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Point Cloud Deep Learning Methods for Pion Reconstruction in the ATLAS Detector

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Reconstructing the type and energy of isolated pions from the ATLAS calorimeters is a key step in the hadronic reconstruction. The baseline methods for local hadronic calibration were optimized early in the lifetime of the ATLAS experiment. Recently, image-based deep learning techniques demonstrated significant improvements over the performance over these traditional techniques. We present an extension of that work using point cloud methods that do not require calorimeter clusters or particle tracks to be projected onto a fixed and regular grid. Instead, transformer, deep sets, and graph neural network architectures are used to process calorimeter clusters and particle tracks as point clouds. We demonstrate the performance of these new approaches as an important step towards a full deep learning-based low-level hadronic reconstruction.

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