



Contribution ID: 26

Type: 2.Parallel session talk

Multi-neutron Detection Based on Machine Learning

Thursday, 26 September 2024 16:50 (20 minutes)

The structure of neutron-rich nuclei in the neutron-drip-line region is one of the frontiers of nuclear physics. By directly detecting the neutrons emitted during their decay, the structure and multi-neutron correlations of the nucleus can be investigated, which is not only important for advancing our understanding of the structure and interactions of the finite nuclei, but also helps to gain new insights into the properties of neutron-rich matter.

One essential yet challenging task for multi-neutron detection experiments is to distinguish true multi-neutron events from the background signals (so-called crosstalks). A neural network-based multi-neutron identification algorithm is developed, which significantly improves the four-neutron detection efficiency (>10 times) compared with the traditional algorithm while keeping the energy resolution at a comparable level.

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Session Classification: Parallel 6: Few-body aspects of nuclear physics and nuclear astrophysics

Track Classification: Few-body aspects of nuclear physics and nuclear astrophysics