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Accelerating the simulation process in gas based charged particle detectors

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Simulation is an important tool in the R&D process of detectors and their optimization. Fine tuning of detector parameters and running conditions can be achieved by means of advanced simulation tools thus reducing cost associated to prototyping.
This simulation, however, in complex detector geometries, large volumes and high gas gain becomes computationally expensive and can run for several days or weeks.
A common tool in charged particle detector simulation is the Garfield simulation suite. Although Garfield has been very critical to the simulation of many Micro-Pattern Gas Detectors (MPGD) variants, the simulation of recent complex structures such as (multi-stage GEM and Micromegas) is CPU consuming, in particular in situations where a high gas gain and large volumes are needed.

In this work, we have explored the possibility to reduce the computation time by following several approaches. On one hand, we developed a parallel variant of the software allowing the simulation to be spread over hundreds of cores in a multicore distributed environment. Secondly, with advanced profiling, we optimized the electron avalanche development leading a speedup factor of 20 for large structures such as triple-GEM detectors. Moreover, we also adapted the code to multi-threading architecture allowing more computational efficiency.

We will present the three strategies and the results in terms of speedup factor and parallel efficiency. Results from serial and parallel/optimized versions of the codes will also be presented and discussed.

Consider for promotion

No

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