

Search for a SM Higgs Boson in the $H \rightarrow WW \rightarrow l\nu l\nu$ Channel

with 2011 pp-collision data at $\sqrt{s} = 7$ TeV recorded with CMS

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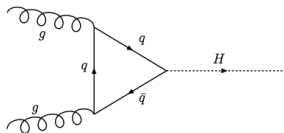
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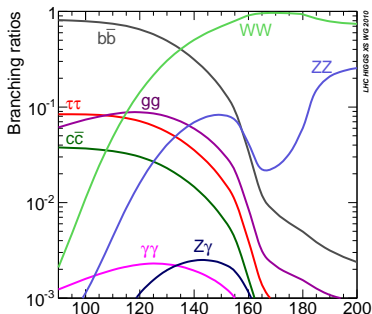
The Standard Model Higgs Boson at the LHC

- Higgs mechanism predicts a Higgs boson - m_H is free parameter
- Direct Limits: $m_H > 114$ GeV (LEP) and excluded 158 – 173 GeV (Tevatron) at 95% C.L.

- Dominant production process:
Gluon-fusion



- $H \rightarrow WW \rightarrow l\nu l\nu$ channel,
 $l = e^\pm / \mu^\pm$
- $BR \approx 1$ for $m_H = 150 - 190$ GeV



Analysis Strategy

Two high p_T leptons and large missing E_T from the neutrinos.

No mass peak for discovery, need exact understanding of background modeling!

Luminosity

2011 data - 4.6 fb^{-1}

Main backgrounds:

- WW
- top
- DY
- W+Jets
- Di-Boson

WW-level preselection:

- Trigger
- Two oppositely charged high p_T leptons
- Z veto: $m_Z \pm 15 \text{ GeV}$
- Low mass resonances: $m_{ll} > 12 \text{ GeV}$
- $p_{T,ll} > 45 \text{ GeV}$
- Top tagging
- Third lepton veto
- Jet counting

Analysis Strategy

Cut based analysis:

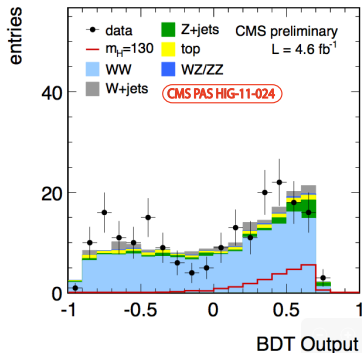
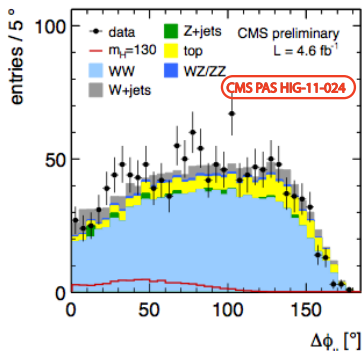
m_H dependent cuts on:

- p_T of the leptons
- dilepton mass
- transverse Higgs mass
- $\Delta\phi_{ll}$ between leptons

Multivariate analysis:

Boosted decision tree

- 0-jet, same flavour
- use BDT output in shape analysis



Systematics

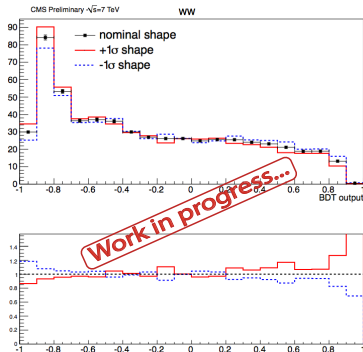
Experimental Uncertainties:

- Lepton efficiencies
- Lepton p_T scale/resolution
- MET resolution
- Jet energy scale
- Luminosity
- Pileup
- Background estimates

Theoretical Uncertainties:

- Higgs cross section
- PDFs
- WW simulation

e.g. **Theoretical uncertainty:**
comparison of BDT output from
Madgraph and MC@NLO



0-jet same flavour

Limits and Conclusions

- BDT analysis with CLs method
- 129-270 GeV @ 95% C.L.
- Combined exclusion: 127-600 GeV
- See also:
- CMS PAS HIG-11-024
- CMS PAS HIG-11-032

