Neutrino energy reconstruction is one of the largest sources of systematic uncertainty in modern neutrino oscillation experiments. One significant source of energy mis-reconstruction occurs when final state particles re-interact before observation. This is referred to as Secondary Interactions (SI) if an it occurs in the detector after escaping the target nucleus. Energy can be lost in SI if particles interact inelastically or are unable to be reconstructed because of scattering. This will be a significant problem for the future DUNE experiment, and must be studied.

Due to a historical lack of pion-Argon scattering data, there is no understanding of pion-Argon SI. The recent Liquid Argon in a Testbeam (LArIAT) experiment has finally provided low energy pion-Argon scattering data, and my upcoming measurement on the prototype detector, ProtoDUNE, will provide data at higher energies that will be relevant for DUNE. A next step is to use the LArIAT data to constrain SI models in simulations.

Geant4 is used to simulate particles as they travel through a detector, and will be used by DUNE to simulate SI. It currently does not support the ability to tune its SI model to pion scattering data. My first goal for this research is to implement this ability into Geant4. Then, I will provide a tuning to the recent LArIAT data. This will be informed by previous work conducted by other experiments, and will allow the data from ProtoDUNE to be used for future tuning.