CEBAF EXPERIMENT 94-106
Nucleon Structure Study by Virtual Compton Scattering at High Momentum Transfer

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Determining the short distance structure of the proton is an important topic in our quest for an understanding of the strong interactions in terms of the fundamental quark and gluon degrees of freedom. Elastic virtual compton scattering: $(e + p \rightarrow e + p + \gamma)$, at high energy and moderately high momentum transfer is a powerful probe of nucleon structure. It is the natural complement to form factors, real compton scattering, and deep inelastic scattering.

We will use the CW 6 GeV beam at CEBAF to make the first measurements of virtual compton scattering (VCS) above the nucleon resonance region. These measurements will extend CEBAF experiment 93-050[1] into the high energy regime. We will use the two HRS spectrometers in hall A to detect the scattered electron in coincidence with the recoil proton. From the measured momenta k' and p' of the electron and proton, we reconstruct the four momentum q'_μ of the missing particle. VCS events are characterized by $q'^2_\mu = 0$. The VCS events are separated from *e.g.* coherent pion production events with $q'^2_\mu = m^2_\pi$. Our measurements will cover the kinematic domain 0.3 GeV$^2 \leq Q^2 \leq$ 1.2 GeV^2, $s = 5$ GeV^2, and 1.0 GeV$^2 \leq -t \leq$ 4.3 GeV^2.

In addition to the new experimental tools that CEBAF provides, we have new theoretical tools with which to study the VCS reaction. Perturbative QCD[2]–[4] and QCD sum-rule calculations[5]make predictions for the high energy VCS amplitude. In addition, the diquark model[6] provides a bridge between pQCD and the constituent quark model. It appears to be a more successful model than the pure quark picture at present medium energies. In the CEBAF accessible energy domain, it is one of the hadronic scenarios we will be able to accurately test with VCS.

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