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Deep learning based event reconstruction for the HEPD-02 detector on board the China Seismo-Electromagnetic Satellite

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HEPD-02 is a new, upgraded version of the High Energy Particle Detector as part of a suite of instruments for the second mission of the China Seismo-Electromagnetic Satellite (CSES-02) to be launched in 2023. Designed and realized by the Italian Collaboration LIMADOU of the CSES program, it is optimized to identify fluxes of charged particles (mostly electrons and protons) and determine their energy and incoming direction, providing new measurements of cosmic rays at low energies (up to 200 MeV for protons and up to 100 MeV for electrons). As already experienced in the previous version of the detector, i.e. HEPD-01 on board CSES-01, the reconstruction of the collected events will be performed using a strategy based entirely on deep learning˜(DL). This choice is motivated by the fact that deep learning models are very effective when working with particle detectors, in which a variety of electrical signals are produced and may be treated as low-level features. The new HEPD-02 DL-based event reconstruction will be trained on dedicated Monte Carlo simulation and tested on both simulated and test-beam data. Moreover, the collaboration is working on new deep-learning approaches to increase the robustness of the performance assessments, especially when passing from simulated samples to real data, and the interpretability of these algorithms to be used in future analysis.

In this contribution, the entire event reconstruction of the HEPD-02 detector will be described and the performance will be reported.

Experiment context, if any

Contribution submitted on behalf of the CSES-Limadou Collaboration

References

Significance

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