CEBAF EXPERIMENT 94-003

Study of the $\Delta(1232)$
Using Double Polarization Asymmetries

A Hall B CLAS N* Collaboration Experiment

Spokespersons:

P. Stoler (Contact Person)
Rensselaer Polytechnic Institute, Troy, N.Y.
E-mail: stolep@rpi.edu
Ph: (518)276-8388
Fax (518)276-6680

V. Burkert
CEBAF, Newport News Va.

Z. Li
Christopher Newport University, Newport News, Va.

R. Minehart
University of Virginia, Charlottesville, Va.

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This experiment is part of the CLAS N^* program to measure the properties of baryon excitation. We use a polarized electron beam and a polarized hydrogen target to measure double polarization asymmetries for the $\Delta(1232)$ resonance over a Q^2 range from about 0.5 to 4 GeV^2. by means of the kinematically complete reactions $p(e,e'p)\pi^0$ and $p(e,e'\pi^+)n$ over the full $\Delta(1232)$ mass range, and obtain nearly full coverage for the π angular distribution for several kinematic regions in Q^2.

This experiment will provide us with unique information about the $N \rightarrow \Delta$ transition amplitudes, M_{1+} , E_{1+} and S_{1+}, as well as the non-resonant amplitudes, which is complementary to measurements of cross sections using unpolarized beam or target, since the polarization asymmetries involve different combinations of the contributing amplitudes than unpolarized cross sections. Also, the measurement of asymmetries will give rise to much smaller systematic errors which occur in absolute cross section measurements. The goal is to map the absolute and relative magnitudes of the amplitudes from the lowest to the highest possible Q^2 in order to assess the regions of applicability of various microscopic models of the baryon structure, such as the constituent quark model, and to study the transition to the high Q^2 regime where these models become inadequate.

The, experiment is especially well suited to Hall B since the maximum acceptable luminosity of the polarized NH_3 target matches that of the CLAS spectrometer. In this experiment it will only be necessary to detect the scattered electrons and one of the emitted hadrons to achieve full kinematic reconstruction. Most of the experiment, especially the low Q^2 part, will utilize beam time already approved in conjunction with experiment E-91-23. Additional beam time will be required at 4 GeV to obtain increased statistical accuracy at higher Q^2.