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Biasing in Geant4

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There is a class of simulation problems for which the events of interest are rare. The shielding problem - with very few particles exiting the shield, where the dose estimates are to be made-, the very thin detector case -with very few particles interacting in it- or the dose estimate in an electronic chip inside a satellite -because of the tiny volume of the chip compared to the large satellite structure one- are some examples of such problems. In these, “standard” -also called “analog”- simulations are very inefficient, as spending only a marginal fraction of the CPU time inside the region of interest, often leading to poor estimates. Biasing techniques are a set of methods to simulate rare events efficiently by focusing the CPU power on the region of interest, still exploiting the same accurate physics modeling of the analog simulation. Very used in packages like MCNP, they are being developed in Geant4 to -not only provide exiting techniques- but also to allow advanced users to invent and implement their own customized techniques. We will present how this scheme is realized in Geant4 and the status of these developments.

Author: VERDERI, Marc (Centre National de la Recherche Scientifique (FR))

Presenter: VERDERI, Marc (Centre National de la Recherche Scientifique (FR))

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