CEBAF EXPERIMENT 94-012

Measurement of Photoproton Polarization in the $H(\gamma,\vec{p})\pi^0$ Reaction

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We plan to measure photoproton cross sections and polarizations in the reaction $\mathrm{H}(\gamma,\vec{p})\pi^0$. Photon energies will be in the range 0.8 to 4.0 GeV. Center of mass angles will be between 45° and 90°.

An important issue in intermediate energy physics is to what degree one can understand exclusive reactions from the viewpoint of perturbative quantum chromodynamics, pQCD. Strong theoretical arguments exist that pQCD should not be applicable at intermediate energies and momentum transfers, but experimental cross sections generally follow the constituent counting rules that can be derived from pQCD. Polarization data are limited, but suggest for pp scattering that a simple pQCD picture is not applicable.

Existing cross section data for $\mathrm{H}(\gamma,\pi^+)n$ exhibit an energy dependence near $\theta_{cm} = 90°$ consistent with asymptotic scaling for photon energies above about 2 GeV. Moreover, no polarization data exist for any exclusive photoreactions at high energy. Since there can be no large polarization in photoreactions from Landshoff terms, the combination of high energy differential cross section and polarization measurements for a simple photoreaction involving spin should provide a stringent test for asymptotic scaling in exclusive processes.

This experiment will use bremstrahlung photons produced from the CEBAF electron beam. The photons will irradiate a hydrogen target, and protons will be detected in the Hall A hadron spectrometer. The π^0 production channel can be selected in a singles measurement because of kinematics and small backgrounds. Electroproduction backgrounds are subtracted by comparison of yields with and without the bremstrahlung radiator in the beam.