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The High Energy Particle Detector ready to fly onboard CSES-02

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The China Seismo-Electromagnetic Satellite (CSES) space mission foresees a constellation of satellites devoted to the study of plasma, electromagnetic fields and particles perturbations potentially correlated with the occurrence of seismic events.

Like the first satellite, launched in February 2018, CSES-02 hosts several payloads, among which the Italian High Energy Particle Detector (HEPD).

Besides the study of bursts of Van Allen belt electron fluxes (particle precipitation) generated by high magnitude earthquakes, HEPD-02 will contribute to the study of the solar terrestrial environment, Solar Energetic Particle (SEP) events and low-energy galactic cosmic rays.

For this purpose, the instrument comprises several subdetectors, with major improvements with respect to the first one: the Direction Detector, the first silicon-pixel tracker ever designed for space, an improved trigger system, providing trigger pre-scaling and concurrent trigger configurations, a calorimeter, composed of a tower of plastic scintillators followed by an array of LYSO crystal and surrounded by a Veto system, and the Housekeeping system, with increased detector configurability and active monitoring.

Thanks to the simultaneous trigger configurations and prescaling capability, HEPD-02 will be able to perform measurements of the different particles that populate distinct orbital zones and whose flux can vary by many orders of magnitude, as well as to detect impulsive events, making it a perfect instrument for Space Weather purposes. Furthermore, a dedicated trigger algorithm exploiting the LYSO crystals extends its detection capability to gamma rays in the 2-20 MeV range.

HEPD-02, after a large test campaign for the space qualification and calibration, has been installed on satellite with the other payloads and is currently undergoing the tests at satellite level before launch, scheduled for December 2024.

In this contribution I will describe the instrument, focusing on its improved design, and the test campaign for the instrument space qualification and calibration.

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