CEBAF EXPERIMENT 91-014

Quasi-Free Strangeness Production in Nuclei

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This experiment will use tagged photons (1 to 2 GeV) in the CLAS to measure the differential A(γ,K) and A(γ,KY) cross sections on ^{3}He, ^{4}He, and ^{12}C, in quasi-free kinematics. Both K^+ and K^o, as well as Y = Λ and Σ production will be measured. These measurements complement similar CLAS experiments on H and D. We expect photo-kaon production to be dominated by incoherent production on individual nucleons (quasi-free production). However, the results from quasi-free (e,e') and $(e,e'p)$ measurements demonstrate that the quasi-free mechanism can be substantially altered by two-nucleon currents and possibly by polarization of the static properties of nucleons in nuclei.

This experiment is designed to study the relative importance of the one-nucleon (γ,K) current, two-nucleon (γ,K) currents, and kaon and hyperon final state interactions (FSI). We define FSI as interactions that are incoherent with the N(γ,K)Y vertex: coherent interactions must be considered as two-nucleon currents. These different mechanisms can be identified at least partially phenomenologically by examining specific observables.

Due to strangeness conservation, the total photo-kaon cross section should be insensitive to kaon FSI. Furthermore, the D:^{4}He:C ratio in a quasi-free model is relatively insensitive to the extraction of the $n(\gamma,K)Y$ amplitude from the data on Deuterium. Thus the A-dependence of the total cross section is primarily a search for medium effects on the elementary amplitude (either nucleon polarization or two-nucleon currents).

The differential ^{3}He data will be a detailed test of the quasi-free model, in a context where the (e,e') data suggest the nuclear medium effects are small.

The A-dependence (for N=Z) of the K^+/K^o ratio is largely insensitive to the details of the quasi-free mechanism. Thus this ratio is a probe for either two-nucleon currents, or charge-exchange final state interactions.

In order to trigger on both K^o and K^+ events, we require a minimum bias trigger. Thus our data stream will include copious non-strangeness events, such as $(\gamma,NN)X$, or $(\gamma,N\pi)X$. A particularly interesting class of events are ^{3}He (γ,ppn) events with all three nucleons carrying large transverse momentum in the final state. These events necessarily involve three-nucleon correlations: in either the initial state, final state, or in the current.