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Multivariate Analysis for particle identification in a Highly Granularity Semi-Digital Hadronic Calorimeter for ILC Experiments

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The Semi-Digital Hadronic CALorimeter(SDHCAL) using Glass Resistive Plate Chambers (GRPCs) is one of the two hadronic calorimeter options proposed by the ILD (International Large Detector) project for the future (ILC) International Linear Collider experiments.
It is a sampling calorimeter with 48 layers. Each layer has a size of 1 m^2 and finely segmented into cells of 1 cm^2 ensuring a high granularity which is required for the application of the Particle Flow Algorithm (PFA) in order to improve the jet energy resolution which is the corner stone of ILC experiments.
The electronic of SDHCAL provide 2-bit readout. It is equiped with power pulisng mode reducing the power consumption and thus heating related problems.
The performance of the SDHCAL technological prototype was tested successfully in beam tests several times at CERN during 2012, 2014 and 2015.
The pion test beam data taken at CERN suffers from a significant contamination of muons and electrons which should be drastically reduced in order to study the hadronic showers, and reconstruct their energy. In this purpose, a selection based on a simple cut on a topological variables is applied to single out the pions.
Furthermore, in order to achieve better results in particle identification, several MultiVariate methods, provided by TMVA toolkit, were tested on Monte Carlo simulation.
The main classification methods used to separate the signal from the background events were the Neural Network method with the Multivariate Perceptron class (MLP) and the Boosted Decision Tree method.
A comparison of MVA based cuts with the traditional cuts will be shown and discussed. Preliminary tests indicate this technique is promising and can be reliable for the real data analysis.

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