FCC-ee Phenomenology

(an incomplete, personal and biased review)

Seventh FCC-ee Physics Workshop

June 19-12, 2014

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Rich physics perspectives for e^+e^- machines

TLEP (physics case) '13

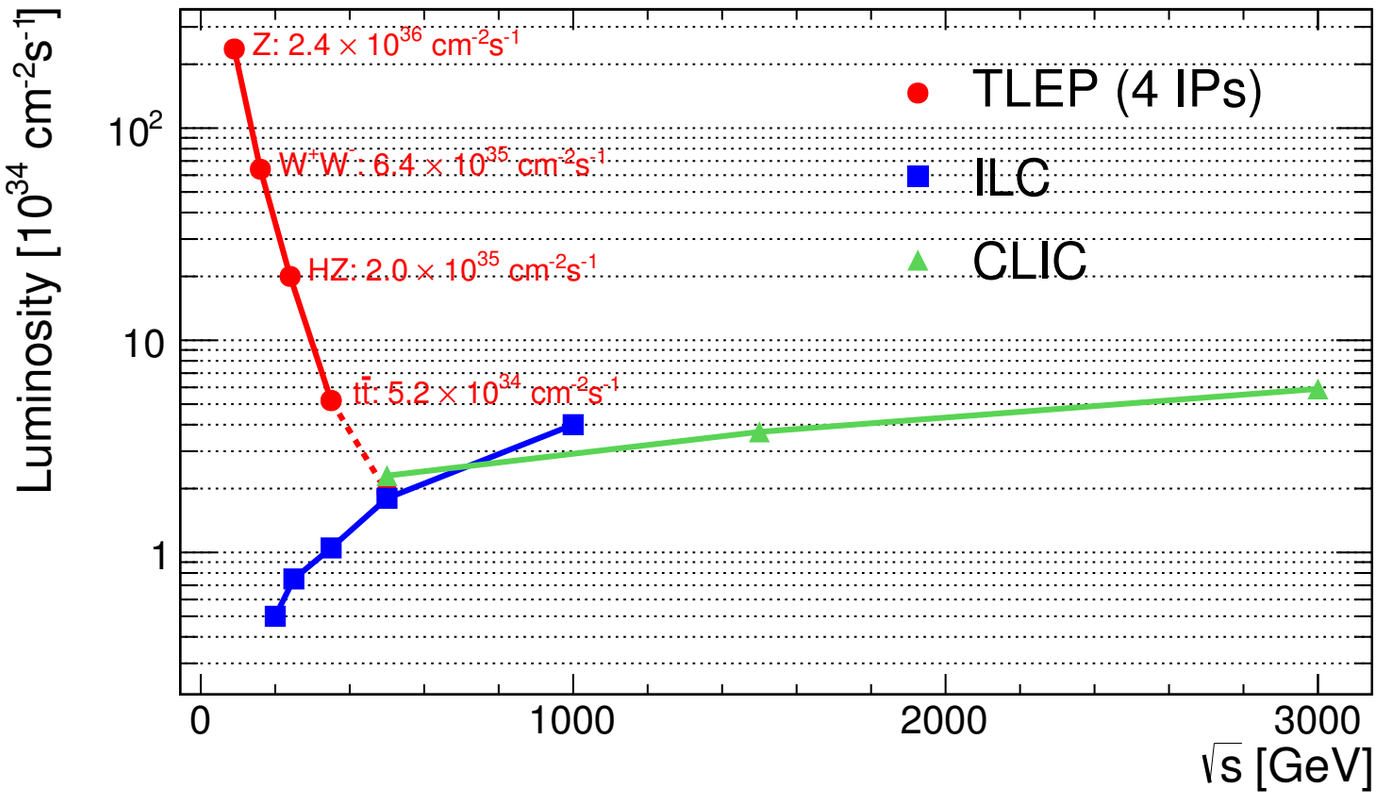

Figure 3. Instantaneous luminosity, in units of 10^{34} cm^{-2}s^{-1}, expected at TLEP (full red line), in a configuration with four interaction points operating simultaneously, as a function of the centre-of-mass energy. For illustration, the luminosities expected at linear colliders, ILC (blue line) and CLIC (green line), are indicated in the same graph. As explained in the text, the TLEP luminosity at each interaction point would increase significantly if fewer interaction points were considered. The possible TLEP energy upgrade up to 500 GeV, represented by a dashed line, is briefly discussed in section 5.

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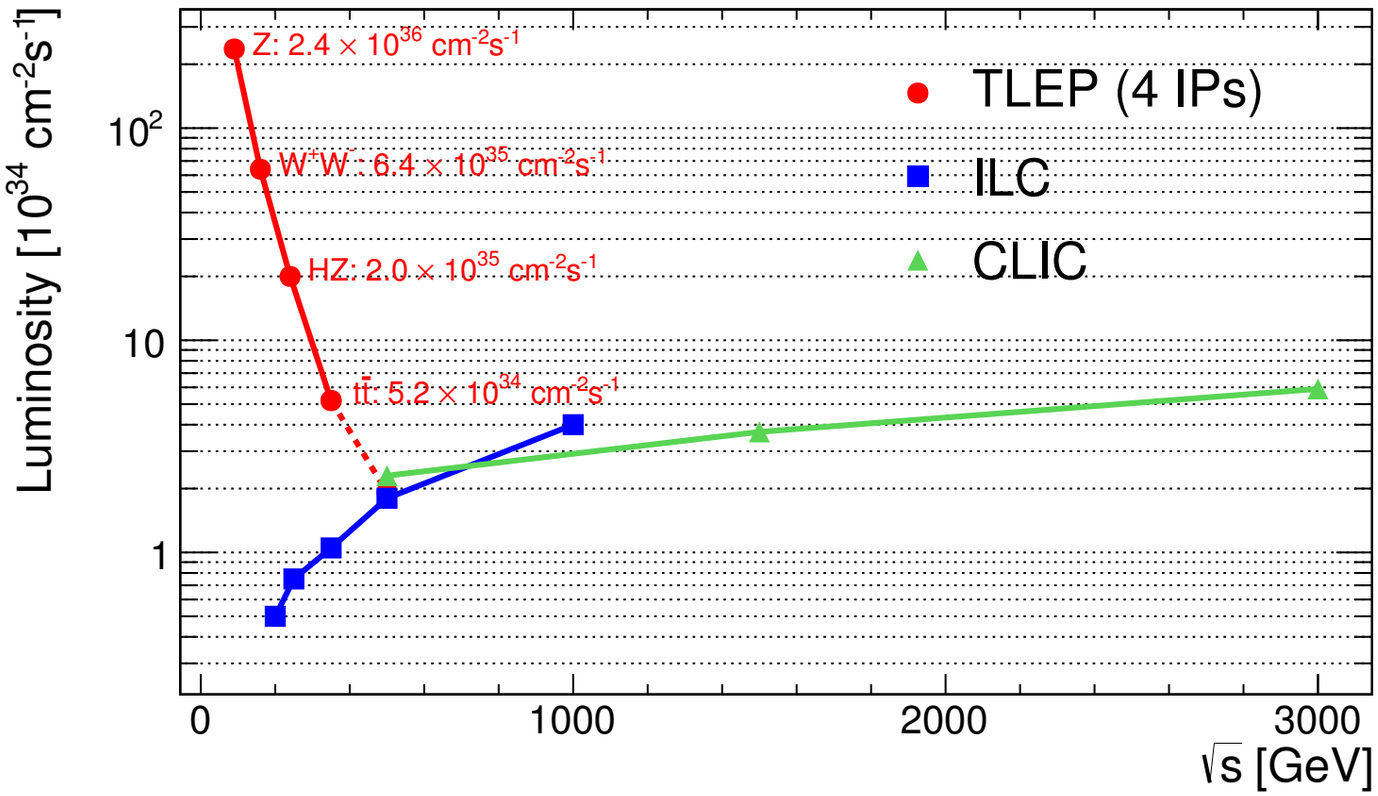

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What are the luminosity/energy good for?

- Higgs boson physics
- indirect search for new physics
- top quark physics

Rich physics perspectives for FCC machines

-- Higgs physics:
- precision studies
- higher-dimensional operators, composite Higgs
- rare and exotic decays
- multiple Higgs production
- extra Higgs bosons

-- Interface with cosmology:
- dark matter
- baryogenesis
- right-handed/(almost) sterile neutrinos

-- New physics related to EWSB:
- WW scattering
- supersymmetry
- extra dimensions
- composite models

-- Rare flavour-changing processes:
- Rare H decays
- Rare Z decays
- Rare top decays
- lepton-flavour violation

-- Extensions of the SM:
- extra vector-like fermions
- $SU(2)_R$ models
- leptoquarks

-- QCD:
- Perturbation theory
- Modelling final states

-- EW/SM precision issues
- parameter measurements (m_{top}, m_W)
- higher-order EW corrections
- triple and quadruple gauge boson (anomalous) couplings
- top (anomalous) couplings
- charm/bottom flavor studies

A good share between FCC-ee & FCC-hh

Higgs and lepton colliders: a love affair

Peskin, LCWS, Tokyo '13

Lepton colliders bring important advantages to the study of the Higgs Boson couplings:

Higgs rates are 1% of the total cross section, not 10^{-10}.

Low backgrounds and high flavor tagging efficiency make possible the direct observation of hadronic decay channels $h \to b\bar{b}, c\bar{c}, gg$.

The reaction $e^+e^- \to Zh$ provides tagged Higgs decay. This gives a tool for measuring branching fractions and a way to discover invisible and otherwise unexpected Higgs decays.

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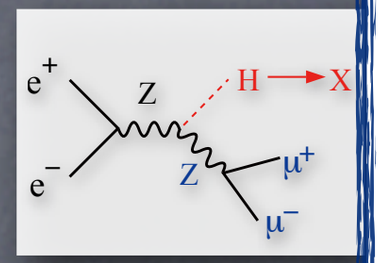
Recent studies make the case even stronger…

Higgs @ e^+e^-: the energy thresholds

TLEP@240

- ZH @ 230 GeV (=mZ+mH+20GeV) : 250fb^-1 - 500fb^-1 $+\nu\nu H$
  - mh, gamma_h, JCP
  - Gauge quantum numbers
  - absolute measurement of ZZH coupling (Recoil mass)
  - BR(h->VV,qq,ll,invisible) : V=W/Z(direct), g,A(loop)
    -> Yukawa couplings except for top



K. Fuji, Kobe '12

Higgs @ e^+e^-: the energy thresholds

TLEP@240

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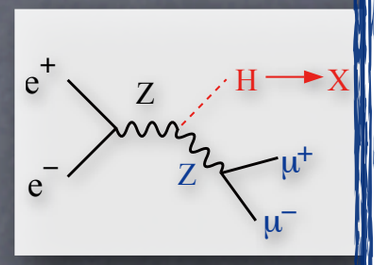
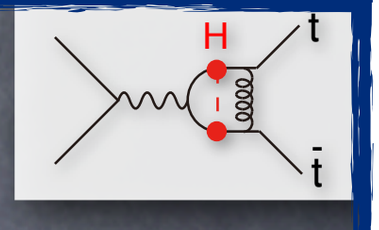
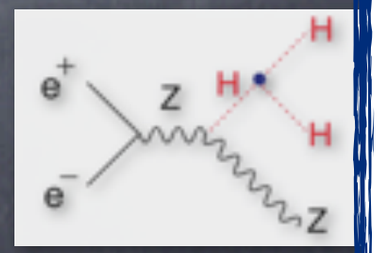


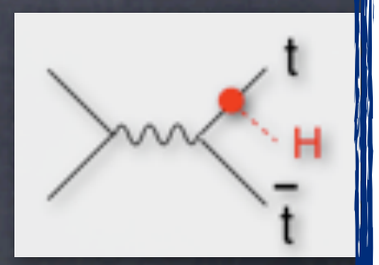
- ttbar @ 340-350GeV (~2mt) : 200fbˆ-1, solid threshold (+ZH)
  - threshold scan -> Indirect top Yukawa meas.
  - AFB, momentum distribution
  - Form factor measurements

Possibility of γγ → HH @ 350GeV



- ZHH @ 500GeV (~mZ+2mH+170GeV) : 2abˆ-1 +ννHH@1TeV
  - cross section peaks at around 500GeV -> Higgs self-coupling
- ttbarH @ 500GeV (~2mt+mH+30GeV) : 1abˆ-1
  - Optimum at around 700GeV but QCD enhancement allows measurement concurrent to ZHH -> Direct top Yukawa meas.



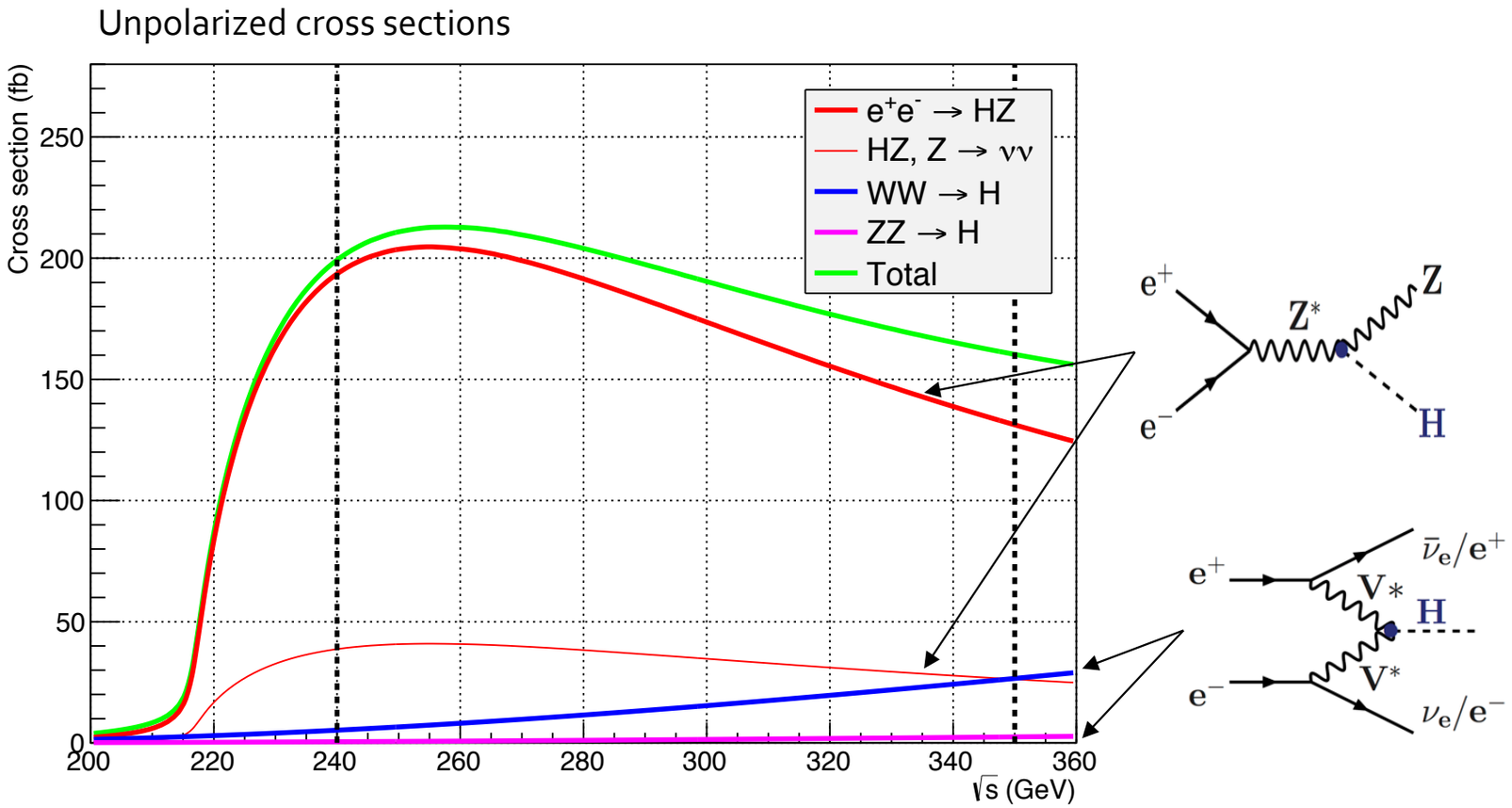


TLEP@350/500

K. Fuji, Kobe '12

Higgs @ TLEP

TLEP (physics case) '13



	TLEP 240	ILC 250
Total Integrated Luminosity (ab^{-1})	**10**	0.25
Number of Higgs bosons from $\mathrm{e^+e^-} \to \mathrm{HZ}$	**2,000,000**	70,000
Number of Higgs bosons from boson fusion	**50,000**	3,000

	TLEP 240	ILC 250
σ_{HZ}	**0.4%**	2.5%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mathrm{b\bar{b}})$	**0.2%**	1.1%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mathrm{c\bar{c}})$	**1.2%**	7.4%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mathrm{gg})$	**1.4%**	9.1%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mathrm{WW})$	**0.9%**	6.4%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \tau\tau)$	**0.7%**	4.2%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mathrm{ZZ})$	**3.1%**	19%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \gamma\gamma)$	**3.0%**	35%
$\sigma_{\mathrm{HZ}} \times \mathrm{BR}(\mathrm{H} \to \mu\mu)$	**13%**	100%

TLEP = the ultimate Higgs factory

Higgs & New Physics @ e^+e^- colliders

Precision /indirect searches (high lumi.) vs. direct searches (high energy)

NP

typical mass scale

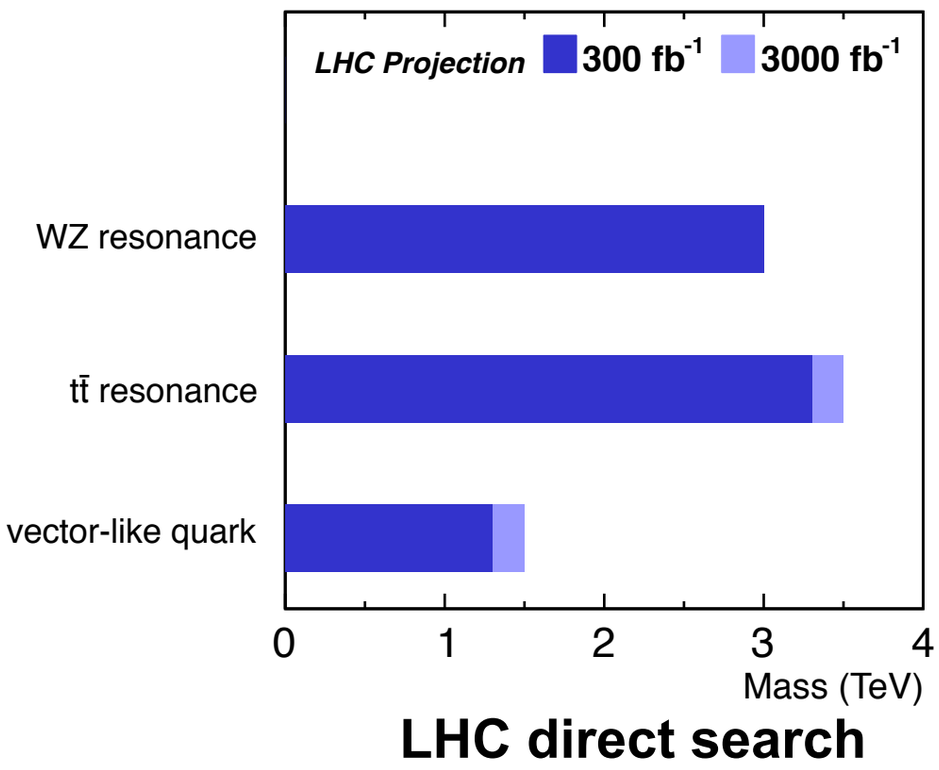
$M = g_* f$

SM

EW scale v=246GeV

g, g', y_t

g^2_{SM}/g_*



LHC direct search

- Precision Higgs study: $\xi \equiv \frac{\delta g}{g} = \frac{v^2}{f^2}$
- Direct searches for resonances: $m_\rho \approx g_* f$

Which one is doing best?
it depends on value of g_*

Higgs & New Physics @ e^+e^- colliders

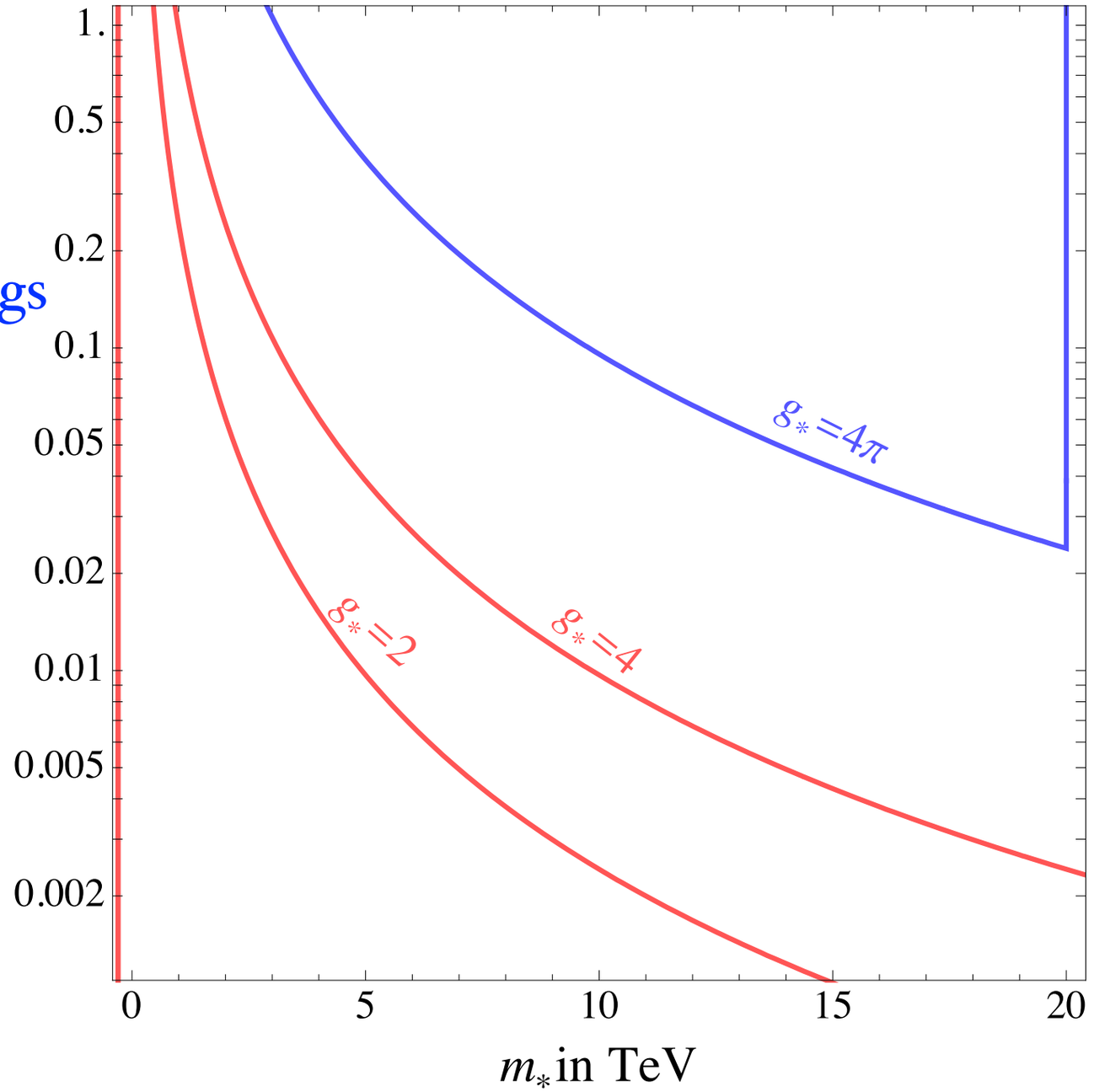
Precision /indirect searches (high lumi.) vs. direct searches (high energy)

Mass reach:

ee machines are best to test strongly coupled NP

pp machines are best to test weakly coupled NP

Higgs couplings



direct searches

Rattazzi, BSM@100TeV, CERN '1

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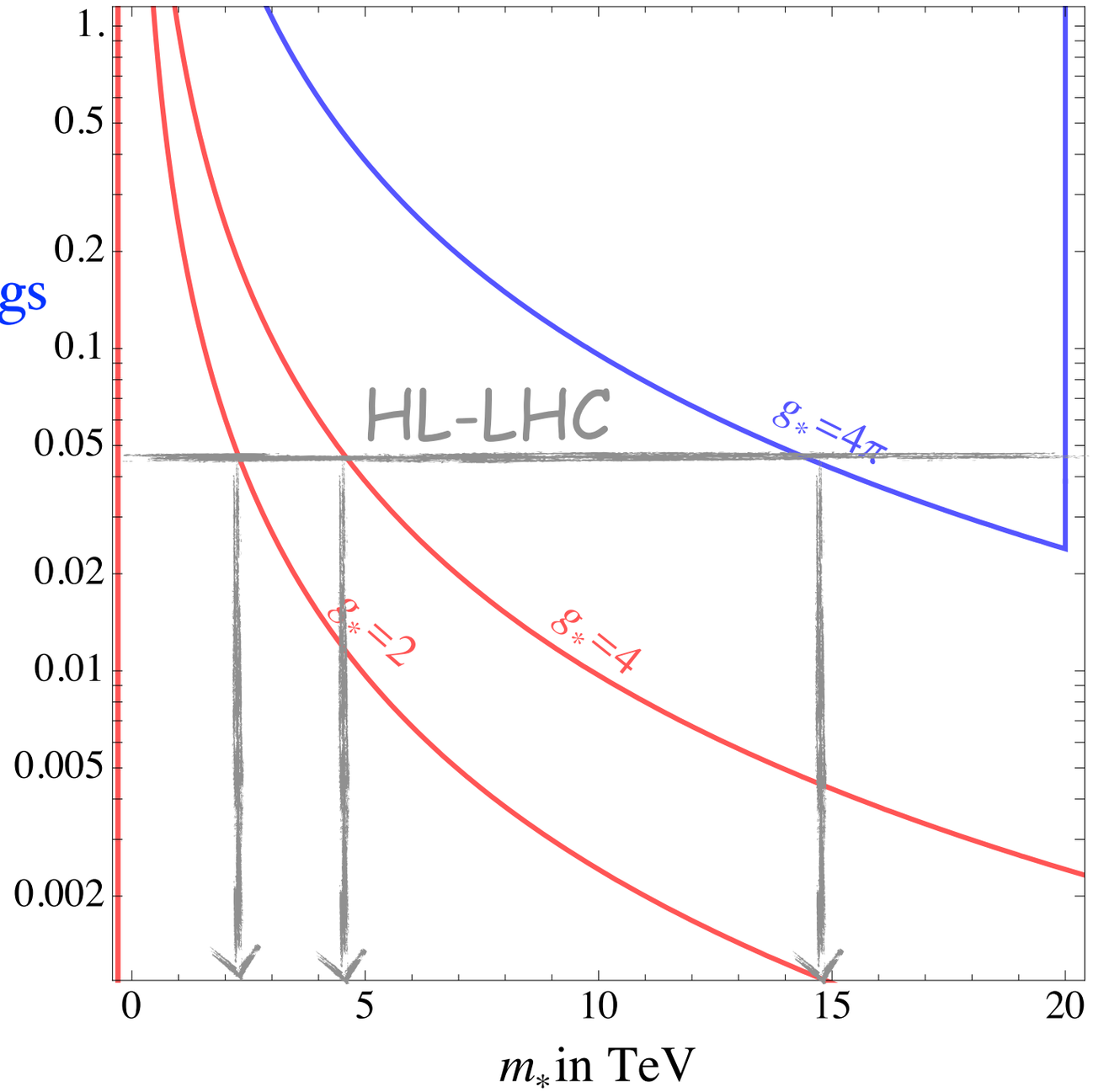

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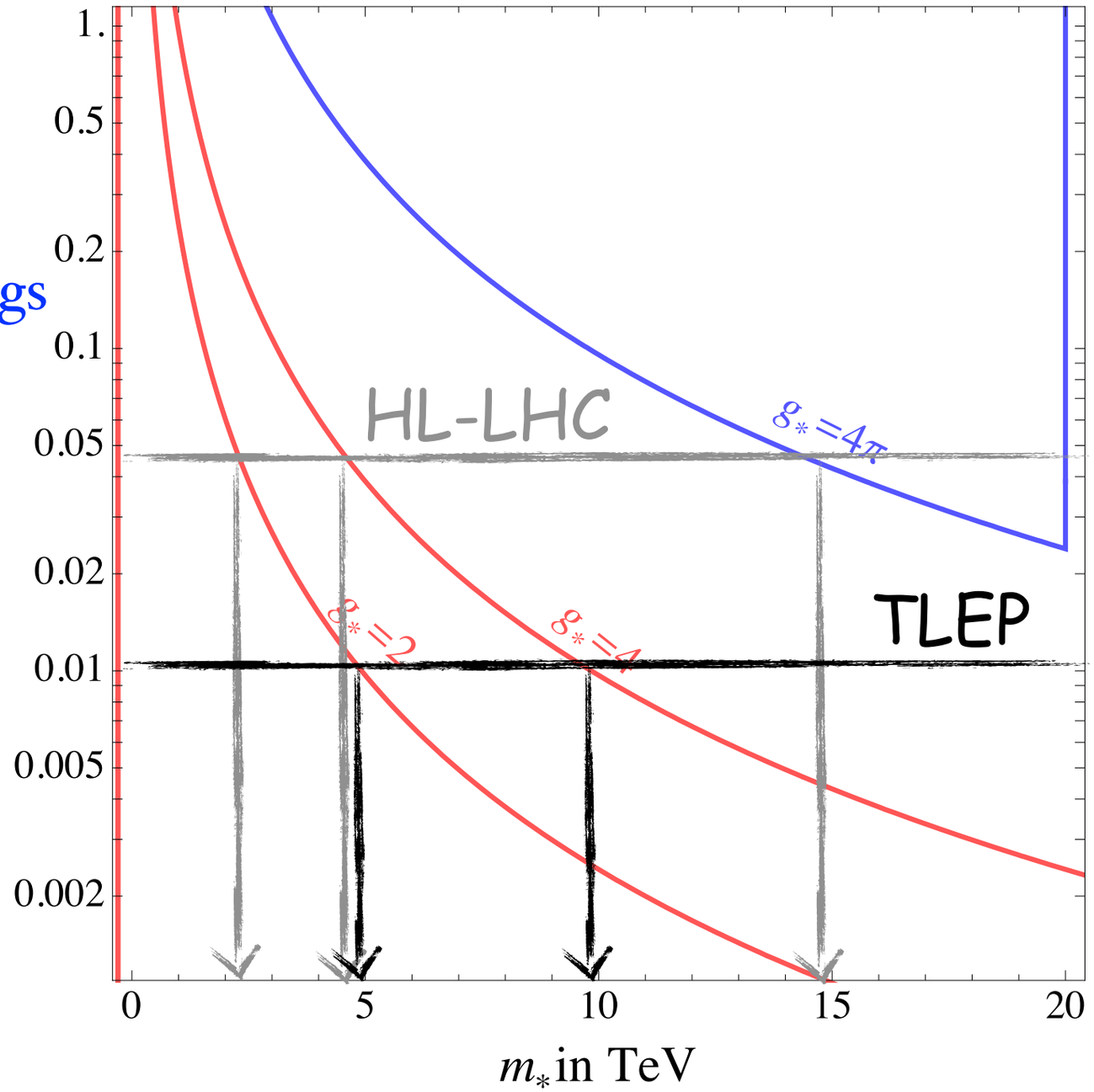

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Complementarity Higgs & EW precision data

The benefit of being precise

LEP: 10^6 Z's ➠ TLEP: 10^{12} Z's

The benefit of being precise

LEP: 10^6 Z's ➠ TLEP: 10^{12} Z's

TLEP (physics case) '13

Quantity	Physics	Present precision	Measured from	Statistical uncertainty	Systematic uncertainty	Ratio TLEP/LEP
$m_{\rm Z}$ (keV)	Input	91187500 ± 2100	Z Line shape scan	5 (6)	< 100	20
$\Gamma_{\rm Z}$ (keV)	$\Delta\rho$ (not $\Delta\alpha_{\rm had}$)	2495200 ± 2300	Z Line shape scan	8 (10)	< 100	20
R_ℓ	$\alpha_{\rm s}, \delta_{\rm b}$	20.767 ± 0.025	Z Peak	0.00010 (12)	< 0.001	25
N_ν	PMNS Unitarity, ...	2.984 ± 0.008	Z Peak	0.00008 (10)	< 0.004	
N_ν	... and sterile ν's	2.92 ± 0.05	Zγ, 161 GeV	0.0010 (12)	< 0.001	
$R_{\rm b}$	$\delta_{\rm b}$	0.21629 ± 0.00066	Z Peak	0.000003 (4)	< 0.000060	10
$A_{\rm LR}$	$\Delta\rho$, ϵ_3, $\Delta\alpha_{\rm had}$	0.1514 ± 0.0022	Z peak, polarized	0.000015 (18)	< 0.000015	100
$m_{\rm W}$ (MeV)	$\Delta\rho$, ϵ_3, ϵ_2, $\Delta\alpha_{\rm had}$	80385 ± 15	WW threshold scan	0.3 (0.4)	< 0.5	3
$m_{\rm top}$ (MeV)	Input	173200 ± 900	$t\bar{t}$ threshold scan	10 (12)	< 10	100

Table 9. Selected set of precision measurements at TLEP. The statistical errors have been determined with *(i)* a one-year scan of the Z resonance with 50% data at the peak, leading to 7×10^{11} Z visible decays, with resonant depolarization of single bunches for energy calibration at O(20min) intervals; *(ii)* one year at the Z peak with 40% longitudinally-polarized beams and a luminosity reduced to 20% of the nominal luminosity; *(iii)* a one-year scan of the WW threshold (around 161 GeV), with resonant depolarization of single bunches for energy calibration at O(20min) intervals; and *(iv)* a five-years scan of the $t\bar{t}$ threshold (around 346 GeV). The statistical errors expected with two detectors instead of four are indicated between brackets. The systematic uncertainties indicated below are only a "first look" estimate and will be revisited in the course of the design study.

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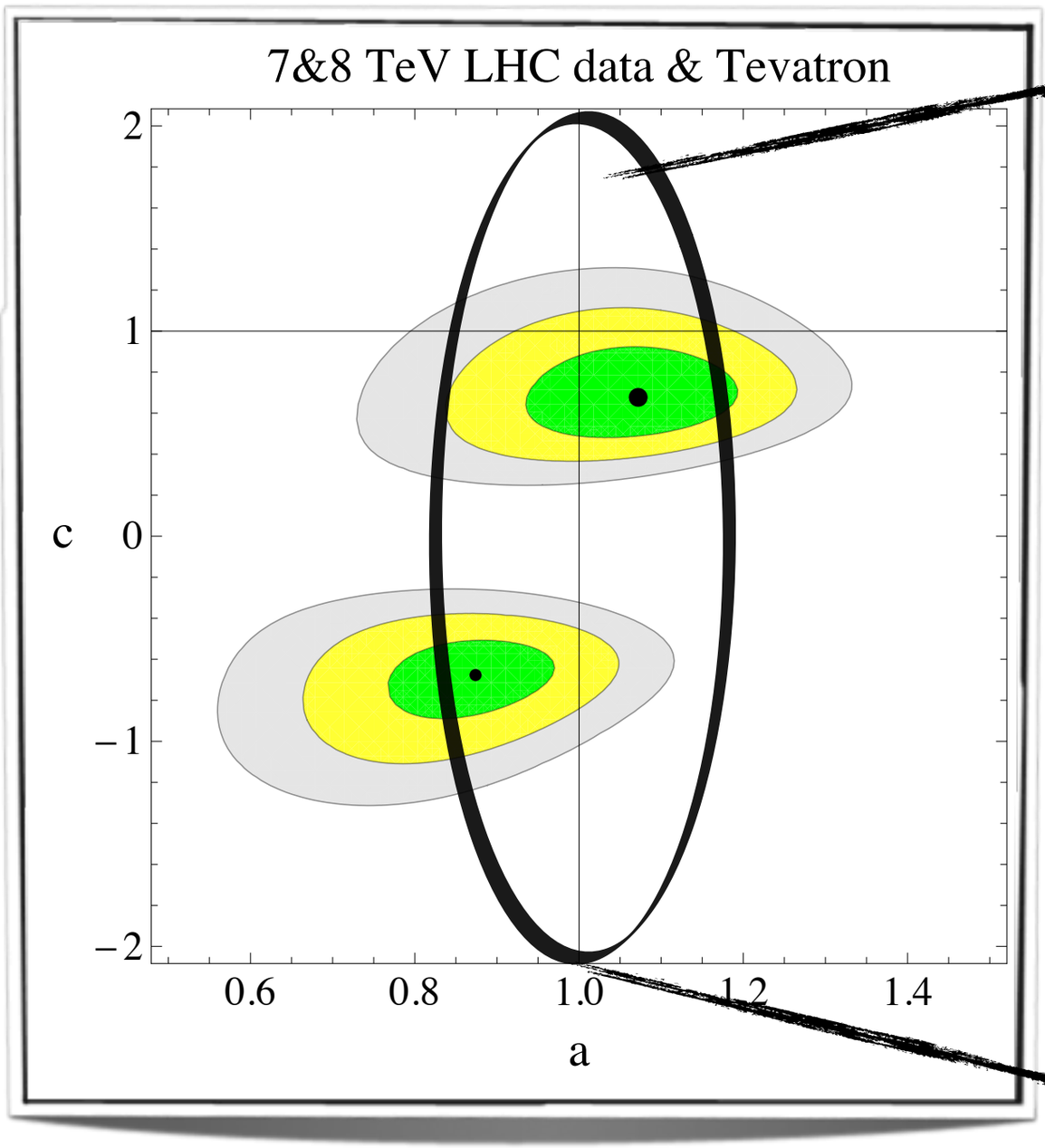
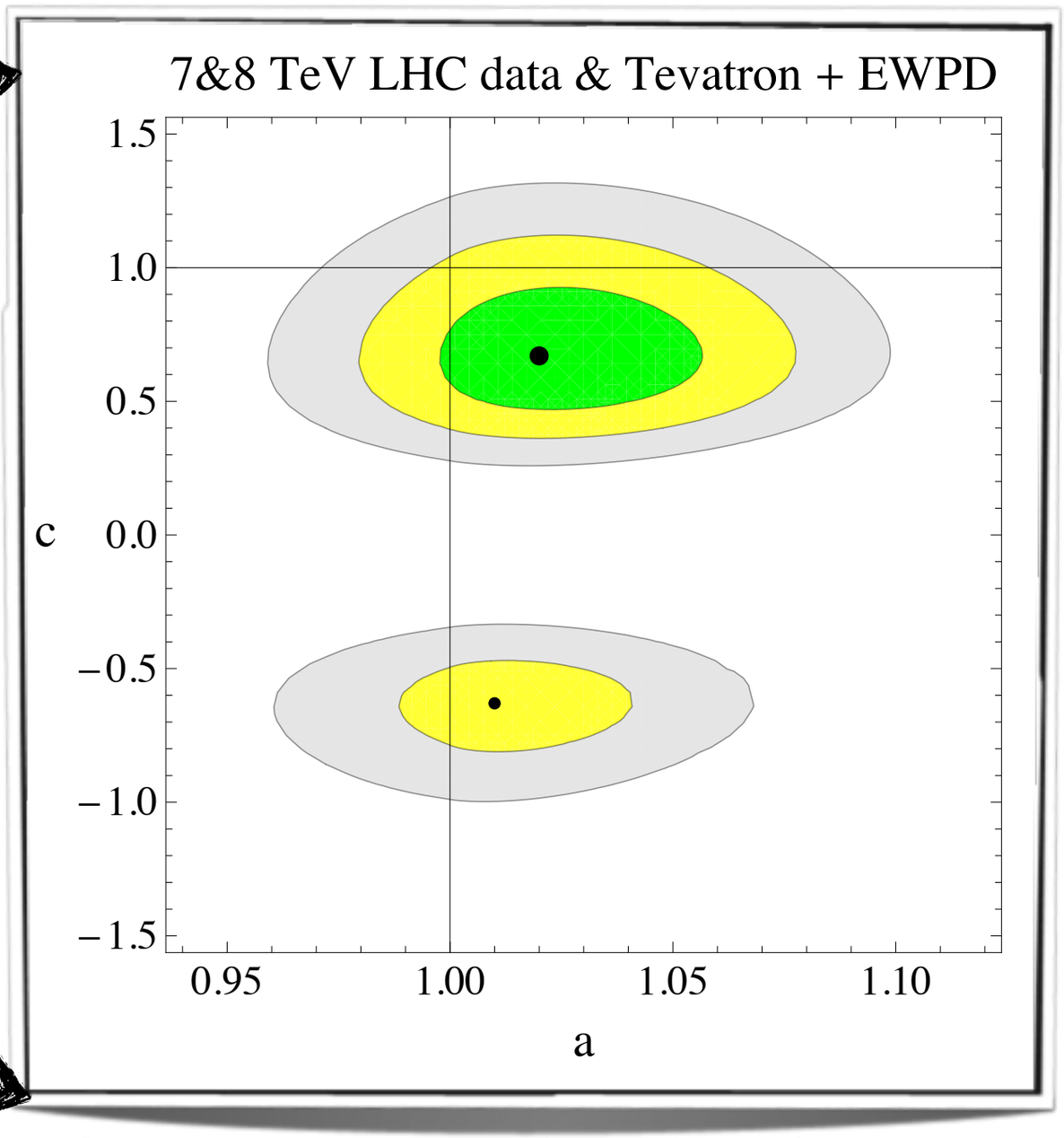
Would be important to present a prospective full EW fit!

Can we improve the systematics uncertainties?

Higgs physics: Don't forget LEP!

Espinosa, Grojean, Muhlleitner, Trott '12





EW data prefer value of 'a' close to 1

a shift of the hVV coupling induce oblique corrections
that are already highly constrained by LEP data

for other complete studies along this line, see

Falkowski, Riva, Urbano '13

Elias-Miro, Espinosa, Masso, Pomarol '13

RG-bounds on EW/Higgs data

Elias-Miro, Grojean, Gupta, Marzocca '13

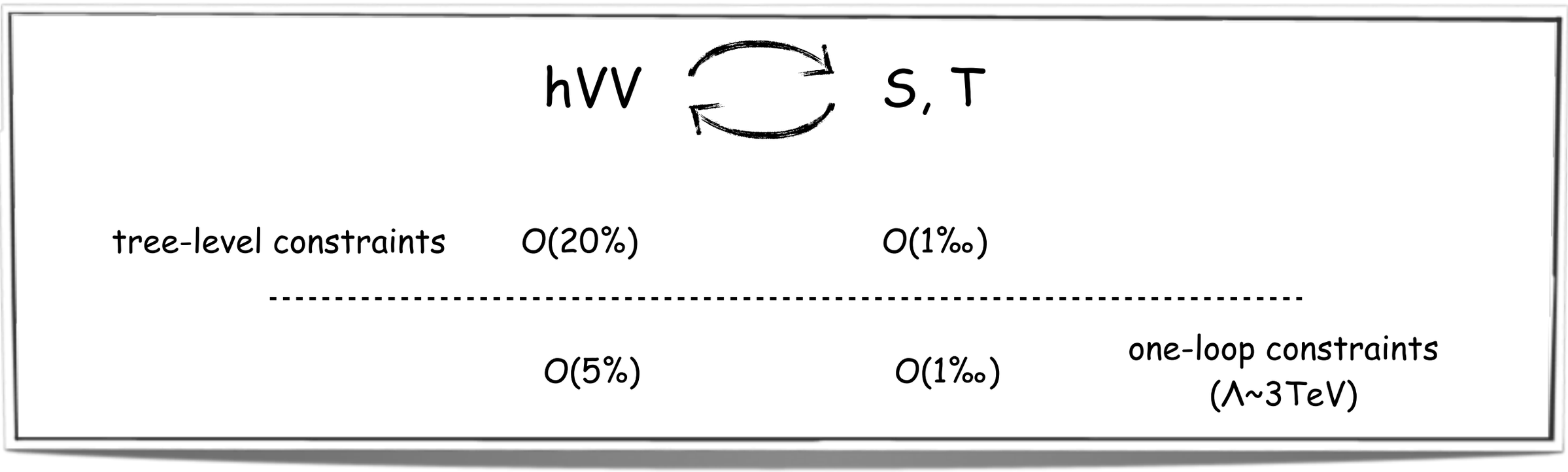
$$\mathcal{O}^{\rm obs}_{i|\rm EW} = \mathcal{O}^{\rm obs}_{i|\rm UV} + \Delta\mathcal{O}^{\rm obs}_{i|\rm RG}\left(\mathcal{O}^{\rm obs}_{j|\rm EW}, \Lambda\right)$$

absence of fine-tuning:

$$\left|\mathcal{O}^{\rm obs}_{i|\rm UV} - \mathcal{O}^{\rm SM}_{i|\rm EW}\right| < \epsilon_i^{\rm exp}$$

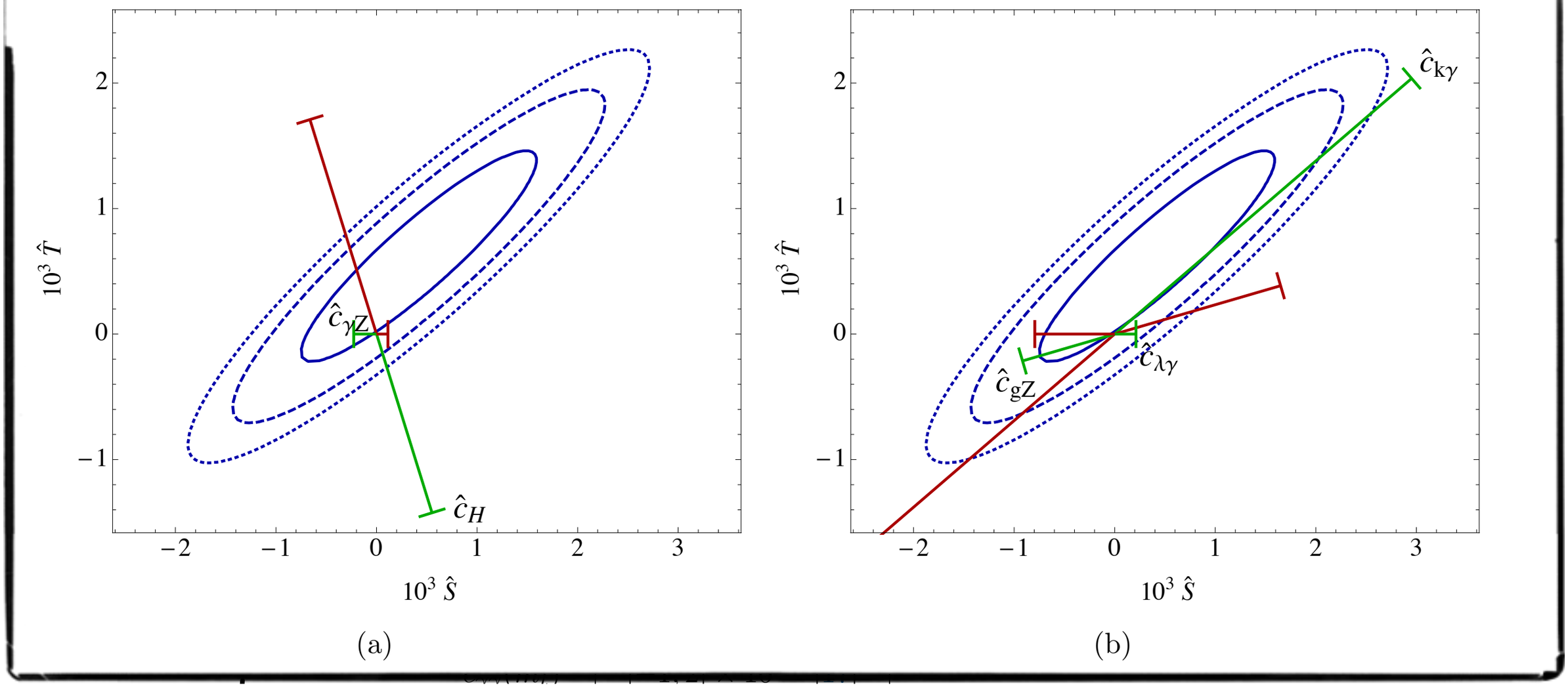
$$\left|\Delta\mathcal{O}^{\rm obs}_{i|\rm RG} - \mathcal{O}^{\rm SM}_{i|\rm EW}\right| < \epsilon_i^{\rm exp} \quad \Leftrightarrow \quad \mathcal{O}^{\rm obs}_{i|\rm EW} < \mathcal{E}_i\left(\epsilon_j^{\rm exp}, \Lambda\right)$$

Particularly relevant to bound the operators "poorly constrained" at tree-level through their mixing with operators "strongly constrained" at tree-level



RG-bounds on EW/Higgs data

Elias-Miro, Grojean, Gupta, Marzocca '13

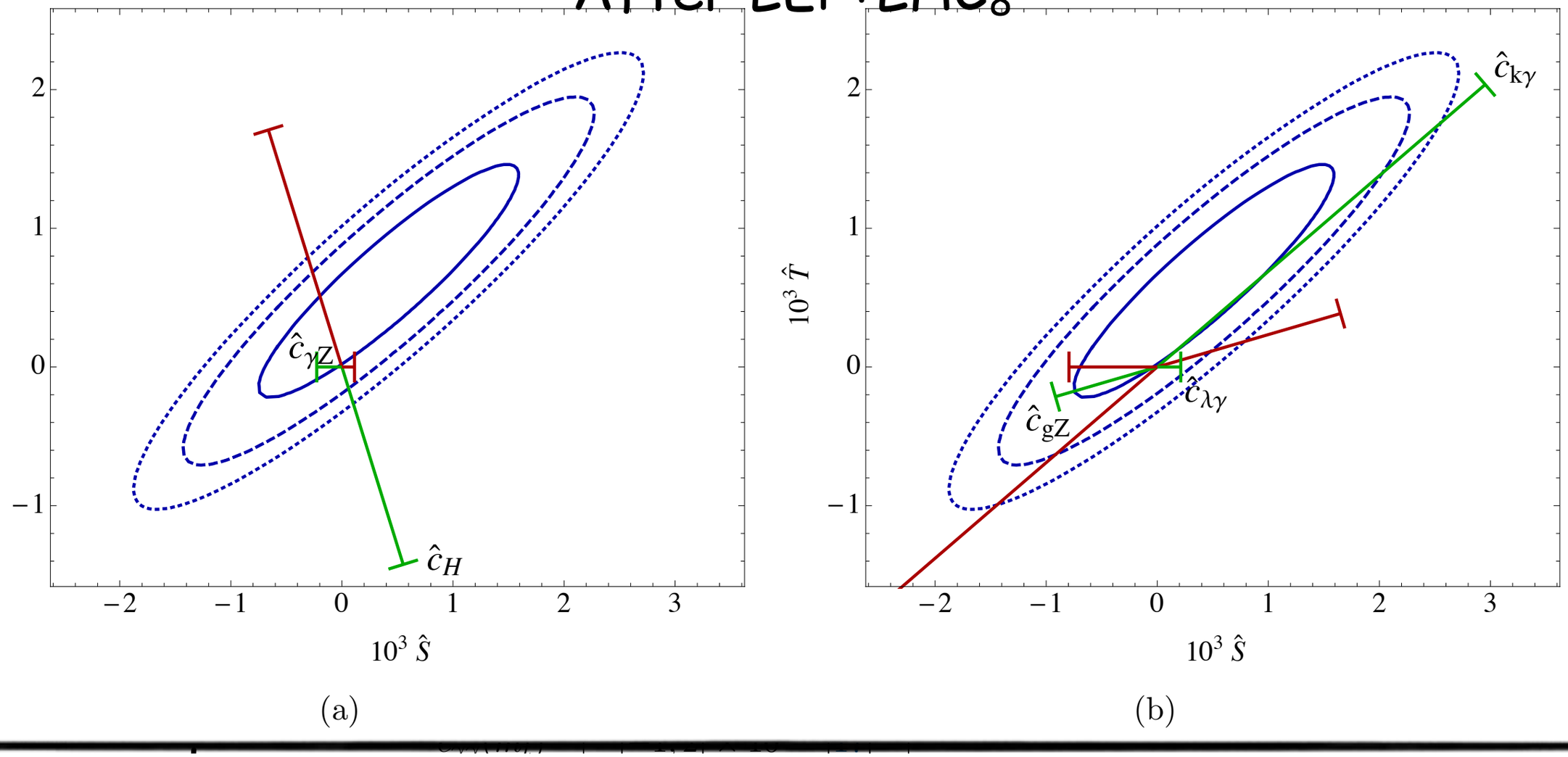


The blue ellipses represent the 68% (solid), 95% (dashed) and 99% (dotted) CL bounds on S and T.
The straight lines represent the RG-induced contribution to the oblique parameters
from the weakly constrained observable couplings, divided in Higgs couplings (a) and TGC couplings (b).
The length of the lines corresponds to their present 95% CL direct bounds.

RG-bounds on EW/Higgs data

Elias-Miro, Grojean, Gupta, Marzocca '13

After LEP+LHC$_8$



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EW/Higgs data: the TLEP improvement

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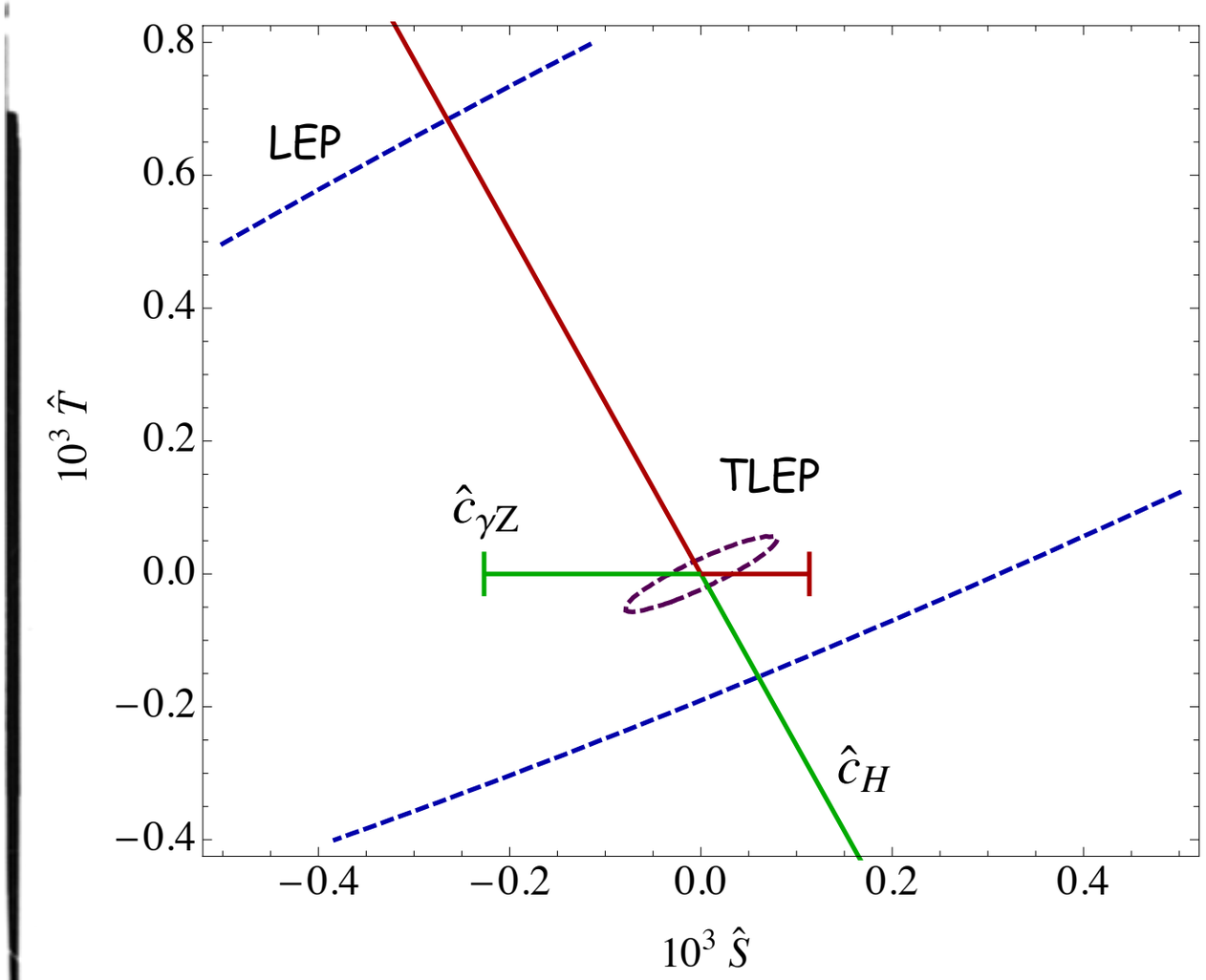

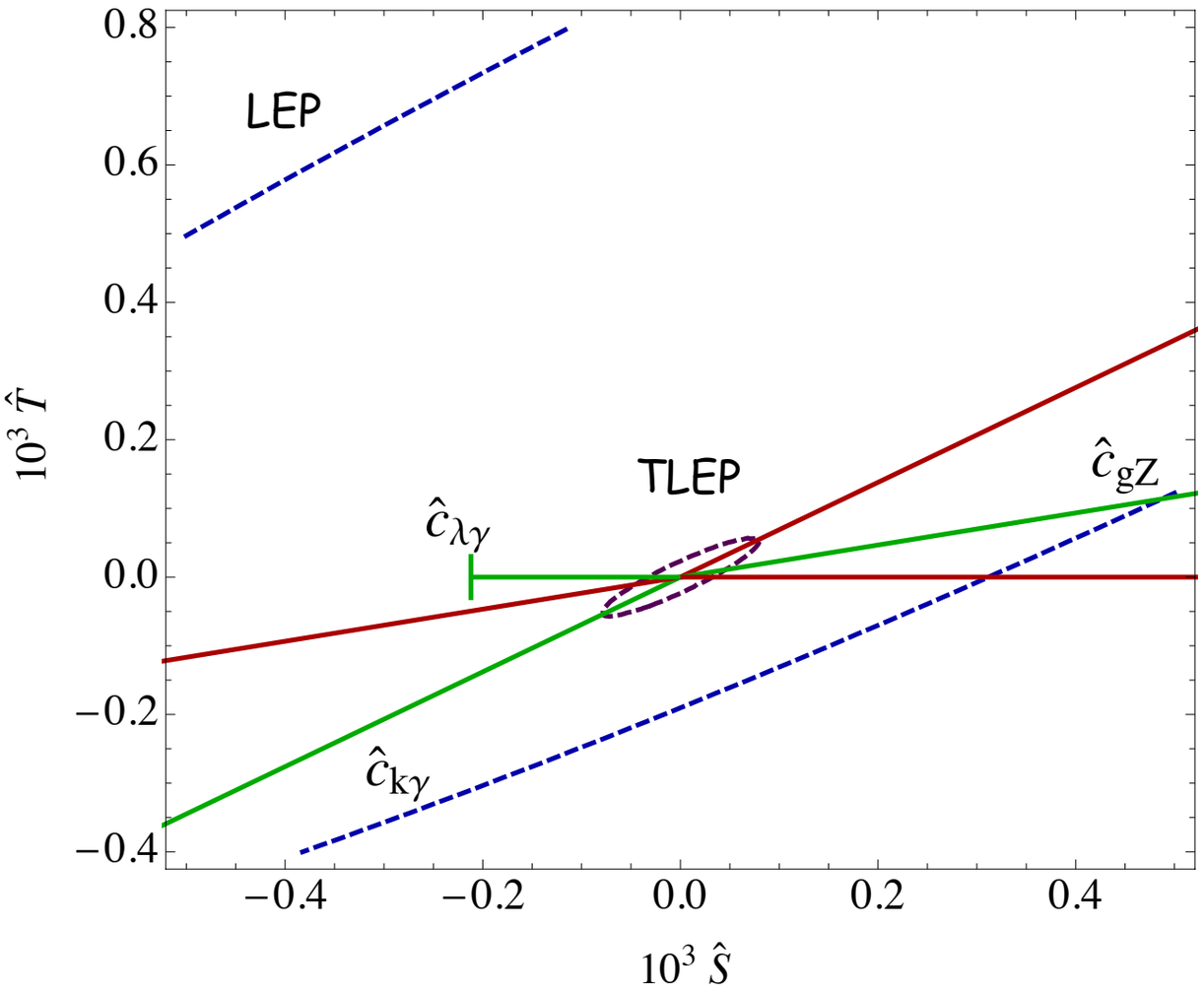

O(20-30) improvement in EW oblique parameters measurement

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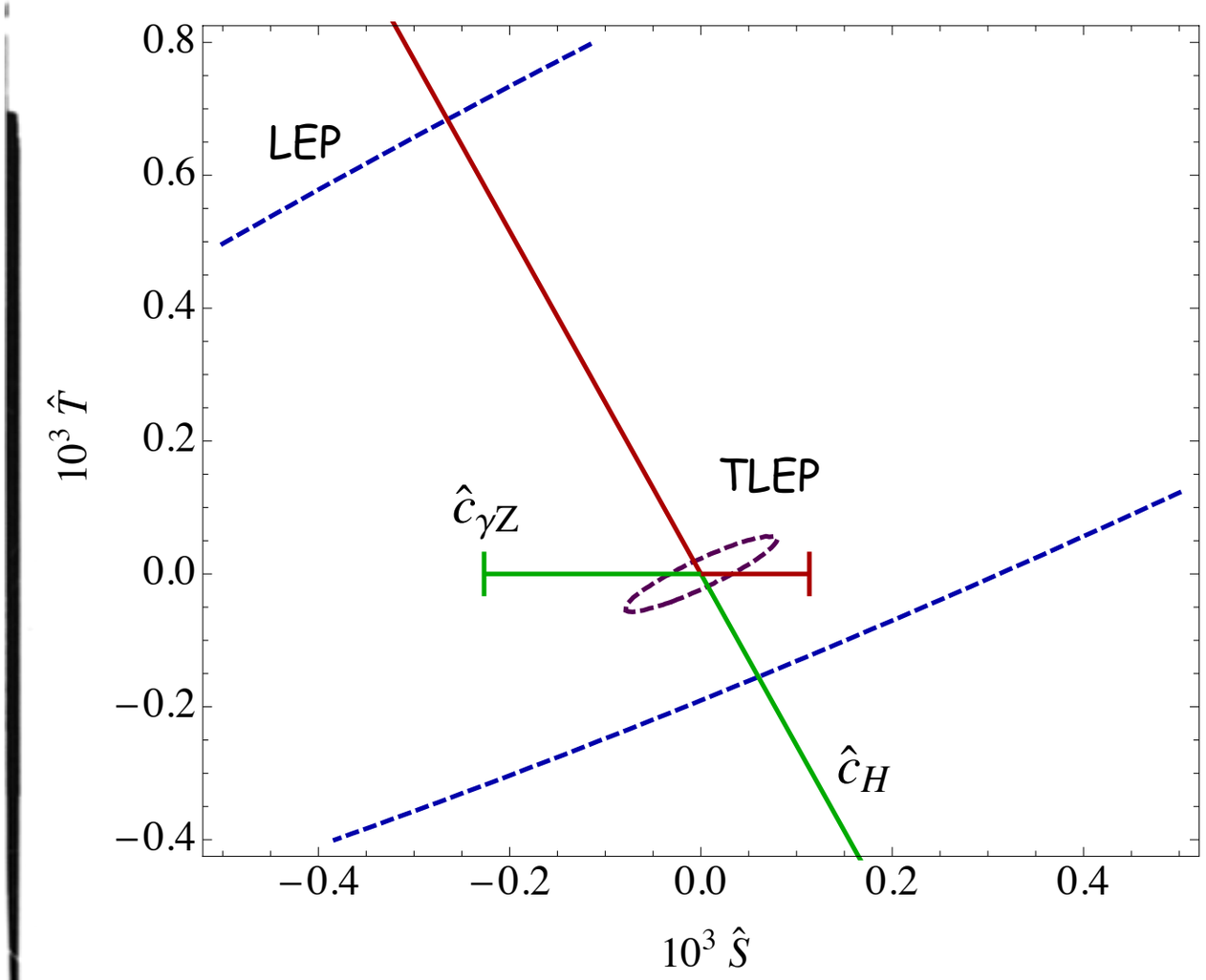

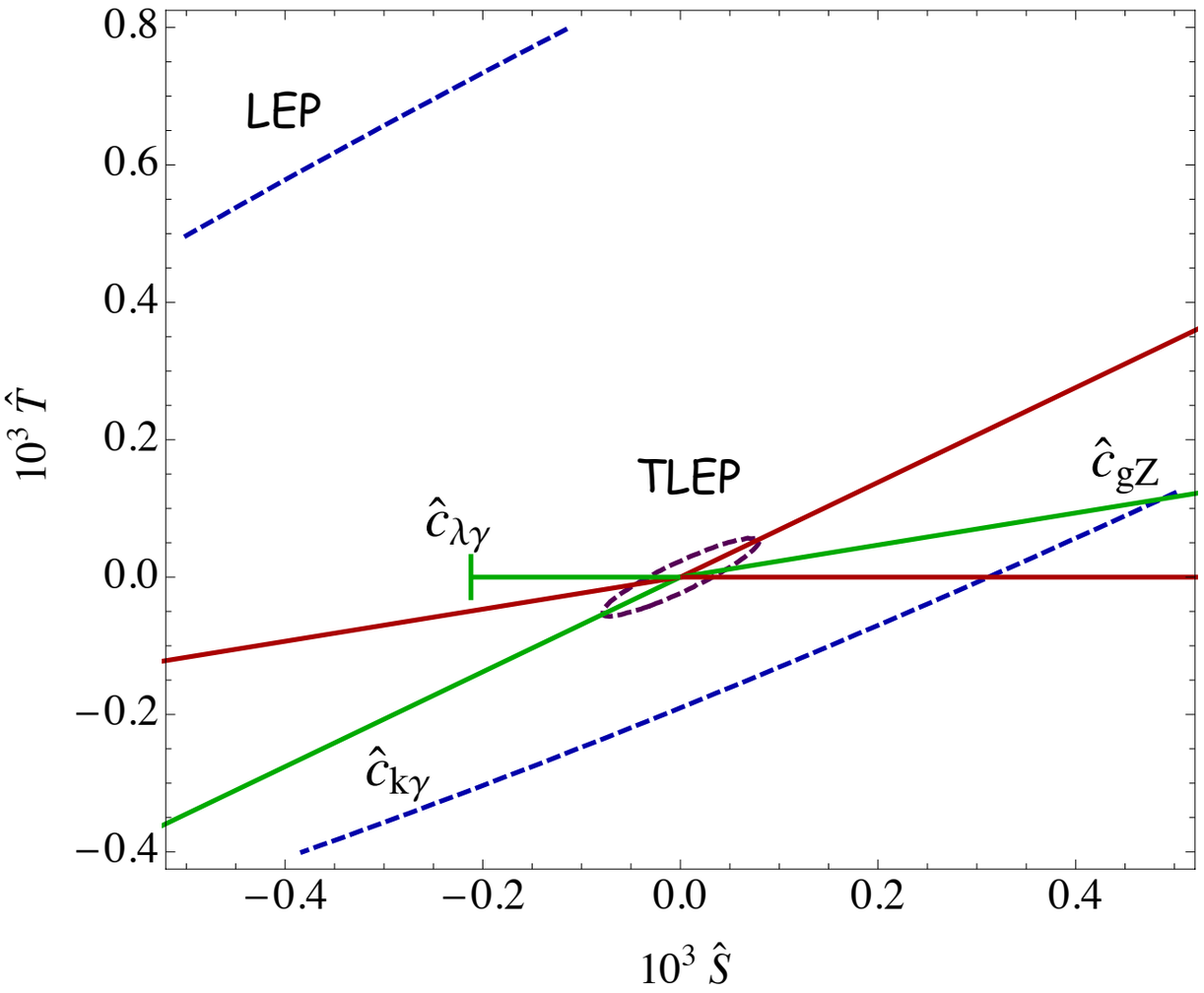

O(20-30) improvement in EW oblique parameters measurement

1 order of magnitude in TGC
1-2 orders of magnitude in Higgs couplings

⇨

can probe tuning
between UV and RG contributions

2

Precision EW measurements & New Physics

Large statistics

- 10^{12} Z (line-shape, mass & width, probe rare (FCNC) decays)
- 10^{8} W (mass)
- $3x10^{10}$ tau/muon pairs
- $2x10^{11}$ b/c quarks $\Rightarrow$ >20'000 $B_s \rightarrow \tau^+\tau^-$
- TLEP@340/500: 10^{6} top pairs (pole mass, probe FCNC decays, top Yukawa)

W mass and New Physics

In the SM, W mass is "predicted" in terms of Z mass, G_F, α_{em}...

$$M_W^2\left(1-\frac{M_W^2}{M_Z^2}\right)=\frac{\pi\,\alpha}{\sqrt{2}\,G_\mu}(1+\Delta r)$$

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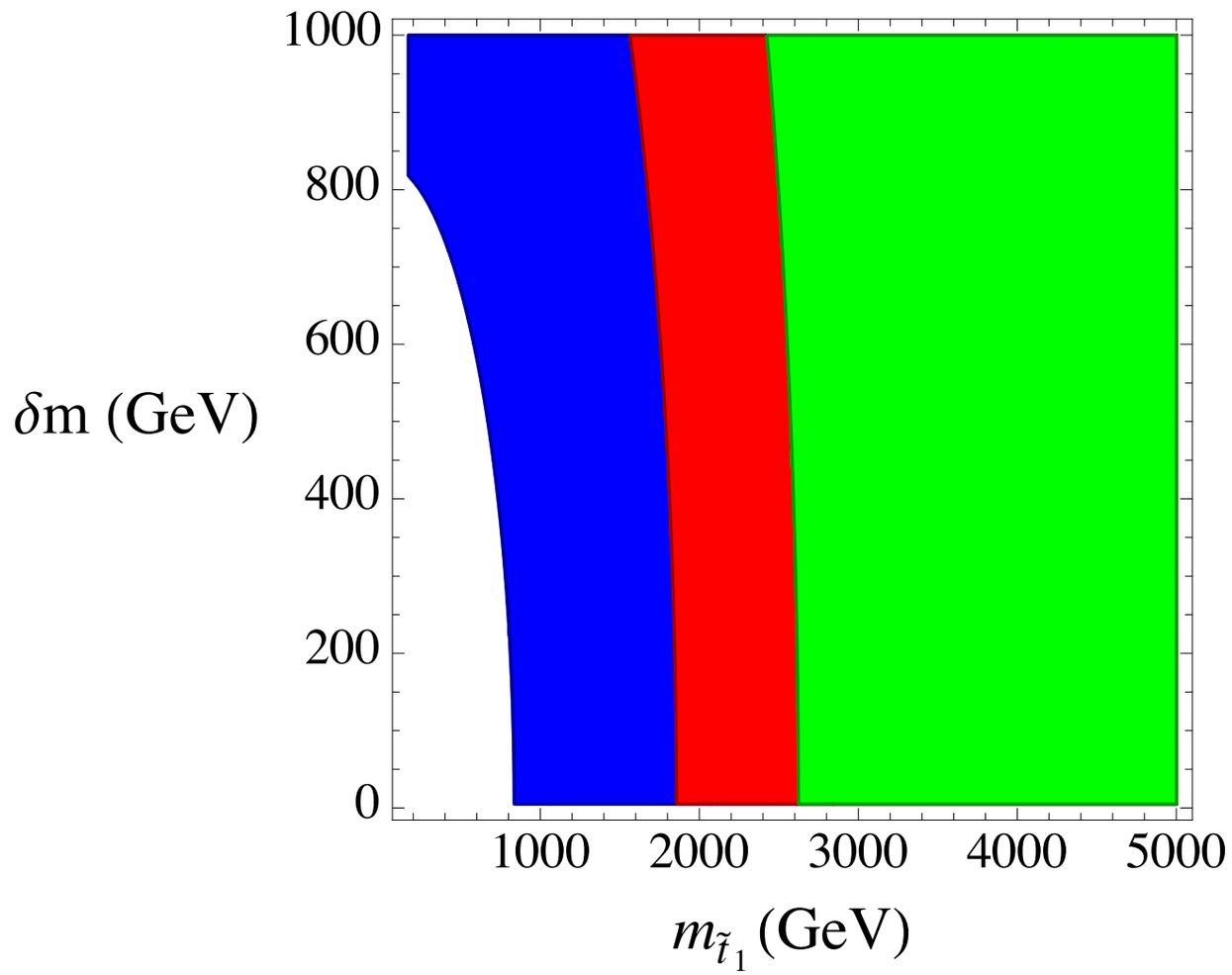


Probing MSSM stops

$$\delta m_W < 5\,\text{MeV} \Rightarrow m_{\tilde{t}_1} > 850\,\text{GeV}$$

$$\delta m_W < 1\,\text{MeV} \Rightarrow m_{\tilde{t}_1} > 1.9\,\text{TeV}$$

$$\delta m_W < 0.5\,\text{MeV} \Rightarrow m_{\tilde{t}_1} > 2.6\,\text{TeV}$$

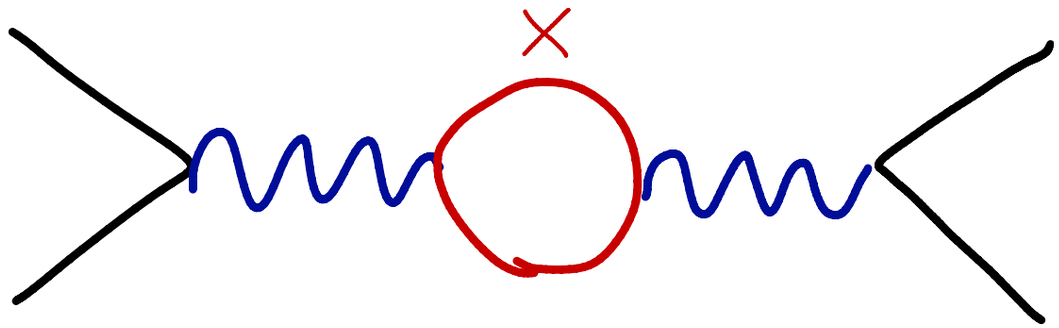
TLEP (physics case) '13

3

Model independent search of EW charged new physics

measuring running weak couplings

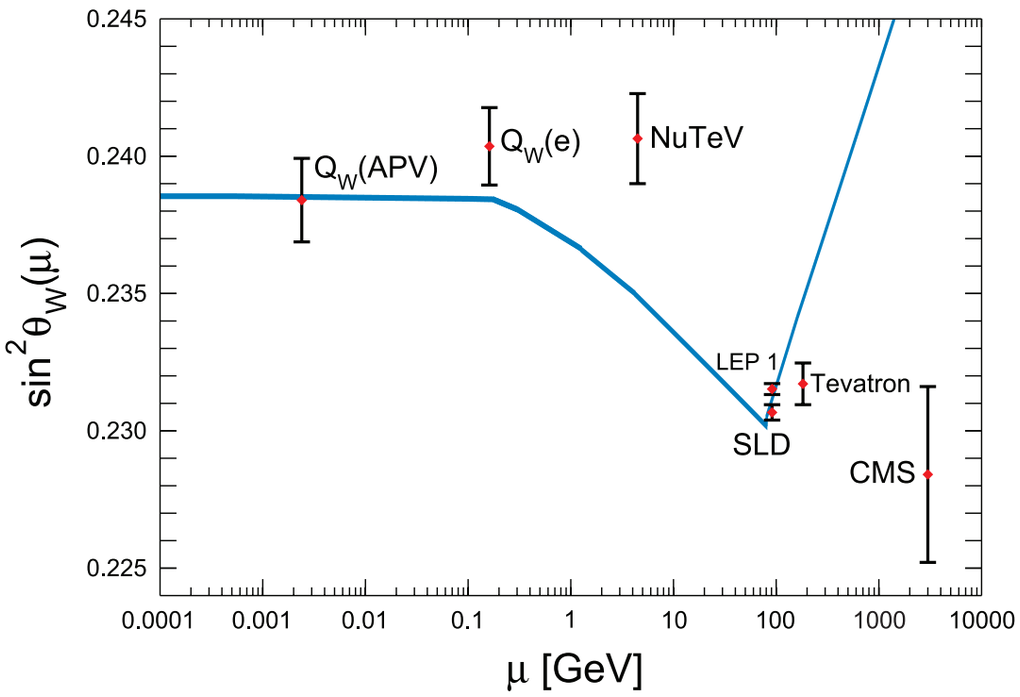
D. Alves, J. Galloway, J. Ruderman 'to appear

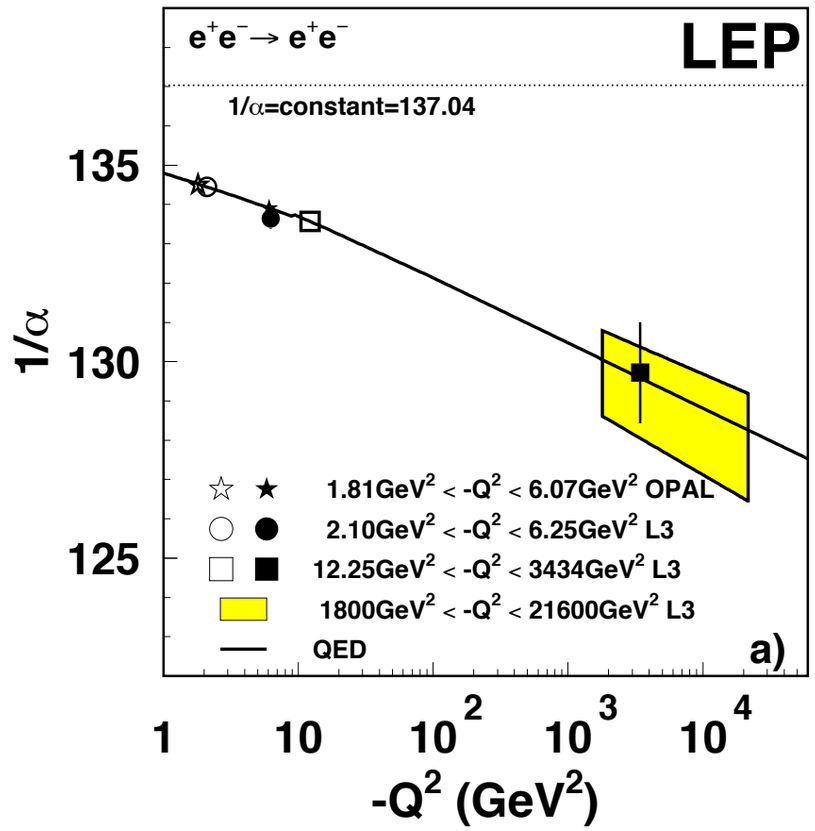


so far only measured in the broken regime:

$$q^2 \lesssim m_Z^2$$

Slides from J. Ruderman, BSM @100 TeV





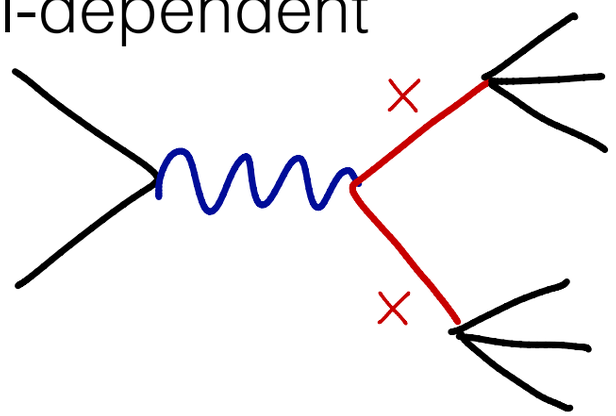
why measure running weak-couplings?

- may be possible to show α_2 is asymptotically free

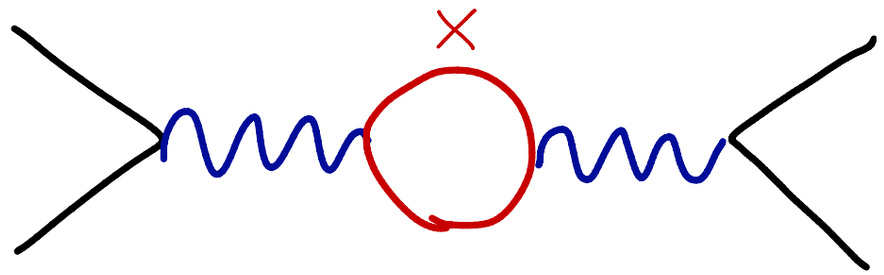
SM: $\frac{\delta\alpha_2}{\alpha_2}(1\ \text{TeV}) \approx -3\%$ $\frac{\delta\alpha_2}{\alpha_2}(10\ \text{TeV}) \approx -7\%$

- model-independent limits on new electroweak states

model-dependent



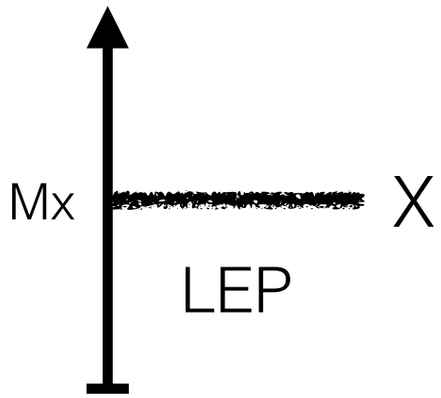
model-independent

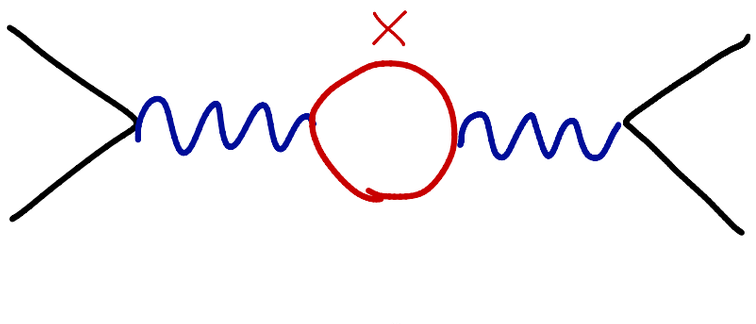


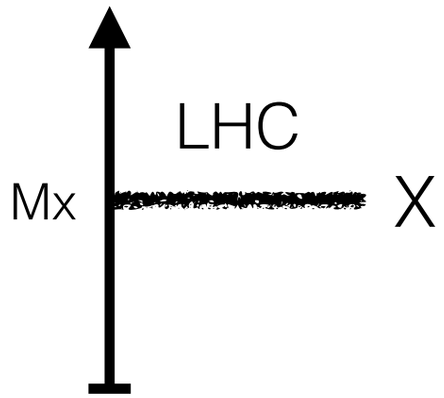
Slides from J. Ruderman, BSM @100 TeV

Precision Electroweak

below threshold vs. above threshold







$$\frac{\left(D_\rho W^a_{\mu\nu}\right)^2}{2g^2} \qquad \frac{\left(\partial_\rho B_{\mu\nu}\right)^2}{2g'^2}$$

$$W = \Delta b_2 \, \frac{\alpha_2}{20\pi} \, \frac{m_W^2}{M^2} \qquad Y = \Delta b_1 \, \frac{\alpha_1}{20\pi} \, \frac{m_W^2}{M^2}$$

$$W, Y \lesssim 10^{-3}$$

see for ex: Barbieri, Pomarol, Rattazzi, Strumia 0405040

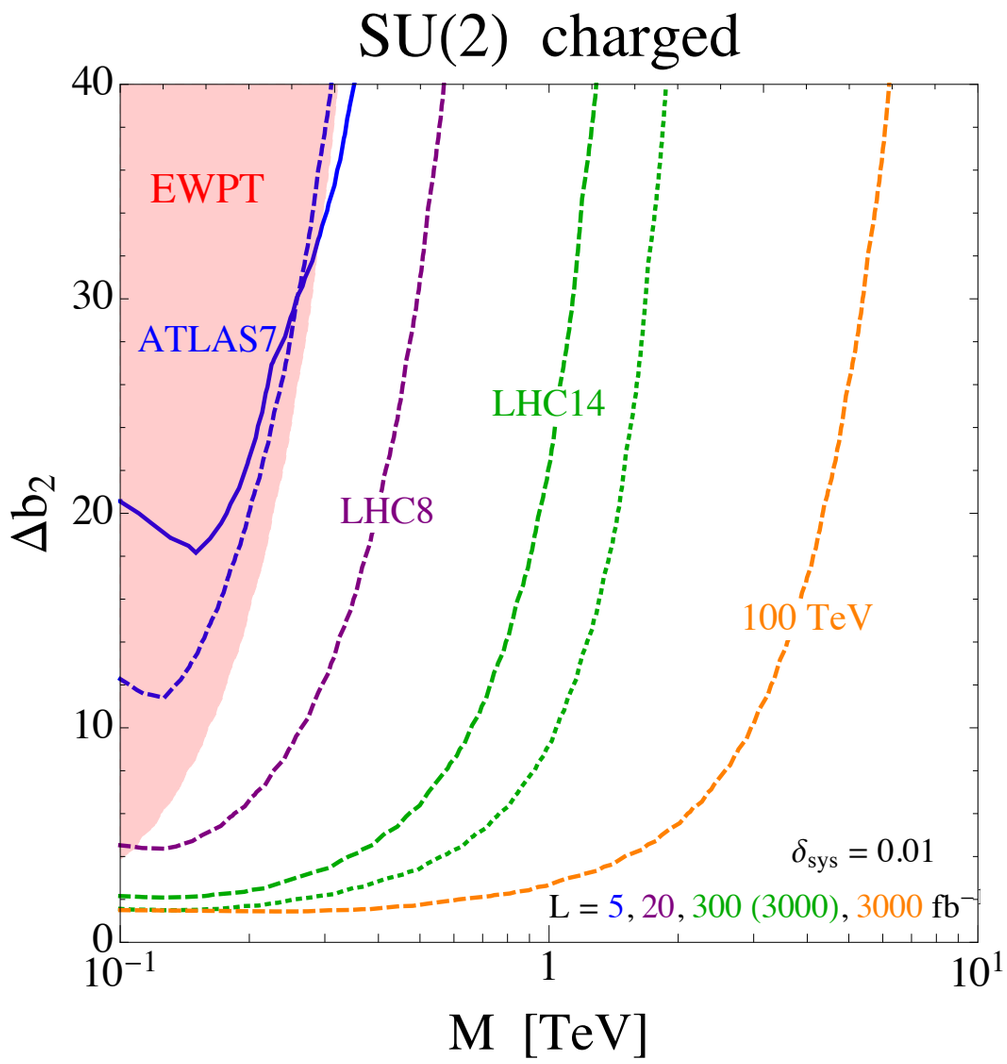
$$\frac{\delta\sigma}{\sigma}(Q) \propto \Delta b_{1,2} \, \frac{\alpha_{1,2}}{\pi} \log\left(\frac{Q}{M}\right)$$

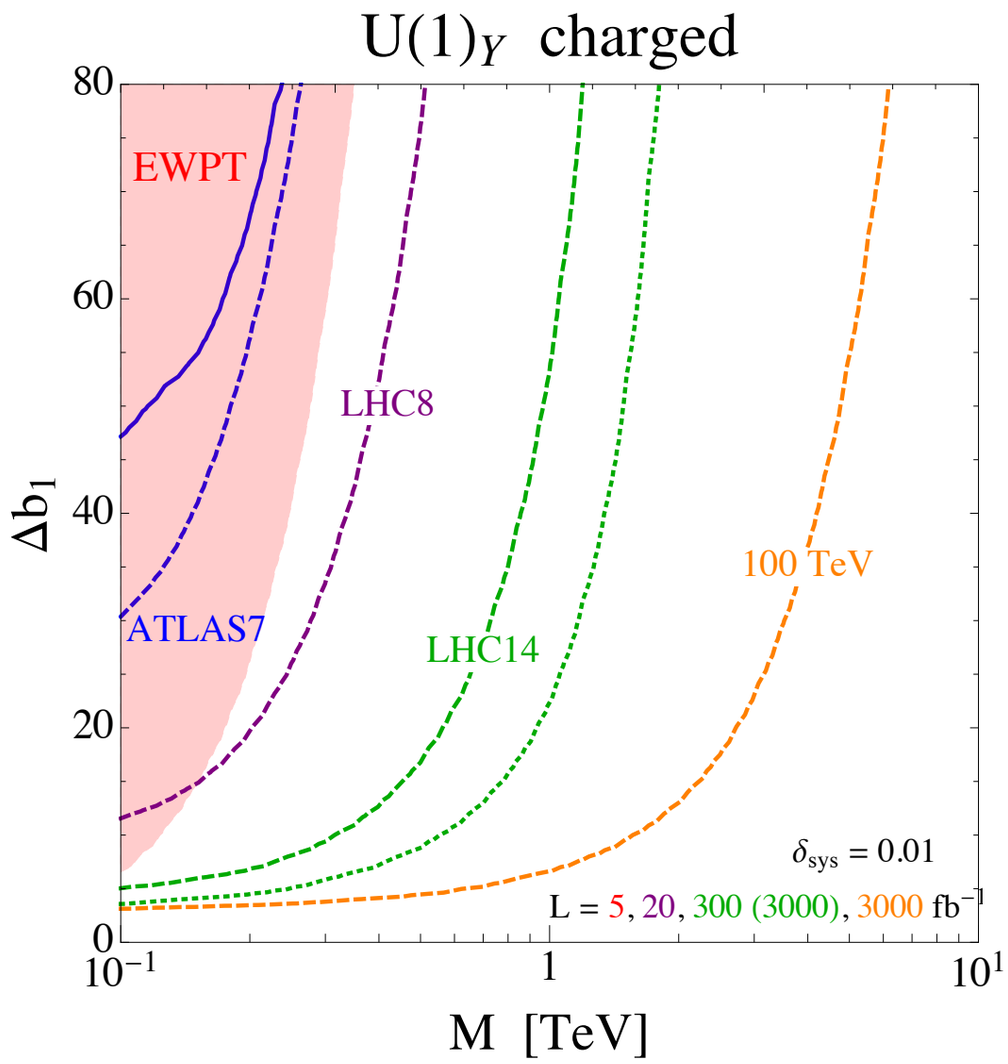
SM: $(b_1^0, b_2^0) = \left(\frac{41}{10}, -\frac{19}{6}\right)$

Slides from J. Ruderman, BSM @100 TeV

general limits

Slides from J. Ruderman, BSM @100 TeV





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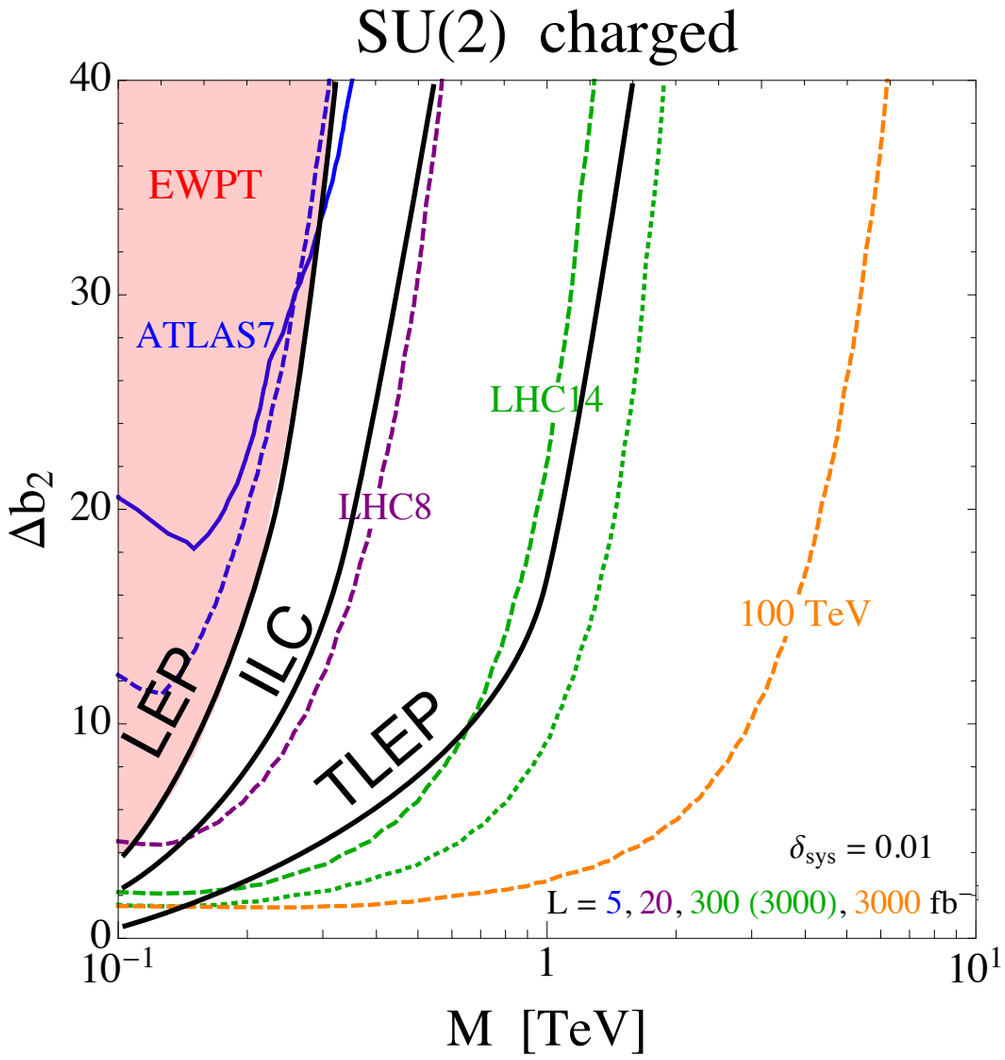
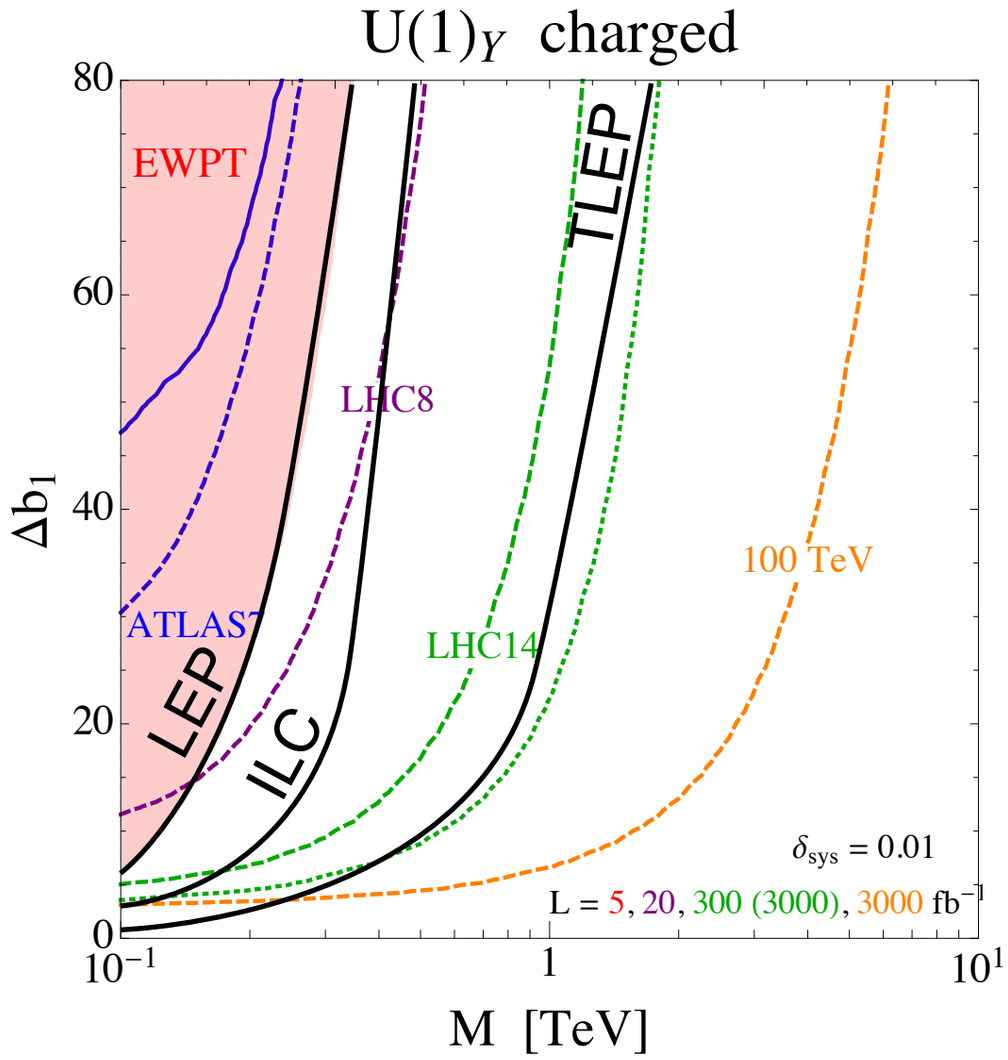




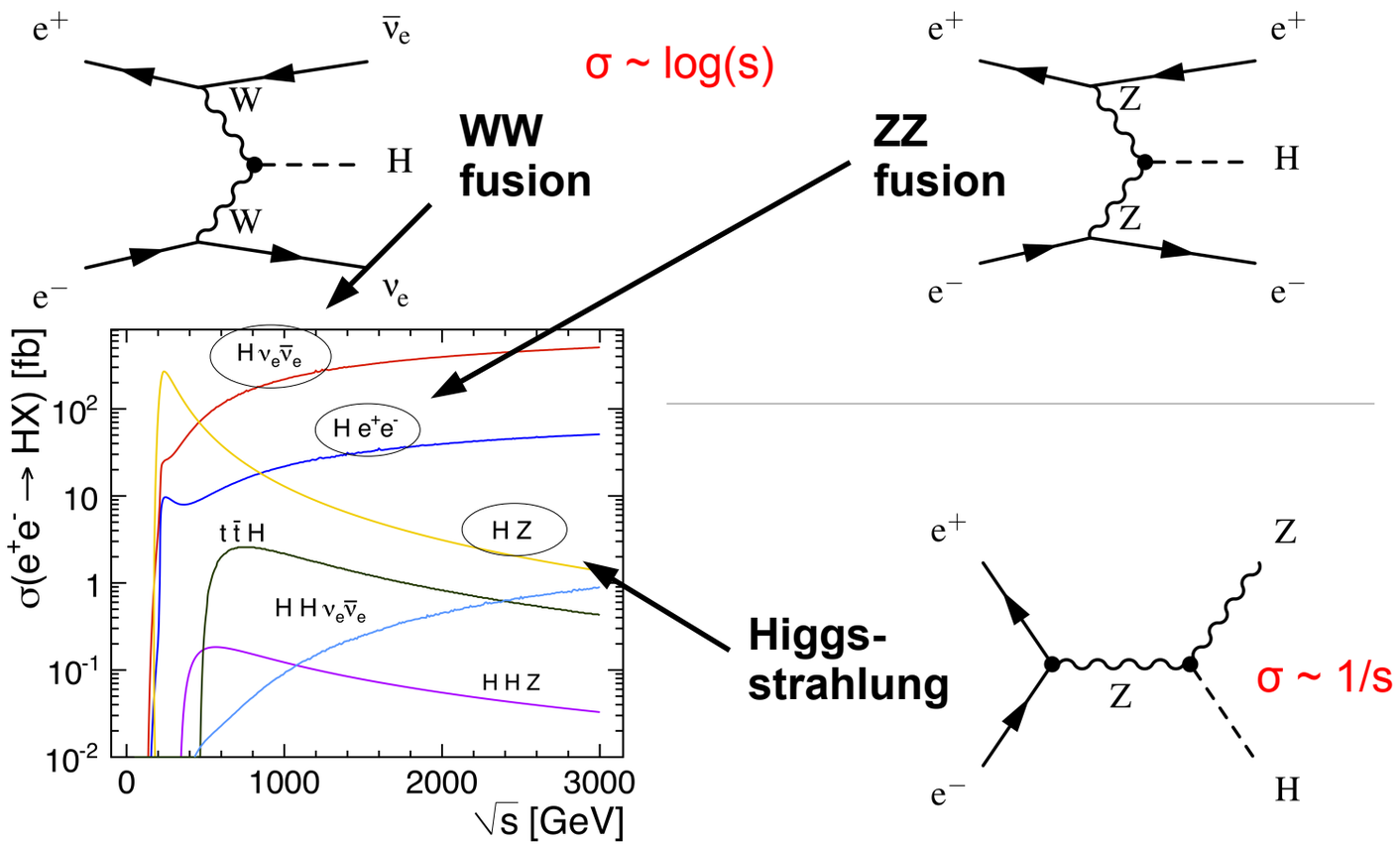
improved bounds:

$\Delta b_i \approx \Delta(W,Y)$

$\Delta M \approx 1/\sqrt{\Delta(W,Y)}$

4

Higgs coupling measurements



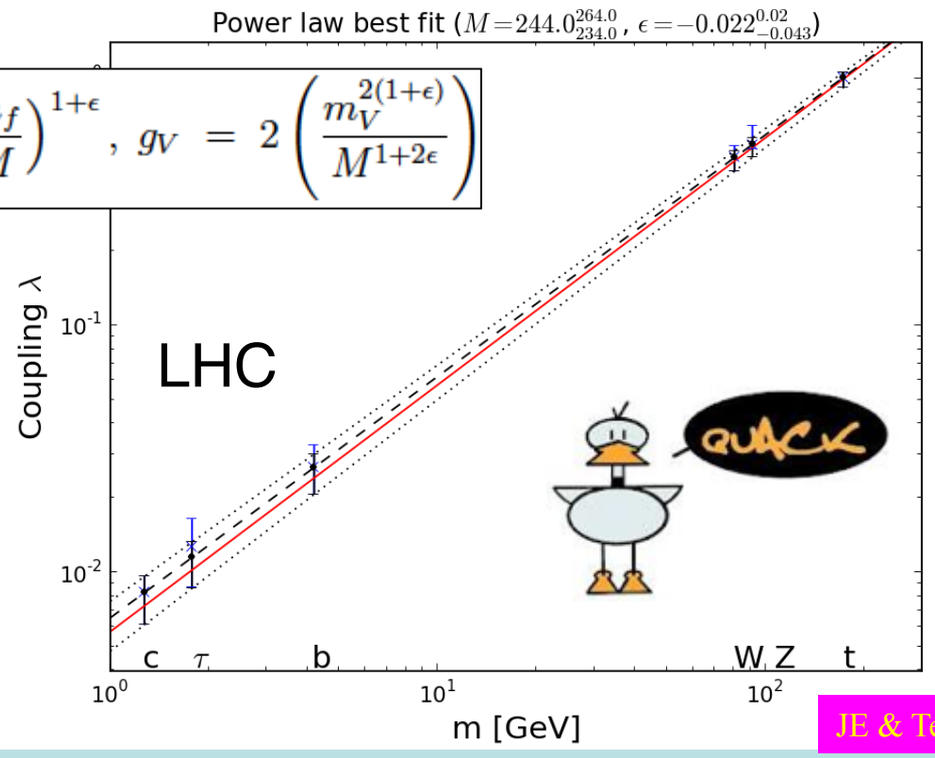
4

Higgs coupling measurements

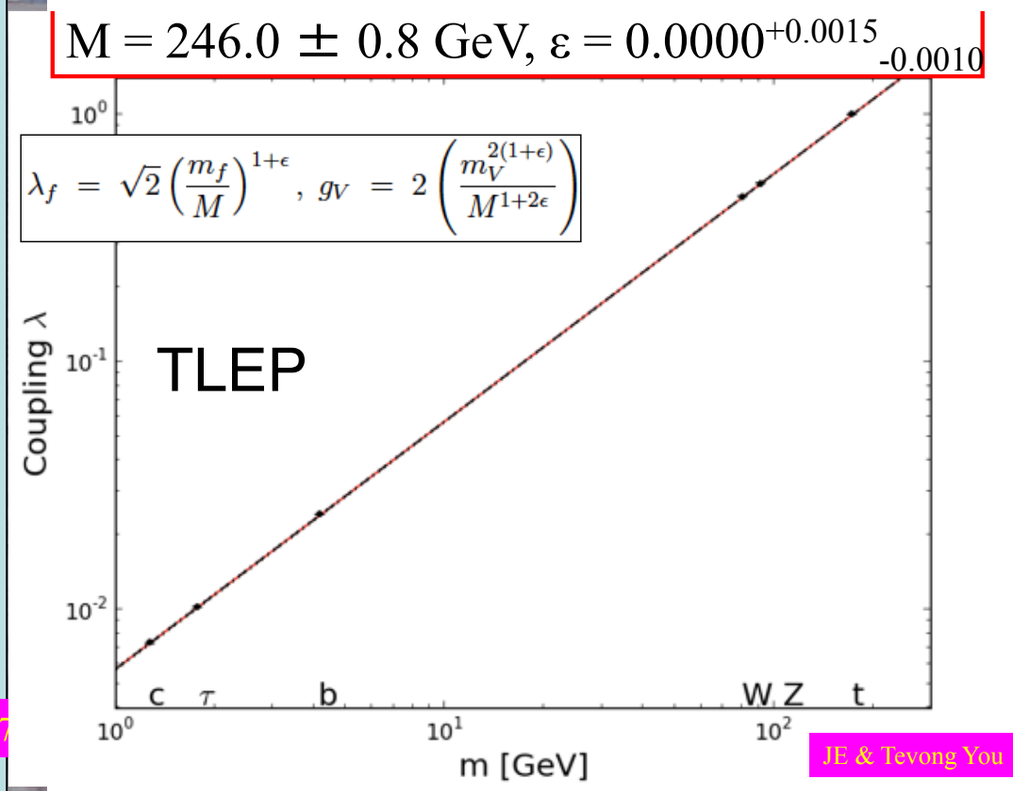
Higgs coupling global fit

$$\lambda_f = \sqrt{2}\left(\frac{m_f}{M}\right)^{1+\epsilon}, \; g_V = 2\left(\frac{m_V^{2(1+\epsilon)}}{M^{1+2\epsilon}}\right)$$

Global fit



JE & Tevong You, arXiv:1303.387



JE & Tevong You

- **Red line = SM**, dashed line = best fit

remarkable accuracy but 2 drawbacks:

- no direct measurement of htt (unless TLEP@500GeV?)
- limited access to hμμ ≈O(10%)(ILC too)

what about h^3?

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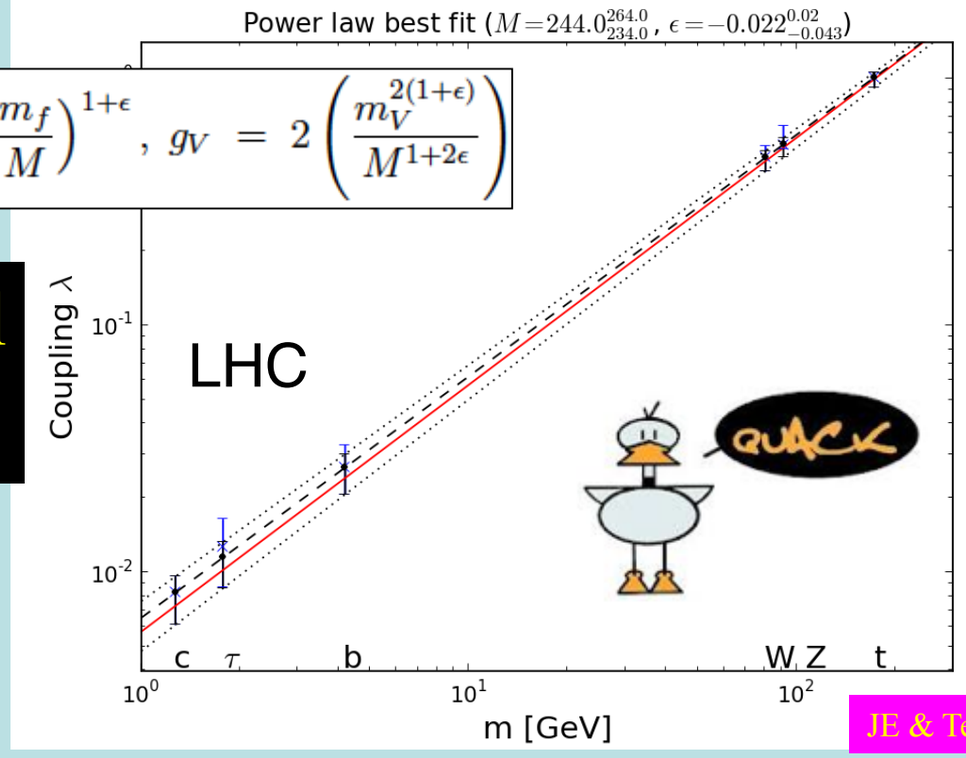

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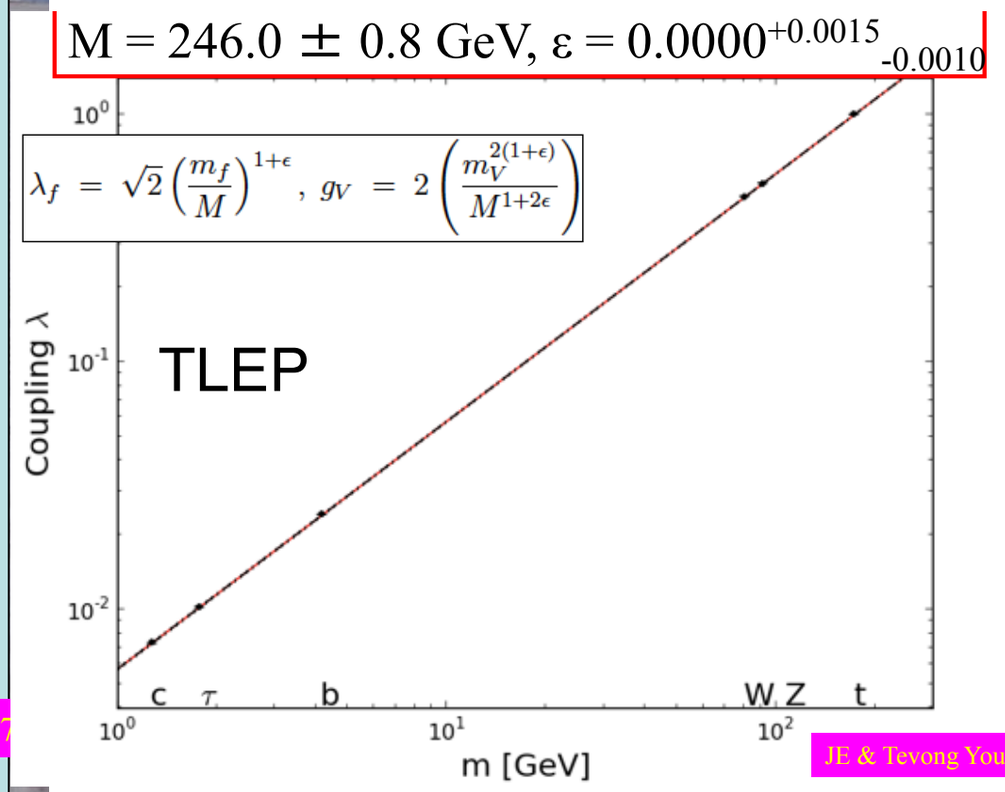

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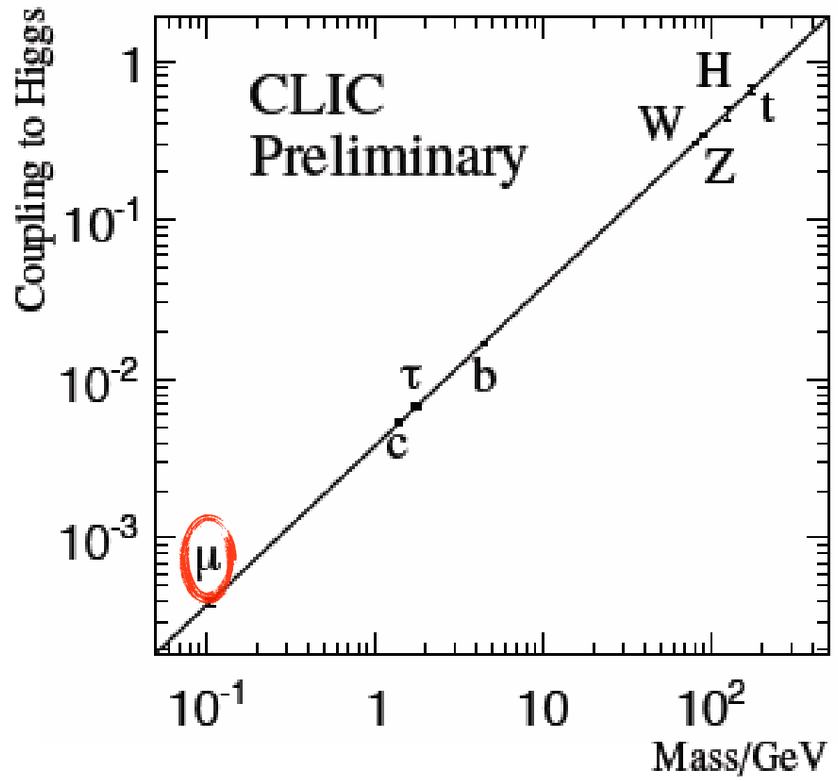
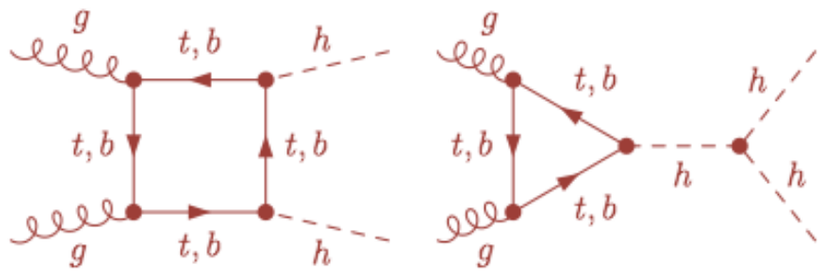


H^3 @ TLEP

- At LHC (Requires $E_{CM} > 2\ m_h$):



Dolan, Englert, Spannowsky

Slides from M. McCullough, TLEP vidyo '14

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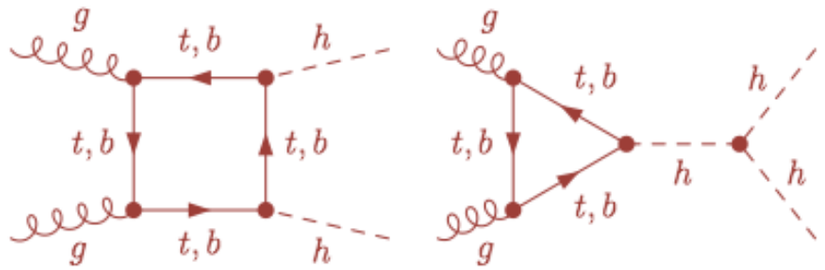
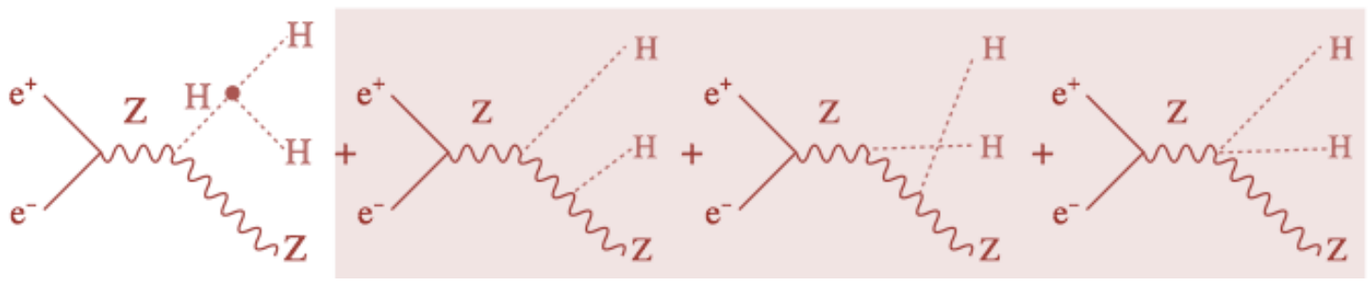


Dolan, Englert, Spannowsky

- At ILC (Requires $E_{CM} > 2\ m_h + m_Z$):



J. Tian, K. Fujii

Slides from M. McCullough, TLEP vidyo '14

H^3 @ TLEP

Slides from M. McCullough, TLEP vidyo '14

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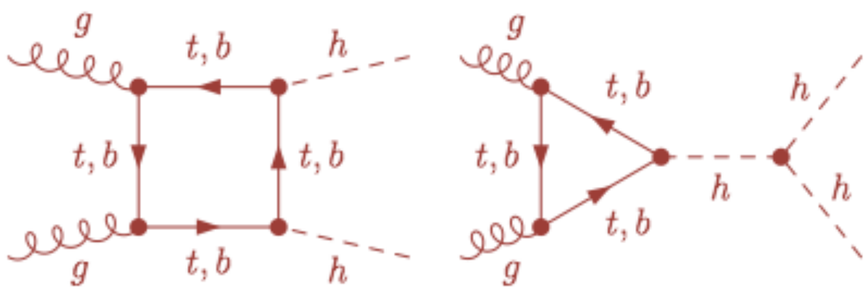

Dolan, Englert, Spannowsky

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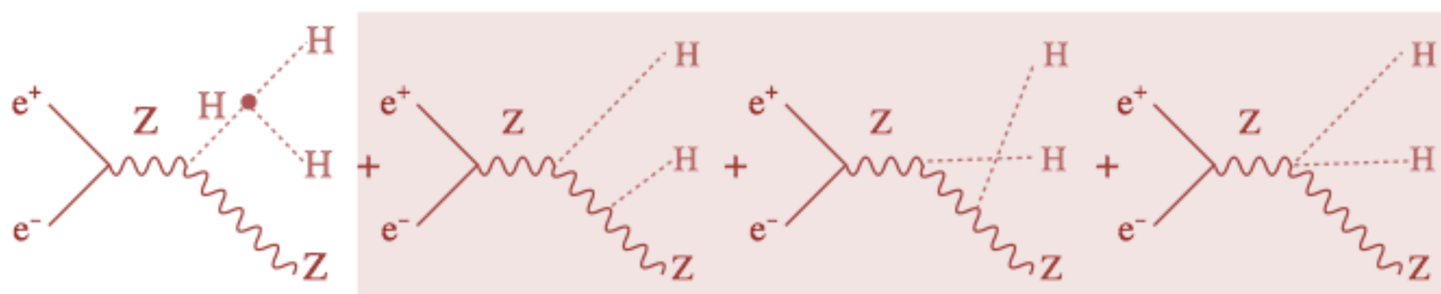
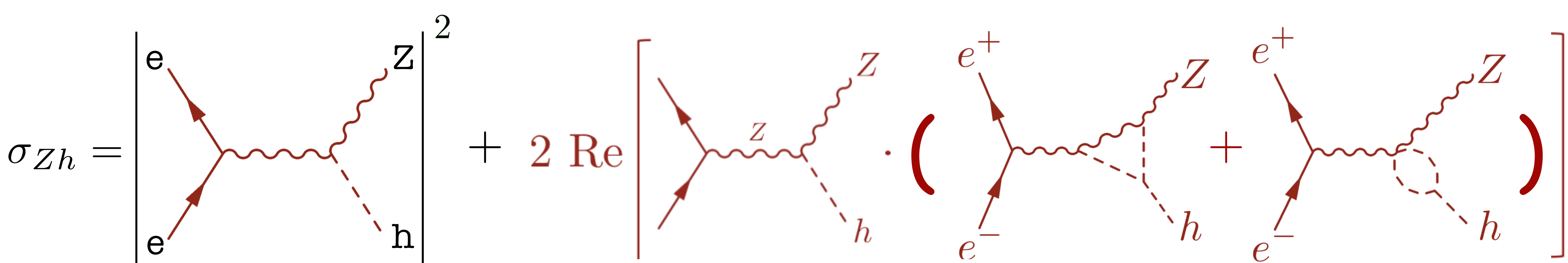


J. Tian, K. Fujii

- At TLEP 240 GeV: M. McCullough '14



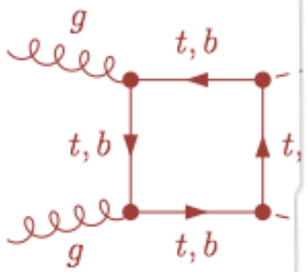
$$\delta_\sigma^{240} = 100\,(2\delta_Z + 0.014\delta_h)\,\%$$

tiny effect but visible thanks to the extraordinary TLEP sensitivity on Zh (0.05%)

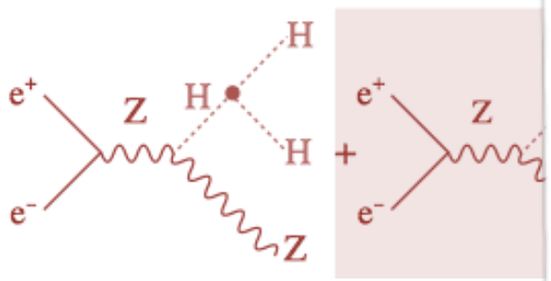
H^3 @ TLEP

Slides from M. McCullough, TLEP vidyo '14

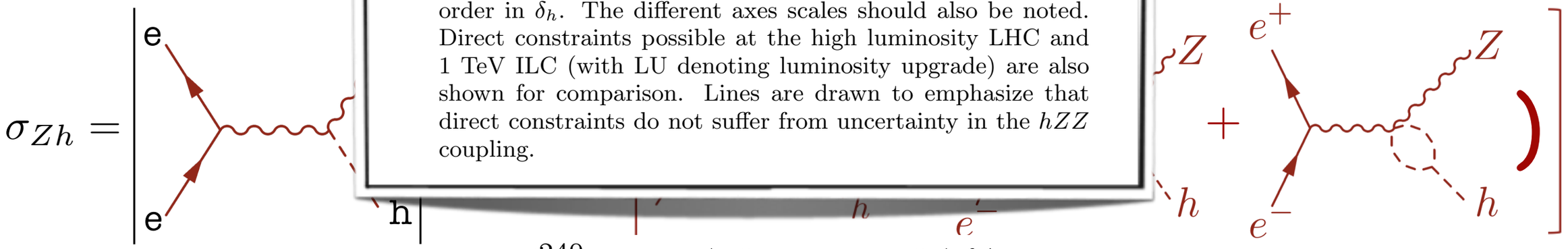
- At LHC (Requi



- At ILC (Requir



- At TLEP 240 (



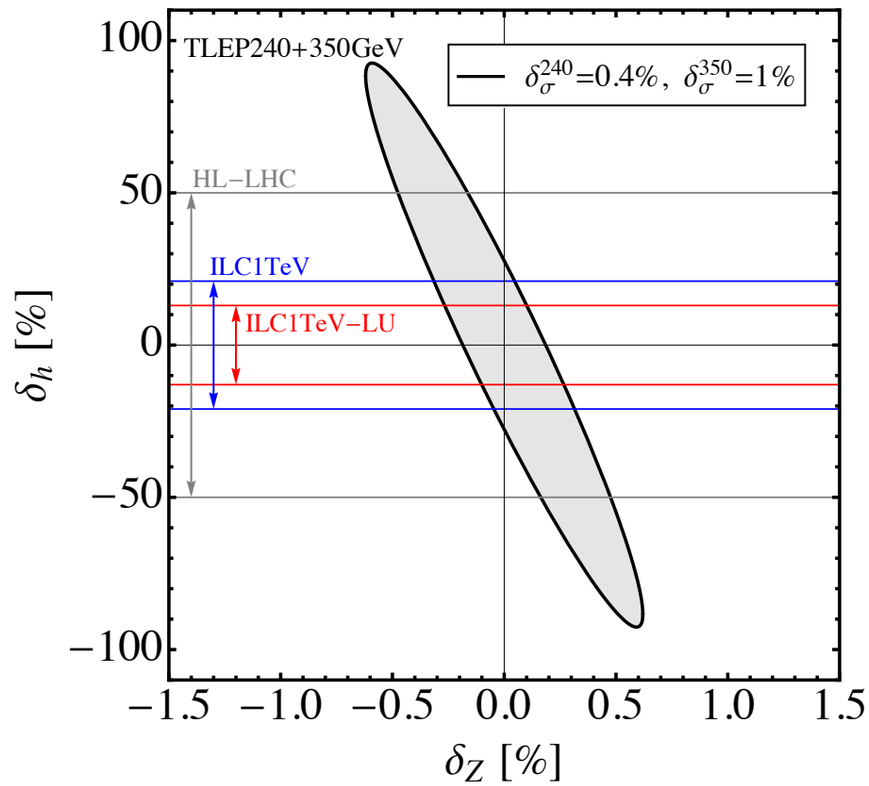


FIG. 3: Indirect 1σ constraints possible in $\delta_Z - \delta_h$ parameter space by combining associated production cross section measurements of 0.4% (1%-estimated) precision at $\sqrt{s} = 240$ GeV, (350 GeV) in solid black. It should be kept in mind that for large values of $|\delta_h|$ this ellipse can only be considered qualitatively as the calculation is only valid to lowest order in δ_h. The different axes scales should also be noted. Direct constraints possible at the high luminosity LHC and 1 TeV ILC (with LU denoting luminosity upgrade) are also shown for comparison. Lines are drawn to emphasize that direct constraints do not suffer from uncertainty in the hZZ coupling.

$$\delta_\sigma^{240} = 100\,(2\delta_Z + 0.014\delta_h)\,\%$$

tiny effect but visible thanks to the extraordinary TLEP sensitivity on Zh (0.05%)

Beyond SM couplings: Higgs rare decays

Beyond SM couplings: Higgs rare decays

1

Look for SM forbidden LF violating decays $h \to \mu\tau$ and $h \to e\tau$

Blankenburg, Ellis, Isidori '12

- not currently strongly constrained: BR<10%
- ATLAS and CMS have in principle the sensitivity to set bounds O(1%)

Harnik et al '12

Davidson, Verdier '12

- but ILC/CLIC can certainly do much better

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2

Isidori et al '13

VP mode	$\mathcal{B}^{\rm SM}$	VP^* mode	$\mathcal{B}^{\rm SM}$
$W^-\pi^+$	0.6×10^{-5}	$W^-\rho^+$	0.8×10^{-5}
W^-K^+	0.4×10^{-6}	$Z^0\phi$	0.4×10^{-5}
$Z^0\pi^0$	0.3×10^{-5}	$Z^0\rho^0$	0.4×10^{-5}
$W^-D_s^+$	2.1×10^{-5}	$W^-D_s^{*+}$	3.5×10^{-5}
W^-D^+	0.7×10^{-6}	W^-D^{*+}	1.2×10^{-6}
$Z^0\eta_c$	1.4×10^{-5}	Z^0J/ψ	1.4×10^{-5}

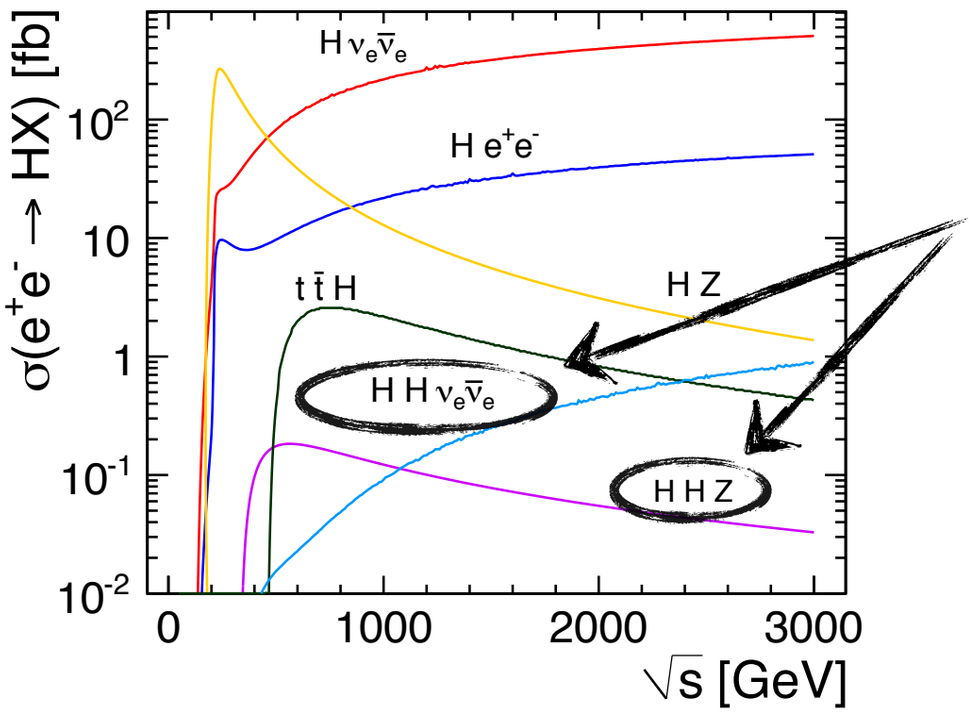
rare semi-hadronic decays of the type

$h \to W/Z+P$

can be a good probe of NP

5

non-linear Higgs coupling measurements



subdominant processes that need high √s

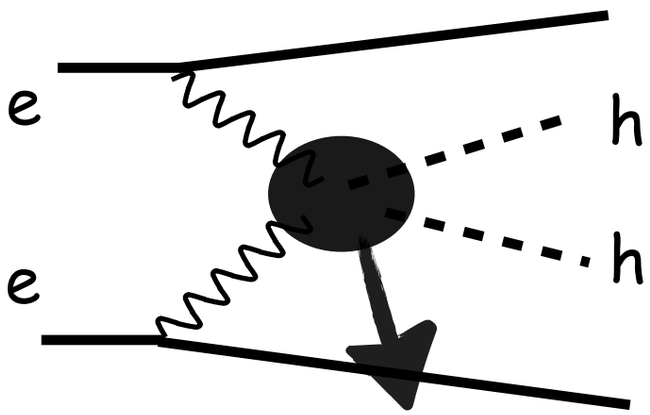
5

non-linear Higgs coupling measurements

VVHH: probe of Higgs strong interactions

in the SM, the Higgs is essential to prevent strong interactions in EWSB sector

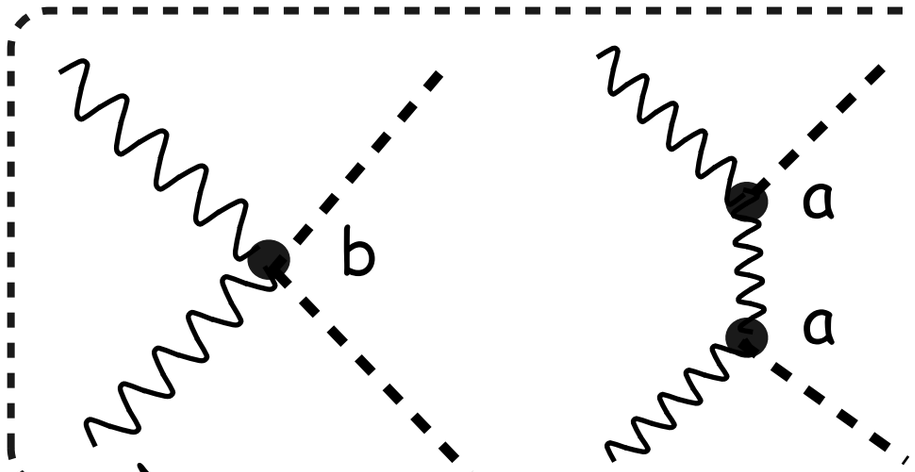
(e.g. WW scattering)



$$\mathcal{L}_{\rm EWSB} = \frac{v^2}{4}{\rm Tr}\left(D_\mu \Sigma^\dagger D_\mu \Sigma\right)\left(1 + 2a\frac{h}{v} + b\frac{h^2}{v^2}\right)$$

SM: $a=b=d_3=d_4=1$

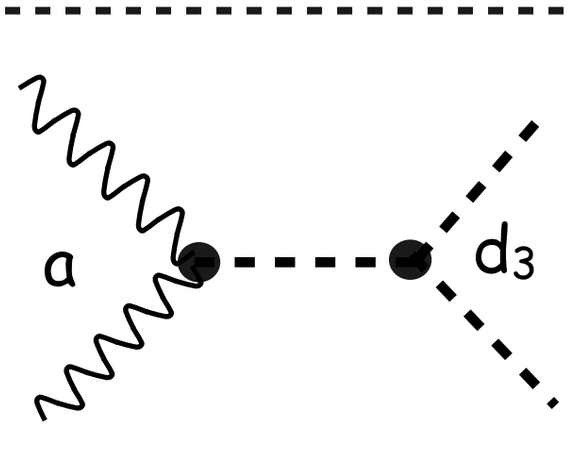
$$V(h) = \frac{1}{2}m_h^2 h^2 + d_3\frac{1}{6}\left(\frac{3m_h^2}{v}\right)h^3 + d_4\frac{1}{24}\left(\frac{3m_h^2}{v^2}\right)h^4 + \dots$$



$$\mathcal{A} \underset{m_{hh}^2 \gg m_W^2}{\sim} \left(b - a^2\right)\frac{4m_{hh}^2}{v^2}$$

asymptotic behavior

sensitive to strong interaction



$$\mathcal{A} \underset{m_{hh}^2 \sim 4m_h^2}{\sim} {\rm cst.} + 3ad_3\frac{m_h^2}{v^2}$$

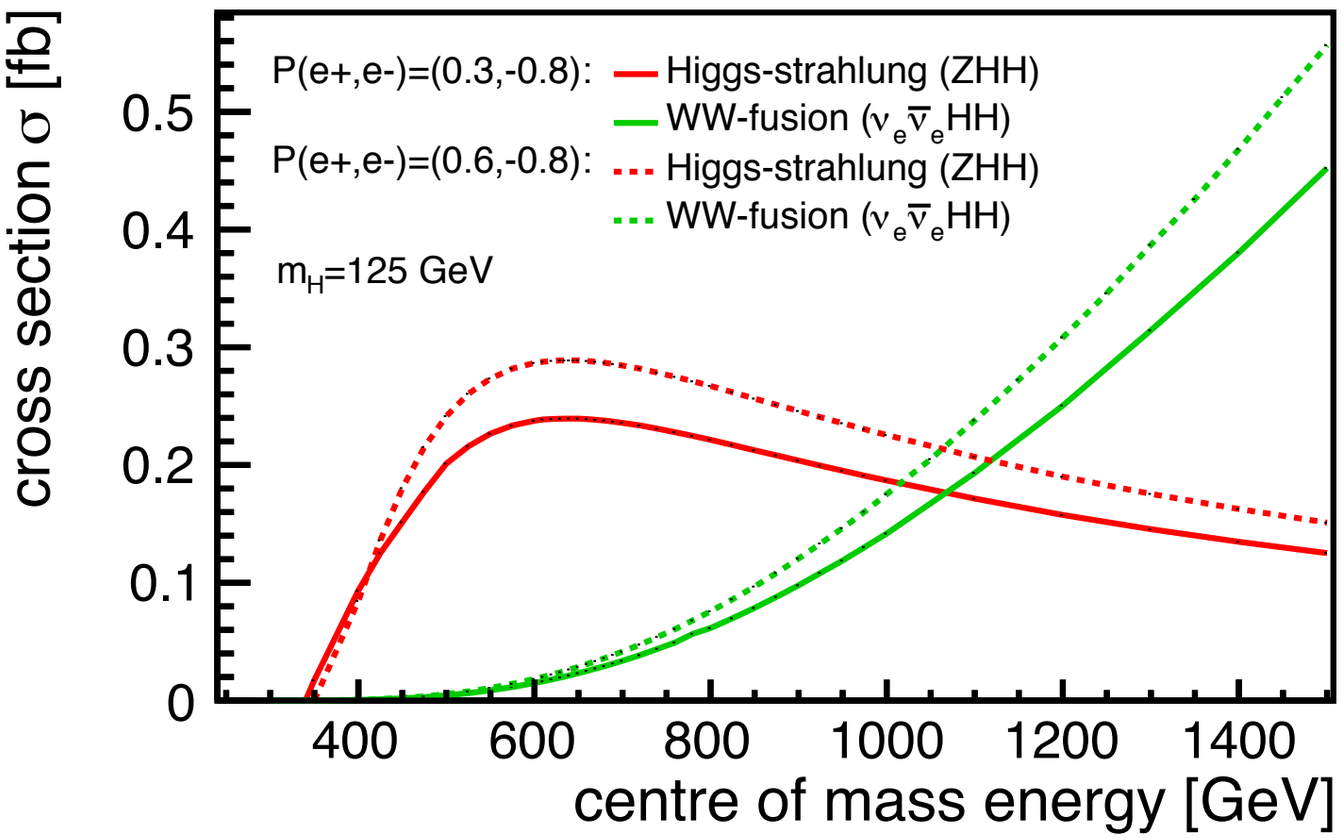
threshold effect

anomalous coupling'

VVHH: probe of Higgs strong interactions

in the SM, the Higgs is essential to prevent strong interactions in EWSB sector
(e.g. WW scattering)

VV→HH is difficult, i.e. inaccessible, at FCC-ee (even @ 500GeV)

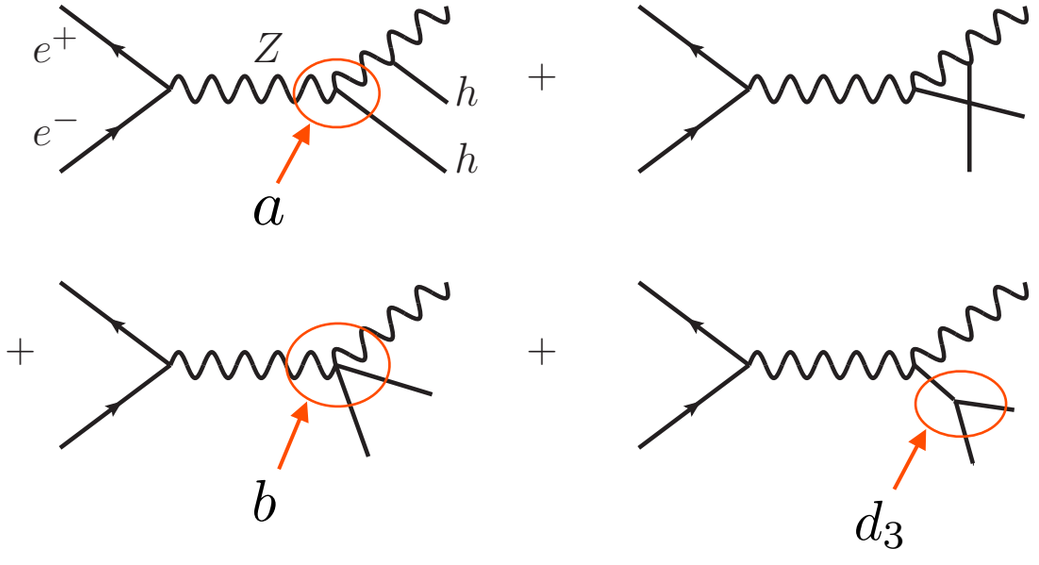


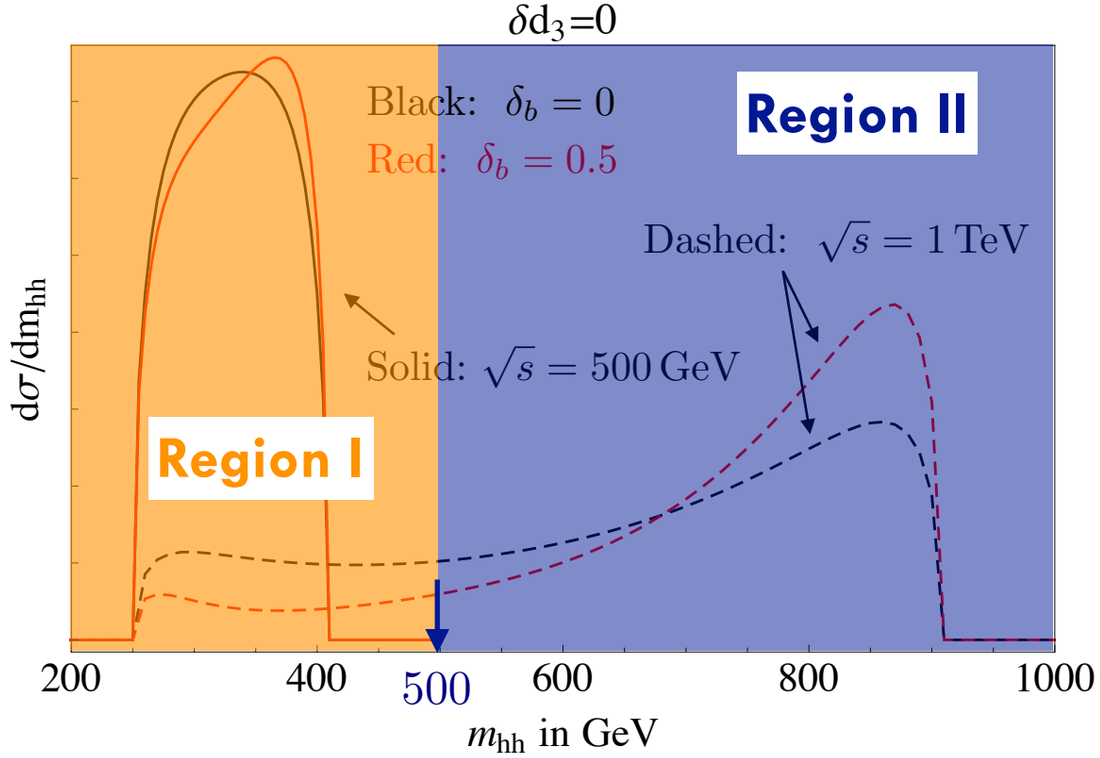
We could also access VVHH through ZHH

VVHH @ e^+e^-

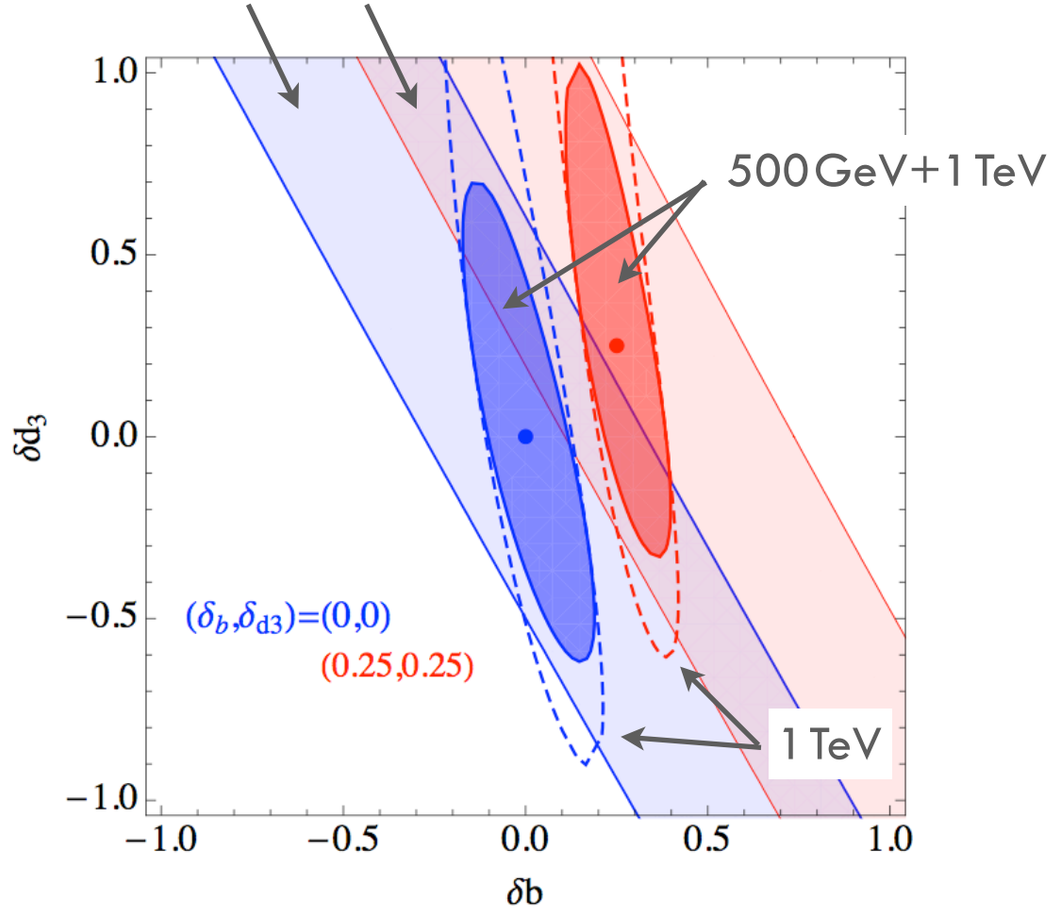
An e^+e^- collider with $\sqrt{s} = 500\,\text{GeV} - 1\,\text{TeV}$ can reach a precision of ~20% on b through the double Higgsstrahlung process

Contino, Grojean, Pappadopulo, Rattazzi, Thamm '13





Cut on m_{hh} useful at $\sqrt{s} = 1\,\text{TeV}$



Rich physics perspectives for e^+e^- machines

TLEP (physics case) '13

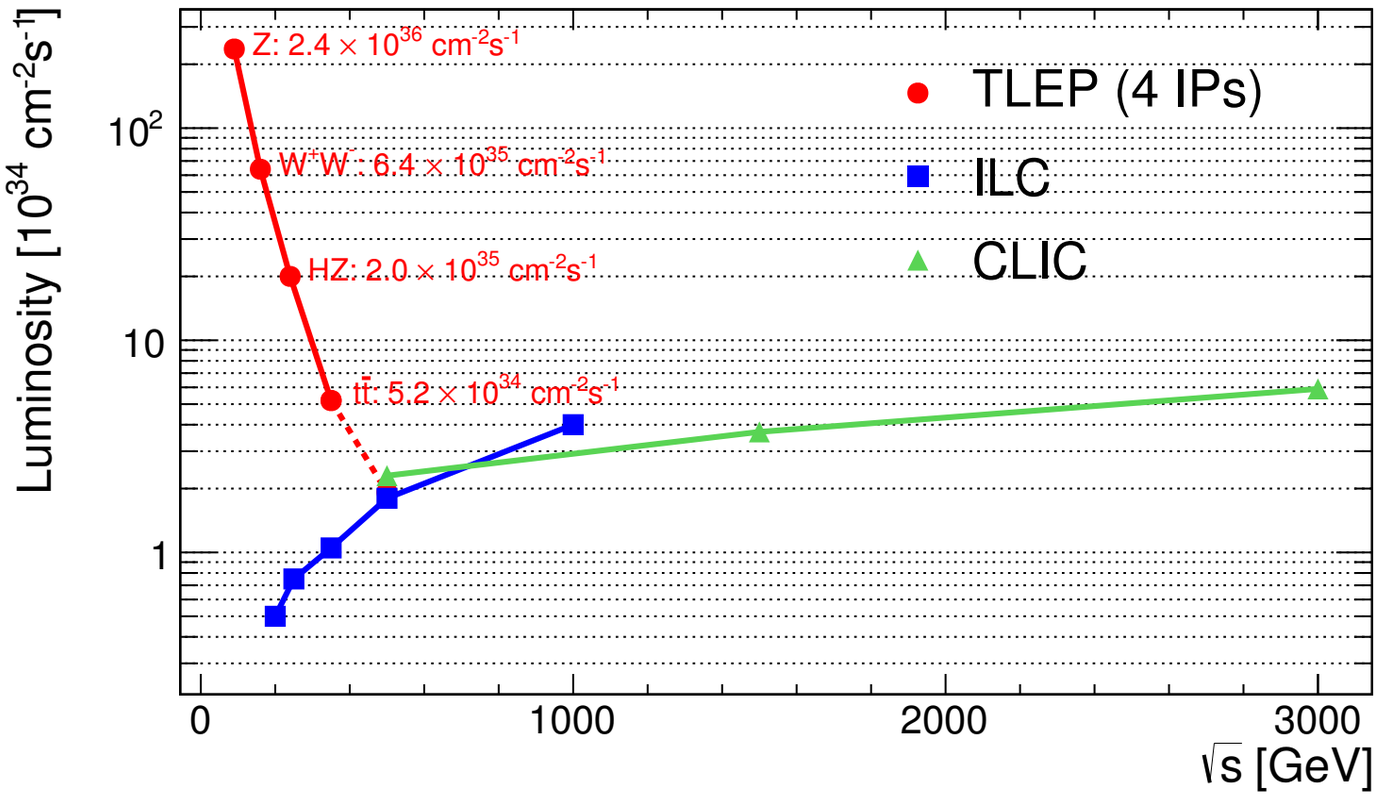


Figure 3. Instantaneous luminosity, in units of 10^{34} cm^{-2}s^{-1}, expected at TLEP (full red line), in a configuration with four interaction points operating simultaneously, as a function of the centre-of-mass energy. For illustration, the luminosities expected at linear colliders, ILC (blue line) and CLIC (green line), are indicated in the same graph. As explained in the text, the TLEP luminosity at each interaction point would increase significantly if fewer interaction points were considered. The possible TLEP energy upgrade up to 500 GeV, represented by a dashed line, is briefly discussed in section 5.

the luminosity/energy good for

- Higgs boson physics
- indirect search for new physics
- top quark physics

Join our Physics Study meetings!

TLEP Physics Vidyo meeting #1

chaired by Patrick Janot (CERN), Jonathan R. Ellis (CERN)

Monday, 2 December 2013 from **15:00** to **17:00** (Europe/Zurich)
at **CERN (513-1-024)**

Description First TLEP Physics meeting via Vidyo.

To subscribe to the TLEP Design Study and be included in the mailing lists, please
"Your contribution to the design study".

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Monday, 2 December 2013

15:00 - 15:15 TLEP and FCC news *15'*
Speaker: Alain Blondel (Universite de Geneve (CH))
Material: Slides

15:20 - 15:50 The ALICE Inner Tracking System upgrade: a benchmark
Speaker: Luciano Musa (CERN)
Material: Slides

15:55 - 16:15 First estimate of vacuum chamber size *20'*
Speaker: Dr. Jorg Wenninger (CERN)
Material: Slides

16:20 - 16:35 Final Focus options: your input for possible interference wi
Speakers: m Koratzinos (Universite de Geneve (CH)), Hector Garcia
Catalunya (ES))
Material: Slides

16:40 - 16:50 An acceptable position for final focussing quadrupoles ? *10'*
Speaker: Patrick Janot (CERN)
Material: Slides

TLEP Physics Vidyo meeting #2

Monday, 6 January 2014 from **15:00** to **17:00** (Europe/Zurich)
at **CERN (40-2-A01)**

Description 2nd TLEP Physics meeting
Video Services Vidyo public room : TLEP_Physics_Vidyo_meeting__2 More I

Monday, 6 January 2014

15:00 - 15:15 News *15'*
Speakers: Alain Blondel (Universite de Geneve (CH)), Pa
Material: Slides-Alain

15:20 - 15:50 A TPC as a tracker for TLEP ? *30'*
Speaker: Philippe Schwemling (CEA/IRFU,Centre d'etude
Material: Slides

15:55 - 16:15 Higgs mass calculations in the MSSM, present ar
Speaker: Sven Heinemeyer (CSIC (Santander, ES))
Material: Slides

16:20 - 16:40 Detector design: From ILC to TLEP *20'*
Speaker: Manqi Ruan (Ecole Polytechnique (FR))
Material: Slides

16:45 - 17:00 A new probe of the Higgs self coupling *15'*
Speaker: Matthew McCullough (Oxford University)
Material: Slides

TLEP Physics Vidyo meeting #3

Monday, 3 February 2014 from **11:00** to **13:00** (Europe/Zurich)
at **CERN (40-2-A01)**

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Monday, 3 February 2014

11:00 - 11:15 FCC / TLEP News *15'*
Speakers: Alain Blondel (Universite de Geneve (CH)), Patrick Janot (CERN)
Material: Alain-news First-look-paper

11:20 - 11:40 New TLEP parameter set in a 100km tunnel *20'*
Speaker: Dr. Jorg Wenninger (CERN)
Material: Slides

11:45 - 12:05 Impact of TLEP precision measurements on SUSY *20'*
Speaker: Jonathan R. Ellis (CERN)
Material: Slides

12:10 - 12:30 Very first look at searches for new physics at TLEP with 10^12 Z's (tbc) *20'*
Speaker: Daniel Treille (CERN)
Material: Slides

12:35 - 12:55 Measurement of the Z invisible width *20'*
Speaker: Serguei Ganjour (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))
Material: Slides

oupling on the ZH cross section (update) *5'*
gh (Oxford University)

TLEP Physics Vidyo meeting #4

Monday, 10 March 2014 from **15:00** to **17:30** (Europe/Zurich)
at **CERN (40-2-A01)**

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Monday, 10 March 2014

15:00 - 15:10 FCC / TLEP News *10'*
Speakers: Alain Blondel (Universite de Geneve (CH)), Patrick Janot (CERN)
Material: Slides

15:15 - 15:40 DELPHES: a parametric simulation for TLEP detectors ? *25'*
Speaker: Alexandre Jean N Mertens (Universite Catholique de Louvain (UCL) (BE))
Material: Paper Slides

15:45 - 16:10 Recent phenomenological progress for future lepton colliders *25'*
Speaker: Christophe Grojean (ICREA - Institucio catalana de recerca estudis avancats (E
Material: Slides

16:15 - 16:35 Study on theoretical uncertainties (QED) in the measurement of the Z invi
the ratio $\sigma(e^-e^+ \to \nu + \bar{\nu} + \gamma)/\sigma(e^-e^+ \to \mu + \bar{\mu} + \gamma)$ using KK MC *20'*
Speaker: Bennie Ward (Baylor University (US))
Material: Slides

16:40 - 16:55 Potential for b asymmetry measurement at TLEP *15'*
Speaker: Roberto Tenchini (Sezione di Pisa (IT))
Material: Slides

16:59 - 17:00 Top phenomenology at TLEP (postponed) *1'*
Speaker: Martin Beneke (Stanford University)

TLEP Physics Vidyo meeting #5

Monday, 14 April 2014 from **15:00** to **17:00** (Europe/Zurich)
at **CERN (40-2-A01)**

Description To subscribe to the FCC-ee design study, go to http://cern.ch/fcc-ee, and click on "Join us".
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Monday, 14 April 2014

15:00 - 15:10 News *10'*
Speakers: Alain Blondel (Universite de Geneve (CH)), Patrick Janot (CERN)
Material: Slides

15:15 - 15:35 Wireless readout and power transmission for FCC detectors ? *20'*
Speaker: Elizabeth Locci (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))
Material: Slides

15:40 - 16:00 Measurement of the coupling of the Higgs boson to electrons *20'*
Speaker: Dr. Roy Aleksan (CEA/IRFU,Centre d'etude de Saclay Gif-sur-Yvette (FR))
Material: Slides

FCC-ee (TLEP) Physics Vidyo meeting #6

Monday, 19 May 2014 from **15:00** to **17:00** (Europe/Zurich)
at **CERN (40-2-A01)**

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Monday, 19 May 2014

15:00 - 15:20 News *20'*
Speakers: Alain Blondel (Universite de Geneve (CH)), Patrick Janot (CERN)
Material: updated slides

15:20 - 15:40 present status of FCC-ee and IP design *20'*
Speaker: Dr. Rogelio Tomas Garcia (CERN)
Material: Slides

15:40 - 16:00 Issues in Luminosity monitor design *20'*
Speaker: Mogens Dam (University of Copenhagen (DK))
Material: Slides

16:00 - 16:20 measuring Higgs CP in e+e- using the TLEP DELPHES card *20'*
Speaker: Ning CHEN
Material: Slides

16:20 - 16:40 Exp Physics studies for CEPC *20'*
Speaker: Manqi Ruan (CERN)
Material: Slides