International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy

Study of the proton structure by measurements of polarization transfers in Wide Angle Real Compton scattering at JLab

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Real Compton Scattering (RCS) in the hard scattering limit is a powerful probe of the structure of the nucleon; the two photon couplings allow to access information which are complementary to DIS and elastic electron scattering. RCS experiments, devoted to measure the components of the recoil proton polarization with longitudinally polarized incident photons, have been performed in Hall A and Hall C in the recent past [1]. In the hard scale, when Mandelstam variables s, $-t$ and $-u$ are all large compared to the proton mass, the transition amplitude is expected to factorize into the convolution of a perturbative hard scattering amplitude with an overlap of initial and final soft non-perturbative wave functions. Different factorization schemes have been applied to RCS and these can be distinguished by the number of active constituents participating in the hard scattering subprocess [2],[3].

A remarkable result from JLab [4] has shown that the longitudinal polarization transfer is consistent with the "handbag" prediction and completely inconsistent with a prediction based on pQCD, two of the most explored mechanisms. This result requires additional measurements over a broader kinematic range, at higher photon energy for a better experimental verification of the handbag description. Furthermore, RCS could also shed light on the Generalized Parton Distributions (GPDs), one of the most promising theoretical tool to determine the total angular momentum contribution of quarks and gluons to nucleon spin. In this respect, Hall C experiment is expected to provide additional information on the RCS mechanism in the hard regime, at three large values of the center of mass proton scattering angle (70, 90, 110), at large energy (s = 9 $(GeV/c)^2$). The experiment has utilized an untagged, longitudinally polarized bremsstrahlung photon beam generated by the CEBAF electron beam on a copper radiator. The photons have been scattered from a liquid hydrogen target, transferring polarization to the recoil protons. Scattered photon and recoil protons have been detected in coincidence. A focal plane polarimeter measures the polarization of the recoiling protons by the azimuthal asymmetry in the angular distribution of protons scattered in carbon based analyzers.

The analysis of the collected data is underway with the main aim to extract the three polarization observables of the RCS process K_{LL}, K_{LT} and P_N with excellent accuracy, providing consolidated validation of the handbag reaction mechanism. Byproduct of the experiment is the measurement of the ratio of the transverse and longitudinal polarization recoil proton components, which is directly proportional to the ratio of the electromagnetic proton form factors.

The preliminary results of the data analysis will be presented.

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