed measurements of the quark transversity and polarized fragmentation function. To this end, HERMES has installed and is commissioning a new transverse polarization magnet and will run in this mode for approximately two years.

Access to Skewed Parton Distributions can be possible through the measurement of exclusive processes such as Deeply Virtual Compton Scattering (DVCS) and exclusive meson production. In order to improve the exclusivity of such processes, HERMES is currently designing a recoil detector to be placed around the HERMES target. This detector will consist of two layers of silicon around the target cell, two scintillating fiber trackers located outside the beam pipe, and an external layer of scintillator strips or pads to detect π^os. Such a system would detect more than 85% of recoil protons from Deeply Virtual Compton Scattering. Projections have been made for DVCS measurements in Run 2. The current statistical significance would be significantly increased as well as give some ability to look at the dependence of DVCS asymmetries on several key kinematic variables.

The physics program of HERMES RUN 2 is rich and varied and will significantly contribute to the further understanding of the spin structure of the nucleon.