

Identification of low-energy antiprotons on pi-meson background using machine learning methods in PAMELA experiment

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One of main tasks in PAMELA experiment is identification of cosmic ray (CR) antiprotons on different kinds of background. One example of such background at low energies are pi-meson particles which are generated in elements of spectrometer construction by high-energy CR protons. We propose an approach based on machine learning methods, in particular, Support Vector Machines (SVM). We use two different sets of features for classification: track system features (12 measurements of ionization energy losses along particle track) and calorimeter features (different combinations of energy release inside calorimeter along reconstructed particle trajectory).

Constructed classifier showed classification accuracy of 96% for antiprotons and 89% for pi-mesons when rigidity R is up to 2 GeV. When $R \in (2, 5]$ classification accuracy for pi-mesons is 15%. For evaluation of classification accuracy we used k-fold cross-validation method with $k = 5$.

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