

PYTHIA

T. Sjöstrand

CERN, Geneva, Switzerland, and

Department of Theoretical Physics, Lund University, Sweden

The PYTHIA program is a standard tool for the generation of high-energy collisions, containing a realistic description of the full story, from a hard interaction involving a few partons to an observable hadronic final state of hundreds of particles. The current PYTHIA 6.3 version is described in detail in the manual [1], with the most recent update notes to be found on the PYTHIA webpage

<http://www.thep.lu.se/~torbjorn/Pythia.html>,

together with the code itself, sample main programs and some further material. The latest published version is [2] and a recent brief review is found in [3]. The 6.3 version includes new transverse-momentum-ordered showers and a new multiple-interactions and beam-remnant scenario [4], described elsewhere in these proceedings.

From the onset, all PYTHIA code has been written in Fortran 77. For the LHC era, the experimental community has made the decision to move heavy computing completely to C++. Hence the main future development line is PYTHIA 8, which is a re-implementation in C++. Many obsolete options will be removed and various aspects modernized in the process.

With the rise of automatic matrix-element code generation and phase-space sampling, input of process-level events via the Les Houches Accord (LHA) [5] reduces the need to have extensive process libraries inside PYTHIA itself. Thus emphasis is on providing a good description of subsequent steps of the story, involving elements such as initial- and final-state parton showers, multiple parton-parton interactions, string fragmentation, and decays. All the latter components now exist as C++ code, even if in a preliminary form, with finer details to be added, and still to be better integrated and tuned. At the current stage, however, there is not even the beginning of a PYTHIA 8 process library; instead a temporary interface is provided to PYTHIA 6, so that all hard processes available there can be generated and sent on to PYTHIA 8, transparent to the user.

PYTHIA 8 is intended to be a standalone program, i.e. does not require any external libraries. However, in addition to the LHA interface, hooks also exist for external parton distribution functions, particle decays and random numbers, and more may be added.

This project was started in September 2004, and so is still at an early stage. A first public version, PYTHIA 8.040, can be found on the PYTHIA webpage (look under the “Future” link). This should be viewed as a development snapshot, to allow early feedback from the LHC experimental community, and cannot be used for any serious physics studies. It is intended/hoped that a first realistic version, PYTHIA 8.100, could be ready by early 2007, but even this version will be clearly limited in its capabilities, and strongly focused on LHC applications. It is therefore to be expected that PYTHIA 6 and PYTHIA 8 will co-exist for several years.

References

- [1] T. Sjöstrand, L. Lönnblad, S. Mrenna, and P. Skands (2003). [hep-ph/0308153](#).
- [2] T. Sjöstrand *et al.*, *Comput. Phys. Commun.* **135**, 238 (2001). [hep-ph/0010017](#).
- [3] M. A. Dobbs *et al.* (2004). [hep-ph/0403045](#).
- [4] T. Sjöstrand and P. Z. Skands, *JHEP* **03**, 053 (2004). [hep-ph/0402078](#);
T. Sjöstrand and P. Z. Skands, *Eur. Phys. J.* **C39**, 129 (2005). [hep-ph/0408302](#).
- [5] E. Boos *et al.* (2001). [hep-ph/0109068](#).