



Contribution ID: 6

Type: **Plenary**

ACTS Vertexing and Deep Learning Vertex Finding

Wednesday, April 22, 2020 3:30 PM (15 minutes)

The reconstruction of particle trajectories and their associated vertices is an essential task in the event reconstruction of most high energy physics experiments.

In order to maintain or even improve upon the current performance of tracking and vertexing algorithms under the upcoming challenges of increasing energies and ever increasing luminosities in the future, major software upgrades are required.

Based on the well-tested ATLAS tracking and vertexing software, ACTS (*A Common Tracking Software*) aims to provide a modern, experiment-independent set of track- and vertex reconstruction software, specifically designed for parallel execution.

Exploiting modern software concepts, thread-safe implementations of iterative and multi-adaptive primary vertex finding algorithms, as well as a full Billoir vertex fitter, Z-Scan- and Gaussian track density seed finder, are available in ACTS and being deployed in the multi-threaded version of the ATLAS software framework AthenaMT.

In addition to these computationally optimized reimplementations of classical primary vertexing algorithms, all of which have been validated against the original ATLAS implementations, ACTS provides a solid code base for evaluating new approaches to primary vertex finding, such as applications of sophisticated deep learning methods.

Associating tracks to the correct vertex candidate is a crucial step in vertexing and will become even more important in the high-pileup environments expected for HL-LHC or FCC-hh in order not to merge close-by vertices.

Learning a track representation in an embedding space in such a way that tracks emerging from a common vertex are close together while tracks from neighboring vertices are further separated from one another allows for the determination of a similarity score between a pair of tracks.

Constructing undirected, edge-weighted graphs from these results allows the subsequent usage of classical graph algorithms or graph neural networks for clustering tracks to vertex candidates.

The current status of the ACTS vertexing as well as new results on deep learning approaches to vertex finding will be presented in this talk.

Consider for young scientist forum (Student or postdoc speaker)

Yes

Second most appropriate track (if necessary)

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Session Classification: Recording sessions