

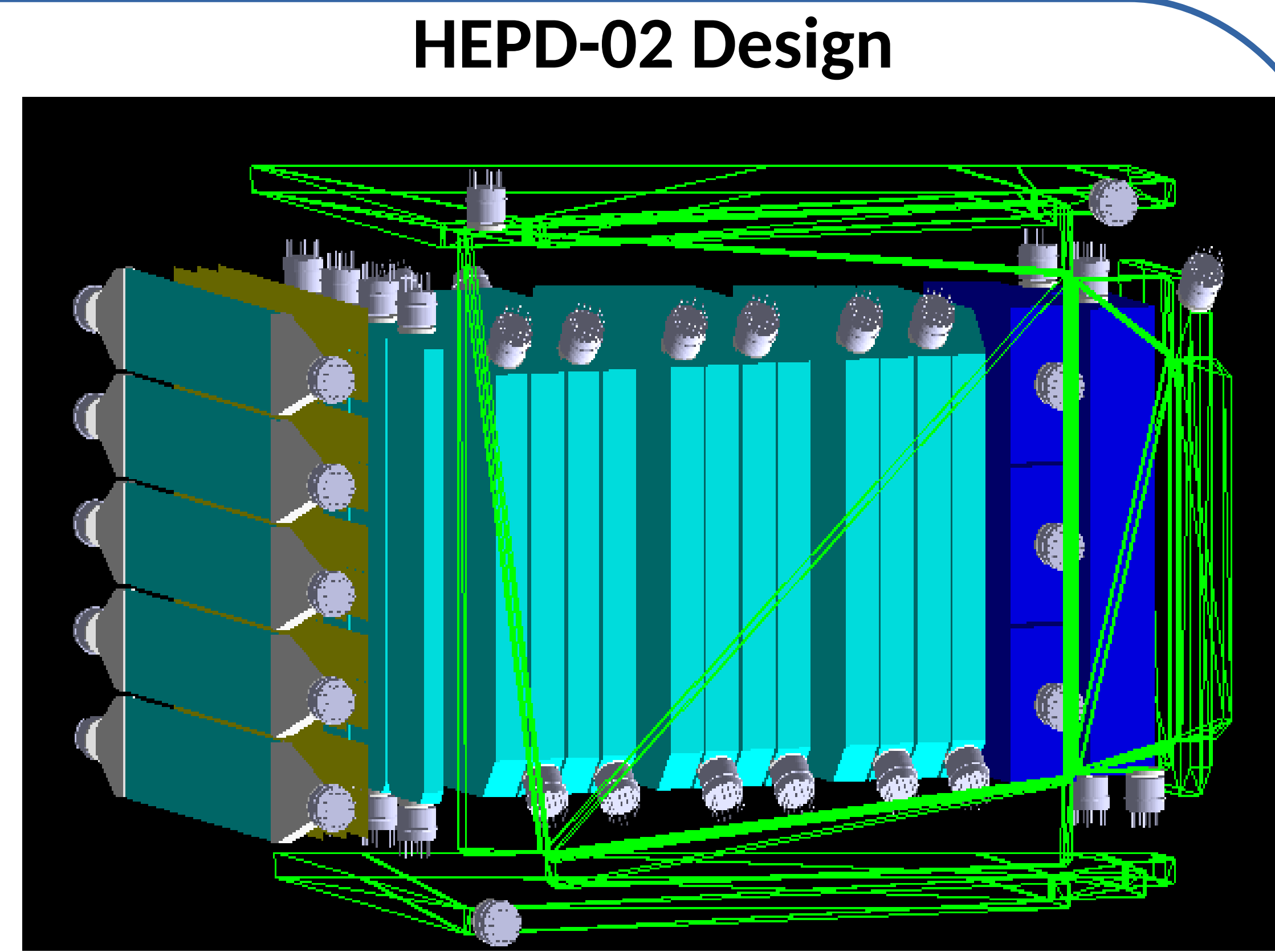
Expected performance of the High-Energy Particle Detector on-board the second China Seismo-electromagnetic Satellite

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The HEPD-02 detector

The **H**igh **E**nergy **P**article **D**etector (HEPD-02) developed by the Italian LIMADOU collaboration is a second generation particle detector to be flown on-board the CSES space mission [1, 2]. It is dedicated to measure electron and proton fluxes in the range 3 – 100 MeV and 30 – 200 MeV, respectively.

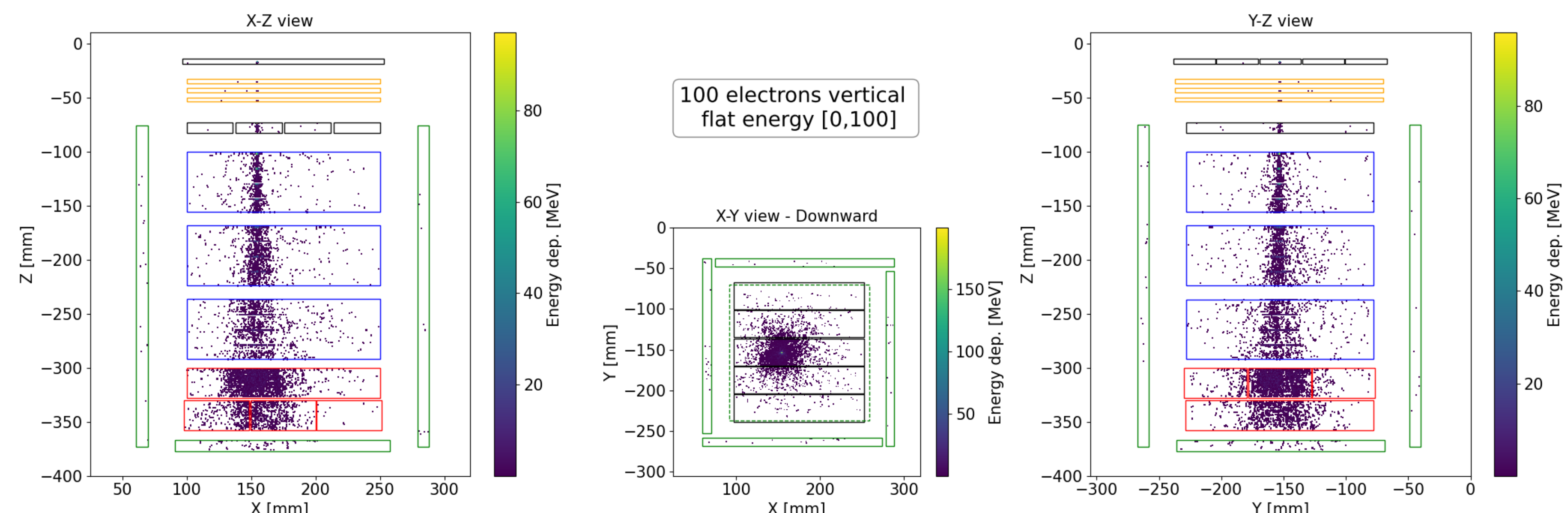


A suitable vertical segmentation and overall thickness allow the updated HEPD design to meet scientific requirements.

Monte Carlo Simulation

A full Monte Carlo simulation based on the GEANT4 toolkit was developed to

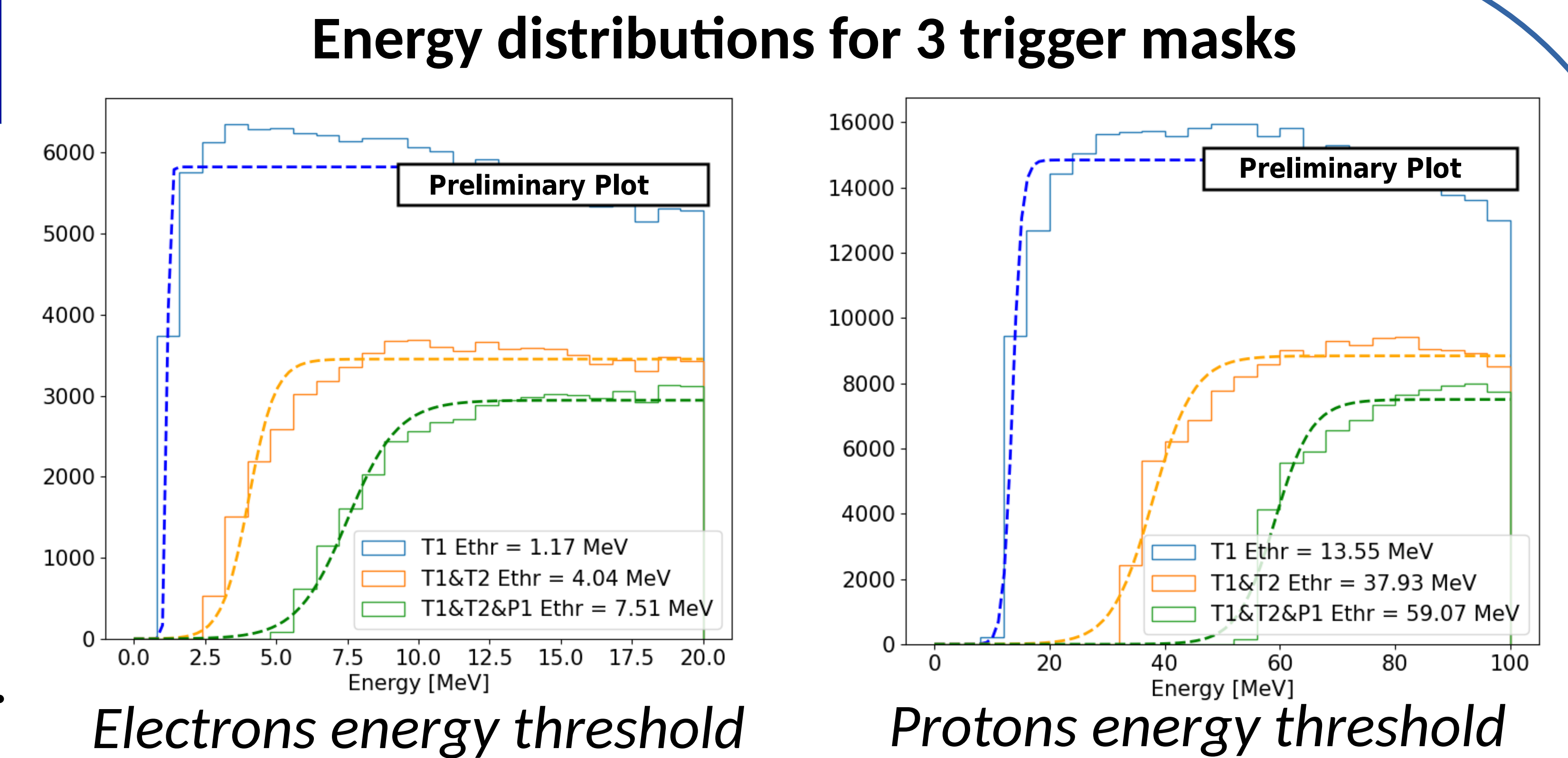
study the response of HEPD to electrons, protons and light ions. It is also used to train and test Machine Learning algorithms for event reconstruction. The initial energy is reconstructed from the energy deposited in each sensitive detector.



Energy release of vertical electrons in the HEPD sensitive detector modules

Scientific Performance

Electron and proton energy distributions were examined for 3 different trigger masks (T1, T1&T2, T1&T2&P1). → the T1 (1st trigger plane), with its 2 mm thickness, has been chosen to improve the energy threshold of the design.



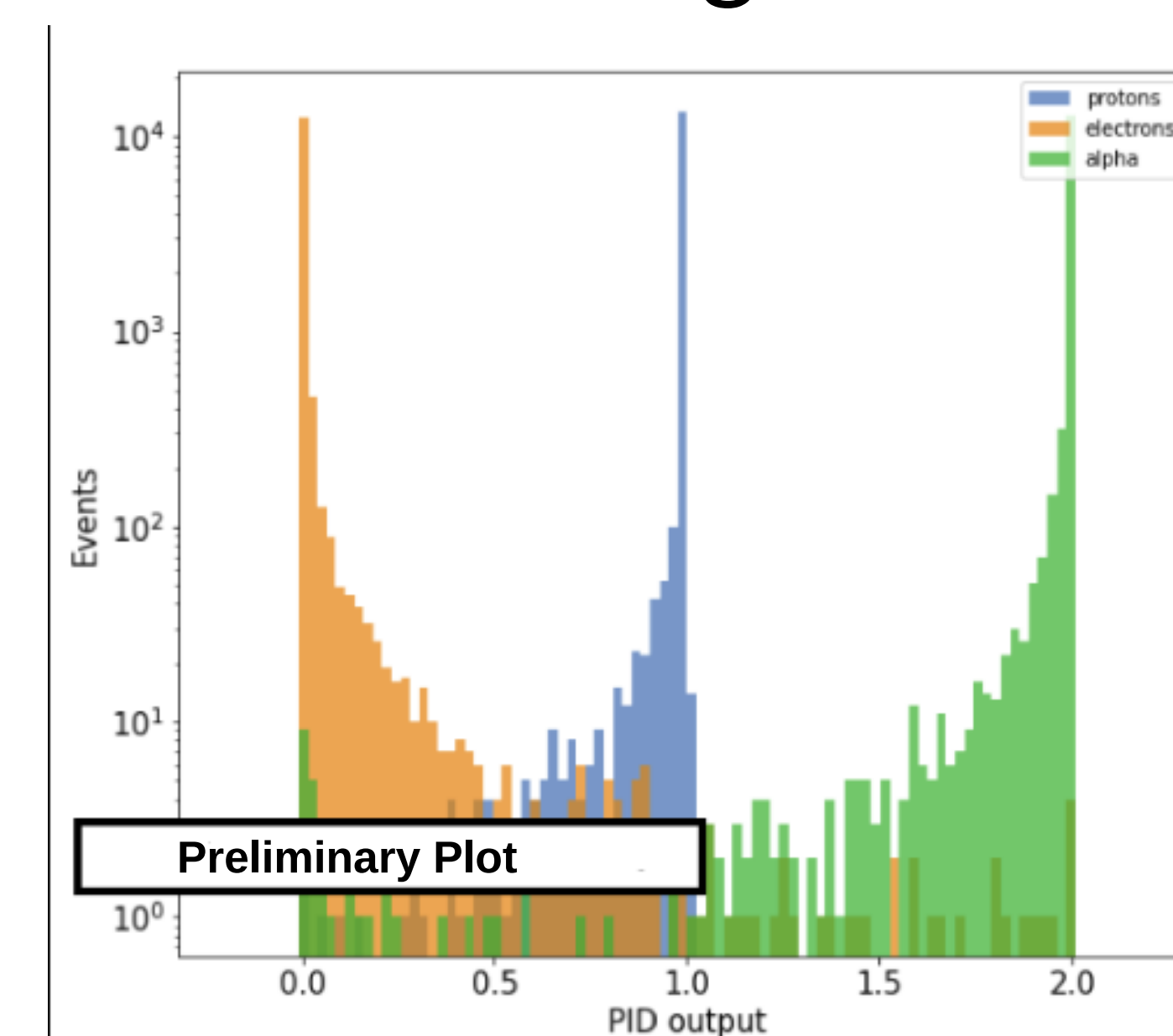
Electrons energy threshold

Protons energy threshold

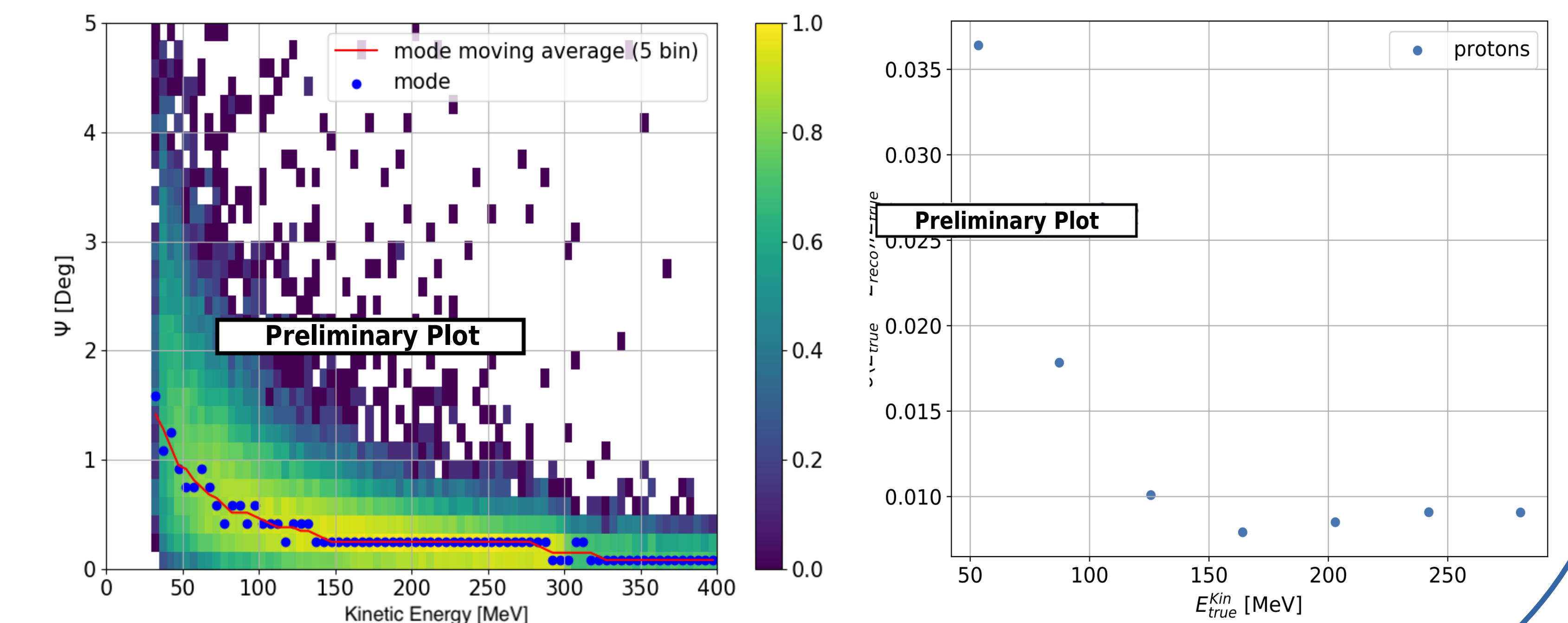
→ a significant fraction of incoming electrons and protons, in the considered kinetic energy range, reach at least the first trigger plane.

Reconstruction

Particle discrimination, angular and energy reconstruction are performed from trained neural network algorithms.



Particle Identification



Protons angular and energy resolution

References

- [1] X. Shen, X. Zhang, S. Yuan et al., Sci. China Tech. Sci. 61 (2018) 634.
- [2] P. Picozza, R. Battiston, G. Ambrosi et al., Ap. J. Supp. Ser. 243 (2019) 16.
- [3] A. Ambrosi, S. Bartocci, L. Basara et al., HEPD-02 QM Design Report, internal report, RPT-LIM2-004-2.