CEBAF EXPERIMENT 93-036

***Measurement of Single Pion Electroproduction from the Proton with Polarized Beam and Polarized Target Using CLAS***

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The study of the hadronic structure of baryons at CEBAF will be signfiicantly enhance through the use of polarized electron beams and polarized targets. Experiment 93-036 will measure the polarization asymmetries for the reactions

$$\vec{e} + \vec{p} \rightarrow e' + \pi^{+} + (n)$$

and

$$\vec{e} + \vec{p} \rightarrow e' + p + (\pi^{0}).$$

We have used the AO computer program developed at CEBAF to estimate the expected order of magnitude and the errors of these asymmetries which can be obtained at CEBAF using the CLAS system. The results indicate that the proposed experiment will provide precision asymmetry measurements over a large range of $Q^2$ and W.

We have shown, using models for the resonance region with parameters chosen to fit existing experimental cross section data, that the expected asymmetries can be very large. The sensitivity to the details of the models of the baryon resonances was demonstrated by calculations using different assumptions about the nature of the Roper Resonance ($P_{11}$(1440). In the non-relativistic quark model, this resonance is assigned to a radially excited 3-Quark state [$q^3$] within the SU(6) X 0(3) super-multiplet. These have, however, been recent theoretical speculations that the Roper resonance might be the hybrid equivalent of the nucleon [$q^3G$], consisting of 3-quarks with one valence gluon. The results of our AO calculations indicate a very large difference between the expected polarization asymmetries for these two different models of the Roper resonance. Furthermore, the behavior is very $Q^2$-dependent.

The asymmetry data which we expect to obtain in this experiment will be combined with unpolarized data in order to determine the six parity conserving complex helicity-amplitudes ($H_1$-$H_6$) in a model independent analysis. This will be the first ever measurements of these observables. Our simulations indicate a very strong sensitivity in these observables to the nature of the models of the various resonances which we will excite. Indeed, they are sensitive to the presence (or lack thereof) of a number of resonances weakly excited in electroproduction experiments.

This experiment will run concurrently with experiment 91-023. No new beam time has been requested.