Nuclear Physics with Short-Lived Beams

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Short-lived beam particles in nuclear physics present problems for both the beam flux and target thickness calculations. Historically, bubble chamber experiments measured these quantities directly during datataking. Although precise, they were statistics-limited, due to rate limitations of bubble chambers. Modern large-acceptance detectors can overcome this limitation, with data rates several orders of magnitude greater than bubble chambers. The final-state particles are either detected directly or reconstructed from their decay particles. The beam particle is not detected directly, but is inferred via a missing mass calculation. A recent study with the CLAS detector at JLab in Newport News, Virginia used a version of this technique to measure the cross section for $\Lambda p \rightarrow \Lambda p$. The scattered Λ was inferred via its decay to $\pi^{-} p$; the presence of two protons in the final state reduced greatly the amount of data to be analyzed. Although the incident momentum range was limited, the number of events in this measurement was far greater than any previous measurement for this process. This talk will present the motivations for the development of short-lived beams, the present status of this project with the CLAS Collaboration, and plans for future improvements to the technique.