Problem Statement for GEANT4-GPU

Stuart Douglas (1214422), Matthew Pagnan (1208693),
Rob Gorrie (1222547), Victor Reginato (1209975)

September 23, 2015

Description of Problem

GEANT-4 is a widely-used simulation program used to simulate particle interactions. There are currently several members of McMaster's Engineering Physics department that use the program, and are being limited by the performance of the software. This means that they cannot simulate particle interactions that take place over the course of minutes (or even seconds), and they also can't simulate large numbers of particles.

Increasing the runtime of the simulation or the number of particles would greatly increase the accuracy of their results, allowing the researchers to understand the systems they're modeling better. This is especially true when modeling complex systems, such as McMaster's nuclear reactor. Depending upon the level of success of the project, the solution could potentially benefit groups that use GEANT-4 outside of McMaster as well.

Stakeholders

The McMaster Engineering Physics Department is the main stakeholder of this project as they use GEANT-4 for their simulations of the nuclear reactor. If the project is extremely successful, and the code is submitted back to the GEANT-4 repository, CERN and other users of GEANT-4 would be considered stakeholders as well, as the changes we make would increase the performance of the application to all users.

Context & Environment

The project is designed on a specific-need basis for McMaster's department of Engineering Physics. It aims to alleviate research problems in the field of physics, and will be used in simulations of McMaster's nuclear reactor. If the project is extremely successful, the changes could be incorporated into the GEANT-4 code, pushing its reach to all users of GEANT-4. Thus, the setting in which the software will be implemented is primarily academic; Engineering and Physics labs and offices, running on desktop computers. That said, there are no restrictions limiting the solution to purely scholastic uses, it is open to be used for all research that uses GEANT-4 for simulations.