Manual for slepton pair production in the POWHEG BOX

This document describes the settings and input parameters that are specific to the implementation of slepton pair production at the LHC within the POWHEG BOX framework. The parameters that are common to all POWHEG BOX implementations are given in the manual-BOX.pdf document in the POWHEG-BOX/Docs directory. If you use our program, please quote Refs. [1–6].

Running the program

Download the POWHEG BOX, following the instructions at the web site

http://powhegbox.mib.infn.it/

Before compiling the code make sure that:

- fastjet is installed and fastjet-config is in the path,
- lhapdf is installed and lhapdf-config is in the path,
- gfortran or ifort is in the path, and the appropriate libraries are in the environment variable LD_LIBRARY_PATH.

If LHAPDF or fastjet are not installed, the code can still be run using a dummy analysis routine and built-in PDFs. For this and other build options, see the Makefile in the project directory sleptons.

For a convenient illustration of compiling and running the code, we are providing a Makefile in the sub-directory testrun-lhc. Go to this directory by typing

```
$ cd POWHEG-BOX/sleptons/testrun-lhc
```

Compile and run the code in its default mode by executing

```
$ make
```

Physics parameters are read from the file params.slha which is formated according to the SUSY Les Houches Accord (SLHA) [7, 8] and can be taken from standard SUSY spectrum generators. Technical parameters are specified in the powheg.input file.

In the last step of the run, the generated events are showered via PYTHIA. Various settings of PYTHIA can be modified by editing the file setup-PYTHIA-lhef.f prior to compilation. We modified PYTHIA in such a way that by setting the flag mstp(41)=1, slepton decays are activated. PYTHIA generates the decays according to the masses provided in params.slha. For the case of each slepton decaying into a lepton and the lightest neutralino, our sample analysis provides various histograms for the decay products.

References

[1] B. Jäger, A. von Manteuffel, and S. Thier, *Slepton pair production in the POWHEG BOX*, arXiv:1208.2953.

[2] S. Alioli, P. Nason, C. Oleari, and E. Re, *A general framework for implementing NLO calculations in shower Monte Carlo programs: the POWHEG BOX*, JHEP **1006** (2010) 043 [arXiv:1002.2581 [hep-ph]].

[3] R. K. Ellis and G. Zanderighi, *Scalar one-loop integrals for QCD*, JHEP **0802** (2008) 002 [arXiv:0712.1851 [hep-ph]].

[4] G. J. van Oldenborgh, *FF: A Package to evaluate one loop Feynman diagrams*, Comput. Phys. Commun. **66** (1991) 1.

[5] T. Hahn, *SUSY Les Houches Accord 2 I/O made easy*, Comput. Phys. Commun. **180** (2009) 1681 [hep-ph/0605049].

[6] T. Sjostrand, S. Mrenna, P. Z. Skands, *PYTHIA 6.4 Physics and Manual*, JHEP **0605** (2006) 026. [hep-ph/0603175].

[7] P. Z. Skands *et al.*, *SUSY Les Houches accord: Interfacing SUSY spectrum calculators, decay packages, and event generators*, JHEP **0407** (2004) 036 [hep-ph/0311123].

[8] B. C. Allanach *et al.*, *SUSY Les Houches Accord 2*, Comput. Phys. Commun. **180** (2009) 8 [arXiv:0801.0045 [hep-ph]].