Geant 4

Kernel updates

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Kernel updates



- There is almost no update in the categories of run, event, digits_hits and particles except for the massive modifications related to multi-threading.
- So, taking this opportunity, let me explain the major code flow taken care by these categories in multi-threaded mode.
 - 1. Before/During run_initialization in master thread
 - 2. BeamOn in master thread
 - During run_initialization in worker thread
 - 4. BeamOn in worker thread
- Also, let me add a few notes on split class and also on some error messages.



Before/During run_initialization in master thread G4MTRun **G4ParticleTbl** Detector PhysicsList G4MTRunManager Construction / G4IonTable ManagerKernel instantiate SetPhysics() ConstructParticle() SetObjectID() Construct() InitializePhysics() ConstructPhysics() SetCuts() Constructions()



BeamOn in master thread UserWorkerThread G4Worker **G4Worker** G4MTRun G4MTRun Worker Initialization Thread ManagerKerne RunManager Manager **UIManager** InitializeEventLoop() SetUpDecayChannel(DoEventLoop() InitializeSeeds() CreateAndStartWorker() StartThread() PrepareCommandStack() instantiate Split class BuildGeometryAndPhysicsVector() CreateWorkerRunManager() instantiate Initialize() instantiate ApplyCommand()



During run_initialization in worker thread G4WorkerRun **Detector** G4WorkerRun PhysicsList Construction Manager ManagerKernel instantiate SetPhysics() article() Constru ConstructSDandField() InitializePhysics() ConstructPhysics() SetCuts()



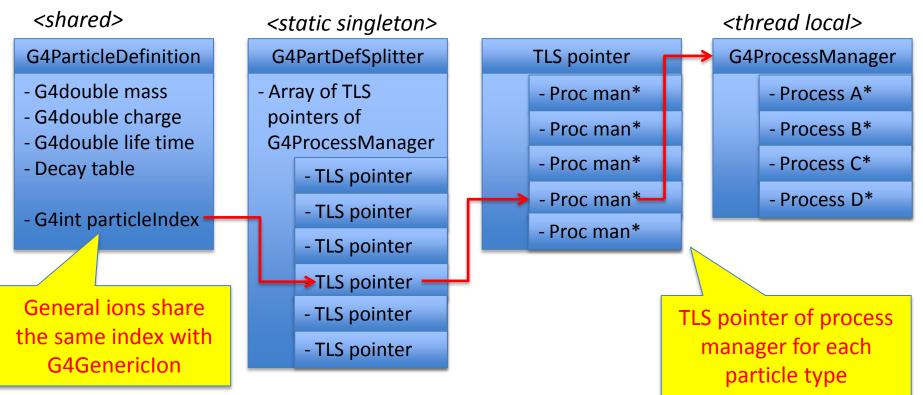
During BeamOn in worker thread G4WorkerRun G4MTRun LocalRunAction MasterRun LocalRun Manager Manager InitializeEventLoop() CreateRun() instantiate BeginOfRunAction() DoEventLoop() Get number of events as SetUpNEvents() a bunch and their seeds RecordEvent() TerminateEventLoop() MergeRun() Merge() RunTerminate() EndOfRunAction()



Split class – case of particle definition



- In Geant4, each particle type has its own dedicated object of G4ParticleDefinition class.
 - Static quantities: mass, charge, life time, decay channels, etc.,
 - To be shared by all threads.
 - Dedicated object of G4ProcessManager: list of physics processes this particular kind of particle undertakes.
 - Physics process object must be thread-local.





Error message - 1



```
*** G4Exception : Run0035
    issued by : G4RunManagerKernel::G4RunManagerKernel()
Size of G4ProcessVector is inconsistent between master and worker threads for the particle <B+>.
size of G4ProcessVector for worker thread is 4 while masther thread is 5.
*** Fatal Exception *** core dump ***
```

- Check your physics list. Most-likely your ConstructPhysics() method or its granular method has a data member Boolean flag or something similar to protect not to execute this method more than once.
- Physics list is a singleton object, while this ConstructPhysics() method is invoked for each worker thread.



Error message - 2



```
----- EEEE ----- G4Exception-START ----- EEEE -----

*** G4Exception : PART122

issued by : G4ParticleTable::Insert()

The particle geantino has already been registered in the Particle Table

*** Fatal Exception *** core dump ***

----- EEEE ----- G4Exception-END ------ EEEE ------
```

- Something in the worker thread tries to create a new particle.
 - It is not PhysicsList::ConstructParticle(), that is not invoked in a worker thread.
- This is not allowed except for general ions.



Error message - 3



```
----- WWWW ----- G4Exception-START ----- WWWW -----
*** G4Exception : PART11117
    issued by : G4ParticleTable::FindIon()
This method is obsolete and will be dropped from v10.0. Use
G4IonTable::FindIon().
*** This is just a warning message. ***
----- WWWW ------ G4Exception-END ------ WWWW ------
```

- GetIon() and FindIon() methods in G4ParticleTable are obsolete and should not be used any more.
- Use similar (and enhanced) methods in G4IonTable.
- Currently, this warning message is issued. Soon these methods will be actually removed, so that classes that still use these methods won't compile any more.



A request



Don't do

```
ionTable -> GetIon("ion_name") -> GetMass();
ionTable -> GetIon(A, Z, IvI) -> GetMass();
```

Instead, do
 ionTable -> GetMass("ion_name");
 ionTable -> GetMass(A, Z, IvI);

- GetIon() method creates an ion object. If the mass is the only information you need, don't create the ion.
- For the full list of GetIon(), FindIon(), GetMass() and other methods on ions, please consult to G4IonTable class.

