

The Higgs Working Group: Summary of Snowmass '05 Activities

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1. Our charge, our interpretation of it, our approach
2. Some complaints
3. Higgs at the LHC/ILC
4. Precision Observables and Polarization

1. Our charge, our interpretation of it, our approach

The charge:

- A) What are the **most important** measurements for Higgs physics?
- B) What are **new and important recent** developments?
- C) What will the **ILC add** to what will be known from the **LHC** ?
- D) What are the corresponding **detector requirements** to allow the corresponding **measurements** with the **appropriate precision** ?
- E) What are the corresponding **theory requirements** to allow the corresponding **measurements** with the **appropriate precision** ?

⇒ open for participation and contributions!

⇒ many interesting talks

We started a document to

- collect known and new **results** on Higgs, LHC \oplus ILC
- **coordinate** our efforts
- list **open issues** and possibilities for contributions
- fold in **Snowmass '05 results**

→ all files are available at the web page

→ was and is under construction, awaiting contributions

Sessions and summaries:

- Higgs in the SM, coupling measurements
→ Heather (3)
- Higgs in the MSSM (cosmological connections)
→ Shinya (4)
- joint Higgs/top/QCD session \Rightarrow Higgs/EWPO and e^+ polarization
→ S.H. (1)
- Higgs at the $\gamma\gamma$ collider
→ Heather (3)
- non-standard/exotic models
→ Tim (5)
- Higgs precision and detector issues
→ Alexei (2)

... looks as if we have been very productive

2. Some complaints

... looks as if we have been very productive

However: not much has happened besides the talks

To fulfill our charge we needed

- active participants who have time and “the right mood”
- collaboration between experimentalists and theorists
(convenors: 4 theorists, 1 experimentalist)

Experimentalists:

- too many things in parallel (too many competing structures)
- often couldn't even attend the physics plenary
- hardly had time to interact with theorists

Theorists:

- many talks (most participants mostly interested in (their) talks)
- Aspen is still too far away
- hardly any contributions here besides talks

But physics input is important for detector/accelerator requirements

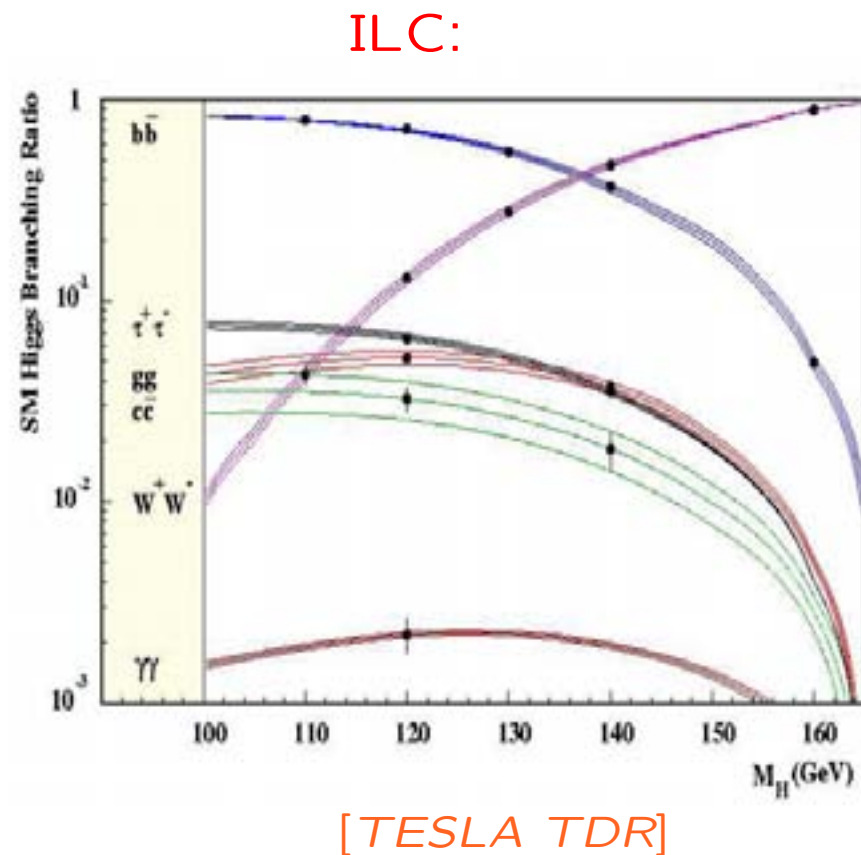
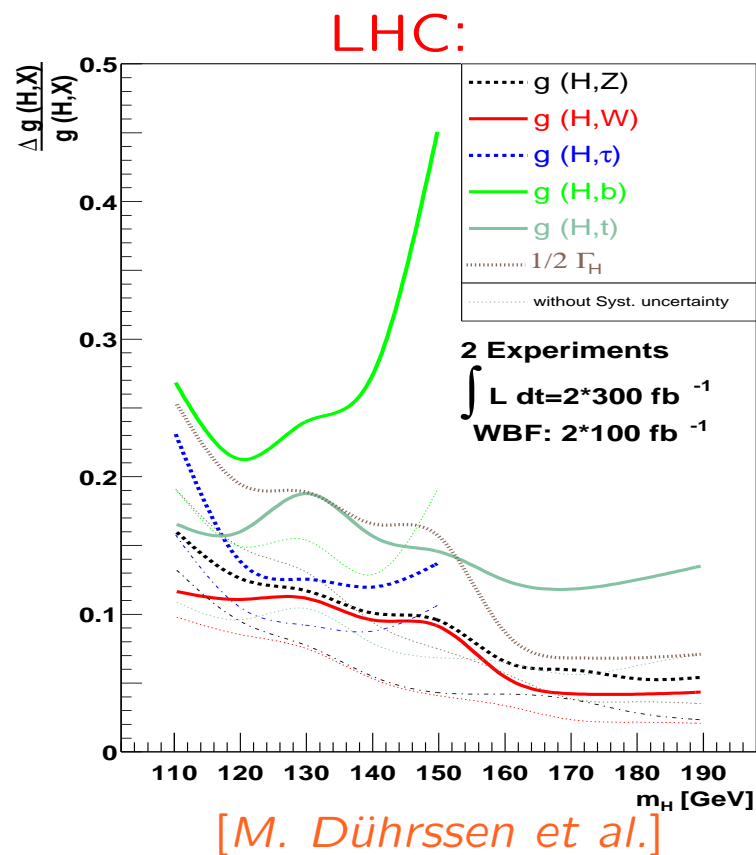
⇒ bad planning ... (time could be spent more “economically”)

3. Higgs at the LHC \oplus ILC

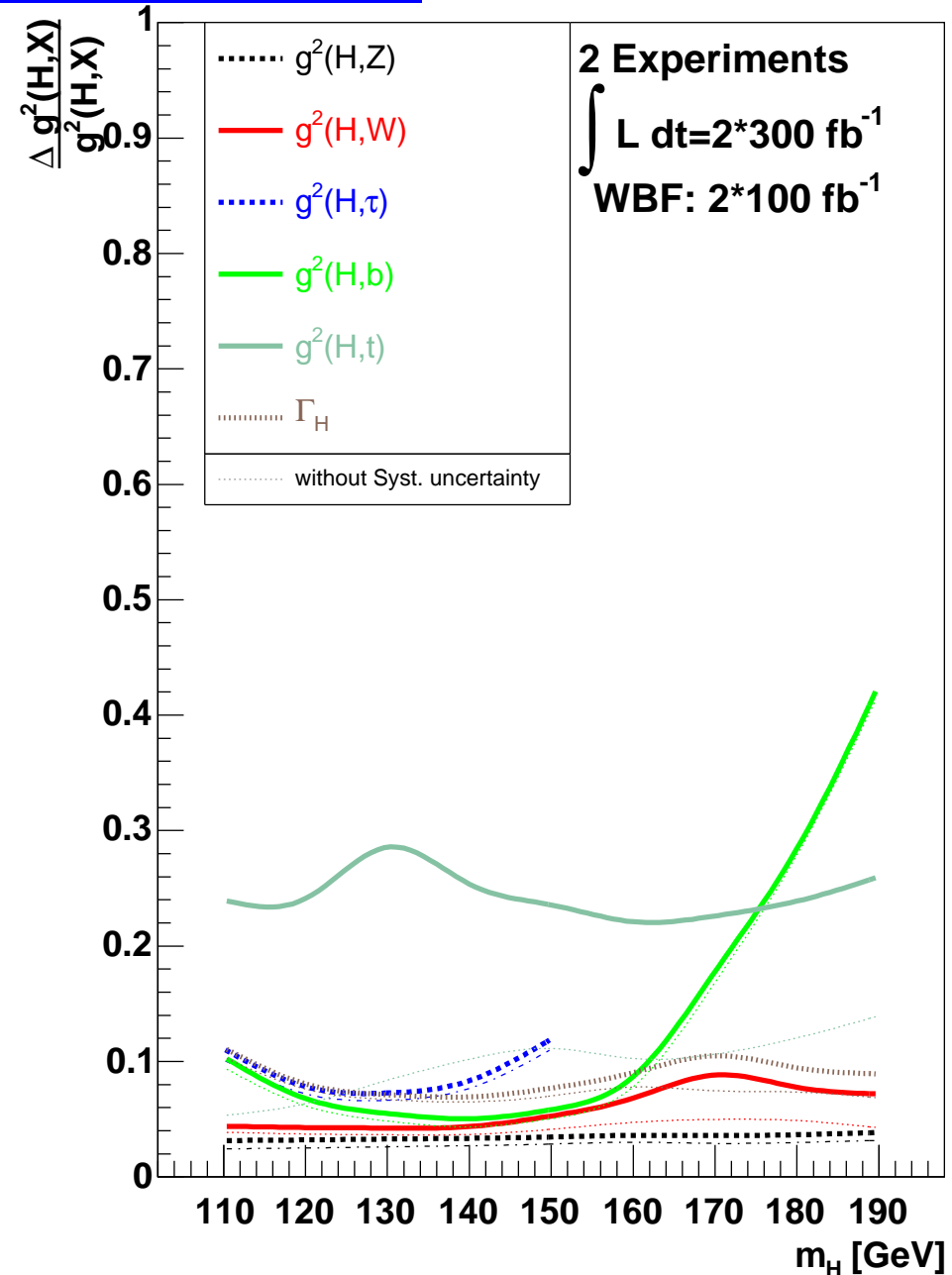
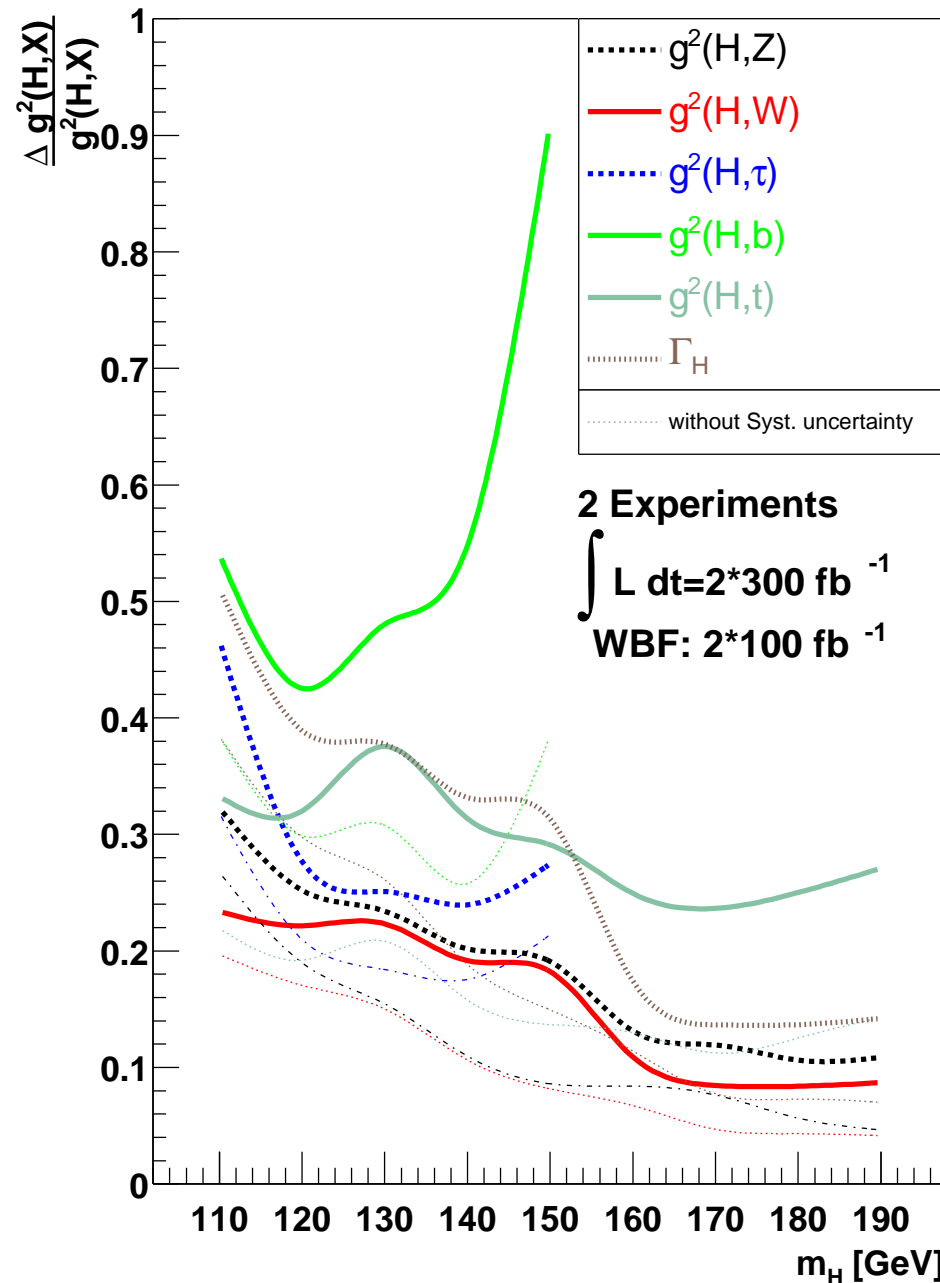
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(although originally not foreseen)
- interesting talk by Kyle Cranmer

3. Higgs at the LHC \oplus ILC

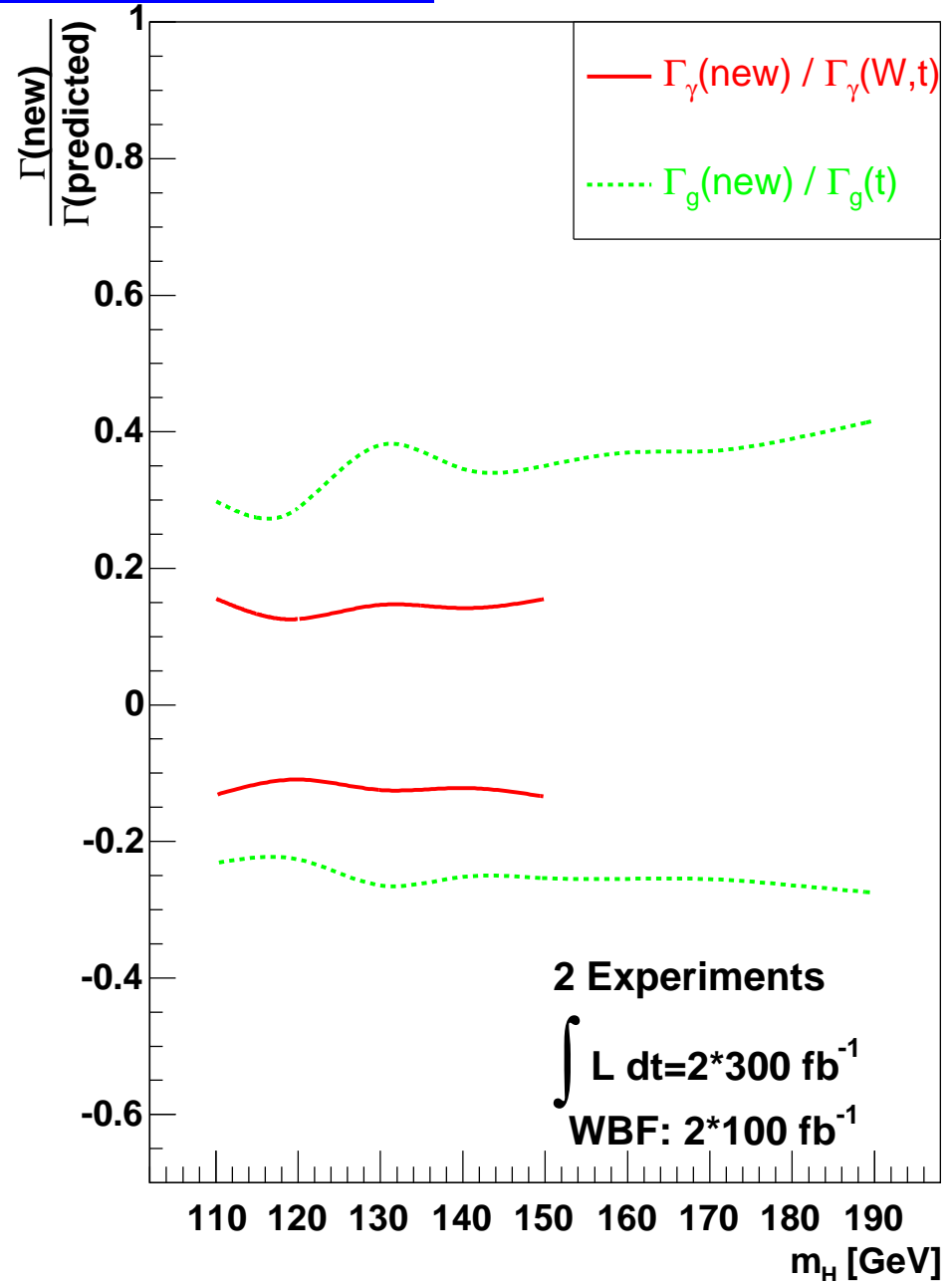
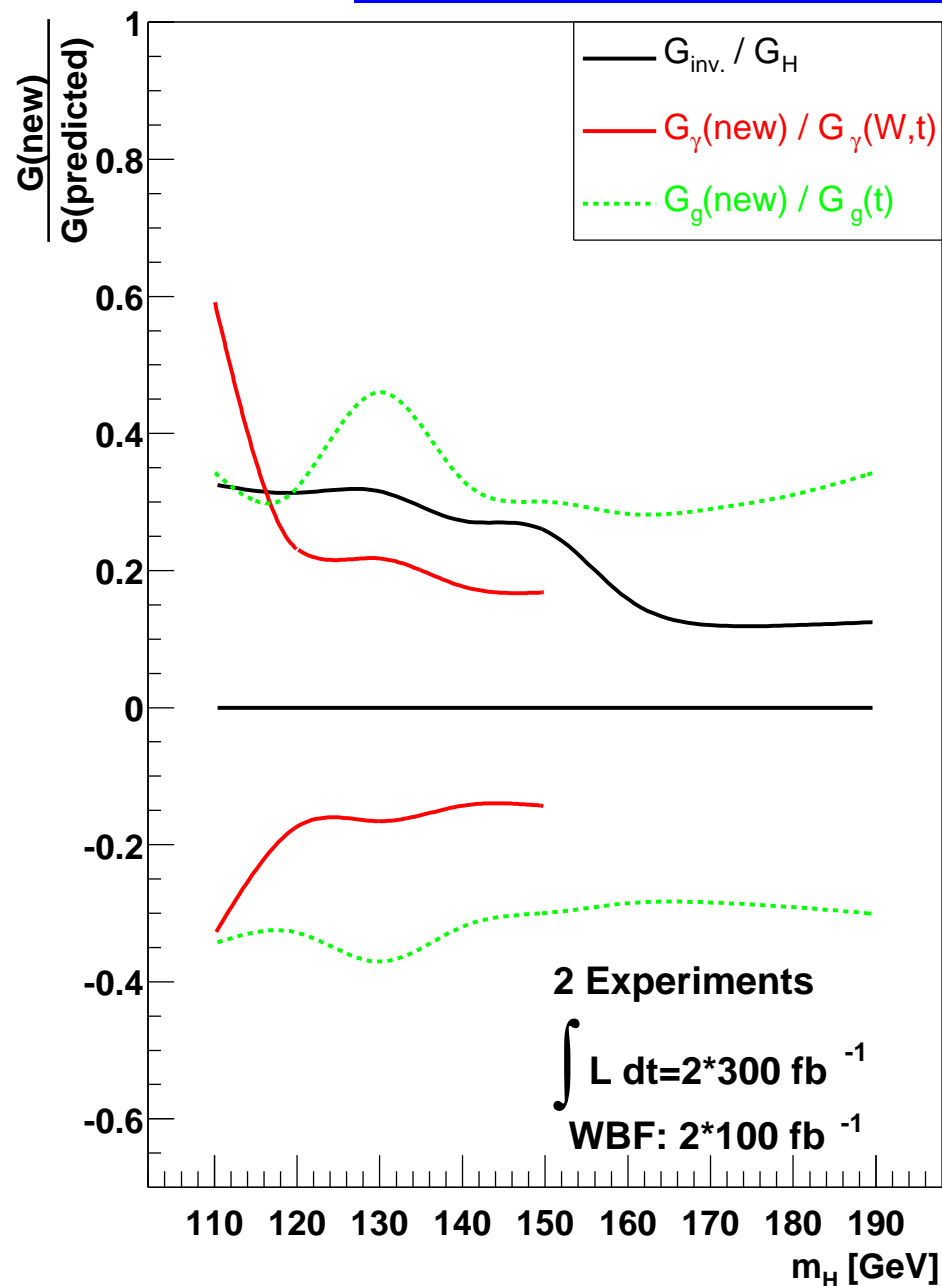
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LHC \oplus ILC: Compare old and new results for $g_{Ht\bar{t}}$: [M. Dührssen et al.]



LHC \oplus ILC: Compare old and new results for $g_{H\gamma\gamma}$: [M. Dührssen et al.]



4. Precision Observables and Polarization

Joint Higgs/top/QCD session: → talk by Gudi Moortgat-Pick

⇒ connection of e^+ polarization with Higgs physics and electroweak precision observables

⇒ not only detector and theory issues, but also accelerator issues to get the required precision!

Two examples:

- polarization to enhance small Higgs cross sections
- e^+ polarization for EWPO

Example I: polarization to enhance small Higgs cross sections

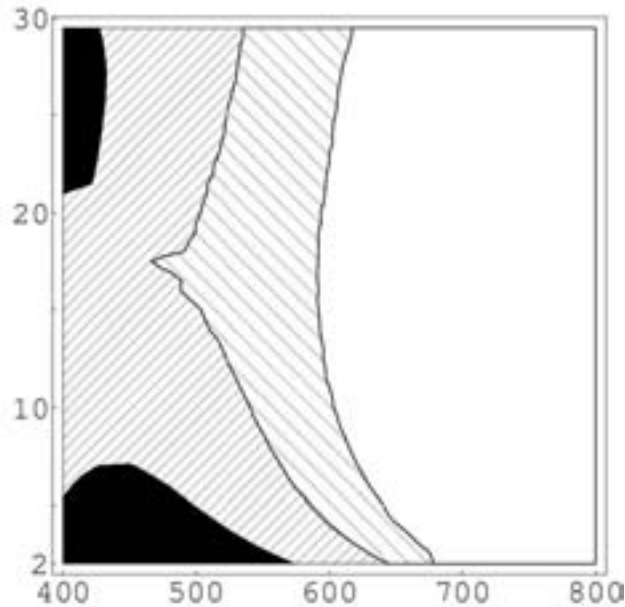
Q: How can the reach for heavy MSSM Higgs bosons be extended beyond the kinematic reach $M_H \lesssim \sqrt{s}$?

Example I: polarization to enhance small Higgs cross sections

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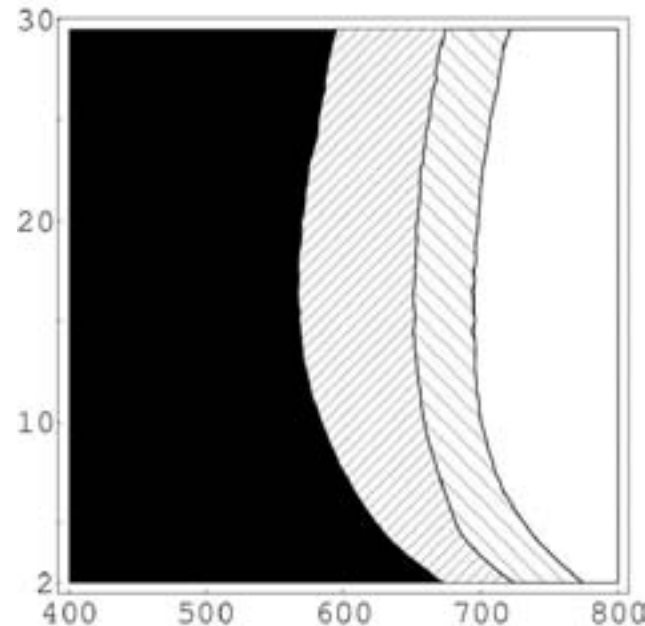
A: Possibly by $e^+e^- \rightarrow \nu\bar{\nu}H$ including loop corrections and polarization
[*T. Hahn et al. '03*]

$\tan\beta$



M_A [GeV]

$\tan\beta$



M_A [GeV]

\Rightarrow large enhancement in ILC reach

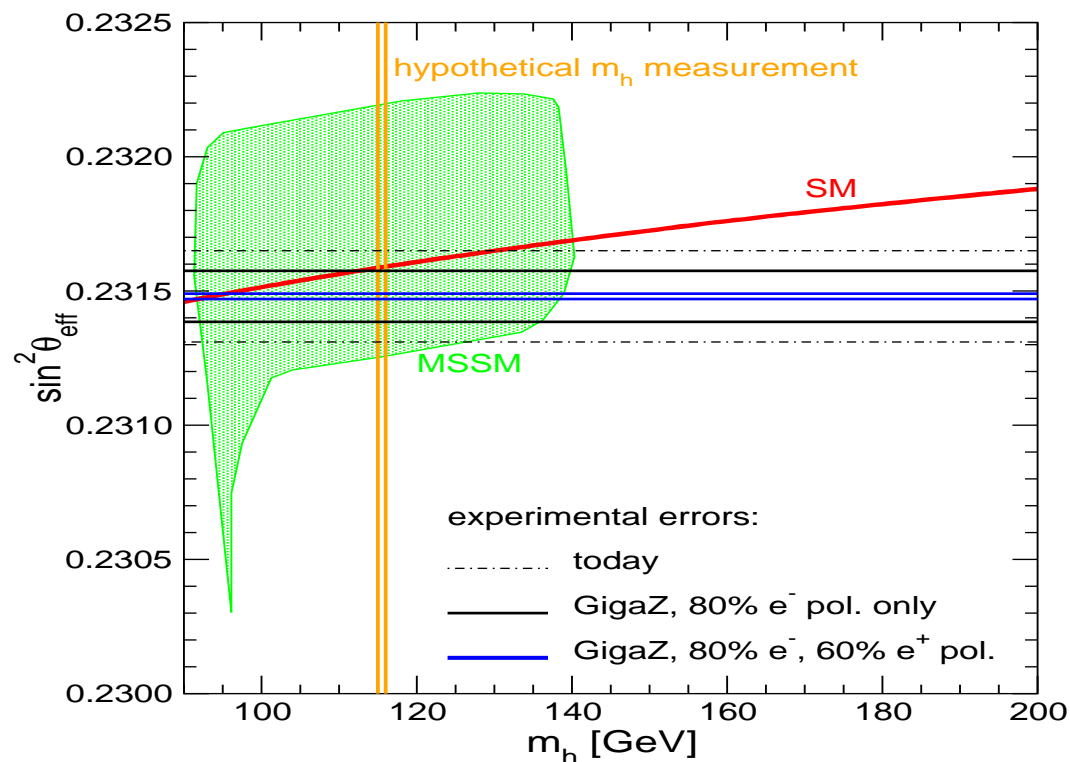
Example II: e^+ polarization for EWPO

Q: What is the improvement in $\sin^2 \theta_{\text{eff}}$?

Example II: e^+ polarization for EWPO

Q: What is the improvement in $\sin^2 \theta_{\text{eff}}$?

A: A lot! (factor of ~ 5) [S.H., G. Weiglein '04]



⇒ very sensitive test of SM/MSSM

⇒ even sensitive beyond direct reach of LHC/ILC

⇒ e^+ polarization is an important accelerator requirement

5. Continuation:

- Higgs precision and detector issues
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