Simulation of two neutron detection for invariant mass spectroscopy of unstable nuclei

JYUNICHI TSUBOTA, Tokyo Institute of Technology, SAMURAI COMMISSIONING COLLABORATION — Two neutron detection in invariant mass spectroscopy is essential to study neutron rich nuclei near and beyond neutron drip line. Recently, Coulomb breakup measurements of $^{19}$B and $^{22}$C, and study of the unbound nucleus $^{26}$O were performed at RIBF. Goal of the Coulomb breakup measurements is to study di-neutron like correlation, while $^{26}$O is interesting as a candidate of two neutron radioactivity. In these measurements, decay products, $^{24}$O and two neutrons from $^{26}$O, for example, are detected in coincidence by SAMURAI spectrometer. The neutrons are detected by large acceptance plastic scintillator array NEBULA. If a neutron scatters twice or more, this may cause a fake signal (crosstalk), and become a background. The crosstalk background can be eliminated by causality cut using time, position, pulse height information. The cut condition is investigated by a Monte-Carlo simulation based on the Geant4 tool kit to obtain high detection efficiency with small crosstalk background. The simulation is compared with experimental data of quasi-monoenergetic neutrons at 200 MeV and 250 MeV produced in the $^7$Li(p,n)$^7$Be(g.s.+0.43 MeV) reaction. A new algorithm of crosstalk cut will also be discussed.

Jyunichi Tsubota
Tokyo Institute of Technology

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