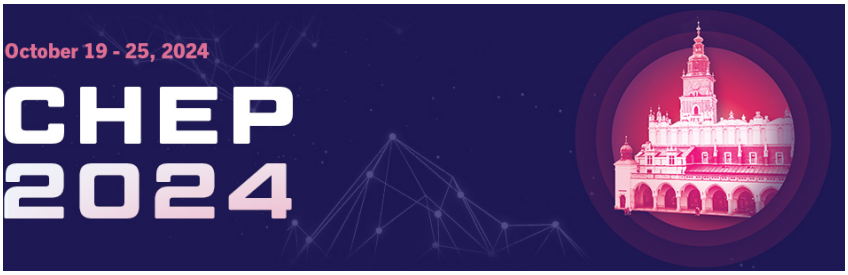

Contribution ID: **271** Type: **Talk**

ML-Assisted Charged Particle Tracking at GlueX

Wednesday 23 October 2024 14:24 (18 minutes)

Tracking charged particles resulting from collisions in the presence of strong magnetic field is an important and challenging problem. Reconstructing the tracks from the hits created by those generated particles on the detector layers via ionization energy deposits is traditionally achieved through Kalman filters that scale worse than linearly as the number of hits grow. To improve efficiency there is a need for developing new tracking methods. Machine Learning (ML) has been leveraged in several science applications for both speedups and improved results. To this line, a class of ML algorithms called Graph Neural Networks (GNNs) are explored for charged particle tracking. Each event in the particle tracking data naturally imposes itself as a graph structure with the event hits represented as graph nodes while track segments are represented as a subset of the graph edges that need to be correctly classified by the ML algorithm. We compare three different approaches for tracking at GlueX experiment at Jefferson Lab, namely traditional track finding, GPU-based GNN, and FPGA-based GNN. The comparison is held in terms of inference time and performance results. Beside presenting data processing, graph construction, and the used GNN model, we provide insight into resolving the missing hits issue for GNN training and evaluation. We show that the GNN model can achieve significant speedup by processing multiple events in batches which exploits the high parallel computation capability of GPUs. We present results on real GlueX data in addition to the collective results of the simulation data.

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