Extracting Information

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Outline

Core Information Classes

- G4Step
- G4StepPoint
- G4Track
- G4Event
- G4DynamicParticle
- G4ParticleDefinition

G4Step

- Smallest unit of simulation in Geant4
- Available in G4UserSteppingAction
- Key extraction components
  - G4StepPoint* GetPreStepPoint()[1]
    - Information on particle state before the step
  - G4StepPoint* GetPostStepPoint()[2]
    - Information on particle state following the step
  - G4Track* GetTrack()
  - G4bool IsLastStepInVolume() / G4bool IsFirstStepInVolume()
  - Energy deposit (total and non-ionizing)
  - Delta time, position, momentum, energy
  - List of secondary particles created in step

[1] will always return valid pointer
[2] may not return valid pointer

G4StepPoint

- Position
- Local, global, and proper time
- Momentum, Momentum Direction
- Total energy, kinetic energy
- Velocity
- Polarization
- Charge
- Weight
- Magnetic moment
- Process defined step
- Material
- Touchable handle

G4Track

- Track ID
  - Track ID $= 1 \Rightarrow$ Primary particle
  - Track ID $> 1 \Rightarrow$ Secondary particle
- Kinetic energy
- Material, next material
- Volume, next volume
- Track length
- Current G4Step, step number
- Creator process
- Track status
- Weight
- Local, global, and proper time

G4Event

- Event ID
- Number of primary vertex
- Primary vertex(es)
- Hits collection of the event
- Digit collection of the event

G4DynamicParticle

- Dynamic portions of particle
  - Electron occupancy
  - Position
  - Energy
  - Time
  - Polarization
  - Charge
  - Spin
  - Decay products
  - Mass

G4ParticleDefinition

- Static portions of particle
  - Name
  - PDG (Particle Data Group) Mass, Width, Spin, Charge
  - Lepton number
  - Baryon number
  - Quark content
  - Process manager
  - Atomic number
  - Atomic mass

Fitting it all together

- G4Step will give access to parent G4Track
- G4Step will give access to G4ParticleDefinition and G4DynamicParticle
- G4Step will give access to G4StepPoint
- G4Track will give access to G4ParticleDefinition and G4DynamicParticle
- G4DynamicParticle will give access to G4ParticleDefinition
- G4Track will give access to current G4Step
- ... Many more. Explore the manual pages on the server or the Geant4 doxygen documentation online. There are many routes to access the data

```
// ... G4Step* s;
if(s->GetTrack()->GetDynamicParticle()->GetParticleDefinition()
   == G4Electron::Definition()) // ...
// ... G4Track t;
if(t->GetStep()->IsFirstStepInVolume()) // ...
// ... G4Event* aEvent;
G4HCofThisEvent* HCE = aEvent->GetHCofThisEvent();
```