

## Abstract

We propose to measure two-body photoproduction of  $K^+$  from the proton, leading to  $K^+\Lambda$  and  $K^+\Sigma^0$  final states, for  $\theta_{CM} = 90^\circ$  and for photon energies between 1.4 and 3.4  $GeV$ . No measurements have been made between 1.7 and 4  $GeV$ . Existing data is qualitatively different at low and high energies and it has been suggested that quarklike degrees of freedom are relevant for  $E_\gamma \geq 4$   $GeV$ . The experiment can be done using equipment already needed for approved experiments in Hall C, and makes little demand on the accelerator.

## 1 Introduction

The dynamics of strange quarks and their relation to nucleon structure is a much discussed subject in strong interaction physics. For example, “hidden strangeness” in the nucleon has been suggested experimentally. That is, even though the nucleon has no net strangeness, dynamics of the  $s\bar{s}$  sea may account for some of the nucleon’s mass, spin, magnetic moment, and charge radius [1]. It may be possible to gain a handle on understanding these effects by studying processes where strangeness is directly produced. For example, some fraction of the time the nucleon may be a strange baryon with a strange meson “cloud” and the experimental meson-nucleon-baryon couplings are used to predict various “hidden strangeness” matrix elements [2]. Direct strangeness production gives us these couplings.

Exclusive  $K^+$  photoproduction from the proton is a primary source of information on strange meson-baryon-nucleon interactions. Various analyses [3, 4, 5, 6] use this data to extract the various couplings in the context of “effective field theories” [5]. For example, two recent works [5, 6] analyze data on  $\gamma p \rightarrow K^+\Lambda$  for  $E_\gamma \leq 1.4$   $GeV$  in terms of energy-independent coupling constants and obtain reasonably good fits. There is little data above 1.4  $GeV$ .

An entirely different picture of  $\gamma p \rightarrow K^+\Lambda$  and  $\gamma p \rightarrow K^+\Sigma^0$  is based on the notion that hadrons are composed of “pointlike constituents”, e.g. quarks. The “constituent counting rules” [7, 8] state that for any exclusive reaction  $A + B \rightarrow C + D$ , the differential cross section  $d\sigma/dt \rightarrow f(\theta_{CM})/s^{n-2}$  (as  $s$ ,  $t$ , and  $u \rightarrow \infty$ ), where  $n$  is the total number of pointlike constituents. Some data above 4  $GeV$  suggest that  $d\sigma/dt \propto 1/s^7$  for  $K^+$  photoproduction, but the evidence is not strong. In addition, such behavior would be poorly understood if we assume that the constituents are quarks and their interactions are governed by QCD [9, 10].

Almost no data on the differential cross sections exists between  $\approx 1.5$  and 4  $GeV$ . See Fig. 1. We propose to begin to fill in the gap by measuring at  $\theta_{CM} = 90^\circ$  for  $1.4 \leq E_\gamma \leq 3.4$   $GeV$ . Existing data suggest that  $\theta_{CM} = 90^\circ$  may be a good place to look first for signs of a  $1/s^7$  dependence. The limits on  $E_\gamma$  are imposed for technical reasons.