

# Application of DeepSets Machine Learning in FPGA to Improve the ATLAS L0 Global Trigger for HL-LHC

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The ATLAS detector is a general purpose detector at the Large Hadron Collider (LHC) that investigates a variety of physics, ranging from Higgs boson to possible particles that make up of dark matter. The LHC will be upgraded to become High-Luminosity LHC (HL-LHC) at the end of this decade, and in subsequent run periods a high-pileup environment resulting in up to 200 events per proton-proton collision bunch-crossing is expected. A more efficient trigger system in ATLAS is required to identify and calibrate the different physics objects in this high-pileup environment. Previous offline studies has shown that machine learning like GNN and DeepSets performs much better in identifying particle shower types and calibrating energy in the calorimeter compared to the existing architecture in the detector. The possible utilization of the DeepSets machine learning model for this calibration process in the online trigger is now being explored. Our DeepSets calibration model is being optimized to improve energy resolution while minimizing resources and latency. A first potential implementation proposal for inclusion in the Level-0 (L0) Global trigger in ATLAS will be discussed.

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