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Resonance-aware NLOPS matching for off-shell top-pair plus tW production with semileptonic decays

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The increasingly high accuracy of top-quark studies at the LHC calls for a theoretical description of $t\bar{t}$ production and decay in terms of exact matrix elements for the full $2 \to 6$ process that includes the off-shell production and the chain decays of $t\bar{t}$ and tW intermediate states, together with their quantum interference. Corresponding NLO QCD calculations matched to parton showers are available for the case of dileptonic channels and are implemented in the bb4l Monte Carlo generator, which is based on the resonance-aware POWHEG method. In this talk, I present the first NLOPS predictions of this kind for the case of semileptonic channels. In this context, the interplay of off-shell $t\bar{t}$ + tW production with various other QCD and electroweak subprocesses that yield the same semileptonic final state is discussed in detail. On the technical side, we improve the resonance-aware POWHEG procedure by means of new resonance histories based on matrix elements, which enable a realistic separation of $t\bar{t}$ and tW contributions. Moreover, I introduce a general approach which makes it possible to avoid certain spurious terms that arise from the perturbative expansion of decay widths in any off-shell higher-order calculation, and which are large enough to jeopardise physical finite-width effects. Presented results and simulation tools will be of paramount importance for future precision top-quark studies and for the modelling of irreducible backgrounds in BSM searches.

Primary author: LINDERT, Jonas (University of Sussex)

Presenter: LINDERT, Jonas (University of Sussex)

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