Extracting Neutron Yield From High Mass Background[1]

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The Neutron Detection Efficiency (NDE) is an essential property of the CLAS12 Detector at Jefferson Laboratory. It is measured with the ratio of detected neutrons and expected neutrons from the $e^{1}\mathrm{H} \rightarrow e' \pi^{+} n$ reaction which is a source of tagged neutrons. Expected neutrons are found by swimming the neutron track, using only the $e' \pi^{+}$ information, to see if it strikes the CLAS12 detector. Detected neutrons are ones observed in the region of the expected neutron. Missing mass (MM) spectra of the neutron are created through four-momentum conservation and can be used to determine the neutron yield. We fit the spectra to separate the neutron events from the higher missing mass background. The fitting is done asymmetrically using the Crystal Ball function. The function is a combination of a gaussian fit around a central peak and a low - MM tail that is fit with a power law, MM^{n}, where n is a fit parameter. The overlap point of the two functions is determined by another fit parameter, α. The fit is done with the CLAS12 Common Tools written in Java. We found the Crystal Ball function produces better fits to the neutron peak ($<\chi^2/\nu> \sim 1.3$) than a gaussian alone. The fit parameters vary smoothly with missing momentum of the neutron, over the range of p_{mm} = 0.4 GeV - 7.0 GeV.

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