A First Report on Fast Simulation with Geant4 for an FCC Detector

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First Steps

- GitHub Repository
- Learned the basics of Geant4
- 3 main examples used:
  - Pythia Generator

examples/extended/eventgenerator/HepMC/HepMCEx02

  - GDML

examples/extended/persistency/gdml/G01

  - Parametrisation

examples/extended/parametrisations/Par01

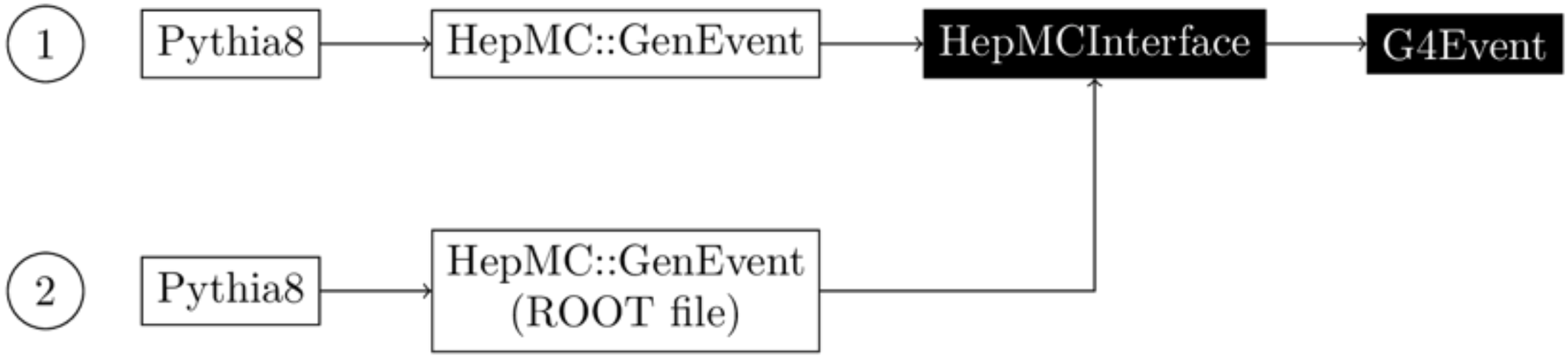
Pythia Event Generator

- Updated available example on Geant from Pythia6 to Pythia8
- Two possible choices for generator

  (1) Pythia called from Geant4 for each event

  (2) Event read from ROOT file (HepMC format)

  Preliminary test done with ASCII file



Pythia Event Generator

(1) Options for Pythia are set in Geant macro

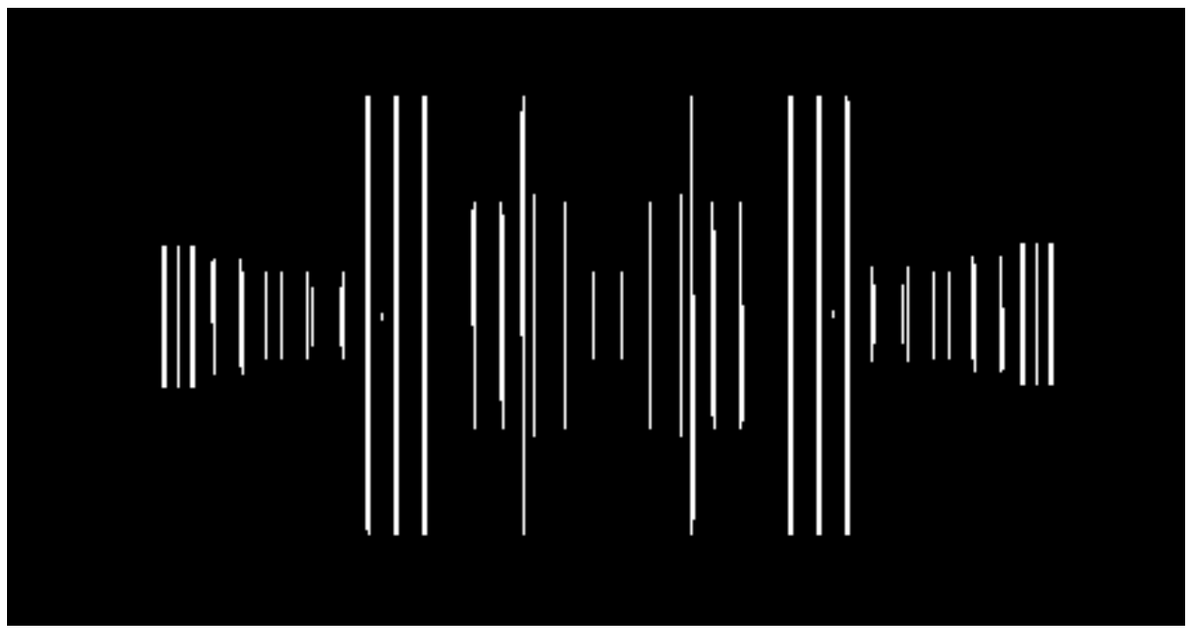
```
/generator/select pythia8
/generator/pythia8/read "HardQCD:all = on"
/generator/pythia8/read "PhaseSpace:pTHatMin = 20."
/generator/pythia8/init 2212 2212 14000.
```

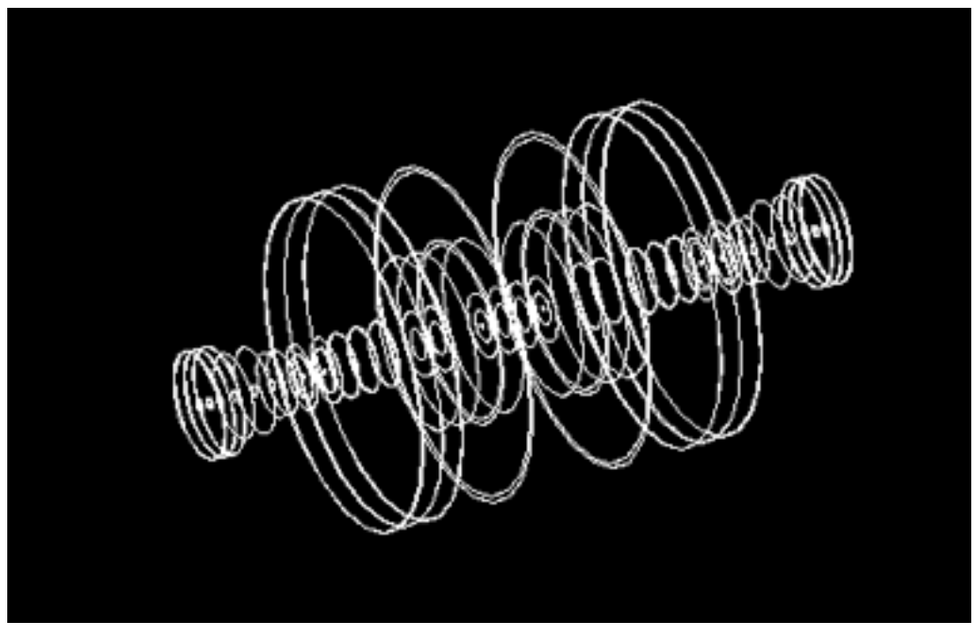
(2) Standalone Pythia8 program is used to generate HepMC ASCII output `example.root`

(To be implemented from Pythia8 examples/main41.cc or examples/main42.cc)

GDML

- Geometry Description Markup Language
  - Based on XML
- First FCC geometry obtained from Andrea Dell'Acqua
- Can be translated into DD4HEP if and when necessary





Fast Simulation Configuration

- Geometry in GDML is relatively easy to change

- Physics of Pythia is set in a Geant4 macro (processes, energy ...)

Next Steps

- Pythia Physics need discussing
- HepMC root input/output to be implemented
- Parametrisation - Simple smearing to start, What next ?
  - More sophisticated particle *makers* – discussing with A. dell'Acqua for the algorithms
  - GFlash?, need a more detailed *detector* model
- Output - ROOT ntuple, discussing what to store?

  (vertex, $\sigma_{\mathbf{vertex,}}$ {$\mathbf{p}$, $\sigma_{\mathbf{p}}$, PID…})