

# H cross section and mass measurement with $H \rightarrow WW \rightarrow \ell\nu\ell\nu$ at the LHC

G. Davatz, M.D. and F. Pauss, Phys. Rev D76 (2007) 032001

Using signal cross section plus analysis of the lepton  $p_T$  spectra (assuming the SM Higgs cross section is known with  $\pm 5\%$ ) with about  $10 \text{ fb}^{-1}$  SM Higgs mass accuracy  $\pm 2\text{-}2.5 \text{ GeV}$

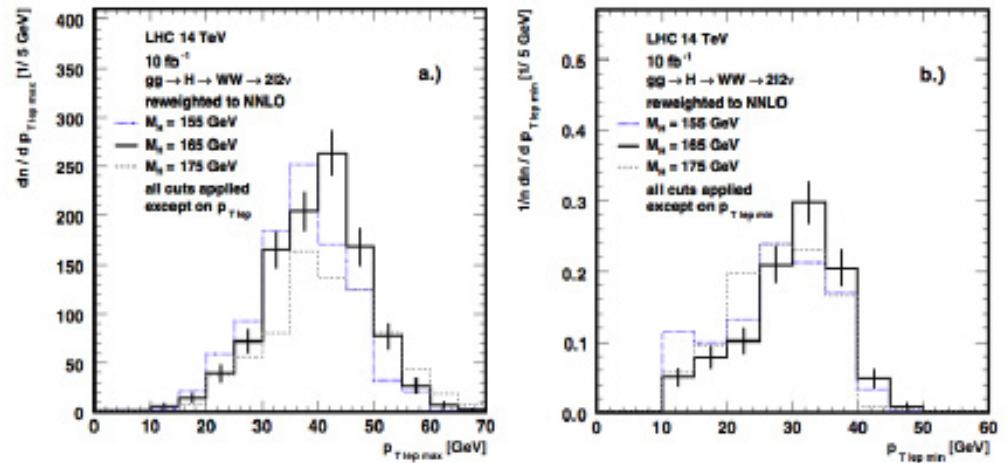
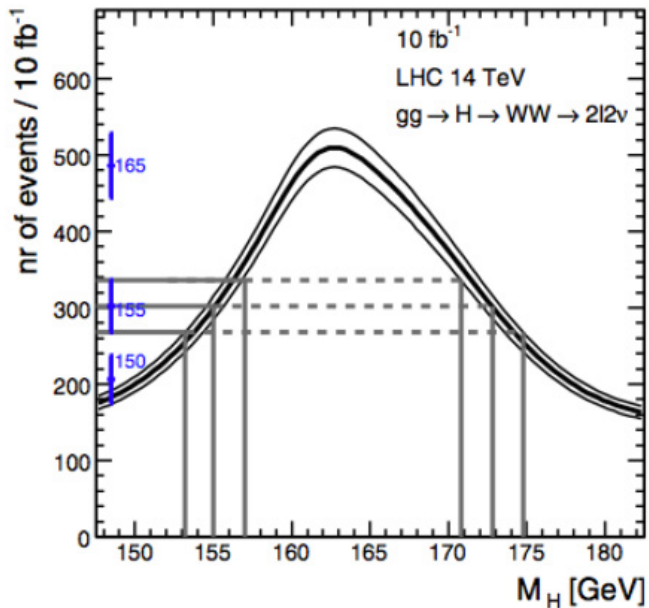
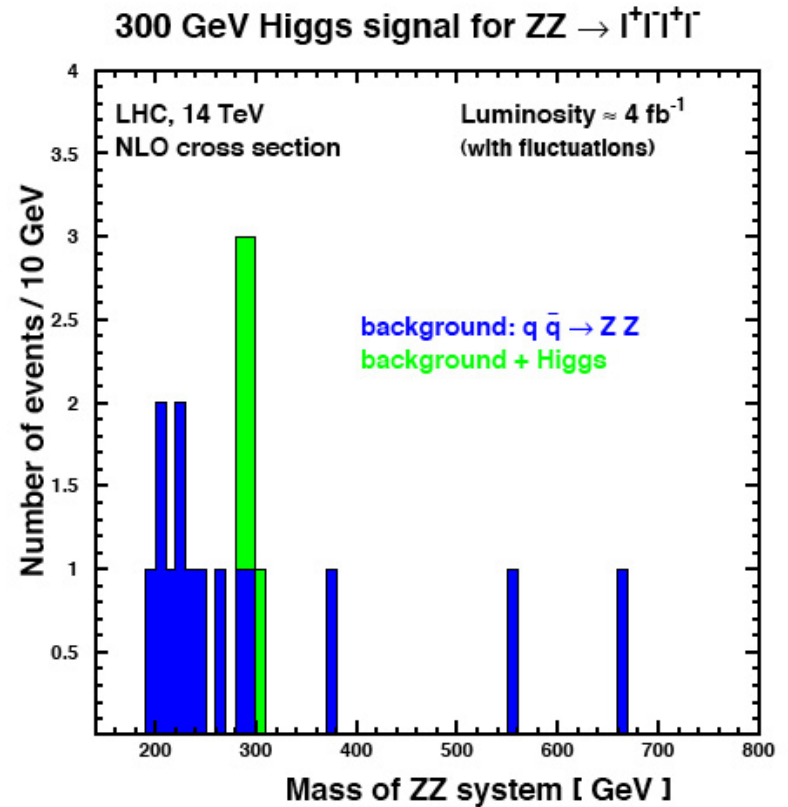
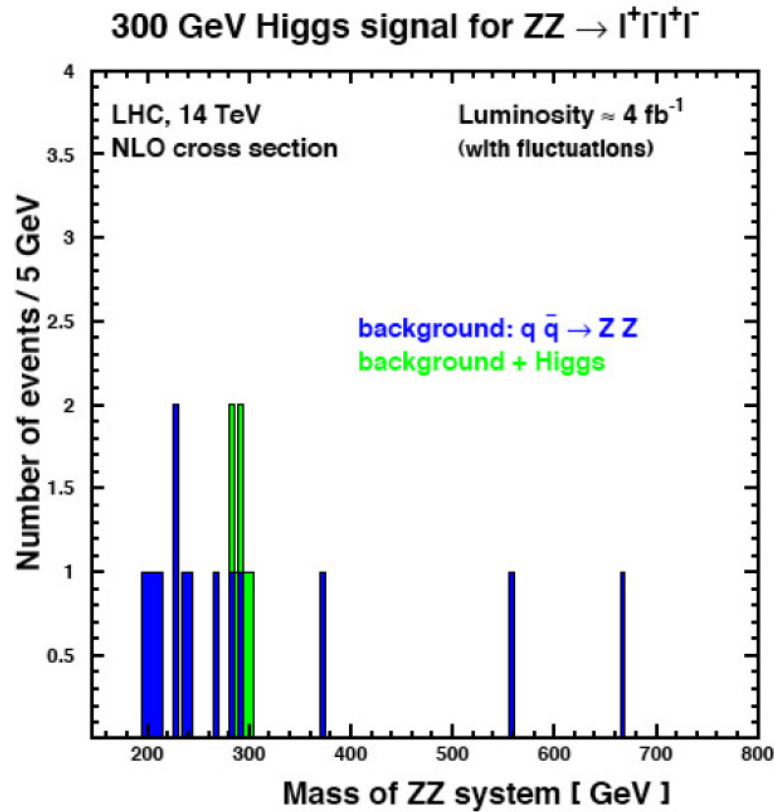


FIG. 10 (color online). Normalized  $p_T$  distribution of the leptons for different Higgs masses and for a luminosity of  $10 \text{ fb}^{-1}$ . (a) All cuts are applied except the ones on  $p_T$  of the leptons (b) all cuts are applied except the one on  $p_{T \text{ lep min}}^{\ell}$ .

# A warning: how 5 sigma 4-lepton signals would look like with $4 \text{ fb}^{-1}$



Attention: Identical events but plots with 5 GeV and 10 GeV binning!

## Higgs searches within realistic(?) LHC boundaries (2010-2012) (1)

**2009/2010 (current scenario)  $\leq 10$  TeV and  $0.2 \text{ fb}^{-1}$ :**

**end of 2010(!) at best some exclusions near 160-170 GeV!**

**2011/2012 most likely scenario:**

**in steps to 12 TeV and perhaps 13 TeV**

**unlikely to achieve good luminosity with changing energies!**

**Signal cross section:  $\sigma(10 \text{ TeV}) = 0.5 \sigma(14 \text{ TeV})!$**

**$\approx 12.5\%$  drop for every TeV loss!**

**some loss for the “peak” luminosity? 10% per TeV(?)**

**$\rightarrow 5\text{-}10 \text{ fb}^{-1}$  at 10 TeV  $\approx 2\text{-}4 \text{ fb}^{-1}$  at 14 TeV!**

**$\rightarrow$  end of 2012: Higgs sensitivity near 155-180 GeV mass  
starting to see some 3-4 sigma effects in the  $H \rightarrow ZZ \rightarrow llll$   
channel for 140-155 GeV and 200-350 GeV.**

## Higgs searches within realistic(?) LHC boundaries (2010-2012) (2)

alternative scenario (no running in 2009) but startup somewhat less risky (all sectors corrected) and perhaps time to understand the 14 TeV magnet problem!

an optimistic energy (14 TeV) and luminosity scenario:

no data in 2009(!) and no or tiny difference for 2010!

$\leq 10$  TeV and  $0.2 \text{ fb}^{-1}$ : at best some exclusions near 160-170 GeV.

but can still hope for reaching 14 TeV already in 2011!

.. 2011  $\leq 14$  TeV and  $1 \text{ fb}^{-1}$ : Higgs sensitivity near 160-170 GeV mass

2012 running at 14 TeV!!!! with 5-10  $\text{fb}^{-1}$ :

Higgs sensitivity near 150-180 GeV (signals for  $gg \rightarrow WW$  and  $qq \rightarrow qqWW$ )

Possible 5 sigma signal  $H \rightarrow ZZ$  4 leptons

(mass range from 140-150 GeV and 200-350 GeV)

For me this scenario looks more interesting! What about you?

Small problem remains: "What to do with the 11 million saved euro?"