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Study of gamma/hadron discriminant variables in application to high-energy cosmic-ray air showers

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Identification of the primary cosmic rays on an event-by-event basis stands as one of the main goals for any cosmic-ray observatory. Several cosmic-ray air-shower experiments use photon tags for gamma/hadron primary particle discrimination. These photon tag variables, for example Ptail or Sb, are easily built from the total signals measured in an array of detectors and are correlated with the total number of muons in the air shower. This work shows a study of the Ptail discriminant variable and its comparison with the Sb variable for simulated showers with energy about 10^{17} eV. The simulations were performed for the detectors of the Infill array of the Pierre Auger Observatory (433m-spaced detectors). For application to the Pierre Auger Observatory the time-based analysis was introduced for the Ptail discriminant, the detector traces (the signal time distributions) were used in the analysis instead of just the total signal. As the variables discussed are based on signals and traces, which can be directly measured in real data, they can be used as the discriminant variables in the real cosmic ray experiments.

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