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Study of the response to antiprotons from HEPD-02 on CSES-02

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The China Seismo-Electromagnetic Satellite (CSES) mission is a collaborative effort between China and Italy aimed at building a constellation of multi-payload space observatories dedicated to studying Earth's geophysical properties from space using non-imaging remote sensing methods. The project seeks to develop a network of small satellites that continuously gather data from the entire surface of the planet to characterize the spatial-temporal behavior of electromagnetic fields, particle fluxes and plasma composition within the iono-magnetospheric system. The primary objective of this space program is to investigate and validate lithosphere-atmosphere-ionosphere-magnetosphere coupling mechanisms that induce perturbations in the upper ionosphere and the lower boundary of the radiation belts.

By doing so, CSES also provides an excellent opportunity to study the magnetosphere, the heliosphere and the cosmic radiation reaching Earth. Protons and antiprotons play a fundamental role in particle physics and cosmology, offering insights into matter-antimatter asymmetry and annihilation processes. In the low kinetic energy region (< 50 MeV), CSES covers a range which are not accessible to other cosmic ray detectors. This motivated an investigation about possible distinctive signatures of antiprotons: we performed Monte Carlo simulation, applying specific selection criteria.

We simulated beam spots at different energies and spectra (monochromatic and flat) in the 1–20,000 MeV range, generating approximately 10,000 events along the Z-axis for protons and antiprotons. The analysis focused on comparing the total deposited energy in the calorimeter and trigger planes, along with additional observables such as the cluster size, which represents the number of activated pixels in the tracker planes, and the χ^2, which assess the quality of the track reconstruction. These parameters were examined to identify potential differences between protons and antiprotons, contributing to the optimization of the selection criteria for their discrimination.

Eligibility for "Best presentation for young researcher" or "Best poster for young researcher" prize

Yes

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