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Precise predictions for ttH production at the LHC

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The top quark plays a pivotal role in particle physics, providing a powerful tool to test the SM and physics beyond it. Indeed, its large mass, near the electroweak scale, enables a detailed scrutiny of its interactions with the Higgs and electroweak bosons. Although its total rate is only few percent of the dominant Higgs production mode via gluon fusion, the hadroproduction of a top–antitop pair in association with a Higgs boson ($t\bar{t}H$) is crucial since it provides a direct access to the top Yukawa coupling. Given the precise experimental measurements expected at the HL-LHC, improving the accuracy of the corresponding theoretical predictions is of high priority.

In this talk we will present NNLO results in QCD, obtained by relying on the q_T-subtraction formalism for the treatment of infrared singularities arising at the intermediate stages of the calculation. A crucial ingredient are the relevant two-loop scattering amplitudes. The exact two-loop amplitudes being currently out of reach, we rely on physically motivated and reasonable approximations for this part of the calculation. Beyond our previously published results for the total cross section at NNLO, we will present a more sophisticated procedure, based on the combination of a soft-boson approximation and massification approach. We will also include the full tower of NLO EW corrections, thus providing the best theoretical prediction for $t\bar{t}H$ production up to date. Results for the total cross section as well as for several phenomenologically relevant distributions will be discussed.

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