



# Sample Project: Fast simulation prototype development

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## Title

Fast simulation prototype development

## Description

GeantV is a simulation project focused on the R&D of extreme optimisation techniques for particle transport, by dealing with vectors of tracks rather than single ones. The goal is to maximize parallelism on many levels while improving code and data locality with respect to the classical GEANT approach. The project explores alternatives for improving the throughput of both geometry and physics algorithms by using new scheduling techniques. A prototype is being developed to assemble all these new techniques and measure their combined performance as function of several parameters.

The challenge of the prototype is to be able to maintain an optimal level of concurrency and utilize additional computing resource such as co-processors while making use of efficient SIMD operations and preventing memory inflation or I/O bottlenecks. The model has complex dynamics requiring tuning the thresholds to switch between the normal transport regime and special modes, i.e. prioritizing events to allow flushing memory, adding new events in the transport pipeline to boost locality, dynamically adjusting the particle vector size or switching between vectorized to single track mode when vectorization causes only overhead.

The prototype development is one of the core components of the GeantV project. You will find yourself among an enthusiastic young team facing great challenges.

Required qualification and skills:

Degree in computer science and/or physics (or similar) with a high computational background.

Proficient in C++

Knowledge and previous exposure to high-performance computing (multithreading, parallel and concurrent processing, vectorisation and optimisation on modern architectures)

Sound software engineering knowledge.

## Skills

## Disciplines

Information Technologies

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