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A scalable and asynchronous detector simulation system based on ALFA

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In the context of the common online-offline computing infrastructure for Run3 (ALICE-O2), ALICE is reorganizing its detector simulation software to be based on FairRoot, offering a common toolkit to implement simulation based on the Virtual-Monte-Carlo (VMC) scheme. Recently, FairRoot has been augmented by ALFA, a software framework developed in collaboration between ALICE and FAIR, offering portable building blocks to construct message-based and loosely-coupled multiprocessing systems.

We will report here on the implementation of a scalable and asynchronous detector simulation system which is based on ALFA. The system offers parallelization at the primary-track level, going beyond the usual inter-event parallelism of Geant4-MT, and the possibility to asynchronously and simultaneously process simulation data for the purpose of digitization and clusterization. Core advantages of our implementation are an ideal reduction of the processing time per event as well as a reduction of the memory footprint, allowing us to make significantly better use of opportunistic resources, such as HPC backfills, than before. Moreover, the track-level parallelism opens up the interesting possibility to use different simulation engines (such as Geant4 and Fluka) concurrently, based on simple selection filters on the primary particles. The integration of fast MC processes, such as machine learning kernels running on a dedicated GPU, are a natural extension to the system.

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