

The POWHEG-BOX-ZZ manual

1 Introduction

The POWHEG-BOX-ZZ program [1] can be used to generate the QCD production of ZZ events, with the Z bosons decaying into leptons, in hadronic collisions, with NLO accuracy in QCD, in such a way that matching with a full shower program is possible. It is based upon the calculation of refs. [2], [3], [4]. The effect of Z - γ interference, as well as the effect of off-shell singly resonant graphs, are fully included in the calculation.

This document describes the input parameters that are specific to this implementation. The parameters that are common to all POWHEG BOX implementation are given in the `manual-BOX.pdf` document, in the POWHEG-BOX/Docs directory.

2 Generation of events

Do

```
$ cd POWHEG-BOX/ZZ
```

```
$ make pwhg_main
```

Then do (for example)

```
$ cd test
```

```
$ ../pwhg_main
```

At the end of the run, the file `pwgevents.lhe` will contain events for Z pair production in the Les Houches format. In order to shower them with PYTHIA:

```
$ cd POWHEG-BOX/ZZ
```

```
$ make main-PYTHIA-lhef
```

```
$ cd test
```

```
$ ../main-PYTHIA-lhef
```

3 Input parameters

Parameters in `powheg.input` that are specific to ZZ pair production:

```
vdecaymode1 11      ! decay mode of 1st Z (11=electron, 12=nue, etc)
```

```
vdecaymode2 13      ! decay mode of 2nd Z (13=muons, etc.)
```

Only leptonic decay modes are implemented at this stage. In the case of decay into neutrino, a neutrino flavour must be indicated explicitly. It is up to the user to multiply the whole cross section by three to include all neutrino flavour decays.

```
mllmin 50           ! minimum mass of lepton pair in decay is 50 GeV
```

```
zerowidth 0         ! If 1 (true) use zero width approximation (default 0)
```

```
dronly 0           ! If 1 (true) use only double resonant contributions
```

```
! (default 0)
```

If `zerowidth` is absent or equal to zero, the Z 's are given finite width, Z - γ interference is accounted for. Singly resonant graphs are also included by default, unless the `dronly` flag is set to 1.

Bibliography

- [1] T. Melia, P. Nason, R. Rontsch, and G. Zanderighi.
 - [2] L. J. Dixon, Z. Kunszt, and A. Signer, *Helicity amplitudes for $O(\alpha_s)$ production of W^+W^- , $W^\pm Z$, ZZ , $W^\pm\gamma$, or $Z\gamma$ pairs at hadron colliders*, *Nucl.Phys.* **B531** (1998) 3–23, [[hep-ph/9803250](#)].
 - [3] J. M. Campbell and R. Ellis, *An Update on vector boson pair production at hadron colliders*, *Phys.Rev.* **D60** (1999) 113006, [[hep-ph/9905386](#)].
 - [4] J. M. Campbell, R. Ellis, and C. Williams, *Vector boson pair production at the LHC*, [arXiv:1105.0020](#).
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