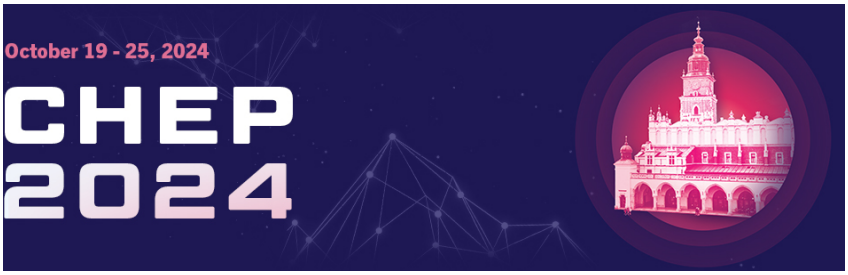

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Prospects for novel track reconstruction algorithms based on Graph Neural Network models using telescope detector testbed

Tuesday 22 October 2024 16:51 (18 minutes)

The upcoming upgrades of LHC experiments and next-generation FCC (Future Circular Collider) machines will again change the definition of big data for the HEP environment. The ability to effectively analyse and interpret complex, interconnected data structures will be vital. This presentation will delve into the innovative realm of Graph Neural Networks (GNNs). This powerful tool extends traditional deep learning techniques to handle graph-structured data and may provide new and fast algorithms for track reconstruction in both the 3D and 4D domains.

Projecting challenging task of track reconstruction, especially challenging in harsh hadronic environment, into non-Euclidean domain of GNNs may leverage the intrinsic structure of graph data to extract addition crucial features and patterns that are either difficult or impossible for traditional statistical or intelligent reconstruction algorithms.

We present our initial studies using various GNN models implemented within the ACTS (A Common Tracking Software Project) framework. In our studies, we created a telescope detector that resembles an LHCb silicon vertex locator and used toy-generated data with truth information. Using such simulated setup, we were able to successfully train several GDN models to perform track reconstruction tasks. Based on these initial results, we performed preliminary studies to obtain efficiencies and resolutions for selected kinematical variables.

Our preliminary studies are very promising and show significant potential for using GDNs models as track reconstruction engines for future LHC upgrades and beyond.

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