

Model independent extraction of top Yukawa coupling from LHC + LC

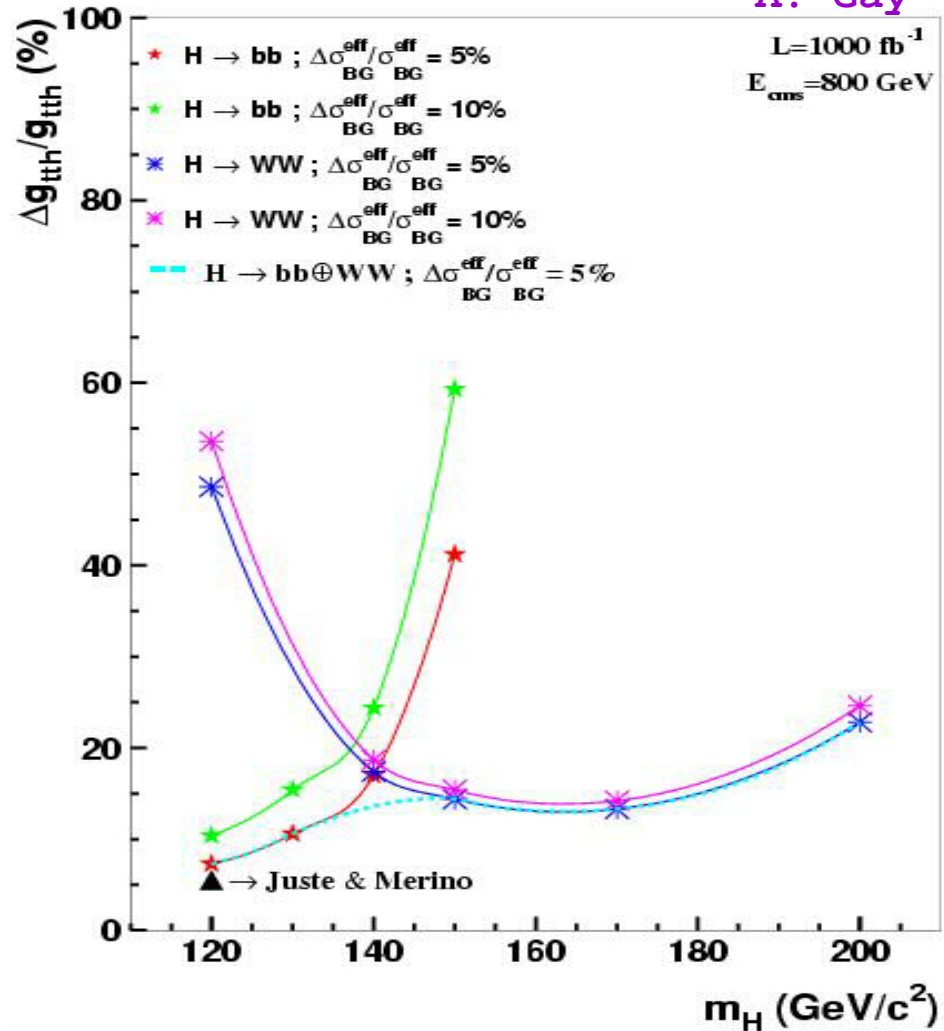
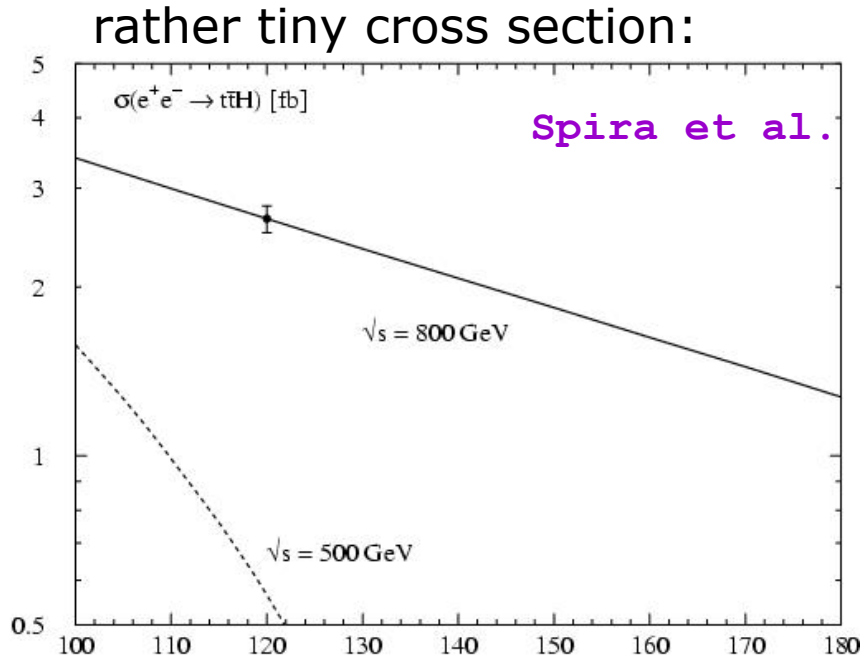
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M. Schumacher (Bonn)
LHC/LC meeting
CERN 14/02/03

- top Yukawa coupling is a good place to hope for surprises
⇒ how can we measure it absolutely?
- sensitivity both at LHC and LC:
 - from $gg \rightarrow H$ at LHC (but what else is in the loop?, large QCD uncertainties)
 - from $BR(H \rightarrow gg)$ at LC (same problem)
 - from threshold of $e^+e^- \rightarrow t\bar{t}$ (but very little sensitivity)
 - from $e^+e^- \rightarrow t\bar{t}H$ at LC (but need high energy, 800 GeV)
 - from $gg \rightarrow t\bar{t}H$ at LHC (but need to know Higgs BR's)

Top Yukawa coupling at 800 GeV LC:

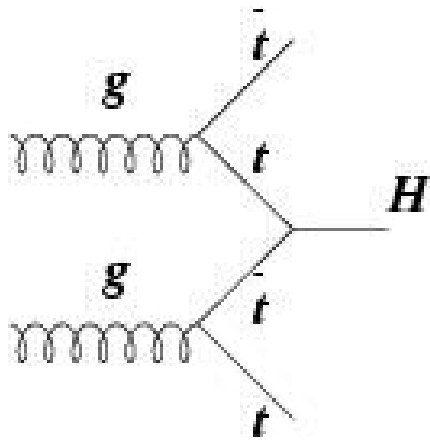
A. Gay

$L=1000 \text{ fb}^{-1}$
 $E_{\text{cms}}=800 \text{ GeV}$



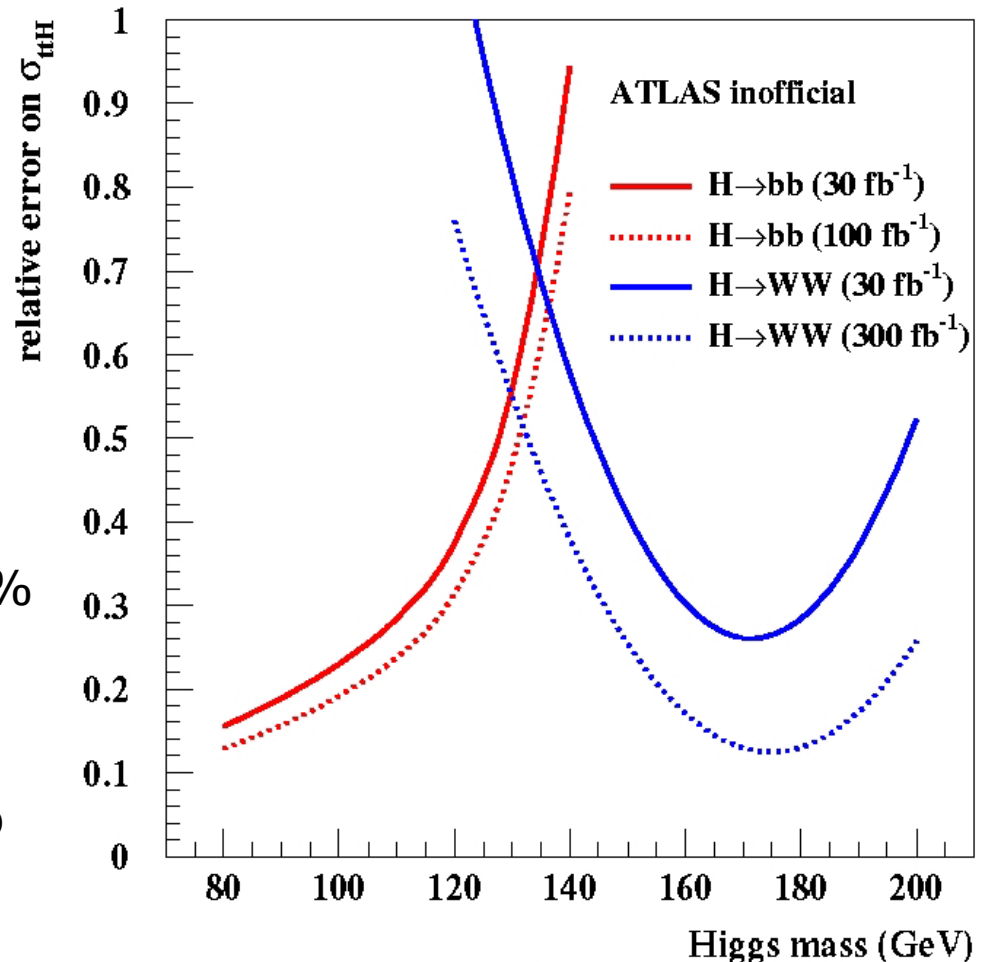
limited mass reach...

ttH production Yukawa coupling at LHC



- controllable QCD uncertainties (Spira et al, Dawson et al) 10-15%
- rather low rate
- final States $H \rightarrow bb$ and $H \rightarrow WW$ being analysed in ATLAS (more to come...)

statistical error only:



Top Yukawa coupling from LC + LHC

Idea: take absolute BR measurement from LC and cross section measurement from LHC.

Assumptions:

Cross section uncertainty at LHC (incl 15% from NLO+SF)

120 GeV 34% (incl 15% from NLO+SF, from bb, 100 fb⁻¹)

160 GeV 23% (" " , from WW, 300 fb⁻¹)

200 GeV 30% (" " , from WW, 300 fb⁻¹)

LC uncertainties (TESLA TDR)

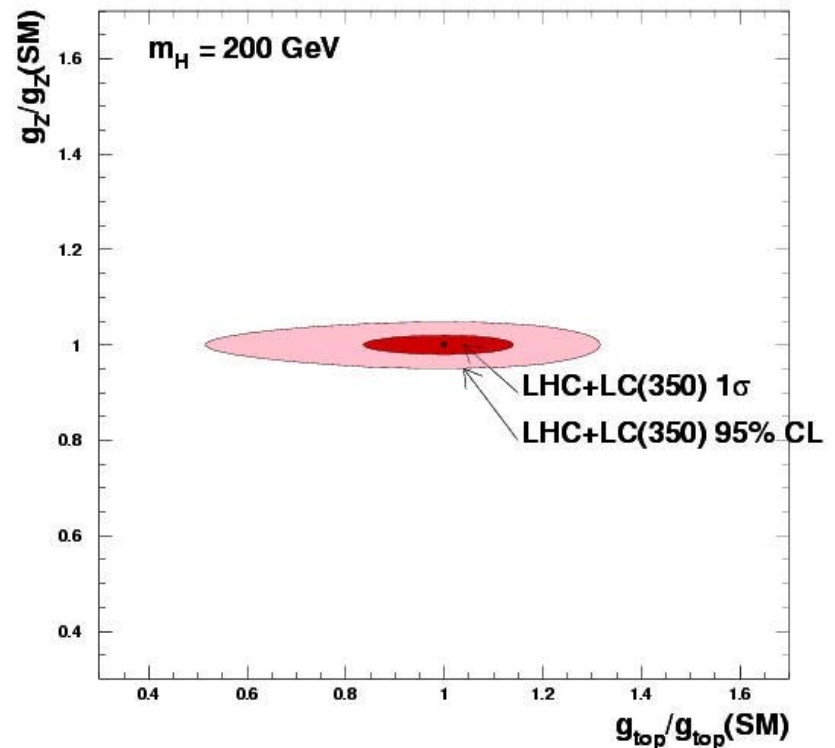
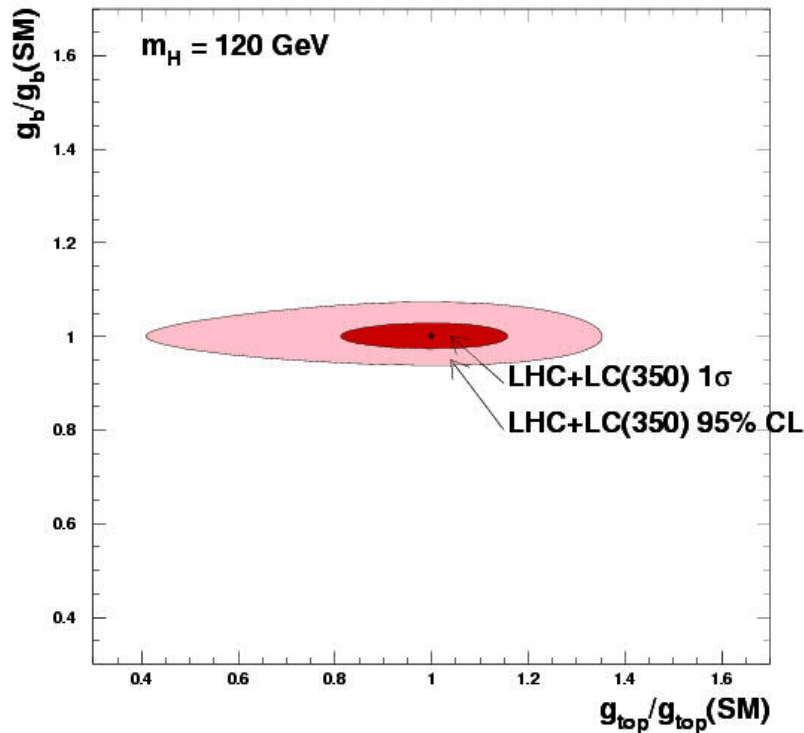
120 GeV: BR(bb) 2.4%, BR(WW) 5.1%, σ (HZ) 2.4%, σ (WW) 2.0%

200 GeV: BR(bb) none, BR(WW) 4%, ZZ 4%, σ (HZ) 4%, σ (WW) –
(BR(cc),BR(gg) etc are not used!)

First Very Preliminary Result

Error on g_{ttH} 16.8% (@120 GeV) 14.9% (@200 GeV)

HFITTER:



Looks promising...

Next: BG uncertainties, closer look at SF uncertainties

Other projects for LHC/LC (abstracts for WG document):

- E. Gross, S.Heinemeyer, F.Moortgat, M. Schumacher, G.Weiglein, KD:

SUSY Higgs BR's: direct vs. indirect

Longer term goal:

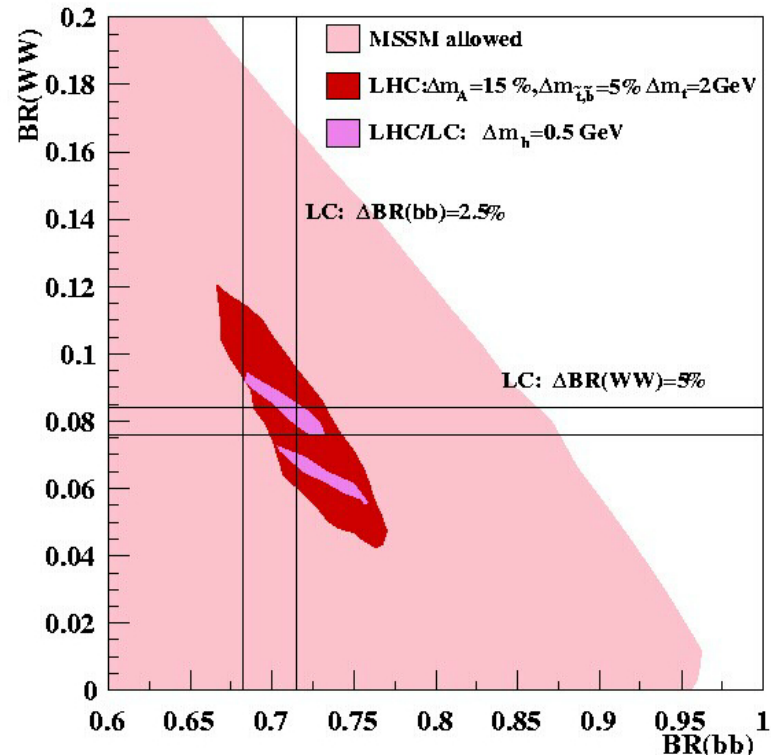
Joint interpretation of all

Observables relevant for

MSSM Higgs sector

⇒ consistency within MSSM?

⇒ sensitivity to beyond-MSSM?

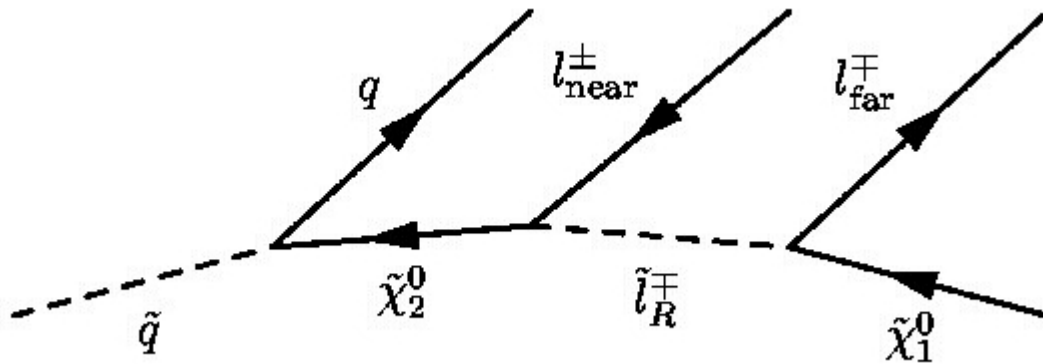


Other projects for LHC/LC (abstracts for WG document):

- N Godbhande , KD, N.N.:

Squark masses at LHC in scenarios with stau NLSP

⇒ could the tau tau spectrum be fitted with input of light sparticle masses from LC?



Here we need help from an LHC friend... any volunteers?