NE697: Introduction to Geant4

Geant4: Review, Final Questions

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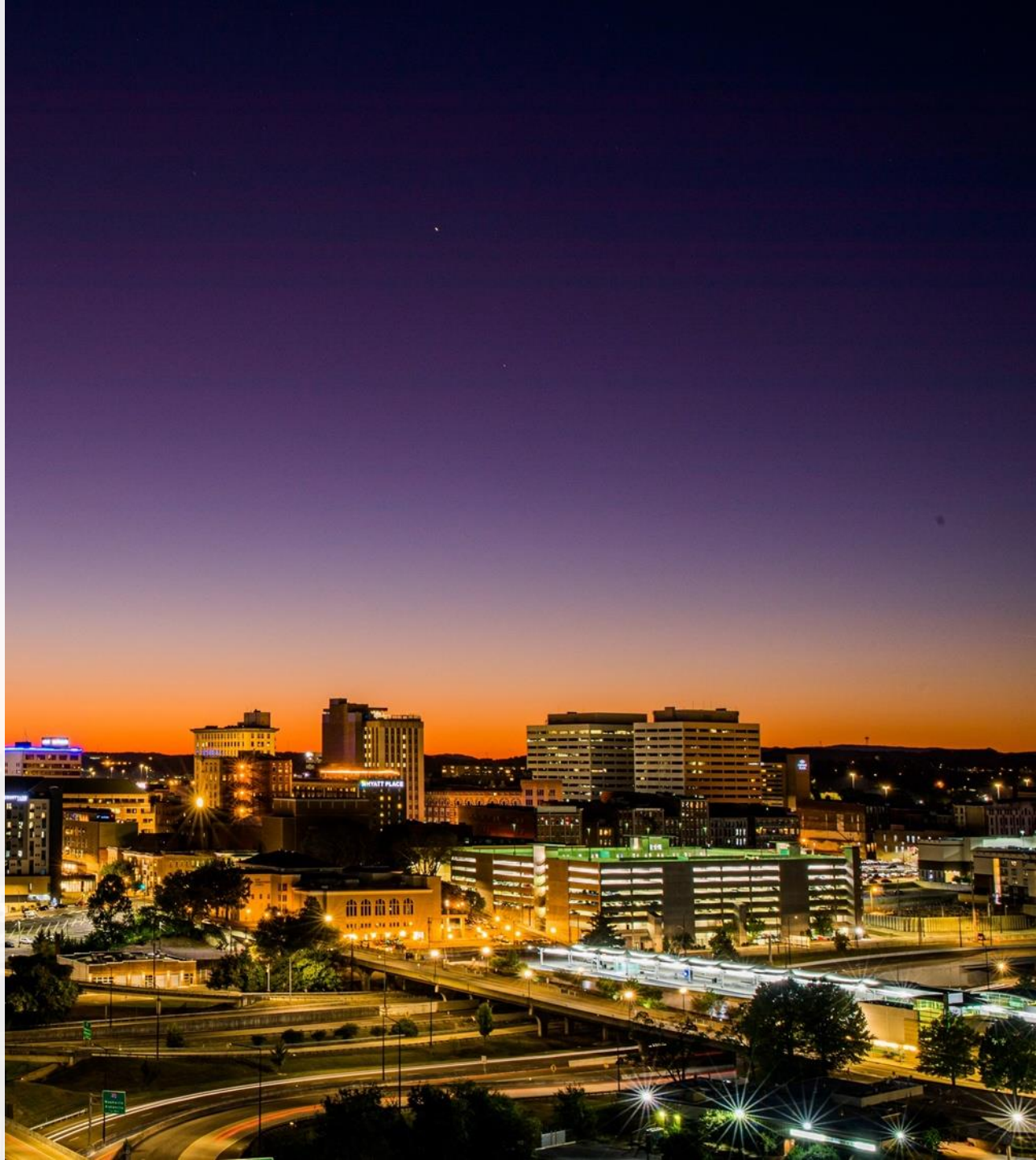

Today's Agenda

- Assignment 7 questions?
- Semester review
  - Please interrupt and ask for a quick demo!
- Any final questions – open to ending early (officially) while I stick around
- Please do your course evaluations!
  - https://utk.campuslabs.com/eval-home/direct/8448823

Review: Compiling C++

- Which program do we use to compile? (multiple right answers)
- Which program do we use to configure our build system?
- What is the entry point function for every C/C++ program?
  - What arguments does it take?
- What are the core components (files) of a basic C++ program?

Review: C++ Basics

- Built-in types
  - Primitives: bool, int, char, float, double, void
  - Standard Template Library (STL): std::string, std::array<T>, std::vector<T>
  - Others/Modifiers: signed (implicit), unsigned, short, long, enum, const
  - Don’t forget typedef: “typedef std::vector<float> FVector;”
- Helpful headers
  - <iostream>, <vector>, <array>, <cmath>, <numeric>, <algorithm>
- Templates
  - The “template argument” is a type, instead of a variable: std::vector<std::string>

Review: Pointers

- What is the value of a pointer – what does it store?
- Reference vs pointer? (this is a tough one)
- Stack vs heap?
- Generally, what do pointers empower us to do?

Review: Pointers

- What is the value of a pointer – what does it store? **Address**
- Reference vs pointer? (this is a tough one)
  - **Pointer**: just an address. Can change which address, or be NULL
  - **Reference**: an address *of an existing variable*. Cannot assign NULL, cannot change address after assignment (similar to **const*** [a const pointer])
- Stack vs heap?
  - **Stack**: where local variables are stored; vanishes after **return**; ~8 MB limit
  - **Heap**: global application memory; exists until the program exits; limited by your computer
- Generally, what do pointers empower us to do?
  - Pass things around (persistence)
  - Explicitly manage memory lifetime
  - Take advantage of inheritance (e.g. pointer to the base)
  - Mitigate circular dependencies

Review: C++ Best Practices

- Which part is const? The type (int) or the operator (*, &)?
  - const int my_var;
  - int const my_var;
  - int const& my_var;
  - int* const my_var;
  - int const* const my_var;
- Common function signatures? Which, when? Assume an “int” type
  - void my_func(<by value>) = ?
  - void my_func(<by reference>) = ?
  - void my_func(<by const reference>) = ?
  - void my_func(<pointer>) = ?

Review: C++ Best Practices

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  - int const my_var;
  - int const& my_var;
  - int* const my_var;
  - int const* const my_var;
- Common function signatures? Which, when? Assume an “int” type
  - void my_func(<by value>) = **int my_val**
  - void my_func(<by reference>) = **int& my_val**
  - void my_func(<by const reference>) = **int const& my_val**
  - void my_func(<pointer>) = **int* my_val**

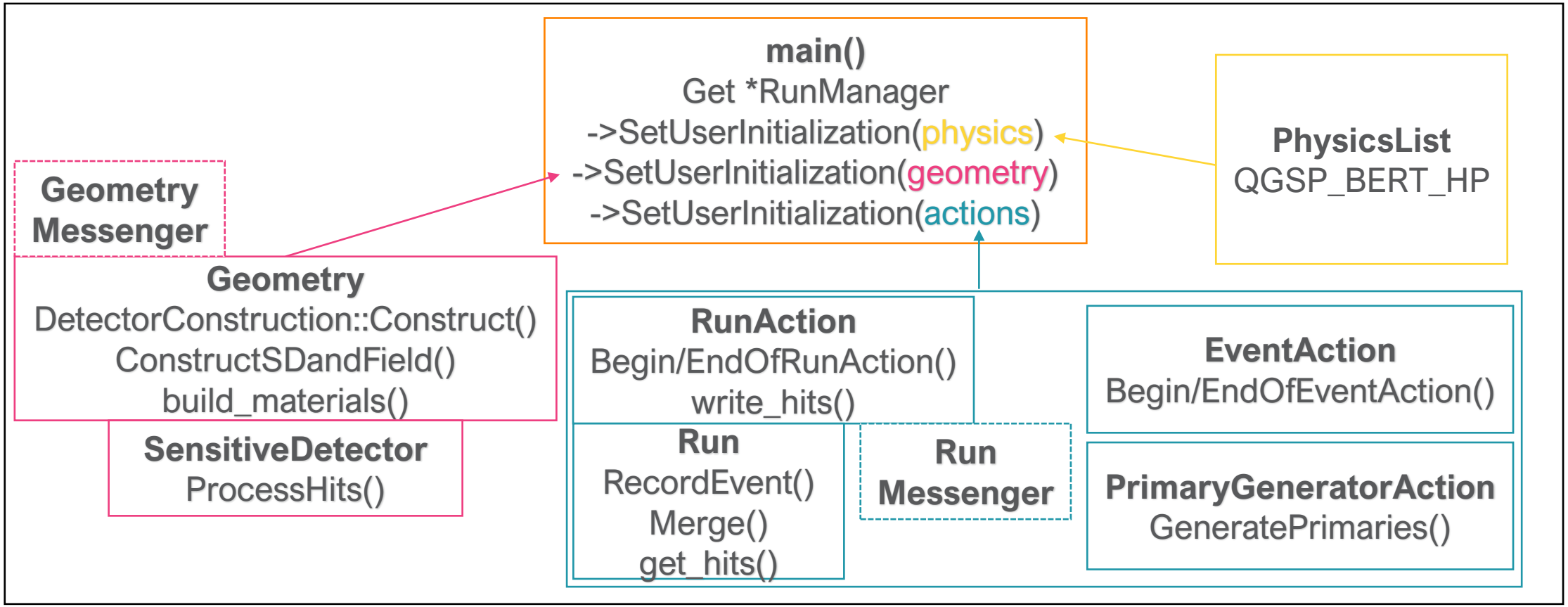
Review: Geant4 Basics

- Anatomy of a Geant4 program:
  - What do we override for the geometry?
  - What do we override to generate particles?
  - What do we override to take actions re: the run?
  - What do we override to take actions re: the events?
  - What do we override to generate hits?
- Where are the examples?
- Where's the first place to look when you've got a question?

Review: Geant4 Basics

- Anatomy of a Geant4 program:
  - What do we override for the geometry? **DetectorConstruction**
  - What do we override to generate particles? **PrimaryGeneratorAction**
  - What do we override to take actions re: the run? **RunAction**
  - What do we override to take actions re: the events? **EventAction**
  - What do we override to generate hits? **Sensitive Detector**
- Where are the examples? **<G4 dir>/share/Geant4-<ver>/examples**
- Where's the first place to look when you've got a question? **Application Developer's Guide**

Geant4 Program Anatomy



Review: Geant4

- How are the Messengers structured?
- If I wanted to modify the particle source with a Messenger, what should the Target be?
- What are the built-in command types? (G4UIcmd…)

Review: Open Floor

- Any other questions, comments, etc?