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

Spokes-persons: A. Camsonne (JLab), C. Hyde[1] (ODU), C. Munoz-Camacho(CNRS-France) and J. Roche (OU)

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.

Previous results by our collaboration[2] showed that Deeply Virtual Compton Scattering (DVCS) is particularly suited to study GPDs. Indeed, indications of early scaling (twist-2 dominance) were observed already at a Q^2 of about 2 GeV^2. However, the 6 GeV beam available at the time of this first measurement provided a limited lever arm in Q^2 in order to perform strong scaling tests of the DVCS amplitude. Experiment E12-06-114 will take advantage of the newly upgraded 12 GeV beam to extend the Q^2 range (up to 9 GeV^2) of the test at three difference central values of the Bjorken variable x_B (from 0.36 to 0.60). By measuring separately, and as a function of Q^2, the unpolarized cross section and the helicity-dependent cross sections, we will be able to provide independent tests of scaling for the real and the imaginary parts of the DVCS amplitude. We will also measure $\vec{e}p \to ep\pi^0$ cross-sections at the same kinematics as DVCS.

For E12-06-114, we will use the successful technique of our first measurement, that is, detecting the electron in one of the HRS of Hall A and the photon in our dedicated electromagnetic calorimeter. The exclusivity of the reaction is ensured by reconstructing the missing mass of the proton. This simple system allows us to perform a precise measurement of the absolute cross-section (about 4% relative precision). Two hardware pieces are necessary to ensure the success of the experiment: the Analog Ring Samplers and the coincidence trigger. The 1 GHz Analog Ring Samplers digitize the PMT signals of the calorimeter allowing the offline removal of pile-up events. The DVCS coincidence trigger is a level-2 decision module that selects events forming a cluster in the calorimeter above a programmable energy threshold.

[1]Contact person: hyde@jlab.org

[2]Phys.Rev.Lett. 97 (2006) 262002