I would like to express my gratitude to Jefferson Science Associates for the opportunity to be a graduate fellow for the 2019-2020 period. This award allowed me to play a vital role in the J/Psi Photoproduction experiment in association with CLAS12, one of the prime experiments in Experimental Hall B. My graduate research during this time period was full of advancements and improvements to two parallel projects: the CLAS12 Torus field mapping project and analysis of the Fall 2018 RG-A dataset for the measurement of the J/Psi photoproduction cross sections.

TORUS Field Mapping Project Results

Using measured data of the precise values of the Torus field at selection positions, various models were used as comparisons to determine the true positions of the six coils. It was determined that the best agreement between the model and the measured values were in the middle portion of the six coils, which are further from the upstream and downstream corners. Closer to the corners, there was disagreement in the datasets due to imperfections in the modeling of the shape of the six coils. Therefore, an ad-hoc correction was made to the corners by adding the shape of the upstream corner as a parameter in the fitting algorithm that I coded. That fitting code, which uses an optimization routine in ROOT, determines the translational displacements of the six coils as well as the magnitude of the shape change, resulting in 24 parameters. The results were coordinated with the magnet scientists and a new model was placed in the CLAS12 reconstruction software. Such efforts play a vital role in the quality of the Drift Chamber reconstruction, which measures the four-vector and vertex information of charged particles in CLAS12.

Summary Of Results
J/Psi Photoproduction Near Threshold With CLAS12

From 2019 to 2020, advancements have been made with the development of the analysis framework for J/Psi analysis using the CLAS12 detector. With a portion of the RG-A Fall 2018 run, optimizations were made to particle identification, event selection, momentum corrections using radiative photons, fiducial cuts, background merging, efficiency, and Bethe-Heitler rates. These components lay the groundwork for J/Psi detection.

Around March 2020, RG-A completed the calibration and processing of the vast majority of the in-bending polarity runs for Fall 2018. Using the analysis framework that was developed in C++/ROOT, the J/Psi yield was quantified using the specialized cuts. It was satisfying to see a clear, high-quality J/Psi resonance peak above the Bethe-Heitler background.

Talk

In April 2020, I presented at the Virtual APS Meeting on “J/Psi Photoproduction Near Threshold With CLAS12”. I discussed the latest developments regarding particle identification, event selection, and the preliminary analysis of the J/Psi resonance.

Future Plans

As of now, CLAS12 possesses both the Fall 2018 and Spring 2019 RG-A datasets, which include enough statistics to calculate the preliminary differential and total cross sections for J/Psi photoproduction. Work is underway to understand the results and the systematic effects. My dissertation and defense will be complete by May 2021. In parallel to the thesis, work is being directed towards getting J/Psi photoproduction results published.