

LHC HIGGS WORKING GROUP*

PUBLIC NOTE

Predictions for Production Cross Sections of the Higgs Boson at the
LHC and HL-LHC

WG1 conveners: Hannah Arnold¹, Alessandro Calandri², Alexander Karlberg³, Bernhard
Mistlberger⁴

ggF conveners:

VBF conveners:

VH conveners:

$t\bar{t}H/tH$ conveners:

$b\bar{b}H/bH$ conveners:

In collaboration with:

¹*Brookhaven National Laboratory, PO Box 5000, Upton, NY 11973, USA*

²*ETH Zurich—Institute for Particle Physics and Astrophysics (IPA), Zurich, Switzerland*

³*CERN, Theoretical Physics Department, CH-1211 Geneva 23, Switzerland*

⁴*SLAC National Accelerator Laboratory, Stanford University, Stanford, CA 94039, USA*

Abstract This note documents state-of-the-art predictions for the production cross sections of the Higgs Boson at the LHC. Specifically, Standard Model predictions for the LHC with centre-of-mass. energy of 7, 8, 13, 13.6 and 14 TeV are presented.

* <https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCHWG>

Contents

1	Introduction	1
2	Common setup	2
3	ggF	2
4	VBF	2
5	VH	2
6	$t\bar{t}H$ and tH	2
7	$b\bar{b}H$	2
8	Conclusions	2
A	Reference tables	3
A.1	ggF	3
A.2	VBF	3
A.3	VH	3
A.4	$t\bar{t}H$	3
A.5	$b\bar{b}H$	3

1 Introduction

Production cross sections for the Higgs boson based on the Standard Model of particle physics were collected in the CERN Yellow Report "Deciphering the Nature of the Higgs Sector" (YR4) (CERN-2017-002) [1]. Since this document became public many advancements in our abilities to predict production cross sections were achieved. Furthermore, the LHC performed measurements at a higher centre-of-mass energy of 13.6 TeV for which YR4 does not contain any predictions. Looking ahead to Run-3 and the High Luminosity phase of the LHC (HL-LHC) and the associated wealth of data that will be collected an update of the HWG recommendation of all production cross sections to reflect the current state of the art is called for. The aim of this note is to document recent advancements and review the ingredients for the prediction of Standard Model predictions for the production cross sections of the Higgs boson at the LHC (similar in spirit as in YR4). Updated numerical predictions for central values of the production cross sections and associated theoretical and parametric uncertainties are the main result of this article.

For now, instructions and input parameters for the generation of numerical values can be found here: <https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCHWG136TeVxsec>

2 Common setup

3 ggF

4 VBF

5 VH

6 $t\bar{t}H$ and tH

7 $b\bar{b}H$

8 Conclusions

Acknowledgments

This work was done on behalf of the LHCHWG.

A Reference tables

A.1 ggF

A.2 VBF

A.3 VH

A.4 ttH

A.5 bbH

References

- [1] LHC HIGGS CROSS SECTION WORKING GROUP collaboration, D. de Florian et al., *Handbook of LHC Higgs Cross Sections: 4. Deciphering the Nature of the Higgs Sector*, 1610.07922.