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Software framework and reconstruction software of the DAMPE gamma-ray telescope

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An overview is given for the offline software framework and reconstruction software of the DAMPE (DArk Matter Particle Explorer) gamma-ray telescope. DAMPE is one of the five satellite missions in the framework of the Strategic Pioneer Research Program in Space Science of the Chinese Academy of Sciences, with a launch date scheduled for the fall 2015. The telescope consists of silicon-tungsten tracker-converter, comprising 6 layers of double-sided silicon-strip detectors, interleaved with 3 layers of tungsten converters, BGO calorimeter, and plastic scintillator, serving as anti-coincidence detector, and a layer of neutron detector in the bottom of the calorimeter. DAMPE analysis and reconstruction software is implemented based on the custom-made software framework, where the core software is written in C++, while the management part is done in Python. We take advantage of the boost-python libraries, whereby the bridge between the core and management part is done, allowing us to fully exploit the computational power of modern CPUs, while keeping the framework flexible and easy to deploy. The building blocks of the framework are the algorithms, which are stacked together and configured in the the job-option files. The geometry of the detector is implemented in the GDML format, through the direct conversion from the CAD drawings of the detector to the geant4-compatible format. The data flow is handled by the dedicated input-output service, based on ROOT. The simulation algorithms are implemented with the Geant4 tool kit. In the heart of the reconstruction software lies the pattern recognition for the initial track finding, which is refined further by the track filtering algorithm, based on the adaptation of Kalman technique. The software has been extensively put on test during the beam test campaigns at CERN, in 2014-2015 years, proving its sustainability to a wide range of data-processing challenges, encountered in a particle-physics experiment.

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Primary author: Dr TYKHONOV, Andrii (Universite de Geneve (CH))

Presenter: Dr TYKHONOV, Andrii (Universite de Geneve (CH))

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