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Machine Learning and Particle Identification for Neutron-Unbound Studies at FRIB

A. Wantz, Michigan State University – Particle identification is a critical task when performing measurements involving rare isotope beams. Invariant mass spectroscopy for the study of neutron-unbound states, the focus of the MoNA Collaboration, requires that the fragments resulting from the decay of the unbound states be accurately identified. These measurements necessitate deconvolving the flight time and emittance parameters for ions deflected by the Sweeper magnet in order to identify the products of individual reaction channels. For the first time, machine learning approaches are being pursued to streamline this step of the analysis. The Toolkit for Multivariate Analysis (TMVA), which is included within the analysis tool ROOT, was used. Both experimental data and simulation produced with NPTool (a ROOT-and-GEANT4-based tool) were used for training and evaluating the performance of machine learning algorithms. Classification and regression algorithms were applied to test their particle identification capabilities. The primary methods used for training were the deep neural network and the multilayer perceptron. A comparison of various methods of particle identification will be presented.

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