1 Overview

Since I received the JSA/Jefferson Lab Graduate Fellowship award for the academic year 2013-2014, I focused on two research topics and one CLAS FTOF12 upgrade project.

2 Research Progress

2.1 Data analysis

The main goal of the research that was supported by the JSA/JLab Graduate Fellowship Program is to provide new information on exclusive pion electroproduction off the neutron in deuterium, i.e. in the $\gamma^*(n) \rightarrow p\pi^-$ reaction channel. The CLAS e1e run, that includes both a hydrogen and deuterium target run period, allows a combined analysis of pion electroproduction off the free proton, bound proton, and bound neutron. I focus on the pion electroproduction off bound neutron analysis part. The sub-studies I have finished during the fellowship period are listed as follows:

1) proton and pion fiducial cuts
2) background subtraction
3) cut dependent final state interaction
4) preliminary analysis to the exclusive $D(e, e'\pi^-pp_n)$ channel

All above studies brought my understanding of the detector and the physics process to a deeper level.

2.2 Simulation

I first tried to use a modified “genev” event generator to generate $\gamma^*(n) \rightarrow p\pi^-$ channel, which includes the Fermi momentum of the neutron via the Bonn potential instead of assuming a neutron at rest. In this way, we are already able to include Fermi smearing in the simulation to describe the kinematics analog to the experimental data analysis. But the comparison between the data and simulation was still not satisfactory. Since the “genev” event generator is optimized for the two pion channels, I am currently modifying the “MAID” event generator in a way that includes the spectator information and the Fermi smearing in the thrown events in order to get better agreement between simulation and experimental data in the single pion channel ($\gamma^*(n) \rightarrow p\pi^-$).
3 Service

In parallel to working on my PhD research, I have been engaged in the FToF12 project. In July of 2013, we shipped the FTOF12 Panel-1b detector elements to JLab for the final implementation into the sector frames and pre-commissioning, and I took part in the final assembly, cabling, and testing of our detectors at JLab. From then till the beginning of January of 2014, we remotely measured the time resolution of half the Panel-1b detector elements with JLab electronics, and I was in charge of the data analysis. The results we obtained are as good as the results we had got at USC.

4 Travel

JSA/Jefferson Lab Graduate Fellowship travel funding was used to travel to the Annual Fall Meeting of the Division of Nuclear Physics on October 2013 in Newport News, VA. I presented an invited talk entitled *Exclusive $\pi^-$ Electroproduction off the Neutron in Deuterium in the Resonance Region* [1].

References