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An innovative technique for direct Cosmic Ray Detection based on the Monolithic Active Pixel Sensors tracker of HEPD-02

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MAPS are silicon-based solid-state detectors used in high-energy physics experiments, such as the Inner Tracking System of the ALICE experiment at CERN, used for their high granularity and minimal material budget. Here we present the first application of this technology to a spaceborne detector, the High Energy Particle Detector (HEPD-02), scheduled for launch during 2025 onboard the China Seismo-Electromagnetic Satellite (CSES-02) mission.
The main novelty of HEPD-02 compared to past experiments is the first space application of ALTAI MAPS in the tracker system, whose main advantage is the digital read-out circuit integrated on the same silicon substrate.
The tracker system of HEPD-02 consists of 80 Mpixel divided in three layers, covering a region of 15 cm x 15 cm.
The high-granularity of the ALTAI MAPS-based tracker, with its 5 μm single-hit resolution, allows antimatter studies, since it is able to provide the reconstruction of the annihilation process, crucial for discriminating matter from antimatter.
This unprecedented granularity enables the potential detection of low-energy antimatter (p-bar or d-bar) annihilations in the 10–30 MeV/n range, a region unexplored by any current or past experiment, such as BESS-Polar II.
This contribution wants to highlight, from a detector perspective, a new experimental technique usage of MAPS-based tracking technology for the direct detection of antimatter in space.

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

Yes

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