constants

$$G_F = 1.1663787 \times 10^{-5}\ \text{GeV}^{-2}$$

$$m_Z = 91.1882\ \text{GeV}$$

$$\alpha(m_Z) = \frac{1}{127.952}$$

$$m_W = 80.361\ \text{GeV}$$

$$\sin^2\theta_W = 0.22337$$

Inputs: Higgs @ future e+e-

in unit of %

250GeV	0.9 ab^{-1} @ (-0.8,+0.3)		0.9 ab^{-1} @ (+0.8,-0.3)		5 ab^{-1} @ (0,0)	
prod.	**ZH**	**vvH**	**ZH**	**vvH**	**ZH**	**vvH**
σ	1.07	-	1.07	-	0.537	-
σxBR$_{bb}$	0.714	4.27	0.714	17.4	0.380	2.78
σxBR$_{cc}$	4.38	-	4.38	-	2.08	-
σxBR$_{gg}$	3.69	-	3.69	-	1.75	-
σxBR$_{ZZ}$	9.49	-	9.49	-	4.49	-
σxBR$_{WW}$	2.43	-	2.43	-	1.16	-
σxBR$_{\tau\tau}$	1.70	-	1.70	-	0.822	-
σxBR$_{\gamma\gamma}$	17.9	-	17.9	-	8.47	-
σxBR$_{\mu\mu}$	37.9	-	37.9	-	17.9	-
σxBR$_{inv.}$	0.336	-	0.277	-	0.226	-

***toy fit: input consistently extrapolated from same set of full simulation analyses for both polarized and unpolarized cases, including common 0.2% systematic errors for all channels except for H—>bb (0.3%)

Inputs: Higgs @ future e+e-

in unit of %

350GeV	135 fb^{-1} @ (-0.8,+0.3)		45 fb^{-1} @ (+0.8,-0.3)		5 ab^{-1} @ (0,0)	
prod.	**ZH**	**vvH**	**ZH**	**vvH**	**ZH**	**vvH**
σ	2.46	-	4.25	-	0.842	-
σxBR$_{bb}$	2.05	2.46	3.54	17.7	0.711	1.14
σxBR$_{cc}$	15.0	25.9	25.9	186	5.00	11.9
σxBR$_{gg}$	11.4	10.5	19.8	75.4	3.82	4.82
σxBR$_{ZZ}$	34.0	27.2	58.9	191	11.4	12.5
σxBR$_{WW}$	7.62	7.76	13.2	56.6	2.55	3.57
σxBR$_{ττ}$	5.45	21.8	9.43	156	1.83	10
σxBR$_{γγ}$	53.1	61.2	91.9	424	17.7	28.1
σxBR$_{μμ}$	118	218	205	1580	39.6	100
σxBR$_{inv.}$	1.15	-	1.83	-	0.416	-

Inputs: Higgs @ future e+e-

in unit of %

500GeV	1.6 ab^{-1} @ (-0.8,+0.3)		1.6 fb^{-1} @ (+0.8,-0.3)	
prod.	**ZH**	**vvH**	**ZH**	**vvH**
σ	1.67	-	1.67	-
σxBR$_{bb}$	1.01	0.418	1.01	1.52
σxBR$_{cc}$	7.12	3.48	7.12	14.2
σxBR$_{gg}$	5.93	2.30	5.93	9.49
σxBR$_{ZZ}$	13.8	4.75	13.8	19.0
σxBR$_{WW}$	3.05	1.36	3.05	5.54
σxBR$_{\tau\tau}$	2.42	3.88	2.42	15.8
σxBR$_{\gamma\gamma}$	18.6	10.7	18.6	43.5
σxBR$_{\mu\mu}$	47.4	39.5	47.4	166
σxBR$_{inv.}$	0.825	-	0.599	-

Inputs: EWPO @ future e+e-

	ILC	**FCC-ee**
$\Delta\alpha^{-1}$	0.0178	0.00387
ΔG_F	6.0×10^{-7}	6.0×10^{-7}
Δm_W	2.4MeV	0.5MeV
Δm_Z	2.1MeV	0.1MeV
Δm_H	14MeV	11MeV
$\Delta\Gamma_W$	2MeV	1.2MeV
$\Delta\Gamma_Z$	2.3MeV	0.1MeV
ΔA_l	0.00013	0.00004
$\Delta\Gamma_l$	0.086MeV	0.0054MeV

***A_l, Γ_l: for $Z\rightarrow l^+l^-$

Z->other flavors will be added later

Inputs: Higgs @ HL-LHC

in unit of %

HL-LHC	3 ab-1 @ 14 TeV ATLAS+CMS (S2)				
prod.	**ggH**	**VBF**	**WH**	**ZH**	**ttH**
σ	-	-	-	-	
σxBR$_{bb}$	19.1	-	8.3	4.6	10.2
σxBR$_{cc}$	-	-	-	-	-
σxBR$_{gg}$	-	-	-	-	-
σxBR$_{ZZ}$	2.5	9.5	32.1	58.3	15.2
σxBR$_{WW}$	2.5	5.5	9.9	12.8	6.6
σxBR$_{\tau\tau}$	4.5	3.9	-	-	10.2
σxBR$_{\gamma\gamma}$	2.5	7.9	9.9	13.2	5.9
σxBR$_{\gamma Z}$	24.4	51.2	-	-	-
σxBR$_{\mu\mu}$	11.1	30.7	-	-	-
σxBR$_{inv.}$	-	2.5	-	-	-
m_H	10-20MeV				

wishlist: correlation matrix; differential x-section is not included now, but can be considered if available

(Fit-1): Higgs + WW+ EWPO + Drell-Yan

observables

Electroweak Precision Observables (9)

+

e+e- —> WW (Optimal Obv.)

+

Higgs observables at LHC & e+e- (σ, σxBR)

Drell-Yan at LHC

assumptions

w/o 4-f contact interactions

flavor diagonal

CP-even

w/ & w/o lepton flavor univ.

w/ & w/o Higgs exotic decays

operators (Warsaw)

$$
\begin{aligned}
\mathscr{L}_{\text{SMEFT}_{\text{ND,FU}}} = \;& \frac{C_\phi}{\Lambda^2}\left(\phi^\dagger\phi\right)^3 + \frac{C_{\phi\Box}}{\Lambda^2}\left(\phi^\dagger\phi\right)\Box\left(\phi^\dagger\phi\right) \\
& + \frac{C_W}{\Lambda^2}\varepsilon_{abc}W_\mu^{a\,\nu}W_\nu^{b\,\rho}W_\rho^{c\,\mu} \\
& + \frac{C_{\phi B}}{\Lambda^2}\phi^\dagger\phi B_{\mu\nu}B^{\mu\nu} + \frac{C_{\phi W}}{\Lambda^2}\phi^\dagger\phi W_{\mu\nu}^a W^{a\,\mu\nu} + \frac{C_{\phi G}}{\Lambda^2}\phi^\dagger\phi G_{\mu\nu}^A G^{A\,\mu\nu} \\
& + \frac{C_{\phi D}}{\Lambda^2}\left(\phi^\dagger D_\mu\phi\right)\left((D^\mu\phi)^\dagger\phi\right) + \frac{C_{\phi WB}}{\Lambda^2}\phi^\dagger\sigma_a\phi W_{\mu\nu}^a B^{\mu\nu} \\
& + \left(\frac{\left(C_{e\phi}\right)_{ii}}{\Lambda^2}\left(\phi^\dagger\phi\right)\left(\bar{l}_L^i\phi e_R^i\right) + \frac{\left(C_{d\phi}\right)_{ii}}{\Lambda^2}\left(\phi^\dagger\phi\right)\left(\bar{q}_L^i\phi d_R^i\right) + \frac{\left(C_{u\phi}\right)_{ii}}{\Lambda^2}\left(\phi^\dagger\phi\right)\left(\bar{q}_L^i\tilde{\phi}u_R^i\right) + \text{h.c.}\right) \\
& + \frac{\left(C_{\phi l}^{(1)}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu\phi)(\bar{l}_L^i\gamma^\mu l_L^i) + \frac{\left(C_{\phi l}^{(3)}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu^a\phi)(\bar{l}_L^i\gamma^\mu\sigma_a l_L^i) \\
& + \frac{\left(C_{\phi e}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu\phi)(\bar{e}_R^i\gamma^\mu e_R^i) \\
& + \frac{\left(C_{\phi q}^{(1)}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu\phi)(\bar{q}_L^i\gamma^\mu q_L^i) + \frac{\left(C_{\phi l}^{(3)}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu^a\phi)(\bar{q}_L^i\gamma^\mu\sigma_a q_L^i) \\
& + \frac{\left(C_{\phi u}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu\phi)(\bar{u}_R^i\gamma^\mu u_R^i) + \frac{\left(C_{\phi d}\right)_{ii}}{\Lambda^2}(\phi^\dagger i\overleftrightarrow{D}_\mu\phi)(\bar{d}_R^i\gamma^\mu d_R^i) \\
& + \frac{\left(C_{ll}\right)_{1221}}{\Lambda^2}\left(\bar{l}_1\gamma_\mu l_2\right)\left(\bar{l}_2\gamma^\mu l_1\right).
\end{aligned}
$$