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PF hadron calibration

To analyze high-energy collisions that occur in the CMS detector, the particles that come from these collision events need to be identified and reconstructed. This process is done by using the particle-flow (PF) reconstruction algorithm.

The energy response of the CMS detector to particles is non-linear. This effect is particularly prominent for PF hadrons. Hadrons are categorized into EH-hadrons that start their shower in the ECAL and H-hadrons starting to shower in the HCAL. In order to correct for the energy dependent effect, we define calibrated energy as functions of the energy deposited in each calorimeter corrected by an introduced parameter, as well as taking into account the true energy of the particles.

$E_{\text{calibrated}}|_{\text{EH-hadrons}} = a\ E_e + b\ E_h + 3.5\ \text{GeV}$

$E_{\text{calibrated}}|_{\text{H-hadrons}} = c\ E_h + 2.5\ \text{GeV}$

The calibration constants a, b and c are determined by an analytic χ^2 minimization, taking into account the true energy of the particles. These coefficients are obtained by simulating single pion events with the same detector conditions and low-level calibrations that are used for central collision event production in physics analyses.

Due to the calibrated energy dependence with pseudorapidity η, once the energy calibration has been done, we have to correct the residual η dependence as well. In both calibrations, it is necessary to take into account the different parts of the detector - barrel and endcap - and calibrate them separately.

Two different frameworks have been developed by the CMS collaboration to calculate the corrected energies: online and offline. Currently, they provide different results. The goal of this work is to achieve the same results for both frameworks. That is done by looking for the differences in both frameworks, and trying to make them as compatible as possible.

The calibration codes of both frameworks use some set of NTuples that contain all variables for the different events, and those NTuples seem to be different for the online and offline codes: there is a huge tail for low E_{true} when we represent the 2D histogram $(Ecal + Hcal)/E_{\text{true}}$ vs E_{true} in the case of online NTuples, that is not present for offline NTuples.

Type of contribution

Poster

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