

The High-Energy Particle Detector (HEPD-01) as a space weather monitoring instrument on board the CSES-01 satellite

Francesco Palma

on behalf of the LIMADOU-HEPD Collaboration

francesco.palma@roma2.infn.it



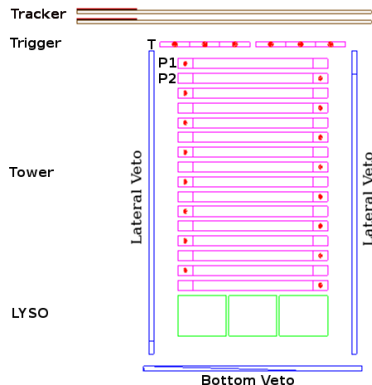
INFN-Sezione di Roma Tor Vergata
V. della Ricerca Scientifica 1, I-00133 Rome, Italy
At ASI Space Science Data Center (SSDC) also
V. del Politecnico, I-00133 Rome, Italy

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- ▶ Magnetic storms belong to a set of phenomena known collectively as *space weather*;
- ▶ Magnetic storms represent major signatures of variability in the Sun-Earth interaction and can severely impact infrastructures at the ground level and in space, also posing a hazard to human health;
- ▶ On 20th August 2018, a large-scale filament gradually erupted from a quiet region of the Sun into an interplanetary coronal mass ejection that affected the Earth's environment a few days later, starting **on late 25th August 2018** and giving rise to the **third largest geomagnetic storm of Solar Cycle 24**;
- ▶ The magnetospheric disturbance was **strong enough to trigger a response in the High-Energy Particle Detector (HEPD-01)** on board the China Seismo-Electromagnetic Satellite (CSES-01).

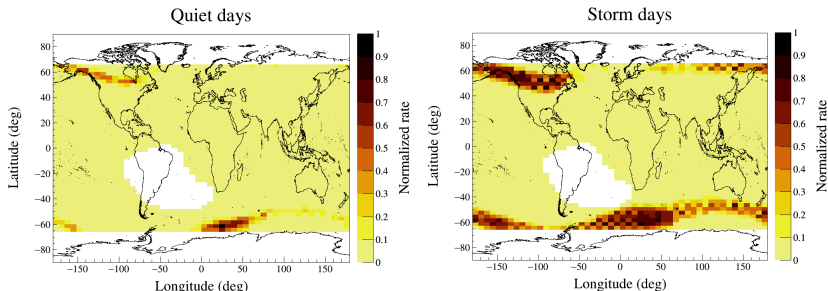
The HEPD-01 detector is made up of:

- ▶ a silicon **tracking system**;
- ▶ a **trigger system** including one plastic scintillator layer segmented into six paddles;
- ▶ a **range calorimeter** comprising a tower of 16 plastic scintillator planes and a matrix of 3×3 LYSO (lutetium–yttrium oxyorthosilicate) scintillator crystals;
- ▶ an **anti-coincidence system** equipped with 5 plastic scintillator planes.



Schematic of the HEPD-01 detector

An increase in HEPD-01 count rate was observed at **both northern and southern latitudes**—especially in the southern region—as a consequence of the storm's arrival.

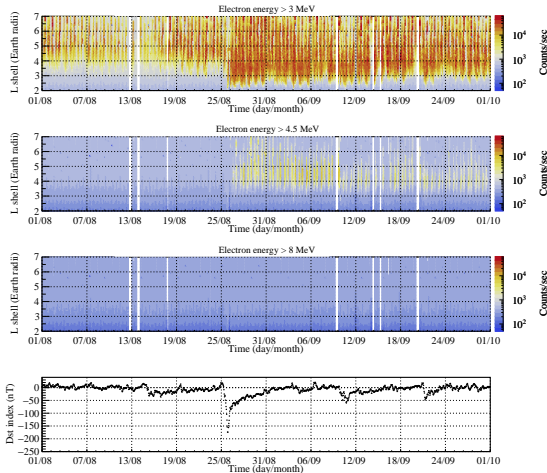


HEPD-01 trigger rate map before the impact of the storm (20th-23rd August)

HEPD-01 trigger rate map after the impact of the storm (25th-27th August)

Both maps are related to the trigger configuration providing the lowest energy threshold for electron detection (> 3 MeV)

A clear enhancement of HEPD-01 trigger rate during the storm's recovery phase was observed at L-shells $\gtrsim 3$, thus suggesting a phenomenon of acceleration of energetic electrons.



Top three panels: Trigger rates for three different HEPD-01 configurations over the period August-September 2018

Bottom panel: Time evolution of the Disturbance storm-time index