Modelling associated $b\bar{b}$H production for the LHC

ABSTRACT: Higgs production in association with bottom quarks involves both bottom-quark (y_b) and top-quark Yukawa (y_t) interactions. We present new, state-of-the-art predictions for SM Higgs, computed in accordance with the recommendations of the LHC Higgs Working Group. Together with their relevance in di-Higgs searches, we describe NLO+PS results for the y_t^2 contribution and NNLO+PS predictions for the y_b^2 contribution in both massless and massive flavour schemes. New matched predictions at fixed-order level are provided using the FONLL method to combine N3LO 5FS and NLO 4FS results. Finally, we study the sensitivity to light-quark Yukawa couplings in Higgs production with resummation analytic results and novel NNLO+PS simulations.

Contents

1 Introduction

Introduction by Micheal Spira

2 Matching of N³LO 5FS and NLO 4FS cross-sections

Based on 2004.04752 (ref. Bernhard Mistlberger).

3 Monte Carlo simulations

3.1 NNLO+PS in the massless scheme

Based on 2402.04025 for MiNNLO$_{\rm PS}$. *{CB: New numbers ready. }*
Based on 250x.xxxxx for Geneva (ref. Alessandro Gavardi).

3.1.1 MiNNLO$_{\rm PS}$ and Geneva comparison

{CB: TODO. }

3.1.2 Heavy-Higgs for BSM studies in MiNNLO$_{\rm PS}$

{CB: Ready. }

3.2 Bottom-Yukawa squared contribution at NNLO+PS in 4FS

Based on 2412.09510 with MiNNLO$_{\rm PS}$. *{CB: TODO: run with LHCHWG setup. }*

3.3 Top-Yukawa squared contribution at NLO+PS in 4FS

Based on 2307.09992 (ref. Marco Zaro).

4 Modelling $b\bar{b}$H for background studies in HH searches

Focus on 2307.09992 mainly (and 2412.09510) in fiducial cuts for HH searches (ref. Stefano Manzoni). *{CB: In 2412.09510 we focus only on 2b2γ but in principle we can do 2b2τ also for the NNLO y_b^2 if useful/needed. }*

5 Light-quark Yukawa sensitivity in Higgs spectra

5.1 Transverse momentum resummation at NNLL'+aN3LO

Based on 2306.16458 (ref. Rebecca von Kuk).

5.2 Novel predictions at NNLO+PS with MiNNLO$_{\rm PS}$

{CB: Ready. }

6 Outlooks and Conclusions

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Citation policy.

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