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On the statistical effects of multiple reusing of simulated air showers in detector simulations

Abstract content

The simulations of extensive air showers as well as the detectors involved in their detection play a fundamental role in the study of the high energy cosmic rays. At the highest energies the detailed simulation of air showers is very costly in processing time and disk space due to the large number of secondary particles generated in interactions with the atmosphere, e.g. $\sim 10^{11}$ for 10^{20} eV proton shower. Therefore, in order to increase the statistics, it is quite common to recycle single showers many times to simulate the detector response. In this work we present a datailled study of the artificial effects introduced by the multiple use of single air showers for the detector simulations. In particular, we study the effects introduced by the repetitions in the kernel density estimators which are frequently used in composition studies.

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