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Geant 4 full and fast simulation framework

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Geant4 is the most common framework for the full simulation studies in HEP. It has been integrated with the FCCSW, in order to provide the users the possibility to perform the simulation within the common software framework.

The full simulation takes into account all the physics processes the particles may encounter, being very detailed thus time and CPU consuming. At the early stage of the detector design and for different physics cases such accuracy is not needed, making the fast simulation better suited. Geant4 provides the tools to define the parametrisation, where the overall response of the detector is simulated in a parametric way.

The parametrisation may come from either external sources, or from the full simulation. The detector resolutions may originate from our knowledge of the existing detectors as well as from the external tools, for instance those used in the tracker performance studies. One of such tools is tkLayout. The more sophisticated approach involves the semi-automatic procedure of obtaining the resolutions within FCCSW from a sample of full simulations of single-particle events. Such resolutions are unique for tested detectors, hence they may be used for parametrisation with a better accuracy. Implementation of this approach is still in progress. The parametrisation for the tracking detectors is performed by smearing the particle space-momentum coordinates, while for the calorimeters - by reproducing the particle showers. For instance, GFlash library, implemented in Geant4, parametrises the calorimeter longitudinal and radial profiles.

The fast simulation in FCCSW can be applied to any type of particles in any region of the detector. Possibility to run both full and fast simulation in Geant4 creates a chance for an interplay, performing the CPU-consuming full simulation only for the regions and particles of interest.

This presentation will show the current status of the Geant4 full and fast simulation in the FCC common software framework.

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