

GEANT-4 GPU Port:

Design Document: Detailed Design

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1 Introduction

1.1 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
Added sections for Errors and Key Algorithms	Stuart	2016-01-08

1.2 Document Structure & Template

The design documentation for the project is based off of templates from WHAT TEMPLATES??????, and is broken into two main documents.

The system architecture document details the system architecture, including an overview of the modules that make up the system, analysis of aspects that are likely and unlikely to change, reasoning behind the high-level decisions, and a table showing how each requirement is addressed in the proposed design.

This detailed design document covers the specifics of several key modules in the project. For each module, an MIS is given fully detailing the interface of the module. Then, the methods for handling errors within the module are discussed, and finally the main algorithms and data structures used by the module are presented.

1.3 List of Tables

Table #	Title
1	Revision History
2	NeutronHPDataPoint – interface syntax
4	NeutronHPVector – interface syntax

1.4 Note About G4 variables

Geant4 uses its own basic types for standard C++ types (G4int, G4bool, G4double, etc). These types are currently just `typedefs` to the respective type as defined in the system libraries.

2 NeutronHPDataPoint

2.1 Description

2.2 MIS (Module Interface Specification)

2.2.1 Access Program Syntax

Table 2: NeutronHPDataPoint – access program syntax

Routine Name	Input	Output	Exceptions
G4NeutronHPDataPoint			
G4NeutronHPDataPoint	G4double, G4double		
+	G4NeutronHPDataPoint		
GetEnergy		G4double	
GetXsection		G4double	
SetEnergy	G4double		
SetXsection	G4double		
GetX		G4double	
GetY		G4double	
SetX	G4double		
SetY	G4double		
SetData	G4double, G4double		

2.2.2 Access Program Semantics

Table 3: NeutronHPDataPoint – access program semantics

Routine Name	Semantics
G4NeutronHPDataPoint	
G4NeutronHPDataPoint	
+	
GetEnergy	
GetXsection	
SetEnergy	
SetXsection	
GetX	
GetY	
SetX	
SetY	
SetData	

2.2.3 State Variables

- energy : G4Double
- xSec : G4Double

2.2.4 Environment Variables

There are no environment variables for this Module.

2.2.5 Assumptions

The following can be assumed for this module:

-

2.3 Error Handling

2.4 Key Algorithms

3 G4NeutronHPVector

3.1 Description

3.2 MIS (Module Interface Specification)

3.2.1 Access Program Syntax

Table 4: G4NeutronHPVector – access program syntax

Routine Name	Input	Output	Exceptions
G4NeutronHPVector			
G4NeutronHPVector	G4int		
SetVerbose	G4int		
Times	G4double		
SetPoint	G4int, G4NeutronHPDataPoint		
SetData	G4int, G4double,G4double		
SetX	G4int, G4double		
SetEnergy	G4int, G4double		
SetY	G4int, G4double		
SetXsec	G4int, G4double		
GetEnergy	G4int	G4double	

GetXsec	G4int	G4double
GetXsec	G4double	G4double
GetXsec	G4double,G4int	G4double
GetX	G4int	G4double
GetY	G4double	G4double
GetY	G4int	G4double
GetVectorLength		G4int
GetPoint	G4int	const G4NeutronHPDataPoint &
Hash		
ReHash		
InitInterpolation	istream	
Init	istream,G4int, G4double, G4double	
Init	istream, G4double,G4double	
ThinOut	G4double	
SetLabel	G4double	
GetLabel		G4double
CleanUp		
Sample		G4double
Debug		G4double *
Merge	G4NeutronHPVector *, G4NeutronHPVector *	
Merge	G4InterpolationScheme, G4double, G4NeutronHPVector *, G4NeutronHPVector *	
SampleLin		G4double
IntegrateAndNormalise		
Integrate		
GetIntegral		G4double
SetInterpolationManager	const G4InterpolationManager &	
SetInterpolationManager	G4InterpolationManager &	
G4InterpolationManager		const G4InterpolationManager &

SetScheme	G4int,const G4InterpolationScheme &		
GetScheme	G4int	G4InterpolationScheme	
GetMeanX		G4double	
GetBlocked		vector<G4double>	
GetBuffered		vector<G4double>	
Get15percentBorder		G4double	
Get50percentBorder		G4double	
Check	G4int		G4Hadronic- Exception
IsBlocked	G4double	G4bool	

3.2.2 Access Program Semantics

Table 5: G4NeutronHPVector – access program semantics

Routine Name	Description
G4NeutronHPVector	
G4NeutronHPVector	
SetVerbose	
Times	
SetPoint	
SetData	
SetX	
SetEnergy	
SetY	
SetXsec	
GetEnergy	
GetXsec	
GetXsec	
GetXsec	
GetX	
GetY	
GetY	
GetVectorLength	
GetPoint	
Hash	
ReHash	
InitInterpolation	
Init	

Init
ThinOut
SetLabel
GetLabel
CleanUp
Sample
Debug
Merge
Merge
SampleLin
IntegrateAndNormalise
Integrate
GetIntegral
SetInterpolationManager
SetInterpolationManager
G4InterpolationManager
SetScheme
GetScheme
GetMeanX
GetBlocked
GetBuffered
Get15percentBorder
Get50percentBorder
Check
IsBlocked

3.2.3 State Variables

- G4NeutronHPInterPolator : theLine
- totalIntegral : G4double
- G4NeutronHPDataPoint * : theData
- G4InterpolationManager : theManager
- 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

3.2.4 Environment Variables

There are no environment variables for this Module.

3.2.5 Assumptions

3.3 Error Handling

3.4 Key Algorithms

4 CMake Files

4.1 Description

4.2 MIS (Module Interface Specification)

4.2.1 Access Program Syntax

NA

4.2.2 Access Program Semantics

NA

4.2.3 State Variables

- useCuda : Bool

4.2.4 Environment Variables

- NeutronHPVectorGPU.cu : cuda file with GPU code

4.2.5 Assumptions

4.3 Error Handling

4.4 Key Algorithms