NeutronHP, Hadronic Framework

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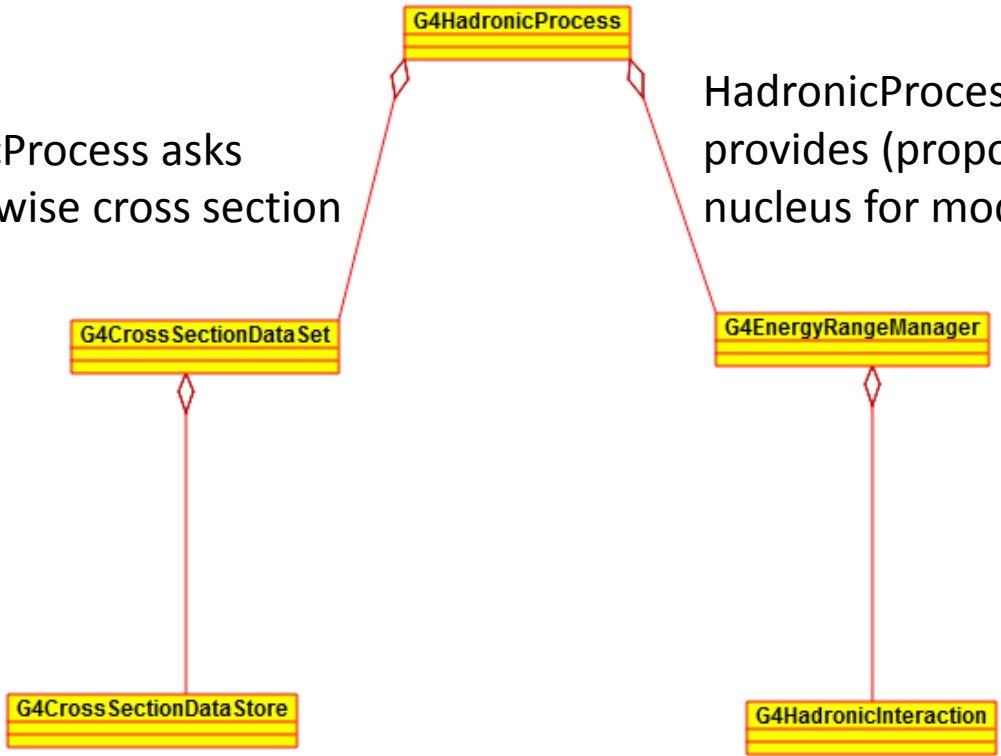
Background

- **HadrnicProcess** defines the top level of Hadronic framework (See next slide)
  - It is not an abstract class at all.
- **NeutronHP** package provides cross sections and models for hadronic framework of Geant4 with the same manner to the other hadronic models and cross sections
- Energy coverage of the package is quite extended in lower side in a comparison to other hadronic models and cross sections
  - Down to 10^{-5} eV

Hadronic Framework

G4NeutronInelasticProcess
G4NeutronCaptureProcess
G4NeutronFissionProcess,,,,



HadronicProcess asks
isotope wise cross section

HadronicProcess
provides (proposes)
nucleus for model

G4NeutronHPElasticData
G4NeutronInelasticData
G4NeutronHPThermalScatteringData,,,

G4NeutronHPElastic
G4NeutronInelastic
G4NeutronHPThermalScattering,,,

Problems

- HadronicProcess is implicitly designed for interaction between projectile particle and target nucleus (at rest).
  - In other words **Particle-Particle**
- **At ultra low energy**, several physics quantities (e.g. thermal motion of target nucleus, bounding energy of atoms and so on)become important
- To handle such interaction correctly, neutronHP requests providing those information to HadronicProcess
  - They are unused (unecessary) in most of others.
- Sometime neutronHP compensate information tricky way
  - Requesting special names for “element”
- Cross sections and models of NeutronHP package is not fully independently swappable
  - We had a trouble on this
- As the result, both HadronicProcess and NeutronHP package enhanced its complexity to keep the framework

Proposal

- Introduce a new NeutronHPProcess (tentative name) and separate (some part of) NeutronHP package from hadronic framework (HadronicProcess)

- Following slides show possible implementation in physics list

Possible implementation 1

- Create a new **HPProcess** by wrapping a HadronicProcess and register only the new process in process manager of neutron

- PhysicsList will be like

```
neutronInelasticProcess = new G4NeutronInelasticProcess;
,,,,,
neutronHPInelasticProcess = new
G4NeutronHPInelasticProcess(neutronInelasticProcess);
,,,,,
neutronProcessManager-
>AddProcess(neutronHPInelasticProcess);
```

Possible implementation 2

- Create a new **HPProcess** and set energy limitation to HadronicProcess (new functionality) and register both of them in process manager of neutron

- PhysicsList will be

  neutronInelastic = new G4NeutronInelasticProcess

  ,,,,,,

  neutronInelasticProcess->SetEmin(1*keV);

  neutronProcessManager->AddProcess(neutronInelasticProcess);

  neutronHPInelastic = new **G4NeutronHPInelasticProcess**;

  ,,,,,,

  neutronProcessManager>AddProcess(neutronHPInelasticProcess);