e^+e^- colliders

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Where we stand politically. 2013 Strategy update

There is a strong scientific case for an electron-positron collider… The Technical Design Report of the International Linear Collider (ILC) has been completed, with large European participation... Europe looks forward to a proposal from Japan to discuss a possible participation.

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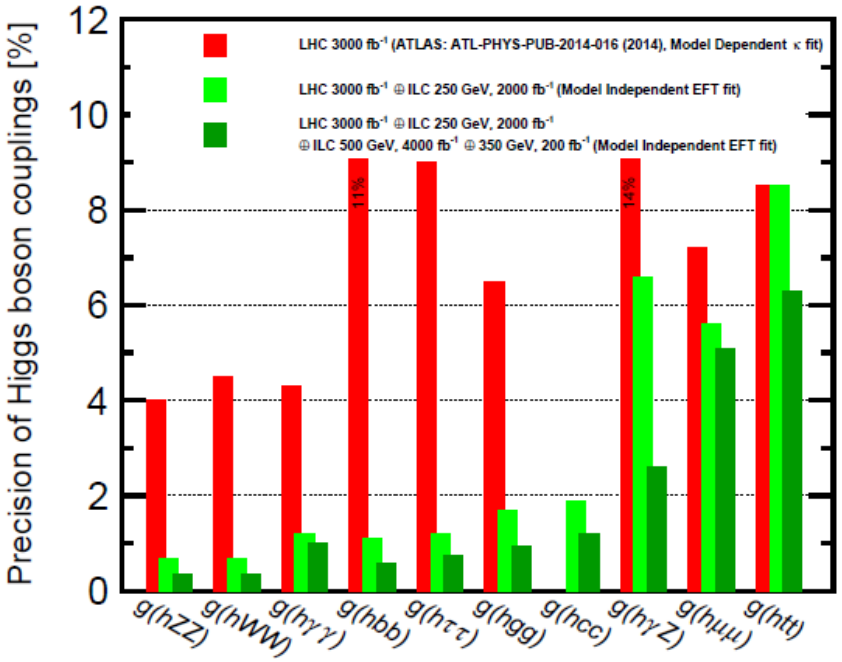
The e^+e^- market place

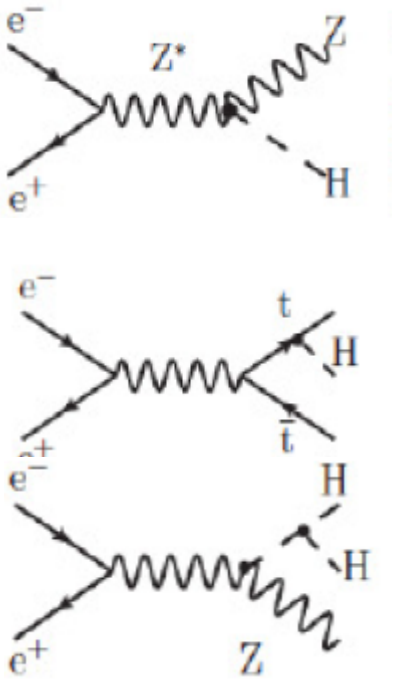
Collider	$\sqrt{s}$ (TeV)	$\int \mathcal{L}$ (ab^{-1})	Location	Type	Date	Mature
ILC	0.25 0.5,1.0 ?	2	Japan	Linear	>2030	Shovel-ready TDR (2013)
CLIC	0.38 1.5,3	0.5 1.5,2	CERN	Linear	>2035	CDR (2012)
FCC-ee	0.25/0.36	10/2.6	CERN	Circular	>2035	No
LEP3	0.9/2.5	1	CERN	Circular (FCC magnets in LHC ring)	>2035	No
CEPC	0.25	5	China	Circular		CDR (2017)

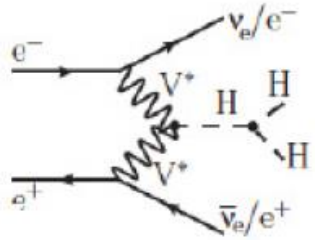
$e^+ + e^- \Leftrightarrow$ high precision Higgs factory

$$\frac{\sigma(pp \to H + X)}{\sigma(pp \to X)} : 10^{-9} \qquad \frac{\sigma(e^+e^- \to H + X)}{\sigma(e^+e^- \to X)} : 0.01$$



ILC~CLIC~LEP3 sensitivity
Further improvements with FCCee
(factors ~2-5)





$\sqrt{s} = 250$ GeV

g_Z, BR's ,

(LHC)-invisible

+

$\sqrt{s} = 500$ GeV

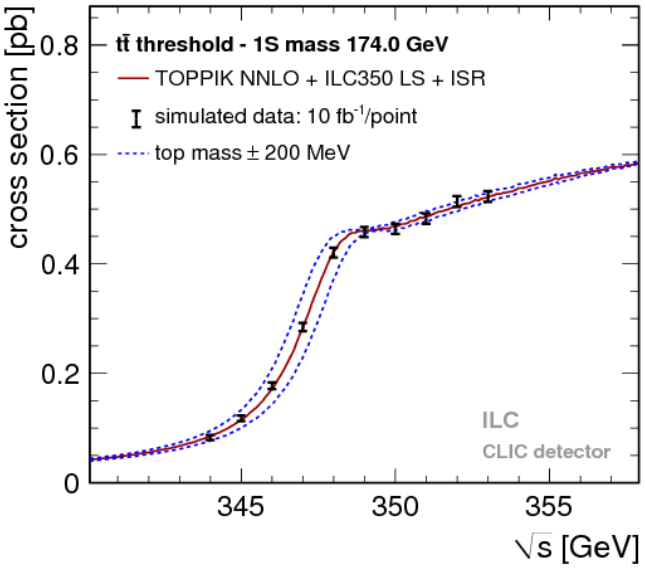
g_t, g_{HHH}

+

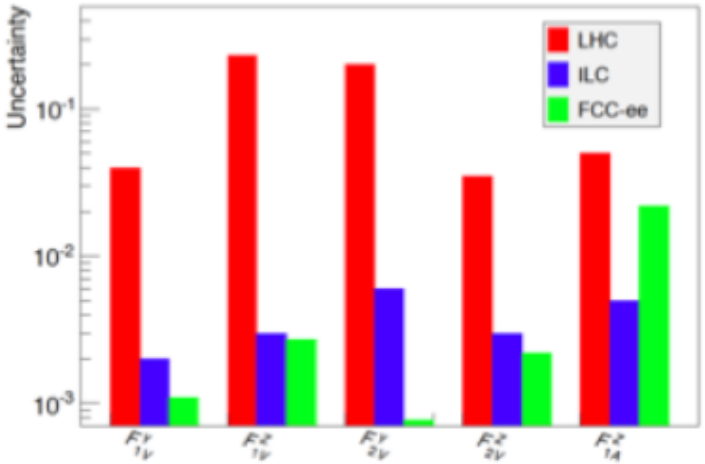
$\sqrt{s} = 1000$ GeV

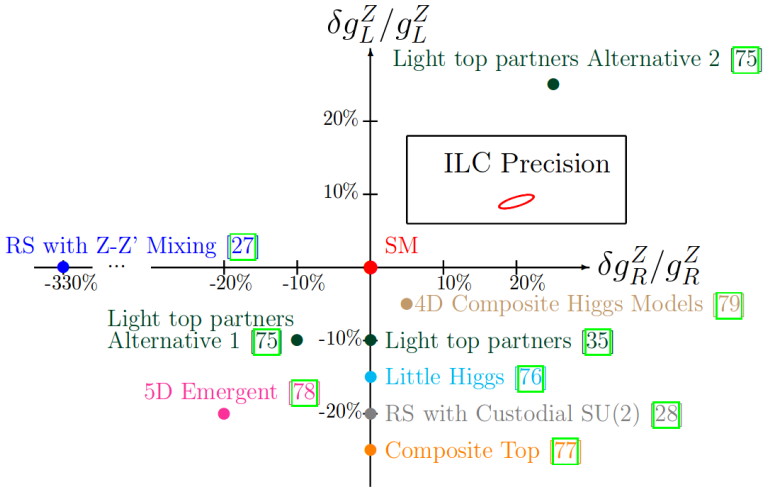
g_{HHH}

Top Physics ($\sqrt{s} > 340$ GeV)



High precision threshold scan

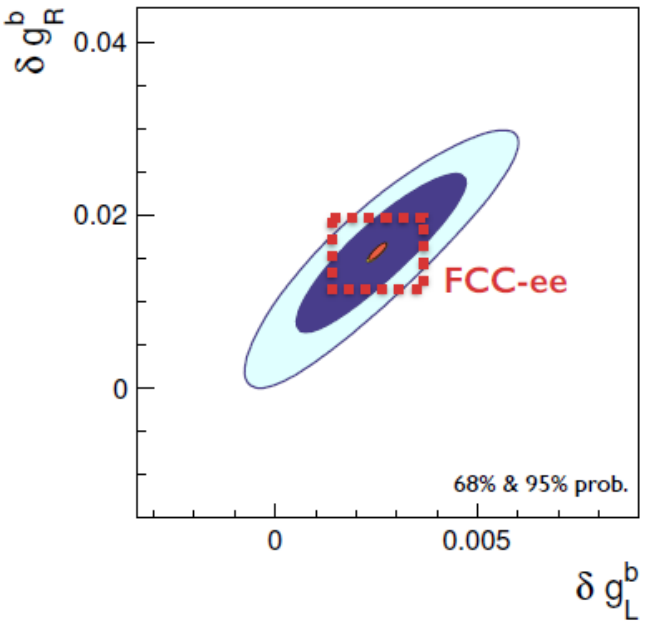




Boson couplings

Related areas

	Current Data	HL-LHC	ILC	FCCee	CEPC
$\alpha_s(M_Z^2)$	0.1180±0.0010				
$\Delta\alpha^{(5)}_{\rm had}(M_Z^2)$	0.02750±0.00033				
M_Z[GeV]	91.1875±0.0021			±0.0001	±0.0005
m_t[GeV]	173.34±0.76	±0.6	±0.017	±0.014	
m_H[GeV]	125.09±0.24	±0.05	±0.015	±0.007	±0.0059
M_W[GeV]	80.385±0.015	±0.011	±0.0024	±0.001	±0.003
Γ_W[GeV]	2.085±0.042			±0.005	
Γ_Z[GeV]	2.4952±0.0023			±0.0001	±0.0005
σ^0_h[nb]	41.540±0.037			±0.025	
$\sin^2\theta^{\rm lept}_{\rm eff}$	0.2324±0.0012			±0.0001	±0.000023
$P^{\rm pol}_\tau$	0.1465±0.0033			±0.0002	
A_ℓ	0.1513±0.0021			±0.000021	
A_c	0.670±0.027			±0.01	
A_b	0.923±0.020			±0.007	
$A^{0,\ell}_{\rm FB}$	0.0171±0.0010			±0.00001	±0.0010
$A^{0,c}_{\rm FB}$	0.0707±0.0035			±0.0008	
$A^{0,b}_{\rm FB}$	0.0992±0.0016			±0.0004	±0.00014
R^0_ℓ	20.767±0.025			±0.001	±0.007
R^0_c	0.1721±0.0030			±0.0005	
R^0_b	0.21629±0.00066			±0.00017	±0.00018



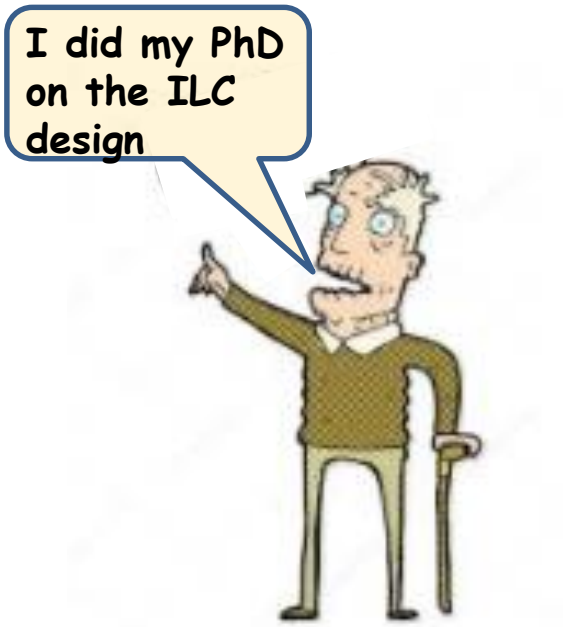
Non-standard *Zbb* couplings.

Factor ： 5 improvements in electoweak precision observables.

+Dedicated searches for new phenomena inc. dark matter in "cracks" left by the LHC.

The ILC

- 1990s -TESLA (Europe), NLC (US), JLC (Japan)
- 2005 - Global Design Effort formed.
- 2011 - Japanese Expression of Interest to host.
- 2013 - Technical Design Report
  - Site: Kitakami - northern Japan
- 2018
  - Japanese MEXT study groups Physics, TDR and cost, manpower, impact and spin-offs
  - Waiting for picture from the LHC to become clear.
  - International discussions between funding agencies
  - Decision in 2018 in time for PP strategy ?



Original plan $\sqrt{s}$=500 GeV $\rightarrow$ 1 TeV . Too expensive!

2018: $\sqrt{s}$=250 GeV , maybe 380 GeV, 500 GeV

A Higgs factory $e^+ + e^- \rightarrow ZH$ + limited EW tests + BSM search potential.

Lose top, trilinear (g_{HHH}),some EW tests + BSM searches ?

Where we do we want to stand in 2020 ?

2013

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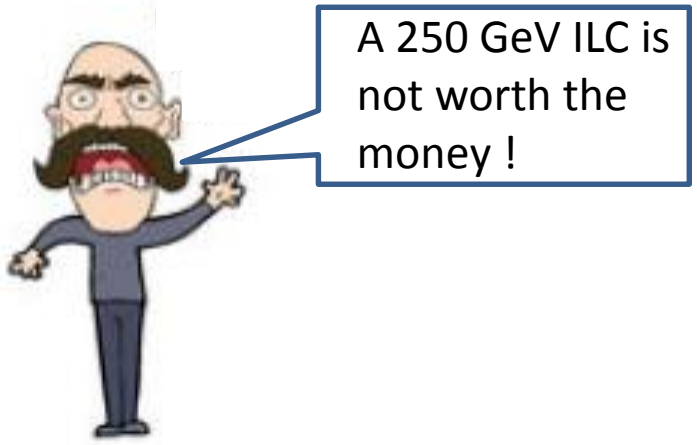

Is the reduced ILC still what is needed ?
What works best for European PP ?
What works best for us ?

FCCee (or CEPC) in the strategy? How well motivated in light of Run 2 results ? HE-LHC/LEP3 ?