

Status of C++ Event Generators

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Outline

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- ThePEG
- Pythia7
- Herwig++
- Sherpa
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- LCG support
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The Physics improvements

The need of new C++ Event Generators is motivated by the fact that it is extremely difficult to maintain the current Fortran generators. But we have already now a long list of physics improvements, many of which would require a major restructuring of the existing code.

Some Physics improvements:

- ME + PS matching
- Consistent showering of unstable particles
- Non-QCD showering
- Spin-polarization effects
- Underlying event

Leif Lonnblad

Toolkit for High Energy Physics Event Generation

Version 1.0 α <http://www.thep.lu.se/ThePEG>

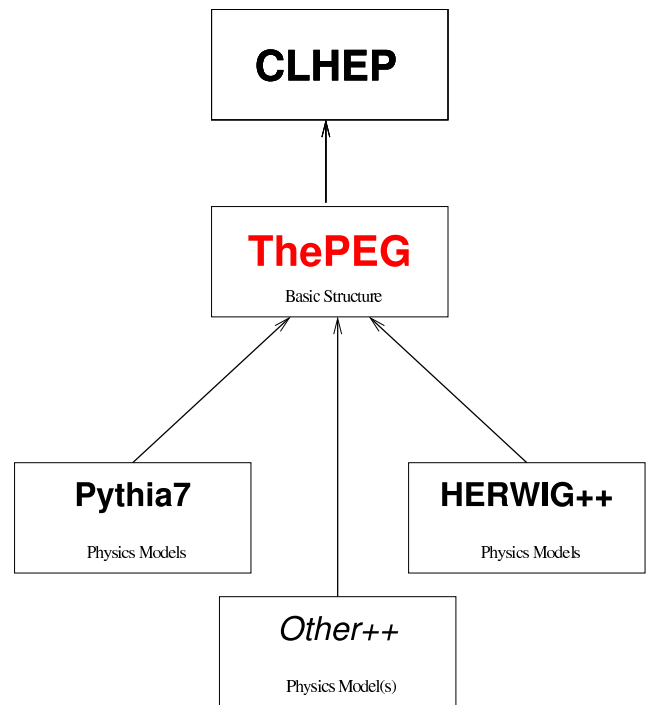
Interface to HepMC is implemented.

What is THEPEG

THEPEG consists of the parts of PYTHIA7 which were not specific to the PYTHIA physics models. It provides a general structure for implementing models for event generation.

Both PYTHIA7 and HERWIG++ are built on THEPEG.

But it is open for anyone...



Pythia7

Version 1.0 α <http://www.thep.lu.se/Pythia7>

Authors: M. Bertini, L. Lonnblad, T. Sjostrand.

What is already implemented:

- Initial and Final State Showering, exactly as in Pythia6
- A simplified version of Lund String Fragmentation

What remains to do:

- Rework fragmentation to include junction strings
- Multiple Interactions
- Proper particle decays
- All the rest...

Herwig++

<http://www.hep.phy.cam.ac.uk/~gieseke/Herwig++>

Authors: S. Gieseke, A. Ribon, M. Seymour,
P. Stephens, B. Webber

What is already implemented:

- Improved Final State Showering
- Cluster Hadronization

What remains to do:

- Initial State Showering
- Proper particle decays
- Multiparton and Soft Physics
- All the rest...

Sherpa

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tutorial → document**

Authors: F. Krauss, R. Khun, A. Schaelicke,
S. Schumann, G. Soff

What is already implemented:

- Very powerful Matrix Element generator
- Initial and Final State Showering
- ME + PS Matching
- Wrap to Pythia6 String Fragmentation
- Interface to HepMC

What remains to do:

- Improved Cluster Hadronization
- Hadron Decayer
- Underlying Event
- All the rest...

Some comments

- **Pythia7** and **Herwig++** share the same framework (ThePEG) which depends on **CLHEP**. Advantages: code reuse; same user interface; easy to mix e.g. Herwig++ Showering with Pythia7 String Fragmentation.
- **Sherpa** was born, and has its main strength as Matrix Element generator, but aims to provide a standalone (completely independent from external code) full Event Generator (Parton Shower, Hadronization, Underlying Event).
- Pythia7 and Herwig++ very likely will use Sherpa as ME generator.
- First α releases available for all of them, including the interface to **HepMC** . But they don't provide yet a physical sound simulation for hadron colliders, mainly for the absence of the Underlying Event.

User Requirements

...NOT MUCH so far !!!

- $t_0 - 2$ years

where t_0 is the LHC start, which means be ready by 2005 , with some high-Pt physics processes, and a reasonable underlying event.

- (advice) do not spend time to build a Graphical User Interface, because anyhow the experiments will dismantle it to fit the one they want in their frameworks.

LCG Support

For the time being, there are two main requests from the Event Generator authors to the LCG:

- Try to use the α releases, and give **feedback** (criticisms, comments, suggestions) to the authors.

Warning: not yet much documentations available (but the authors are keen to help!), and not use it for massive physics simulation production!

- A person (hopefully from CMS and/or ATLAS) who can write a **Graphical User Interface** for ThePEG (hence for Pythia7 and Herwig++), on top of the existing simple text-based interface. (I estimate roughly 1 month FTE for a person with GUI experience).

Summary

- 3 C++ Event Generators: Pythia7, Herwig++, Sherpa.
- Few people involved who did already a lot but still a lot has to be done.
- α releases are available and need to be used as soon as possible for getting user feedbacks.
- For LHC, physical sound versions should be ready by 2005.
- No problem for Matrix Elements, Initial and Final State Showering, Hadronization.
- The critical part will be the Underlying Event.

<http://www.thep.lu.se/ThePEG>

<http://www.thep.lu.se/Pythia7>

<http://www.hep.phy.cam.ac.uk/gieseke/Herwig++>

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