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Reconstruction software of the silicon tracker of DAMPE mission

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DAMPE is a powerful space telescope launched in December 2015, able to detect electrons and photons in a wide range of energy (5 GeV to 10 TeV) and with unprecedented energy resolution. Silicon tracker is a crucial component of detector, able to determine the direction of detected particles and trace the origin of incoming gamma rays. This contribution covers the reconstruction software of the tracker, comprising the geometry convertor, track reconstruction and detector alignment algorithms. The convertor is an in-house, standalone system that converts the CAD drawings of the detector and implements the detector geometry in the GDML (Geometry Description Markup Language) format. Next, the particle track finding algorithm is described. Since the DAMPE tracker identifies independently the particle trajectory in two orthogonal projections, there is an inherent ambiguity in combining the two measurements. Therefore, the 3D track reconstruction becomes a computationally intensive task and the number of possible combinations increases quadratically with the number of particle tracks. To alleviate the problem, a special technique is developed, which reconstructs track fragments independently in two projections and combine the final result using a 3D Kalman fit of pre-selected points. Finally, the detector alignment algorithm allows to align the detector geometry based on real data with precision better than the resolution of tracker. The algorithm optimises a set of around four thousand parameters (offsets and rotations of detecting elements) in an iterative procedure, based on the minimisation of the global likelihood fit of reconstructed tracks. Since the algorithm is agnostic of the detector premises, it could be used for similar optimisation problems with minor modifications by other projects. This contribution will give an insight into the developed algorithms and the results obtained during the first years of operational experience on ground and on orbit.

Tertiary Keyword (Optional)

Collaborative tools

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Reconstruction

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