NE697: Introduction to Geant4

Geant4 from Scratch

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Today's Agenda

- Building our own Geant4 simulation

- Think about what you want to do for your final project
  - Proposal due by class, Thursday, November 11th
  - Create a "detection scenario": some sort of radiation bouncing around an environment
  - Ideally something relevant to your work (it's ok to simplify it a lot)
  - Record the hits and do something interesting with it
    - Imaging, different spectra, event reconstruction, dose calculation, etc
  - May use our current WIP as starting point

Information Tracking

- There are multiple ways to keep track of what happened in the simulation

- Completely dependent on what you want to learn!

- B1: accumulates in the SteppingAction (inefficient)
  - Kind of messy passing around the RunAction and EventAction pointers

- Another option: using PrimitiveScorers
  - We won't use this but they're a totally fine option

- Logically, we want to store Hits in the Run and write them to disk at the end with the RunAction
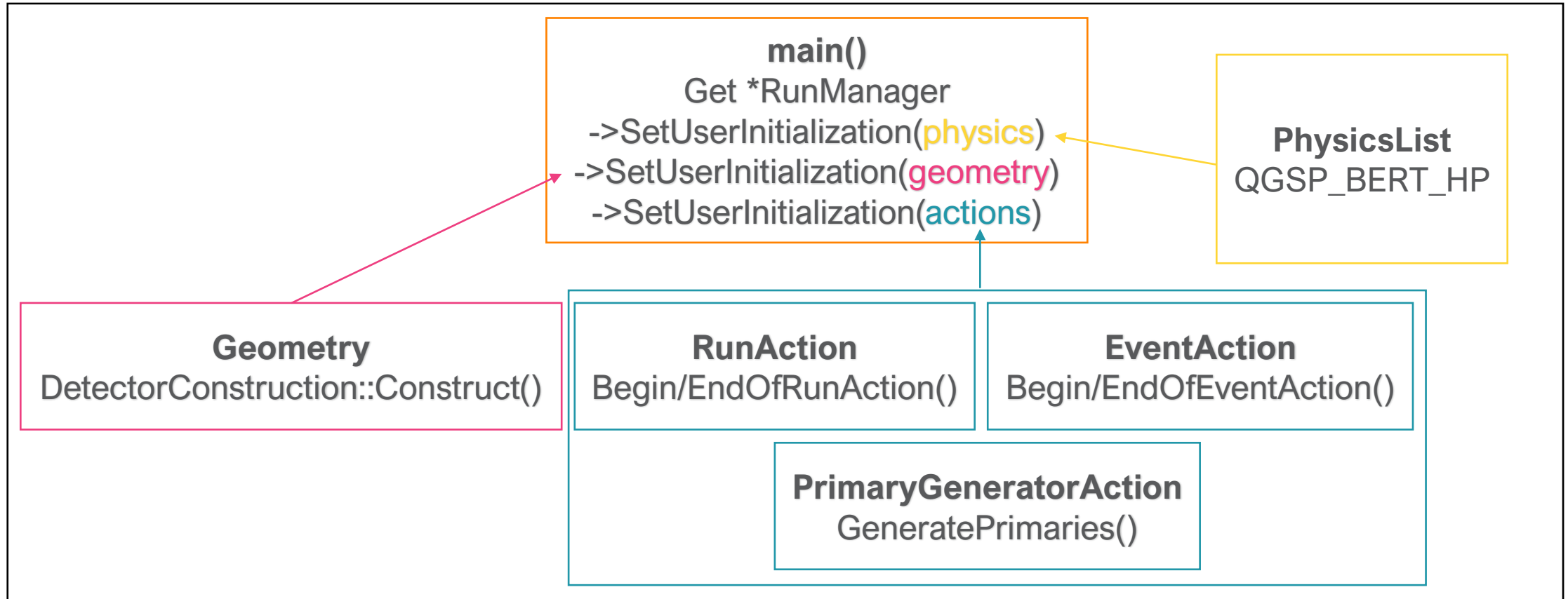
Information Tracking

- Instead of checking every step, making a G4LogicalVolume *sensitive*
  - "Sensitive detector": only check when in this volume
  - Each SD may connect to more than 1 logical volume
- Inherit from G4VSensitiveDetector
  - Initialize() to set up HitsCollection
  - ProcessHits(G4Step) to record a Hit to the HitsCollection
  - Reminder: G4Event has a HitsCollection (similar to vector<Hit>)
- In Run::RecordEvent(G4Event), collect all of the Hits from each G4Event into the Run object
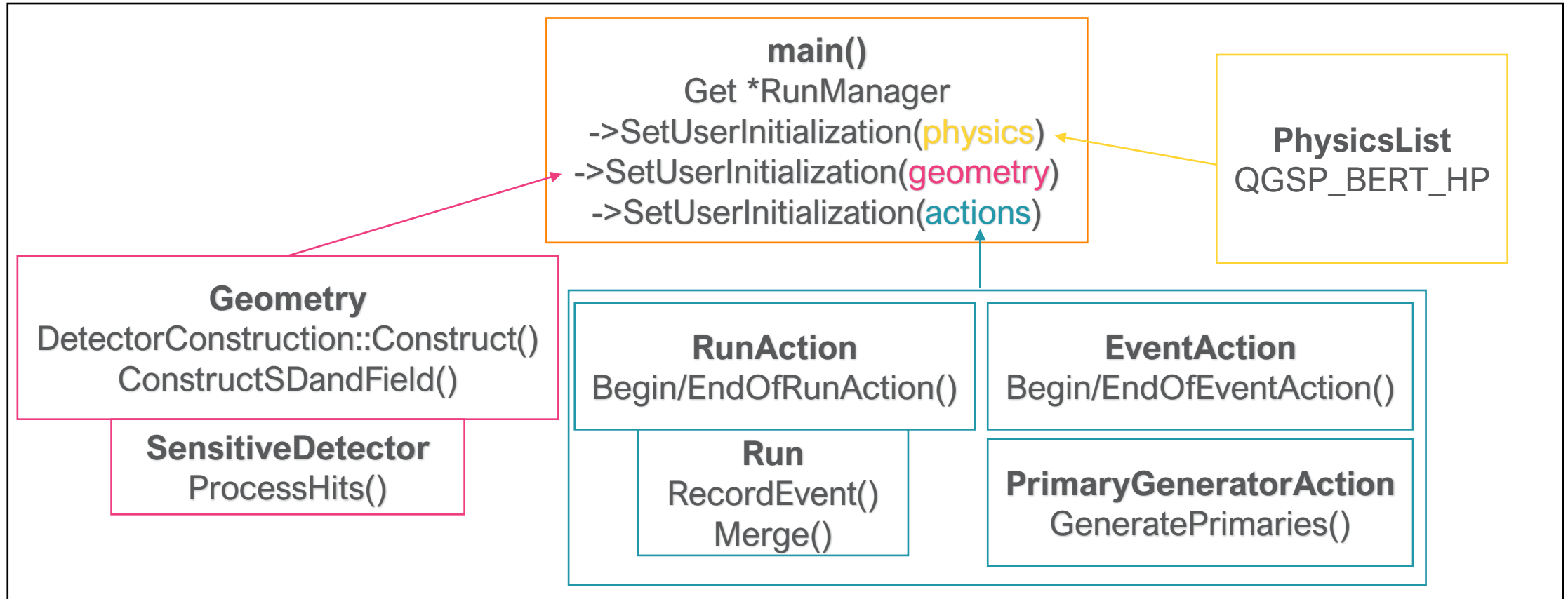- In RunAction::EndOfRunAction(), write all of the Hits to .csv

Information Tracking

- Highly recommended: https://geant4-userdoc.web.cern.ch/UsersGuides/ForApplicationDeveloper/html/Detector/hit.html

Geant4 Core Program Anatomy

Geant4 Program Anatomy

Geant4: NE697 Version

- Minimum working example using best practices
- [DEMO]
  - Build system & directory structure - done
  - main() - DONE
  - DetectorConstruction - world created
  - Physics - DONE
  - PrimaryGeneratorAction – mostly done
  - ActionInitialization - DONE
  - EventAction – mostly done
  - RunAction – mostly done

Geant4: NE697 Version

- Next steps…
- [DEMO]
  - Run object – need to add Hit storage
  - Hit
  - HitTracker (Sensitive Detector)
  - File IO → .csv (inefficient, but simple!)
- Coming up…
  - Custom material definitions
  - Messengers (custom UI commands)

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