



Status of GFlash example for sampling calorimeter

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27/09/2022 Parallel session: Biasing and Fast Simulation update

27th Geant4 Collaboration Meeting - Rennes 2022

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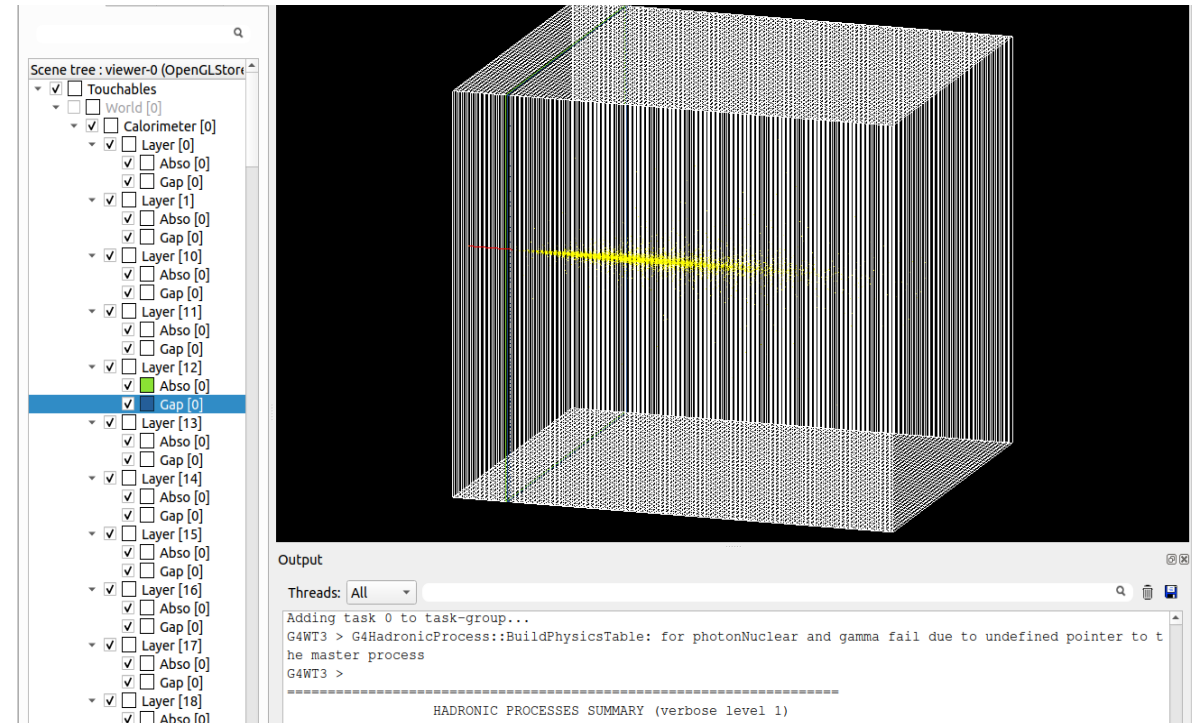
27/09/2022 Parallel session: Biasing and Fast Simulation update

ExGflashb example

The application will allow compare and tune GFlash sampling shower parametrization versus full Geant4 shower development.

- All calorimeter is a single Gflash envelope
- Single “Gap” plate used as a SD volume
- Possibility to change materials and layer geometry
- Several geometry examples (macro files)
- The example produce following histograms:

- h0 : energy deposit per event
- h1 : the number of hits per event
- h2 : the energy per hit (in MeV)
- p0 : longitudinal energy profile
- p1 : radial energy profile
- p2 : cumulated longitudinal energy profile
- p3 : cumulated radial energy profile

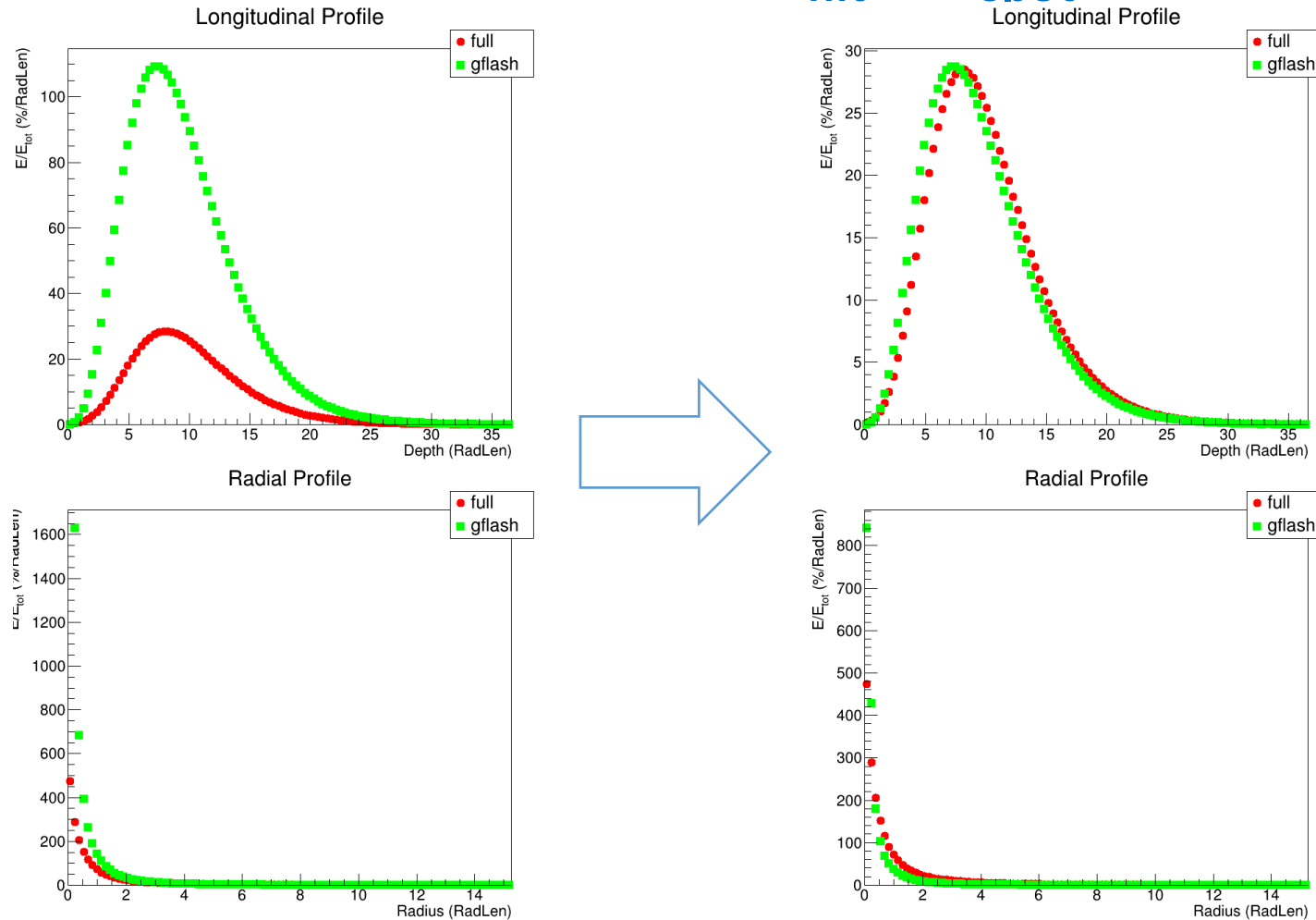


GFLASH Hits in Pb + Scintillator sampling calorimeter (aka LHCb), e^- , 50 GeV

ExGflashb

comparison of full Geant4 and GFLASH

Simple correction: $E_{\text{hit}} = E_{\text{spot}} \times C$



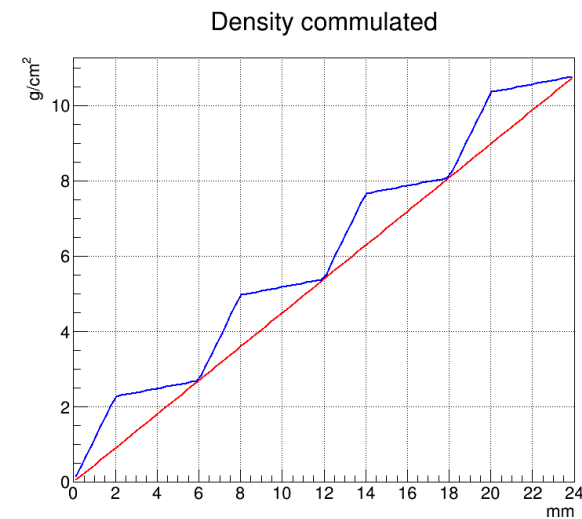
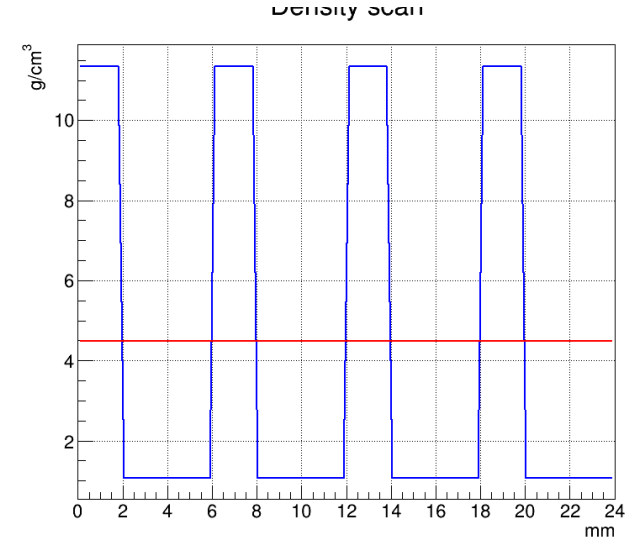
Budget of materials

The GFLASH replace the absorber and deceptor materials with averaged muxtured material.

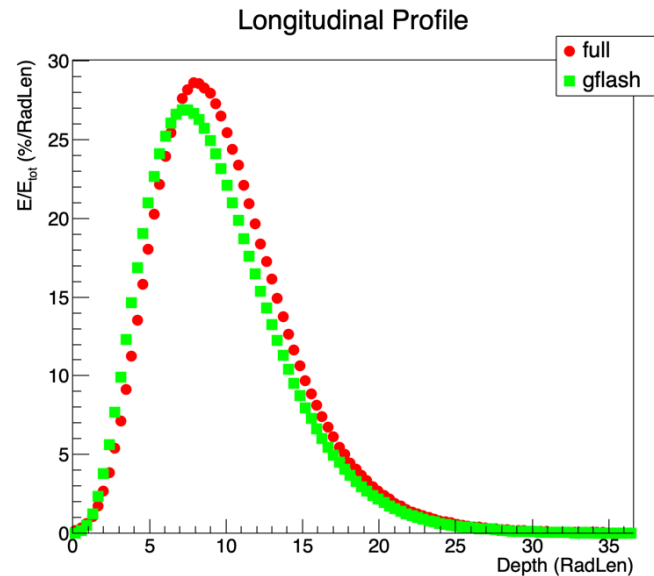
This give higher enrgy deposition in detector (usually low dence material) and low energy depostion in absorber part(usually hight dence material) with respect of full simulation.

The total energy deposition remain correct.

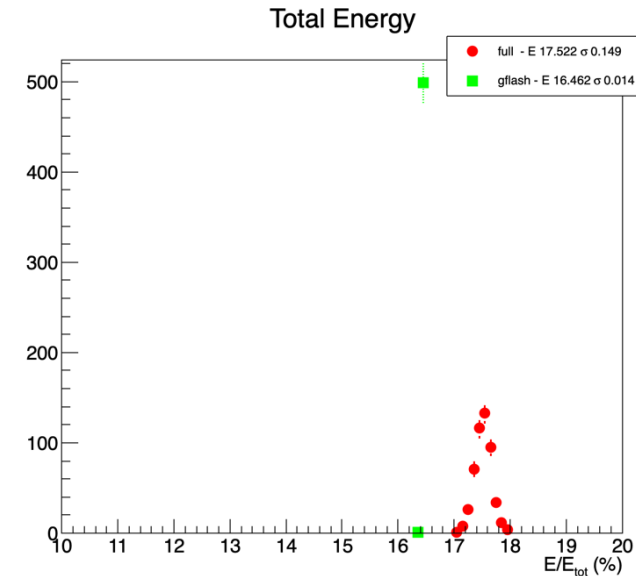
Radiation length values also replaced by average Radiation length, this also changes the final energy depositions in absorbers and detectors layers.



Automatic correction with density ratio

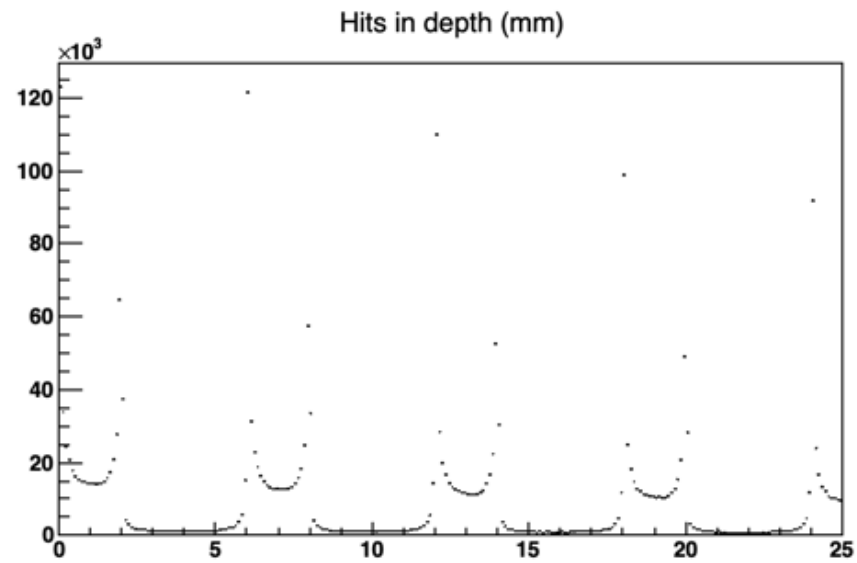


GFLASH vs Full simulation after density correction

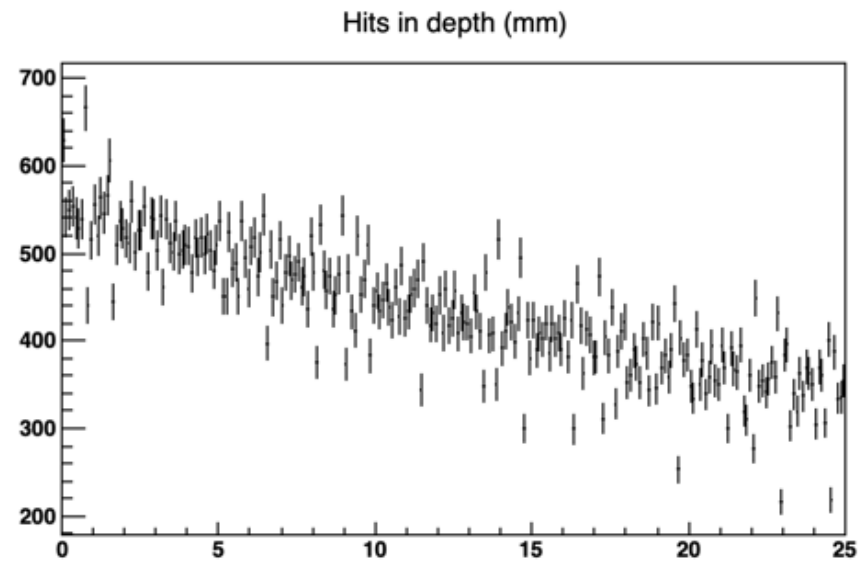


GFLASH peak of E distriction much nerrow then the peak from full simulation.

Hits distribution



Full Simulation



• **GFLASH**

Summary

- The sampling calorimeter example ExGflahb code ready to commit and tested with Geant4 v11.0.0
- Some tuning of GLASH Sampling parameters may be necessarily
- Needs in final formula for automatic correction of energy deposition.
- The modification in GFLASH code was necessarily to take into account sampling fluctuation.
- The development slow down this summer. I will became more available in December.
- I will return to work on new tuning class implementation and lazy transformation matrix calculation when the sampling shower parametrization example will not be published

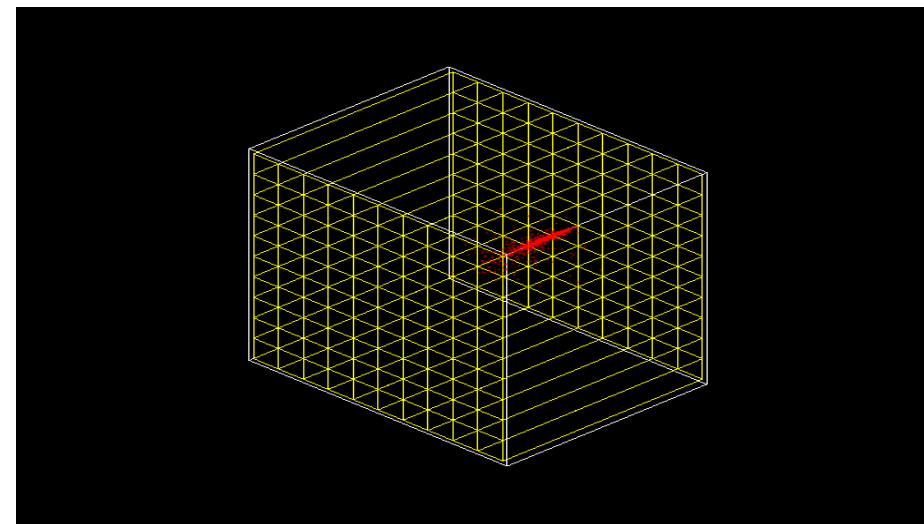
Thank You !

GFlasha example

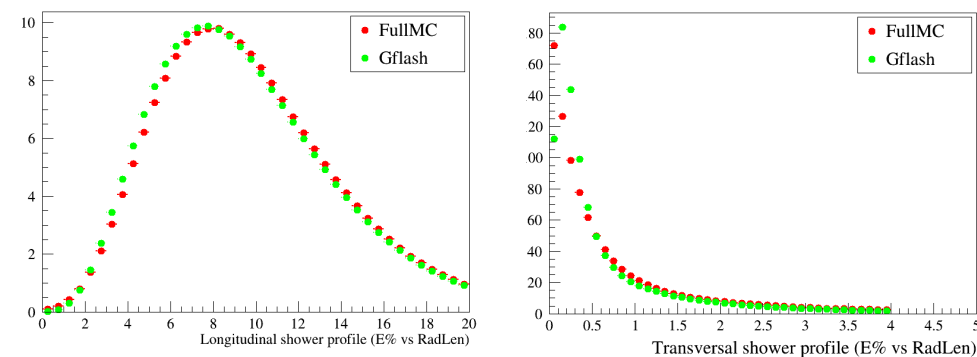
The application with allow compare and tune GFlash shower parametrization versus full Geant4 shower development.

In 2022:

- Modification for compatibility with Geant4 v11.0.0 and new HistoManager
- Formatting of code according .clang-format
- Code cleanup



GFLASH Hits in homogeneous calorimeter



Shower profiles in homogeneous calorimeter

GFlashe - multiple envelopes

The application to make studies of GFlash shower parametrization with multiple placement of Flash envelope volume. Possibility to lazy evaluation for transformation matrix.

The G4AffineTransform matrixes can be calculated on demand when track entered particular G4Envelope volume first time and cached inside of G4FastTrack.

Even transformation was cashed in Navigator, the idea to replace single AffineTransformation and InverseAffineTransformation object by vector of objects indexing by Physical Volume ID and calculated only when class will access this object.

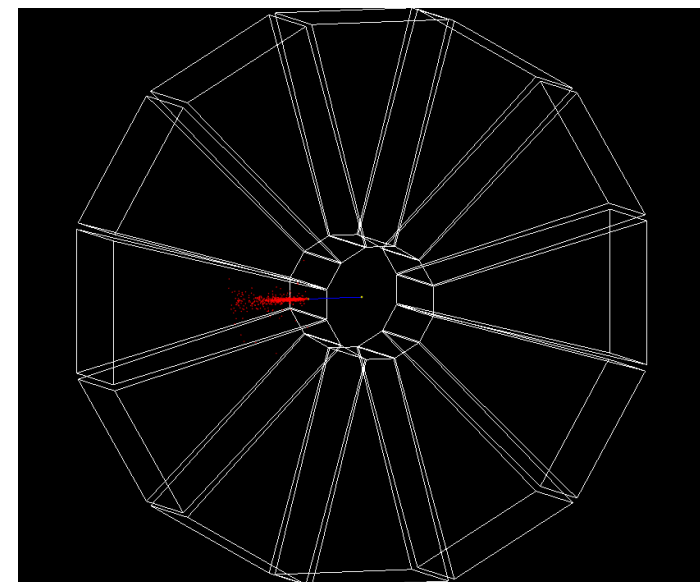
The example

- First (**WRONG**) version of geometry was created,
12 G4Trd volumes must be replaced with single G4Polyhedra volume
- The simple analysis to check efficiency of GFlash and execution time was created but need to be finalized.

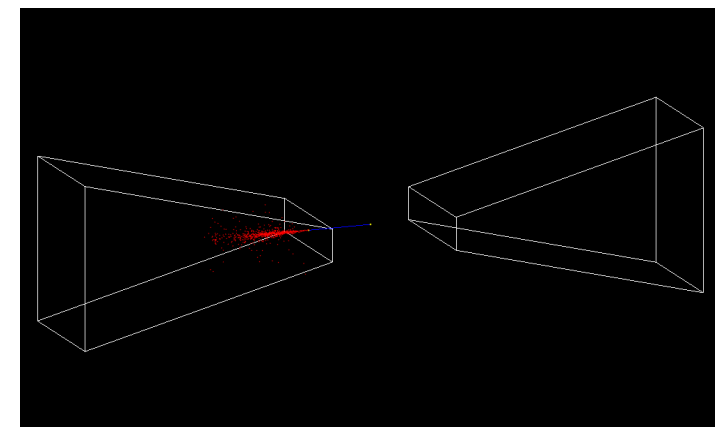
Question:

Do we allow adjacent envelope volumes or must replace them with volume aggregation ?

No progress in 2022.



Example of wrong geometry



Correct usage of multiple envelopes