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Tracking for the next ATLAS event filter with GNNs on GPUs

Graph Neural Networks (GNNs) have been in the focus of machine-learning-based track reconstruction for high-energy physics experiments during the last years. Within ATLAS, the GNN4ITk group has investigated this type of algorithm for track reconstruction at the High-Luminosity LHC (HL-LHC) using the future full-silicon Inner Tracker (ITk).

The Event Filter (EF) is part of the ATLAS Trigger and Data Acquisition (TDAQ) system and will consist of a computing farm that runs a limited set of event reconstruction algorithms to provide the accept/reject decision for offline storage. The decision on the system design choice for the EF farm is scheduled for late 2025.

We are exploring the use of the GNN4ITk track-finding approach alongside other tracking tools from the open-source ACTS (A Common Tracking Software) toolkit to develop a candidate pipeline targeting GPU hardware aimed at meeting the ATLAS Event Filter throughput and physics performance goals.

We will present the implementation strategy, optimizations and computing performance results, as well as the track reconstruction performance for the proposed candidate pipeline.

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