Study of Missing Mass Background in the CLAS12 Detector

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At Jefferson Lab we use the CLAS12 detector to measure the neutron magnetic form factor. An accurate measurement of the CLAS12 neutron detection efficiency (NDE) is required. We use the nuclear reaction $ep \rightarrow e'\pi^+ n$ as a source of tagged neutrons and obtain the NDE from the ratio of expected neutrons to detected ones. We assume the final state consists of $e'\pi^+ n$ only, use the $e'\pi^+$ information to predict the neutron's position(expected) and then search for that neutron(detected). We select neutrons with the missing mass (MM) technique. We use simulation to validate our methods. We simulated events with the Monte-Carlo code GEMC and included background events. Even with background, the resolution of the simulated data is too small, so we used an existing smearing function and increased the resolution of the magnitude of the momentum and the angles of the electron and pion by a Resolution Scale Factor (RSF) to make the neutron MM resolution more realistic. We compared the simulated results with the run data distributions for several quantities like MM, energy, angles, etc. We selected the RSF that produced the best match. We then studied the composition of the low-MM background to understand its source.