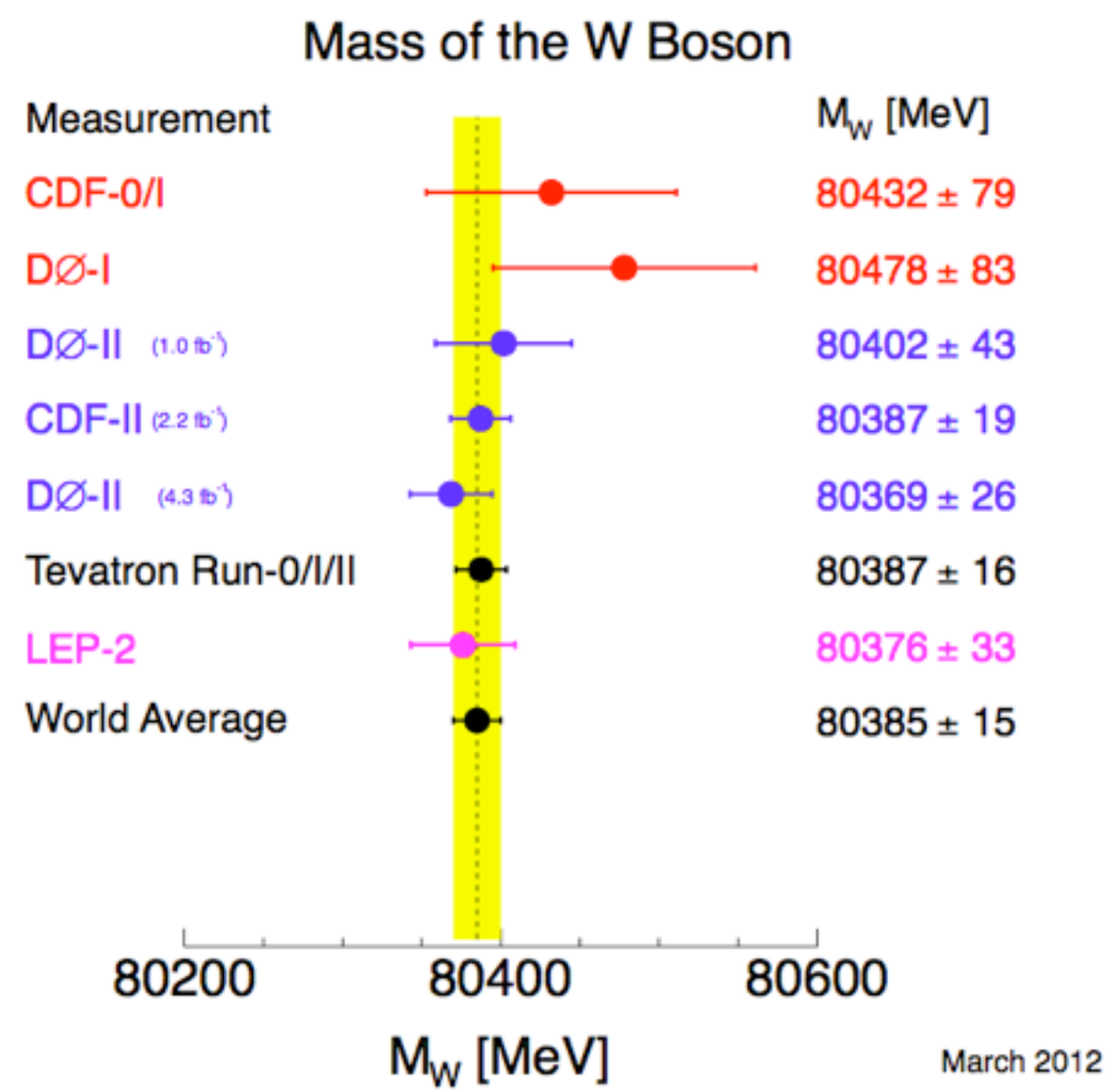
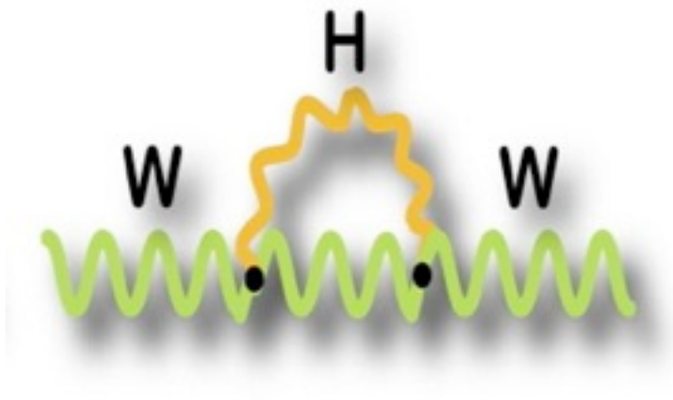
Searches for H→bb at DØ

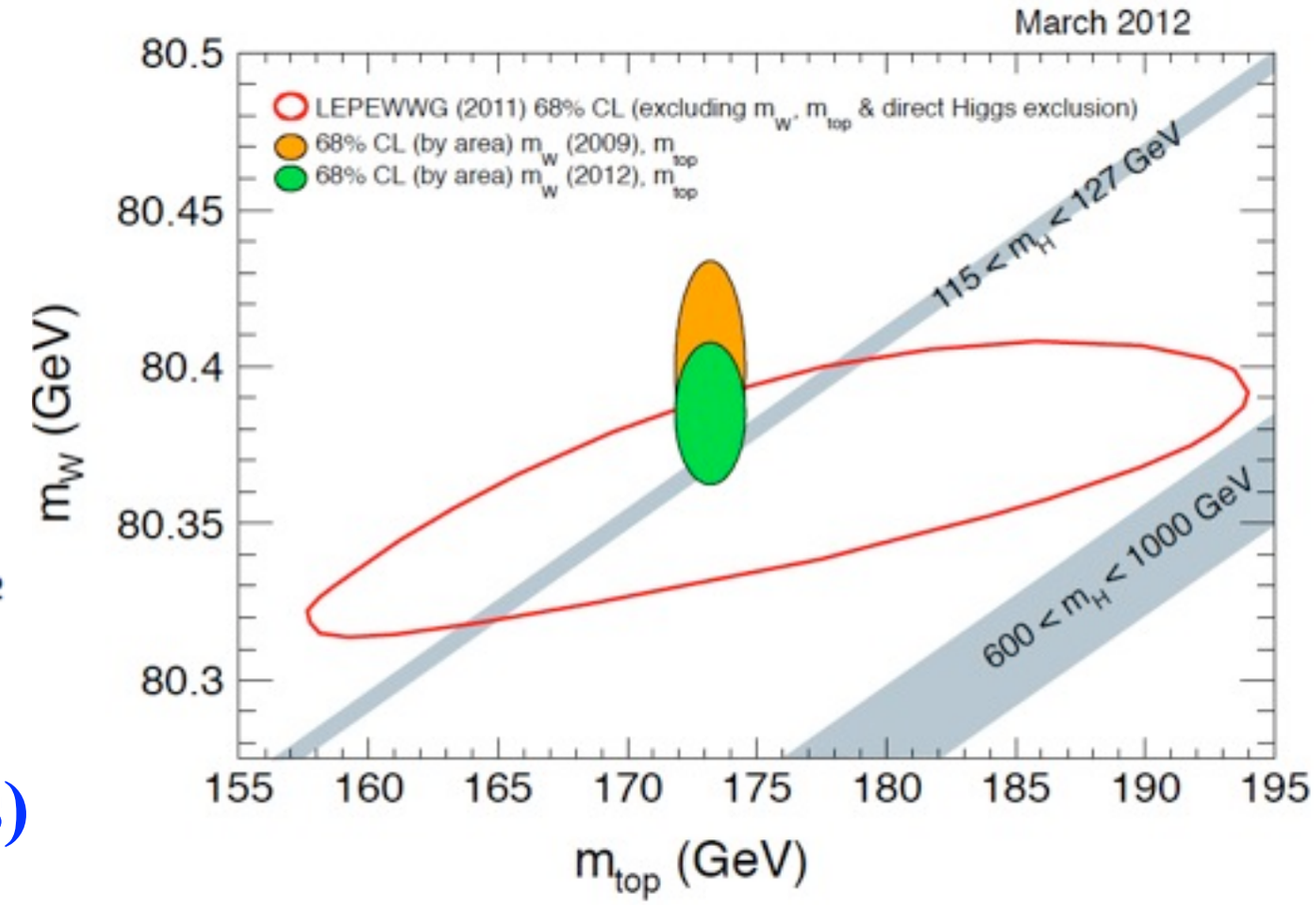
Satish Desai - Fermilab
on behalf of the DØ Collaboration

36th International Conference on High Energy Physics
Melbourne, Australia, 2012

As of Last Week

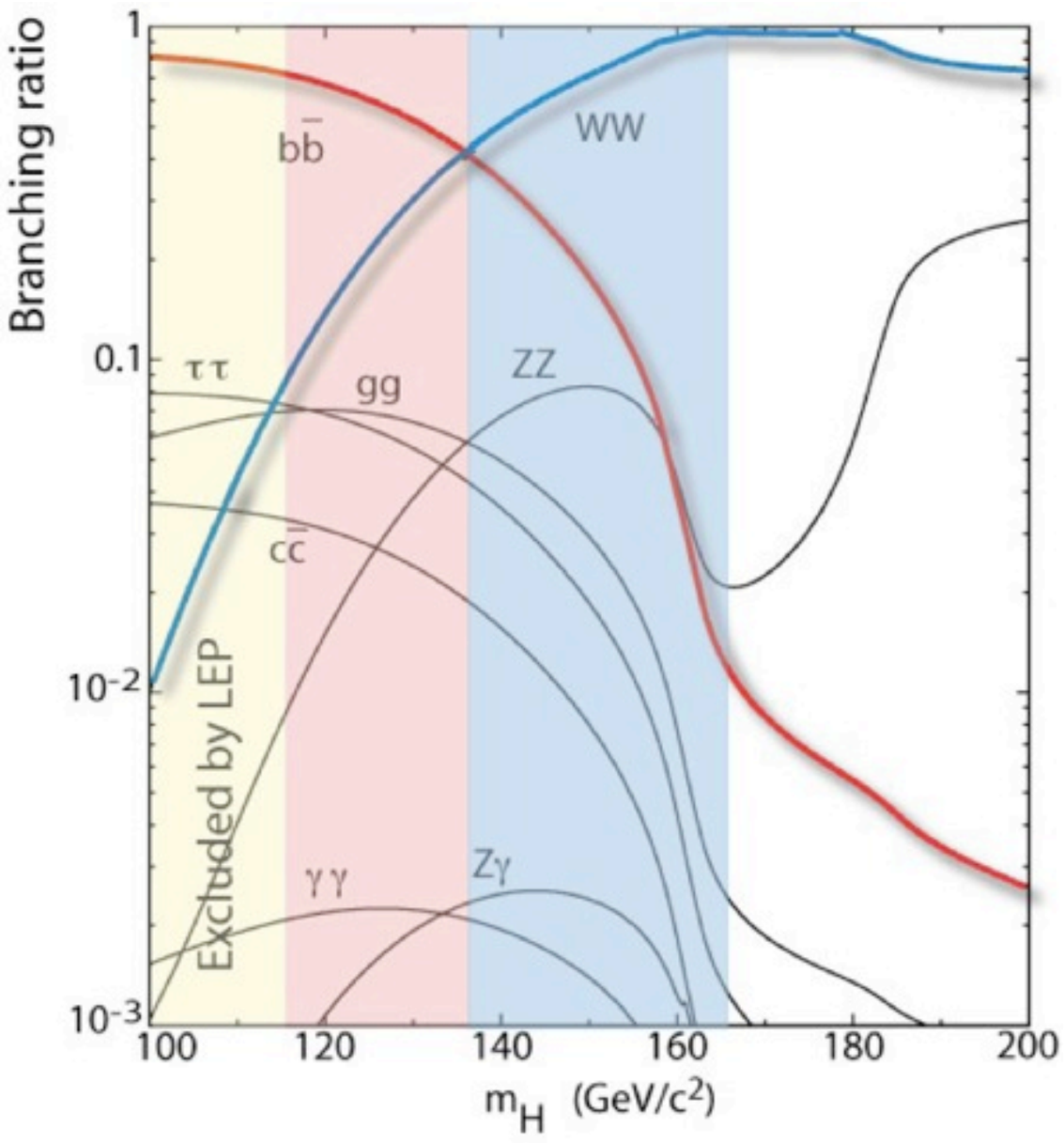


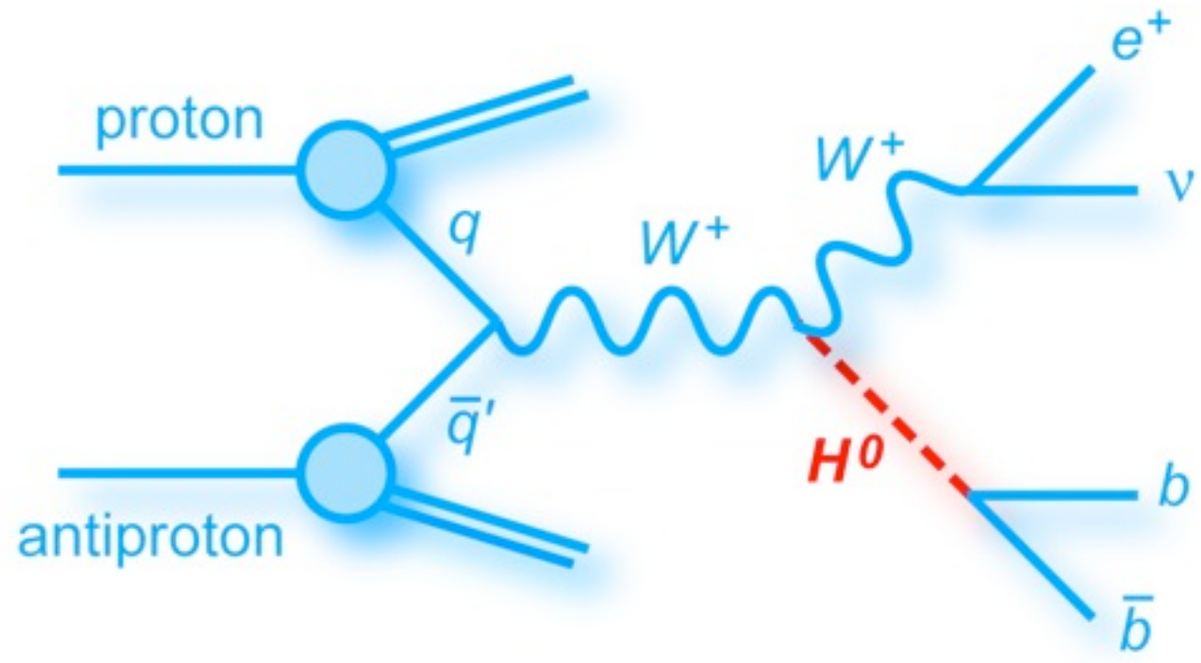


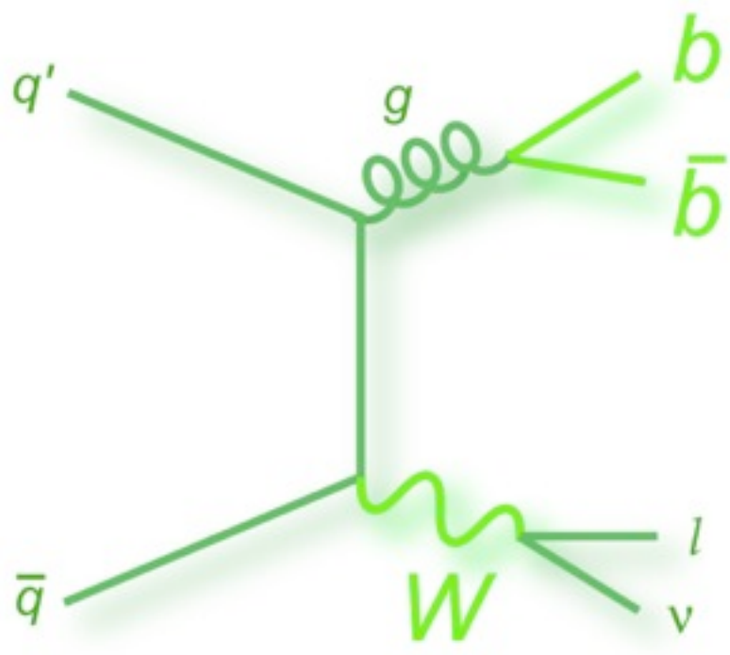


M_H < 152 GeV (indirect constraints)
122 < M_H < 127 GeV (searches)

The Search Strategy

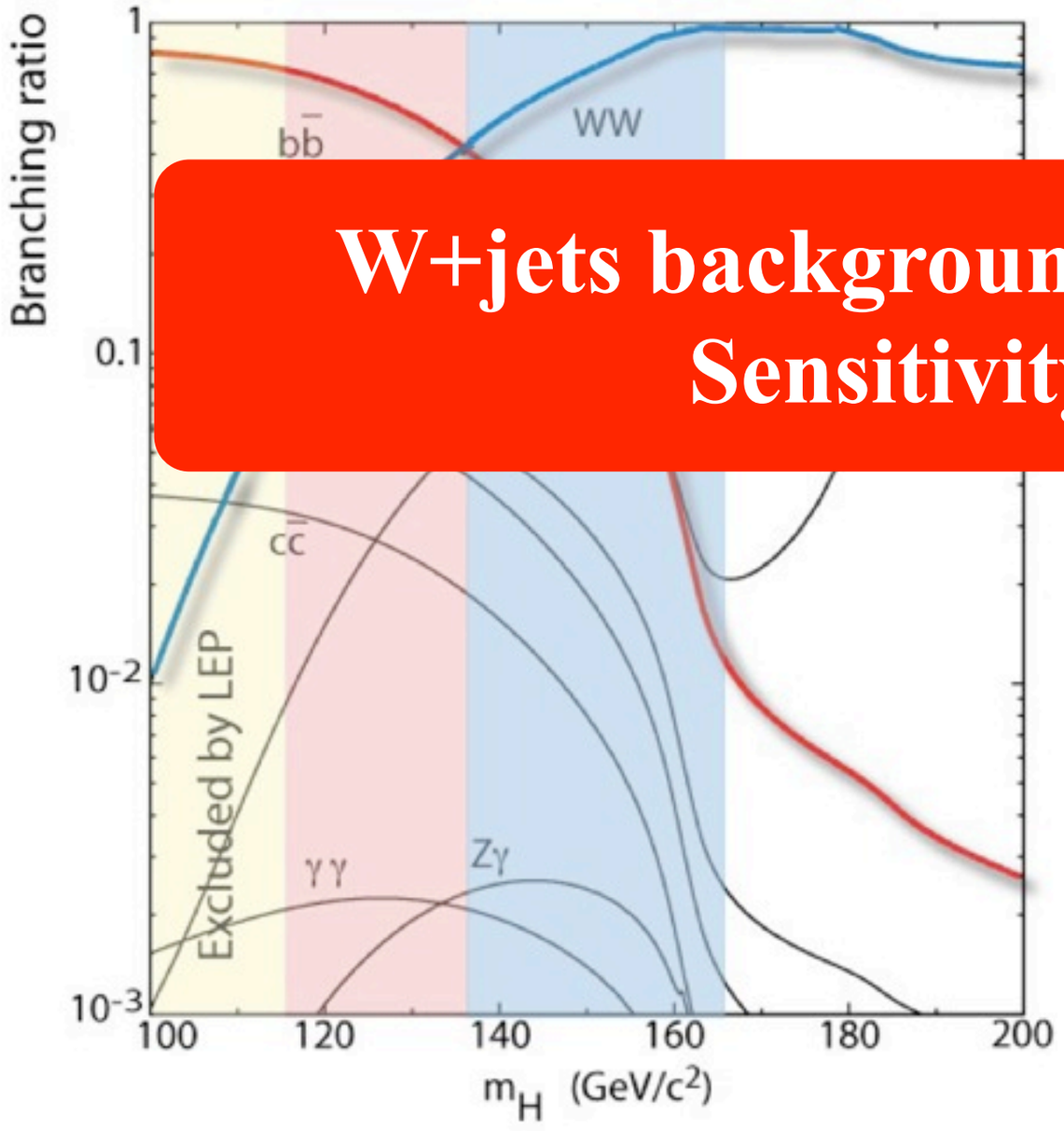




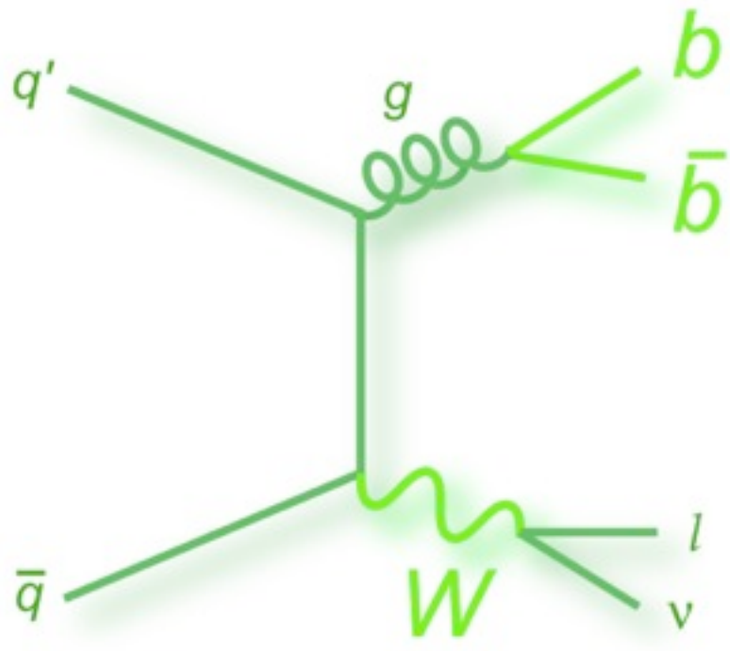


Main Decay: H→bb

The Search Strategy

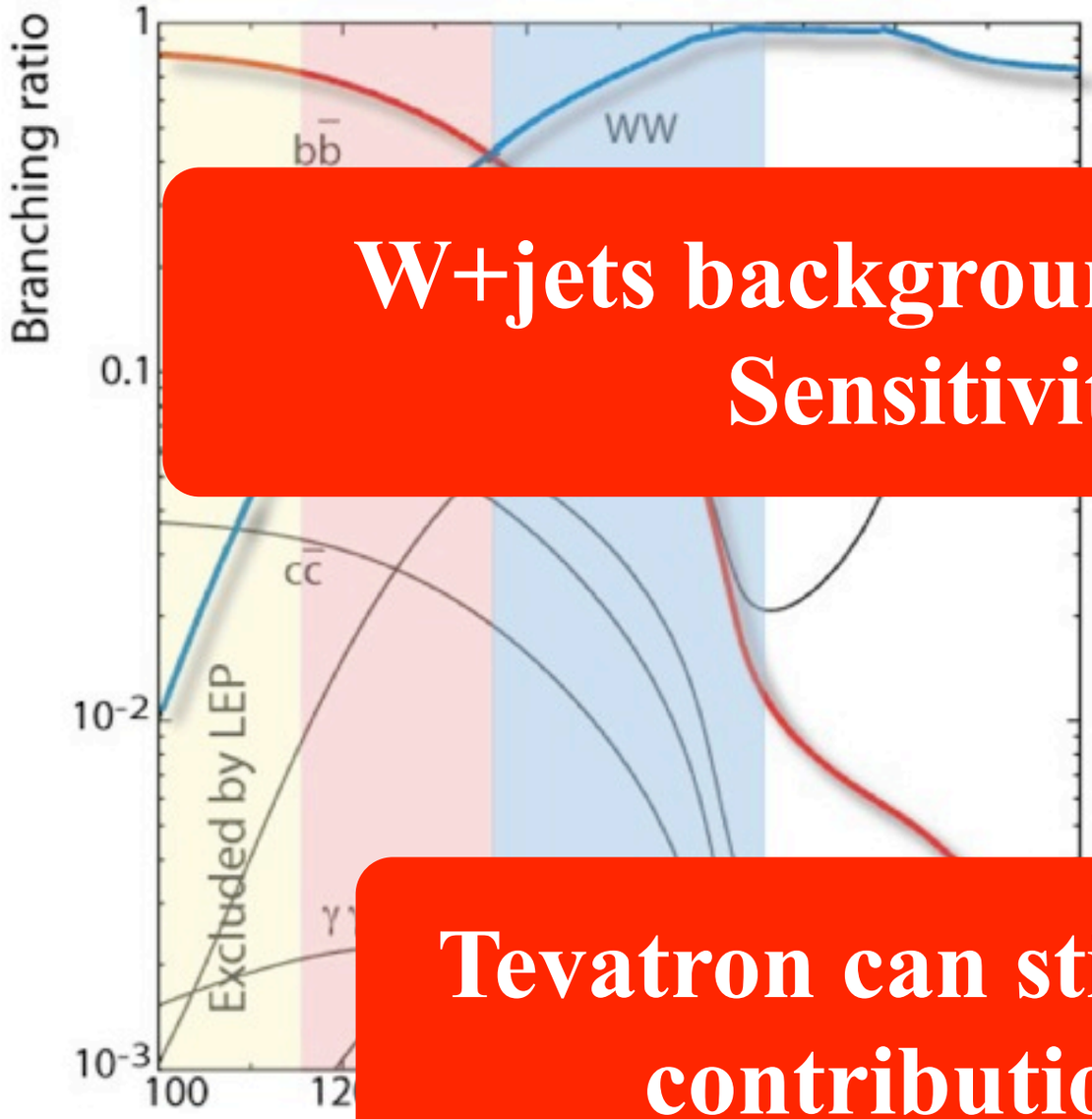


W+jets backgrounds even worse at LHC: Sensitivity at H→γγ/ZZ



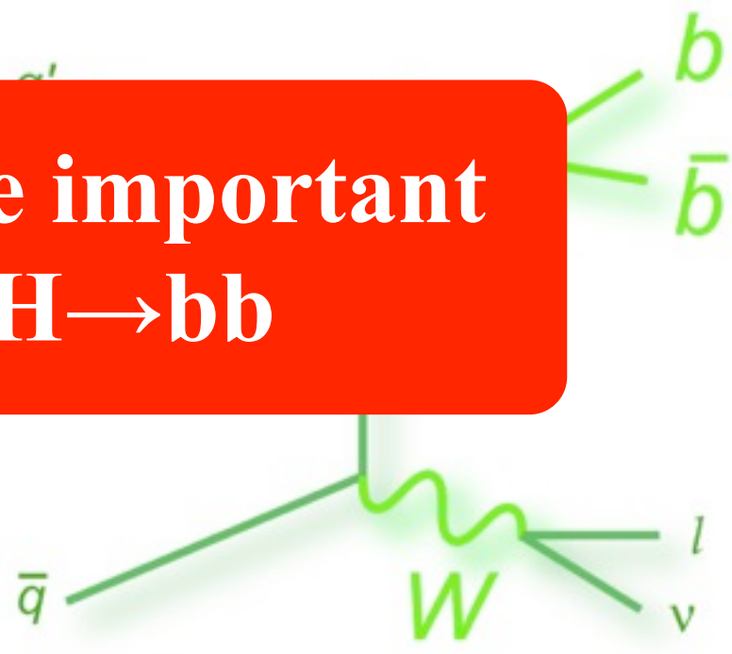
Main Decay: H→bb

The Search Strategy



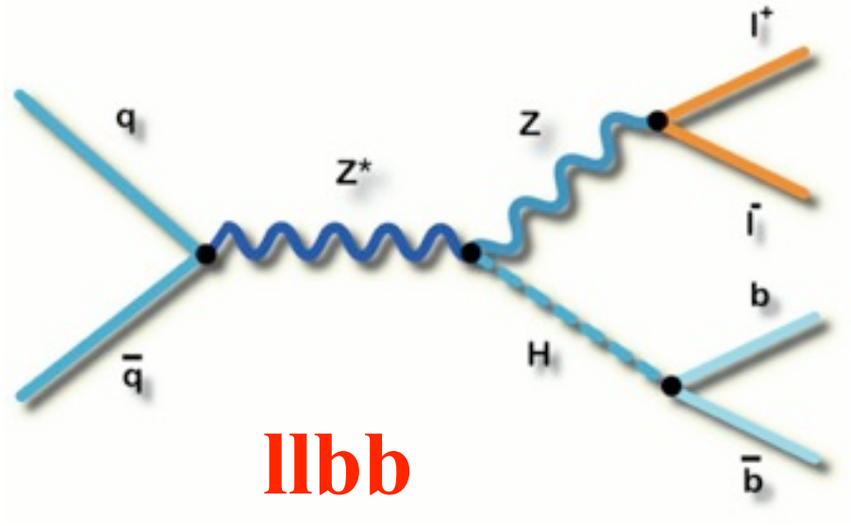
W+jets backgrounds even worse at LHC: Sensitivity at H→γγ/ZZ

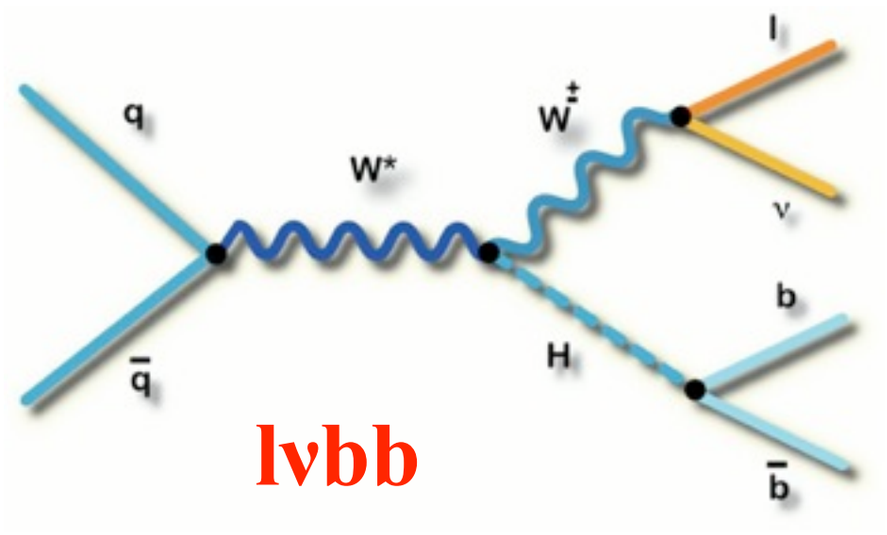
Tevatron can still make important contributions for H→bb

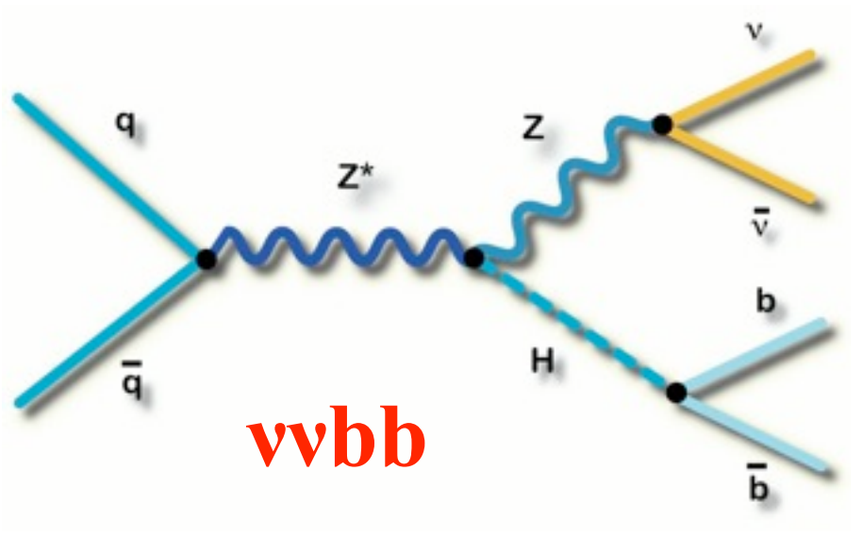


Main Decay: H→bb

Search Ingredients

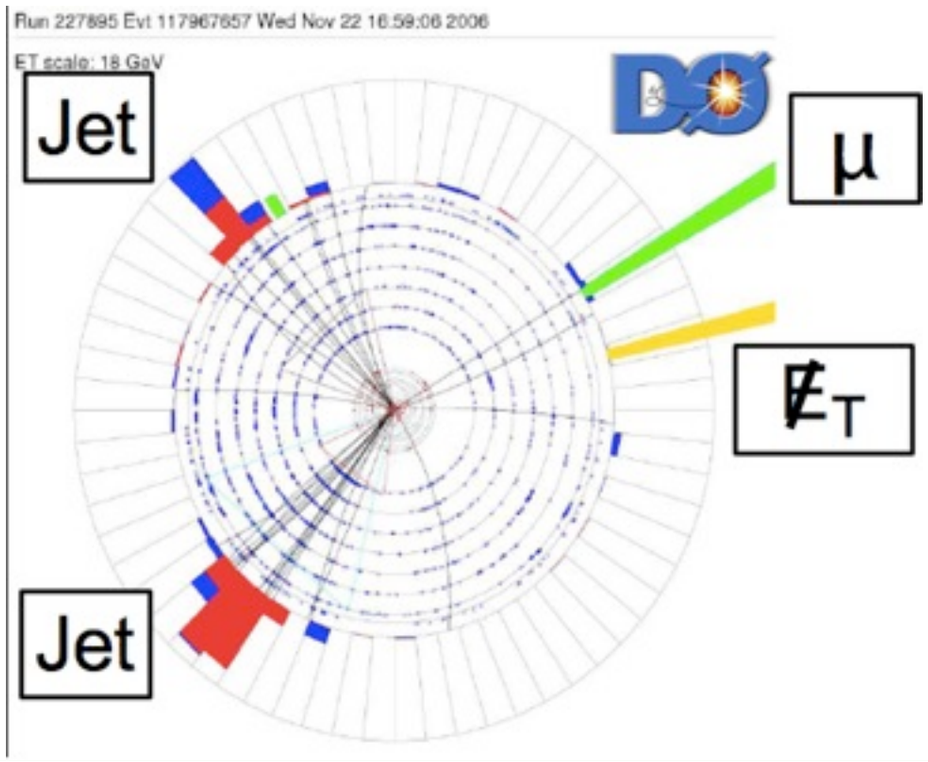






- Maximize acceptance and efficiency
- Efficient b-tagging
- Split into subsamples with different purities
- Multivariate Techniques

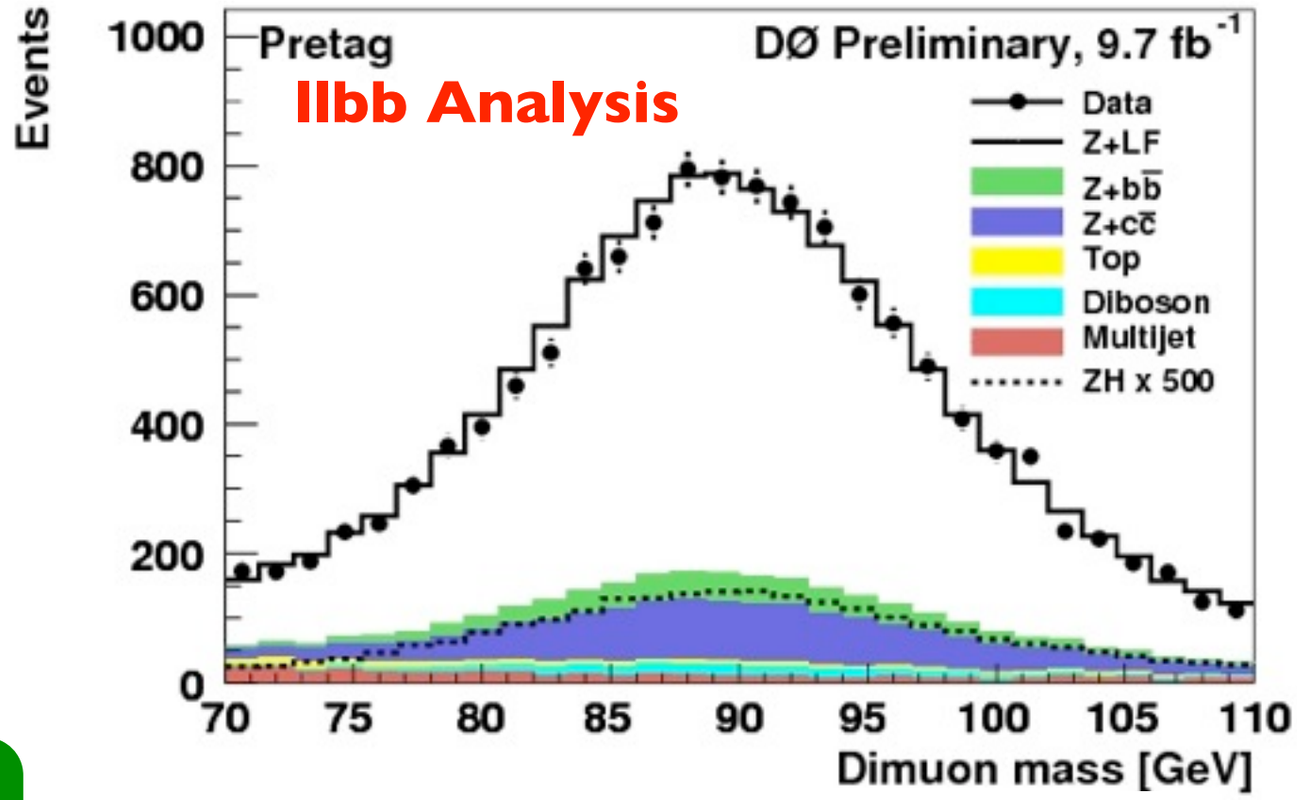
Increasing Acceptance

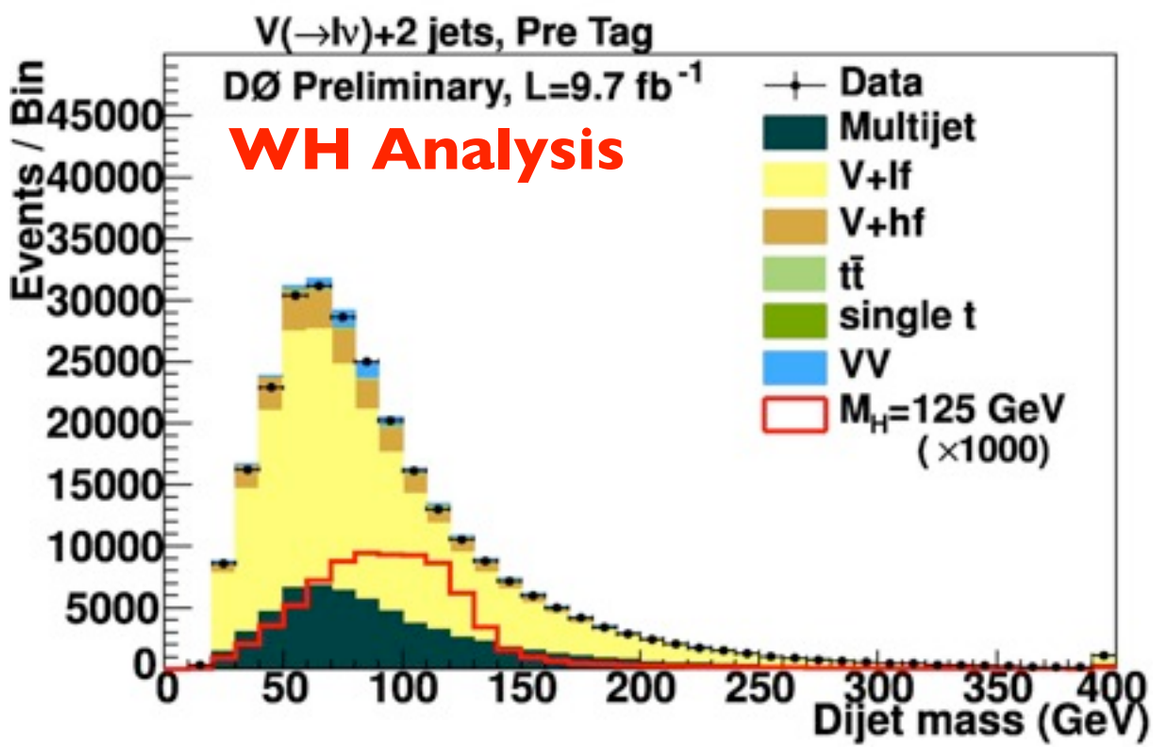


Expanded event selection

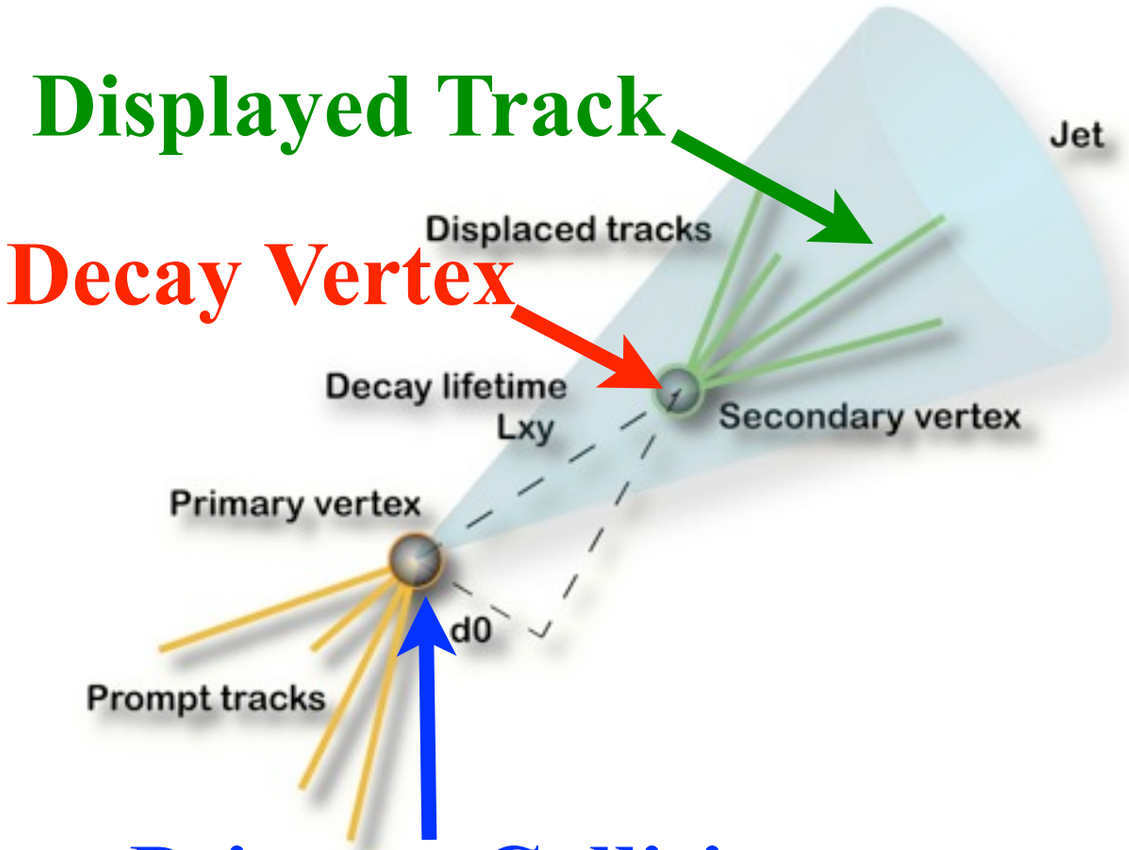
5-6% acceptance increase for WH→μνbb

6% acceptance increase for ZH→llbb

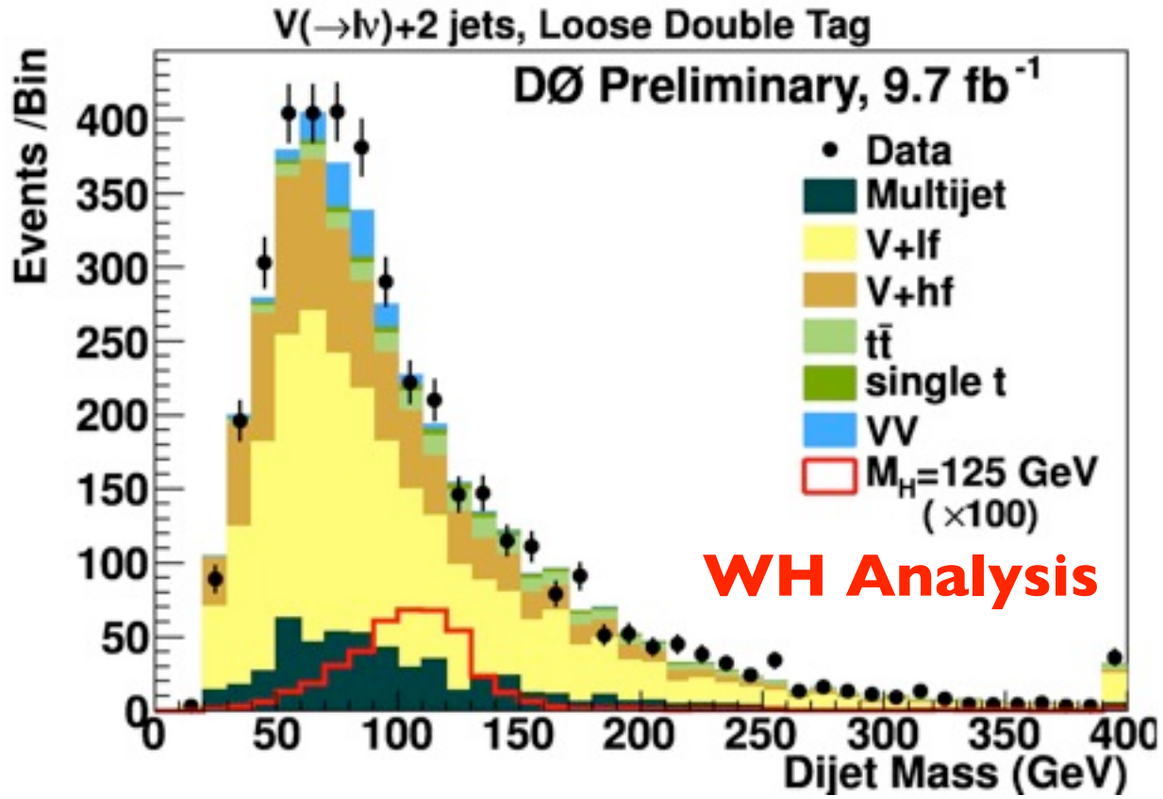


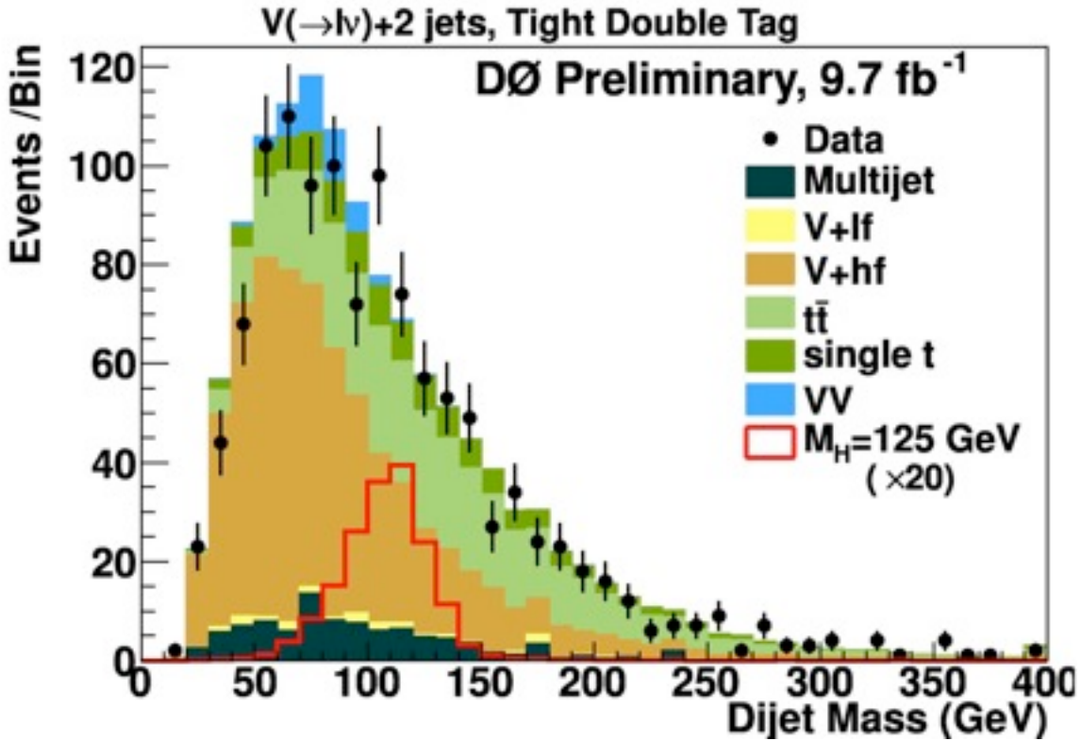


More b-tagging Categories



	S/B
Tight One Tag	1/1600
Loose Two Tag	1/1400
Medium Two Tag	1/360
Tight Two Tag	1/200





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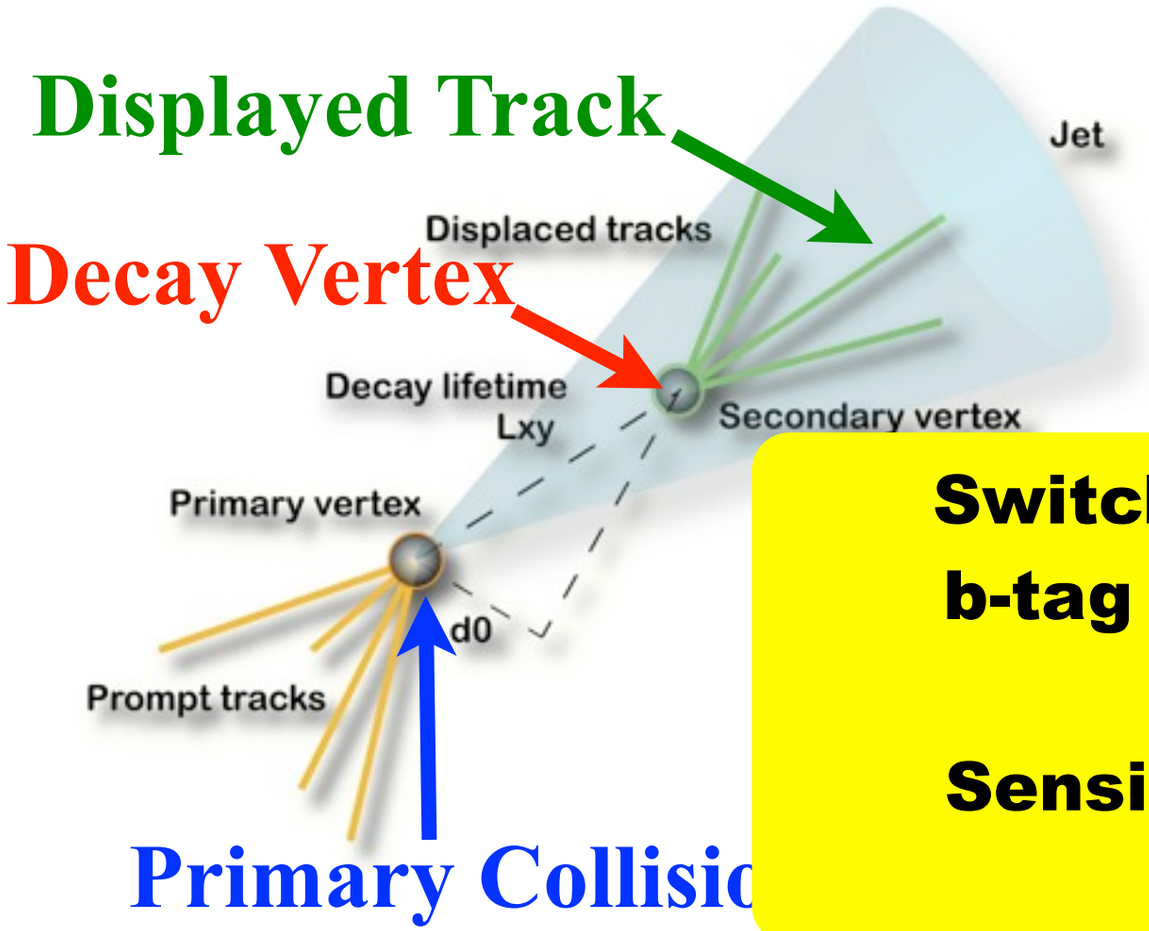
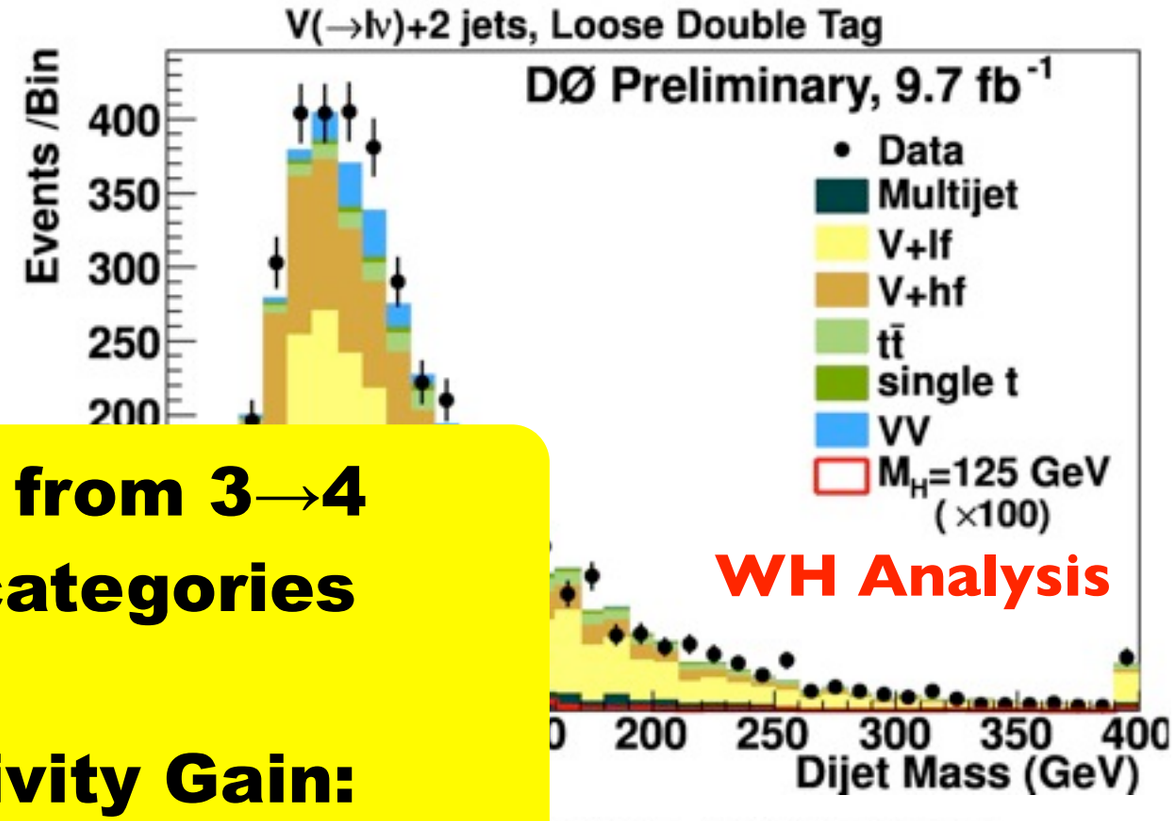
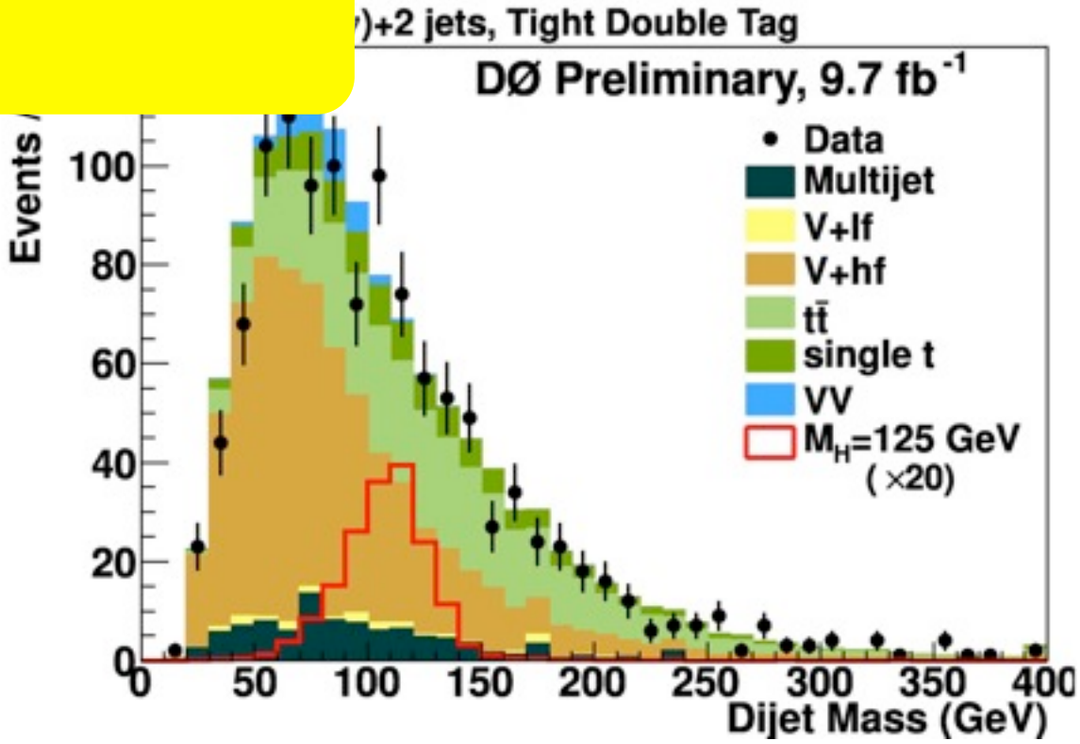


Switch from 3→4 b-tag categories

Sensitivity Gain: 4-5%





	S/B
Tight One Tag	1/1600
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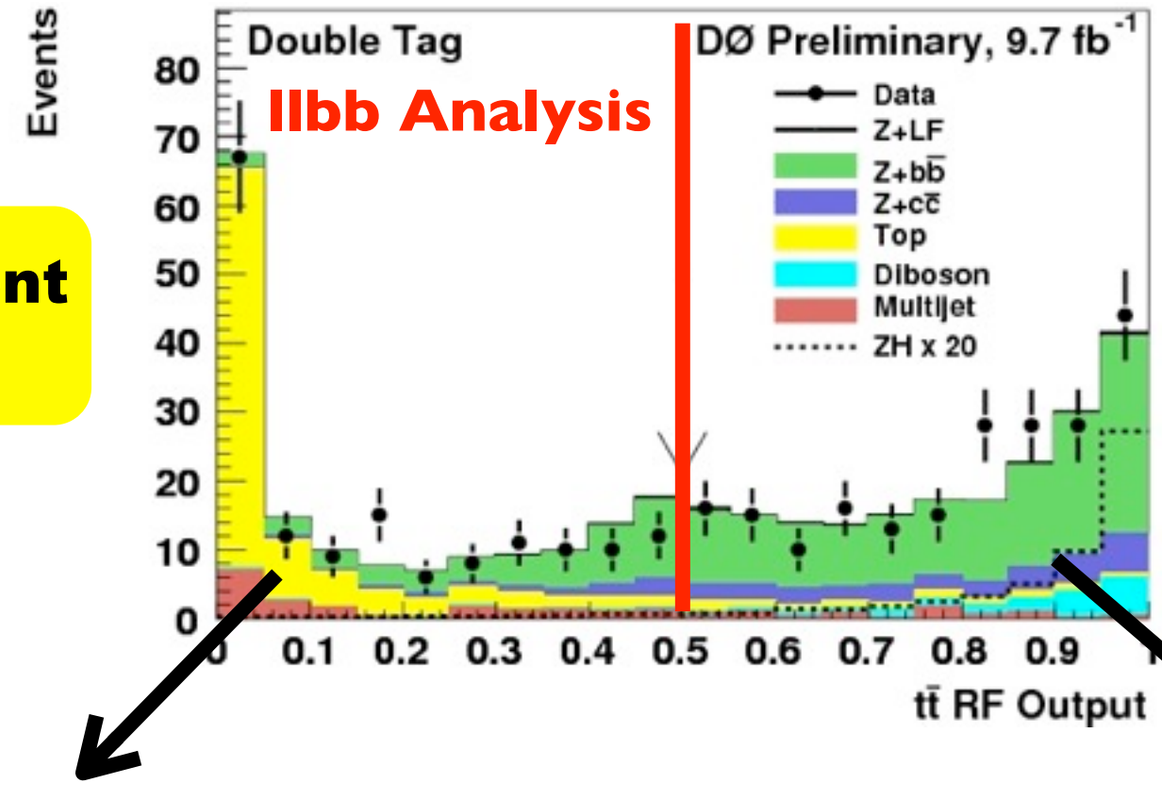
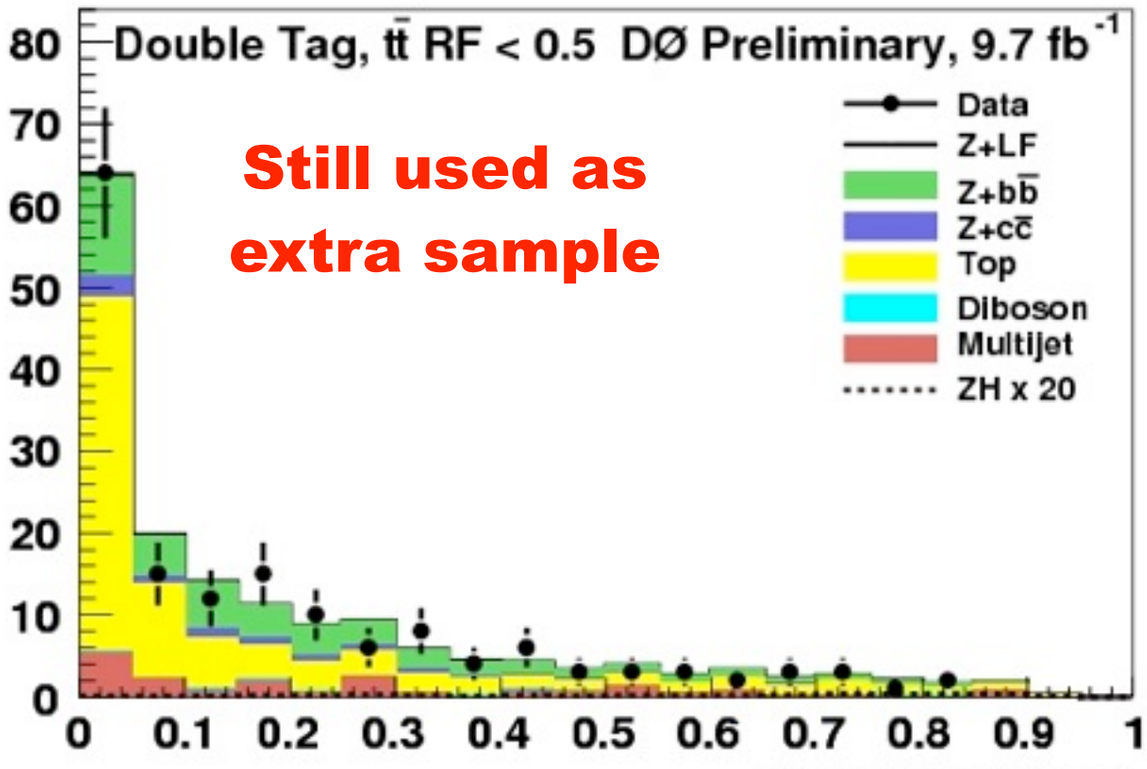
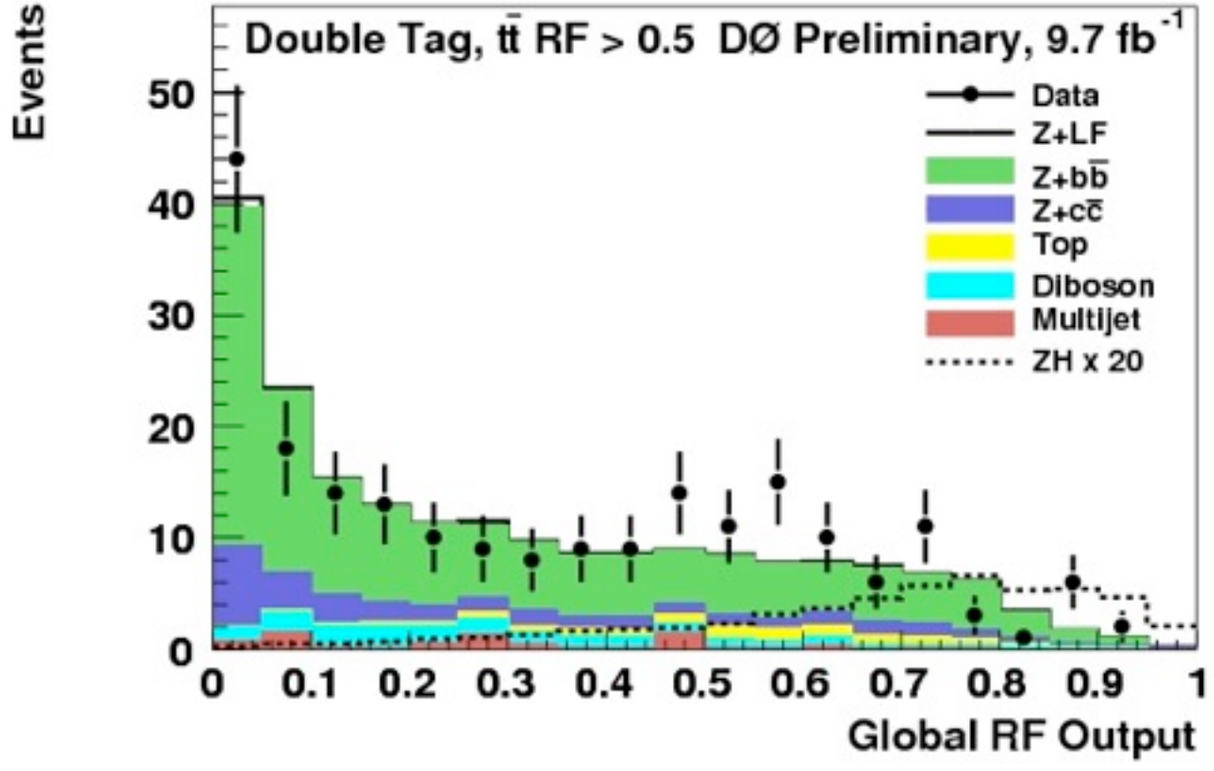
Targeting Top

7-8% improvement in sensitivity



Remove 45% of background
Keep 94% of signal



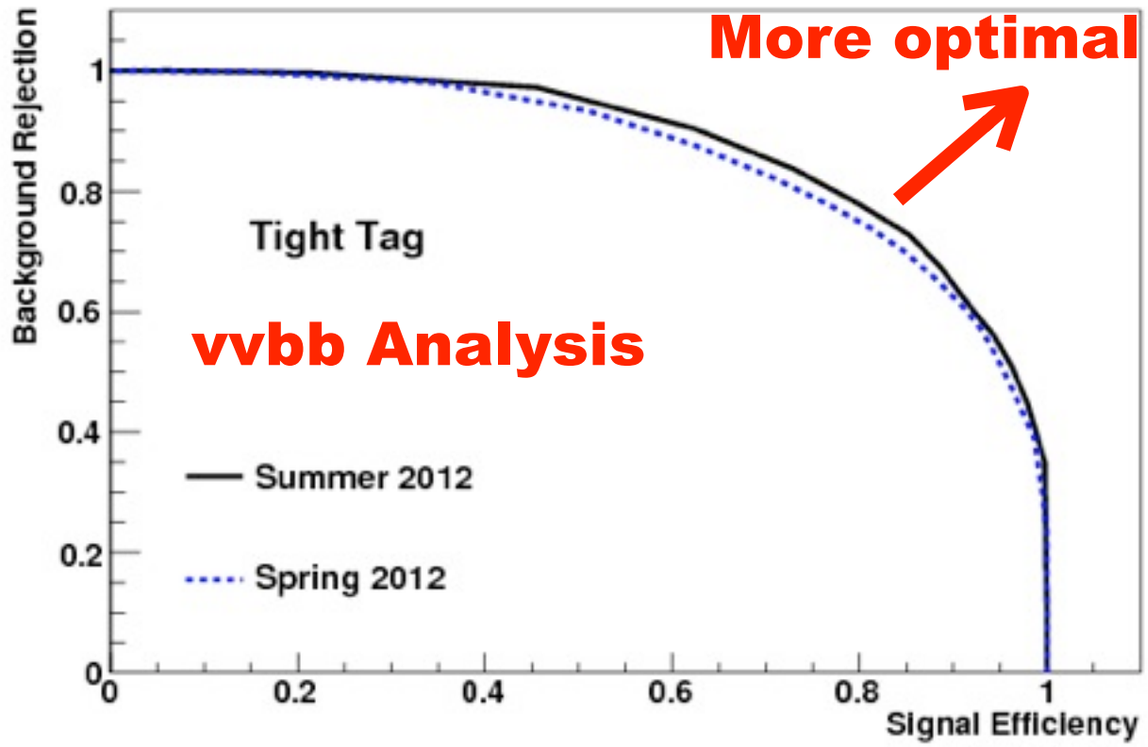


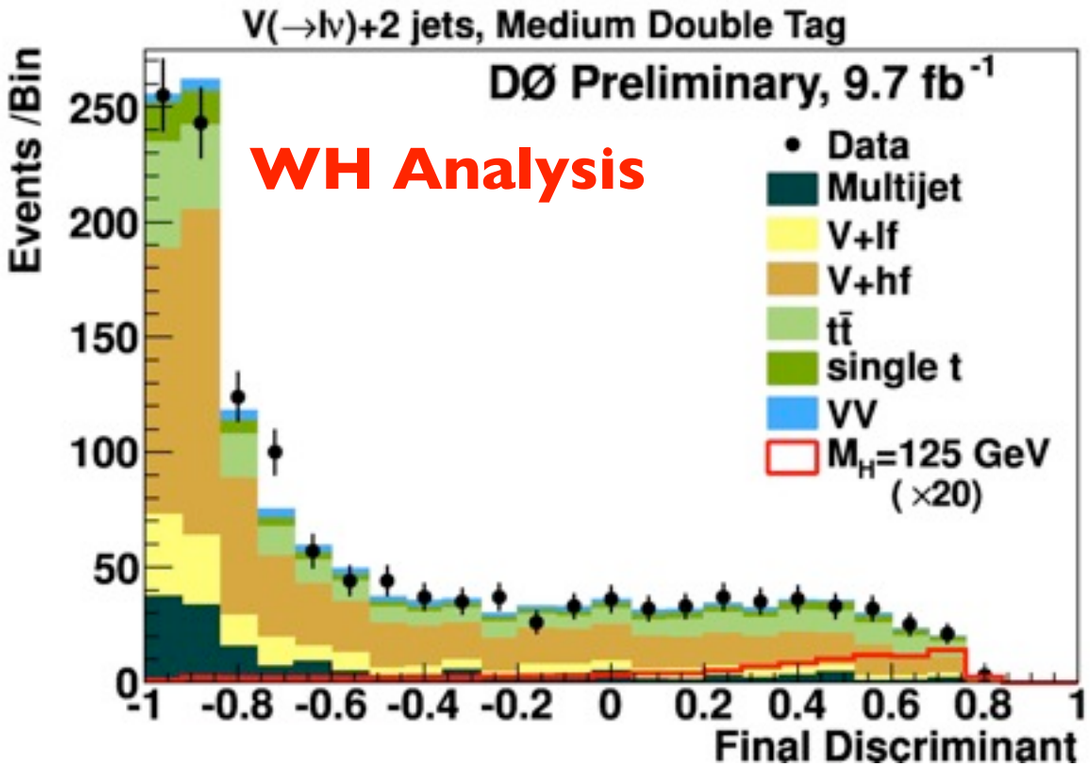
Multivariate Techniques

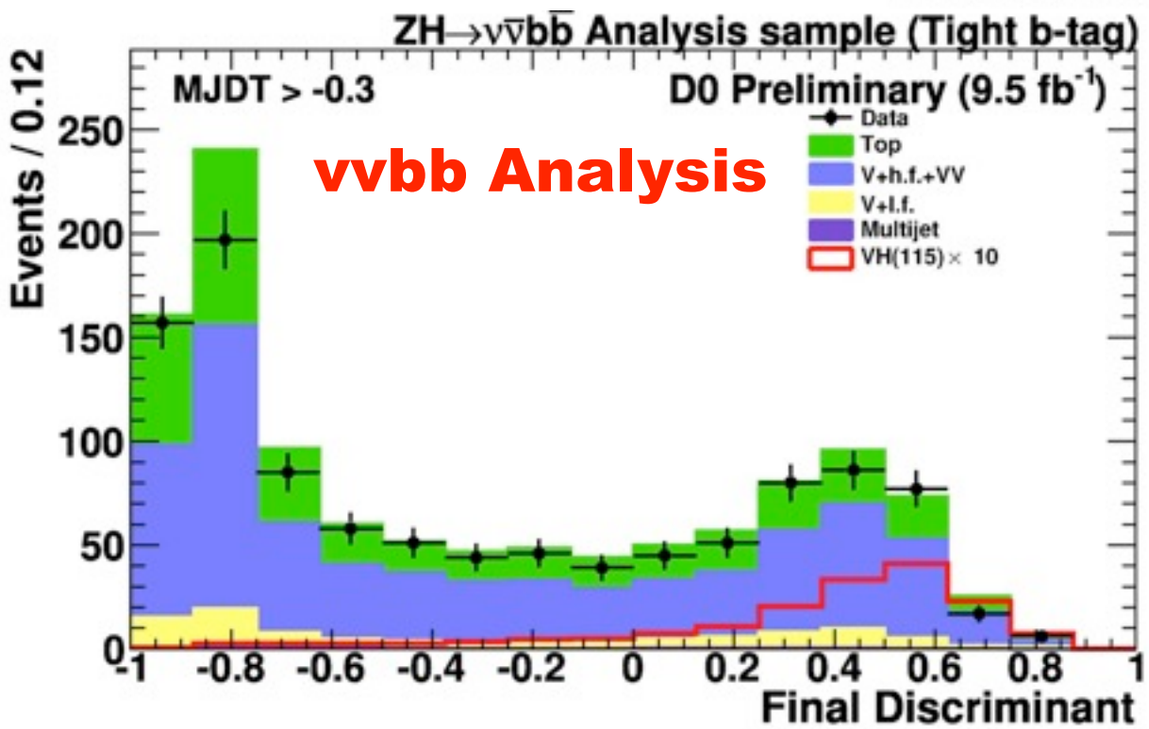
Add new variables

Improved training procedures

Sensitivity Improvements:
4-5% for lvbb
10% for vvbb







Validation with Dibosons

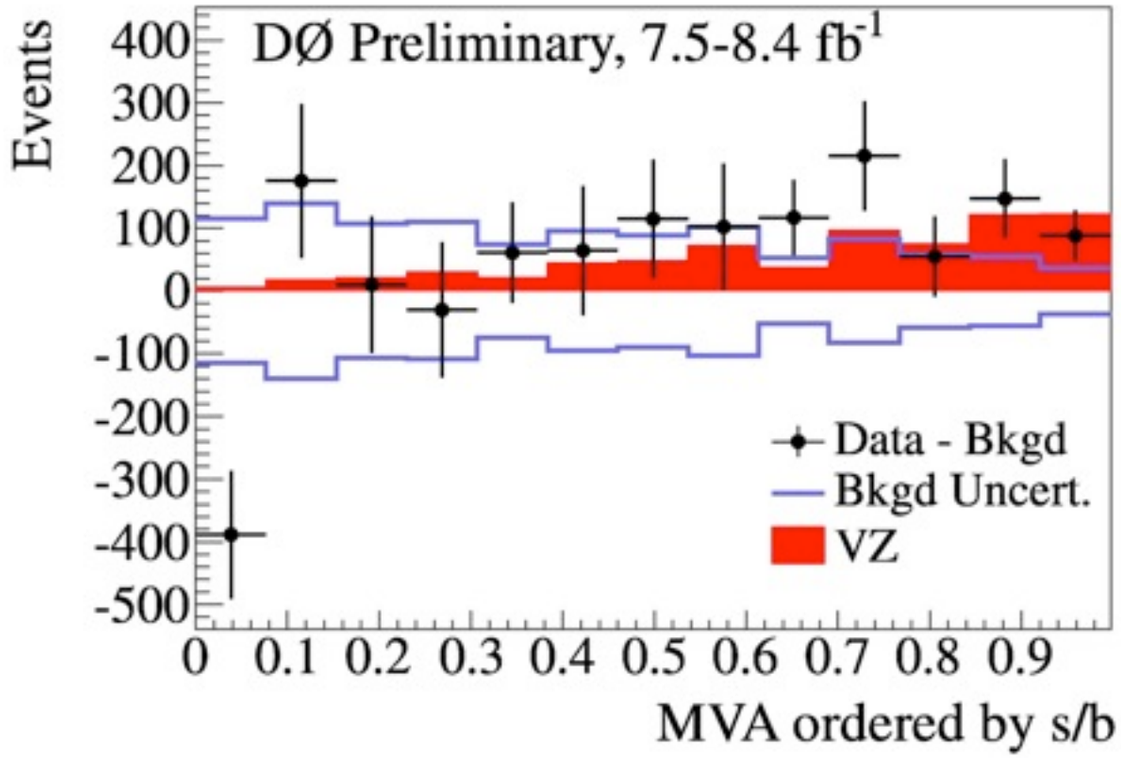
See talk by B. Penning

Search for WZ/ZZ→X+bb

Same final state as WH/ZH→X+bb searches
Cross section is five times larger

Use same search strategy:
Same event selection
Same multivariate discriminants
Same statistical analysis tools

Seeing this signal is a crucial test of analysis techniques

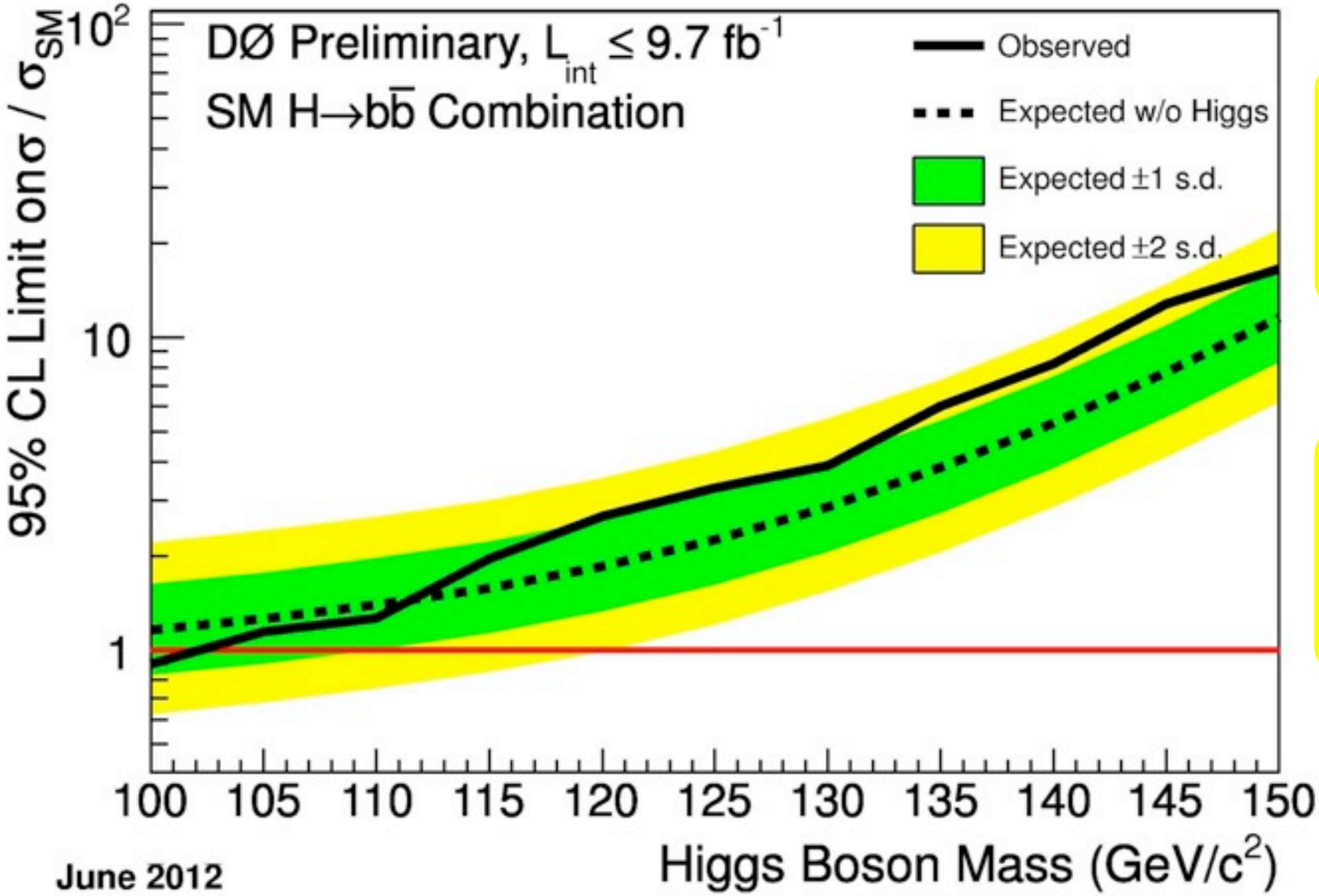


DØ only combination
Significance: 3.3σ

Tevatron combination
Significance: 4.6σ

Cross section:
Measure: 4.5±0.6±0.7 pb
Theory: 4.4±0.3 pb

Results



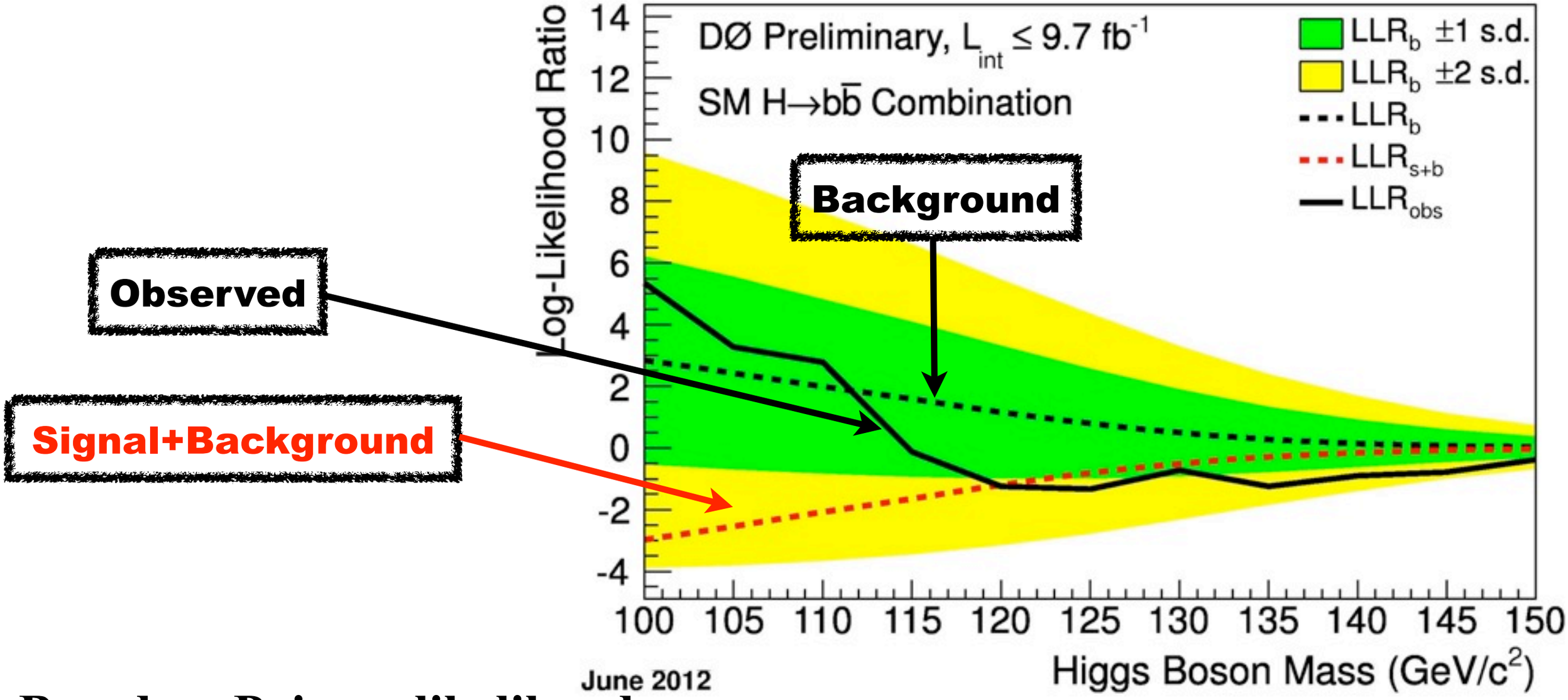
Limits at M_H=115 GeV
Exp: 1.58×σ_{SM}
Obs: 1.96×σ_{SM}

Limits at M_H=125 GeV
Exp: 2.25×σ_{SM}
Obs: 3.30×σ_{SM}

Overall sensitivity improves by 10-15%

The Log Likelihood Ratio

Test statistic used for CLs Method

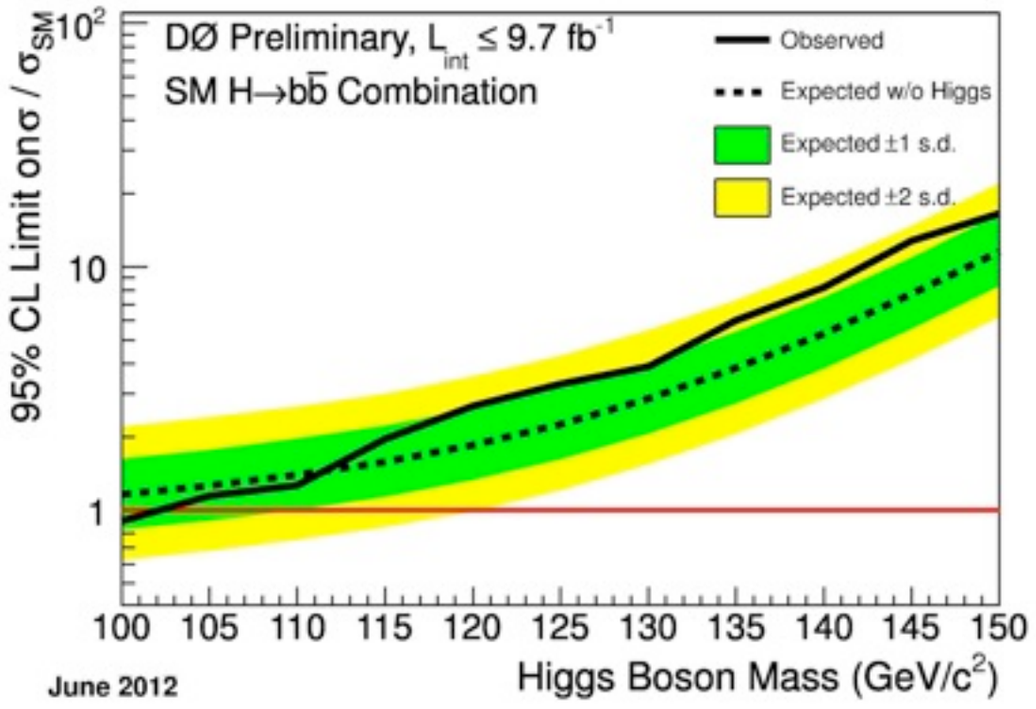


Based on Poisson likelihoods for two hypotheses:
signal+background
background only

Log likelihood ratio acts like $\Delta\chi^2$ of fits to models

Summary

- Tevatron sensitivity to H→bb complements LHC results
- Evidence for VZ→X+bb used as a proving ground for H→bb search
- Modest excess for M_H>120 GeV
- See additional Tevatron Higgs talks at this conference
- Finalizing results now

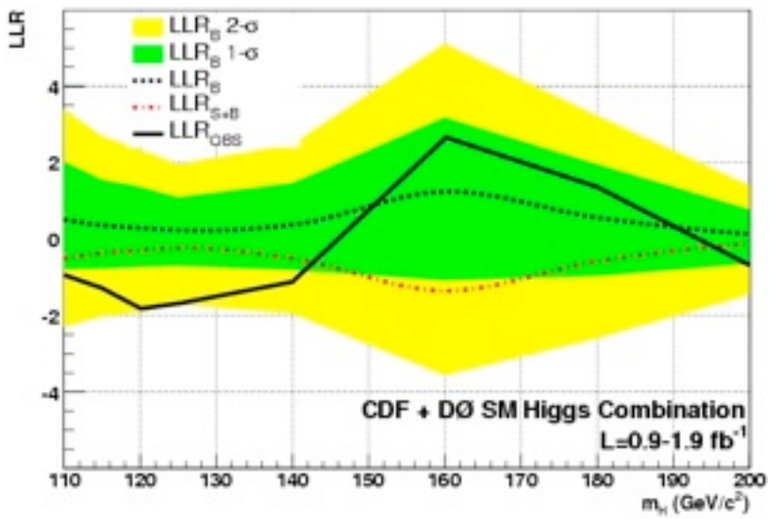


http://www-d0.fnal.gov/Run2Physics/WWW/results/higgs.htm

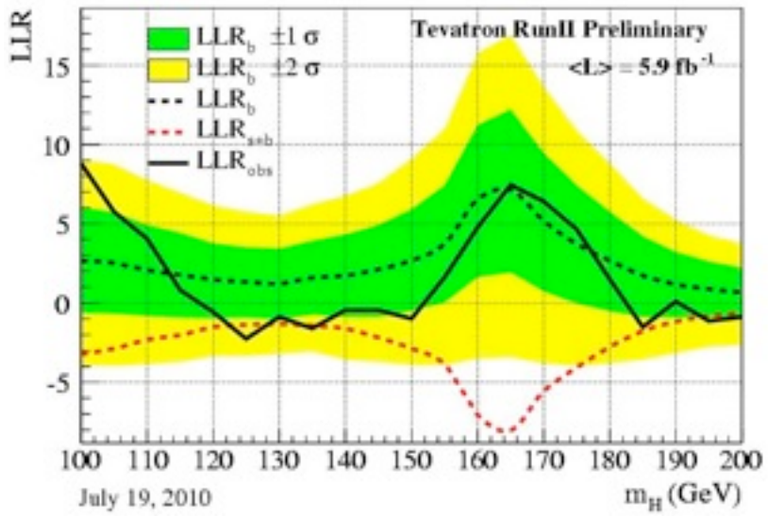

BACKUP

Searching through the years

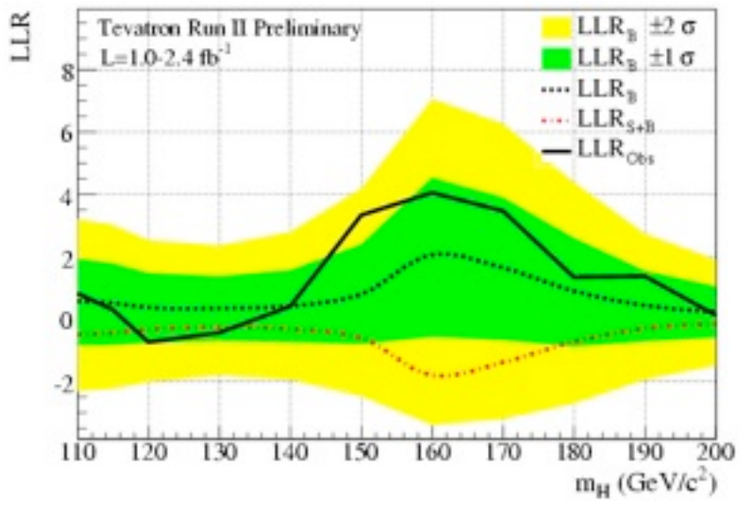
2007



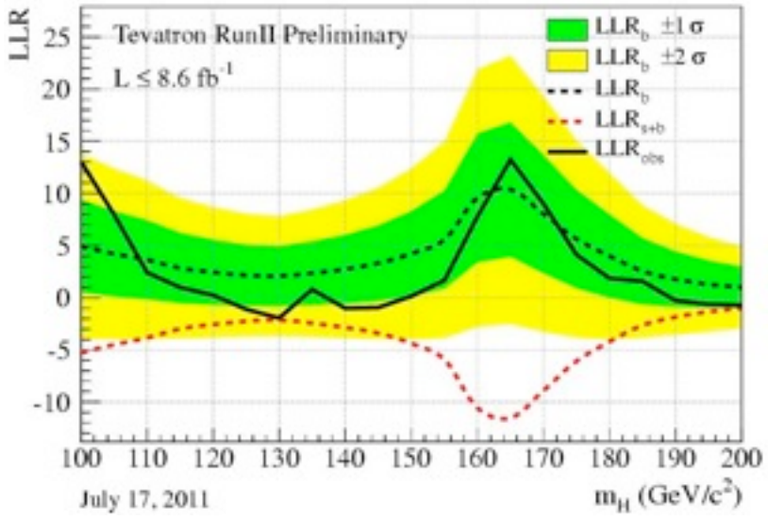
2010



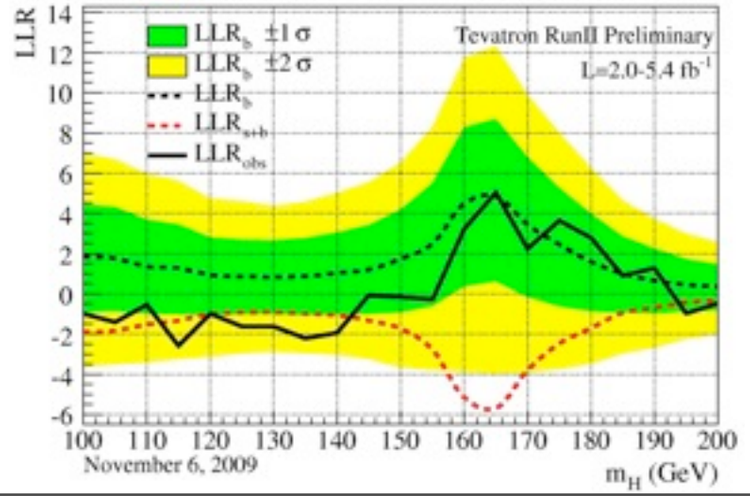
2008



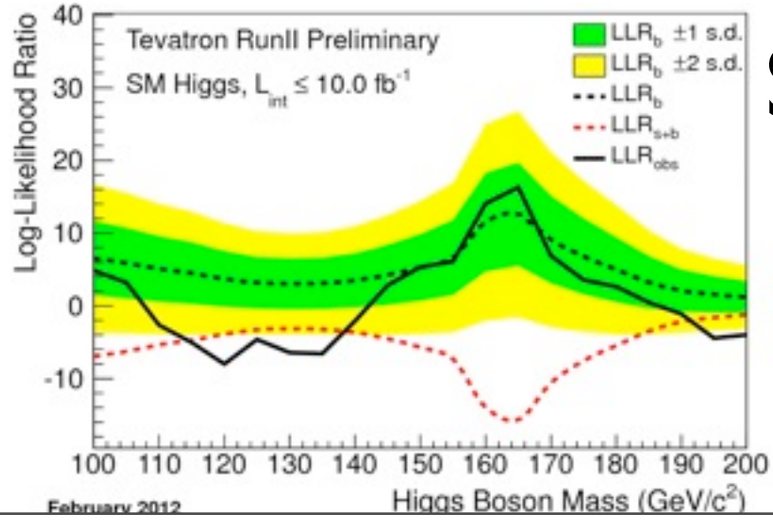
2011



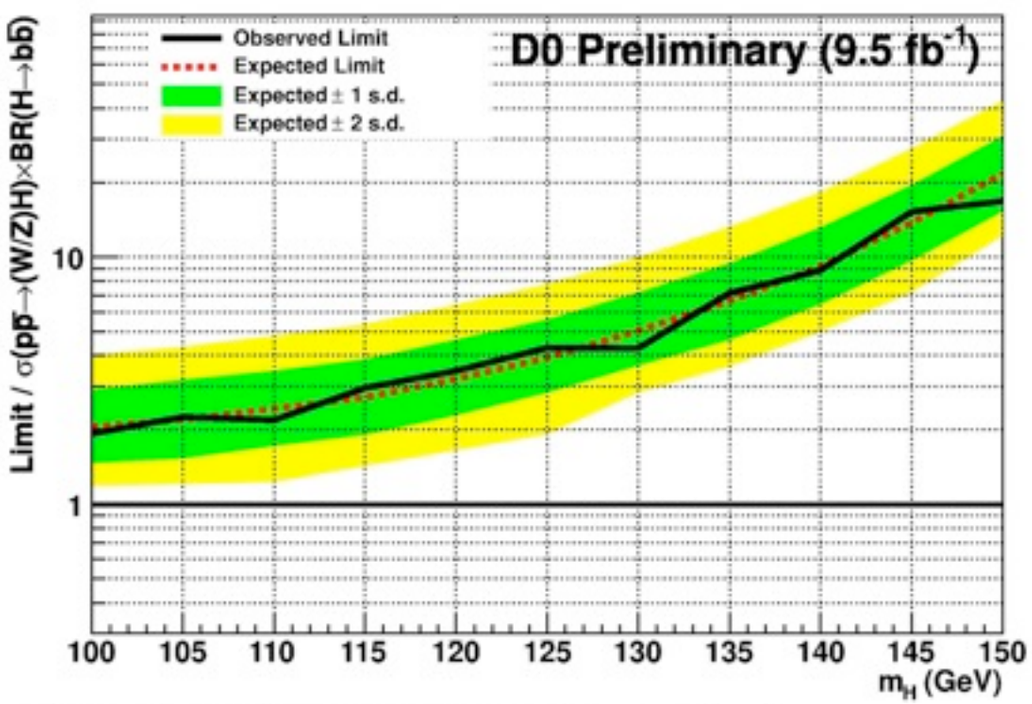
2009

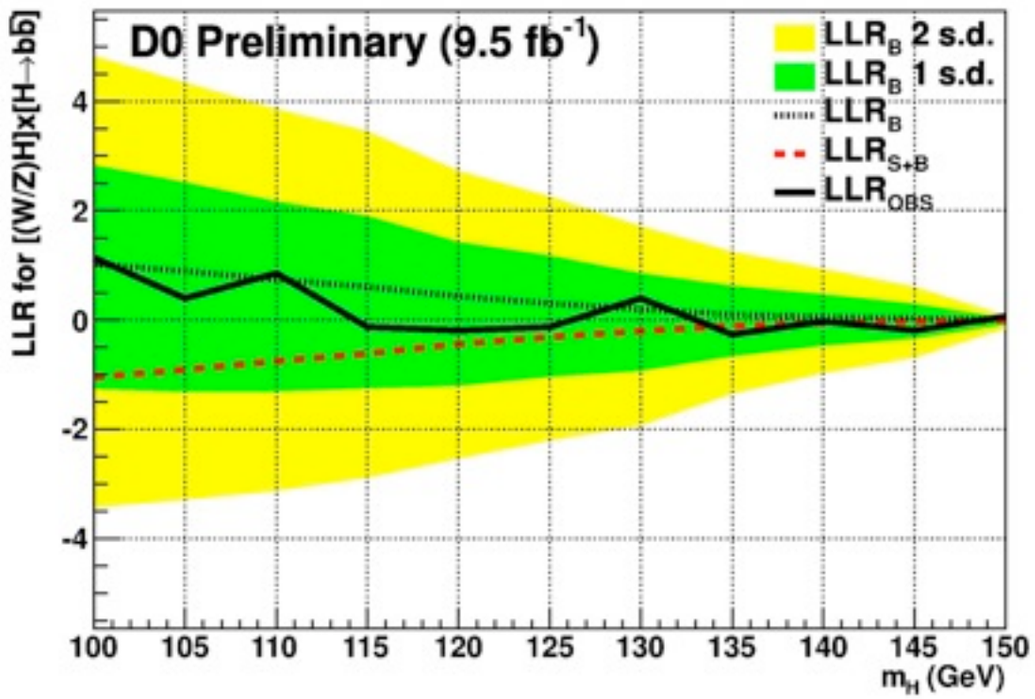


Spring 2012

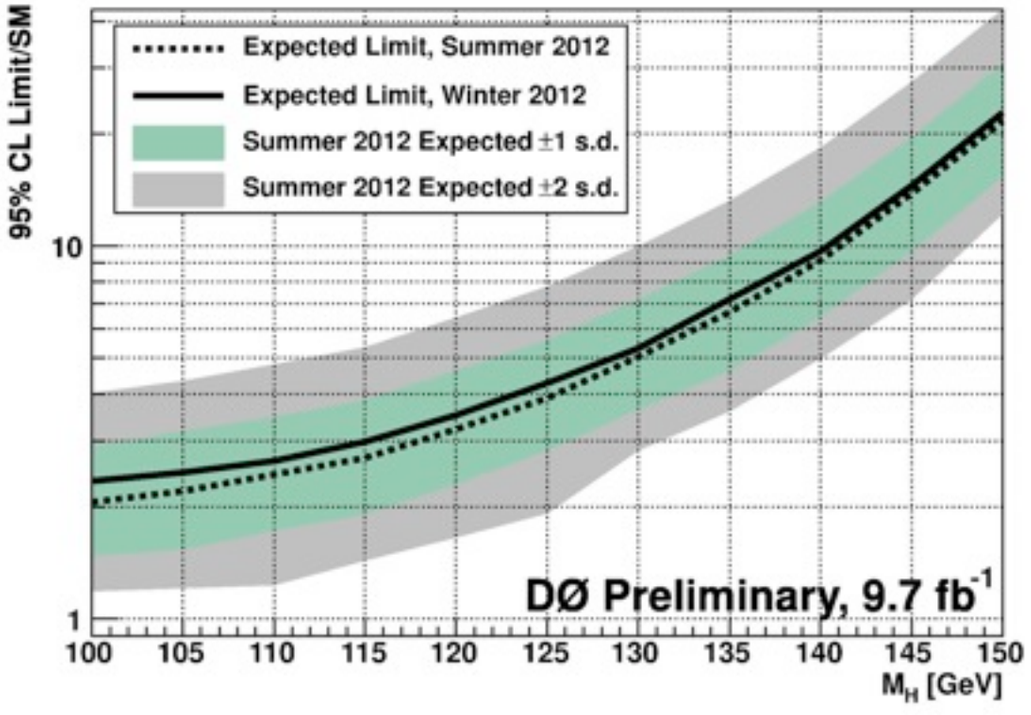


Results for ZH→ννbb





Comparison of Expected limits: ZH→ ννbb



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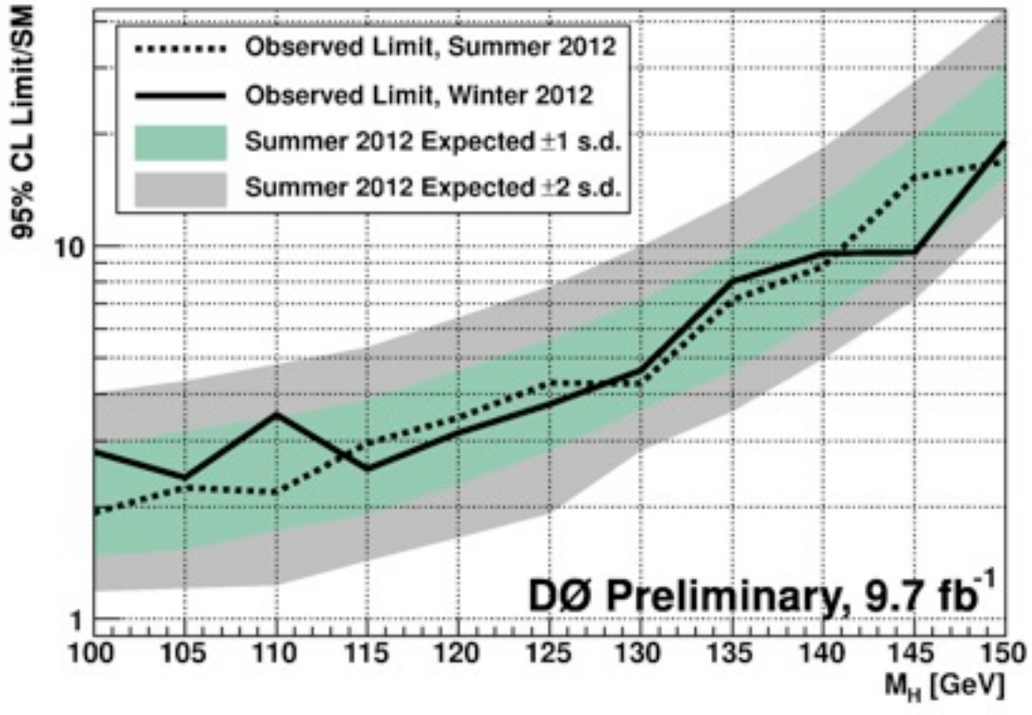
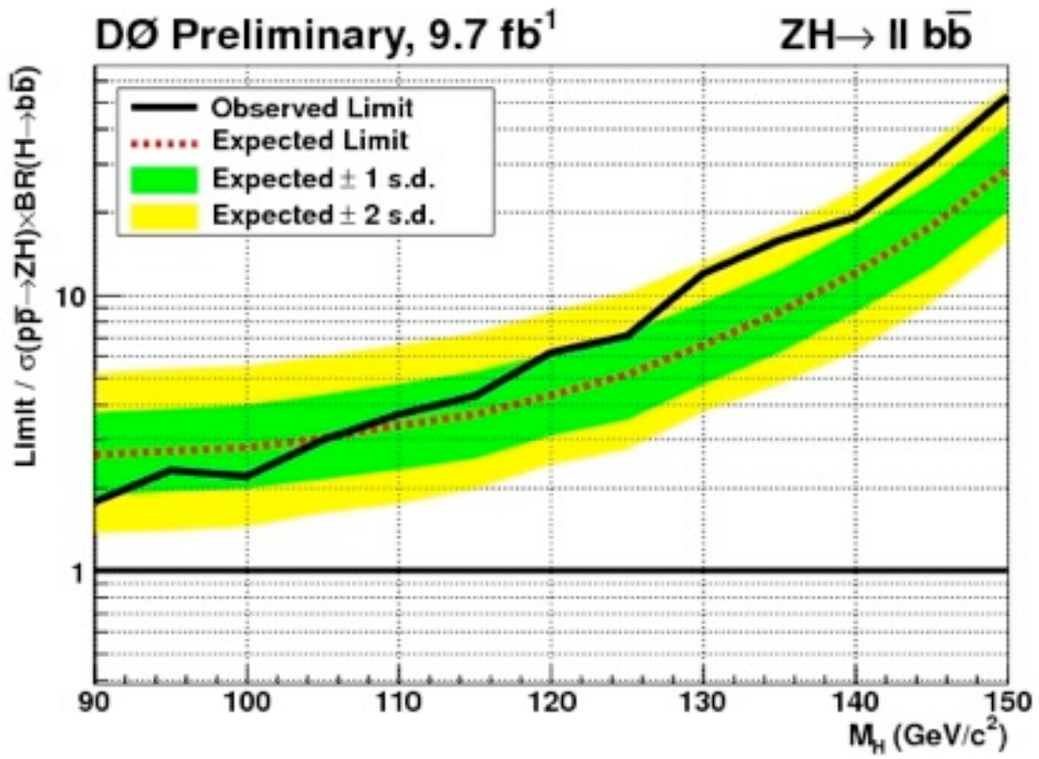
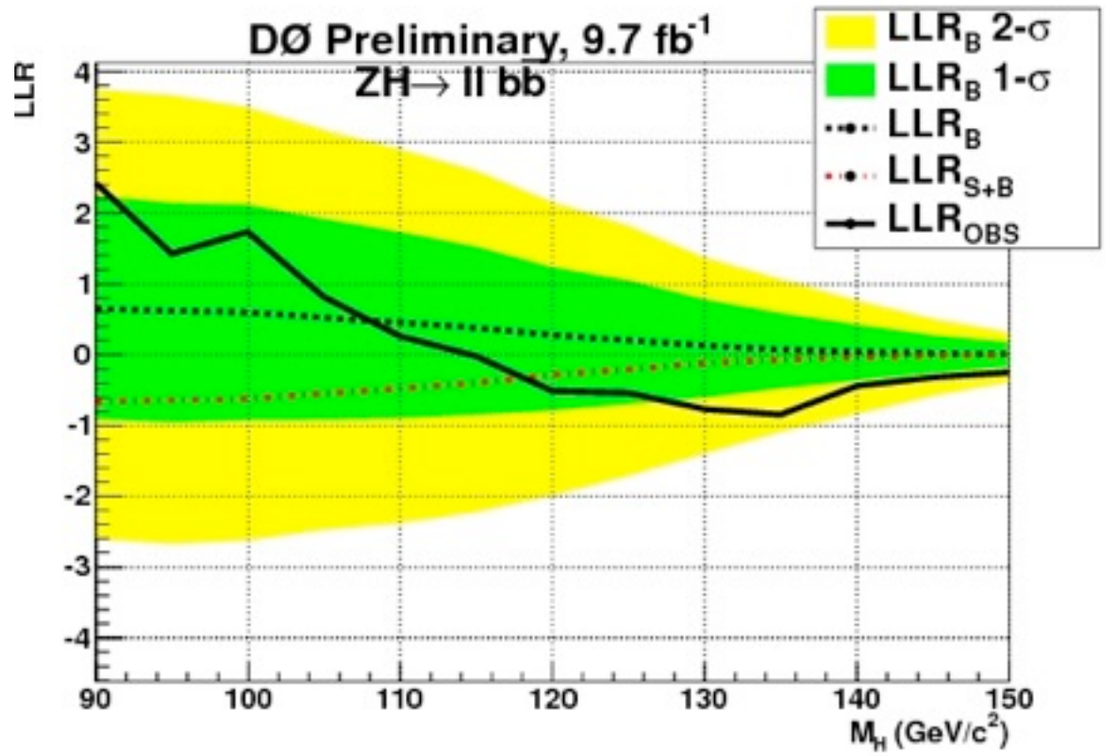
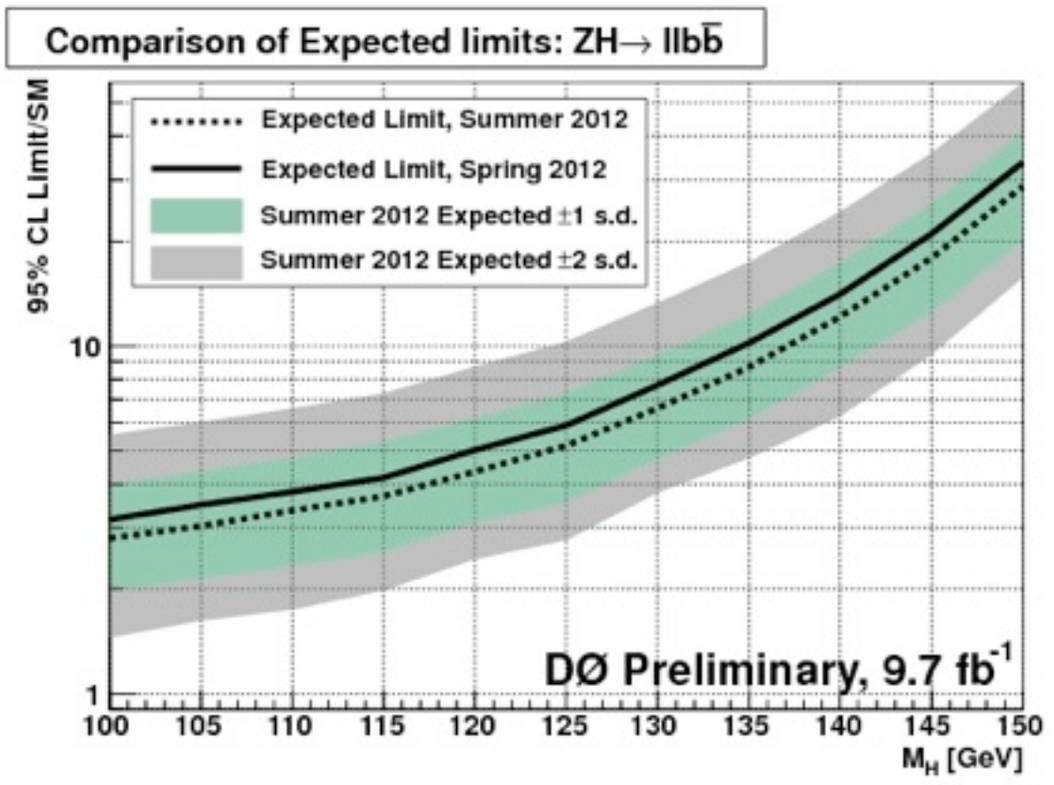
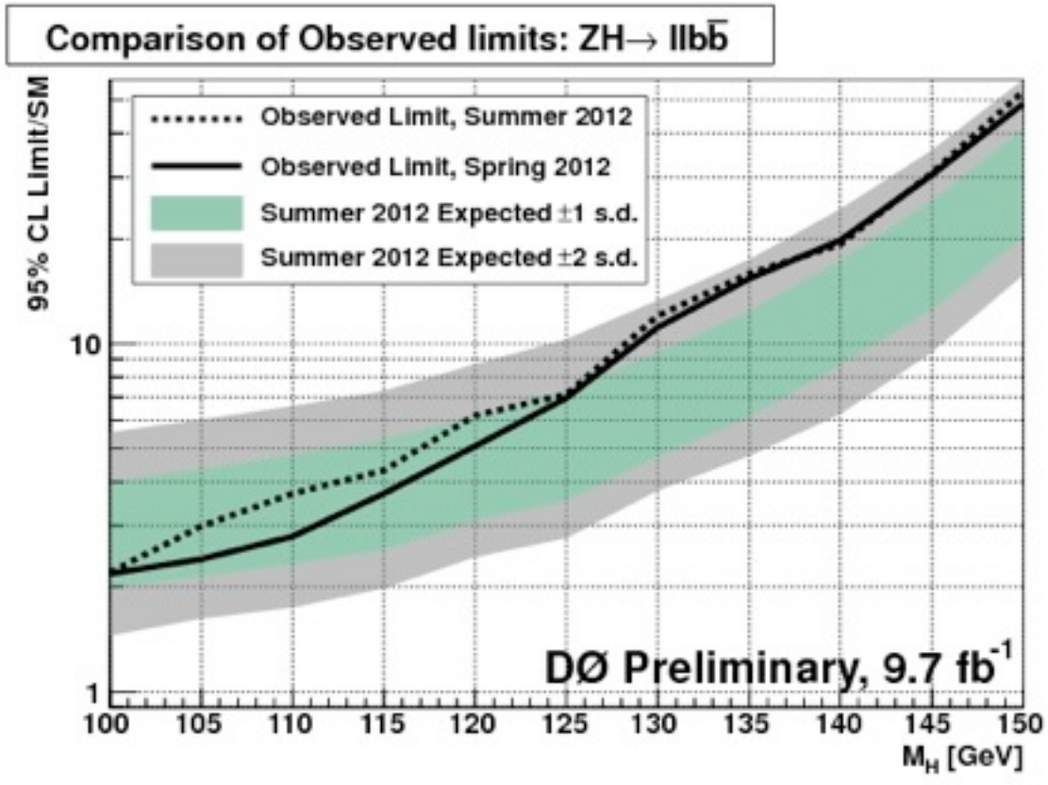


Results for ZH→llbb

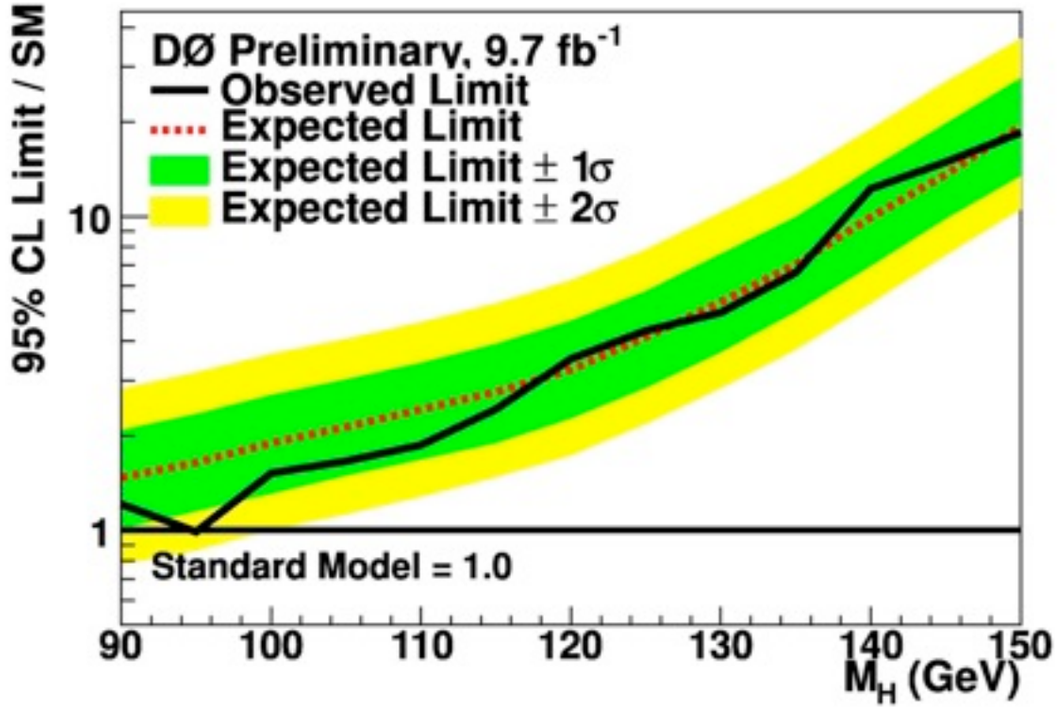


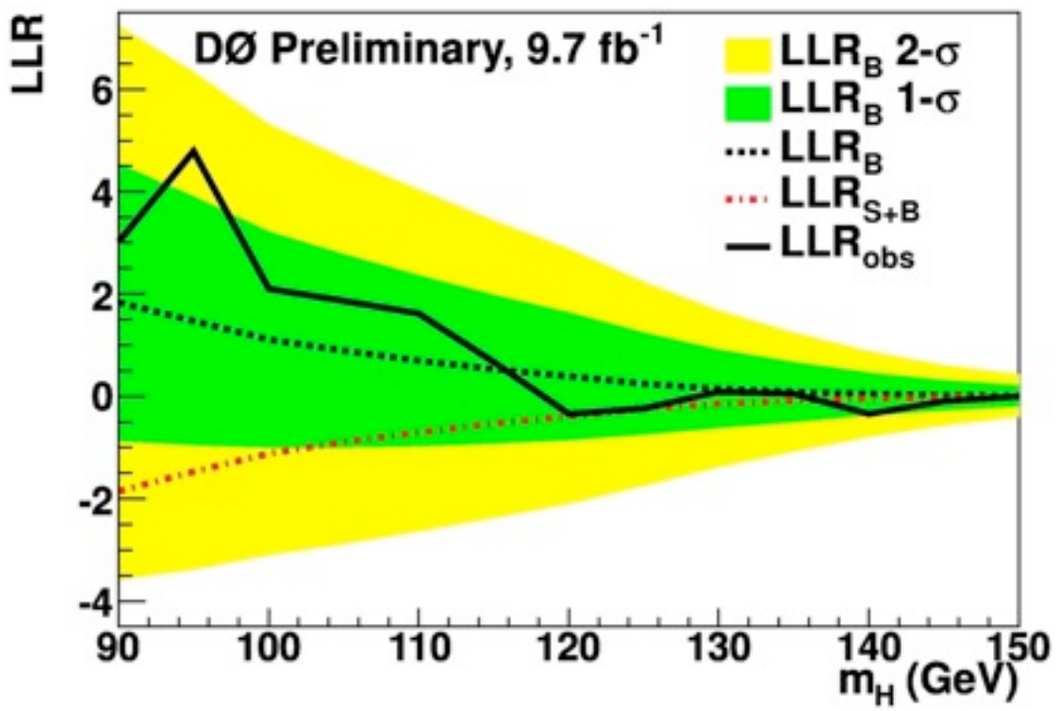






Results for WH→lνbb





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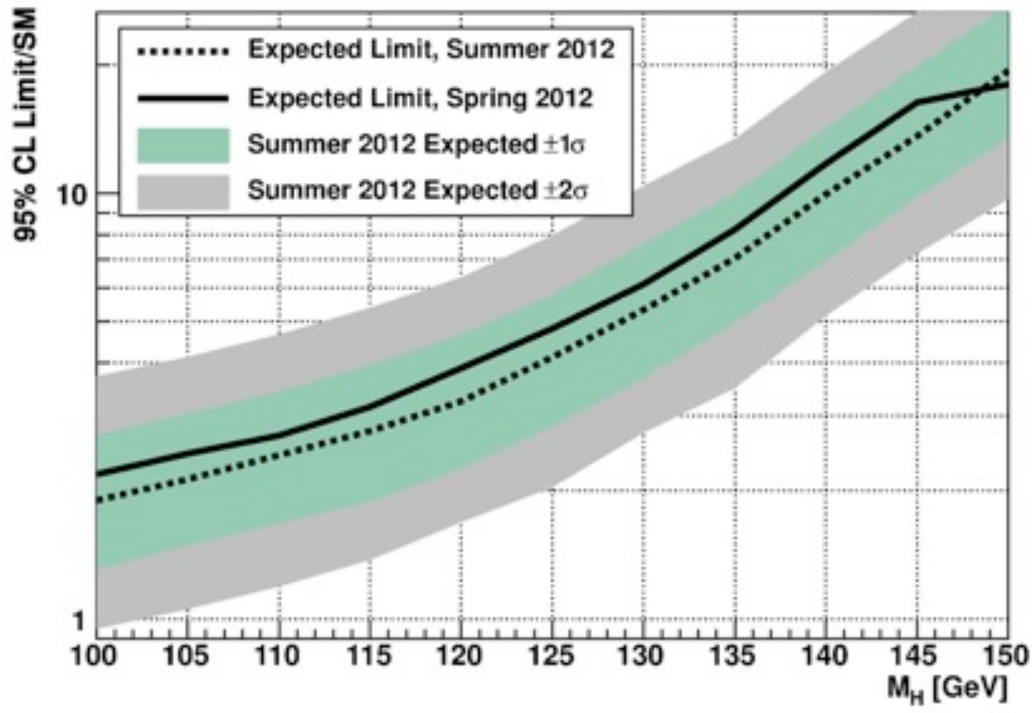
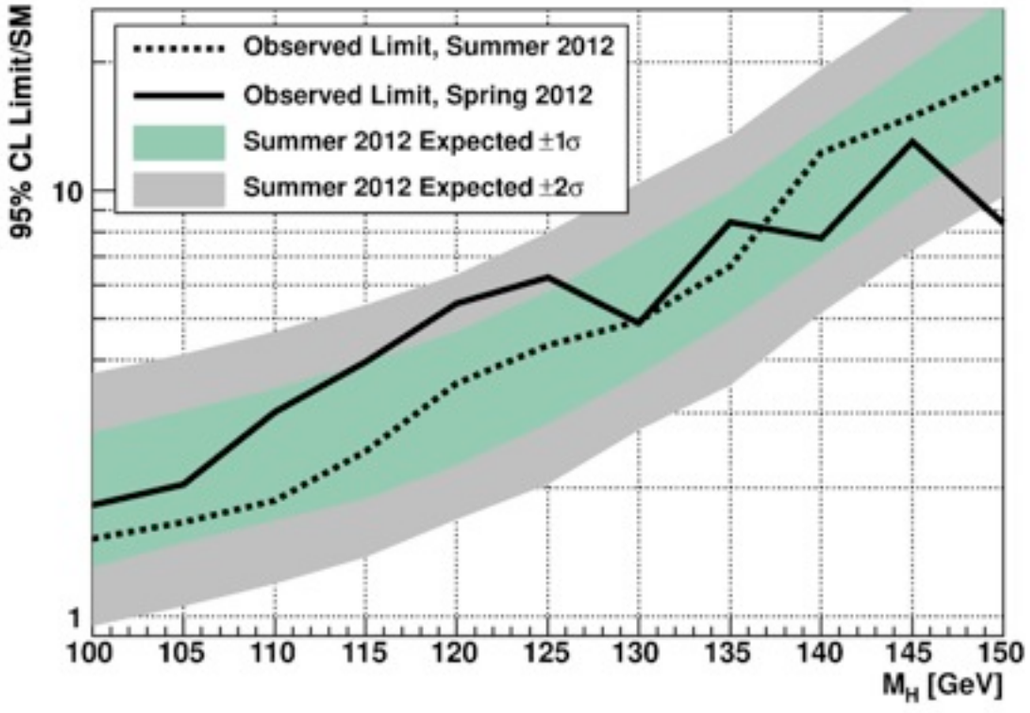
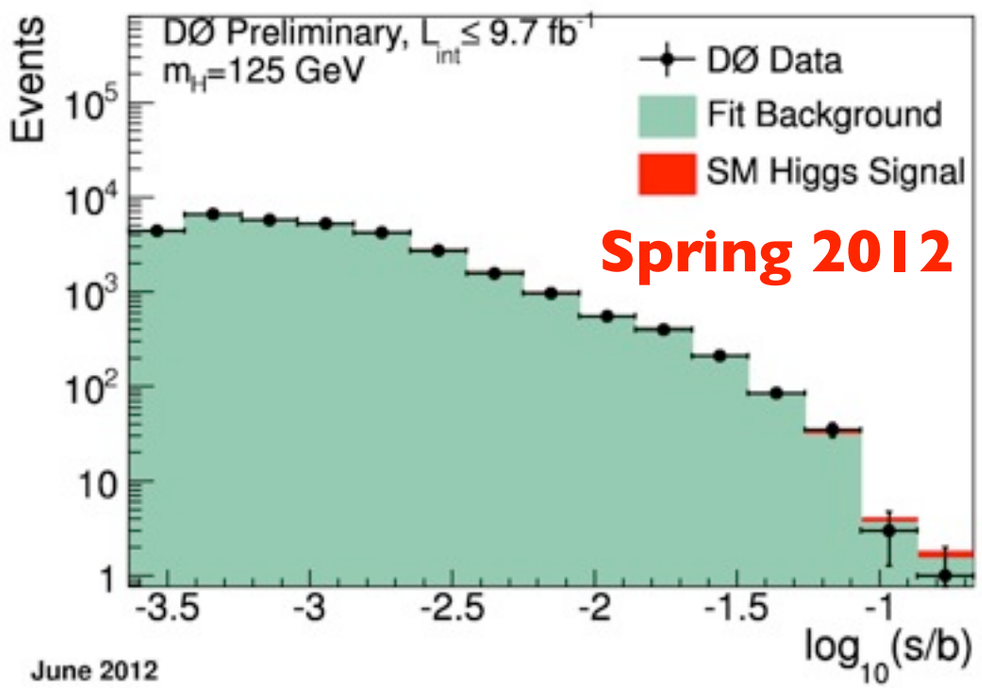
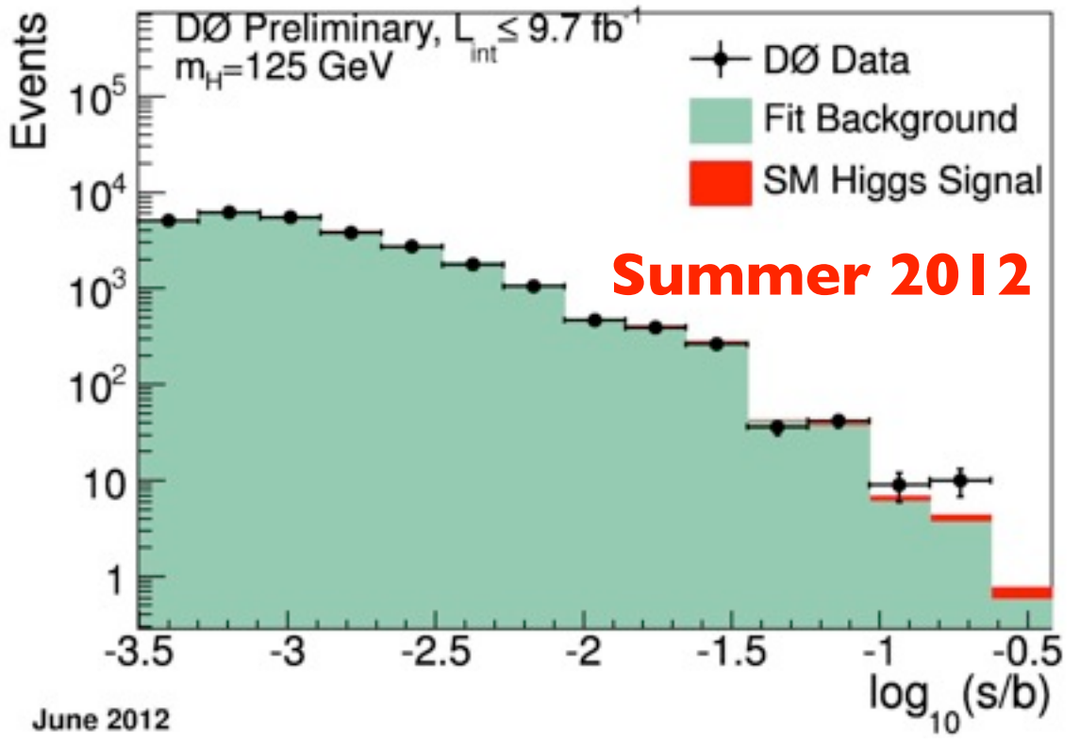


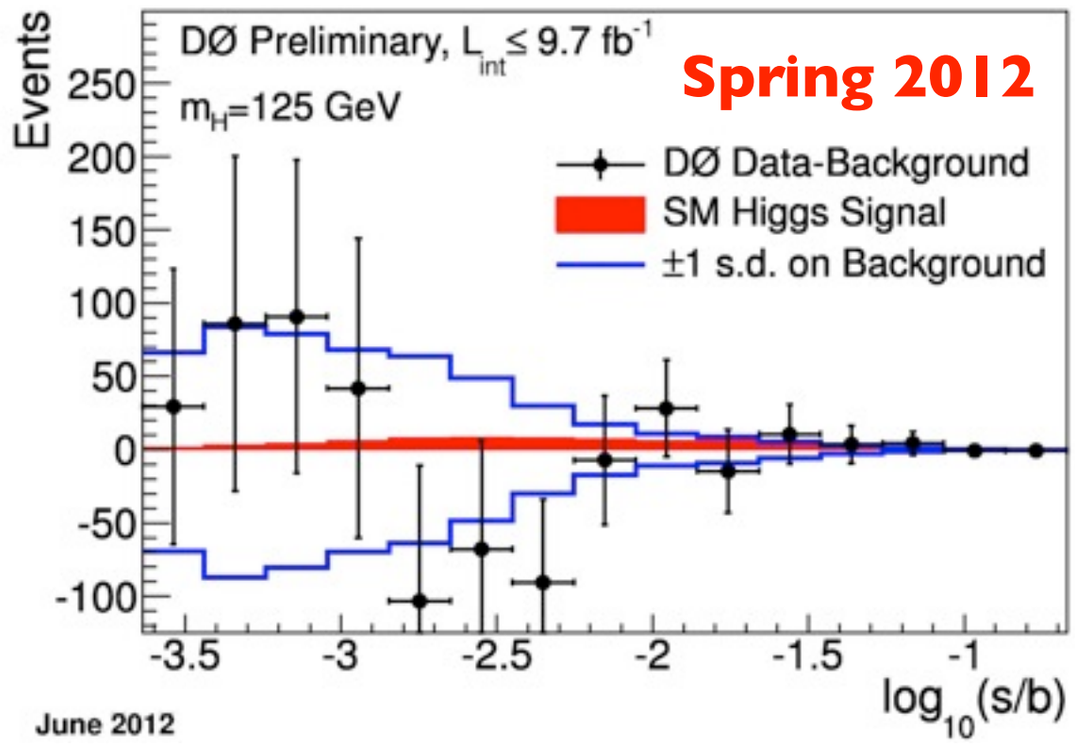
Comparison of Observed limits

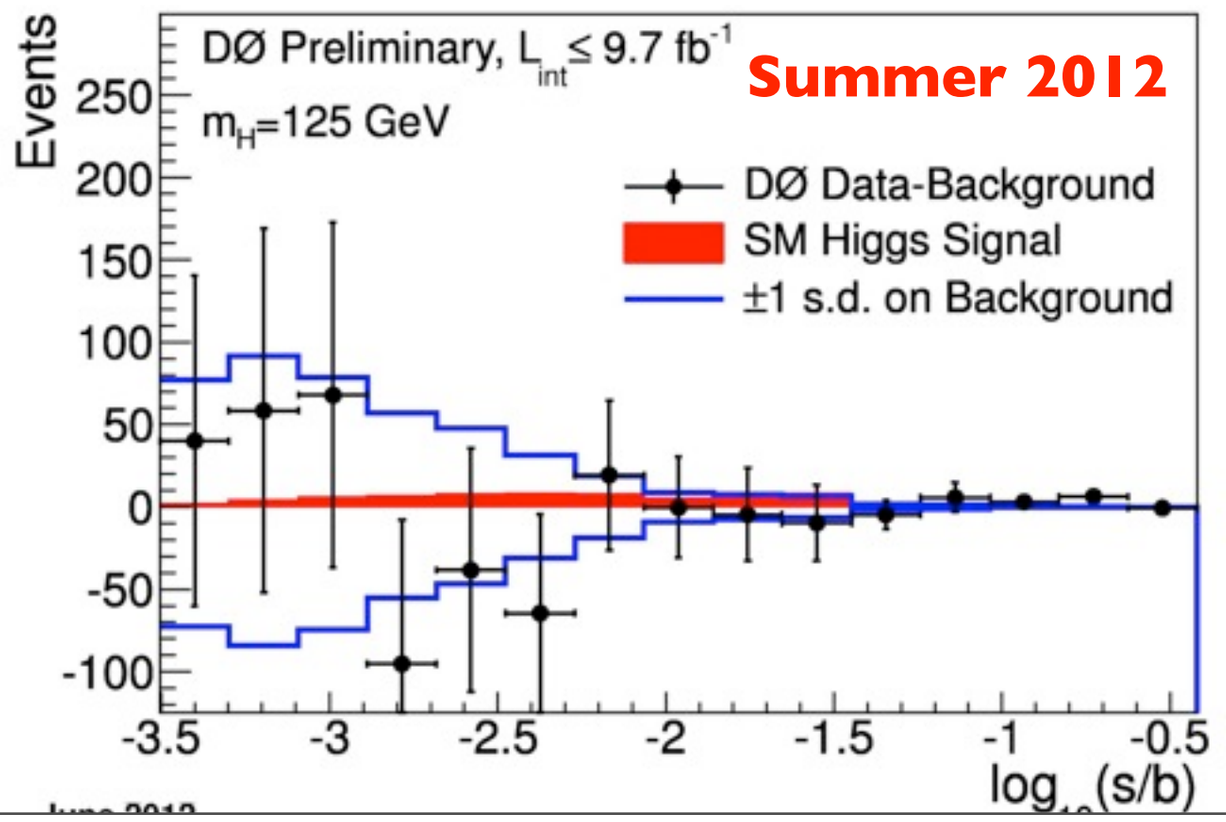


S/B Distributions









Accumulated Signal