

Model Independent Coupling Summary

$$\Delta g_{Hxx} / g_{Hxx}$$

Mode	ILC(250)	ILC500	ILC(1000)	ILC(LumUp)
ZZ	1.3 %	1.3 %	1.3 %	0.61 %
WW	4.8 %	1.4 %	1.4 %	0.65 %
$b\bar{b}$	5.3 %	1.8 %	1.5 %	0.75 %
$c\bar{c}$	6.8 %	3.0 %	2.0 %	1.1 %
gg	6.4 %	2.5 %	1.8 %	0.94 %
$\tau^+\tau^-$	5.7 %	2.5 %	2.0 %	1.0 %
$\gamma\gamma$	18 %	8.4 %	4.1 %	2.4 %
$\mu^+\mu^-$	–	–	16 %	10 %
$\Gamma_T(h)$	11 %	6.0 %	5.6 %	2.7 %
$t\bar{t}$	– %	18 %	4.0 %	2.5 %
self	–	88%	25 %	16 %
* BR(invis.)	< 0.69 %	< 0.69 %	< 0.69 %	< 0.32 %

* 95% C.L. limit

Model Dependent Coupling Fit

It is sometimes useful to extract couplings from ILC data using certain model assumptions in order to compare experimental precisions with facilities that cannot determine Higgs couplings in a model independent manner.

We believe the most straightforward way to compare ILC and LHC Higgs coupling precisions is to have both facilities perform a global coupling fit with only the assumption $g_{HWW}^2 < g_{HWW}^2|_{SM}$ and $g_{HZZ}^2 < g_{HZZ}^2|_{SM}$

$$\Delta g_{Hxx} / g_{Hxx} \text{ assuming } g_{HWW}^2 < g_{HWW}^2|_{SM} \text{ and } g_{HZZ}^2 < g_{HZZ}^2|_{SM}$$

Mode	ILC(250)	ILC500	ILC(1000)	ILC(LumUp)
WW	1.9 %	0.24 %	0.17 %	x.xx %
ZZ	0.44 %	0.30 %	0.27 %	x.xx %
$b\bar{b}$	2.7 %	0.94 %	0.69 %	x.xx %
gg	4.0 %	2.0 %	1.4 %	x.xx %
$\gamma\gamma$	4.9 %	4.3 %	3.3 %	x.xx %
$\tau^+\tau^-$	3.3 %	1.9 %	1.4 %	x.xx %
$c\bar{c}$	4.7 %	2.5 %	2.1 %	x.xx %
$t\bar{t}$	14.2 %	9.3 %	3.7 %	x.xx %
$\mu^+\mu^-$	–	–	16 %	x.xx %
self	–	88%	25 %	x.xx %
BR(invis.)	< 0.44 %	< 0.30 %	< 0.26 %	x.xx %
$\Gamma_T(h)$	4.8 %	1.6 %	1.2 %	x.xx %

Model Dependent Coupling Fit

assuming $g_{HWW}^2 < g_{HWW}^2|_{SM}$ and $g_{HZZ}^2 < g_{HZZ}^2|_{SM}$

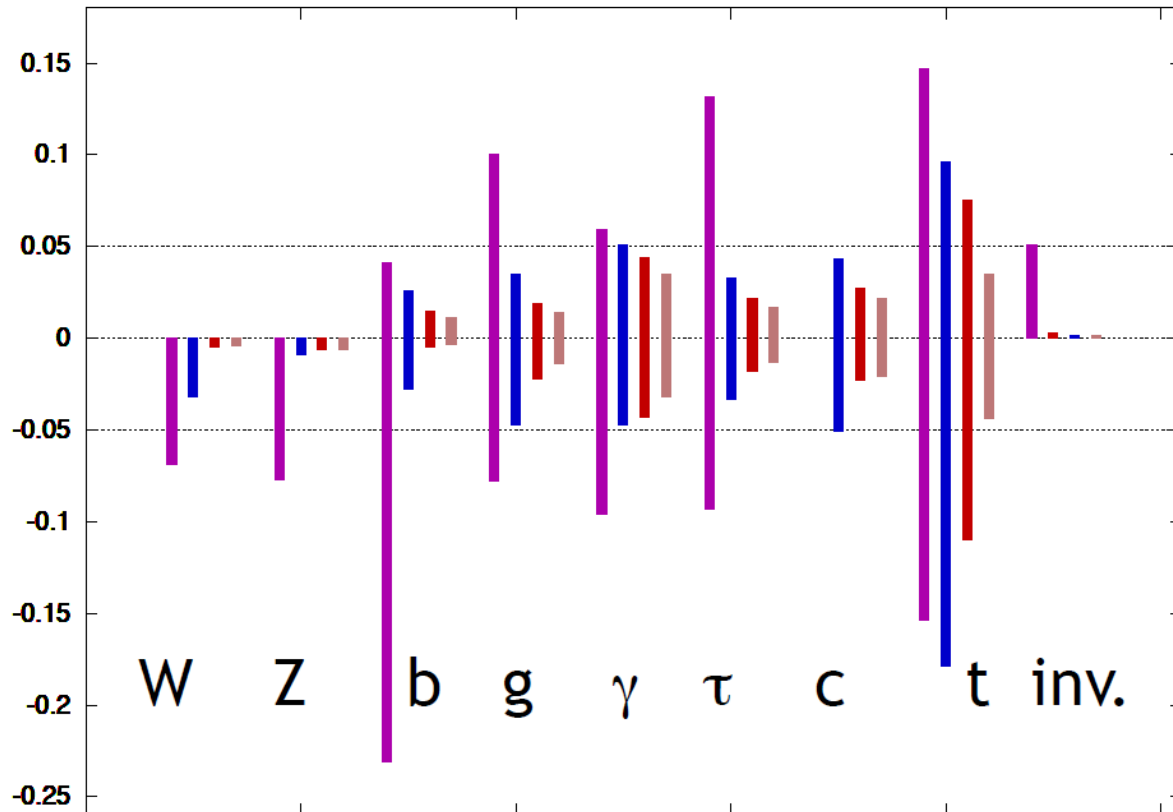
LHC: 300 fb^{-1} , 1 detector @ $\sqrt{s} = 14 \text{ TeV}$

HLC: $250 \text{ fb}^{-1} e^+e^-$ @ $\sqrt{s} = 250 \text{ GeV}$

ILC: $+500 \text{ fb}^{-1} e^+e^-$ @ $\sqrt{s} = 500 \text{ GeV}$

ILCTEV: $+1000 \text{ fb}^{-1} e^+e^-$ @ $\sqrt{s}=1000 \text{ GeV}$

$g(hAA)/g(hAA)|_{SM} - 1$ LHC/ILC1/ILC/ILCTeV



Model Dependent Coupling Fits

Alternatively, ILC can fit for the κ_i coupling scaling factors of arXiv : 1029.0040.

Coupling Comparison

ILC projections are from Tim Barklow. The rest is mostly taken from the presentation by Patrick Janot at the BNL workshop. The LHC numbers are *per experiment* (unless noted) of CMS projections of two scenarios of systematics assumptions.

Facility	LHC	HL-LHC	ILC	Full ILC	CLIC	LEP3 (4 IP)	TLEP (4 IP)
Energy (GeV)	14,000	14,000	250	250+500+1000	350+500+1500	240	240+350
$\int \mathcal{L} dt$ (fb $^{-1}$)	300/expt	3000/expt	250	250+500+1000	500+500+1500	2000	10000+1400
N_H produced	1.7×10^7	1.7×10^8	80,000	370,000	618,000	600,000	3,200,000

ILC Scenario 1

coupling	250 GeV
κ_W	5.6 %
κ_Z	1.1 %
κ_t	9.8 %
κ_b	6.0 %
κ_τ	7.2 %
κ_γ	18.0 %
κ_g	8.6 %
Γ_0	11.3 %

	Measurement precision						
m_H (MeV)	100	50	35	35	70	26	7
$\Delta\Gamma_H$	–	–	11%	6%	6%	4%	1.3%
BR_{inv}	NA	NA	<0.8%	<0.8%	NA	<0.7%	<0.3%
$\Delta g_{H\gamma\gamma}$	5.1 – 6.5%	1.5 – 5.4%	18%	4.1%	NA	3.4%	1.4%
Δg_{Hgg}	5.7 – 11%	2.7 – 7.5%	6.4%	1.8%	NA	2.2%	0.7%
Δg_{HWW}	2.7 – 5.7% [†]	1.0 – 4.5% [†]	4.8%	1.4%	1%	1.5%	0.25%
Δg_{HZZ}	2.7 – 5.7% [†]	1.0 – 4.5% [†]	1.3%	1.3%	1%	0.25%	0.2%
$\Delta g_{H\mu\mu}$	< 30%	< 10%	–	16%	15%	14%	7%
$\Delta g_{H\tau\tau}$	5.1 – 8.5%	2.0 – 5.4%	5.7%	2.0%	3%	1.5%	0.4%
Δg_{Hcc}	–	–	6.8%	2.0%	4%	2.0%	0.25%
Δg_{Hbb}	6.9 – 15%	2.7 – 11%	5.3%	1.5%	2%	0.7%	0.22%
Δg_{Htt}	8.7 – 14%	3.9 – 8.0%	–	4.0%	3%	–	30%
Δg_{HHH}	–	30% [‡]	–	26%	16%	–	–

Note: with the luminosity upgrade, the ILC coupling precision improves by a factor of ~ 2 .

[†] assuming the same deviation for the HWW and HZZ couplings. [‡] two experiments.

Model Dependent Coupling Fits

Alternatively, ILC can fit for the κ_i coupling scaling factors of arXiv : 1029.0040.

Coupling Comparison

ILC projections are from Tim Barklow. The rest is mostly taken from the presentation by Patrick Janot at the BNL workshop. The LHC numbers are *per experiment* (unless noted) of CMS projections of two scenarios of systematics assumptions.

ILC Scenario 4

Facility	LHC	HL-LHC	ILC	Full ILC	CLIC	LEP3 (4 IP)	TLEP (4 IP)
Energy (GeV)	14,000	14,000	250	250+500+1000	350+500+1500	240	240+350
$\int \mathcal{L} dt$ (fb ⁻¹)	300/expt	3000/expt	250	250+500+1000	500+500+1500	2000	10000+1400
N_H produced	1.7×10^7	1.7×10^8	80,000	370,000	618,000	600,000	3,200,000

coupling	high-lumi
κ_W	0.57 %
κ_Z	0.47 %
κ_t	1.7 %
κ_b	1.2 %
κ_τ	1.7 %
κ_γ	3.4 %
κ_g	1.7 %
Γ_0	1.8 %

	Measurement precision						
m_H (MeV)	100	50	35	35	70	26	7
$\Delta\Gamma_H$	–	–	11%	6%	6%	4%	1.3%
BR_{inv}	NA	NA	<0.8%	<0.8%	NA	<0.7%	<0.3%
$\Delta g_{H\gamma\gamma}$	5.1 – 6.5%	1.5 – 5.4%	18%	4.1%	NA	3.4%	1.4%
Δg_{Hgg}	5.7 – 11%	2.7 – 7.5%	6.4%	1.8%	NA	2.2%	0.7%
Δg_{HWW}	2.7 – 5.7% [†]	1.0 – 4.5% [†]	4.8%	1.4%	1%	1.5%	0.25%
Δg_{HZZ}	2.7 – 5.7% [†]	1.0 – 4.5% [†]	1.3%	1.3%	1%	0.25%	0.2%
$\Delta g_{H\mu\mu}$	< 30%	< 10%	–	16%	15%	14%	7%
$\Delta g_{H\tau\tau}$	5.1 – 8.5%	2.0 – 5.4%	5.7%	2.0%	3%	1.5%	0.4%
Δg_{Hcc}	–	–	6.8%	2.0%	4%	2.0%	0.25%
Δg_{Hbb}	6.9 – 15%	2.7 – 11%	5.3%	1.5%	2%	0.7%	0.22%
Δg_{Htt}	8.7 – 14%	3.9 – 8.0%	–	4.0%	3%	–	30%
Δg_{HHH}	–	30% [‡]	–	26%	16%	–	–

Note: with the luminosity upgrade, the ILC coupling precision improves by a factor of ~ 2 .

[†] assuming the same deviation for the HWW and HZZ couplings. [‡] two experiments.