

The innovative particle tracker for the HEPD space experiment onboard the CSES-02

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China Seismo-Electromagnetic Satellites are the most advanced initiative for the study of the ionosphere-lithosphere coupling from space. They are sensitive to any type of short- to long-lasting perturbations in the ionosphere, thanks to the variety of instruments that they host on board. Among them, the High-Energy Particle Detector is devoted to the observation of electrons and protons with energy thresholds of 3 MeV and 30 MeV respectively. The Limadou collaboration has designed an improved version of the HEPD for the second satellite of the CSES constellation, whose launch is scheduled for mid-2022. The main upgrade pertains to the tracker, which will be made of Monolithic Active Pixel Sensors, never used so far in space. With respect to the standard hybrid silicon microstrip technology, MAPS are more precise, more robust, easier to control and readout, cheaper and less invasive. On the other hand, they are still relatively small-sized and power-demanding.

We report on the process of spatialisation carried out by the HEPD-02 tracker team, which has adapted the operation mode of the ALPIDE sensor to realize a modular and compact particle detector, made of 5 turrets, each one containing 3 stacked sensitive planes. All of 150 ALPIDE sensors are controlled and readout with a Hybrid Integrated Circuit and supported by Carbon Fiber Reinforced Plastics staves, housed in an aluminium case. We describe in detail the HEPD-02 tracker project, demonstrating the advantages of using MAPS in space and manifesting the pioneering nature of the project for next-future larger size space missions.

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Collaboration

other (fill field below)

other Collaboration

CSES-Limadou

Subcategory

Experimental Methods & Instrumentation

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