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Deep learning assisted unbinned measurements of jet substructure observables with the H1 detector

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The radiation pattern within quark- and gluon-initiated jets (jet substructure) is used extensively as a precision probe of the strong force and for optimizing event generators for particle physics. Jet substructure measurements in electron-proton collisions are of particular interest as many of the complications present at hadron colliders are absent.

In this contribution, a detailed study of jet substructure observables, so-called jet angularities, are presented using data recorded by the H1 detector at HERA. The measurement is unbinned and multi-dimensional, using a novel machine learning technique to correct for detector effects. All of the available reconstructed object information inside a jet is interpreted using a graph neural network and training of these networks was performed using the Perlmutter supercomputer at Berkeley Lab. Results are reported at high transverse momentum transfer $Q^2 > 150$ GeV^2, and the analysis is also performed in sub-regions of Q^2, thus probing scale dependencies of the substructure variables.

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