PR12-22-004

Scientific Rating: A-

Recommendation: Approved for 38 PAC days

Title: Measurement of the Beam Normal Single Spin Asymmetry in Deep Inelastic Scattering using the SOLID Detector

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Motivation: It is proposed to measure the beam-normal single-spin asymmetry A_N for DIS on a proton target. In the Born approximation, in which a single photon is exchanged, single spin normal asymmetries– with either the electron or the hadron target polarized transverse to the scattering plane – are strictly forbidden due to time-reversal and parity invariance. Going beyond the Born approximation, one finds non-zero asymmetries due to two-photon exchange. Previous measurements of parity violating elastic scattering measured large A_N asymmetries, but the 6 GeV PVDIS experiment at JLab (E08-011) found A_N in DIS to be consistent with zero, albeit with large statistical uncertainty. Therefore, the proposed measurement will investigate, for the first time to a high precision, the effect of two-photon exchange in DIS via a beam normal single spin asymmetry. This will provide new constraints to further the understanding of two-photon exchange.

Measurement and Feasibility: The experiment uses an electron beam with the spin polarized in the transverse direction, incident on a 40 cm long liquid hydrogen target. Scattered electrons will be detected in the SoLID spectrometer in Hall A in its PVDIS configuration, with the scattering angle θ between 22° and 35°, and with full azimuthal angle (φ) coverage. By flipping the electron spin direction between beam-left and beam-right or between vertical up and down, the beam-normal asymmetry A_N will be determined by the φ-dependence of the measured asymmetry.

Issues: As SoLID is still at a very early stage of being designed, the performance of the individual subdetectors and of SoLID as a whole is not yet understood in detail. This makes it difficult to evaluate the experiment's technical realizability as currently proposed. Possible concerns are: the background suppression; the efficient and clean identification of the electron; the question whether all subdetectors, i.e., GEM-trackers, can be operated at the proposed luminosity; performance changes of the subdetectors due to radiation damage.

Summary: The PAC agrees that the experiment is scientifically well motivated and addresses an important question to characterize two-photon exchange. The PAC recommends that the issues listed above be revisited at future PAC Jeopardy reviews of the proposal.

The PAC recommends approval of the requested 38 PAC days. We note that the allocation of beam time is based on the assumption that SoLID will reach its performance specifications.