SAMPO

Gaudi-based framework status report

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Project overview

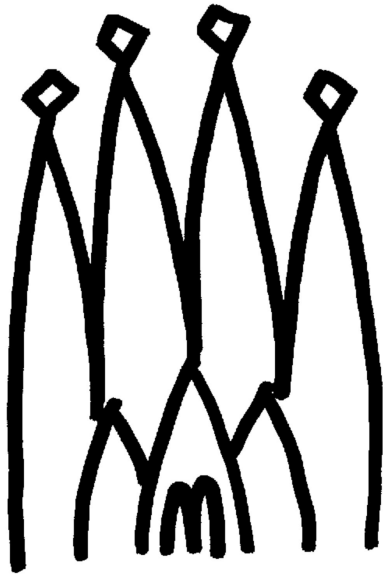
Gaudi-based offline software, substitution for SPDRoot.

Updates since VIII collaboration meeting in yellow.

Current functionality:

- Pythia8 for events generation
- GeoModel for detector description
- HepMC3 as main format for generators
- Geant4 for simulation
- Magnetic field description features

Main update



Useful links:

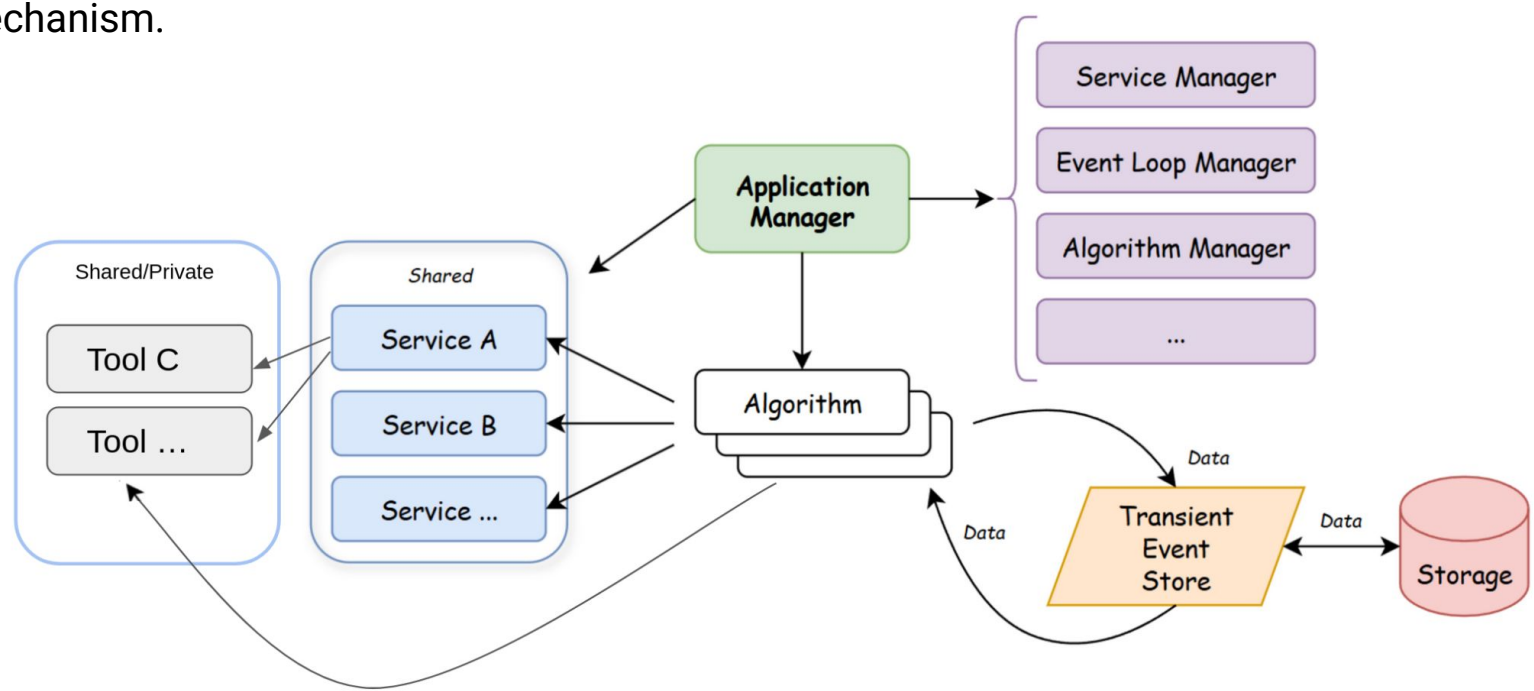
Gaudi Docker image: https://git.jinr.ru/spd/spd-sw/gaudi (develop branch)

Gaudi Tutorial: https://git.jinr.ru/lsimbir/gauditutorial/

Sampo repo: https://git.jinr.ru/spd/spd-sw/sampo/ (develop branch)

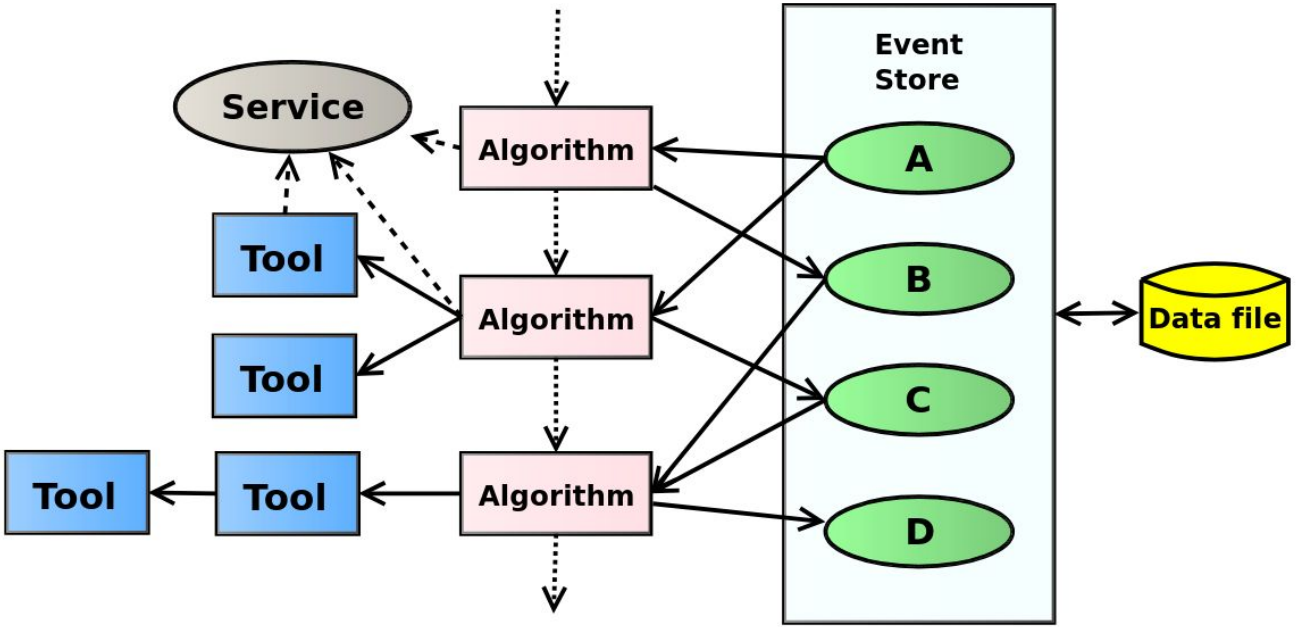
Gaudi architecture (single-threaded): Key components

Concept: Data objects are manipulated by Algorithms that are launched on per-event basis. Algorithms use Services and Tools to delegate work. All are dynamically configurable via Properties mechanism.



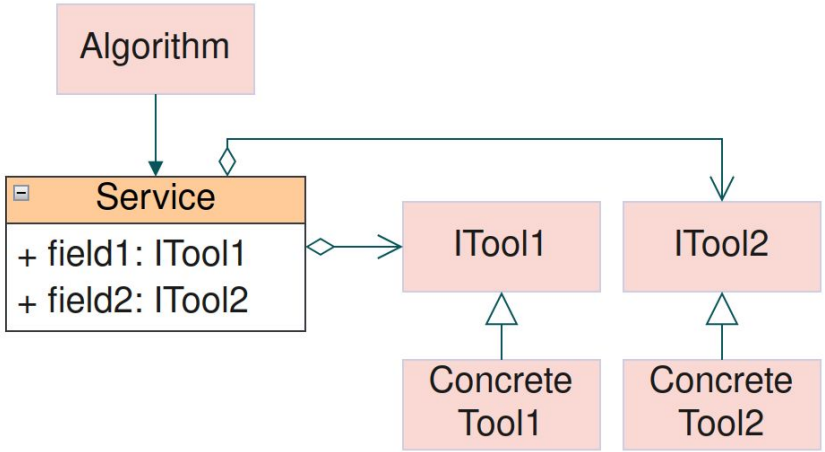
Gaudi architecture (single-threaded): Control and data flow

Concept: The dotted lines indicates the control flow. The solid lines indicate data flow. Dashed lines indicate a non-owning reference between components.



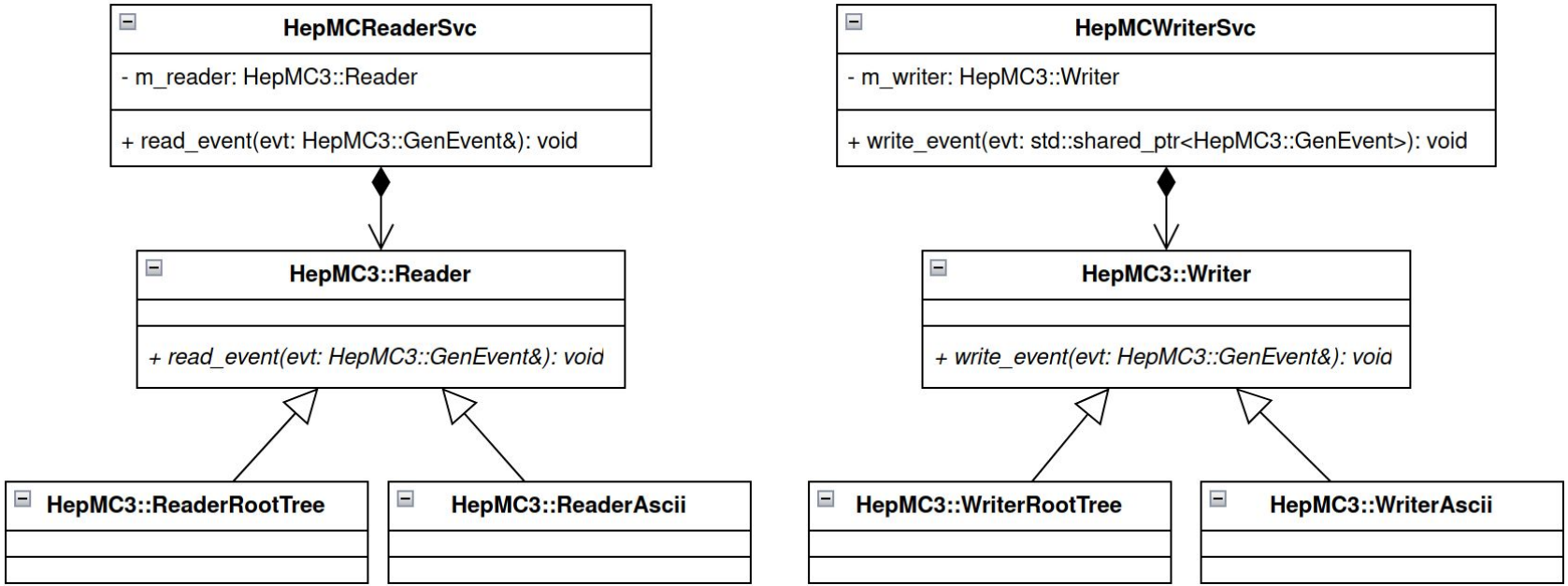
Gaudi architecture: Tools and Services

Concept: Services encapsulate high-level logic whereas Tools can be used for details implementation. Concrete Tools can be selected via job options.



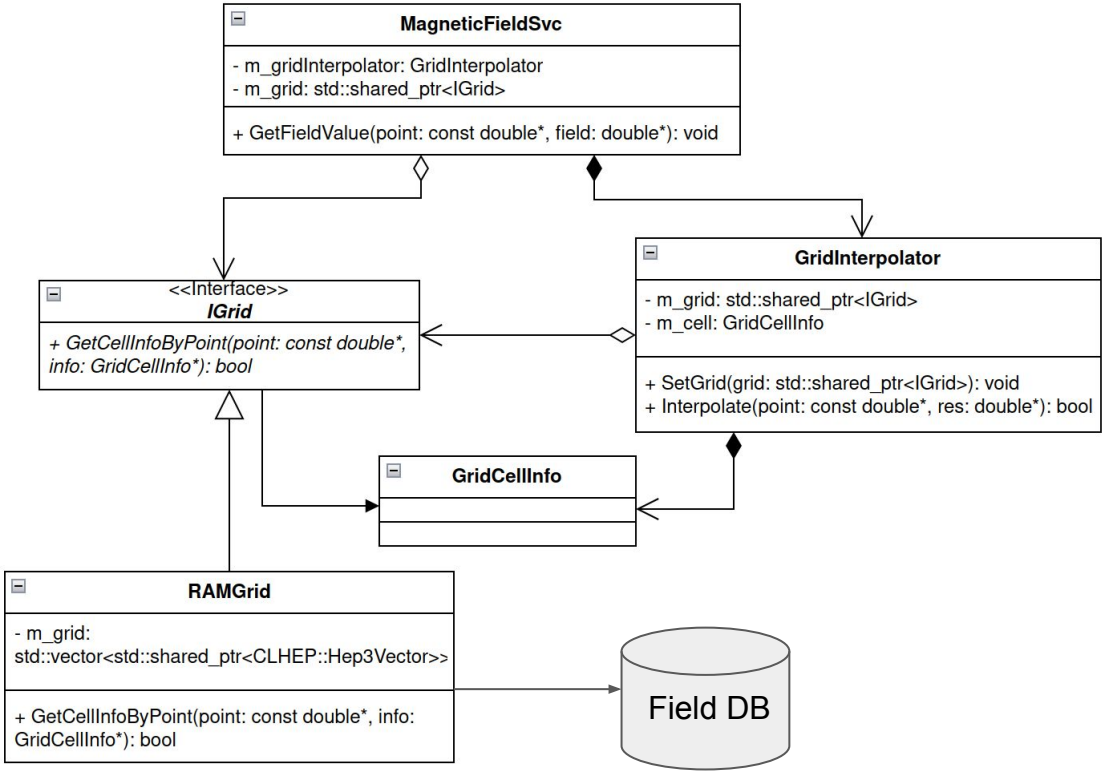
HepMC3 IO

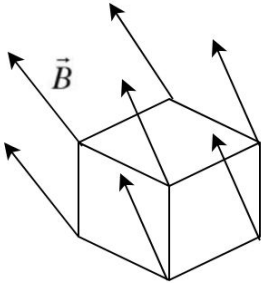
Concept: HepMCReaderSvc and HepMCWriterSvc are responsible for HepMC3 IO.
HepMCReaderSvc has list input files, having read last event it schedules EventLoop to stop.



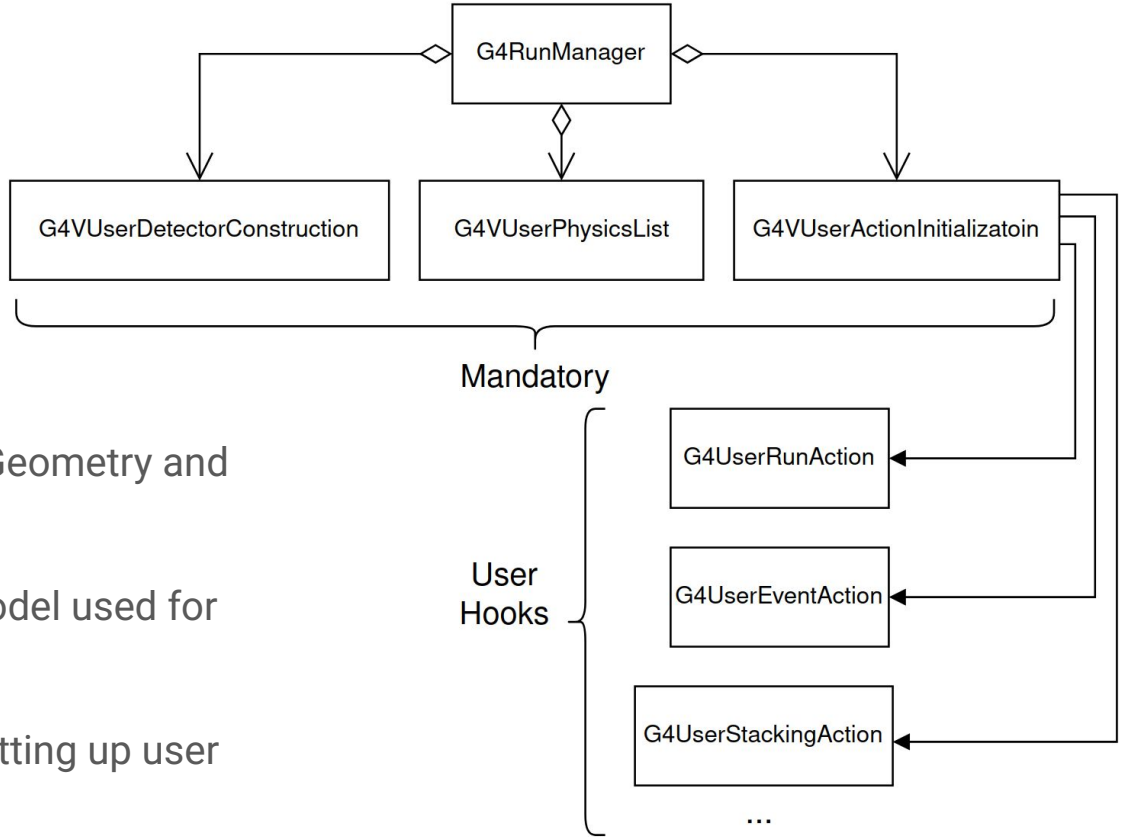
Magnetic field

Concept: Field stored as 3D map in SQLite DB. Trilinear interpolation for evaluation at target point.





Geant4: Features



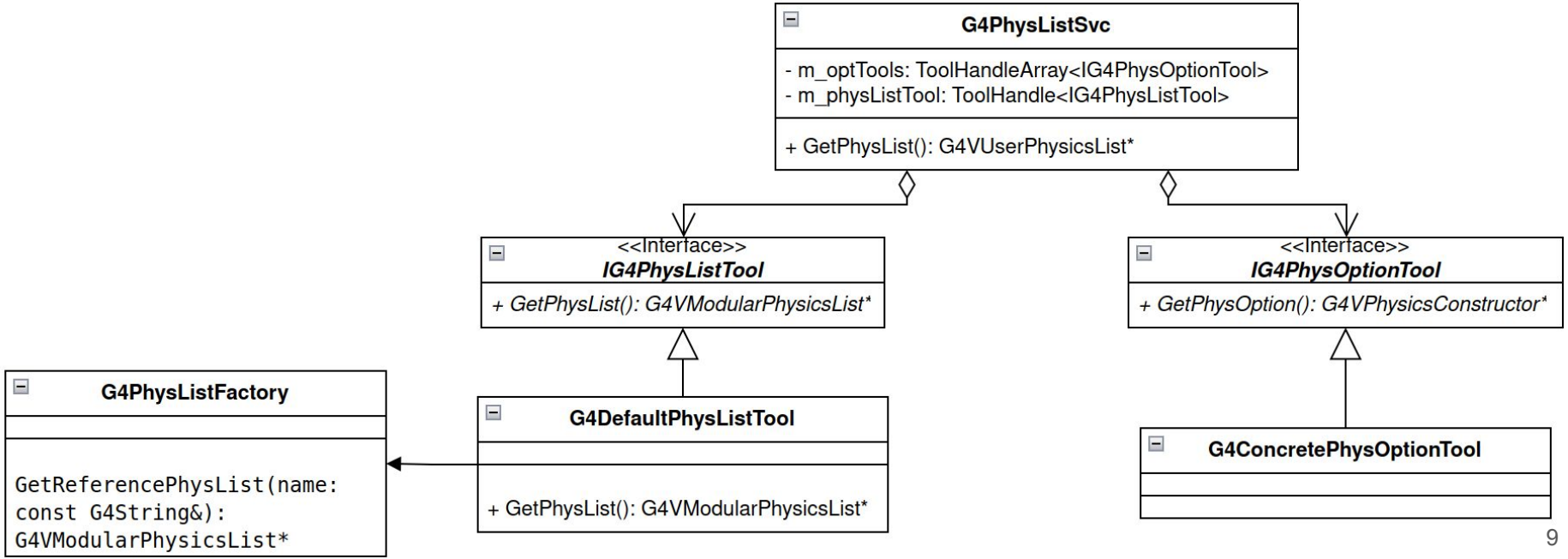
G4VUserDetectorConstruction -> Geometry and sensitive parts of the detector

G4VUserPhysicsList -> Physics model used for calculations

G4VUserActionInitioalization -> Setting up user hooks

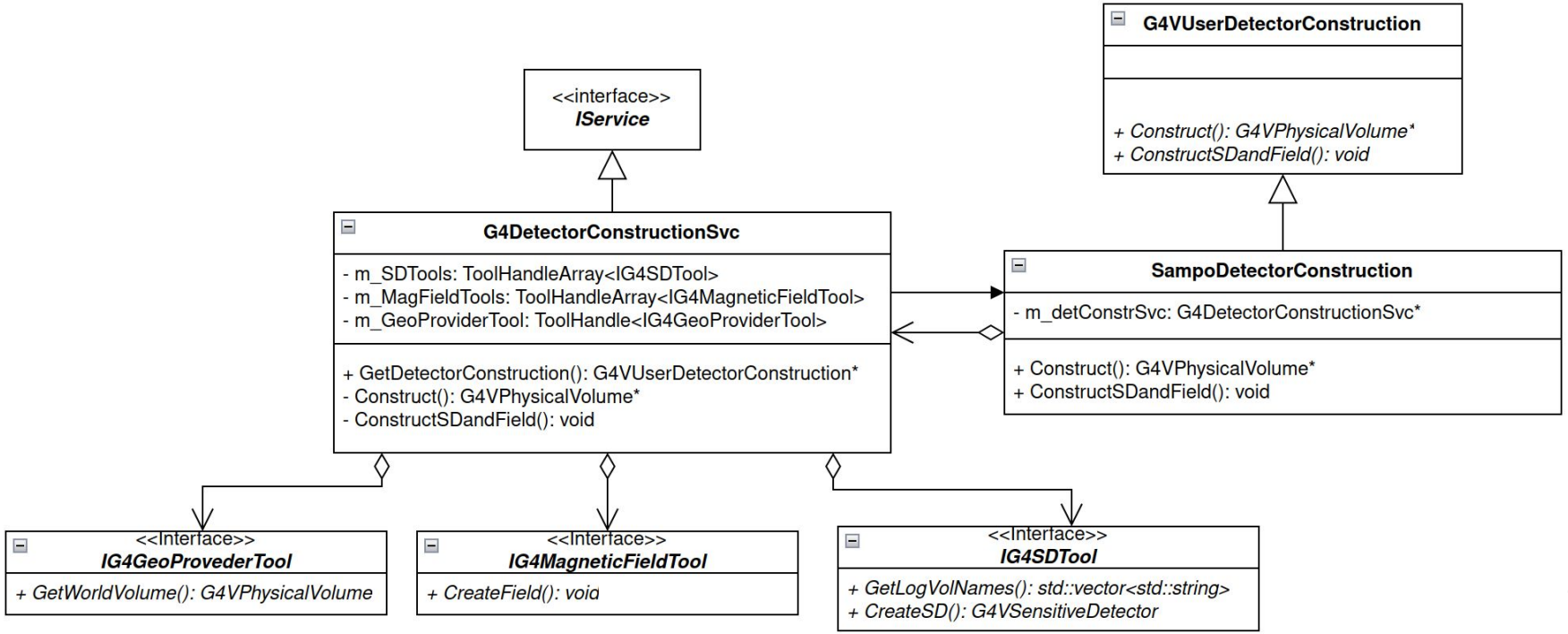
G4PhysListSvc

Concept: G4PhysListSvc is used to construct G4VUserPhysicsList. G4ConcretePhysListTool constructs PhysList itself and then hooks constructed by G4ConcretePhysOptionTools are applied. Two types of options: Register and Replace.



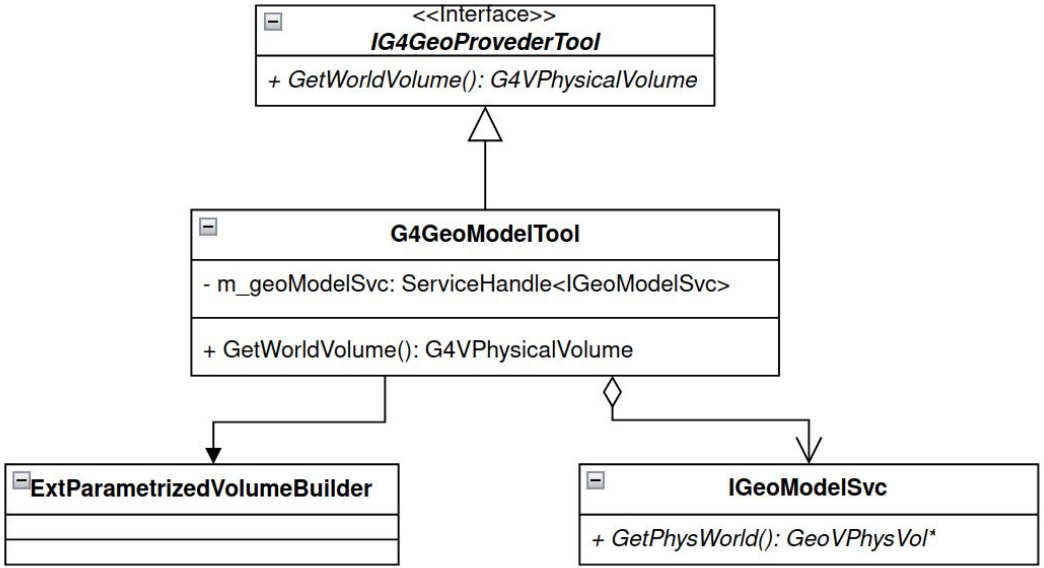
G4DetectorConstructionSvc

Concept: G4DetectorConstructionSvc wraps itself into adapter class SampoDetectorConstruction. Main work of detector and field creation is delegated to contained tools.

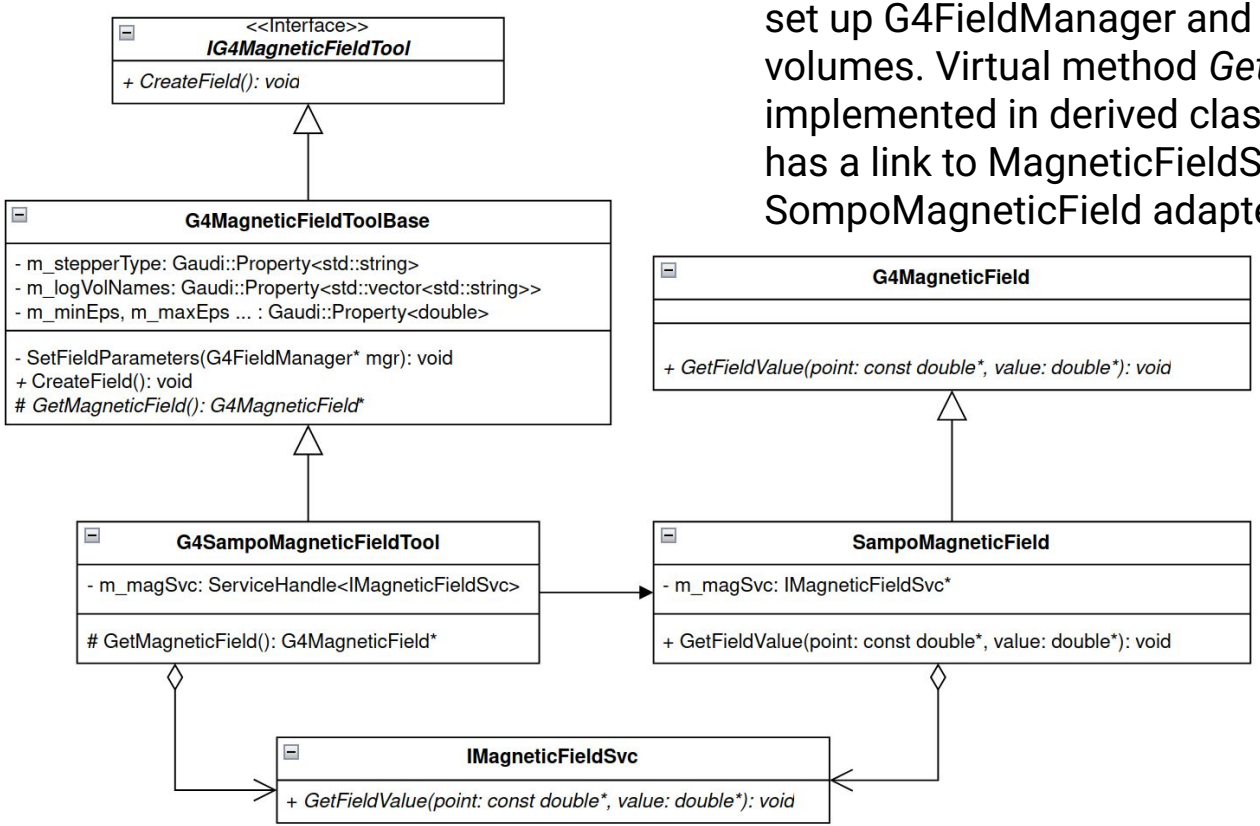


G4GeoModelTool

Concept: GeoModelTool has a link to GeoModelSvc and knows how to convert GeoModel volumes to Geant4 volumes.



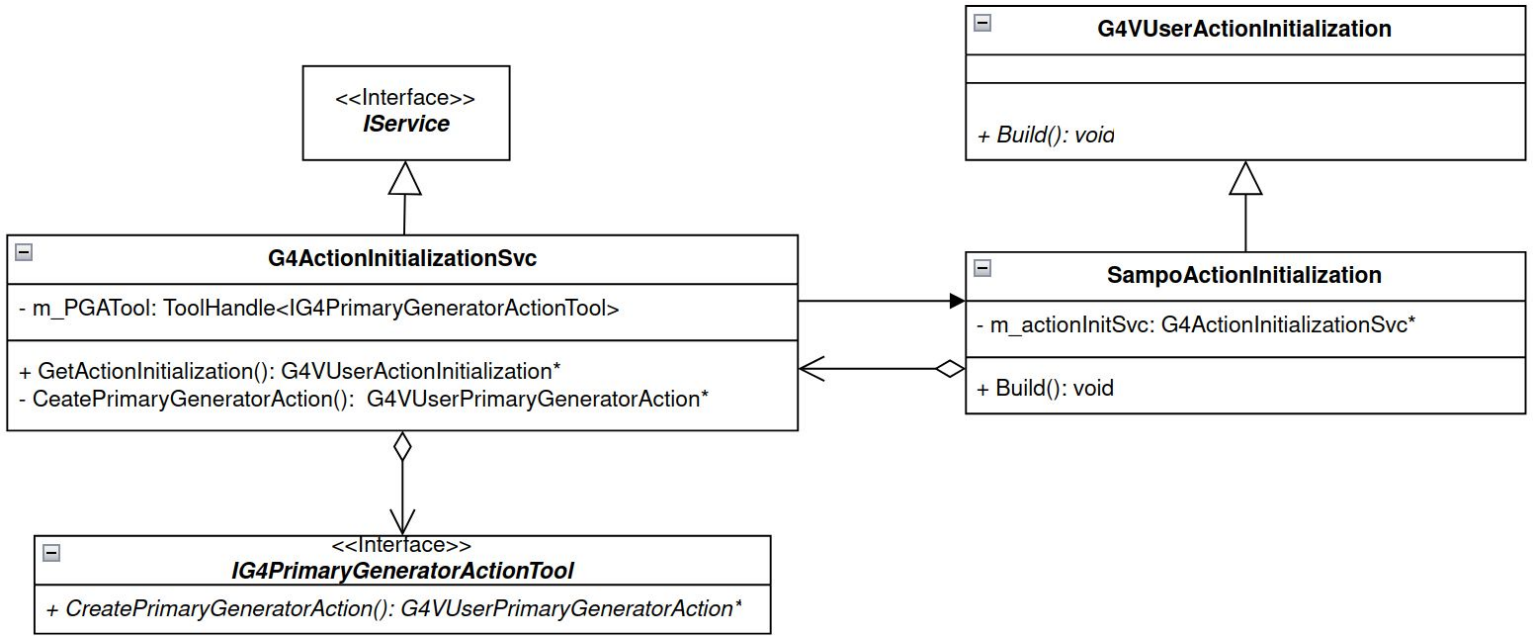
G4SampoMagneticFieldTool



Concept: G4MagneticFieldToolBase is used to construct and set up G4FieldManager and to assign it to selected logical volumes. Virtual method *GetMagneticField()* has to be implemented in derived classes. G4SampoMagneticFieldTool has a link to MagneticFieldSvc and is used to wrap it into SompoMagneticField adapter class.

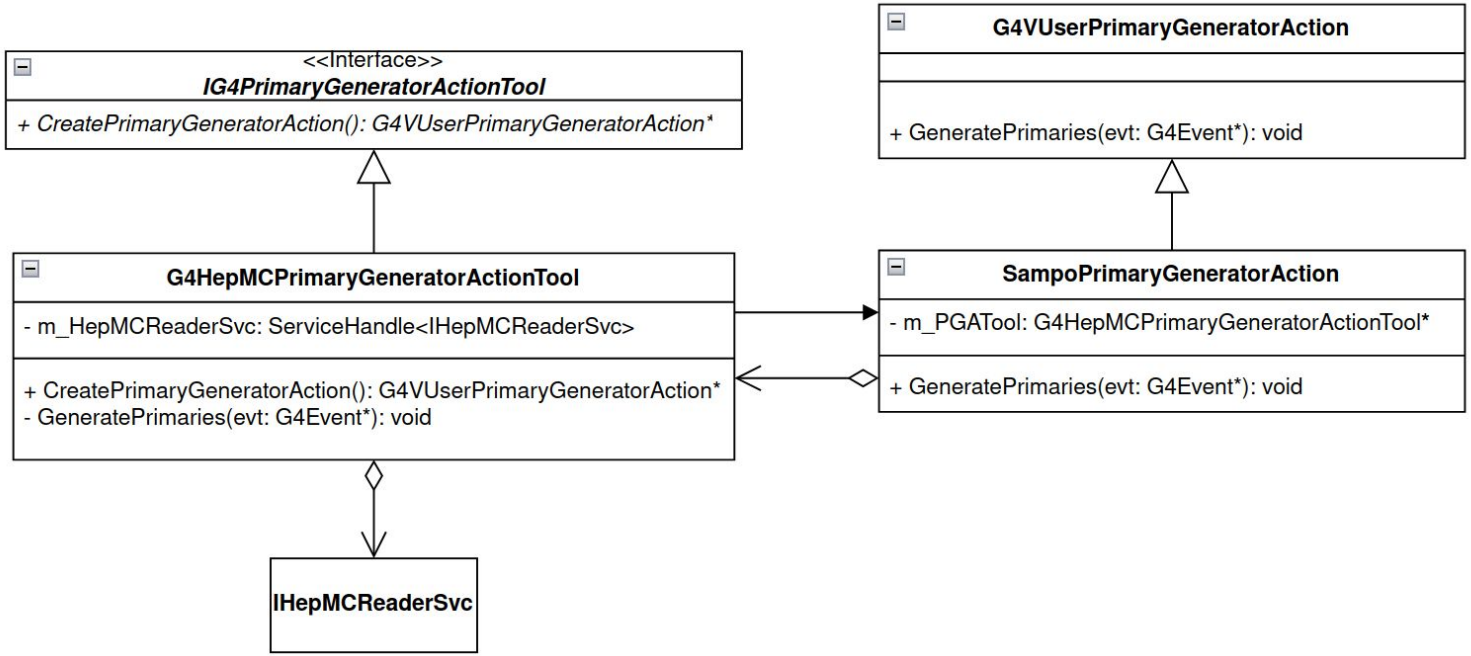
G4ActionInitializationSvc

Concept: G4ActionInitializationSvc wraps itself into adapter class SampoActionInitialization. Main work of user hooks creation is delegated to contained tools.



G4HepMCPrimaryGeneratorActionTool

Concept: G4AHepMCPrimaryGeneratorActionTool uses HepMCReaderSvc to read events and then converts them to G4Events. It wraps itself into adapter class SampoPrimaryGeneratorAction.



Conclusion:
Framework has now most of the necessary functionality for simulation chain, but further development is impossible without participation of physicists. Such things as Hits, Sensitive Detectors, etc. must be described by experts.

Plans:

- Integration with middleware
- Hits and Sensitive Detectors description
- Digitization

The Forging of the Sampo, Akseli Gallen-Kallela, 1893