Abstract

The long-standing question of "missing resonances", i.e. experimentally not established baryon states which are predicted by SU(6)$\times$O(3) symmetric quark models but not expected by the di-quark model, can only be settled if measurements unambiguously identify some of these resonances. Symmetric quark models predict several "missing" baryon states to couple strongly to γp as well as $K\Lambda$ or $K\Sigma$ but not significantly to πN. Resonances with these properties would not have been observed in pion beam experiments on which most of the data analyses are based.

We propose to measure a large set of single and double polarization observables in associated strangeness production using a polarized target and polarized photon beams. The final goal of this experiment, in concert with the CLAS-g1 experiment on hyperon photoproduction (E89-004) and the **C**LAS **A**pproved **A**nalysis of $\vec{\gamma}p \to \mathrm{K}^+\Lambda$ (as part of CLAS-g8), is to perform a complete set of measurements for ground-state hyperon photoproduction in the reactions $\gamma p \to \mathrm{K}^+\Lambda$, $\gamma p \to \mathrm{K}^+\Sigma^0$, and $\gamma p \to \mathrm{K}^0\Sigma^+$. This will allow us to perform a full partial wave analysis and to determine the contributing multipoles as a function of the center-of-mass energy $W=\sqrt{s}$, thus we will extract the transition amplitudes not only of established baryon resonances but also from resonant states which are not yet experimentally observed.

Due to the weak decay of Λ and Σ^+, the **recoil** polarization can be determined in coincidence with polarization states of the incoming particles: **beam photon** and **target proton**. We will extract – for each individual reaction – more than the eight required observables which fully describe these reaction channels. The simultaneous measurement of most double polarization observables involving polarized targets will allow for powerful constraints on the fits and extensive checks of systematics. Calculations based on isobar models show that polarization observables involving beam and target polarization are most sensitive to s-channel contributions, e.g. contributions of N^* or Δ^* states.

In order to perform a complete set of measurements, we have to measure different sets of double polarization observables which can be obtained by two categories of measurements: (1) with longitudinally polarized target and circularly polarized photon beam, (2) with transversely polarized target and linearly polarized beam.

We propose to perform the measurements using the Hall-B photon beam facility and the CLAS detector which is a unique magnetic spectrometer with large acceptance, suitable for a crucial part of this experiment as it allows to operate a transversely polarized frozen spin target. The measurements will cover almost the full angular range and a large energy range: from $W = 1.705$ GeV to $W = 2.34$ GeV ($1.08 < E_\gamma < 2.5$ GeV).

While we will share the approved beam time of E01-104 **for the measurement on longitudinally polarized target, we request additional 20 days of beam time for 1.6 GeV electron beam and 20 days for 2.6 GeV electron beam.**
For the measurement on transversely polarized target and linearly polarized beam we request 38 days of beam time at $\mathbf{E_0 = 4.5}$ GeV, probing the photon energy range between 1.2 GeV and 2.5 GeV via coherent bremsstrahlung.