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Research Statement

I completed my Ph.D. research at Thomas Jefferson Notional Laboratory(JLab) through the University of Tennessee advised by Nadia Fomin. My research brought me from Knoxville to Newport News to gain access to Jefferson Lab's electron accelerator. I used an electron to probe inside of a nucleus to gain a greater understanding of the building blocks of nature and their internal interactions. The results of my research produced the first ever extraction of the inclusive deep inelastic cross section of tritium and the first ever measurement of EMC effect for tritium using extracted cross sections. My research experiences can be broken down into three areas, hands on hardware experience, physics data analysis, and running an experiment. I have interest in continuing to be active in all three areas.

Hardware

My career at JLab started off by working on the BigBite electron spectrometer. This spectrometer is a large acceptance spectrometer with a solid angle of 96 mrads and a momentum acceptance of greater than 500 $\frac{MeV}{c}$. My work on the this spectrometer consisted of constructing the data acquisition system, PMT performance studies, design and construction of coincidence trigger, and installation of consistent and dependable high voltage power for the detector systems.

DAQ and Trigger

- Designed and constructed front end electronics
- Tested and repaired electronic modules like amplifiers and splitters
- Built coincidence trigger between scintillators and Cherenkov
  - used oscilloscope and signal generator to ensure correct timing for trigger signals.

PMT performance studies Reusing BigBite required that I test the PMTs of the Cherenkov. Using a light-tight box and light source driven by a signal generator, I measured the quality of the PMTs. I took effort to replace or repair all PMTs that did not meet a standard signal to background ratio.

High Voltage

- Tested install High Voltage Cards
- Installed HV cabling ensuring adequate support to prevent wire and card damage

My time spent in the lab setting, preparing the spectrometer, was an area of research I enjoyed. I feel like the best way to begin data analysis is by studying the behavior of the detectors and their signals. By beginning my research with refurbishing a spectrometer, I was more prepared to complete analysis because I had a better understanding of the signals that were received. I

wish to grow my experiences in hands on detector work to continue growing my understanding of the signals we analyze. This would include working on new detector designs and reusing old setups.

Data Analysis

My research goals as part of the MARATHON (MeAsurement of F_n^2/F_p^2, d/u RAtios and A=3 EMC Effect in Deep Inelastic Electron Scattering off the Tritium and Helium MirrOr Nuclei) experiment were to determine the EMC effect for the helium-3 and tritium via ratios from extractions of the DIS(deep inelastic scattering) cross section of helium-3, tritium, and deuterium. I developed scripts to measure the yield, efficiencies, background contamination, and luminosity to extract the DIS cross sections. I build these scripts using FORTRAN, C++, python, and SQL databases. I also used Monte Carlo simulations and cross section models to complete comparisons between simulation and data for an absolute measurement of the inclusive cross section.

My interest in continuing work in data analysis spawn from a drive to learn more. I would like to developed my skills in new analysis techniques, examples: machine learning and GEANT simulations. Also, I would like to develop my skills of software development, for instant developing online analysis GUIs for efficient and streamline analysis of detector responses.

Running an Experiment

Being experimental physicist is culminated by successfully completing an experiment. As part of a collaborator at JLab, I have been able to collaborate on completing five different experiments. I contributed to preparing the data acquisition and decoding for all five of these experiments. I spend time has run coordinator (RC) for many of these experiments. As an RC, I served as the first line of communication between the shift works, principal investigators, technicians, and accelerator staff. I focused on ensuring efficient use of beam time to acquire high quality data while collaborating with other experiment halls and lab technicians to complete the over arching goals of the lab. As an experienced hall A collaborator, I spent time mentoring new students on the hall A equipment and software tools helping them prepare and run their experiments.

The feeling received from the rush of adrenalin due to the anticipation for the first beam on target can only be matched by a few things. One of which, is the relief felt when stopping the last beam and wrapping up an experiment. These two events and the chance of discovery during an experiment push me to be more involved in running experiments.

Future Goals

My future goals as stated previously are to continue to develop as an experimental physicist. This requires that I continue to collaborator with our peers, complete projects as the project lead and join projects as a follower. This also means I work with fellow scientist to propose new project ideas and take time to propose my own. I would like to continue my research in nuclear structure and the EMC effect by participating in Hall C and Hall B experiments, but I would also like to branch out to study the fundamentals of physics in the hadronic community in Hall D.