

Title:

VecGeom: A new vectorized geometry library for particle-detector simulation

Abstract:

A geometry modeller library is among the most important components of the software simulating the passage of particles in a detector, and many experiment simulations are currently based on the geometry implementations offered by Geant4 or ROOT.

Here, we report on our effort to extend, re-engineer and evolve these libraries in multiple directions in order to make them ready for the future challenges of computing in HEP.

This includes primarily an extended API as well as SIMD-vectorised algorithms able to efficiently handle geometry queries for multiple particles at the same time. Secondly, we aim for a native support of the geometry module on the GPU or on mixed heterogeneous CPU/GPU platforms.

This effort is one of the essential ingredients of the Geant-Vector project that is focusing on a fine-grained multithreaded and vectorised design, propagating many particles from different events at the same time.

Our presentation will give an overview of the new vectorized, generic and templated geometry library "VecGeom" that accomplishes those primary goals and which also improves the overall geometry performance for current simulation frameworks. Beyond discussing new performance numbers for elementary and higher level geometry algorithms, we will show a first global evaluation of the new library on a realistic detector in form of the geometry description from the CMS experiment.