Title: Exploring jet calibration and jet tagging with machine learning techniques

Author: Bc. Patrik Novotný

Institute: Institute of Particle and Nuclear Physics

Supervisor: Mgr. Martin Rybář, Ph.D., Institute of Particle and Nuclear Physics

Abstract: The presented thesis has two goals. First, it aims to improve the energy calibration of jets, collimated sprays of particles measured in the ATLAS experiment. Jets are considered to be a powerful tool for studying the properties of the quark-gluon plasma produced in heavy-ion collisions at the LHC. Apart from the kinematics properties of the jet, a key information that might play a role in the interaction of jets with the quark-gluon plasma is the "flavor" of the initiating hard parton. The classification of jets according to flavor is the second of the research aims. The work in the thesis explores using various machine learning techniques contained in the TensorFlow and cuML software libraries, which allow computations to be performed on graphics cards to address these two goals. The variables investigated are six variables related to the kinematics of the jet and 24 variables related to the energy deposited in different parts of the ATLAS detector. The differences between the various machine learning models and their settings are extensively discussed.

Keywords: ATLAS, heavy ions, jet energy calibration, cuML, TensorFlow