



Fast simulation (shower parameterization)

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Geant4 Tutorial Course

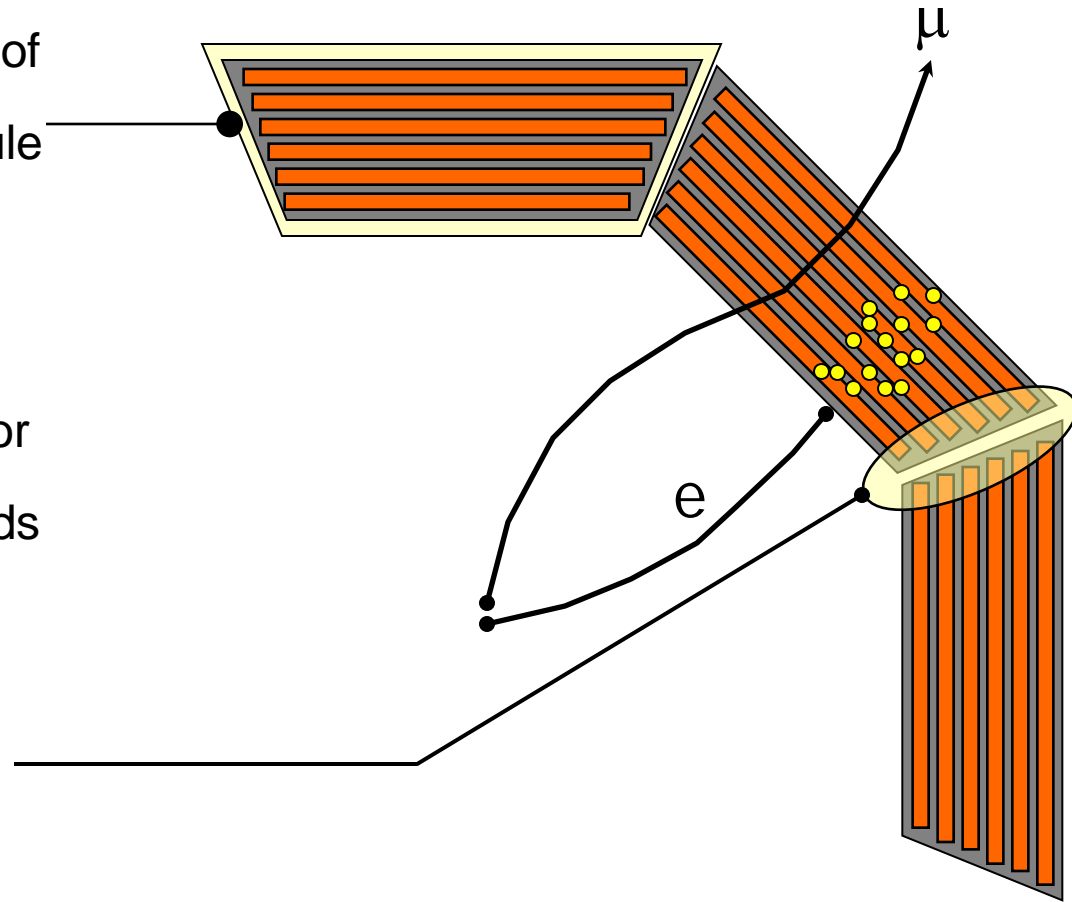
Geant 4

Fast simulation - Generalities

- Fast Simulation, also called as shower parameterization, is a shortcut to the "ordinary" tracking.
- Fast Simulation allows you to take over the tracking and implement your own "fast" physics and detector response.
- The classical use case of fast simulation is the shower parameterization where the typical several thousand steps per GeV computed by the tracking are replaced by a few ten of energy deposits per GeV.
- Parameterizations are generally experiment dependent. Geant4 provides a convenient framework.

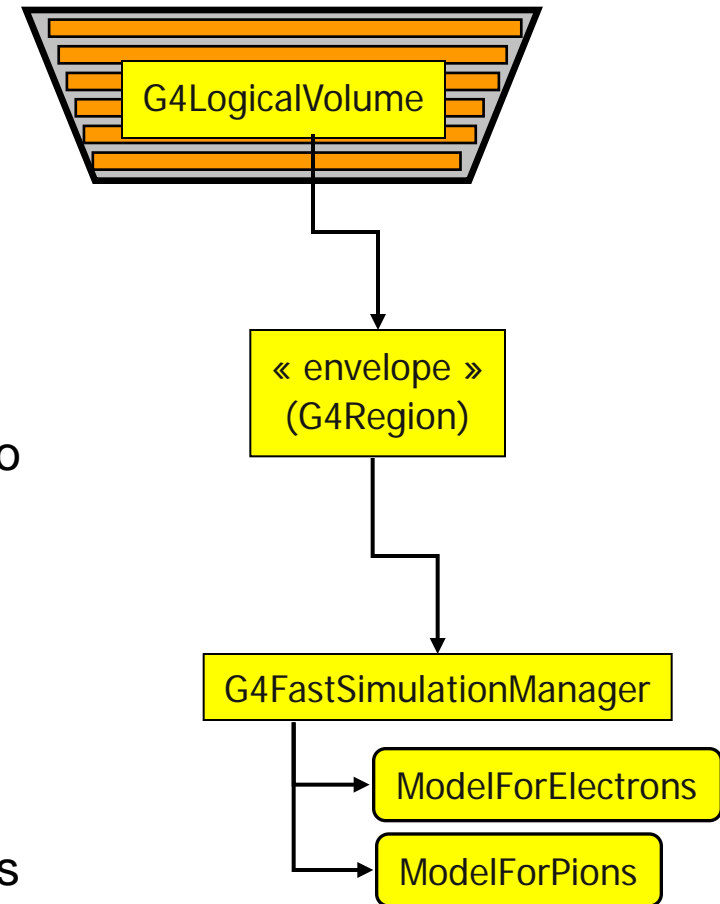
Parameterization features

- Parameterizations take place in an *envelope*. An envelope is a region, that is typically a mother volume of a sub-system or of a major module of such a sub-system.
- Parameterizations are often dependent to particle types and/or may be applied only to some kinds of particles.
- They are often not applied in complicated regions.



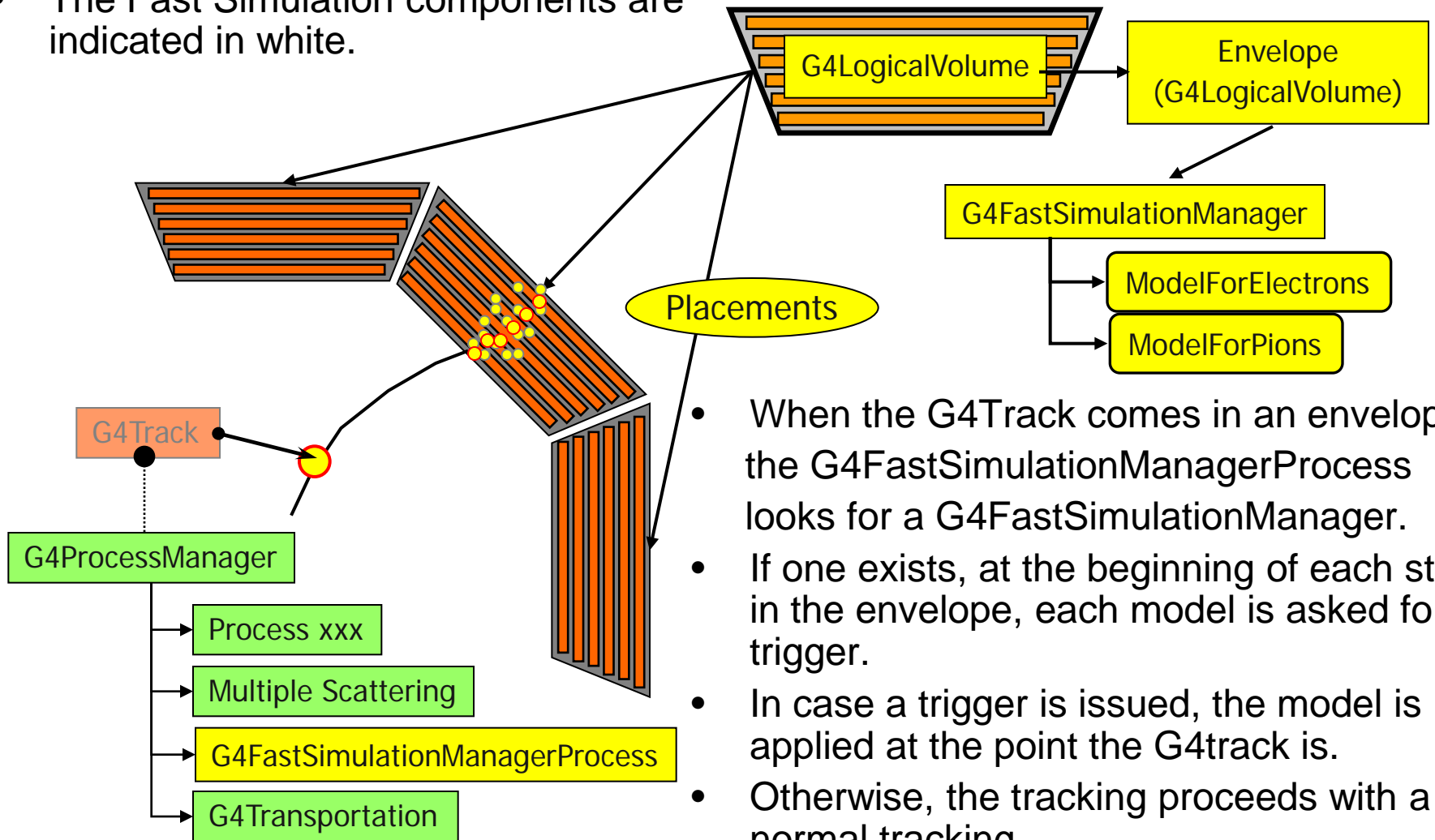
Models and envelope

- Concrete models are bound to the envelope through a G4FastSimulationManager object.
- This allows several models to be bound to one envelope.
- The envelope is simply a G4Region which has G4FastSimulationManager.
- All [grand[...]]daughter volumes will be sensitive to the parameterizations.
- A model may returns back to the "ordinary" tracking the new state of G4Track after parameterization (alive/killed, new position, new momentum, etc.) and eventually adds secondaries (e.g. punch-through) created by the parameterization.



Fast Simulation

- The Fast Simulation components are indicated in white.



- When the G4Track comes in an envelope, the G4FastSimulationManagerProcess looks for a G4FastSimulationManager.
- If one exists, at the beginning of each step in the envelope, each model is asked for a trigger.
- In case a trigger is issued, the model is applied at the point the G4track is.
- Otherwise, the tracking proceeds with a normal tracking.

G4FastSimulationManagerProcess

- The G4FastSimulationManagerProcess is a process providing the interface between the tracking and the fast simulation.
- It has to be set to the particles to be parameterized:
 - The process ordering must be the following:
 - [n-3] ...
 - [n-2] Multiple Scattering
 - [n-1] G4FastSimulationManagerProcess
 - [n] G4Transportation
 - It can be set as a discrete process or it must be set as a continuous & discrete process if using ghost volumes.