

Physics and Computing Performance of the Exa.TrkX TrackML Pipeline

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The Exa.TrkX project has applied geometric learning concepts such as metric learning and graph neural networks to HEP particle tracking. The Exa.TrkX tracking pipeline clusters detector measurements to form track candidates and selects track candidates with competitive efficiency and purity. The pipeline, originally developed using the TrackML dataset (a simulation of an LHC-like tracking detector), has been demonstrated on various detectors, including the DUNE LArTPC and the CMS High-Granularity Calorimeter. This paper documents new developments which were needed to study the physics and computing performance of the Exa.TrkX pipeline on the full TrackML dataset, a first step towards validating the pipeline using ATLAS and CMS data. The pipeline achieves tracking efficiency and purity similar to production tracking algorithms. Crucially for HL-LHC and future collider applications, the pipeline benefits significantly from GPU acceleration, and its computational requirements scale close to linearly with the number of particles in the event.

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