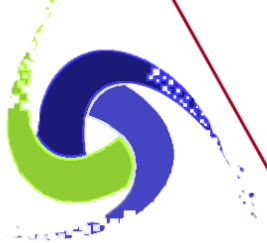

GEANT4
A SIMULATION TOOLKIT

Unified tracking mechanism for exotic particles (ions, muonic atoms, radicals, hyper-nuclear, phonon, e/h)

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Exotic particles

- Each elementary particle and light ion (up to alpha) in Geant4 is represented by a dedicated G4ParticleDefinition class object, and each G4ParticleDefinition class object has its own G4ProcessManager class object to register processes for that particle.
  - ~100 G4ParticleDefinition objects
- This is not the case for ions. Though G4ParticleDefinition class object is created for each ion (A, Z, E, J), they all share one G4ProcessManager class object to register processes for all ions, assigned to G4GenericIon artificial class.
  - ~7000 G4ParticleDefinition objects
- G4MuonicAtom was introduced. Theoretically, any ion may become a muonic atom. Though G4ParticleDefinition class object is created for each muonic atom (A, Z, E, J), they all share one G4ProcessManager class object to register processes for all muonic atoms.
  - G4ProcessManager for muonic atom is different from one for ions.
  - Mechanism of sharing G4ProcessManager was duplicated.
- In G4DNA, radicals (e.g. OH^-) are treated in the same manner. Hyper-nucleus physics is in the scope.
  - ~20000 G4ParticleDefinition objects in four different categories

Work plan / status

- Uniform, transparent and extendable treatment is required.
  - Likely particles of no more than two categories co-exist. Performance overhead must be avoided and at the same time clean code structure is desirable.
- G4SteppingManager is already cleaned up. There is no longer #ifdef, there is no longer indirect access to G4PrcessManager via G4GenericIon (or G4GenericMuonicAtom, etc.).
  - G4IonTable is updated to ensure this.
- Remaining work – Split G4IonTable class
  - G4IonTable::GetMuonicAtom() will be moved to new G4MuonicAtomTable.
  - Hyper-nucleon, radicals, will have their own “table” class.
  - Clean way to enable extendibility for yet another particle family without overhead
  - Plan to finish for ion and muonic atom by 10.5 release, while hyper-nucleon table will be in the coming year.