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Study of residual artificial neural network for PID using the CEPC AHCAL

The CEPC Analogue Hadronic Calorimeter (AHCAL) prototype utilizes a $40 \times 18 \times 18$ array of scintillator tiles and Silicon Photomultipliers (SiPMs) as sensitive cells. In the context of such high granularity, we propose a novel Particle Identification (PID) method which employs the Artificial Neural Networks (ANN) with a Residual Network (ResNet) architecture to discriminate hadron events from muon and electron events in AHCAL. Both Geant4 simulation samples and test beam data collected at CERN SPS-H2 and PS-T9 beamlines are used to compare it with PID based on Boosted Decision Trees (BDT). We observe a significant improvement in the pion signal efficiency and background rejection rate. These findings highlight the prospects of ANN in PID tasks not only for high-granularity calorimeters but also for physics detectors featured in sensitive high-density arrays.

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