

Table of Contents

BSM Higgs production cross sections at $\sqrt{s} = 13$ TeV (update in CERN Report4 2016)	1
BSM Higgs-boson production cross section calculation.....	1
Mass range and step for BSM Higgs boson:.....	1
gluon-gluon Fusion Process.....	1
Point-like effective interaction.....	1
Quark-loop induced interaction.....	2
VBF Process.....	5
WH Process.....	8
ZH Process.....	10
ttH Process.....	12
bbH Process.....	12
tH Process (t-ch).....	15
tH Process (s-ch).....	16

BSM Higgs production cross sections at $\sqrt{s} = 13$ 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.

• BSM Higgs-boson production cross section calculation

- Please check Proposal on how to provide reference "Higgs" cross sections for BSM applications
- Full mass scan should be provided for major Higgs production processes:
 1. Major process: ggF, VBF, WH (also separate W⁺H and W⁻H), ZH (also gg ZH)
 2. Associated Higgs with heavy quark: ttH, bbH
 3. Associated Higgs with single top-quark: tH (bq tHq', bg WtH, qq btH)
- Higgs width should be set to zero (NWA).
- Separate electroweak correction should be provided.
- For relevant processes, and if possible, the contributions proportional to different Higgs couplings should be given separately, together with the corresponding uncertainties.
- All other external parameters should be chosen as in the corresponding best SM predictions as well as the evaluation of the uncertainties.
- SM width: At each mass point, the corresponding Higgs widths calculated in the SM with the same characteristics above should be provided.
- Examples on how to use these predictions in specific cases are provided.

Mass range and step for BSM Higgs boson:

Higgs Mass range	step size	# of points	addendum
[10,150] GeV	5 GeV	29 points	
[150,500] GeV	10 GeV	35 points	+ M _H =125.09 GeV
[500,3000] GeV	50 GeV	50 points	

- Total 115 points for M_H=[10,3000] GeV.
 - Lower mass limit might depend on stability of the code at low Bjorken-x. To be assessed.
-

gluon-gluon Fusion Process

Point-like effective interaction

- The cross section for a scalar particle S which couples to the SM via an effective point-like ggS operator is considered.
- The underlying interaction Lagrangian is

$$\mathcal{L}_{\text{eff}} = -\frac{C}{4v} S G_{\mu\nu}^a G_a^{\mu\nu}$$
 where C is a Wilson coefficient chosen in such a way that this interaction is identical to the one of the SM Higgs-gluon interaction in the heavy-top limit.
- The numbers include N³LO QCD corrections, but no additional mass or electro-weak effects.
- QCD scales: $\mu=\mu_F=\mu_R=M_S/2$ varied in the range of $[M_S/4, M_S]$.
- 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.
- PDF set: PDF4LHC15_nnlo_100

Quark-loop induced interaction.

- The cross section for a scalar particle which couples to gluons via a top- and a bottom-loop in the same way as the SM Higgs is considered.
- Top- and bottom-quark mass effects are included up to NLO. Higher orders adopt the heavy-top limit (even for $m_H \gg 2m_t$).
- The numbers include NNLO+NNLL QCD corrections.
- For $m_H=[100,2500]$ GeV, the NLO EW correction factor $1+_{EW}$ is given in a separate column.
- The calculations are the same as in CERN Report 3 (i.e. top, bottom and charm quark effects are taken into account), except that the NWA (CPS in CERN Report 3) has been adopted.
- 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_S or m_H (GeV)	Point-like effective					Quark-loop induced				
	Cross Section (pb)	+Theory %	-Theory %	TH Gaussian %	±(PDF+ _s) %	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ _s) %	±(PU)
10.00	1.900E+03	+17.8	-21.3	±12.3	±12.2	6.996E+03	+49.9	-38.9	±8.0	±7.5
15.00	1.203E+03	+11.6	-15.0	±8.7	±6.7	4.275E+03	+34.8	-29.2	±5.9	±5.1
20.00	8.458E+02	+8.8	-11.8	±6.8	±5.4	2.085E+03	+25.7	-22.5	±4.8	±3.7
25.00	6.322E+02	+7.1	-10.0	±5.8	±4.9	1.146E+03	+20.8	-18.2	±4.3	±3.1
30.00	4.923E+02	+6.1	-8.8	±5.1	±4.6	7.103E+02	+18.5	-15.6	±4.2	±2.8
35.00	3.949E+02	+5.5	-7.8	±4.5	±4.3	4.846E+02	+16.3	-13.9	±4.0	±2.6
40.00	3.240E+02	+4.8	-7.3	±4.2	±4.2	3.555E+02	+14.8	-12.9	±3.9	±2.4
45.00	2.706E+02	+4.3	-6.7	±3.9	±4.0	2.751E+02	+13.5	-12.1	±3.8	±2.3
50.00	2.294E+02	+3.7	-6.0	±3.5	±4.0	2.214E+02	+12.5	-11.6	±3.7	±2.2
55.00	1.968E+02	+3.5	-5.7	±3.3	±3.8	1.835E+02	+11.7	-11.1	±3.7	±2.2
60.00	1.706E+02	+3.2	-5.4	±3.1	±3.7	1.555E+02	+11.1	-10.7	±3.6	±2.1
65.00	1.492E+02	+3.1	-5.2	±3.0	±3.7	1.341E+02	+10.5	-10.3	±3.5	±2.1
70.00	1.315E+02	+2.8	-4.9	±2.8	±3.6	1.172E+02	+10.1	-10.0	±3.5	±2.0
75.00	1.166E+02	+2.6	-4.7	±2.7	±3.6	1.036E+02	+9.7	-9.7	±3.4	±2.0
80.00	1.041E+02	+2.5	-4.7	±2.7	±3.5	9.240E+01	+9.4	-9.5	±3.4	±2.0
85.00	9.340E+01	+2.4	-4.5	±2.6	±3.5	8.302E+01	+9.1	-9.3	±3.3	±1.9
90.00	8.420E+01	+2.3	-4.3	±2.5	±3.4	7.507E+01	+8.8	-9.1	±3.3	±1.9
95.00	7.630E+01	+2.2	-4.1	±2.4	±3.4	6.825E+01	+8.6	-8.9	±3.3	±1.9
100.00	6.930E+01	+2.0	-4.0	±2.3	±3.4	6.235E+01	+8.4	-8.8	±3.2	±1.9
105.00	6.320E+01	+2.0	-3.9	±2.3	±3.3	5.720E+01	+8.2	-8.6	±3.2	±1.9
110.00	5.790E+01	+1.9	-3.9	±2.3	±3.3	5.268E+01	+8.0	-8.5	±3.2	±1.9
115.00	5.310E+01	+1.8	-3.8	±2.2	±3.3	4.869E+01	+7.9	-8.3	±3.1	±1.8
120.00	4.890E+01	+1.8	-3.7	±2.1	±3.2	4.514E+01	+7.7	-8.2	±3.1	±1.8
125.00	4.520E+01	+1.7	-3.7	±2.1	±3.2	4.198E+01	+7.6	-8.1	±3.1	±1.8
130.00	4.180E+01	+1.7	-3.6	±2.1	±3.2	3.914E+01	+7.5	-8.0	±3.1	±1.8
135.00	3.880E+01	+1.6	-3.5	±2.0	±3.2	3.659E+01	+7.4	-7.9	±3.1	±1.8
140.00	3.600E+01	+1.6	-3.5	±2.0	±3.2	3.428E+01	+7.2	-7.8	±3.0	±1.8
145.00	3.350E+01	+1.5	-3.5	±2.0	±3.2	3.219E+01	+7.1	-7.7	±3.0	±1.8
150.00	3.129E+01	+1.5	-3.4	±2.0	±3.1	3.029E+01	+7.0	-7.6	±3.0	±1.8

160.00	2.737E+01	+1.5	-3.3	± 1.9	± 3.1	2.697E+01	+6.9	-7.5	± 3.0	± 1.8
170.00	2.409E+01	+1.4	-3.2	± 1.8	± 3.1	2.419E+01	+6.7	-7.4	± 3.0	± 1.8
180.00	2.132E+01	+1.3	-3.2	± 1.8	± 3.1	2.184E+01	+6.5	-7.2	± 2.9	± 1.8
190.00	1.896E+01	+1.3	-3.1	± 1.8	± 3.0	1.984E+01	+6.4	-7.1	± 2.9	± 1.7
200.00	1.694E+01	+1.3	-3.2	± 1.8	± 3.0	1.812E+01	+6.3	-7.0	± 2.9	± 1.7
210.00	1.520E+01	+1.4	-3.2	± 1.8	± 3.0	1.665E+01	+6.2	-6.9	± 2.9	± 1.7
220.00	1.369E+01	+1.4	-3.2	± 1.8	± 3.0	1.537E+01	+6.1	-6.8	± 2.9	± 1.7
230.00	1.237E+01	+1.4	-3.2	± 1.8	± 3.0	1.426E+01	+6.0	-6.7	± 2.9	± 1.7
240.00	1.122E+01	+1.4	-3.2	± 1.8	± 3.0	1.331E+01	+5.9	-6.6	± 2.9	± 1.7
250.00	1.020E+01	+1.4	-3.2	± 1.8	± 3.0	1.248E+01	+5.9	-6.5	± 2.9	± 1.8
260.00	9.300E+00	+1.4	-3.2	± 1.8	± 3.0	1.176E+01	+5.8	-6.5	± 2.9	± 1.8
270.00	8.510E+00	+1.4	-3.2	± 1.8	± 3.0	1.114E+01	+5.8	-6.4	± 2.9	± 1.8
280.00	7.800E+00	+1.4	-3.2	± 1.8	± 3.0	1.062E+01	+5.8	-6.3	± 2.9	± 1.8
290.00	7.160E+00	+1.5	-3.2	± 1.8	± 3.0	1.018E+01	+5.8	-6.3	± 2.9	± 1.8
300.00	6.590E+00	+1.5	-3.2	± 1.8	± 3.0	9.823E+00	+5.8	-6.2	± 2.9	± 1.8
310.00	6.080E+00	+1.5	-3.3	± 1.9	± 3.0	9.559E+00	+5.7	-6.1	± 2.9	± 1.8
320.00	5.620E+00	+1.5	-3.2	± 1.8	± 3.0	9.392E+00	+5.7	-6.1	± 2.9	± 1.8
330.00	5.200E+00	+1.5	-3.3	± 1.9	± 3.0	9.349E+00	+5.7	-6.0	± 2.9	± 1.8
340.00	4.820E+00	+1.5	-3.3	± 1.9	± 3.0	9.521E+00	+5.7	-5.9	± 2.9	± 1.8
350.00	4.480E+00	+1.5	-3.3	± 1.9	± 3.0	1.025E+01	+5.7	-5.8	± 2.9	± 1.8
360.00	4.160E+00	+1.5	-3.3	± 1.9	± 3.0	1.063E+01	+5.7	-5.8	± 2.9	± 1.9
370.00	3.880E+00	+1.6	-3.3	± 1.9	± 3.0	1.064E+01	+5.7	-5.7	± 2.9	± 1.9
380.00	3.620E+00	+1.6	-3.3	± 1.9	± 3.0	1.040E+01	+5.7	-5.7	± 2.9	± 1.9
390.00	3.380E+00	+1.6	-3.3	± 1.9	± 3.1	1.000E+01	+5.7	-5.6	± 2.9	± 1.9
400.00	3.160E+00	+1.6	-3.3	± 1.9	± 3.1	9.516E+00	+5.7	-5.5	± 2.9	± 1.9
410.00	2.960E+00	+1.6	-3.4	± 2.0	± 3.1	8.976E+00	+5.7	-5.5	± 3.0	± 2.0
420.00	2.770E+00	+1.6	-3.4	± 2.0	± 3.1	8.415E+00	+5.7	-5.4	± 3.0	± 2.0
430.00	2.600E+00	+1.6	-3.4	± 2.0	± 3.1	7.853E+00	+5.7	-5.4	± 3.0	± 2.0
440.00	2.440E+00	+1.7	-3.4	± 2.0	± 3.1	7.301E+00	+5.7	-5.3	± 3.0	± 2.0
450.00	2.300E+00	+1.6	-3.4	± 2.0	± 3.1	6.771E+00	+5.7	-5.3	± 3.0	± 2.0
460.00	2.160E+00	+1.7	-3.4	± 2.0	± 3.2	6.266E+00	+5.6	-5.2	± 3.0	± 2.1
470.00	2.030E+00	+1.7	-3.4	± 2.0	± 3.2	5.788E+00	+5.6	-5.2	± 3.1	± 2.1
480.00	1.920E+00	+1.7	-3.4	± 2.0	± 3.2	5.341E+00	+5.6	-5.2	± 3.1	± 2.1
490.00	1.810E+00	+1.7	-3.4	± 2.0	± 3.2	4.924E+00	+5.6	-5.1	± 3.1	± 2.1
500.00	1.709E+00	+1.7	-3.5	± 2.0	± 3.3	4.538E+00	+5.6	-5.1	± 3.1	± 2.2
550.00	1.297E+00	+1.8	-3.5	± 2.0	± 3.4	3.008E+00	+5.5	-5.0	± 3.2	± 2.3
600.00	1.001E+00	+1.8	-3.6	± 2.1	± 3.5	2.006E+00	+5.5	-4.9	± 3.4	± 2.5
650.00	7.834E-01	+1.9	-3.6	± 2.1	± 3.7	1.352E+00	+5.5	-4.9	± 3.5	± 2.6
700.00	6.206E-01	+1.9	-3.7	± 2.1	± 3.8	9.235E-01	+5.4	-4.8	± 3.7	± 2.8
750.00	4.969E-01	+2.0	-3.7	± 2.1	± 4.0	6.398E-01	+5.4	-4.8	± 3.9	± 3.0
800.00	4.015E-01	+2.0	-3.8	± 2.2	± 4.2	4.491E-01	+5.5	-4.7	± 4.0	± 3.2
850.00	3.271E-01	+2.1	-3.8	± 2.2	± 4.4	3.195E-01	+5.5	-4.7	± 4.2	± 3.4
900.00	2.685E-01	+2.1	-3.8	± 2.2	± 4.6	2.301E-01	+5.5	-4.8	± 4.4	± 3.6
950.00	2.219E-01	+2.2	-3.9	± 2.3	± 4.8	1.675E-01	+5.5	-4.8	± 4.6	± 3.8
1000.00	1.845E-01	+2.2	-4.0	± 2.3	± 5.0	1.233E-01	+5.5	-4.8	± 4.8	± 4.0
1050.00	1.542E-01	+2.2	-4.0	± 2.3	± 5.2	9.159E-02	+5.5	-4.8	± 5.0	± 4.2
1100.00	1.295E-01	+2.3	-4.0	± 2.3	± 5.4	6.868E-02	+5.5	-4.8	± 5.2	± 4.4
1150.00	1.093E-01	+2.3	-4.1	± 2.4	± 5.6	5.193E-02	+5.6	-4.9	± 5.4	± 4.7
1200.00	9.260E-02	+2.3	-4.1	± 2.4	± 5.9	3.958E-02	+5.6	-4.9	± 5.6	± 4.9
1250.00	7.880E-02	+2.3	-4.1	± 2.4	± 6.1	3.040E-02	+5.6	-4.9	± 5.9	± 5.1

1300.00	6.730E-02	+2.4	-4.2	±2.4	±6.3	2.349E-02	+5.6	-4.9	±6.1	±5.3
1350.00	5.760E-02	+2.3	-4.2	±2.4	±6.6	1.828E-02	+5.6	-5.0	±6.3	±5.6
1400.00	4.950E-02	+2.4	-4.2	±2.4	±6.8	1.431E-02	+5.7	-5.0	±6.5	±5.8
1450.00	4.270E-02	+2.4	-4.2	±2.4	±7.0	1.126E-02	+5.8	-5.0	±6.8	±6.0
1500.00	3.690E-02	+2.4	-4.3	±2.5	±7.3	8.913E-03	+5.9	-5.1	±7.0	±6.3
1550.00	3.190E-02	+2.5	-4.3	±2.5	±7.6	7.089E-03	+6.1	-5.1	±7.3	±6.5
1600.00	2.770E-02	+2.5	-4.3	±2.5	±7.8	5.666E-03	+6.3	-5.1	±7.5	±6.7
1650.00	2.410E-02	+2.5	-4.4	±2.5	±8.1	4.546E-03	+6.5	-5.2	±7.7	±7.0
1700.00	2.100E-02	+2.5	-4.5	±2.6	±8.5	3.662E-03	+6.8	-5.2	±8.0	±7.2
1750.00	1.838E-02	+3.2	-4.4	±2.5	±8.7	2.965E-03	+9.4	-3.5	±7.5	±7.2
1800.00	1.609E-02	+2.5	-4.4	±2.5	±8.9	2.408E-03	+9.1	-3.9	±7.9	±7.6
1850.00	1.411E-02	+2.6	-4.4	±2.5	±9.1	1.963E-03	+8.8	-4.2	±8.2	±7.9
1900.00	1.239E-02	+2.5	-4.4	±2.5	±9.4	1.606E-03	+8.6	-4.5	±8.6	±8.2
1950.00	1.090E-02	+2.6	-4.5	±2.6	±9.7	1.317E-03	+8.4	-4.7	±9.0	±8.4
2000.00	9.600E-03	+2.6	-4.5	±2.6	±9.7	1.084E-03	+8.3	-4.9	±9.4	±8.7
2050.00	8.470E-03	+2.5	-4.5	±2.6	±10.0	8.953E-04	+8.2	-5.1	±9.7	±9.0
2100.00	7.480E-03	+2.6	-4.5	±2.6	±10.5	7.415E-04	+8.1	-5.3	±10.0	±9.3
2150.00	6.620E-03	+2.6	-4.5	±2.6	±10.8	6.144E-04	+8.1	-5.5	±10.4	±9.6
2200.00	5.860E-03	+2.7	-4.6	±2.7	±11.2	5.108E-04	+8.1	-5.6	±10.7	±9.9
2250.00	5.190E-03	+2.6	-4.6	±2.7	±11.8	4.267E-04	+8.1	-5.7	±11.0	±10.1
2300.00	4.610E-03	+2.6	-4.5	±2.6	±12.0	3.569E-04	+8.1	-5.8	±11.3	±10.4
2350.00	4.090E-03	+2.6	-4.5	±2.6	±12.1	2.988E-04	+8.2	-5.9	±11.6	±10.7
2400.00	3.640E-03	+2.6	-4.5	±2.6	±12.4	2.509E-04	+8.3	-6.0	±11.9	±11.0
2450.00	3.240E-03	+2.5	-4.5	±2.6	±12.7	2.110E-04	+8.3	-6.0	±12.2	±11.3
2500.00	2.890E-03	+2.6	-4.5	±2.6	±13.1	1.778E-04	+8.4	-6.1	±12.5	±11.6
2550.00	2.570E-03	+2.5	-4.5	±2.6	±13.4	1.499E-04	+8.5	-6.2	±12.8	±11.9
2600.00	2.300E-03	+2.5	-4.5	±2.6	±13.7	1.272E-04	+8.6	-6.2	±13.1	±12.2
2650.00	2.050E-03	+2.6	-4.6	±2.7	±14.1	1.077E-04	+8.7	-6.3	±13.4	±12.5
2700.00	1.830E-03	+2.7	-4.7	±2.7	±14.5	9.121E-05	+8.7	-6.3	±13.7	±12.8
2750.00	1.640E-03	+2.8	-4.8	±2.8	±14.8	7.771E-05	+8.8	-6.4	±14.0	±13.1
2800.00	1.460E-03	+2.9	-4.9	±2.8	±15.2	6.611E-05	+8.9	-6.5	±14.4	±13.5
2850.00	1.310E-03	+3.0	-5.0	±2.9	±15.6	5.636E-05	+8.9	-6.6	±14.7	±13.8
2900.00	1.170E-03	+3.1	-5.2	±3.0	±15.9	4.809E-05	+8.9	-6.7	±15.1	±14.2
2950.00	1.050E-03	+3.2	-5.3	±3.1	±16.3	4.112E-05	+8.9	-6.8	±15.5	±14.6
3000.00	9.400E-04	+3.4	-5.5	±3.2	±16.7	3.502E-05	+8.9	-6.9	±15.9	±15.0
3050.00	8.470E-04	+3.4	-5.5		±17.3					
3100.00	7.600E-04	+3.5	-5.6		±17.7					
3150.00	6.820E-04	+3.6	-5.7		±18.1					
3200.00	6.130E-04	+3.7	-5.9		±18.5					
3250.00	5.510E-04	+3.9	-6.0		±19.0					
3300.00	4.950E-04	+4.0	-6.2		±19.4					
3350.00	4.450E-04	+4.1	-6.3		±19.9					
3400.00	4.000E-04	+4.3	-6.4		±20.4					
3450.00	3.600E-04	+4.4	-6.6		±20.9					
3500.00	3.240E-04	+4.5	-6.8		±21.4					
3550.00	2.920E-04	+4.7	-6.9		±21.9					
3600.00	2.630E-04	+4.8	-7.1		±22.4					
3650.00	2.370E-04	+5.0	-7.2		±22.9					
3700.00	2.130E-04	+5.1	-7.4		±23.4					
3750.00	1.920E-04	+5.3	-7.6		±24.0					

3800.00	1.730E-04	+5.5	-7.8		±24.5					
3850.00	1.560E-04	+5.6	-7.9		±25.1					
3900.00	1.410E-04	+5.8	-8.1		±25.7					
3950.00	1.270E-04	+6.0	-8.3		±26.3					
4000.00	1.140E-04	+6.1	-8.5		±26.9					
4050.00	1.030E-04	+6.3	-8.7		±27.5					
4100.00	9.300E-05	+6.5	-8.9		±28.1					
4150.00	8.400E-05	+6.7	-9.1		±28.7					
4200.00	7.600E-05	+6.9	-9.3		±29.4					
4250.00	6.800E-05	+7.1	-9.5		±30.0					
4300.00	6.100E-05	+7.3	-9.7		±30.7					
4350.00	5.500E-05	+7.5	-10.0		±31.4					
4400.00	5.000E-05	+7.7	-10.2		±32.1					
4450.00	4.500E-05	+7.9	-10.4		±32.8					
4500.00	4.100E-05	+8.1	-10.7		±33.5					
4550.00	3.700E-05	+8.3	-10.9		±34.2					
4600.00	3.300E-05	+8.5	-11.2		±35.0					
4650.00	3.000E-05	+8.8	-11.4		±35.7					
4700.00	2.700E-05	+9.0	-11.7		±36.5					
4750.00	2.400E-05	+9.2	-11.9		±37.3					
4800.00	2.200E-05	+9.5	-12.2		±38.1					
4850.00	2.000E-05	+9.7	-12.5		±38.9					
4900.00	1.800E-05	+10.0	-12.7		±39.8					
4950.00	1.600E-05	+10.2	-13.0		±40.6					
5000.00	1.400E-05	+10.5	-13.3		±41.5					

VBF Process

- Cross sections are calculated at (approx.) NNLO QCD accuracy.
- Calculations are the same as CERN Report 3, except it is in NWA (CPS in CERN Report 3).
- Program: NNLO QCD (VBF@NNLO)
- QCD scales: $\mu = \mu_F = \mu_R = M_W$, uncertainty estimated in the range $1/2 < \mu/M_W < 2$ (scales have been varied independently by factor 2).
 - ◆ No additional THU nor PU uncertainties assigned.
- PDF set: PDF4LHC15_nnlo_30_pdfas

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ _s) %	±PDF %	± _s %	1+ EW
10.00	1.121E+01	+1.0	-0.7	±2.0	±1.8	±0.9	
15.00	1.074E+01	+1.0	-0.6	±2.0	±1.8	±0.8	
20.00	1.025E+01	+0.9	-0.6	±2.0	±1.8	±0.8	
25.00	9.769E+00	+0.8	-0.6	±2.0	±1.8	±0.8	
30.00	9.299E+00	+0.9	-0.5	±2.0	±1.8	±0.8	
35.00	8.847E+00	+0.8	-0.5	±1.9	±1.8	±0.8	
40.00	8.419E+00	+0.8	-0.5	±1.9	±1.8	±0.7	
45.00	8.011E+00	+0.8	-0.4	±1.9	±1.8	±0.7	
50.00	7.627E+00	+0.8	-0.4	±1.9	±1.8	±0.7	
55.00	7.264E+00	+0.7	-0.4	±1.9	±1.8	±0.7	
60.00	6.924E+00	+0.7	-0.4	±1.9	±1.8	±0.7	
65.00	6.603E+00	+0.7	-0.4	±1.9	±1.8	±0.7	
70.00	6.301E+00	+0.7	-0.4	±1.9	±1.8	±0.7	
75.00	6.016E+00	+0.6	-0.3	±1.9	±1.8	±0.7	

80.00	5.748E+00	+0.6	-0.3	±1.9	±1.8	±0.6	
85.00	5.496E+00	+0.6	-0.3	±1.9	±1.8	±0.6	
90.00	5.258E+00	+0.6	-0.3	±1.9	±1.8	±0.6	
95.00	5.034E+00	+0.6	-0.3	±1.9	±1.8	±0.6	
100.00	4.822E+00	+0.5	-0.3	±1.9	±1.8	±0.6	
105.00	4.623E+00	+0.5	-0.3	±1.9	±1.8	±0.6	
110.00	4.434E+00	+0.5	-0.2	±1.9	±1.8	±0.6	
115.00	4.255E+00	+0.5	-0.2	±1.9	±1.8	±0.6	
120.00	4.086E+00	+0.5	-0.2	±1.9	±1.8	±0.6	
125.00	3.925E+00	+0.5	-0.2	±1.9	±1.8	±0.6	
130.00	3.773E+00	+0.4	-0.2	±1.9	±1.8	±0.6	
135.00	3.629E+00	+0.4	-0.2	±1.9	±1.8	±0.6	
140.00	3.492E+00	+0.4	-0.2	±1.9	±1.8	±0.5	
145.00	3.362E+00	+0.4	-0.2	±1.9	±1.8	±0.5	
150.00	3.239E+00	+0.4	-0.2	±1.9	±1.8	±0.5	
160.00	3.010E+00	+0.4	-0.2	±1.9	±1.8	±0.5	
170.00	2.802E+00	+0.4	-0.2	±1.9	±1.8	±0.5	
180.00	2.612E+00	+0.3	-0.2	±1.9	±1.8	±0.5	
190.00	2.440E+00	+0.3	-0.2	±1.9	±1.8	±0.5	
200.00	2.282E+00	+0.3	-0.2	±1.9	±1.8	±0.5	
210.00	2.138E+00	+0.3	-0.2	±1.9	±1.8	±0.5	
220.00	2.006E+00	+0.3	-0.2	±1.9	±1.8	±0.5	
230.00	1.884E+00	+0.3	-0.1	±1.9	±1.8	±0.4	
240.00	1.772E+00	+0.3	-0.1	±1.9	±1.8	±0.4	
250.00	1.669E+00	+0.3	-0.1	±1.9	±1.8	±0.4	
260.00	1.573E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
270.00	1.485E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
280.00	1.403E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
290.00	1.326E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
300.00	1.256E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
310.00	1.190E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
320.00	1.128E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
330.00	1.071E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
340.00	1.017E+00	+0.3	-0.1	±1.9	±1.9	±0.4	
350.00	9.666E-01	+0.3	-0.1	±1.9	±1.9	±0.3	
360.00	9.194E-01	+0.3	-0.1	±1.9	±1.9	±0.3	
370.00	8.752E-01	+0.3	-0.1	±2.0	±1.9	±0.3	
380.00	8.337E-01	+0.3	-0.1	±2.0	±1.9	±0.3	
390.00	7.947E-01	+0.3	-0.1	±2.0	±1.9	±0.3	
400.00	7.580E-01	+0.3	-0.1	±2.0	±1.9	±0.3	
410.00	7.235E-01	+0.3	-0.0	±2.0	±2.0	±0.3	
420.00	6.909E-01	+0.3	-0.0	±2.0	±2.0	±0.3	
430.00	6.602E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
440.00	6.312E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
450.00	6.038E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
460.00	5.778E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
470.00	5.533E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
480.00	5.301E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
490.00	5.081E-01	+0.3	-0.1	±2.0	±2.0	±0.3	
500.00	4.872E-01	+0.3	-0.1	±2.0	±2.0	±0.2	

550.00	3.975E-01	+0.3	-0.2	±2.1	±2.1	±0.2	
600.00	3.274E-01	+0.3	-0.3	±2.1	±2.1	±0.2	
650.00	2.719E-01	+0.3	-0.3	±2.1	±2.1	±0.2	
700.00	2.275E-01	+0.3	-0.4	±2.2	±2.2	±0.1	
750.00	1.915E-01	+0.3	-0.4	±2.2	±2.2	±0.1	
800.00	1.622E-01	+0.3	-0.5	±2.3	±2.3	±0.1	
850.00	1.380E-01	+0.3	-0.5	±2.3	±2.3	±0.1	
900.00	1.180E-01	+0.3	-0.6	±2.4	±2.4	±0.1	
950.00	1.013E-01	+0.3	-0.6	±2.4	±2.4	±0.0	
1000.00	8.732E-02	+0.3	-0.7	±2.5	±2.5	±0.0	
1050.00	7.551E-02	+0.3	-0.7	±2.5	±2.5	±0.0	
1100.00	6.550E-02	+0.3	-0.8	±2.6	±2.6	±0.0	
1150.00	5.698E-02	+0.3	-0.8	±2.6	±2.6	±0.0	
1200.00	4.970E-02	+0.3	-0.9	±2.7	±2.7	±0.0	
1250.00	4.345E-02	+0.3	-0.9	±2.7	±2.7	±0.1	
1300.00	3.807E-02	+0.3	-0.9	±2.8	±2.8	±0.1	
1350.00	3.343E-02	+0.4	-1.0	±2.8	±2.8	±0.1	
1400.00	2.941E-02	+0.4	-1.0	±2.9	±2.9	±0.1	
1450.00	2.592E-02	+0.4	-1.1	±2.9	±2.9	±0.1	
1500.00	2.288E-02	+0.4	-1.1	±3.0	±3.0	±0.1	
1550.00	2.023E-02	+0.5	-1.2	±3.0	±3.0	±0.1	
1600.00	1.791E-02	+0.5	-1.2	±3.1	±3.1	±0.1	
1650.00	1.588E-02	+0.5	-1.3	±3.2	±3.2	±0.1	
1700.00	1.410E-02	+0.5	-1.3	±3.2	±3.2	±0.2	
1750.00	1.253E-02	+0.6	-1.4	±3.3	±3.3	±0.2	
1800.00	1.115E-02	+0.6	-1.4	±3.4	±3.3	±0.2	
1850.00	9.926E-03	+0.6	-1.5	±3.4	±3.4	±0.2	
1900.00	8.849E-03	+0.6	-1.5	±3.5	±3.5	±0.2	
1950.00	7.896E-03	+0.7	-1.6	±3.6	±3.6	±0.2	
2000.00	7.052E-03	+0.7	-1.6	±3.6	±3.6	±0.2	
2050.00	6.303E-03	+0.7	-1.7	±3.7	±3.7	±0.2	
2100.00	5.638E-03	+0.7	-1.7	±3.8	±3.8	±0.2	
2150.00	5.046E-03	+0.7	-1.8	±3.9	±3.9	±0.2	
2200.00	4.520E-03	+0.8	-1.8	±3.9	±3.9	±0.2	
2250.00	4.051E-03	+0.8	-1.9	±4.0	±4.0	±0.2	
2300.00	3.633E-03	+0.8	-1.9	±4.1	±4.1	±0.2	
2350.00	3.259E-03	+0.9	-2.0	±4.2	±4.2	±0.2	
2400.00	2.925E-03	+0.9	-2.0	±4.3	±4.3	±0.2	
2450.00	2.627E-03	+0.9	-2.1	±4.4	±4.4	±0.2	
2500.00	2.360E-03	+1.0	-2.1	±4.5	±4.5	±0.2	
2550.00	2.122E-03	+1.0	-2.2	±4.6	±4.6	±0.2	
2600.00	1.908E-03	+1.0	-2.2	±4.7	±4.7	±0.2	
2650.00	1.717E-03	+1.0	-2.3	±4.8	±4.8	±0.2	
2700.00	1.545E-03	+1.1	-2.3	±4.9	±4.9	±0.2	
2750.00	1.391E-03	+1.1	-2.4	±5.0	±5.0	±0.2	
2800.00	1.252E-03	+1.1	-2.4	±5.1	±5.1	±0.2	
2850.00	1.128E-03	+1.1	-2.5	±5.3	±5.3	±0.2	
2900.00	1.016E-03	+1.2	-2.5	±5.4	±5.4	±0.2	
2950.00	9.156E-04	+1.2	-2.6	±5.5	±5.5	±0.2	
3000.00	8.253E-04	+1.2	-2.7	±5.7	±5.7	±0.2	

WH Process

- Cross sections are calculated at NNLO QCD accuracy.
 - ◆ Calculations are the same as CERN Report 3.
- Program: NNLO QCD (VH@NNLO)
- QCD scales: $\mu = \mu_F = \mu_R = M_{VH} = (p_V + p_H)^2$ for QCD 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)
- Photon-induced contribution of O(5%)
 - ◆ NOT included for total cross section (agrees with CERN Report 3 numbers within 1%).

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	\pm (PDF+ %)	\pm PDF %	\pm %	EW	W+H (pb)	W-H (pb)
10.00	2.392E+02	+1.1	-2.0	± 2.2				1.390E+02	1.002E+02
15.00	1.487E+02	+0.7	-2.0	± 2.2				8.671E+01	6.201E+01
20.00	9.931E+01	+1.2	-1.5	± 2.2				5.801E+01	4.130E+01
25.00	7.006E+01	+1.0	-1.7	± 2.1				4.109E+01	2.897E+01
30.00	5.108E+01	+0.8	-1.6	± 2.1				3.000E+01	2.108E+01
35.00	3.822E+01	+0.7	-1.4	± 2.1				2.250E+01	1.572E+01
40.00	2.925E+01	+0.6	-1.3	± 2.0				1.730E+01	1.195E+01
45.00	2.278E+01	+0.5	-1.3	± 2.0				1.350E+01	9.282E+00
50.00	1.800E+01	+0.7	-1.2	± 1.9				1.069E+01	7.311E+00
55.00	1.443E+01	+0.7	-1.2	± 1.9				8.581E+00	5.848E+00
60.00	1.170E+01	+0.6	-1.2	± 1.9				6.971E+00	4.727E+00
65.00	9.577E+00	+0.5	-1.0	± 1.9				5.725E+00	3.852E+00
70.00	7.920E+00	+0.3	-1.0	± 1.9				4.745E+00	3.175E+00
75.00	6.591E+00	+0.4	-0.9	± 1.9				3.955E+00	2.636E+00
80.00	5.538E+00	+0.3	-0.9	± 1.9				3.331E+00	2.207E+00
85.00	4.675E+00	+0.5	-0.8	± 1.8				2.816E+00	1.859E+00
90.00	3.977E+00	+0.5	-0.7	± 1.8				2.402E+00	1.575E+00
95.00	3.401E+00	+0.4	-0.7	± 1.8				2.058E+00	1.343E+00
100.00	2.926E+00	+0.4	-0.8	± 1.8				1.775E+00	1.151E+00
105.00	2.531E+00	+0.3	-0.8	± 1.8				1.538E+00	9.934E-01
110.00	2.194E+00	+0.5	-0.5	± 1.8				1.335E+00	8.587E-01
115.00	1.917E+00	+0.3	-0.7	± 1.8				1.169E+00	7.478E-01
120.00	1.679E+00	+0.5	-0.6	± 1.8				1.026E+00	6.525E-01
125.00	1.475E+00	+0.5	-0.7	± 1.9				9.034E-01	5.720E-01
130.00	1.303E+00	+0.4	-0.7	± 1.8				7.995E-01	5.033E-01
135.00	1.153E+00	+0.5	-0.8	± 1.8				7.087E-01	4.447E-01
140.00	1.025E+00	+0.5	-0.8	± 1.9				6.308E-01	3.940E-01
145.00	9.128E-01	+0.5	-0.8	± 1.9				5.630E-01	3.498E-01
150.00	8.154E-01	+0.5	-0.8	± 1.9				5.037E-01	3.117E-01
160.00	6.562E-01	+0.6	-0.8	± 1.9				4.068E-01	2.494E-01
170.00	5.339E-01	+0.7	-0.9	± 1.9				3.321E-01	2.018E-01
180.00	4.380E-01	+0.7	-0.8	± 1.9				2.734E-01	1.646E-01
190.00	3.625E-01	+0.7	-0.9	± 1.9				2.270E-01	1.355E-01
200.00	3.023E-01	+0.7	-0.8	± 1.9				1.899E-01	1.124E-01
210.00	2.538E-01	+0.7	-0.9	± 2.0				1.600E-01	9.383E-02
220.00	2.144E-01	+0.8	-0.9	± 2.0				1.355E-01	7.893E-02
230.00	1.824E-01	+0.8	-1.0	± 2.0				1.156E-01	6.678E-02
240.00	1.559E-01	+0.9	-1.0	± 2.0				9.916E-02	5.675E-02

250.00	1.340E-01	+0.9	-0.9	± 2.0				8.547E-02	4.853E-02
260.00	1.158E-01	+0.9	-1.0	± 2.0				7.404E-02	4.172E-02
270.00	1.004E-01	+0.9	-1.0	± 2.0				6.442E-02	3.602E-02
280.00	8.750E-02	+1.0	-1.0	± 2.1				5.626E-02	3.124E-02
290.00	7.656E-02	+1.0	-1.0	± 2.1				4.937E-02	2.719E-02
300.00	6.724E-02	+1.0	-1.0	± 2.2				4.348E-02	2.376E-02
310.00	5.925E-02	+1.0	-1.1	± 2.2				3.841E-02	2.084E-02
320.00	5.238E-02	+1.1	-1.0	± 2.2				3.404E-02	1.834E-02
330.00	4.645E-02	+1.1	-1.0	± 2.3				3.026E-02	1.619E-02
340.00	4.133E-02	+1.1	-1.0	± 2.3				2.699E-02	1.434E-02
350.00	3.686E-02	+1.2	-1.0	± 2.4				2.413E-02	1.273E-02
360.00	3.298E-02	+1.2	-1.0	± 2.4				2.164E-02	1.134E-02
370.00	2.958E-02	+1.2	-1.1	± 2.4				1.946E-02	1.012E-02
380.00	2.659E-02	+1.1	-1.1	± 2.5				1.753E-02	9.061E-03
390.00	2.395E-02	+1.2	-1.1	± 2.5				1.582E-02	8.128E-03
400.00	2.163E-02	+1.2	-1.1	± 2.5				1.432E-02	7.309E-03
410.00	1.957E-02	+1.2	-1.2	± 2.6				1.299E-02	6.581E-03
420.00	1.774E-02	+1.3	-1.3	± 2.6				1.180E-02	5.944E-03
430.00	1.612E-02	+1.3	-1.2	± 2.6				1.074E-02	5.378E-03
440.00	1.467E-02	+1.3	-1.3	± 2.6				9.800E-03	4.872E-03
450.00	1.337E-02	+1.3	-1.2	± 2.6				8.945E-03	4.424E-03
460.00	1.221E-02	+1.3	-1.3	± 2.6				8.186E-03	4.023E-03
470.00	1.117E-02	+1.3	-1.3	± 2.6				7.502E-03	3.664E-03
480.00	1.023E-02	+1.4	-1.4	± 2.6				6.885E-03	3.342E-03
490.00	9.381E-03	+1.4	-1.4	± 2.7				6.326E-03	3.055E-03
500.00	8.621E-03	+1.3	-1.4	± 2.7				5.825E-03	2.796E-03
550.00	5.746E-03	+1.5	-1.5	± 2.9				3.917E-03	1.829E-03
600.00	3.941E-03	+1.5	-1.6	± 3.1				2.709E-03	1.232E-03
650.00	2.766E-03	+1.6	-1.7	± 3.3				1.916E-03	8.501E-04
700.00	1.982E-03	+1.6	-1.8	± 3.6				1.383E-03	5.990E-04
750.00	1.444E-03	+1.7	-1.8	± 3.8				1.014E-03	4.300E-04
800.00	1.068E-03	+1.8	-1.9	± 4.1				7.545E-04	3.133E-04
850.00	8.000E-04	+1.8	-2.0	± 4.2				5.685E-04	2.315E-04
900.00	6.062E-04	+1.8	-2.1	± 4.5				4.330E-04	1.732E-04
950.00	4.640E-04	+1.9	-2.1	± 4.7				3.331E-04	1.309E-04
1000.00	3.585E-04	+1.9	-2.2	± 5.0				2.585E-04	9.997E-05
1050.00	2.792E-04	+1.9	-2.2	± 5.4				2.022E-04	7.699E-05
1100.00	2.190E-04	+2.0	-2.3	± 5.7				1.592E-04	5.978E-05
1150.00	1.729E-04	+2.0	-2.4	± 6.1				1.261E-04	4.675E-05
1200.00	1.373E-04	+2.0	-2.4	± 6.5				1.005E-04	3.680E-05
1250.00	1.097E-04	+2.0	-2.5	± 6.9				8.051E-05	2.915E-05
1300.00	8.801E-05	+2.1	-2.5	± 7.3				6.480E-05	2.321E-05
1350.00	7.094E-05	+2.1	-2.6	± 7.7				5.236E-05	1.858E-05
1400.00	5.742E-05	+2.2	-2.7	± 8.1				4.247E-05	1.495E-05
1450.00	4.664E-05	+2.2	-2.7	± 8.5				3.457E-05	1.207E-05
1500.00	3.804E-05	+2.2	-2.8	± 8.9				2.824E-05	9.796E-06
1550.00	3.112E-05	+2.2	-2.8	± 9.3				2.314E-05	7.979E-06
1600.00	2.553E-05	+2.2	-2.9	± 9.7				1.901E-05	6.522E-06
1650.00	2.101E-05	+2.3	-3.0	± 10.0				1.566E-05	5.347E-06
1700.00	1.733E-05	+2.3	-3.0	± 10.4				1.293E-05	4.399E-06

1750.00	1.433E-05	+2.4	-3.1	±10.8				1.070E-05	3.629E-06
1800.00	1.187E-05	+2.4	-3.1	±11.2				8.871E-06	3.002E-06
1850.00	9.858E-06	+2.4	-3.2	±11.6				7.368E-06	2.490E-06
1900.00	8.199E-06	+2.5	-3.2	±12.0				6.128E-06	2.071E-06
1950.00	6.833E-06	+2.5	-3.3	±12.4				5.108E-06	1.725E-06
2000.00	5.706E-06	+2.5	-3.3	±12.9				4.265E-06	1.441E-06

ZH Process

- Cross sections are calculated at NNLO QCD accuracy.
 - ◆ Calculations are the same as CERN Report 3.
 - ◆ gg ZH (box-diagram) occurs as a part of NNLO QCD correction and included in the total cross section.
- Program: NNLO QCD (VH@NNLO)
- QCD scales: $\mu = \mu_F = \mu_R = M_{VH} = (p_V + p_H)^2$ for QCD 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_nlo_mc (QCD part)
- Photon-induced contribution of O(1%) or below
 - ◆ NOT included for total cross section (agrees with CERN Report 3 numbers).

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ %)	±PDF %	± %	1+ EW	(gg ZH) (pb)
10.00	1.064E+02	+1.3	-1.8	±2.2				
15.00	6.773E+01	+0.9	-1.6	±2.1				
20.00	4.639E+01	+0.8	-1.5	±2.1				
25.00	3.336E+01	+0.8	-1.8	±2.1				
30.00	2.467E+01	+0.5	-1.2	±2.1				
35.00	1.879E+01	+0.5	-1.2	±2.1				
40.00	1.460E+01	+0.6	-1.1	±2.1				
45.00	1.156E+01	+0.4	-1.2	±2.0				
50.00	9.264E+00	+0.6	-1.1	±1.9				
55.00	7.527E+00	+0.8	-1.1	±1.9				
60.00	6.183E+00	+0.8	-1.3	±1.8				
65.00	5.119E+00	+0.9	-1.0	±1.8				
70.00	4.279E+00	+1.4	-1.2	±1.8				
75.00	3.611E+00	+1.5	-1.3	±1.7				
80.00	3.073E+00	+1.5	-1.6	±1.7				
85.00	2.628E+00	+1.7	-1.8	±1.7				
90.00	2.261E+00	+2.1	-1.8	±1.7				
95.00	1.959E+00	+2.1	-2.0	±1.7				
100.00	1.704E+00	+2.5	-2.1	±1.7				
105.00	1.490E+00	+2.6	-2.2	±1.7				
110.00	1.309E+00	+2.8	-2.4	±1.7				
115.00	1.155E+00	+3.1	-2.4	±1.7				
120.00	1.024E+00	+3.2	-2.7	±1.6				
125.00	9.095E-01	+3.5	-2.8	±1.6				
130.00	8.118E-01	+3.6	-2.9	±1.6				
135.00	7.262E-01	+3.7	-3.2	±1.6				
140.00	6.514E-01	+3.9	-3.2	±1.6				
145.00	5.856E-01	+4.1	-3.3	±1.6				
150.00	5.279E-01	+4.2	-3.5	±1.6				

160.00	4.318E-01	+4.6	-3.6	±1.6				
170.00	3.560E-01	+4.8	-3.9	±1.6				
180.00	2.951E-01	+4.9	-3.9	±1.5				
190.00	2.455E-01	+5.2	-4.0	±1.5				
200.00	2.054E-01	+5.1	-4.0	±1.5				
210.00	1.722E-01	+5.2	-4.0	±1.5				
220.00	1.449E-01	+4.9	-4.0	±1.5				
230.00	1.223E-01	+4.8	-3.9	±1.6				
240.00	1.034E-01	+4.6	-3.8	±1.6				
250.00	8.773E-02	+4.4	-3.5	±1.6				
260.00	7.478E-02	+4.2	-3.4	±1.6				
270.00	6.406E-02	+3.8	-3.3	±1.6				
280.00	5.507E-02	+3.7	-3.0	±1.7				
290.00	4.761E-02	+3.4	-2.9	±1.7				
300.00	4.132E-02	+3.2	-2.7	±1.7				
310.00	3.601E-02	+3.0	-2.5	±1.7				
320.00	3.154E-02	+2.8	-2.5	±1.7				
330.00	2.771E-02	+2.7	-2.3	±1.7				
340.00	2.447E-02	+2.6	-2.2	±1.8				
350.00	2.173E-02	+2.6	-2.2	±1.8				
360.00	1.940E-02	+2.5	-2.3	±1.8				
370.00	1.738E-02	+2.5	-2.2	±1.8				
380.00	1.562E-02	+2.6	-2.3	±1.8				
390.00	1.409E-02	+2.6	-2.3	±1.9				
400.00	1.273E-02	+2.8	-2.3	±1.9				
410.00	1.154E-02	+2.9	-2.5	±1.9				
420.00	1.049E-02	+3.0	-2.5	±1.9				
430.00	9.558E-03	+3.0	-2.7	±1.9				
440.00	8.722E-03	+3.2	-2.8	±2.0				
450.00	7.980E-03	+3.3	-2.9	±2.0				
460.00	7.317E-03	+3.4	-3.0	±2.0				
470.00	6.719E-03	+3.5	-3.2	±2.0				
480.00	6.179E-03	+3.7	-3.2	±2.0				
490.00	5.695E-03	+3.9	-3.4	±2.1				
500.00	5.256E-03	+4.1	-3.5	±2.1				
550.00	3.601E-03	+4.8	-4.3	±2.2				
600.00	2.544E-03	+5.7	-5.0	±2.2				
650.00	1.844E-03	+6.6	-5.8	±2.3				
700.00	1.364E-03	+7.5	-6.5	±2.4				
750.00	1.027E-03	+8.4	-7.2	±2.5				
800.00	7.842E-04	+9.1	-7.9	±2.6				
850.00	6.061E-04	+10.0	-8.5	±2.7				
900.00	4.743E-04	+10.6	-9.2	±2.7				
950.00	3.740E-04	+11.4	-9.7	±2.8				
1000.00	2.977E-04	+11.9	-10.4	±3.0				
1050.00	2.385E-04	+12.7	-10.7	±3.2				
1100.00	1.922E-04	+13.4	-11.2	±3.4				
1150.00	1.559E-04	+13.8	-11.7	±3.6				
1200.00	1.273E-04	+14.3	-12.3	±3.8				
1250.00	1.043E-04	+14.8	-12.7	±4.0				

1300.00	8.583E-05	+15.4	-13.1	±4.2				
1350.00	7.083E-05	+16.0	-13.4	±4.4				
1400.00	5.875E-05	+16.4	-13.9	±4.6				
1450.00	4.885E-05	+16.8	-14.1	±4.8				
1500.00	4.078E-05	+17.1	-14.5	±5.0				
1550.00	3.404E-05	+17.8	-14.6	±5.2				
1600.00	2.865E-05	+17.9	-15.2	±5.4				
1650.00	2.408E-05	+18.4	-15.4	±5.6				
1700.00	2.031E-05	+18.8	-15.7	±5.8				
1750.00	1.718E-05	+19.1	-16.1	±6.1				
1800.00	1.455E-05	+19.5	-16.3	±6.3				
1850.00	1.234E-05	+20.0	-16.6	±6.5				
1900.00	1.050E-05	+20.2	-16.9	±6.7				
1950.00	8.934E-06	+20.6	-17.1	±6.9				
2000.00	7.639E-06	+20.7	-17.5	±7.4				

ttH Process

- Cross sections are calculated at NLO QCD accuracy.
 - ◆ Calculations are the same as CERN Report 3.
- Program: MadGraph5_aMC@NLO (Sherpa+OpenLoops as cross ceck)
- 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

m_H (GeV)	Cross Section (pb)	+QCD Scale %	-QCD Scale %	±(PDF+ _s) %	±PDF %	± _s %	1+ _{EW}
10.00	2.669E+01	+7.8	-9.9	±3.2	±2.6	±1.8	0.980
30.00	8.867E+00	+7.2	-9.7	±3.3	±2.7	±1.8	1.003
70.00	2.113E+00	+6.4	-9.4	±3.4	±2.8	±1.9	1.018
100.00	9.146E-01	+6.1	-9.3	±3.5	±2.9	±1.9	1.020
120.00	5.598E-01	+5.9	-9.3	±3.6	±3.0	±2.0	1.018
125.00	4.987E-01	+5.8	-9.2	±3.6	±3.0	±2.0	1.017
130.00	4.465E-01	+5.8	-9.3	±3.6	±3.0	±2.0	1.017
150.00	2.925E-01	+5.8	-9.3	±3.7	±3.1	±2.0	1.008
200.00	1.222E-01	+6.0	-9.6	±4.0	±3.5	±2.1	0.999
250.00	6.398E-02	+6.5	-10.0	±4.4	±3.9	±2.1	0.991
300.00	3.948E-02	+7.1	-10.6	±4.9	±4.4	±2.2	0.989
400.00	1.985E-02	+7.9	-11.4	±5.8	±5.3	±2.2	0.995
500.00	1.162E-02	+8.7	-12.0	±6.5	±6.0	±2.3	1.039
750.00	3.650E-03	+9.9	-13.0	±8.0	±7.6	±2.6	1.132
1000.00	1.263E-03	+10.6	-13.6	±9.5	±9.0	±2.9	1.211
1500.00	1.860E-04	+11.4	-14.4	±12.6	±12.0	±3.6	1.400
2000.00	3.308E-05	+12.4	-15.2	±16.1	±15.4	±4.6	1.642
2500.00	6.711E-06	+13.5	-16.0	±20.0	±19.1	±5.8	1.934
3000.00	1.466E-06	+14.6	-16.9	±24.2	±23.1	±7.2	2.314

bbH Process

- The cross sections are the Santander matched numbers with 5FS (NNLO) and 4FS (NLO).

- 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) + $M_b + \mu_b$ (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) %	1+ σ_{EW}
10.00	1.138E+02	+91.9	-60.4	
15.00	6.297E+01	+66.3	-52.8	
20.00	4.011E+01	+53.4	-47.4	
25.00	2.729E+01	+44.4	-43.4	
30.00	1.931E+01	+39.8	-40.3	
35.00	1.388E+01	+35.3	-37.6	
40.00	1.029E+01	+34.1	-39.8	
45.00	7.846E+00	+32.9	-40.9	
50.00	6.102E+00	+31.2	-40.2	
55.00	4.849E+00	+29.4	-39.0	
60.00	3.914E+00	+28.5	-37.5	
65.00	3.189E+00	+27.1	-36.1	
70.00	2.633E+00	+26.2	-34.5	
75.00	2.194E+00	+27.2	-33.1	
80.00	1.838E+00	+24.8	-31.7	
85.00	1.549E+00	+24.1	-30.5	
90.00	1.317E+00	+23.4	-29.4	
95.00	1.126E+00	+22.8	-28.4	
100.00	9.669E-01	+22.2	-27.5	
105.00	8.379E-01	+21.8	-26.6	
110.00	7.262E-01	+21.2	-25.8	
115.00	6.325E-01	+20.8	-25.1	
120.00	5.534E-01	+20.3	-24.4	
125.00	4.879E-01	+20.1	-23.9	
130.00	4.304E-01	+19.9	-23.3	
135.00	3.818E-01	+19.7	-22.8	
140.00	3.383E-01	+19.4	-22.3	
145.00	3.018E-01	+19.1	-21.8	
150.00	2.693E-01	+18.9	-21.4	
160.00	2.175E-01	+18.3	-20.4	
170.00	1.769E-01	+18.0	-19.7	
180.00	1.451E-01	+17.5	-19.1	
190.00	1.200E-01	+17.1	-18.5	
200.00	1.000E-01	+17.0	-18.0	
210.00	8.397E-02	+16.7	-17.7	

220.00	7.092E-02	+16.4	-17.5	
230.00	6.021E-02	+16.1	-17.2	
240.00	5.133E-02	+15.8	-17.0	
250.00	4.410E-02	+15.6	-16.7	
260.00	3.799E-02	+15.4	-16.5	
270.00	3.287E-02	+15.3	-16.3	
280.00	2.854E-02	+15.2	-16.2	
290.00	2.491E-02	+15.2	-16.1	
300.00	2.180E-02	+15.1	-15.9	
310.00	1.915E-02	+15.0	-15.8	
320.00	1.689E-02	+14.9	-15.7	
330.00	1.491E-02	+14.7	-15.6	
340.00	1.321E-02	+14.6	-15.6	
350.00	1.174E-02	+14.6	-15.5	
360.00	1.045E-02	+14.5	-15.4	
370.00	9.324E-03	+14.5	-15.3	
380.00	8.351E-03	+14.6	-15.2	
390.00	7.492E-03	+14.6	-15.1	
400.00	6.731E-03	+14.6	-15.0	
410.00	6.046E-03	+14.5	-15.0	
420.00	5.470E-03	+14.5	-15.0	
430.00	4.941E-03	+14.4	-14.9	
440.00	4.472E-03	+14.4	-14.9	
450.00	4.057E-03	+14.5	-14.9	
460.00	3.690E-03	+14.6	-14.8	
470.00	3.352E-03	+14.6	-14.8	
480.00	3.055E-03	+14.6	-14.8	
490.00	2.784E-03	+14.4	-14.7	
500.00	2.547E-03	+14.5	-14.8	
550.00	1.651E-03	+14.7	-14.7	
600.00	1.101E-03	+15.1	-14.9	
650.00	7.518E-04	+15.5	-15.0	
700.00	5.251E-04	+15.8	-15.1	
750.00	3.723E-04	+16.2	-15.0	
800.00	2.692E-04	+16.8	-15.3	
850.00	1.967E-04	+17.3	-15.7	
900.00	1.457E-04	+17.7	-16.0	
950.00	1.091E-04	+18.2	-16.2	
1000.00	8.258E-05	+18.4	-16.7	
1050.00	6.299E-05	+18.6	-17.2	
1100.00	4.856E-05	+18.8	-17.5	
1150.00	3.773E-05	+18.9	-18.1	
1200.00	2.950E-05	+19.1	-18.6	
1250.00	2.322E-05	+19.3	-19.2	
1300.00	1.863E-05	+19.7	-20.1	
1350.00	1.465E-05	+20.1	-20.9	
1400.00	1.172E-05	+20.5	-21.7	
1450.00	9.329E-06	+20.8	-22.5	
1500.00	7.618E-06	+21.5	-23.4	
1550.00	6.179E-06	+22.2	-24.0	

1600.00	5.038E-06	+23.1	-24.6	
1650.00	4.120E-06	+24.0	-25.2	
1700.00	3.380E-06	+24.8	-25.8	
1750.00	2.787E-06	+25.7	-26.4	
1800.00	2.303E-06	+26.6	-27.0	
1850.00	1.910E-06	+27.3	-27.7	
1900.00	1.586E-06	+28.0	-28.3	
1950.00	1.332E-06	+28.7	-28.9	
2000.00	1.105E-06	+29.4	-29.7	
2050.00	9.255E-07	+30.1	-30.4	
2100.00	7.769E-07	+30.7	-31.1	
2150.00	6.532E-07	+31.4	-32.0	
2200.00	5.511E-07	+32.1	-33.1	
2250.00	4.742E-07	+32.9	-34.0	
2300.00	3.941E-07	+34.1	-35.3	
2350.00	3.343E-07	+35.1	-36.4	
2400.00	2.837E-07	+36.2	-37.6	
2450.00	2.415E-07	+37.1	-38.7	
2500.00	2.059E-07	+38.3	-39.8	
2550.00	1.748E-07	+39.4	-41.1	
2600.00	1.466E-07	+41.0	-42.8	
2650.00	1.265E-07	+41.6	-43.6	
2700.00	1.090E-07	+42.9	-44.6	
2750.00	9.444E-08	+44.0	-45.4	
2800.00	8.022E-08	+46.1	-46.7	
2850.00	6.968E-08	+46.8	-47.3	
2900.00	5.972E-08	+48.3	-48.3	
2950.00	5.178E-08	+49.6	-49.2	
3000.00	4.467E-08	+51.1	-50.1	

tH Process (t-ch)

- Cross sections are calculated at NLO QCD accuracy in 5FS.
- Program: MadGraph5_aMC@NLO
- QCD scales: $\mu = \mu_F = \mu_R = (M_{top} + M_H)/4$, uncertainty estimated in the range $1/2 < \mu / \{(M_{top} + M_H)/4\} < 2$ (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+ s) %	\pm PDF %	\pm s %	1+ EW	tH (pb)	tbarH (pb)
10.00	1.848E+00	+8.2	-12.5	± 2.6	± 2.4	± 0.9		1.174E+00	6.740E-01
15.00	1.274E+00	+8.5	-13.0	± 2.6	± 2.4	± 0.9		8.130E-01	4.620E-01
20.00	9.350E-01	+8.6	-13.2	± 2.7	± 2.5	± 0.9		5.998E-01	3.368E-01
30.00	5.613E-01	+8.9	-13.1	± 2.7	± 2.6	± 1.0		3.616E-01	1.993E-01
45.00	3.095E-01	+9.0	-12.4	± 2.9	± 2.7	± 1.0		2.013E-01	1.081E-01
70.00	1.542E-01	+8.5	-10.6	± 3.2	± 3.0	± 1.0		1.013E-01	5.290E-02

100.00	9.414E-02	+7.5	-13.0	±3.6	±3.4	±1.1		6.211E-02	3.216E-02
150.00	6.389E-02	+5.8	-16.4	±3.9	±3.7	±1.2		4.185E-02	2.190E-02
200.00	5.191E-02	+4.9	-18.3	±4.0	±3.8	±1.3		3.409E-02	1.787E-02
300.00	3.743E-02	+3.9	-20.4	±4.3	±4.1	±1.3		2.470E-02	1.275E-02
450.00	2.301E-02	+3.1	-22.6	±4.6	±4.4	±1.4		1.535E-02	7.640E-03
700.00	1.041E-02	+2.4	-25.5	±5.3	±5.1	±1.5		7.090E-03	3.310E-03
1000.00	4.270E-03	+2.1	-28.3	±6.3	±6.0	±1.6		2.970E-03	1.300E-03
1500.00	1.100E-03	+2.1	-32.4	±8.2	±7.9	±2.1		7.800E-04	3.100E-04
2000.00	3.110E-04	+2.4	-36.1	±10.7	±10.4	±2.7		2.270E-04	8.400E-05
3000.00	2.820E-05	+3.6	-42.0	±17.1	±16.5	±4.5		2.140E-05	6.800E-06

tH Process (s-ch)

- Cross sections are calculated at NLO QCD accuracy 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 %	1+ EW	tH (pb)	tbarH (pb)
10.00	1.041E-01	+2.4	-1.9	±1.9	±1.8	±0.5		6.490E-02	3.930E-02
15.00	7.410E-02	+2.4	-1.9	±1.9	±1.8	±0.5		4.624E-02	2.779E-02
20.00	5.568E-02	+2.3	-1.9	±1.9	±1.9	±0.5		3.489E-02	2.080E-02
30.00	3.487E-02	+2.3	-1.8	±1.9	±1.9	±0.5		2.195E-02	1.290E-02
45.00	1.980E-02	+2.2	-1.8	±2.0	±1.9	±0.4		1.258E-02	7.240E-03
70.00	9.420E-03	+2.2	-1.6	±2.0	±2.0	±0.4		6.056E-03	3.386E-03
100.00	4.678E-03	+2.4	-1.7	±2.1	±2.1	±0.3		3.032E-03	1.642E-03
150.00	1.888E-03	+2.4	-1.8	±2.3	±2.3	±0.2		1.245E-03	6.420E-04
200.00	9.290E-04	+2.4	-2.0	±2.5	±2.5	±0.1		6.220E-04	3.070E-04
300.00	3.140E-04	+2.3	-2.1	±2.8	±2.8	±0.0		2.150E-04	9.900E-05
450.00	9.390E-05	+2.1	-2.1	±3.3	±3.3	±0.2		6.610E-05	2.790E-05
700.00	2.130E-05	+2.0	-2.4	±4.1	±4.1	±0.5		1.540E-05	5.800E-06
1000.00	5.170E-06	+2.1	-2.8	±5.0	±5.0	±0.7		3.840E-06	1.330E-06
1500.00	7.140E-07	+2.5	-3.3	±6.3	±6.2	±1.0		5.420E-07	1.710E-07
2000.00	1.240E-07	+2.9	-3.9	±7.4	±7.2	±1.4		9.500E-08	2.900E-08
3000.00	4.800E-09	+3.9	-5.2	±12.8	±12.8	±2.3		3.590E-09	1.210E-09

-- ReiTanaka - 2016-03-01

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