- Non-zero particle masses are $m_t = 173$ GeV, $m_H = 125$ GeV, $m_Z = 91.188$ GeV, $m_W = 80.419$ GeV. The bottom-quark mass is set to $m_b = 4.7$ GeV in the four-flavour-scheme (4FS) simulations, and to $m_b = 0$ in the five-flavour-scheme (5FS) ones. The CKM matrix is $V_{\rm CKM} = \mathbb{1}$, and the fine-structure constant is $\alpha = 1/132.507$.

- Renormalisation and factorisation scales are chosen as $\mu_R = \mu_F = \frac{1}{2}\sum_k m_T^{(k)}$, $m_T^{(k)}$ being the transverse mass of the k-th final-state particle. Independent variation of μ_R and μ_F in the range $[1/2, 2]$ is obtained in an exact way without rerunning the code, through the reweighting technique described in [1]. The uncertainty associated with this variation is shown as a dark band in the plots of the following sections.

- As parton distribution functions (PDFs) we use the MSTW 2008 NLO (68% c.l.) sets [2], relevant to four or five active flavours, depending on the flavour scheme employed in the simulation. PDF uncertainties are estimated according to the asymmetric-hessian prescription provided by the PDF set, and obtained automatically as in explained in [1]. They are shown as a light band in the plots of the following sections. The value and the running of the strong coupling constant $\alpha_{\rm S}$ are as well set according to the PDF set.

- Whenever relevant, jets are clustered by means of the anti-k_T algorithm [3] as implemented in FastJet [4], with $\Delta R = 0.7$, and $p_T(j) > 20$ GeV (if not otherwise specified).

- Whenever relevant, photons are isolated by means of the Frixione smooth-cone criterion [5], with parameters $R_0 = 0.4$, $p_T(\gamma) > 20$ GeV, $\epsilon_\gamma = n = 1$.

- Loop-induced processes are generated in the 4FS.

		Process	$\sigma_{\rm NLO}$(8 TeV) [fb]	$\sigma_{\rm NLO}$(100 TeV) [fb]	ρ
pp	$\to$	$H\ (m_t, m_b)$	$1.44 \cdot 10^{4}\ ^{+20\%}_{-16\%}\ ^{+1\%}_{-2\%}$	$5.46 \cdot 10^{+5}\ ^{+28\%}_{-27\%}\ ^{+2\%}_{-2\%}$	38
gg	$\to$	H (LI)	$6.85 \cdot 10^{+3}\ ^{+33\%}_{-24\%}\ ^{+1\%}_{-1\%}$	$2.21 \cdot 10^{+5}\ ^{+58\%}_{-39\%}\ ^{+1\%}_{-1\%}$	32
pp	$\to$	Hjj (VBF)	$1.61 \cdot 10^{3}\ ^{+1\%}_{-0\%}\ ^{+2\%}_{-2\%}$	$7.40 \cdot 10^{4}\ ^{+3\%}_{-2\%}\ ^{+2\%}_{-1\%}$	46
pp	$\to$	Hjj (LI)	$1.89 \cdot 10^{+3}\ ^{+67\%}_{-37\%}\ ^{+1\%}_{-1\%}$	$2.02 \cdot 10^{+5}\ ^{+66\%}_{-38\%}\ ^{+0\%}_{-1\%}$	107
pp	$\to$	$Ht\bar{t}$	$1.21 \cdot 10^{2}\ ^{+5\%}_{-9\%}\ ^{+3\%}_{-3\%}$	$3.25 \cdot 10^{4}\ ^{+7\%}_{-8\%}\ ^{+1\%}_{-1\%}$	269
pp	$\to$	$Hb\bar{b}$ (4FS)	$2.37 \cdot 10^{2}\ ^{+9\%}_{-9\%}\ ^{+2\%}_{-2\%}$	$1.21 \cdot 10^{4}\ ^{+2\%}_{-10\%}\ ^{+2\%}_{-2\%}$	51
pp	$\to$	Htj	$2.07 \cdot 10^{1}\ ^{+2\%}_{-1\%}\ ^{+2\%}_{-2\%}$	$5.21 \cdot 10^{3}\ ^{+3\%}_{-5\%}\ ^{+1\%}_{-1\%}$	252
pp	$\to$	$HW^{\pm}$	$7.31 \cdot 10^{2}\ ^{+2\%}_{-1\%}\ ^{+2\%}_{-2\%}$	$1.54 \cdot 10^{4}\ ^{+5\%}_{-8\%}\ ^{+2\%}_{-2\%}$	21
pp	$\to$	HZ	$3.87 \cdot 10^{2}\ ^{+2\%}_{-1\%}\ ^{+2\%}_{-2\%}$	$8.82 \cdot 10^{3}\ ^{+4\%}_{-8\%}\ ^{+2\%}_{-2\%}$	23
gg	$\to$	HZ (LI)	$22.9\ ^{+33\%}_{-23\%}\ ^{+1\%}_{-2\%}$	$2.50 \cdot 10^{+3}\ ^{+35\%}_{-26\%}\ ^{+1\%}_{-1\%}$	109
pp	$\to$	HW^+W^- (4FS)	$4.62 \cdot 10^{0}\ ^{+3\%}_{-2\%}\ ^{+2\%}_{-2\%}$	$1.68 \cdot 10^{2}\ ^{+5\%}_{-6\%}\ ^{+2\%}_{-1\%}$	36
gg	$\to$	HW^+W^- (LI)	N/A	N/A	[–]
pp	$\to$	$HZW^{\pm}$	$2.17 \cdot 10^{0}\ ^{+4\%}_{-4\%}\ ^{+2\%}_{-2\%}$	$9.94 \cdot 10^{1}\ ^{+6\%}_{-7\%}\ ^{+2\%}_{-1\%}$	46
pp	$\to$	$HW^{\pm}\gamma$	$2.36 \cdot 10^{0}\ ^{+3\%}_{-3\%}\ ^{+2\%}_{-2\%}$	$7.75 \cdot 10^{1}\ ^{+7\%}_{-8\%}\ ^{+2\%}_{-1\%}$	33
pp	$\to$	$HZ\gamma$	$1.54 \cdot 10^{0}\ ^{+3\%}_{-2\%}\ ^{+2\%}_{-2\%}$	$4.29 \cdot 10^{1}\ ^{+5\%}_{-7\%}\ ^{+2\%}_{-2\%}$	28
gg	$\to$	$HZ\gamma$ (LI)	$2.12 \cdot 10^{-3}\ ^{+34\%}_{-23\%}\ ^{+1\%}_{-2\%}$	$0.279\ ^{+33\%}_{-25\%}\ ^{+0\%}_{-1\%}$	132
gg	$\to$	HH (LI)	$5.46\ ^{+34\%}_{-24\%}\ ^{+2\%}_{-2\%}$	$7.74 \cdot 10^{+2}\ ^{+32\%}_{-24\%}\ ^{+0\%}_{-1\%}$	142
pp	$\to$	ZZ	$7.18 \cdot 10^{+3}\ ^{+3\%}_{-3\%}\ ^{+2\%}_{-2\%}$	$1.62 \cdot 10^{+5}\ ^{+6\%}_{-10\%}\ ^{+2\%}_{-2\%}$	23
gg	$\to$	ZZ (LI)	$4.93 \cdot 10^{+2}\ ^{+30\%}_{-21\%}\ ^{+1\%}_{-1\%}$	$2.92 \cdot 10^{+4}\ ^{+42\%}_{-30\%}\ ^{+1\%}_{-1\%}$	59
pp	$\to$	$Z\gamma$	$3.63 \cdot 10^{+4}\ ^{+5\%}_{-5\%}\ ^{+2\%}_{-1\%}$	$6.00 \cdot 10^{+5}\ ^{+13\%}_{-16\%}\ ^{+3\%}_{-3\%}$	17
gg	$\to$	$Z\gamma$ (LI)	$3.98 \cdot 10^{+2}\ ^{+29\%}_{-21\%}\ ^{+1\%}_{-1\%}$	$1.70 \cdot 10^{+4}\ ^{+52\%}_{-35\%}\ ^{+1\%}_{-1\%}$	43
pp	$\to$	$\gamma\gamma$	$1.15 \cdot 10^{+5}\ ^{+14\%}_{-15\%}\ ^{+2\%}_{-1\%}$	$1.52 \cdot 10^{+6}\ ^{+32\%}_{-29\%}\ ^{+8\%}_{-6\%}$	13
gg	$\to$	$\gamma\gamma$ (LI)	$2.54 \cdot 10^{+4}\ ^{+56\%}_{-37\%}\ ^{+1\%}_{-1\%}$	$4.59 \cdot 10^{+5}\ ^{+89\%}_{-50\%}\ ^{+3\%}_{-3\%}$	18
pp	$\to$	HZZ	$1.10 \cdot 10^{0}\ ^{+2\%}_{-2\%}\ ^{+2\%}_{-2\%}$	$4.20 \cdot 10^{1}\ ^{+4\%}_{-6\%}\ ^{+2\%}_{-1\%}$	38
pp	$\to$	W^+W^- (4FS)	$5.30 \cdot 10^{4}\ ^{+3\%}_{-3\%}\ ^{+2\%}_{-2\%}$	$1.12 \cdot 10^{6}\ ^{+9\%}_{-11\%}\ ^{+2\%}_{-2\%}$	21
gg	$\to$	W^+W^- (LI)	N/A	N/A	[–]
pp	$\to$	HZZ	$1.10 \cdot 10^{0}\ ^{+2\%}_{-2\%}\ ^{+2\%}_{-2\%}$	$4.20 \cdot 10^{1}\ ^{+4\%}_{-6\%}\ ^{+2\%}_{-1\%}$	38
gg	$\to$	HZZ (LI)	$3.56 \cdot 10^{-2}\ ^{+35\%}_{-24\%}\ ^{+2\%}_{-2\%}$	$7.29\ ^{+28\%}_{-22\%}\ ^{+0\%}_{-1\%}$	205
gg	$\to$	$H\gamma\gamma$ (LI)	$2.24 \cdot 10^{-3}\ ^{+35\%}_{-24\%}\ ^{+2\%}_{-2\%}$	$0.374\ ^{+31\%}_{-24\%}\ ^{+0\%}_{-1\%}$	167
pp	$\to$	$HW^{\pm}j$	$3.18 \cdot 10^{2}\ ^{+4\%}_{-4\%}\ ^{+2\%}_{-1\%}$	$1.07 \cdot 10^{4}\ ^{+2\%}_{-7\%}\ ^{+2\%}_{-1\%}$	34
pp	$\to$	$HW^{\pm}jj$	$6.06 \cdot 10^{1}\ ^{+6\%}_{-8\%}\ ^{+1\%}_{-1\%}$	$4.90 \cdot 10^{3}\ ^{+2\%}_{-6\%}\ ^{+1\%}_{-1\%}$	81
pp	$\to$	HZj	$1.71 \cdot 10^{2}\ ^{+4\%}_{-4\%}\ ^{+1\%}_{-1\%}$	$6.31 \cdot 10^{3}\ ^{+2\%}_{-7\%}\ ^{+2\%}_{-1\%}$	37
pp	$\to$	$HZjj$	$3.50 \cdot 10^{1}\ ^{+7\%}_{-10\%}\ ^{+1\%}_{-1\%}$	$2.81 \cdot 10^{3}\ ^{+2\%}_{-5\%}\ ^{+1\%}_{-1\%}$	80

Table 1: Production of a single Higgs boson at the LHC and at a 100 TeV FCC-hh. The rightmost column reports the ratio ρ of the FCC-hh to the LHC cross sections. Theoretical uncertainties are due to scale and PDF variations, respectively. Monte-Carlo-integration error is always smaller than theoretical uncertainties, and is not shown. For $pp \to HVjj$, on top of the transverse-momentum cut of section **??**, I require $m(j_1, j_2) > 100$ GeV, j_1 and j_2 being the hardest and next-to-hardest jets, respectively. Processes $pp \to Htj$ and $pp \to Hjj$ (VBF) do not feature jet cuts.

		Process	$\sigma_{\rm NLO}$(8 TeV) [fb]	$\sigma_{\rm NLO}$(100 TeV) [fb]	ρ
pp	$\to$	$W^+W^-W^\pm$ (4FS)	$8.73 \cdot 10^{1}\ ^{+6\%}_{-4\%}\ ^{+2\%}_{-2\%}$	$4.25 \cdot 10^{3}\ ^{+9\%}_{-9\%}\ ^{+1\%}_{-1\%}$	49
pp	$\to$	W^+W^-Z (4FS)	$6.41 \cdot 10^{1}\ ^{+7\%}_{-5\%}\ ^{+2\%}_{-2\%}$	$4.01 \cdot 10^{3}\ ^{+9\%}_{-9\%}\ ^{+1\%}_{-1\%}$	63
gg	$\to$	W^+W^-Z (LI)	N/A	N/A	[–]
pp	$\to$	$Z\gamma\gamma$	$6.06 \cdot 10^{+1}\ ^{+4\%}_{-4\%}\ ^{+2\%}_{-1\%}$	$1.37 \cdot 10^{+3}\ ^{+12\%}_{-13\%}\ ^{+2\%}_{-2\%}$	23
gg	$\to$	$Z\gamma\gamma$ (LI)	$5.58 \cdot 10^{-2}\ ^{+28\%}_{-21\%}\ ^{+1\%}_{-1\%}$	$3.42\ ^{+44\%}_{-31\%}\ ^{+1\%}_{-1\%}$	61
pp	$\to$	$\gamma W^\pm Z$	$7.11 \cdot 10^{1}\ ^{+8\%}_{-7\%}\ ^{+2\%}_{-1\%}$	$3.61 \cdot 10^{3}\ ^{+12\%}_{-12\%}\ ^{+1\%}_{-1\%}$	51
pp	$\to$	$W^\pm ZZ$	$2.16 \cdot 10^{1}\ ^{+7\%}_{-6\%}\ ^{+2\%}_{-2\%}$	$1.36 \cdot 10^{3}\ ^{+10\%}_{-10\%}\ ^{+1\%}_{-1\%}$	63
pp	$\to$	γZZ	$2.24 \cdot 10^{1}\ ^{+4\%}_{-3\%}\ ^{+2\%}_{-2\%}$	$6.62 \cdot 10^{2}\ ^{+8\%}_{-9\%}\ ^{+2\%}_{-1\%}$	30
gg	$\to$	γZZ (LI)	$1.13 \cdot 10^{-3}\ ^{+33\%}_{-23\%}\ ^{+1\%}_{-2\%}$	$0.13\ ^{+34\%}_{-25\%}\ ^{+1\%}_{-1\%}$	115
pp	$\to$	ZZZ	$5.97 \cdot 10^{0}\ ^{+3\%}_{-3\%}\ ^{+2\%}_{-2\%}$	$2.55 \cdot 10^{2}\ ^{+5\%}_{-7\%}\ ^{+2\%}_{-1\%}$	43
gg	$\to$	ZZZ (LI)	N/A	N/A	[–]
gg	$\to$	HHH (LI)	N/A	N/A	[–]
gg	$\to$	$HHHH$ (LI)	$2.63 \cdot 10^{-5}\ ^{+39\%}_{-26\%}\ ^{+3\%}_{-3\%}$	$1.30 \cdot 10^{-2}\ ^{+23\%}_{-18\%}\ ^{+1\%}_{-1\%}$	494
pp	$\to$	HHZ	$1.31 \cdot 10^{-1}\ ^{+2\%}_{-2\%}\ ^{+2\%}_{-2\%}$	$5.36 \cdot 10^{0}\ ^{+3\%}_{-5\%}\ ^{+2\%}_{-1\%}$	41
gg	$\to$	HHZ (LI)	$1.60 \cdot 10^{-2}\ ^{+36\%}_{-24\%}\ ^{+2\%}_{-2\%}$	$3.35\ ^{+29\%}_{-22\%}\ ^{+0\%}_{-1\%}$	209
gg	$\to$	$HH\gamma$ (LI)	N/A	N/A	[–]
pp	$\to$	$W^+W^-W^\pm\gamma$ (4FS)	$6.78 \cdot 10^{-1}\ ^{+8\%}_{-6\%}\ ^{+2\%}_{-2\%}$	$7.42 \cdot 10^{1}\ ^{+8\%}_{-8\%}\ ^{+1\%}_{-1\%}$	109
pp	$\to$	$W^+W^-W^\pm Z$ (4FS)	$3.48 \cdot 10^{-1}\ ^{+8\%}_{-7\%}\ ^{+2\%}_{-2\%}$	$5.95 \cdot 10^{1}\ ^{+7\%}_{-7\%}\ ^{+1\%}_{-1\%}$	171
pp	$\to$	$W^+W^-W^+W^-$ (4FS)	$3.01 \cdot 10^{-1}\ ^{+7\%}_{-6\%}\ ^{+2\%}_{-2\%}$	$4.11 \cdot 10^{1}\ ^{+7\%}_{-6\%}\ ^{+1\%}_{-1\%}$	137
pp	$\to$	W^+W^-ZZ (4FS)	$2.01 \cdot 10^{-1}\ ^{+7\%}_{-6\%}\ ^{+2\%}_{-2\%}$	$3.34 \cdot 10^{1}\ ^{+6\%}_{-6\%}\ ^{+1\%}_{-1\%}$	166
pp	$\to$	$W^\pm ZZZ$	$3.40 \cdot 10^{-2}\ ^{+10\%}_{-8\%}\ ^{+2\%}_{-2\%}$	$7.06 \cdot 10^{0}\ ^{+8\%}_{-7\%}\ ^{+1\%}_{-1\%}$	208
pp	$\to$	$ZZZZ$	$8.72 \cdot 10^{-3}\ ^{+4\%}_{-4\%}\ ^{+3\%}_{-2\%}$	$8.05 \cdot 10^{-1}\ ^{+4\%}_{-4\%}\ ^{+2\%}_{-1\%}$	92
pp	$\to$	$W^+W^-W^+W^-\gamma$ (4FS)	$5.18 \cdot 10^{-3}\ ^{+8\%}_{-7\%}\ ^{+3\%}_{-2\%}$	$1.58 \cdot 10^{0}\ ^{+6\%}_{-5\%}\ ^{+1\%}_{-1\%}$	305
pp	$\to$	$ZZZZZ$	$1.07 \cdot 10^{-5}\ ^{+5\%}_{-4\%}\ ^{+3\%}_{-2\%}$	$2.04 \cdot 10^{-3}\ ^{+3\%}_{-3\%}\ ^{+2\%}_{-1\%}$	191

Table 2: Production of multiple vector bosons at the LHC and at a 100 TeV FCC-hh. The rightmost column reports the ratio ρ of the FCC-hh to the LHC cross sections. Theoretical uncertainties are due to scale and PDF variations, respectively. Monte-Carlo-integration error is always smaller than theoretical uncertainties, and is not shown.

Process			$\sigma_{\rm NLO}$(8 TeV) [fb]	$\sigma_{\rm NLO}$(100 TeV) [fb]	ρ
pp	$\to$	$t\bar{t}\gamma$	$6.50 \cdot 10^{2}$ ${}^{+12\%}_{-13\%}$ ${}^{+2\%}_{-2\%}$	$1.24 \cdot 10^{5}$ ${}^{+11\%}_{-11\%}$ ${}^{+1\%}_{-1\%}$	192
pp	$\to$	$t\bar{t}Z$	$1.99 \cdot 10^{2}$ ${}^{+10\%}_{-12\%}$ ${}^{+3\%}_{-3\%}$	$5.63 \cdot 10^{4}$ ${}^{+9\%}_{-10\%}$ ${}^{+1\%}_{-1\%}$	282
pp	$\to$	$t\bar{t}W^{\pm}$	$2.05 \cdot 10^{2}$ ${}^{+9\%}_{-10\%}$ ${}^{+2\%}_{-2\%}$	$1.68 \cdot 10^{4}$ ${}^{+18\%}_{-16\%}$ ${}^{+1\%}_{-1\%}$	82
pp	$\to$	$t\bar{t}\gamma j$	$1.22 \cdot 10^{2}$ ${}^{+17\%}_{-18\%}$ ${}^{+3\%}_{-3\%}$	$6.07 \cdot 10^{4}$ ${}^{+8\%}_{-10\%}$ ${}^{+1\%}_{-1\%}$	498
pp	$\to$	$t\bar{t}Zj$	$3.51 \cdot 10^{1}$ ${}^{+15\%}_{-18\%}$ ${}^{+4\%}_{-4\%}$	$2.77 \cdot 10^{4}$ ${}^{+7\%}_{-9\%}$ ${}^{+1\%}_{-1\%}$	789
pp	$\to$	$t\bar{t}W^{\pm}j$	$3.59 \cdot 10^{1}$ ${}^{+18\%}_{-18\%}$ ${}^{+2\%}_{-2\%}$	$1.36 \cdot 10^{4}$ ${}^{+14\%}_{-13\%}$ ${}^{+1\%}_{-1\%}$	379
pp	$\to$	$t\bar{t}W^{\pm}jj$	$5.67 \cdot 10^{0}$ ${}^{+24\%}_{-23\%}$ ${}^{+3\%}_{-2\%}$	$6.52 \cdot 10^{3}$ ${}^{+11\%}_{-14\%}$ ${}^{+1\%}_{-1\%}$	1150
pp	$\to$	$t\bar{t}W^{+}W^{-}$ (4FS)	$2.27 \cdot 10^{0}$ ${}^{+11\%}_{-13\%}$ ${}^{+3\%}_{-3\%}$	$1.10 \cdot 10^{3}$ ${}^{+9\%}_{-9\%}$ ${}^{+1\%}_{-1\%}$	486
pp	$\to$	$t\bar{t}\gamma\gamma$	$2.23 \cdot 10^{0}$ ${}^{+14\%}_{-13\%}$ ${}^{+2\%}_{-1\%}$	$4.81 \cdot 10^{2}$ ${}^{+13\%}_{-11\%}$ ${}^{+1\%}_{-1\%}$	216
pp	$\to$	$t\bar{t}Z\gamma$	$1.11 \cdot 10^{0}$ ${}^{+12\%}_{-13\%}$ ${}^{+2\%}_{-2\%}$	$4.20 \cdot 10^{2}$ ${}^{+10\%}_{-9\%}$ ${}^{+1\%}_{-1\%}$	378
pp	$\to$	$t\bar{t}W^{\pm}Z$	$9.71 \cdot 10^{-1}$ ${}^{+10\%}_{-11\%}$ ${}^{+3\%}_{-2\%}$	$1.68 \cdot 10^{2}$ ${}^{+16\%}_{-13\%}$ ${}^{+1\%}_{-1\%}$	173
pp	$\to$	$t\bar{t}ZZ$	$4.47 \cdot 10^{-1}$ ${}^{+8\%}_{-10\%}$ ${}^{+3\%}_{-2\%}$	$1.58 \cdot 10^{2}$ ${}^{+15\%}_{-12\%}$ ${}^{+1\%}_{-1\%}$	353

Table 3: Production of a top-antitop pair in association with up to two electroweak vector bosons, and with an electroweak boson and up to two jets, at the LHC and at a 100 TeV FCC-hh. The rightmost column reports the ratio ρ of the FCC-hh to the LHC cross sections. Processes $pp \to t\bar{t}Vj(j)$ feature a cut of $p_T(j) > 100$ GeV. Theoretical uncertainties are due to scale and PDF variations, respectively. Monte-Carlo-integration error is always smaller than theoretical uncertainties, and is not shown.

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