SuperB Full Simulation: Core developments

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Outline

- Geometry
- Core G4
- User interface
- Robustness
- Plans for the future

Geometry

- Some developments in detector geometry/readout
  - IFR
  - New IR
- Will be covered in separate talks in this session

Core G4

- Since Paris, migrated at a new G4 version (4.9.2), with a new gdml version
- Several new features were implemented:
  - Bruno now uses the G4 physics list factory, which allows to easily choose at runtime from ALL of the physics lists provided by G4, without need to recompile
  - Step limiter process: needed to define limits on the step length in a given region
  - Parallel navigation (see next slides)

Parallel navigation

- A general feature provided by G4
- Define one mass world, where the physics interactions occurr
- Define as many parallel worlds as you need
  - Volumes in the parallel worlds do not influence physics, but they contribute to step limiting
    - Very useful for implementation of scoring volumes
  - Volumes in the parallel worlds are not bounded by the mass geometry
    - You can have any kind of geometry clash with mass volumes, which gives you more freedom in defining your scoring volumes
- First use case for this feature is interface for fast simulation (see following slides)
- Implementation can be re-used for additional scoring studies
- Note: feature is relatively new, and not yet extensively used in G4
  - Already found some bugs
  - Use with caution

Interface to fast simulation

- Main idea is to use G4 to simulate detailed physics in the innermost part of the detector
- Simulation status is saved to root file, and all tracks killed (to save time)
- Fast simulation uses the output from previous step as input
- For us, this means using a parallel volume to do scoring
  - Volume is presently a (slightly larger) version of final_focus, but can be changed through gdml (no need to recompile, as long as you don't change volume name)
  - The scoring triggers dump to file and track killing
  - All the machinery can be switched on at runtime with the “-f” command line option

User interface

- Some minor changes to the user interface (command line):
  - New “-f” option, to turn on the interface to fast simulation. If this is set, tracks will be killed at the exit of the final_focus volume, and an extra file will be created, to be fed to the fast simulation
  - “-p PHISICS_LIST” option now accepts all physics lists distributed with G4
  - New “-s” option, to turn on the detector survey (geantino map). See wiki documentation for details
- Following a request from fast sim, the default units in output and input have been changed to cm/ns/GeV
  - Please take care of updating your macros accordingly
- Default physics list is now QGSP_BERT

Robustness

- Following user feedback, we found a few places where the simulation was not robust enough
  - By doing apparently normal things, one ends up having meaningless results (wrong production cuts for example)
- We have done some modifications to the code and to the default behavior of the simulation program, so that now things should be better
  - PLEASE keep on trying Bruno, and let us now if you see something unexpected
- Some code cleanup is ongoing, and will result in a simpler and more modular program

Plans for the future

- We reached a point where we should probably concentrate on validation
  - Both computing and physics point of views
- We will prepare in the near future an example of recursive geometry test, to be used by detector experts to be sure that their geometries are consistent
- Detector experts should start thinking about production cuts
  - Is the default ok for you? If not: which one you prefer?
  - This has impact on both physics and CPU time
- Some profiling will help in optimizing the Bruno code as much as possible