E12-13-010: Exclusive deeply virtual Compton and neutral pion cross-section measurements in Hall C

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Generalized Parton Distributions (GPDs) provide an unprecedented way to describe nucleon structure and thus help understand the transition between perturbative and nonperturbative QCD. Experimentally, GPDs can be accessed through hard exclusive processes, provided that the kinematics of the reaction are such that the main mechanism of the reaction is well described by its leading twist contribution. Physically, this corresponds to the limit where the virtual photon interacts with one single parton inside the nucleon. In this case, the unique framework of the GPDs based on a 3D tomographic image of the quark structure of the nucleon that links its momentum and coordinate quark distributions is appropriate to describe the reaction. The simplest process to access GPDs experimentally is Deeply Virtual Compton Scattering (DVCS) : $ep \to ep\gamma$ in the Bjorken limit ($Q^2 \to \infty$ and $\nu \to \infty$ at constant x_B).

Experiment E12-13-010 will measure the cross section of the DVCS reaction accurately in a wide range of kinematics allowed by a set of beam energies up to 11 GeV. It will exploit the azimuthal angle, beam energy and helicity dependence of the cross section to extract the complete set of observables from an unpolarized proton target. The Q^2-dependence of each individual term will be measured and compared to the predictions of the handbag mechanism. This will provide a quantitative estimate of higher-twist effects to the GPD formalism in JLab kinematics. Many of the proposed settings will be run at different beam energies. This will permit to separate the BH-DVCS interference from the DVCS^2 terms of the unpolarized cross section. At the same time we will also perform an L/T separation of the exclusive π^0 electroproduction cross section, also as a function of Q^2.

The experiment will use the Hall C High-Momentum Spectrometer combined with the new Neutral Particle Spectrometer (NPS) facility currently under construction.

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