

The HEPD-02 cosmic-ray experiment ready for flight on-board the CSES-02 satellite.

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The High Energy Particle Detector (HEPD-02) is primarily devoted to observe fluxes of cosmic-ray electrons, protons and light nuclei, with kinetic energies in the MeV range –up to a few hundreds. HEPD-02 will be hosted on-board the China Seismo-Electromagnetic Satellite CSES-02, on a quasi-polar, low-Earth orbit; the launch is currently foreseen in December 2024.

The CSES mission, coordinated by China National Space Administration (CNSA) and Italian Space Agency (ASI), aims at developing a series of satellites for studying the near-Earth environment, by means of electromagnetic, ionospheric, magnetospheric and cosmic-ray observations. The first High Energy Particle Detector (HEPD-01) has been launched in 2018 with the CSES-01 satellite.

HEPD-02 is a state-of-the-art instrument for the identification of various particle species, measuring their energy and arrival direction. Several improvements were applied with respect to HEPD-01, in an effort to optimize the measurement quality, while satisfying multiple requirements for on-satellite operation: size, weight, power and data bandwidth limitations, mechanical robustness, operation between -10 °C and +35 °C in high vacuum, compatibility with radiation effects, adequate failure mitigation to guarantee at least 6 years of in-flight operation.

The core of HEPD-02 is a tower of superposed plastic and crystal scintillator layers, surrounded by containment planes on lateral and bottom sides, all read-out by PMTs for acquisition triggering and measuring particle energy and range. On the top part of the tower, a tracking system with monolithic active pixel sensors (MAPS) constitutes the first ever satellite application of this technology.

Technical tests have been performed according to space qualification requirements, in particular to assess immunity from mechanical stresses at launch, operation in expected temperature/pressure environment and electromagnetic compatibility with satellite instrumentation. Beam tests have been executed to evaluate scientific performances with different particle species and energies.

Collaboration

CSES/Limadou collaboration.

Role of Submitter

I am the presenter

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