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Ring-shaped Calorimetry Information for a Neural e/γ Identification with ATLAS Detector

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After the successful operation of the Large Hadron Collider resulting with the discovery of the Higgs boson, a new data-taking period (Run 2) has started. For the first time, collisions are produced with energies of 13 TeV in the centre of mass. It is foreseen the luminosity increase, reaching values as high as $10^{34} cm^{-2} s^{-1}$ yet in 2015. These changes in experimental conditions bring a proper environment for possible new physics key-findings.

ATLAS is the largest LHC detector and was designed for general-purpose physics studies. Many potential physics channels have electrons or photons in their final states. For efficient studies on these channels precise measurement and identification of such particles is necessary. The identification task consists of disentangling those particles (signal) from collimated hadronic jets (background). Reported work concerns the identification process based on the calorimetric quantities.

We propose the usage of ring-shaped calorimetry information, which explores the shower shape propagation throughout the calorimeter. This information is fed into a multivariate discriminator, currently an artificial neural network, responsible for hypothesis testing. The proposal is taken into account for both the Offline Reconstruction environment performed after data storage as well as the Online Trigger, used for reducing storage rate into viable levels while preserving collision events containing desired signals. . Specifically, this ring description for calorimeter data may be used in the ATLAS High-Level Trigger.

Specifically, this ring description for calorimeter data may be used in the ATLAS High-Level Trigger as a calorimeter-based preselection at the first step in the trigger chain. Preliminary studies on Monte Carlo suggest that the fake rate can be reduced by as much as 50% over the current methods used in the High-Level Trigger, allowing for high-latency reconstruction algorithms such as tracking to run over regions of interest at a later stage of the trigger.

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