Exploring AI Techniques for ALERT Tracking

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Abstract

A series of experiments were proposed to study the fundamental structure of light nuclei, such as ${}^2H$ and ${}^4He$. The program focuses on the exploration of the nuclear Generalized Parton Distributions (GPDs), EMC effects, as well as the nature and origin of nuclear effects. The key feature of these measurements is the challenging detection of the low-momentum recoil particles in a large kinematic range ($1 < Q^2 < 7GeV^2$, $0.1 < x_B < 0.7$). For this purpose, A Low Energy Recoil Tracker (ALERT) is being built to work in conjunction with the CLAS12 spectrometer to measure recoil fragments with momenta as low as 70 MeV/c. The ALERT detector consists of a low gain stereo drift chamber and a scintillator array allowing reliable separation of ${}^4He$, ${}^3He$, ${}^3H$, deuterons, and protons. Implementation of new artificial intelligence (AI) track reconstruction methods are proven to be beneficial for experiments conducted at high instantaneous luminosities in which the number of background hits is significantly increased. The improved tracking accuracy and overall particle identification that can be achieved with modern machine-learning techniques are crucial for these experiments. In this talk, a brief highlight of the ALERT program will be given along with the status of the AI-assisted tracking under development.

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