



Contribution ID: 14

Type: Poster

Towards Fast Displaced Vertex Finding

Many standard model extensions predict long-lived massive particles that can be detected by looking for displaced decay vertices in the inner detector volume. Current approaches to seek for these events in high-energy particle collisions rely on the presence of additional energetic signatures to make an online selection during data-taking. Enabling trigger-level reconstruction of displaced vertices would strongly enhance the reach of such searches.

A proposed strategy is to exploit machine learning techniques to reconstruct approximate vertex positions from raw detector hits. In particular, a two-step procedure would first reconstruct the primary interaction position and exploit trigger-level objects, such as high energy muons, to define a region of interest. The second step would also use the raw detector hits to search for a displaced vertex.

This work focuses on the first step of approximating the location of the primary vertex in an idealised detector geometry using dense neural networks for regression. Properties of vertex reconstruction, such as position resolution and dependency on pile-up interactions will be discussed. Finally, future work will be tackled, including promising approaches for displaced vertex reconstruction given a limited search area.

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Track Classification: 1: Machine learning, algorithms and theoretical analysis