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Time-of-Flight Estimation using Machine Learning Techniques

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Time-of-flight (TOF) reconstruction is under investigation as a method to enhance the particle identification capabilities of detectors proposed for future Higgs factories. By utilising time measurements based on energy deposits of showers in the calorimeter system, the TOF of the particle can be inferred. The focus of our studies is the International Large Detector (ILD), a proposed detector for operation at a future Higgs factory.

Since the current TOF estimator used by ILD can only extract information from a limited number of calorimeter hits, we propose to use machine learning (ML) algorithms that are able to operate on a significantly increased fraction of hits in the shower and thereby access additional information.

Results will be presented for a convolutional neural network and a network using equivariant point cloud (EPiC) layers, operating on calorimeter showers represented as point clouds combined with track feature information. A comparison to the existing TOF estimator will highlight the significant improvements achieved.

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