E12-06-114: Measurements of the Electron-helicity Dependent Cross sections of the DVCS with CEBAF at 12 GeV

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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 non-perturbative 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.

E12-06-114 was approved with A rating by PAC30 (2006) and 100 days of beam-time were allocated by PAC 38 (2011). During 2014–2016 E12-06-114 was scheduled to run 50 days out of the 100 days approved. PAC47 (2019) reviewed the experiment under the jeopardy process and approved 35 days of running in Hall C in order to successfully complete E12-06-114.

The present experiment will use the combination of Hall C's High Momentum Spectrometer and the new Neutral Particle Spectrometer (NPS). It will measure the cross section of deeply virtual Compton Scattering (DVCS), the easiest reaction to access GPDs. This will be done at different beam energies, which will allow both the L/T separation of the exclusive π^0 cross sections and the generalized Rosenbluth Separation of DVCS. Combining the kinematics of this experiment with previously taken Hall A E12-06-114 and approved E12-13-010 data, we will obtain the following energy scans :

— $x_B = 0.48 : Q^2 = 3.4, 4.3,$ & 5.3 GeV^2, 4 and 5 pass beam

— $x_B = 0.60 : Q^2 = 5.5, 6.8,$ & 8.4 GeV^2, 4 and 5 pass beam

The beam-energy dependence of the DVCS cross section has proved to be a powerful tool to further investigate the reaction mechanism of DVCS. Furthermore, precise measurements of absolute cross sections at well-defined kinematics is the best way to understand higher twist and/or higher order corrections to the DVCS process.

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