Protons are not fundamental particles. Experiments performed over years have shown that protons have an internal structure. Physically, protons (as well as other hadronic particles) are composed of quarks. The interaction governing the quark/gluon dynamics is described by Chromodynamics (QCD). Unfortunately, precise calculations in the non-perturbative regime have not yet been possible. For this reason, models are employed that retain enough simplicity to allow predictions to be made.

In the energy regime from the Delta threshold to 3 GeV, the photoproduction experiments are the study of resonances that result from the available energy in the sub-nucleonic system. Many experiments performed at CEBAF to study this resonance spectrum; the widths, lifetimes, and the resonances offer rigid constraints in the understanding of chromodynamics. This experiment will look at a very narrow subset of the possible CEBAF from the baryon resonance spectrum. We will excite the proton by polarized photons and measure the decays of proton resonances.

One of the most successful models in describing the baryon resonance spectrum is the constituent quark model of Isgur and Karl. However, an outstanding prediction of this model is the prediction of more resonances than have been seen experimentally with pion beams. One possible explanation for these missing resonances is that they have a very weak pion coupling. The model does indicate that the resonances have a reasonable coupling to nucleon channels. By looking at the photoproduction of $r$-mesons at the center-of-mass energies where resonances are expected, our experiment may give a clear indication that resonances do exist.

One of the difficulties in extracting fundamental information from the experimental observables is that they only connect observable quantities (such as the partial width or branching ratio) through the case of the photoproduction of a baryon resonance intermediate state. Thus, an unambiguous complete set of experiments must be performed, using polarized beams and measuring the recoil polarization of the proton. This experiment, which uses a polarized photon beam, is the next step in a set of experiments to determine parameters of the resonance spectrum.