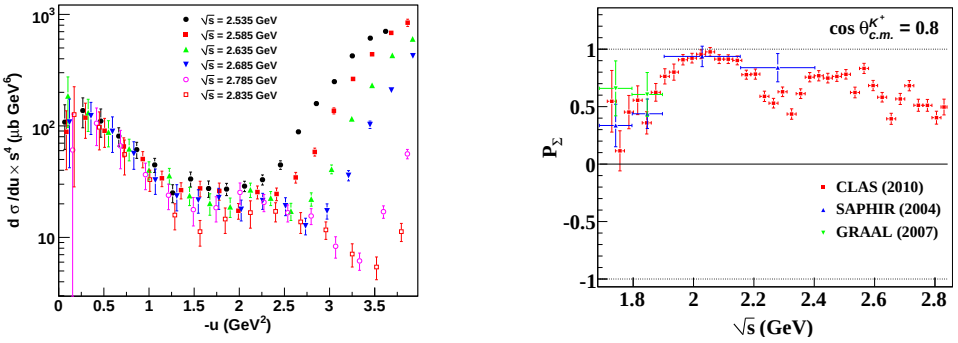
Differential cross-sections and recoil polarizations for $\gamma p \to K^+\Sigma^0$

It is increasingly becoming clear now that polarization information are absolutely vital for understanding the nature of hadronic reactions. Differential cross-sections measure total intensities while polarizations measure asymmetries (differences in the intensities) and are generally much more sensitive to the reaction mechanisms. Due to the self-analyzing nature of the hyperon decays (the angular intensity distributions contain the polarization information), with different configurations of beam, target and outgoing hyperon polarizations, the full complex amplitude of hyperon photoproduction with 8 independent variables can be completely reconstructed. The CLAS Collaboration has an extensive program for measuring several of these single- and double-polarization observables. In the present experiment with an unpolarized beam and unpolarized target, for the reaction $\gamma p \to K^+\Sigma^0$, the accessible variables are the differential cross-sections $(d\sigma/d\cos\theta^{K^+}_{c.m.})$ and the recoil polarizations (P_Σ, the polarization of Σ^0 perpendicular to the production plane). Our center-of-mass energy coverage is from production threshold ($\sqrt{s} \approx 1.69$ GeV) to $\sqrt{s} \approx 2.84$ GeV, with a wide angular coverage $-0.95 \leq \cos\theta^{K^+}_{c.m.} \leq 0.95$. With a 300 MeV increase in energy coverage over previous world data, we can clearly see u-channel contributions in the backward angles, which were previously neglected in model calculations. Our P_Σ are a huge improvement in both statistical precision and kiematical coverage over previous world data. To extract the underlying reaction meahcnisms, a partial wave analysis including the current data and measurements for several other hyperons channels is currently underway.



(a) (b)

Figure 1: (a) The well-collimated set of points at $u \to 0$ for different $c.m.$ energies indicates non-resonant u-channel processes that need to be incorporated into future model calculations. (b) Comparison of P_Σ results with previous world data.