

Towards Precision Studies of Rare Top Final States: ttWW production beyond fixed order calculations

Content

Precision physics at the LHC requires the combination of fixed-order perturbative calculations with the simulation of multiple QCD radiation, which can be described through parton-shower (PS) algorithms, in order to obtain reliable predictions for experimental observables. In this context, simulation frameworks such as MG5_aMC@NLO and POWHEG have proven to be essential tools for achieving a consistent matching between next-to-leading-order (NLO) calculations and parton-shower effects.

In particular, POWHEG implements

$$\begin{equation} \sigma_{\text{pw}} = \int \text{d}\Phi_n \overline{B}(\Phi_n) \left(\Delta_M(\Phi_n, p_T^{\min}) + \int \text{d}\Phi_{n+1} \frac{R(\Phi_{n+1})}{B(\Phi_n)} \Delta_M(\Phi_n, p_T) \right), \end{equation}$$

where $\Delta_M(\Phi_n, p_T^{\min})$ denotes the modified Sudakov form factor, which represents the probability of no emission above a given value of the ordering variable p_T . Unlike the Sudakov form factor implemented in standard parton-shower algorithms, it is constructed from the exact born $B(\Phi_n)$ and real ($R(\Phi_{n+1})$) matrix elements.

In this presentation, I will discuss the work carried out during my graduate research, which focused on the implementation of an event generator for $ttWW$ production at NLO QCD+PS within the POWHEG-BOX framework. This process constitutes a relevant background contribution to multilepton channels associated with $t\bar{t}t$ production, an important process in studies of the Higgs sector, as well as to other rare Standard Model processes that play a central role in precision measurements and indirect searches for new physics.

Our implementation provides more accurate differential predictions for this channel and represents an important step toward a systematic description of the $t\bar{t}VV$ family of processes at NLO+PS accuracy.

Summary

$t\bar{t}WW$ production at next-to-leading order NLO (QCD) + Parton Showers in the POWHEG-BOX at the LHC is presented

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