The POWHEG-BOX-WW manual

1 Introduction

The POWHEG-BOX-WW program [1] can be used to generate the QCD production of WW events, with the W 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. Anomalous coupling can also be included.

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/WW
$ 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 W pair production in the Les Houches format. In order to shower them with `PYTHIA`:

```
$ cd POWHEG-BOX/WW
$ make main-PYTHIA-lhef
$ cd test
$ ../main-PYTHIA-lhef
```

3 Input parameters

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

```
vdecaymodeW1 11      !  decay mode to charged lepton of W (11=e-,-11=e+,etc.)
vdecaymodeW2 13      !  decay mode to charged lepton of W (11=e-,-11=e+=,etc.)
```

Only leptonic decay modes are implemented at this stage.

```
zerowidth 0         !  If 1 (true) use zerowidth approximation (default 0)
withinterference 1  !  If 1 (true) include interference for identical charged
                    !  leptons (default 1)
dronly    0         !  If 1 include only double resonant contributions
                    !  (default 0)
diagCKM   0         !  If 1 (true) use diagonal CKM (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. The charge of the W boson is determined through its decay mode. The CKM matrix can set by default to the PDG values (Vud = 0.974 etc.) unless diagCKM = 1, in which case a diagonal CKM matrix is used. Anomalous couplings are by default switced off (set to 0), unless a non zero value is given in the `powheg.input` file, see ⟨cite | Dixon:1999di⟩ for a definition of the anomalous couplings used (delg1_z, de1g1_g, lambda_z, lambda_g, delk_g, delk_z, tevscale).

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^-, $W^\pm Z$, $Z\,Z$, $W^\pm\gamma$, 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. * Temporary entry *.