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Development of particle flow algorithm with GNN for Higgs factories

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Electron-positron Higgs factories such as ILC or FCCee aim to reveal properties of Higgs and other particles much more precise than current knowledge. One of the key concepts of detectors for Higgs factories is Particle Flow, which utilizes highly-segmented calorimeter cells to separate each particle inside hadronic jets, giving much better jet energy resolution by replacing energies of clusters by charged particles to track momenta. We are working on improving the particle flow algorithm for Higgs factories by utilizing modern machine-learning technologies. We start from Graph Neural Network (GNN)-based algorithm developed in the context of CMS HGCALE clustering. It utilizes GravNet as the GNN architecture and Object Condensation loss function for training. Since the HGCALE algorithm only performs clustering at the calorimeter, we developed track-cluster matching feature inside the network to realize full PFA with this algorithm. Details of initial implementation of the track-cluster matching algorithm as well as performance evaluation with multiple tau events and jet events will be shown in the presentation.

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