# GEANT-4 GPU Port:

# Design Document

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## 1 Introduction

### 1.1 Purpose

The purpose of GEANT4-GPU is to reduce the computation times of particle simulations.

# 1.2 Description

The project aims to improve the computation times of GEANT4 particle simulations by running simulations on the GPU. GEANT4-GPU will allow users to build GEANT4 with an enable GPU acceleration option. Our implementation will be available on Mac, Linux and Windows operating systems with NVIDIA graphics cards. GEANT4-GPU must be able to do particle simulations much faster than running the simulations on a GEANT4 build that runs entirely on the CPU.

### 1.3 Scope

The scope of GEANT4-GPU will be limited to Engineering Physics simulations; particularly those that make use of the NeutronHPVector class.

# **Revision History**

All major edits to this document will be recorded in the table below.

Table 1: Revision History

Description of Changes	Author	Date
Set up sections and filled out Introduction section	Matthew	2015-12-15

- 2 Anticipated and unlikely changes
- 2.1 Likely Changes
- 2.2 Unlikely Changes
- 3 Module Hierarchy
- 4 Connection between requirements and design
- 5 Traceability matrices
- 6 MIS of NeutronHPDataPoint
- 6.1 Interface Syntax
- 6.2 Exported Access Programs
- 6.3 Interface Semantics
- 6.3.1 State Variables

energy: G4Double xSec: G4Double

#### 6.3.2 Environment Variables

There are no environment variables for this Module.

- 6.3.3 Assumption
- 6.3.4 Access Program Semantics

## 7 MIS of NeutronHPVector

- 7.1 Interface Syntax
- 7.2 Exported Access Programs
- 7.3 Interface Semantics
- 7.3.1 State Variables

G4NeutronHPInterPolator: the Lin

totalIntegral: G4double

 $\begin{tabular}{ll} $\rm G4Neutron HPData Point~*: the Data \\ $\rm G4Interpolation Manager: the Manager \\ \end{tabular}$ 

G4double \* : theIntegral

G4int : nEntries G4int : nPoints G4double : label

G4NeutronInterpolator: theInt

G4int : Verbose G4int : isFreed

G4NeutronHPHash: theHash

G4double: maxValue

vector;G4double;: theBlocked vector;G4double;: theBuffered G4double: the15percentBorderCash G4double: the50percentBorderCash

#### 7.3.2 Environment Variables

There are no environment variables for this Module.

#### 7.3.3 Assumption

### 7.3.4 Access Program Semantics

## 8 MIS of CMake Files

- 8.1 Interface Syntax
- 8.2 Exported Access Programs
- 8.3 Interface Semantics
- 8.3.1 State Variables

useCuda: Bool

#### 8.3.2 Environment Variables

NeutronHPVectorGPU.cu: cuda file with GPU code

#### 8.3.3 Assumption

#### 8.3.4 Access Program Semantics