

Proof of Concept Plan for GEANT4-GPU

Stuart Douglas (dougl2), Matthew Pagnan (pagnanmm),
Rob Gorrie (gorrierw), Victor Reginato (reginavb)

November 17, 2015

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 GEANT4 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 GEANT4 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 GEANT4, which will print it to the console. After that, the simulation will continue and an identical output file to (2) will be created.