

The POWHEG BOX user manual: $Z + 1$ jet production

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ABSTRACT: This note documents the use of the package POWHEG BOX for $Z+1$ 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.

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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 $Z + 1$ jet hadroproduction, with $Z \rightarrow \ell^+ \ell^-$ fully taken into account at leading order, as described in ref. [4]

2. Generation of events

Build the executable

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

Then do (for example)

```
$ cd testrun-lhc
$ ../pwhg_main
```

At the end of the run, the file `pwgevents.lhe` will contain 50000 events for $Z + 1$ jet hadroproduction in the Les Houches format. By replacing the `powheg.input` file with the alternative `alt-powheg.input`, the program is run in the weighted-event mode (see ref. [4]).

In order to shower them with PYTHIA do

```
$ cd POWHEG-BOX/Zj
$ make main-PYTHIA-lhef
$ cd testrun-lhc
$ ../main-PYTHIA-lhef
```

3. Process specific input parameters

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

- 1 for e^+e^-
- 2 for $\mu^+\mu^-$
- 3 for $\tau^+\tau^-$

whose masses (`physpar_m1`), 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].
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- [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]].
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