E00-110 : Deeply Virtual Compton Scattering at 6 GeV

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The 00-110 experiment plans to measure for the first time the **exclusive** $ep \to ep\gamma$ reaction in the Bjorken regime (fixed x_B, large Q^2 and $Q^2 >> -t$, where t is the momentum transfer to the proton). This type of deep exclusive experiment has become the subject of considerable interest since it is possible to extract information on a new class of parton distributions, namely the Generalized Parton Distributions (GPD's). These hybrid functions generalize the features of the usual parton distribution functions, the hadron distribution amplitudes and the electromagnetic form factors, and provide a unifying description for all those fundamental quantities of the nucleon structure. The GPD's contain a wealth of information about the transverse momentum and angular momentum carried by the quarks in the nucleon. They can be accessed through hard exclusive electroproduction of mesons and photons. It is the latter that we plan to explore.

The GPD framework relies on the assumption of the factorization theorem of those deep exclusive processes. The question whether JLab at 6 GeV allows one to reach the right regime, where it will be possible to extract information about GPD's cannot yet be answered. Nevertheless, we know that both the $\gamma\gamma^*\pi^0$ form factor and regular structure functions scale early, and both those processes have a close relationship to DVCS.

We propose to measure the beam helicity asymmetry of the $ep \to ep\gamma$ process in Hall A at 6 GeV. This allows us to perform a Q^2 scan from 1.5 GeV^2 to 2.5 GeV^2 at fixed $x_B \approx 0.35$. At this kinematics, the asymmetry is dominated by the DVCS - Bethe-Heitler (BH) interference, which is proportional to the imaginary part of the DVCS amplitude amplified by the full magnitude of the BH amplitude. If the scaling regime is reached, we will make an 8% measurement of the GPD contribution to the DVCS amplitude. Also, this experiment allows us to separately estimate the size of the higher-twist effects, since they are only suppressed by an additional factor $1/Q$ compared to the leading-twist term, and have a different angular dependence.

We will use the CEBAF polarized electron beam and detect the scattered electrons in the HRSe, the real photons in the RCS electromagnetic calorimeter and the recoil protons in a dedicated scintillator array. This will allow us to determine the difference in cross-sections for electrons of opposite helicities. This observable is directly linked to the GPD contribution to the DVCS process.