

Gauss - Generators

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Main Stream Generators - Status

- Pythia:
 - Move to **6.4** (6.3 in DC06), and use now « new » Multiple Interactions Model
 - **New tuning** was necessary to reproduce particle multiplicities, p_T spectrum, B hadron fractions, etc... : provided by Bristol group (K. Lessnoff, A. Muir, P. Sczypka, N. Brook)
 - Recurrent FORTRAN related problem:
 - we have to redefine in Gauss some of the Pythia functions (random number generators), and we have to be sure that the Gauss redefinition is used instead of the original function.
 - Moving to new CMT and using « install area » broke our previous mechanism: solution found by H. Degaudenzi to have a special package **Gen/GENSER** which is forced to be loaded first

Main Stream Generators – Status

- Pythia:
 - *Minimum Bias redefinition*:
 - Use **Color-Octet + Color-Singlet** prompt charmonium (J/ψ , χ_{c0} , χ_{c1} , χ_{c2}) production instead of Color-Singlet only in DC06
 - Add Color-Octet + Color-Singlet prompt **bottomium** ($Y(1S)$, χ_{b0} , χ_{b1} , χ_{b2}) production (new in DC09)
 - Add **prompt $\psi(2S)$, $\psi(3770)$** (N. Brook), **$Y(2S)$, $Y(3S)$, $Y(4S)$** and **$Y(5S)$** Color-Singlet prompt production (modifying some Pythia routines inside LHCb packages)
 - All changes tested and validated: Pythia interface ready for new productions.

Main Stream Generators - Status

- EvtGen:

- We use in LHCb an old BaBar EvtGen version (2004), that we modified to:
 - Implement *incoherent B mixing* and CP violation
 - Fix code for Windows and gcc 3.4 compilation
 - Remove compilation warnings
 - Improve interface to Pythia
 - Add new models used at LHCb (B_s and Λ_b decays)
- Our version of EvtGen is taken by GENSER and used by ATLAS/CMS as « EvtGenLHC »
- An EvtGen workshop was organized by GENSER in January where it was decided to merge all recent EvtGen developments made at BaBar/LHCb/CDF/D0 in a single new version.
- Work made by A. Ryd and D. Lange who provided a new EvtGen version end of last week.

Main Stream Generators – Status

- EvtGen:

- In this new version, all our contributions were included ***except the incoherent mixing and CP violation*** implementation, because a similar implementation was developed in parallel at BaBar.
- We would like to use this new version (which is now in CVS) for new productions because it contains a lot of fixes and the move to this version is transparent, but before using it we have to (~ 1 week):
 - **Test that the B mixing is working correctly**: Warwick group, P. Harrison, M. Whitehead
 - **Test that the Pythia interface does not interfere** with the main Pythia stream: P. Robbe
- Other tests to do (but not preventing starting new productions): test CP violation for the few signal modes using it, test LHCb models, ...

Generator Framework – Status

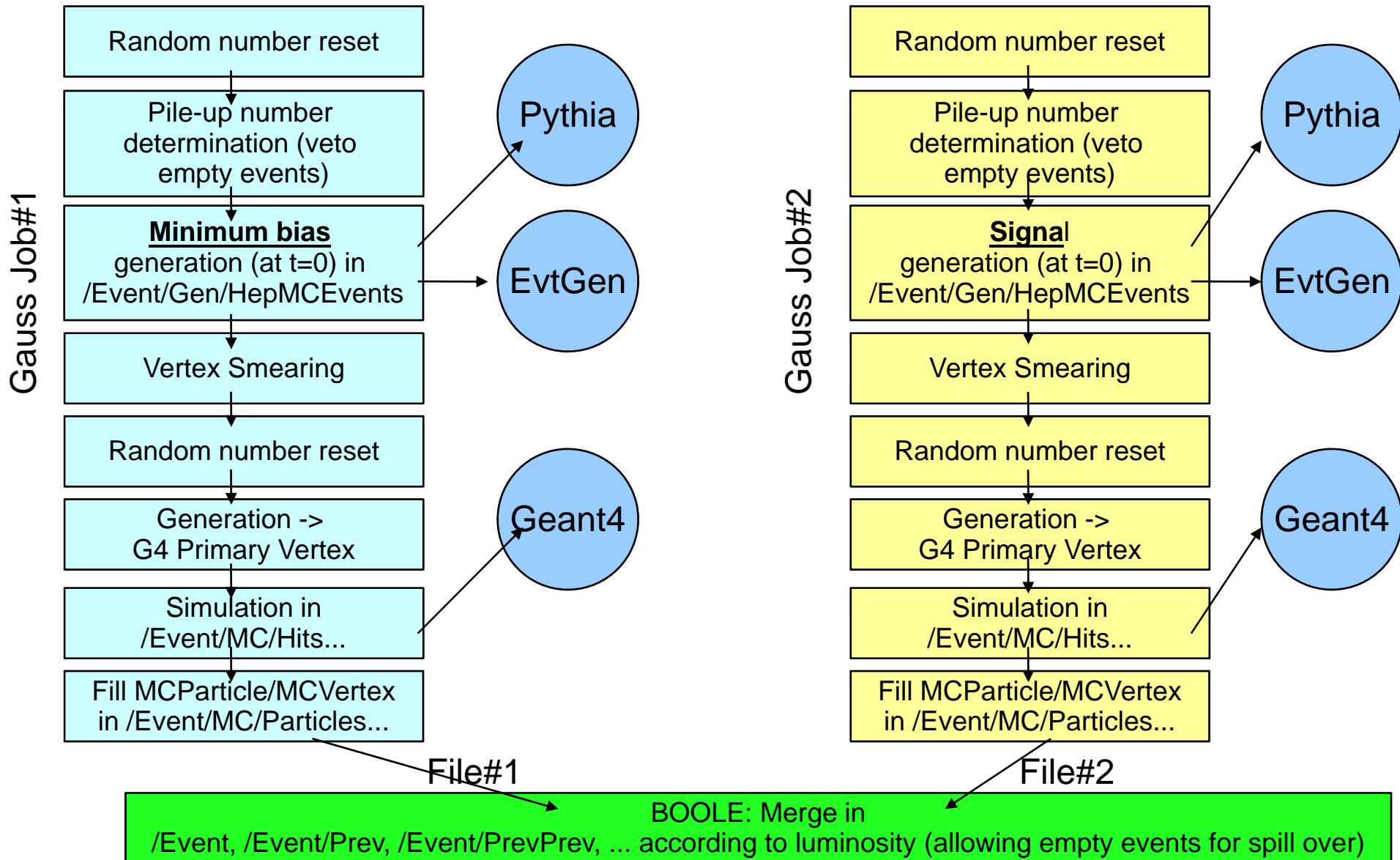
- HepMC: move to **HepMC 2** completed with help of GENSER team, now validated.
- Main EvtGen decay table (DECAY.DEC): **updated to PDG 2008**, huge work by M. Whitehead (Warwick), in CVS and ready to be used for new productions.
- Particle properties: **updated to PDG2008** and in database now. Most obvious inconsistencies have been fixed but other could appear when trying to decay rare modes with incompatible masses.
- Framework: **no change** with respect to DC06, but flexible enough to include easily new generator-level cuts, new pile-up schemes, new beam parameters, etc...

New developments in Generator

- Independant of new productions.
- Hijing and reading of external ASCII files has been updated to HepMC2, under test.
- Integration of SHERPA generator:
 - huge work by Dortmund group (J. Wishahi, T. Brambach) with the help of SHERPA authors.
 - First working version is now in CVS
 - C++ generator providing nice alternatives to Pythia and also EvtGen (can be used as a production or decay tool)

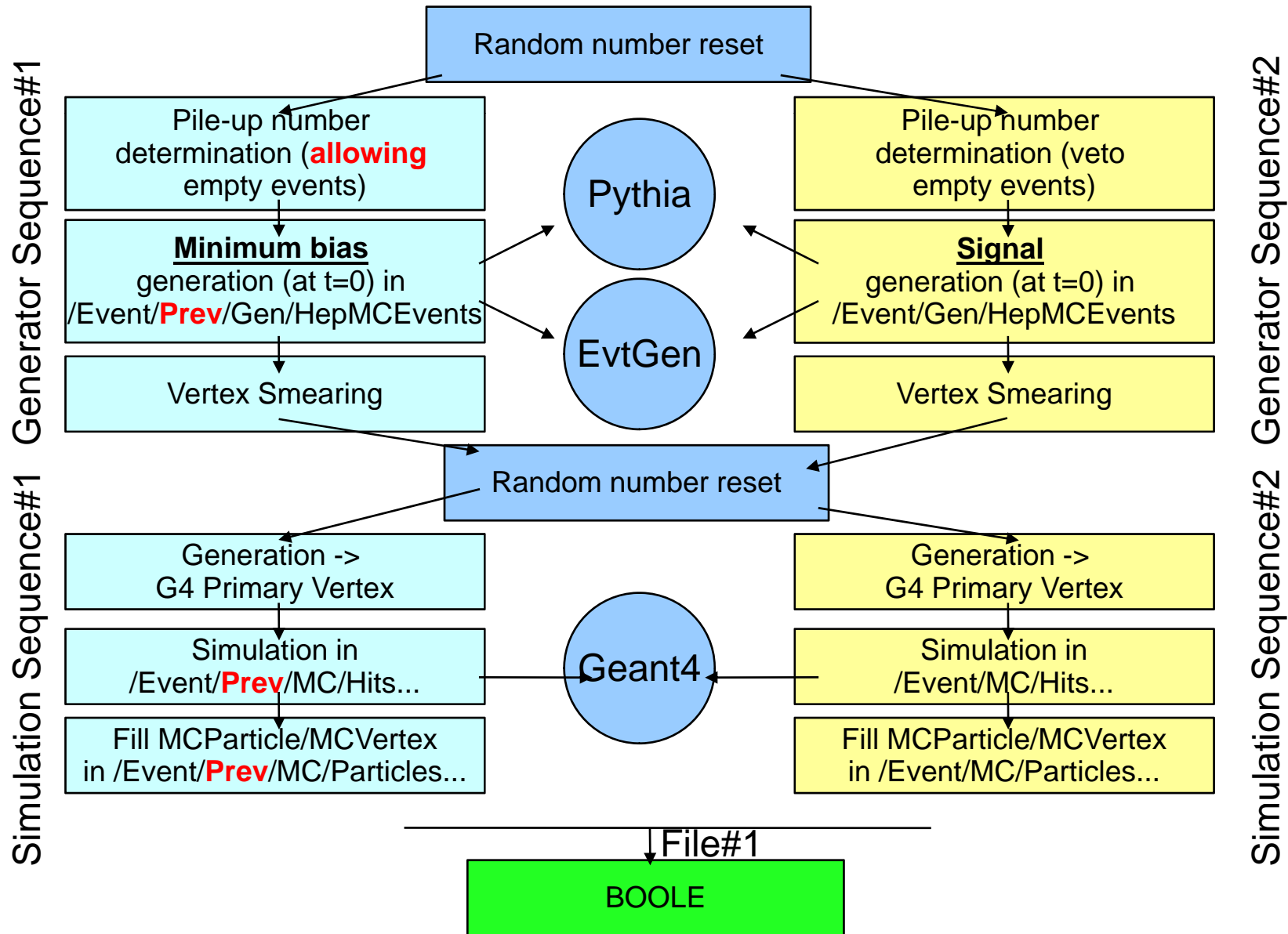
Spill-over in Gauss

- Up to now, spill-over made in Boole using different input files: the signal input file from Gauss and a minimum bias file are merged.



Spill-over in Gauss

- Could generate spill over in Gauss in a single file and a single job:



Spill-over in Gauss

- Main point is that there is a **single instance of Pythia, EvtGen, and Geant4** handling main event and spill-over events.
- Not a problem for Geant4 and EvtGen: no reason to change settings between spill-over and main event
- For Pythia:
 - **Not a problem when Minimum bias settings are used** to generate also the signal main event: this is the case for almost all events generated in LHCb (Inclusive b, J/ψ, signal B⁰, B_s, etc...)
 - But it is not the case for few special events such as Higgs, W, Z, SUSY, etc... where spill over will be switched off until we find a **solution for them** (we had the same problem with pile-up for these events, where we reset from time to time Pythia to generate a bunch of minimum bias events, could adopt the same solution for spill over here)

Spill-over in Gauss

- At first approximation, only a matter of writing more complex job options to define new sequences, no extra code needed.
- Could be improved in a next step: for example only initializing Pythia once, printing statistics counters only for the main event, etc...
- First tests with generation part will be made this week.

Conclusions

- Generator part of Gauss almost ready for new productions:
 - Pythia related part ready and validated
 - Will use new EvtGen version after validating incoherent B mixing
- First ideas to implement spill-over in one single Gauss job, which are under test now.