Measuring the Neutron Detection Efficiency in CLAS12

KeeGAN SHERMAN, GERARD GILFOYLE, Univ of Richmond — One of the central physics goals of Jefferson Lab is to understand how quarks and gluons form nuclei. To that end, one of the approved experiments in Hall B will measure the magnetic form factor of the neutron with the new CLAS12 detector. We will extract the ratio of electron-neutron to electron-proton scattering events from deuterium which requires a measurement of the neutron detection efficiency (NDE). To measure NDE we will take calibration data using a proton target to produce tagged neutrons from the p(e,e'\pi^+)n reaction. We are now simulating this reaction and developing the analysis code to extract the NDE. We use PYTHIA 6.4 to generate p(e,e'\pi^+)n events and simulate the response of CLAS12 with the Geant4-based Monte Carlo code gemc. To tag the neutron, we use the measured, scattered electron, and \pi^+ information to predict the neutron’s path. If the path intersects the fiducial volume of the CLAS12 electromagnetic calorimeters, then we search for a hit near that point. The NDE is the ratio of the number of neutrons found in the calorimeters to the number of neutrons predicted to hit the calorimeters. The analysis was done using the CLAS12 Common Tools. We observe a rapid rise in the NDE at low neutron momentum and a plateau above 60%.

1Work supported by the University of Richmond and the US Department of Energy.

Keegan Sherman
Univ of Richmond