

**Project 7/2014: "NLO Monte Carlo calculations for top-antitop quark production and decay in pp collisions"**

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**Abstract:**

We propose to improve the extraction of the top quark mass from ATLAS data of top-antitop quark production with lepton+jets final states using next-to-leading order (NLO) calculations matched to a Monte Carlo Generator. The total errors of the top quark mass from ATLAS are already at the percent level. At this level theoretical errors arising from uncertainties in the theory needed to model the data as a function of the top quark mass become important. In order to better control these uncertainties we propose to use NLO calculations which go beyond the narrow-width approximation for the complex final states in top-antitop production at the LHC matched to Monte Carlo event generators. Subsequently we can use the improved calculations together with the existing highly optimised top quark mass analyses in ATLAS. Calculations where non-factorising corrections between the production and the decay of top quarks are included at NLO, matched to Monte Carlo generators, are a recent theoretical development and we want to focus on the validation and adjustment to data (tuning) of the improved generators, as well as on integrating the new predictions into the ATLAS analyses.