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Development of the Advanced Multi-neutron Detection Array for the study of multi-neutron clusters

Structure and correlations of nuclei at and beyond the neutron drip line have attracted lots of attention in the last decades [1,2]. Strongly correlated neutrons may also form neutron clusters (e.g., n, 4n). Despite many experimental and theoretical efforts, the properties of these neutron clusters still remain elusive [3,4].

To study the structure of extremely neutron-rich nuclei and the correlations among constituent neutrons, we are now developing the Multi-neutron Detection Array (AMDA), aiming for high-resolution and high-efficiency multi-neutron detection. A prototype detector array was built based on BC408 plastic scintillators, whose performance was evaluated with cosmic ray test and proton beam irradiation as well. The time resolution of which has reached relatively high level (~150 ps). We have also developed a neural network-based multi-neutron identification algorithm, which significantly improved the four-neutron detection efficiency (>10 times) compared with the traditional algorithm.

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