

Addendum:

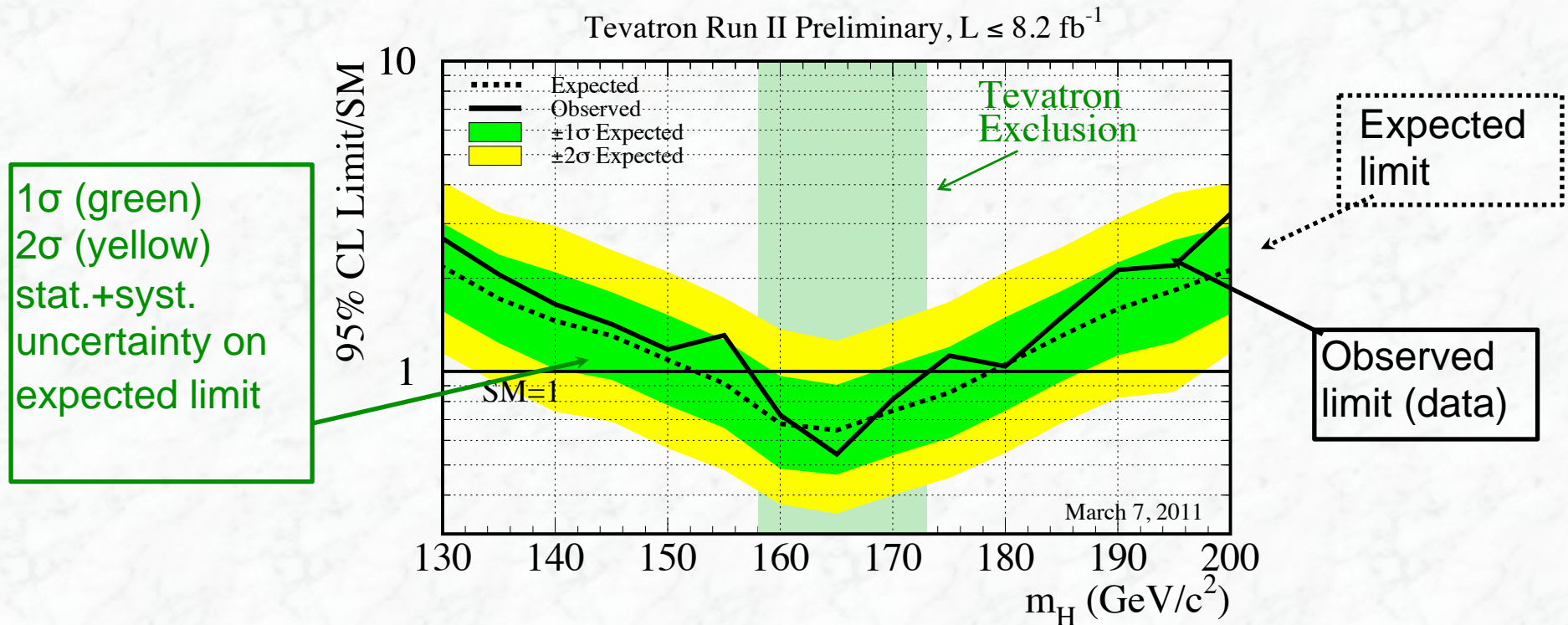
First Constraints on the Higgs boson mass

from the LHC

ATLAS and CMS searches in several channels

Results, as presented at the EPS conference in Grenoble on 22. July 2011

Status so far: Combined Tevatron limits



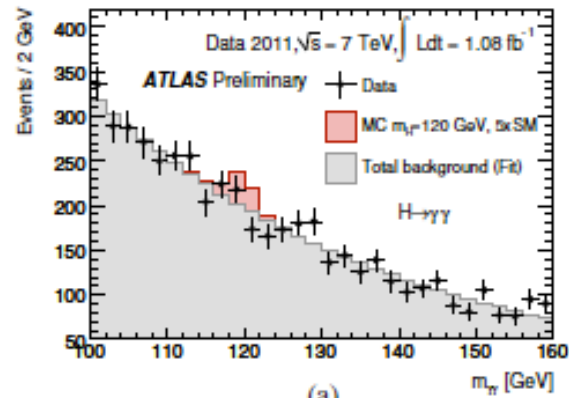
Tevatron experiments set a 95% CL exclusion of a SM Higgs boson in the mass region 158–173 GeV (first direct exclusion since LEP)

At $m_H = 115 \text{ GeV}$ Expected limit: $1.8 \times \sigma_{SM}$

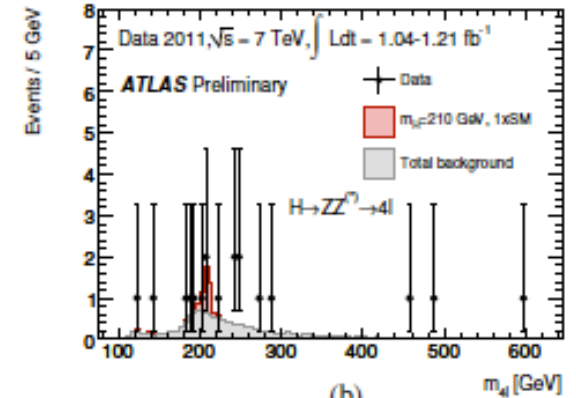
Observed limit: $2.7 \times \sigma_{SM}$

ATLAS and CMS searches in several channels:

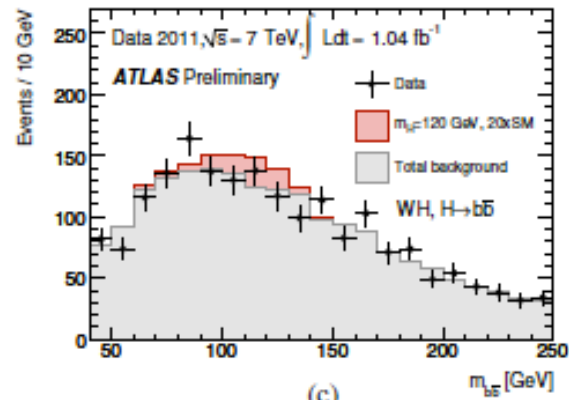
ATLAS



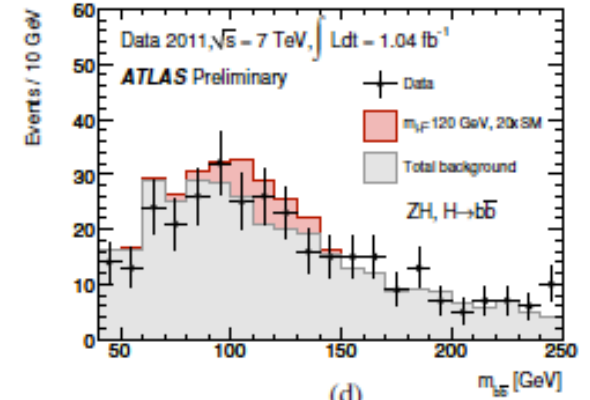
(a)



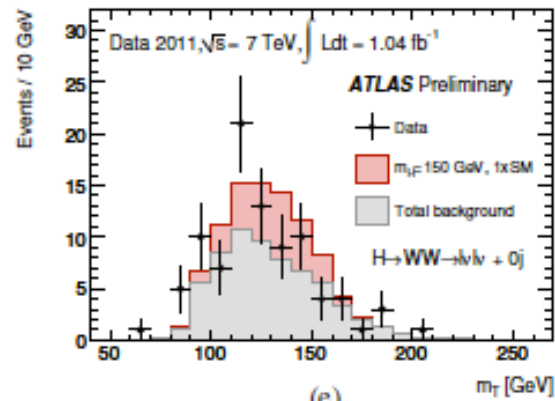
(b)



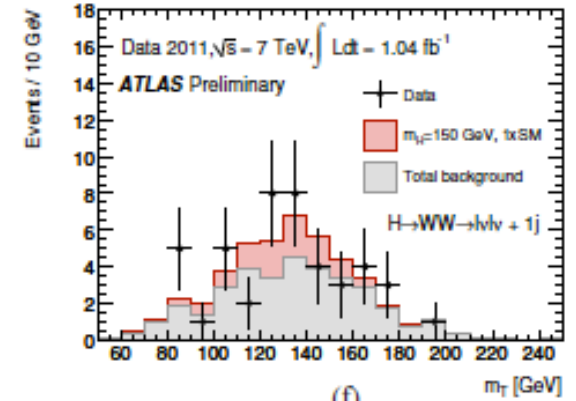
(c)



(d)



(e)



(f)

ATLAS and CMS searches in several channels:

ATLAS

High mass region:

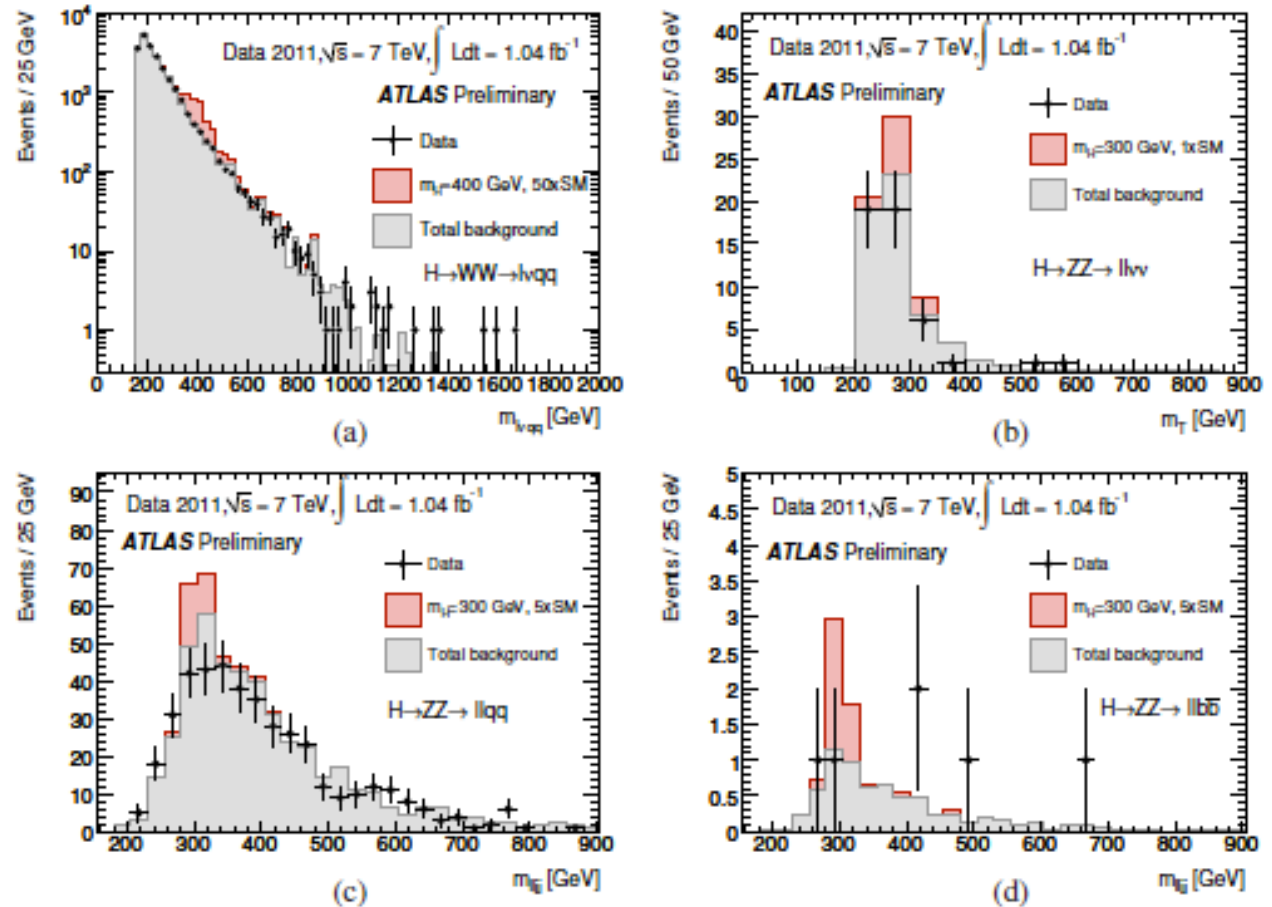
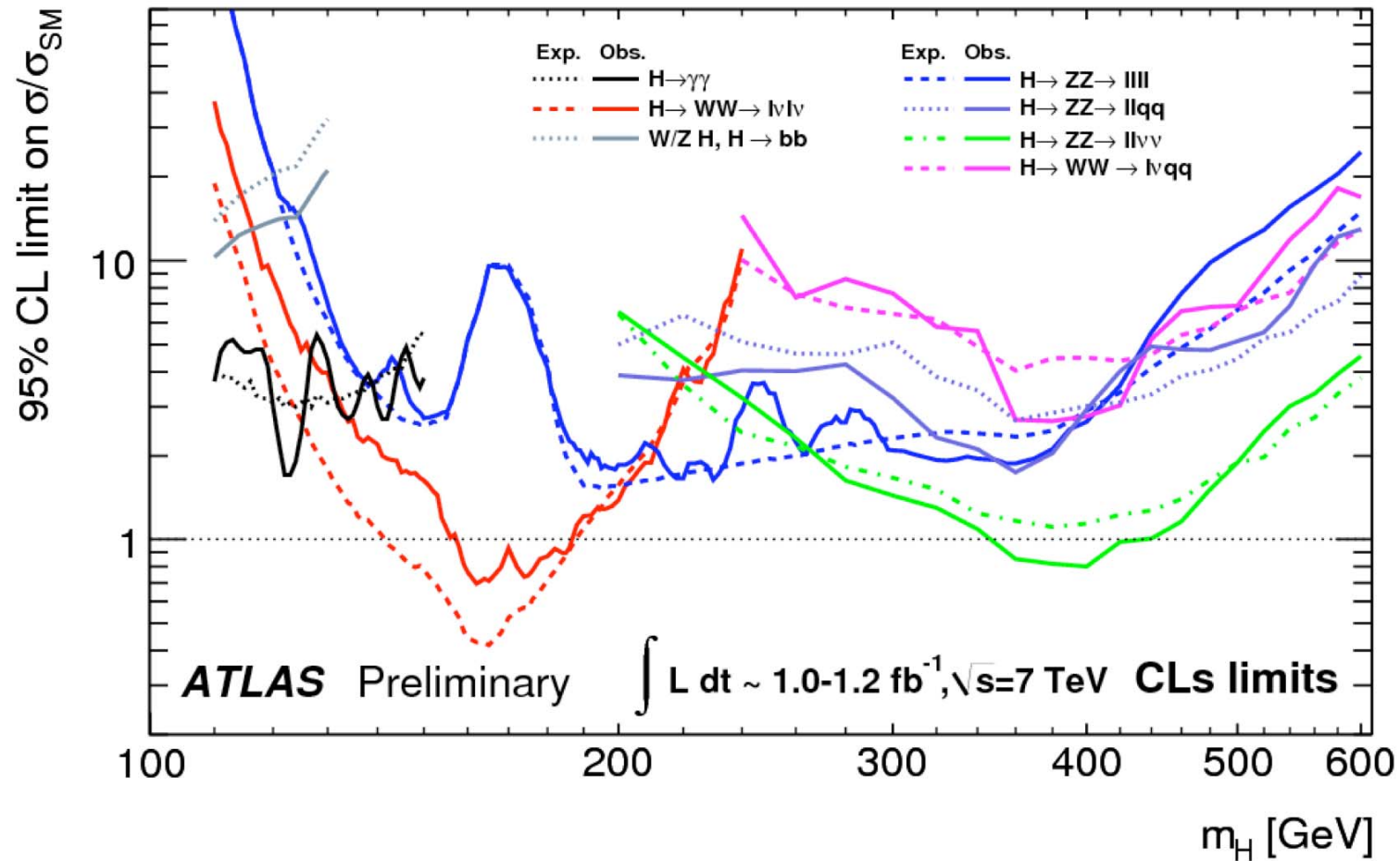


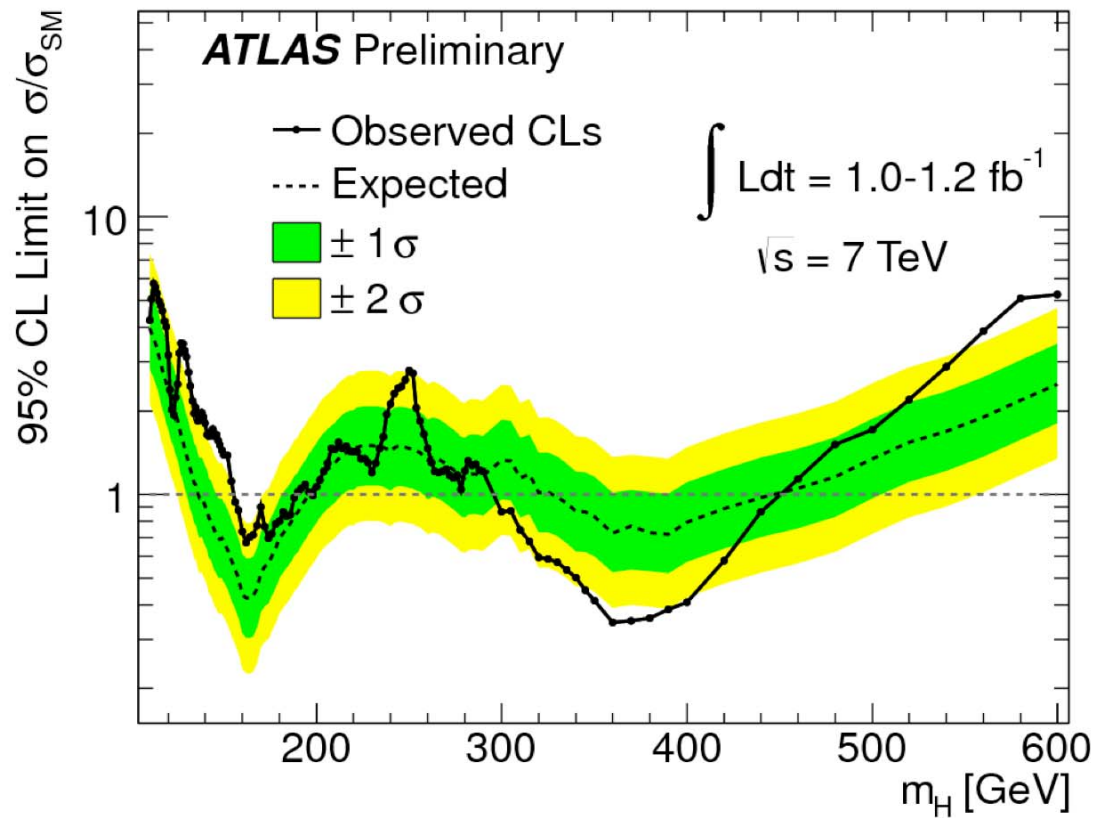
Figure 2: The invariant or transverse mass distributions for the candidate events selected, the total background and the signal expected in the $H \rightarrow WW \rightarrow \ell\nu qq$ (a) and $H \rightarrow ZZ \rightarrow \ell\nu\nu$ (b) channels and the $H \rightarrow ZZ \rightarrow \ell\ell qq$ tagged (c) and untagged (d) categories.

Limits on Higgs boson cross sections:



Limit in the $\text{H} \rightarrow \text{WW}$ channel in the mass region around 140-150 GeV worse than expected (Excess of events seen in ATLAS and CMS)

Combined limit (all channels) on Higgs boson cross sections:

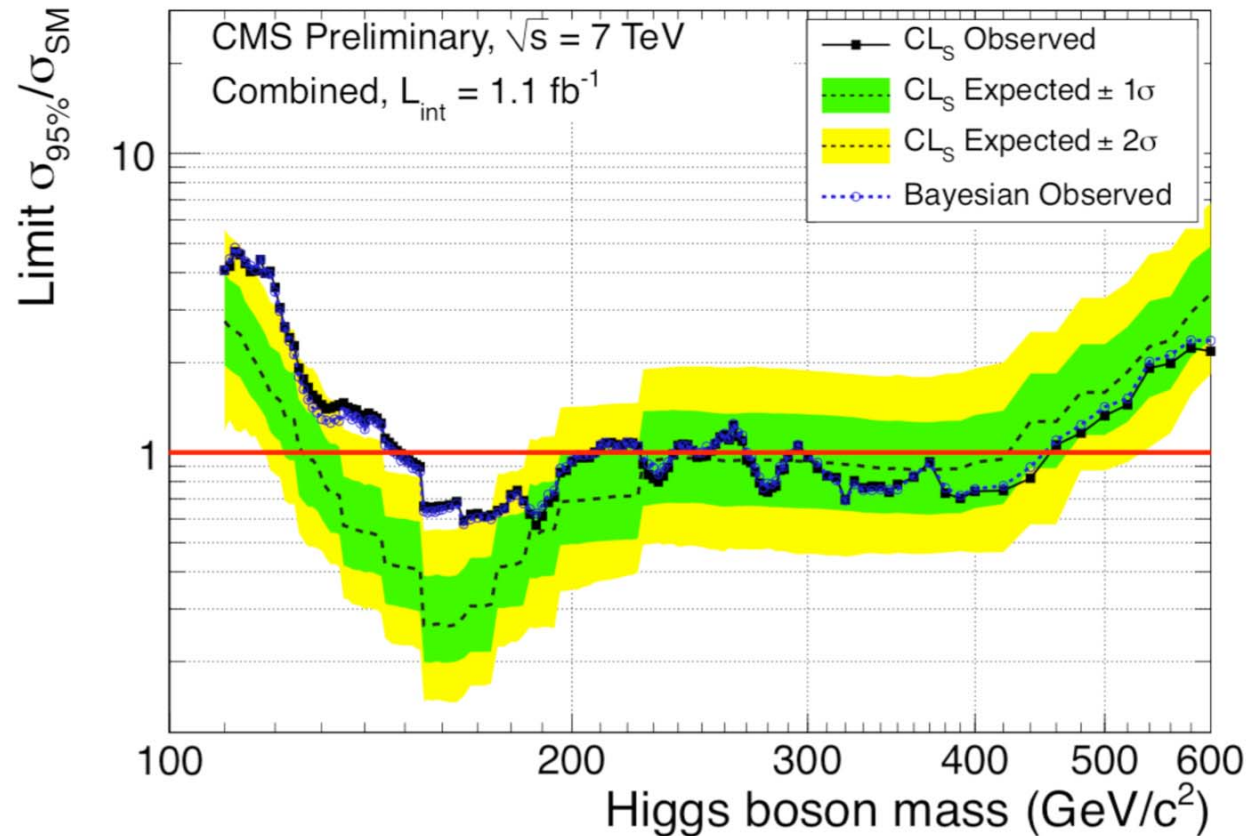


Limit in the $H \rightarrow WW$ channel in the mass region around 140-150 GeV worse than expected (**Excess of events seen in ATLAS and CMS**)

Excluded mass regions: 155 – 190 GeV
and 295 - 450 GeV

expected (no signal): 136 – 196 GeV
327 – 443 GeV

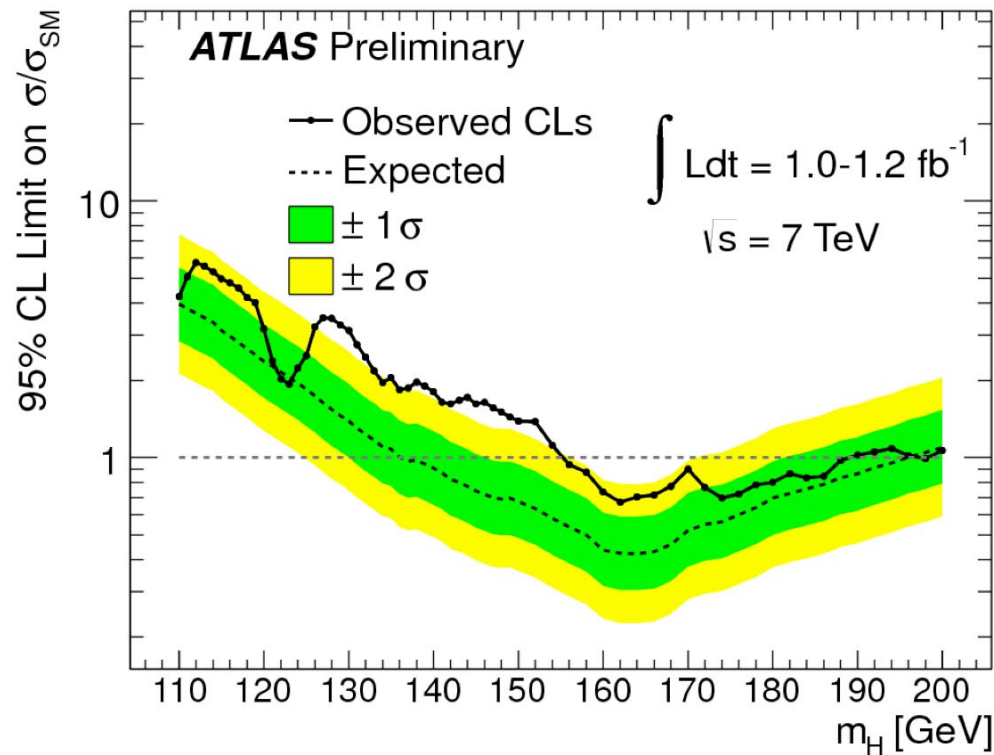
Combined limit (all channels) on Higgs boson cross sections:



Limit in the $H \rightarrow WW$ channel in the mass region around 140-150 GeV worse than expected (Excess of events seen in ATLAS and CMS)

Excluded mass regions: 149 – 206 GeV expected (no signal): 127 – 420 GeV

Combined limit (all channels) in the low mass region:

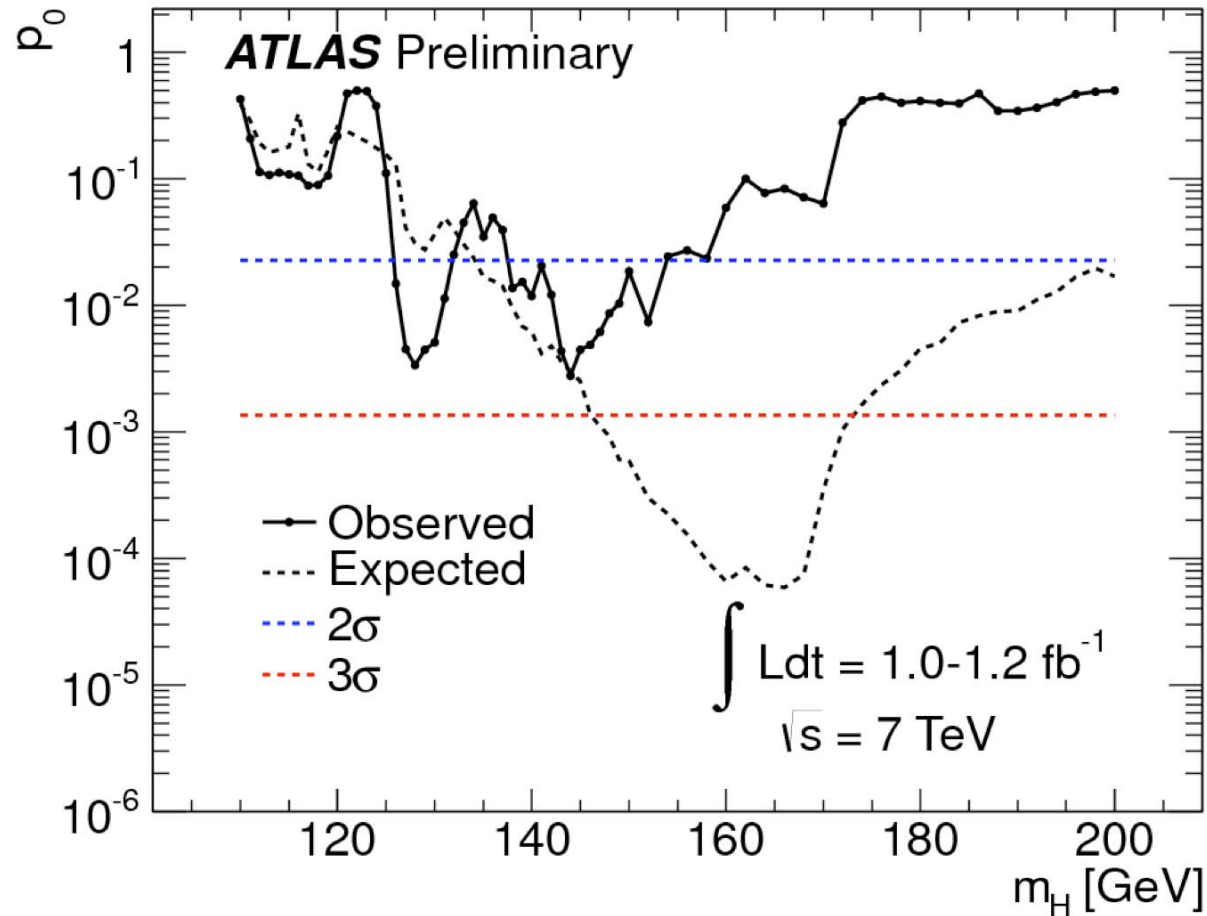


Limit in the $H \rightarrow WW$ channel in the mass region around 140-150 GeV worse than expected (**Excess of events seen in ATLAS and CMS**)

Excess in mass region 120 – 140 GeV: $\sim 2.8\sigma$

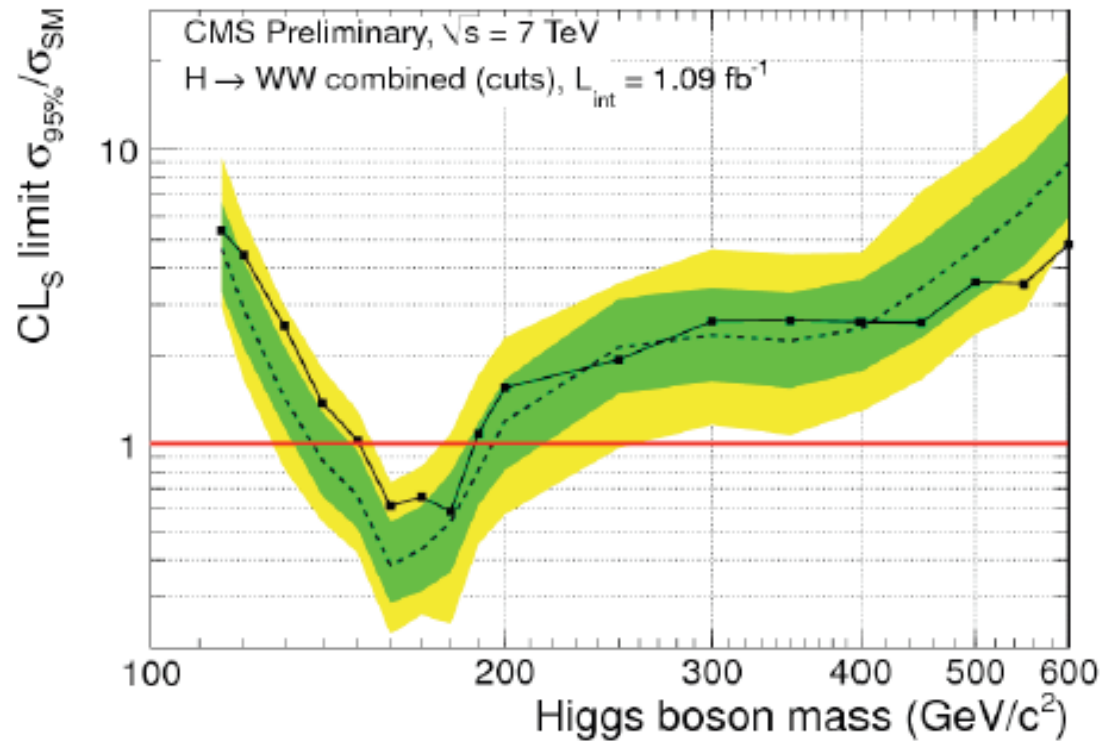
Excluded mass regions: 155 – 190 GeV expected (no signal): 136 – 196 GeV

Consistency of the data with the background only hypothesis:



The consistency of the observed results with the background-only hypothesis is shown in the low mass range. The dashed line shows the median expected significance in the hypothesis of a signal. The two horizontal dashed lines indicate the p-values corresponding to significances of 2 σ and 3 σ .

CMS exclusion plot in the $H \rightarrow WW$ channel:



Limit in the $H \rightarrow WW$ channel in the mass region around 140-150 GeV worse than expected (Comparable excess of events as seen in ATLAS)

Excluded mass regions: 150 – 193 GeV