Contribution ID: **207**   Type: **Oral**

End-to-end particle and event identification for regular and boosted topologies with CMS Open Data

Tuesday, 21 May 2019 16:40 (20 minutes)

From particle identification to the discovery of the Higgs boson, neural network algorithms have become an increasingly important tool for data analysis at the Large Hadron Collider. We present a novel approach to event and particle identification, called end-to-end deep learning, that combines deep learning image classification algorithms with low-level detector representation. Using two physics examples as references: quark and gluon discrimination and top quark jet tagging, we demonstrate the performance of the end-to-end approach using high-fidelity detector simulations from the CMS Open Data. Additionally, we explore the relevance of the information collected from various sub-detectors and describe how end-to-end techniques can be useful for full-event interpretation.

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Session Classification: Machine Learning, Big Data and Quantum Information

Track Classification: Machine Learning, Big Data and Quantum Information