Search for BSM physics with Emerging Jets and the ATLAS detector during Run-3 && Development of a new calibration technic for large-R jets using a DNN

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"In the framework of the ATLAS Run-3 data-taking period, an early-data analysis targeting emerging jets is in preparation. This analysis is the first effort to study this signature in the ATLAS collaboration.
Emerging jets are part of a global Beyond the Standard Model (BSM) theory called Dark QCD. This BSM theory predicts the existence of a new dark sector : containing QCD-like particles and interactions, that is seperated from the Standard Model (SM), but accessible through a portal productible in proton-proton collisions at LHC. In addition, Emerging jets model predict that dark particles produced at LHC can decay back to the Standard Model with a long lifetime, leading to displaced objects (tracks, vertices) in the ATLAS detector. This leads to a highly exotic type of signature that until recently was poorly studied. This Run-3 analysis will benefit from a new trigger dedicated to this signature and software upgrades for large radius objects reconstruction. An overview of the current state of this analysis will be presented.

Preliminary studies made by Pierre-Antoine Delsart have shown very promising performances when using deep neural network (DNN) for the calibration of the energy and mass of large-R jets. Since Nov. 2021, we've been developing a new official method for calibrating large-R jets in ATLAS using a DNN. The main goal was to find a DNN setup (architecture, loss, training procedure) that is capable of predicting simultaneously the energy and mass calibrations which need to be applied to any reconstructed large-R jet. Different key aspects linked to the underlying jet physics made this more complex than a simple regression problem (detector geometry, energy/mass response of the detector, jet's topologies, …). An overview of the current state of this project will be presented."