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POWHEG BOX 1.0

The POWHEG BOX user manual: $W^{\pm} + 1$ jet production

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Abstract: This note documents the use of the package POWHEG BOX for $W^{\pm} + 1$ jet production processes. Results can be easily interfaced to shower Monte Carlo programs, in such a way that both NLO and shower accuracy are maintained.

Keywords: POWHEG, Shower Monte Carlo, NLO.

Contents

1. Introduction

The POWHEG BOX program is a framework for implementing NLO calculations in Shower Monte Carlo programs according to the POWHEG method. An explanation of the method and a discussion of how the code is organized can be found in refs. [1, 2, 3]. The code is distributed according to the "MCNET GUIDELINES for Event Generator Authors and Users" and can be found at the web page

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

In this manual, we describe the POWHEG NLO implementation of $W^{\pm} + 1$ jet hadroproduction, with $W^{\pm} \to \ell^{\pm}\bar{\nu}_{\ell}$ fully taken into account at leading order, closely following the implementation in ref. [4]

2. Generation of events

Build the executable

```
$ cd POWHEG-BOX/Wj
$ make pwhg_main
```

Then do (for example)

```
$ cd testrun-lhc
$ echo wp | ../pwhg_main
```

At the end of the run, the file wp-events.lhe will contain 50000 events for $W^{+} + 1$ jet hadroproduction in the Les Houches format.
In order to shower them with PYTHIA do

```
$ cd POWHEG-BOX/Wj
$ make main-PYTHIA-lhef
$ cd testrun-lhc
$ echo wp | ../main-PYTHIA-lhef
```

3. Process specific input parameters

The decay of the W boson is controlled by the token `vdecaymode`, in this way:

- 1 for e channel
- 2 for μ channel
- 3 for τ channel

whose masses (`physpar_ml`), together with all other input physical parameters, are set in the `init_couplings.f` file.

References

[1] P. Nason, "A new method for combining NLO QCD with shower Monte Carlo algorithms," JHEP **0411** (2004) 040 [arXiv:hep-ph/0409146].

[2] S. Frixione, P. Nason and C. Oleari, "Matching NLO QCD computations with Parton Shower simulations: the POWHEG method," JHEP **0711** (2007) 070 [arXiv:0709.2092 [hep-ph]].

[3] S. Alioli, P. Nason, C. Oleari and E. Re, "A general framework for implementing NLO calculations in shower Monte Carlo programs: the POWHEG BOX," [arXiv:1002.2581 [hep-ph]].

[4] S. Alioli, P. Nason, C. Oleari and E. Re, "Vector boson plus one jet production in POWHEG," JHEP **1101**, 005 (2011) [arXiv:1009.5594 [hep-ph]].