

# Proof of Concept Plan for GEANT4-GPU

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## Significant Risks

The majority of the risks posed by the project relate to the integration of changes to the (large) existing codebase:

- Installation of GEANT4 and G4-STORK taking too long due to their complexity, and numerous dependencies
- Learning curve for existing G4-STORK codebase is too steep, cannot gain adequate understanding to implement changes in time constraints
- The current product's interface for the specific algorithms that will be ported to the GPU is not well-enough defined to have a simple mechanism to enable or disable GPU execution
- Unable to invoke CUDA code from within the G4-STORK program when it's running due to technical barriers

## Demonstration Plan

The goal of the project is to port GEANT4 simulations to run on a GPU to reduce computation time. Our proof of concept plan aims to show how we can overcome the biggest risks associated with that – setting up development environments with the existing codebase, as well as invoking a CUDA program on the GPU from G4-STORK. There will be three aspects of the demonstration:

1. Run an existing GEANT4 example to demonstrate the installation of GEANT4 and its dependencies
2. Run our modified G4-STORK program with a flag or similar mechanism *disabling* GPU execution. The program will take input parameters, run a simulation, and produce an output file.
3. Run our modified G4-STORK program with a flag or similar mechanism *enabling* GPU execution. The program will take input parameters as in (2), but will additionally invoke a trivial CUDA program which will send a simple result (e.g. a vector or an integer) back to G4-STORK, which will print it to the console. After that, the simulation will continue and an identical output file to (2) will be created.