Running GEANT4 Functions on a GPU

Discussion of Results

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Overview

Brief Project Overview

Take an existing particle simulation toolkit - GEANT4 - and have some functions run on a GPU device to improve performance.

Definition: GEANT4

GEANT4 is

Stakeholders

What is GEANT4

- Geant4 is a toolkit that is meant to simulate the passage of particles through matter.
- It has been developed over the years through collaborative effort of many different institutions and individuals.
- Geant4 has many different applications, including applications in high energy physics, space and radiation, medical.

What is GP-GPU

- General purpose graphic processing unit computing is a re-purposing of graphics hardware
- Allows GPUs to perform computations that would typically be computed on the CPU
- If problems are suitable to mass parallelization

Scope

Purpose

Why G4ParticleHPVector

Two Implementations

Entire G4ParticleHPVector Object on GPU

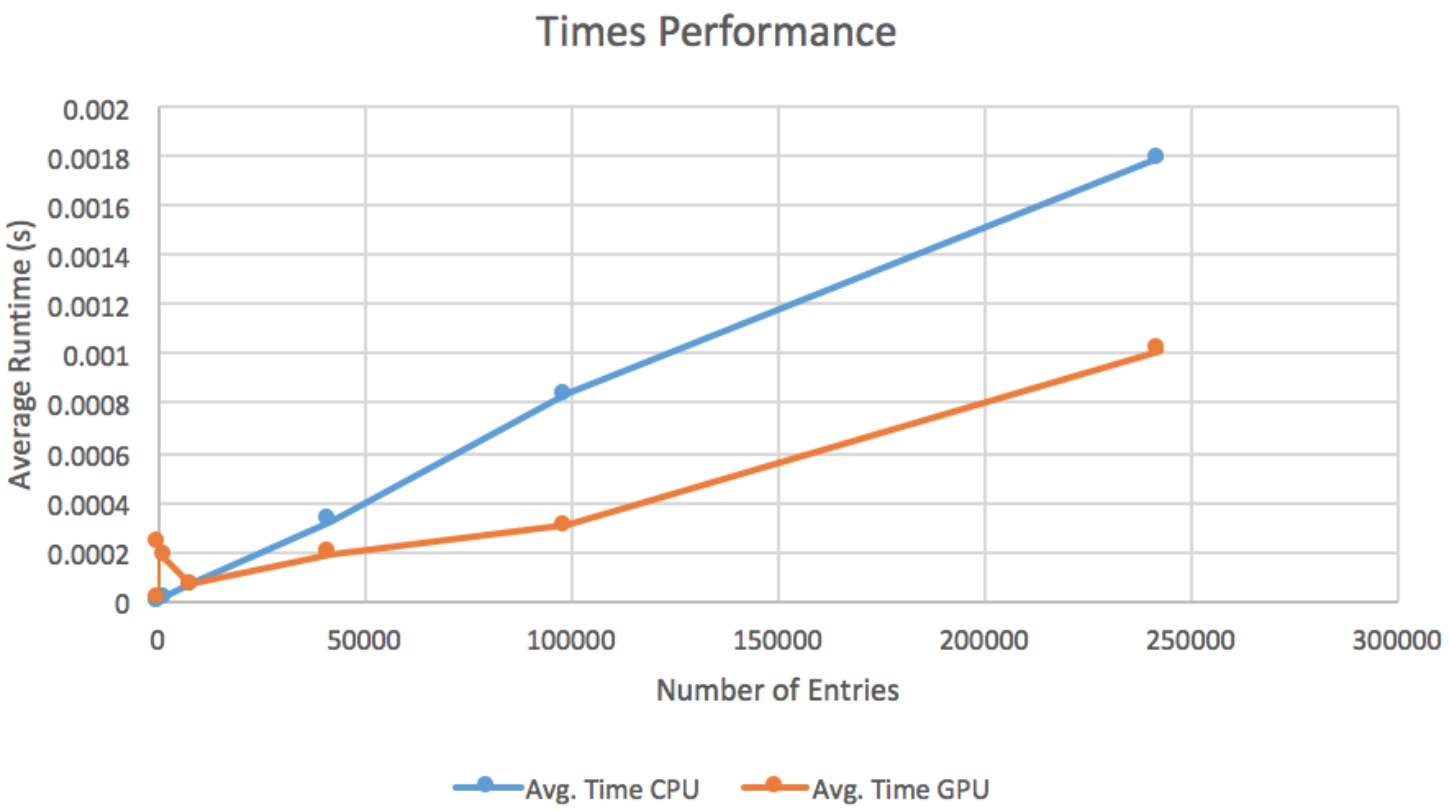
Add New Function on GPU

Performance Summary

- Most functions slower on GPU until ~10,000 entries
- Most *commonly-used* functions significantly slower on GPU
  - Lots of data accesses
- Many problems in vector class not well-suited to parallelism

Performance Results - `Times`

- Multiplies each point in vector by factor



Performance Discussion

Accuracy

Testing

Summary of Results

Recommendations