

Table of Contents

SM Higgs production cross sections at $\sqrt{s} = 8$ TeV (update in CERN Report4 2016)	1
Mass range and step for SM-like Higgs boson:.....	1
gluon-gluon Fusion Process.....	1
VBF Process.....	2
WH Process.....	3
pp WH Total Cross Section (with approximation).....	4
WH l H ($l=e,\mu$ or τ) Process.....	4
ZH Process.....	5
gg ZH Cross Section.....	6
pp ZH Total Cross Section (with approximation).....	6
ZH ll H, ll H ($l=e,\mu$ or τ) Process.....	7
ttH Process.....	8
bbH Process.....	9
tH Process.....	10
t-ch (qb tHq).....	10
s-ch (qq tHb).....	11
W-associated (gb tHW).....	12

SM Higgs production cross sections at $\sqrt{s} = 8$ TeV (update in CERN Report4 2016)

- Cross sections reported in CERN Report 4. See here and here here for previous numbers in CERN Report 3.
- Higgs cross sections and BRs in Spread sheet are available in xlsx format [NEW](#)
- You can find figures at our gallery here.

Mass range and step for SM-like Higgs boson:

Higgs Mass range	step size	# of points	addendum
[120,124] GeV	0.5 GeV	9 points	
[124,126] GeV	0.1 GeV	20 points	+ $M_H=125.09$ GeV
[126,130] GeV	0.5 GeV	8 points	

- Total 38 points for $M_H=[120,130]$ GeV.

gluon-gluon Fusion Process

N3LO QCD cross sections supercede those of NNLO+NNLL QCD

- Cross sections are calculated by Zürich group at N3LO QCD and NLO EW accuracies [Anastasiou:2016cez].
- QCD scales: $\mu=\mu_F=\mu_R=M_H/2$ varied in the range of $[M_H/4, M_H]$.
- Theory uncertainty:
 - ◆ "±Theory" uncertainty is interpreted as a flat 100% confidence level.
 - ◆ "TH Gaussian" uncertainty is interpreted as a one-sigma range. It is estimated by $\max\{+TH, -TH\}/\sqrt{3}$ as discussed in CERN Report 4 ggF section.
 - ◆ "TH Gaussian" uncertainty should be used for the construction of the workspace in the current LHC-HCG prescription [↗](#).
- PDF set: PDF4LHC15_nnlo_100
- Cross sections are calculated with dFG program at NNLO+NNLL QCD and NLO EW accuracies.
- Calculations are the same as CERN Report 3 (i.e. top, bottom and charm quark effects are taken into account), except it is in NWA (CPS in CERN Report 3).
- Program: dFG
- QCD scales: $\mu=\mu_F=\mu_R=M_H$, uncertainty estimated in the range $1/2 < \mu/M_H < 2$ with $1/2 < \mu_F/\mu_R < 2$ constraint.
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nnlo_30

m_H (GeV)	N3LO							NNLO+NNLL			
	Cross Section (pb)	+Theory %	-Theory %	TH Gaussian %	±(PDF+ %)	±PDF %	± %	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±
120.00	2.322E+01	+4.5	-7.1	±4.1	±3.3	±1.9	±2.7	2.107E+01	+7.5	-8.1	
120.50	2.303E+01	+4.5	-7.0	±4.1	±3.2	±1.9	±2.7	2.090E+01	+7.5	-8.1	
121.00	2.285E+01	+4.5	-7.0	±4.1	±3.2	±1.9	±2.7	2.073E+01	+7.4	-8.1	
121.50	2.266E+01	+4.5	-7.0	±4.0	±3.2	±1.9	±2.6	2.057E+01	+7.4	-8.1	

122.00	2.248E+01	+4.5	-7.0	±4.0	±3.2	±1.9	±2.6	2.041E+01	+7.4	-8.0
122.50	2.230E+01	+4.5	-7.0	±4.0	±3.2	±1.9	±2.6	2.024E+01	+7.4	-8.0
123.00	2.212E+01	+4.5	-7.0	±4.0	±3.2	±1.9	±2.6	2.009E+01	+7.4	-8.0
123.50	2.194E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.993E+01	+7.4	-8.0
124.00	2.177E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.977E+01	+7.4	-8.0
124.10	2.173E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.974E+01	+7.4	-8.0
124.20	2.170E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.971E+01	+7.4	-8.0
124.30	2.166E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.968E+01	+7.4	-8.0
124.40	2.163E+01	+4.5	-6.9	±4.0	±3.2	±1.9	±2.6	1.965E+01	+7.4	-8.0
124.50	2.159E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.962E+01	+7.4	-8.0
124.60	2.156E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.959E+01	+7.4	-8.0
124.70	2.153E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.956E+01	+7.4	-8.0
124.80	2.149E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.953E+01	+7.4	-8.0
124.90	2.146E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.950E+01	+7.3	-8.0
125.00	2.142E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.947E+01	+7.3	-8.0
125.09	2.139E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.944E+01	+7.3	-8.0
125.10	2.139E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.944E+01	+7.3	-8.0
125.20	2.136E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.941E+01	+7.3	-8.0
125.30	2.132E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.938E+01	+7.3	-8.0
125.40	2.129E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.935E+01	+7.3	-8.0
125.50	2.126E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.932E+01	+7.3	-8.0
125.60	2.122E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.929E+01	+7.3	-8.0
125.70	2.119E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.926E+01	+7.3	-8.0
125.80	2.116E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.923E+01	+7.3	-8.0
125.90	2.112E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.920E+01	+7.3	-8.0
126.00	2.109E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.917E+01	+7.3	-8.0
126.50	2.092E+01	+4.4	-6.9	±4.0	±3.2	±1.9	±2.6	1.902E+01	+7.3	-8.0
127.00	2.076E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.887E+01	+7.3	-7.9
127.50	2.060E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.873E+01	+7.3	-7.9
128.00	2.044E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.859E+01	+7.3	-7.9
128.50	2.028E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.845E+01	+7.3	-7.9
129.00	2.013E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.831E+01	+7.3	-7.9
129.50	1.998E+01	+4.4	-6.8	±3.9	±3.2	±1.9	±2.6	1.817E+01	+7.2	-7.9
130.00	1.982E+01	+4.3	-6.7	±3.9	±3.2	±1.9	±2.6	1.803E+01	+7.2	-7.9

VBF Process

- Cross sections are calculated at (approx.) NNLO QCD and NLO EW accuracies.
- Calculations are the same as CERN Report 3, except it is in NWA (CPS in CERN Report 3).
- Program: NNLO QCD (VBF@NNLO) and NLO EW (HAWK).
- QCD scales: $\mu=\mu_F=\mu_R=M_W$, uncertainty estimated in the range $1/2 < \mu/M_W < 2$ (keeping $\mu_F=\mu_R$).
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nnlo_100 (QCD corrections) and NNPDF2.3QED (EW corrections + photon PDF)

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ _s) %	±PDF %	± _s %
120.00	1.676E+00	+0.3	-0.3	±2.2	±2.1	±0.4
120.50	1.668E+00	+0.3	-0.3	±2.2	±2.1	±0.4
121.00	1.661E+00	+0.3	-0.3	±2.2	±2.1	±0.4
121.50	1.653E+00	+0.3	-0.3	±2.2	±2.1	±0.4
122.00	1.645E+00	+0.3	-0.3	±2.2	±2.1	±0.4

122.50	1.638E+00	+0.3	-0.2	±2.2	±2.1	±0.4
123.00	1.631E+00	+0.3	-0.2	±2.2	±2.1	±0.4
123.50	1.623E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.00	1.616E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.10	1.614E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.20	1.613E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.30	1.611E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.40	1.610E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.50	1.609E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.60	1.607E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.70	1.606E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.80	1.604E+00	+0.3	-0.2	±2.2	±2.1	±0.4
124.90	1.603E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.00	1.601E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.09	1.600E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.10	1.600E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.20	1.598E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.30	1.597E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.40	1.596E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.50	1.594E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.60	1.593E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.70	1.591E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.80	1.590E+00	+0.3	-0.2	±2.2	±2.1	±0.4
125.90	1.588E+00	+0.3	-0.2	±2.2	±2.1	±0.4
126.00	1.587E+00	+0.2	-0.2	±2.2	±2.1	±0.4
126.50	1.580E+00	+0.2	-0.2	±2.2	±2.1	±0.4
127.00	1.573E+00	+0.2	-0.2	±2.2	±2.1	±0.4
127.50	1.566E+00	+0.2	-0.2	±2.2	±2.1	±0.4
128.00	1.559E+00	+0.2	-0.2	±2.2	±2.1	±0.4
128.50	1.552E+00	+0.2	-0.2	±2.2	±2.1	±0.4
129.00	1.545E+00	+0.2	-0.2	±2.2	±2.1	±0.4
129.50	1.538E+00	+0.2	-0.2	±2.2	±2.1	±0.4
130.00	1.531E+00	+0.2	-0.2	±2.2	±2.1	±0.4

WH Process

- Cross sections are calculated at NNLO QCD and NLO EW accuracies.
 - ◆ Calculations are the same as CERN Report 3, except photon-induced contribution (see below).
 - ◆ Total cross section is calculated from WH 1 H cross section by subtracting photon-induced cross section, and then scaled via $BR(W 1 H)=0.108535$ in NLO EW accuracy.
- Program: NNLO QCD (VH@NNLO) and NLO EW (HAWK).
- QCD scales: $\mu=\mu_F=\mu_R=M_{VH}=(p_V+p_H)^2$ for QCD part and $\mu=\mu_F=\mu_R=M_{VH}+M_H$ for EW part. Uncertainty is estimated in the range $1/3 < \mu/M_{VH} < 3$ (μ_F and μ_R are varied independently).
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nnlo_mc (QCD part) and NNPDF2.3QED (EW part).
- Photon-induced contribution of O(5%)
 - ◆ NOT included for total cross section (agrees with CERN Report 3 numbers within 1%).
 - ◆ Included in cross sections for dedicated WH 1 H ($l=e,\mu$ or τ) process (we strongly recommend to use these numbers for dedicated analyses).

pp WH Total Cross Section (with approximation)

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm ;(PDF+ s) %	\pm ;PDF %	\pm ; s %	W+H (pb)	W-H (pb)
120.00	8.054E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	5.091E-01	2.963E-01
120.50	7.943E-01	+0.5	-0.9	± 2.1	± 1.9	± 0.7	5.023E-01	2.920E-01
121.00	7.832E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.953E-01	2.878E-01
121.50	7.724E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.887E-01	2.837E-01
122.00	7.620E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.821E-01	2.799E-01
122.50	7.518E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.758E-01	2.760E-01
123.00	7.414E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.694E-01	2.720E-01
123.50	7.314E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.632E-01	2.682E-01
124.00	7.218E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.570E-01	2.648E-01
124.10	7.198E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.559E-01	2.639E-01
124.20	7.180E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.548E-01	2.632E-01
124.30	7.163E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.537E-01	2.626E-01
124.40	7.146E-01	+0.5	-0.9	± 2.1	± 1.9	± 0.7	4.528E-01	2.619E-01
124.50	7.124E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.514E-01	2.610E-01
124.60	7.104E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.500E-01	2.604E-01
124.70	7.082E-01	+0.7	-0.8	± 2.1	± 1.9	± 0.7	4.486E-01	2.595E-01
124.80	7.065E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.477E-01	2.588E-01
124.90	7.046E-01	+0.6	-0.9	± 2.0	± 1.9	± 0.7	4.466E-01	2.580E-01
125.00	7.026E-01	+0.6	-0.9	± 2.0	± 1.9	± 0.7	4.454E-01	2.572E-01
125.09	7.009E-01	+0.7	-0.8	± 2.0	± 1.9	± 0.7	4.443E-01	2.566E-01
125.10	7.009E-01	+0.6	-0.8	± 2.0	± 1.9	± 0.7	4.443E-01	2.566E-01
125.20	6.989E-01	+0.7	-0.9	± 2.1	± 1.9	± 0.7	4.429E-01	2.560E-01
125.30	6.969E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.416E-01	2.553E-01
125.40	6.950E-01	+0.7	-0.9	± 2.1	± 1.9	± 0.7	4.404E-01	2.546E-01
125.50	6.930E-01	+0.7	-0.8	± 2.1	± 1.9	± 0.7	4.391E-01	2.538E-01
125.60	6.912E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.381E-01	2.531E-01
125.70	6.895E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.371E-01	2.525E-01
125.80	6.875E-01	+0.7	-0.8	± 2.1	± 1.9	± 0.7	4.358E-01	2.517E-01
125.90	6.859E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.348E-01	2.511E-01
126.00	6.840E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.336E-01	2.504E-01
126.50	6.749E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.277E-01	2.472E-01
127.00	6.660E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.223E-01	2.437E-01
127.50	6.572E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.167E-01	2.405E-01
128.00	6.488E-01	+0.6	-0.8	± 2.1	± 1.9	± 0.7	4.116E-01	2.373E-01
128.50	6.402E-01	+0.6	-0.9	± 2.1	± 1.9	± 0.7	4.063E-01	2.338E-01
129.00	6.319E-01	+0.6	-0.9	± 2.1	± 2.0	± 0.7	4.010E-01	2.309E-01
129.50	6.236E-01	+0.6	-0.9	± 2.1	± 2.0	± 0.7	3.959E-01	2.277E-01
130.00	6.154E-01	+0.6	-0.9	± 2.1	± 2.0	± 0.7	3.908E-01	2.245E-01

WH I H (l=e,μ or τ) Process

m_H (GeV)	W+H 1+ H							W-H 1-			
	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm ;(PDF+ s) %	\pm ;PDF %	\pm ; s %		Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm ;(PDF+ s) %
120.00	5.646E-02	+0.6	-0.8	± 2.0	± 1.8	± 0.7	1.21E-03	3.288E-02	+0.5	-0.9	± 2.2
120.50	5.573E-02	+0.5	-0.9	± 2.0	± 1.8	± 0.7	1.21E-03	3.241E-02	+0.5	-0.8	± 2.2
121.00	5.497E-02	+0.6	-0.8	± 2.0	± 1.8	± 0.7	1.21E-03	3.196E-02	+0.6	-0.8	± 2.2

121.50	5.424E-02	+0.6	-0.8	±2.0	±1.8	±0.7	1.20E-03	3.151E-02	+0.5	-0.8	±2.2
122.00	5.352E-02	+0.6	-0.8	±2.0	±1.8	±0.7	1.20E-03	3.109E-02	+0.5	-0.8	±2.2
122.50	5.284E-02	+0.6	-0.8	±2.0	±1.8	±0.7	1.20E-03	3.067E-02	+0.5	-0.8	±2.2
123.00	5.214E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.19E-03	3.023E-02	+0.6	-0.8	±2.2
123.50	5.146E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.19E-03	2.981E-02	+0.6	-0.8	±2.2
124.00	5.079E-02	+0.7	-0.8	±2.0	±1.8	±0.8	1.19E-03	2.944E-02	+0.5	-0.8	±2.2
124.10	5.067E-02	+0.6	-0.8	±2.0	±1.8	±0.8	1.19E-03	2.934E-02	+0.5	-0.8	±2.2
124.20	5.054E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.927E-02	+0.5	-0.9	±2.2
124.30	5.042E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.920E-02	+0.5	-0.9	±2.2
124.40	5.032E-02	+0.5	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.912E-02	+0.5	-0.9	±2.2
124.50	5.017E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.903E-02	+0.5	-0.8	±2.2
124.60	5.002E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.896E-02	+0.5	-0.8	±2.2
124.70	4.987E-02	+0.7	-0.8	±2.0	±1.8	±0.8	1.18E-03	2.887E-02	+0.6	-0.8	±2.2
124.80	4.977E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.879E-02	+0.6	-0.8	±2.2
124.90	4.965E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.870E-02	+0.6	-0.8	±2.1
125.00	4.952E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.862E-02	+0.6	-0.8	±2.1
125.09	4.940E-02	+0.7	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.855E-02	+0.6	-0.7	±2.1
125.10	4.940E-02	+0.6	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.855E-02	+0.6	-0.7	±2.1
125.20	4.925E-02	+0.7	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.848E-02	+0.6	-0.8	±2.2
125.30	4.911E-02	+0.7	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.841E-02	+0.5	-0.8	±2.2
125.40	4.898E-02	+0.7	-0.9	±2.0	±1.8	±0.8	1.18E-03	2.832E-02	+0.6	-0.8	±2.2
125.50	4.884E-02	+0.7	-0.8	±2.0	±1.8	±0.8	1.18E-03	2.824E-02	+0.6	-0.7	±2.2
125.60	4.873E-02	+0.6	-0.8	±2.0	±1.8	±0.8	1.18E-03	2.816E-02	+0.6	-0.8	±2.2
125.70	4.861E-02	+0.6	-0.9	±2.0	±1.8	±0.7	1.17E-03	2.809E-02	+0.6	-0.8	±2.2
125.80	4.847E-02	+0.7	-0.8	±2.0	±1.8	±0.7	1.17E-03	2.801E-02	+0.6	-0.7	±2.2
125.90	4.836E-02	+0.6	-0.9	±2.0	±1.8	±0.7	1.17E-03	2.794E-02	+0.6	-0.7	±2.2
126.00	4.823E-02	+0.6	-0.9	±2.0	±1.8	±0.7	1.17E-03	2.787E-02	+0.6	-0.8	±2.2
126.50	4.759E-02	+0.7	-0.8	±2.0	±1.8	±0.7	1.17E-03	2.752E-02	+0.5	-0.8	±2.2
127.00	4.700E-02	+0.6	-0.9	±2.0	±1.8	±0.7	1.17E-03	2.714E-02	+0.6	-0.8	±2.2
127.50	4.639E-02	+0.7	-0.8	±2.0	±1.8	±0.7	1.16E-03	2.679E-02	+0.5	-0.8	±2.2
128.00	4.583E-02	+0.6	-0.8	±2.0	±1.8	±0.7	1.16E-03	2.643E-02	+0.6	-0.9	±2.2
128.50	4.526E-02	+0.6	-0.9	±2.0	±1.8	±0.7	1.16E-03	2.606E-02	+0.6	-0.8	±2.2
129.00	4.467E-02	+0.6	-0.9	±2.0	±1.9	±0.7	1.15E-03	2.574E-02	+0.6	-0.8	±2.2
129.50	4.412E-02	+0.6	-0.9	±2.0	±1.9	±0.7	1.15E-03	2.539E-02	+0.5	-0.8	±2.2
130.00	4.357E-02	+0.6	-1.0	±2.0	±1.9	±0.7	1.15E-03	2.505E-02	+0.6	-0.8	±2.2

ZH Process

- Cross sections are calculated at NNLO QCD and NLO EW accuracies.
 - ◆ Calculations are the same as CERN Report 3, except photon-induced contribution (see below).
 - ◆ Total cross section is calculated from ZH llH, $\gamma\gamma$ H cross sections by subtracting photon-induced cross section, and then scaled via $BR(Z \rightarrow ll)=0.0335962$ and $BR(Z \rightarrow \gamma\gamma)=0.201030$ in NLO EW accuracy.
 - ◆ $gg \rightarrow ZH$ (box-diagram) occurs as a part of NNLO QCD correction and included in the total cross section.
 - ◆ ZH cross section went up by +1~2%, due to +22~16% for $\sqrt{s} = 7-14$ TeV, due to increase in $gg \rightarrow ZH$ for NLO+NLL QCD corrections (NLO in CERN Report 3).
- Program: NNLO QCD (VH@NNLO) and NLO EW (HAWK).
- QCD scales: $\mu = \mu_F = \mu_R = M_{VH} = (p_V + p_H)^2$ for QCD part and $\mu = \mu_F = \mu_R = M_{VH} + M_H$ for EW part. Uncertainty is estimated in the range $1/3 < \mu/M_{VH} < 3$ (μ_F and μ_R are varied independently).

- ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nnlo_mc (QCD part) and NNPDF2.3QED (EW part).
- Photon-induced contribution of O(1%) or below
 - ◆ NOT included for total cross section (agrees with CERN Report 3 numbers).
 - ◆ Included in cross sections for dedicated ZH \rightarrow H, \rightarrow H ($l=e,\mu$ or τ) processes (we strongly recommend to use these numbers for dedicated analyses).

gg ZH Cross Section

- ZH production has two distinct sources of gg ZH:
 1. a genuine NNLO contribution to what called Drell-Yan-like, where ZH is accompanied by two-parton radiation, gg HZ+qqbar.
 2. top- and bottom-loop induced contribution without any additional partons in the final state.
- What is usually meant by gg HZ below is 2) above.
- The statement that all but gg HZ is the same as qq- and qg-initiated is correct only through NLO QCD.
- For separate cross sections and associated QCD scale uncertainties in qq/qg ZH(+gg HZ+qqbar) and gg ZH for NLO/LO MC normalization, use
 - ◆ (all but gg ZH) = (pp ZH)@(NNLO QCD + NLO EW, NLO+NLL QCD gg ZH) - (gg ZH)@(NLO+NLL QCD),
 - ◆ Separate QCD scale uncertainties are (all but gg ZH) or on (gg ZH) are calculated with VH@NNLO program.
- For $M_H=125.0$ GeV and at $\sqrt{s}=8$ TeV,

Process	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm (PDF+ α_s) %	\pm PDF %	\pm α_s %
pp ZH	0.4208	+2.9%	-2.4%	$\pm 1.7\%$	$\pm 1.5\%$	$\pm 0.8\%$
qq/qg ZH, gg HZ+qqbar (all but gg ZH)	0.3814	+0.7%	-0.8%	$\pm 1.9\%$	$\pm 1.8\%$	$\pm 0.7\%$
gg ZH	0.03942	+25.2%	-19.1%	$\pm 3.2\%$	$\pm 2.5\%$	$\pm 1.9\%$

pp ZH Total Cross Section (with approximation)

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm (PDF+ α_s) %	\pm PDF %	\pm α_s %	(gg ZH) (pb)
120.00	4.767E-01	+2.6	-2.4	± 1.7	± 1.5	± 0.8	4.175E-02
120.50	4.705E-01	+2.7	-2.3	± 1.7	± 1.5	± 0.8	4.148E-02
121.00	4.648E-01	+2.7	-2.3	± 1.7	± 1.5	± 0.8	4.123E-02
121.50	4.591E-01	+2.7	-2.3	± 1.7	± 1.5	± 0.8	4.096E-02
122.00	4.534E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	4.086E-02
122.50	4.479E-01	+2.7	-2.4	± 1.7	± 1.5	± 0.8	4.059E-02
123.00	4.421E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	4.031E-02
123.50	4.366E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	4.004E-02
124.00	4.314E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	3.994E-02
124.10	4.303E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	3.977E-02
124.20	4.292E-01	+2.8	-2.4	± 1.7	± 1.5	± 0.8	3.974E-02
124.30	4.282E-01	+2.7	-2.4	± 1.7	± 1.5	± 0.8	3.974E-02
124.40	4.273E-01	+2.8	-2.5	± 1.7	± 1.5	± 0.8	3.969E-02
124.50	4.261E-01	+2.7	-2.5	± 1.7	± 1.5	± 0.8	3.967E-02
124.60	4.250E-01	+2.8	-2.5	± 1.7	± 1.5	± 0.8	3.964E-02
124.70	4.238E-01	+2.9	-2.4	± 1.7	± 1.5	± 0.8	3.947E-02
124.80	4.228E-01	+2.9	-2.4	± 1.7	± 1.5	± 0.8	3.944E-02
124.90	4.217E-01	+2.9	-2.4	± 1.7	± 1.5	± 0.8	3.942E-02
125.00	4.208E-01	+2.9	-2.4	± 1.7	± 1.5	± 0.8	3.942E-02

125.09	4.199E-01	+2.8	-2.4	±1.7	±1.5	±0.8	3.942E-02
125.10	4.199E-01	+2.8	-2.5	±1.7	±1.5	±0.8	3.942E-02
125.20	4.187E-01	+2.8	-2.5	±1.7	±1.5	±0.8	3.937E-02
125.30	4.176E-01	+2.9	-2.4	±1.7	±1.5	±0.8	3.934E-02
125.40	4.166E-01	+2.8	-2.4	±1.7	±1.5	±0.8	3.917E-02
125.50	4.157E-01	+2.8	-2.5	±1.7	±1.5	±0.8	3.914E-02
125.60	4.148E-01	+2.8	-2.5	±1.7	±1.5	±0.8	3.914E-02
125.70	4.136E-01	+2.8	-2.5	±1.7	±1.5	±0.7	3.912E-02
125.80	4.128E-01	+2.7	-2.6	±1.7	±1.5	±0.7	3.909E-02
125.90	4.119E-01	+2.8	-2.6	±1.7	±1.5	±0.7	3.909E-02
126.00	4.107E-01	+2.8	-2.5	±1.7	±1.5	±0.7	3.905E-02
126.50	4.056E-01	+2.9	-2.5	±1.7	±1.5	±0.7	3.877E-02
127.00	4.008E-01	+2.9	-2.5	±1.7	±1.5	±0.7	3.852E-02
127.50	3.961E-01	+2.8	-2.6	±1.7	±1.5	±0.7	3.828E-02
128.00	3.914E-01	+2.9	-2.6	±1.7	±1.5	±0.7	3.818E-02
128.50	3.863E-01	+3.0	-2.5	±1.7	±1.5	±0.7	3.788E-02
129.00	3.818E-01	+2.9	-2.6	±1.7	±1.5	±0.7	3.765E-02
129.50	3.773E-01	+2.9	-2.6	±1.7	±1.5	±0.7	3.738E-02
130.00	3.726E-01	+3.0	-2.6	±1.7	±1.5	±0.7	3.708E-02

ZH IH, H (l=e,μ or) Process

m _H (GeV)	ZH l+lH								Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ %)	±PDF %	± _s	gg ZH (pb)	
	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ %)	±PDF %	± _s										
120.00	1.606E-02	+2.6	-2.4	±1.7	±1.5	±0.8	1.41E-03	4.00E-05	9.581E-02	+2.6	-2.4					
120.50	1.585E-02	+2.7	-2.3	±1.7	±1.5	±0.8	1.40E-03	4.00E-05	9.456E-02	+2.7	-2.3					
121.00	1.566E-02	+2.7	-2.3	±1.7	±1.5	±0.8	1.39E-03	4.00E-05	9.341E-02	+2.7	-2.3					
121.50	1.547E-02	+2.7	-2.3	±1.7	±1.5	±0.8	1.38E-03	4.00E-05	9.227E-02	+2.7	-2.3					
122.00	1.528E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.38E-03	4.00E-05	9.112E-02	+2.8	-2.4					
122.50	1.509E-02	+2.7	-2.4	±1.7	±1.5	±0.8	1.37E-03	4.00E-05	9.001E-02	+2.7	-2.4					
123.00	1.490E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.36E-03	4.00E-05	8.885E-02	+2.8	-2.4					
123.50	1.471E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.35E-03	4.00E-05	8.774E-02	+2.8	-2.4					
124.00	1.454E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.35E-03	4.00E-05	8.669E-02	+2.8	-2.4					
124.10	1.450E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.647E-02	+2.8	-2.4					
124.20	1.446E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.627E-02	+2.8	-2.4					
124.30	1.443E-02	+2.7	-2.4	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.607E-02	+2.7	-2.4					
124.40	1.440E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.587E-02	+2.8	-2.5					
124.50	1.436E-02	+2.7	-2.5	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.565E-02	+2.7	-2.5					
124.60	1.432E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.34E-03	4.00E-05	8.542E-02	+2.8	-2.5					
124.70	1.428E-02	+2.9	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.519E-02	+2.9	-2.4					
124.80	1.425E-02	+2.9	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.497E-02	+2.9	-2.4					
124.90	1.421E-02	+2.9	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.476E-02	+2.9	-2.4					
125.00	1.418E-02	+2.9	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.456E-02	+2.9	-2.4					
125.09	1.415E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.440E-02	+2.8	-2.4					
125.10	1.415E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.440E-02	+2.8	-2.5					
125.20	1.411E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.416E-02	+2.8	-2.5					
125.30	1.407E-02	+2.9	-2.4	±1.7	±1.5	±0.8	1.33E-03	4.00E-05	8.394E-02	+2.9	-2.4					
125.40	1.404E-02	+2.8	-2.4	±1.7	±1.5	±0.8	1.32E-03	4.00E-05	8.373E-02	+2.8	-2.4					
125.50	1.401E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.32E-03	4.00E-05	8.356E-02	+2.8	-2.5					

125.60	1.398E-02	+2.8	-2.5	±1.7	±1.5	±0.8	1.32E-03	4.00E-05	8.336E-02	+2.8	-2.5
125.70	1.394E-02	+2.8	-2.5	±1.7	±1.5	±0.7	1.32E-03	4.00E-05	8.313E-02	+2.8	-2.5
125.80	1.391E-02	+2.7	-2.6	±1.7	±1.5	±0.7	1.32E-03	4.00E-05	8.298E-02	+2.7	-2.6
125.90	1.388E-02	+2.8	-2.6	±1.7	±1.5	±0.7	1.32E-03	4.00E-05	8.279E-02	+2.8	-2.6
126.00	1.384E-02	+2.8	-2.5	±1.7	±1.5	±0.7	1.32E-03	4.00E-05	8.254E-02	+2.8	-2.5
126.50	1.367E-02	+2.9	-2.5	±1.7	±1.5	±0.7	1.31E-03	4.00E-05	8.153E-02	+2.9	-2.5
127.00	1.351E-02	+2.9	-2.5	±1.7	±1.5	±0.7	1.30E-03	4.00E-05	8.054E-02	+2.9	-2.5
127.50	1.335E-02	+2.8	-2.6	±1.7	±1.5	±0.7	1.29E-03	4.00E-05	7.960E-02	+2.8	-2.6
128.00	1.319E-02	+2.9	-2.6	±1.7	±1.5	±0.7	1.29E-03	4.00E-05	7.867E-02	+2.9	-2.6
128.50	1.302E-02	+3.0	-2.5	±1.7	±1.5	±0.7	1.28E-03	4.00E-05	7.763E-02	+3.0	-2.5
129.00	1.287E-02	+2.9	-2.6	±1.7	±1.5	±0.7	1.27E-03	4.00E-05	7.675E-02	+2.9	-2.6
129.50	1.272E-02	+2.9	-2.6	±1.7	±1.5	±0.7	1.26E-03	4.00E-05	7.582E-02	+2.9	-2.6
130.00	1.256E-02	+3.0	-2.6	±1.7	±1.5	±0.7	1.25E-03	4.00E-05	7.490E-02	+3.0	-2.6

ttH Process

- Cross sections are calculated at NLO QCD and NLO EW accuracies.
 - ◆ Calculations are the same as CERN Report 3, except NLO EW corrections are adopted now.
- Program: MadGraph5_aMC@NLO (Sherpa+OpenLoops as cross ceck)
- QCD scales: $\mu=\mu_F=\mu_R=M_{\text{top}}+M_H/2$, uncertainty estimated in the range $1/2 < \mu/(M_{\text{top}}+M_H/2) < 2$ (with $1/2 < \mu_F/\mu_R < 2$ constraint).
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nlo_30_pdfas

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm ;(PDF+) %	\pm ;PDF %	\pm ; %
120.00	1.501E-01	+4.1	-9.2	±4.3	±3.7	±2.1
120.50	1.485E-01	+4.1	-9.2	±4.3	±3.7	±2.1
121.00	1.465E-01	+4.1	-9.3	±4.3	±3.7	±2.1
121.50	1.447E-01	+4.0	-9.2	±4.3	±3.7	±2.1
122.00	1.431E-01	+4.1	-9.2	±4.3	±3.7	±2.1
122.50	1.413E-01	+4.1	-9.2	±4.3	±3.7	±2.1
123.00	1.395E-01	+4.0	-9.2	±4.3	±3.7	±2.1
123.50	1.379E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.00	1.363E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.10	1.361E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.20	1.355E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.30	1.352E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.40	1.349E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.50	1.346E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.60	1.343E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.70	1.339E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.80	1.336E-01	+4.0	-9.2	±4.3	±3.7	±2.1
124.90	1.334E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.00	1.330E-01	+4.1	-9.2	±4.3	±3.7	±2.1
125.09	1.326E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.10	1.327E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.20	1.324E-01	+4.1	-9.2	±4.3	±3.7	±2.1
125.30	1.321E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.40	1.316E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.50	1.314E-01	+4.0	-9.2	±4.3	±3.7	±2.1
125.60	1.310E-01	+4.0	-9.2	±4.3	±3.7	±2.1

125.70	1.306E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
125.80	1.305E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
125.90	1.302E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
126.00	1.299E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
126.50	1.282E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
127.00	1.266E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
127.50	1.253E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
128.00	1.237E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
128.50	1.224E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
129.00	1.208E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.1
129.50	1.194E-01	+3.9	-9.2	± 4.3	± 3.7	± 2.1
130.00	1.181E-01	+4.0	-9.2	± 4.3	± 3.7	± 2.2

bbH Process

- The cross sections are the Santander matched numbers with 5FS (NNLO) and 4FS (NLO). No EW corrections.
- Program: SusHi for 5FS and dedicated version of MadGraph5_aMC@NLO for 4FS.
- QCD scales:
 - ◆ 5FS: $\mu_F = M_H/4$, $\mu_R = M_H$,
 - ◆ 4FS: $\mu_F = \mu_R = (M_H + 2M_b)/4$,
 - ◆ scale with 7-point variation by a factor of 2 in both cases.
- Uncertainties
 - ◆ 5FS: Linearly added scale + (PDF σ_s) + M_b + μ_b (PDF and σ_s uncertainties are added in quadrature).
 - ◆ 4FS: Only scale uncertainties (as they are the dominant ones) and no PDF uncertainties are included.
- PDF set
 - ◆ 5FS: Dedicated sets produced with APFEL are used which are generated from the PDF4LHC15_nlo_100 sets taken below the M_b -threshold and evolved upwards, while generating a b-PDF set at high scale.
 - ◆ 4FS: PDF4LHC15_nlo_nf4_100

m_H (GeV)	Cross Section (pb)	+(QCD Scale+PDF+ σ_s) %	-(QCD Scale+PDF+ σ_s) %
120.00	2.315E-01	+20.8	-22.8
120.50	2.289E-01	+20.8	-22.8
121.00	2.250E-01	+20.7	-22.7
121.50	2.224E-01	+20.8	-22.7
122.00	2.190E-01	+20.6	-22.6
122.50	2.161E-01	+20.7	-22.5
123.00	2.132E-01	+20.7	-22.5
123.50	2.104E-01	+20.7	-22.4
124.00	2.071E-01	+20.6	-22.4
124.10	2.069E-01	+20.7	-22.4
124.20	2.062E-01	+20.6	-22.5
124.30	2.056E-01	+20.7	-22.6
124.40	2.052E-01	+20.8	-22.6
124.50	2.045E-01	+20.6	-22.4
124.60	2.043E-01	+20.7	-22.5
124.70	2.036E-01	+20.7	-22.5
124.80	2.028E-01	+20.6	-22.5
124.90	2.024E-01	+20.7	-22.5

125.00	2.021E-01	+20.7	-22.3
125.09	2.015E-01	+20.6	-22.4
125.10	2.008E-01	+20.6	-22.3
125.20	2.008E-01	+20.7	-22.4
125.30	2.005E-01	+20.7	-22.4
125.40	1.998E-01	+20.7	-22.5
125.50	1.993E-01	+20.6	-22.3
125.60	1.993E-01	+20.6	-22.3
125.70	1.988E-01	+20.7	-22.4
125.80	1.982E-01	+20.7	-22.4
125.90	1.974E-01	+20.8	-22.5
126.00	1.968E-01	+20.6	-22.3
126.50	1.936E-01	+20.6	-22.1
127.00	1.914E-01	+20.5	-22.2
127.50	1.882E-01	+20.4	-22.1
128.00	1.864E-01	+20.4	-22.1
128.50	1.833E-01	+20.3	-22.0
129.00	1.811E-01	+20.3	-22.0
129.50	1.786E-01	+20.4	-22.0
130.00	1.763E-01	+20.3	-21.9

tH Process

t-ch (qb tHq)

- Cross sections are calculated at NLO QCD accuracy (no NLO EW correction) in 5FS.
- Program: MadGraph5_aMC@NLO
- QCD scales: $\mu=\mu_F=\mu_R=(M_{\text{top}}+M_H)/4$, uncertainty estimated in the range $1/2 < \mu/\{(M_{\text{top}}+M_H)/4\} < 2$ (with $1/2 < \mu_F/\mu_R < 2$ constraint).
 - ◆ Flavour scheme (FS) dependence (4FS - 5FS envelope) included in the scale uncertainty. No PU uncertainty assigned.
- PDF set:
 - ◆ PDF4LHC15_nlo_30_pdfas (5FS)
 - ◆ PDF4LHC15_nlo_nf4_100 (4FS central set), used to compute the combined scale+FS uncertainty in tH t-channel.

m_H (GeV)	Cross Section (pb)	+(QCD Scale + FS) %	-(QCD Scale + FS) %	\pm ;(PDF+ %)	\pm ;PDF %	\pm ; %	tH (pb)	tbarH (pb)
120.00	1.959E-02	+7.4	-16.0	± 4.6	± 4.4	± 1.4	1.337E-02	6.220E-03
120.50	1.949E-02	+7.4	-16.0	± 4.6	± 4.4	± 1.4	1.330E-02	6.190E-03
121.00	1.938E-02	+7.4	-16.0	± 4.6	± 4.4	± 1.4	1.325E-02	6.160E-03
121.50	1.929E-02	+7.4	-16.1	± 4.6	± 4.4	± 1.4	1.315E-02	6.130E-03
122.00	1.921E-02	+7.4	-16.1	± 4.6	± 4.4	± 1.4	1.310E-02	6.110E-03
122.50	1.911E-02	+7.4	-16.3	± 4.6	± 4.4	± 1.4	1.302E-02	6.080E-03
123.00	1.902E-02	+7.3	-16.3	± 4.6	± 4.4	± 1.4	1.299E-02	6.050E-03
123.50	1.892E-02	+7.3	-16.2	± 4.6	± 4.4	± 1.4	1.293E-02	6.030E-03
124.00	1.887E-02	+7.3	-16.4	± 4.6	± 4.4	± 1.4	1.286E-02	5.990E-03
124.10	1.882E-02	+7.3	-16.3	± 4.6	± 4.4	± 1.4	1.284E-02	5.990E-03
124.20	1.881E-02	+7.3	-16.4	± 4.6	± 4.4	± 1.4	1.285E-02	6.000E-03
124.30	1.878E-02	+7.3	-16.4	± 4.6	± 4.4	± 1.4	1.284E-02	5.990E-03
124.40	1.876E-02	+7.3	-16.3	± 4.6	± 4.4	± 1.4	1.282E-02	5.970E-03

124.50	1.878E-02	+7.2	-16.4	±4.6	±4.4	±1.4	1.281E-02	5.970E-03
124.60	1.875E-02	+7.3	-16.4	±4.6	±4.4	±1.4	1.278E-02	5.970E-03
124.70	1.875E-02	+7.3	-16.5	±4.6	±4.4	±1.4	1.278E-02	5.960E-03
124.80	1.871E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.276E-02	5.950E-03
124.90	1.870E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.277E-02	5.950E-03
125.00	1.869E-02	+7.3	-16.5	±4.6	±4.4	±1.4	1.273E-02	5.950E-03
125.09	1.866E-02	+7.3	-16.6	±4.6	±4.4	±1.4	1.272E-02	5.950E-03
125.10	1.866E-02	+7.3	-16.6	±4.6	±4.4	±1.4	1.272E-02	5.950E-03
125.20	1.866E-02	+7.3	-16.6	±4.6	±4.4	±1.4	1.274E-02	5.940E-03
125.30	1.864E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.270E-02	5.920E-03
125.40	1.862E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.269E-02	5.930E-03
125.50	1.862E-02	+7.2	-16.6	±4.6	±4.4	±1.4	1.268E-02	5.920E-03
125.60	1.857E-02	+7.2	-16.6	±4.6	±4.4	±1.4	1.266E-02	5.920E-03
125.70	1.855E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.266E-02	5.910E-03
125.80	1.856E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.264E-02	5.900E-03
125.90	1.854E-02	+7.2	-16.5	±4.6	±4.4	±1.4	1.265E-02	5.900E-03
126.00	1.852E-02	+7.2	-16.6	±4.7	±4.4	±1.4	1.262E-02	5.900E-03
126.50	1.844E-02	+7.2	-16.8	±4.7	±4.4	±1.4	1.256E-02	5.870E-03
127.00	1.836E-02	+7.2	-16.4	±4.7	±4.4	±1.4	1.249E-02	5.850E-03
127.50	1.828E-02	+7.1	-16.8	±4.7	±4.4	±1.4	1.245E-02	5.820E-03
128.00	1.820E-02	+7.1	-16.8	±4.7	±4.4	±1.4	1.242E-02	5.790E-03
128.50	1.813E-02	+7.1	-16.8	±4.7	±4.5	±1.4	1.236E-02	5.790E-03
129.00	1.804E-02	+7.1	-16.8	±4.7	±4.5	±1.4	1.230E-02	5.750E-03
129.50	1.796E-02	+7.1	-16.8	±4.7	±4.5	±1.4	1.226E-02	5.720E-03
130.00	1.787E-02	+7.1	-16.9	±4.7	±4.5	±1.4	1.219E-02	5.710E-03

s-ch (qq tHb)

- Cross sections are calculated at NLO QCD accuracy (no NLO EW correction) in 5FS.
- Program: MadGraph5_aMC@NLO
- QCD scales: $\mu=\mu_F=\mu_R=(M_{top}+M_H)/2$, uncertainty estimated in the range $1/2 < \mu/\{(M_{top}+M_H)/2\} < 2$ (with $1/2 < \mu_F/\mu_R < 2$ constraint).
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set:
 - ◆ PDF4LHC15_nlo_30_pdfas (5FS)

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ _s) %	±PDF %	± _s %	tH (pb)	tbarH (pb)
120.00	1.339E-03	+2.8	-2.4	±2.8	±2.8	±0.1	9.130E-04	4.260E-04
120.50	1.326E-03	+2.8	-2.4	±2.8	±2.8	±0.0	9.030E-04	4.220E-04
121.00	1.313E-03	+2.8	-2.3	±2.8	±2.8	±0.0	8.950E-04	4.180E-04
121.50	1.301E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.870E-04	4.130E-04
122.00	1.287E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.780E-04	4.090E-04
122.50	1.274E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.700E-04	4.050E-04
123.00	1.263E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.620E-04	4.010E-04
123.50	1.251E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.540E-04	3.970E-04
124.00	1.238E-03	+2.7	-2.3	±2.8	±2.8	±0.0	8.450E-04	3.930E-04
124.10	1.235E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.430E-04	3.920E-04
124.20	1.233E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.420E-04	3.910E-04
124.30	1.232E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.410E-04	3.900E-04
124.40	1.228E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.390E-04	3.900E-04
124.50	1.225E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.380E-04	3.880E-04

124.60	1.224E-03	+2.7	-2.4	±2.8	±2.8	±0.0	8.360E-04	3.880E-04
124.70	1.221E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.340E-04	3.870E-04
124.80	1.219E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.320E-04	3.860E-04
124.90	1.216E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.310E-04	3.850E-04
125.00	1.214E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.290E-04	3.850E-04
125.09	1.211E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.280E-04	3.840E-04
125.10	1.211E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.280E-04	3.840E-04
125.20	1.209E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.270E-04	3.830E-04
125.30	1.208E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.250E-04	3.830E-04
125.40	1.204E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.240E-04	3.810E-04
125.50	1.202E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.220E-04	3.810E-04
125.60	1.200E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.200E-04	3.800E-04
125.70	1.198E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.180E-04	3.790E-04
125.80	1.195E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.170E-04	3.790E-04
125.90	1.193E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.150E-04	3.780E-04
126.00	1.191E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.140E-04	3.770E-04
126.50	1.179E-03	+2.8	-2.4	±2.8	±2.8	±0.0	8.060E-04	3.730E-04
127.00	1.167E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.980E-04	3.700E-04
127.50	1.158E-03	+2.7	-2.3	±2.8	±2.8	±0.0	7.910E-04	3.660E-04
128.00	1.146E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.840E-04	3.630E-04
128.50	1.134E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.770E-04	3.590E-04
129.00	1.126E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.700E-04	3.560E-04
129.50	1.115E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.630E-04	3.520E-04
130.00	1.103E-03	+2.8	-2.4	±2.8	±2.8	±0.0	7.550E-04	3.480E-04

W-associated (gb tHW)

- Cross sections are calculated at NLO QCD accuracy (no NLO EW correction) in 5FS
 - ◆ With DR2 (Diagram Removal plus interference) described in [Demartin:2016axk]
 - ◆ $(tHW^-) = (tbarHW^+) = ((tHW^-) + (tbarHW^+))/2$
- Program: MadGraph5_aMC@NLO
- QCD scales: $\mu = \mu_F = \mu_R = (M_{top} + M_H + M_W)/2$, uncertainty estimated in the range $1/2 < \mu / \{(M_{top} + M_H + M_W)/2\} < 2$ (with $1/2 < \mu_F/\mu_R < 2$ constraint).
- PDF set:
 - ◆ PDF4LHC15_nlo_30_pdfas (5FS)

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+) %	±PDF %	± %
125.00	3.51E-03	+4.3	-5.7	±7.9	±7.6	±1.9

-- ReiTanaka - 2016-03-01

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