GenTools, Generators in Gaudi

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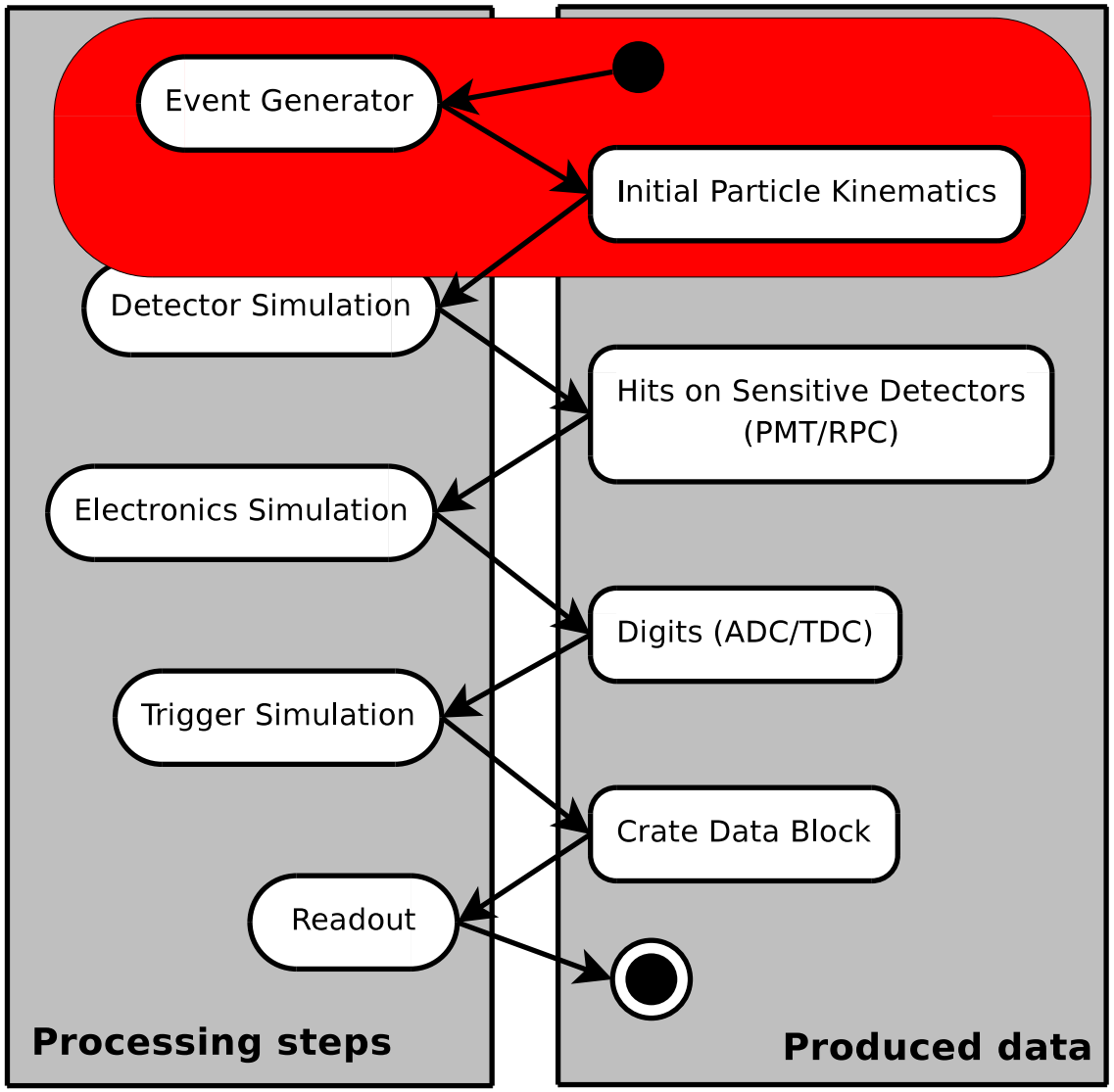
Just the Event Generator, (DetSim, etc, later)



The Generator class

- Lives in `Simulation/GenTools` package (`Gt` for short).
- A single, reusable `GtGenerator` algorithm
- Responsible for:
  - Setting up TES output object. By default uses: `/Event/Gen/HepMCEvents`, but it is configurable.
  - Using one or more "event mutator" tools to completely or partially build the event. These tools do the real work.
  - Storing the final result in the TES
- Possible to generate multiple events with `GaudiSequencer` + multiple `GtGenerator` instances (but this doesn't get us our "15 minutes" yet).

Generator "event mutator" Tools

Existing tools:

`GtHepEvtGenTool` : generate events from a HEPEvt source.

- Source is a file or an executable, can load more than one
- Fully rewritten (not G4dyb's version) no Geant4 needed.

`GtPositionerTool` : place an event in a volume

- `FullVolume` - choose uniform random in entire volue
- `AvoidDaugthers` - as above, but don't fill space ocupied by daughters.
- `Surface` - uniform on surface (not yet implemented, volunteers?)

`GtTimeratorTool` : place an event in time

- Given a rate, select a time based on exponential dist.

`GtGuneratorTool` : classic particle "gun"

- Still needs implementation (volunteers?).

Generator output

- One generator produces one `HepMC::GenEvent`
  - Comunity standard for generator information
  - `GenEvent` holds `HepMC::GenVertex`'s which hold `HepMC::GenParticle`'s
- Default TES storage: `/Event/Gen/HepMCEvents`
- Of type: `DayaBay::HepMCEvents` which is a collection of `DayaBay::HepMCEvent` each which hold one `HepMC::GenEvent`.
- The `DayaBay::` classes are part of our "data model".

These are then used as input for the Detector Simulation (DetSim), but let's leave that for a later meeting (so I can finish it!).

Job Configuration

```
toolSvc = app.toolSvc()
hepevt = toolSvc.create("GtHepEvtGenTool")
hepevt.HepEvtDataSource = "/path/to/Generator.exe -n 10"
app.TopAlg += [ "GtGenerator/Gen", "GtHepMCDumper/Dumper" ]
gen = app.algorithm("Gen")
gen.GenTools = [ "GtHepEvtGenTool" ]
gen.GenName = "My Special Generator"
gen.GenEventLoc = "/Event/Gen/MySpecialHepMCEvents"
```

See GenTools/share/test-GeneratorAlg.py for full example.

How to write your own GenTool (for reference)

Best to add it in your own package. If you think it belongs in `GenTools/`, talk to me.

1. Inherit from:
   `public GaudiTool, public IHepMCEventMutator`
2. Call this in the constructor:
   `declareInterface<IHepMCEventMutator>(this);`
3. Provide method:
   `virtual StatusCode mutate(HepMC::GenEvent& event)`
4. Add to `MyPackage/src/MyPackage_entries.cc` (or your own equivalent, see `GenTools/src/GenTools_entries.cc` for full example):
   - `#include<MyGenTool.h>`
   - `DECLARE_TOOL_FACTORY(MyGenTool);`
   - `DECLARE_TOOL(MyGenTool);`

See `GenTools/src/GtTimerator.*` for a most simple example.

Work that needs doing

- The traditional particle "gun" needs writing.
  (LHCb's `Gen/ParticleGuns/` is ripe for stealing.)
- Implement the "Surface" event placement,
  (when someone actually needs it).
- Further integration of the old style executable generators desired:
  - Would like to remove the requirement to match the # of generated events to the # of processed events.
  - Remove requirement of HEPEvt (still can have it if useful)
- Any user testing is appreciated, and ready for it now.

Any Volunteers?

A last one, which I think is only for me:

- Write Stage/Process classes to implement just-in-time processing needed for D&B's "15 Minutes Of Data" design. This will re-use the generator tools.