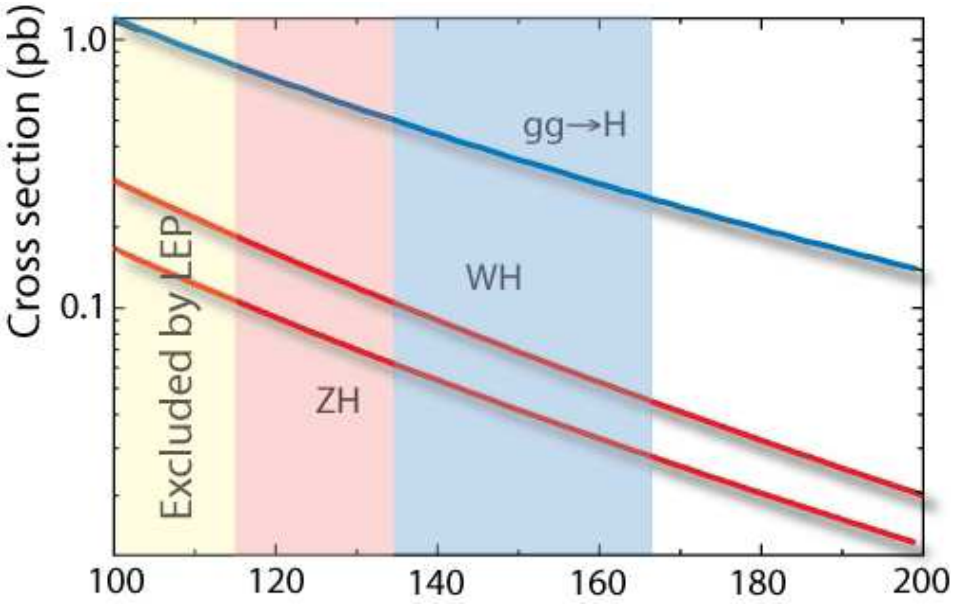
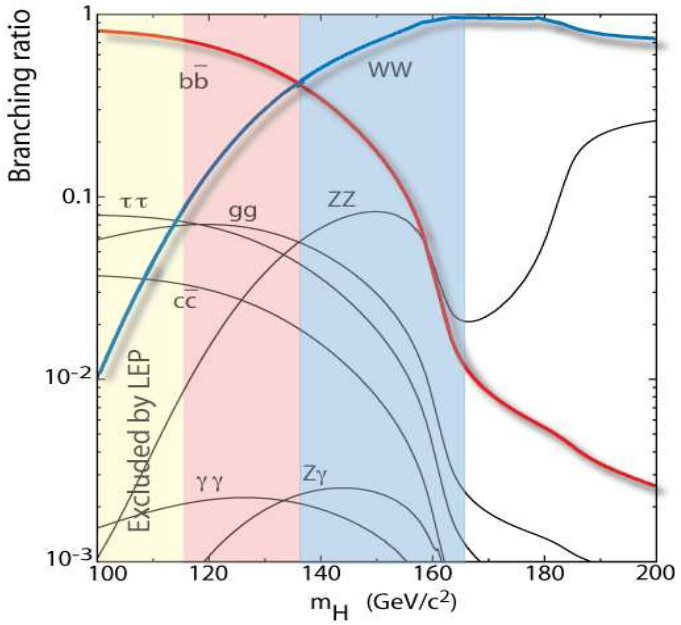
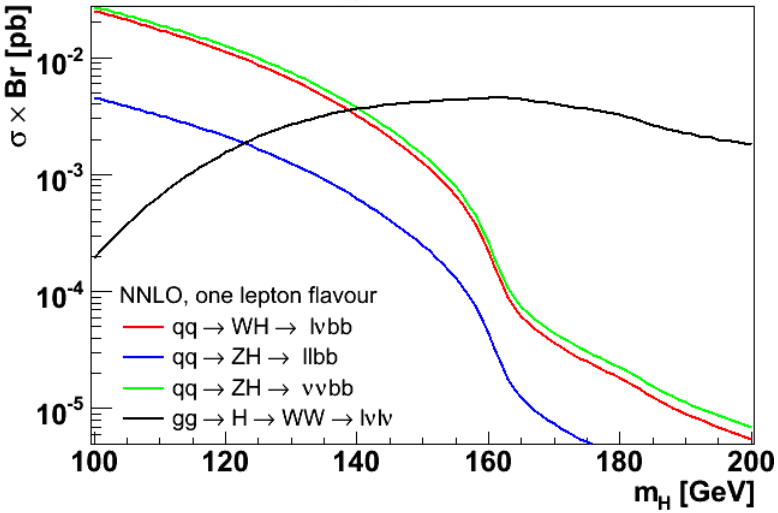
Higgs plans @ D0-France

Basics of SM Higgs searches at the Tevatron



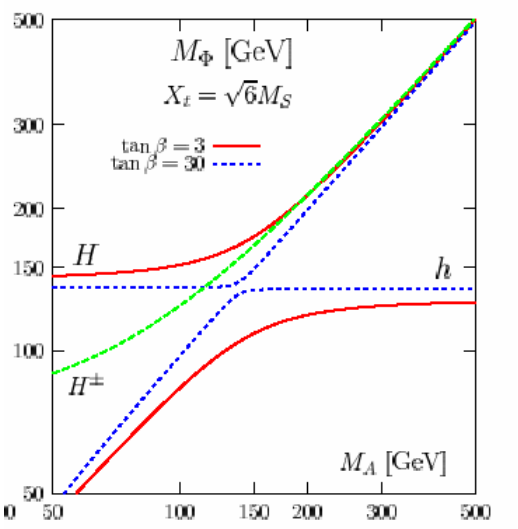


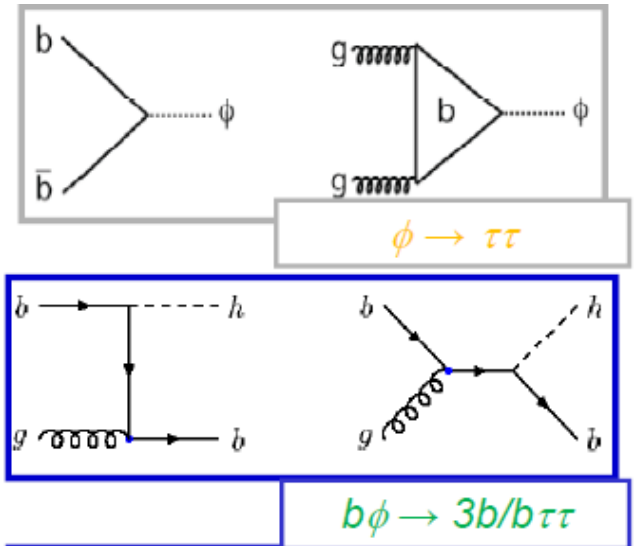
At M_H = 115 GeV: H→bb
- gg →H →bb hopeless
  (gg →H →ττ OK for SUSY @ large tanβ)
- H(W → lν) and H(Z → ll/νν): best processes



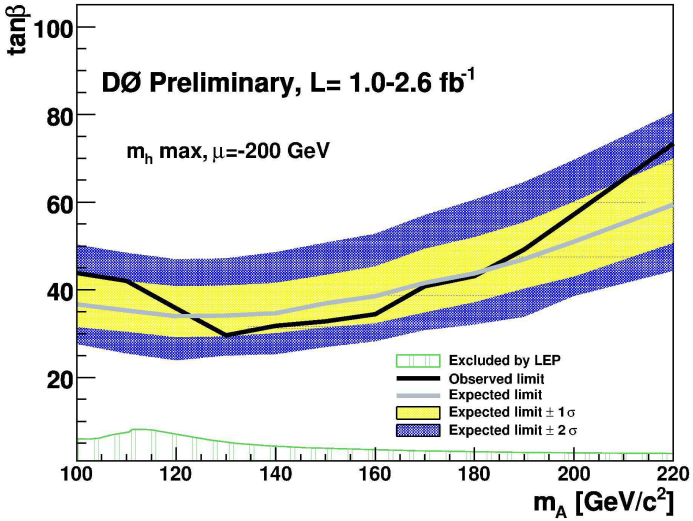
At M_H = 160 GeV: H →WW*
gg →H →(W → lν)(W* →lν): best process

SUSY Higgs searches at the Tevatron





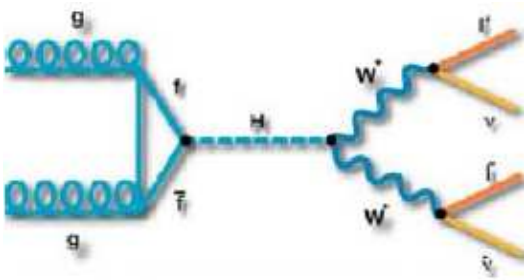
- At low tanβ, similar to SM Higgs
  no sensitivity yet.
- At high tanβ, couplings to b quarks
  enhanced ⇒ New production mechanisms
  + (h or H) and A mass degenerate (Φ)

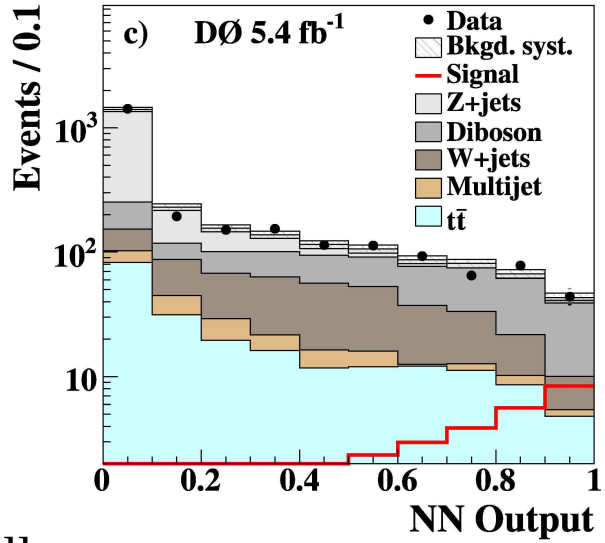


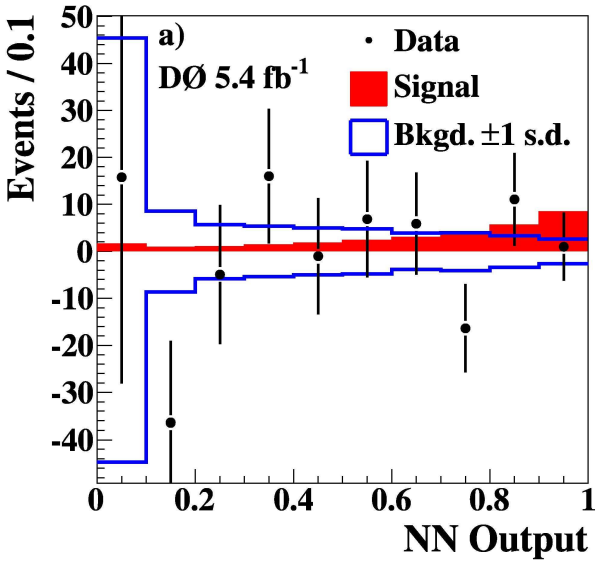
D0 Moriond-09
grand combination
of all 3 channels
(∃ CDF-D0 in ττ)

Combination with more L and with CDF expected for ICHEP
90% CL exclusion of the whole plane expected with 10 fb^{-1}
(combining with SM Higgs searches)

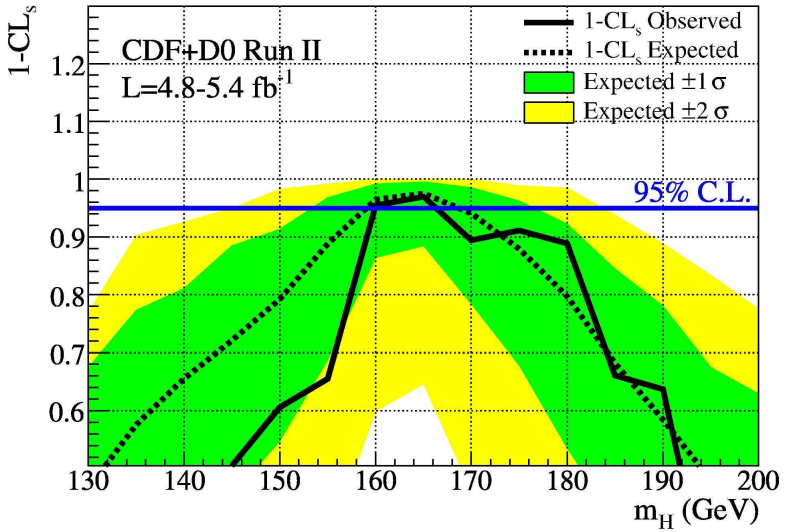
High mass SM Higgs searches







Huge background from Z→ll
Irreducible background from WW
Take advantage of different kinematics
In the end, 30 signal events expected at 165 GeV

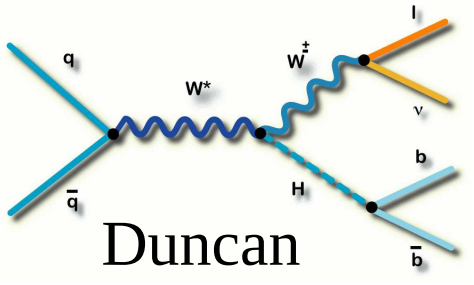


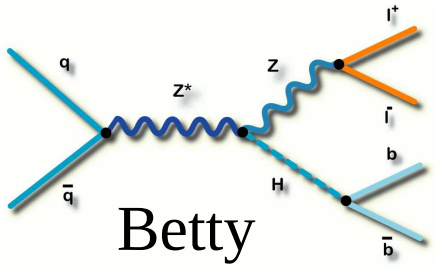
D0 and combined CDF/D0 publications:

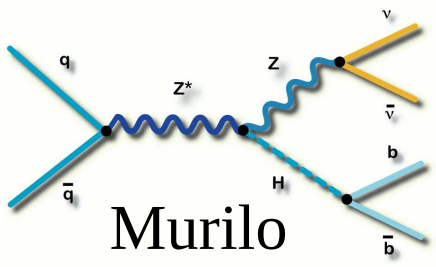
Phys. Rev. Lett. 104, 061804 (2010)

Phys. Rev. Lett. 104, 061802 (2010)

Low mass SM Higgs searches







Phys. Rev. Lett. 104, 071801 (2010)

Main challenges: the backgrounds

e.g., WH @ 115 GeV

$W(H\rightarrow bb)/Wjj \sim 3\ 10^{-5}$

$\Rightarrow$ b tagging (Sebastien, David)

$W(H\rightarrow bb)/Wbb \sim 5\ 10^{-4}$

$\Rightarrow$ MVA

+ mass resolution (Jonathan)

$W(H\rightarrow bb)/W(Z\rightarrow bb) \sim ¼$

The ultimate benchmark…

Summer plans for low mass Higgs:

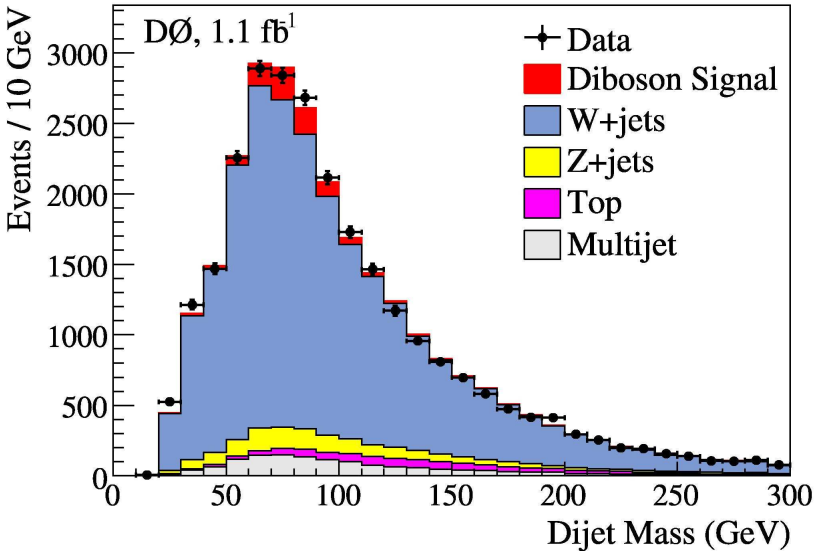
$ZH\rightarrow \nu\nu bb$: 5.2 fb^{-1} published $\Rightarrow$ +1.4 fb^{-1} + upgrades

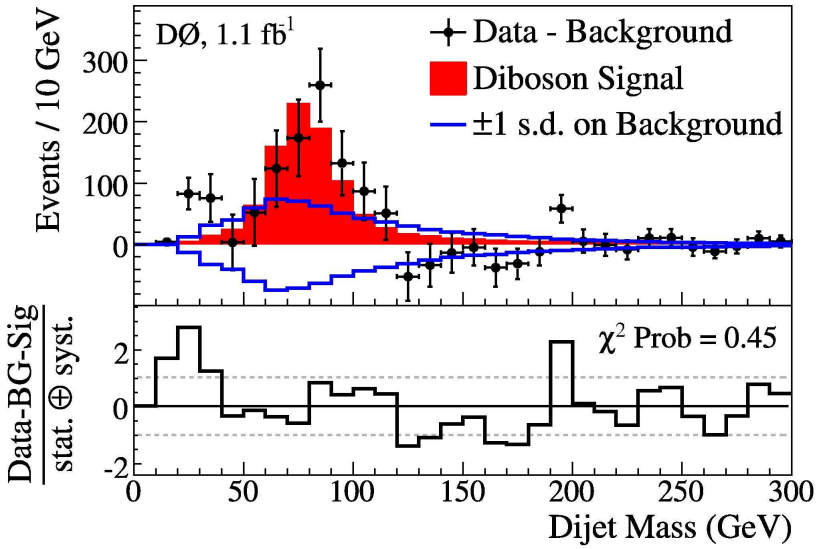
$ZH\rightarrow l\ l\ bb$: 4.2 fb^{-1} in EB $\Rightarrow$ publish + update/upgrades

$WH\rightarrow l\nu bb$: first publish 5.4 fb^{-1}; next update/upgrades

Towards the ultimate benchmark

With 1.1 fb^{-1}, D0 saw evidence at 4.4 σ
for W(W/Z) production in the (W→lν)(W/Z→jj) channel

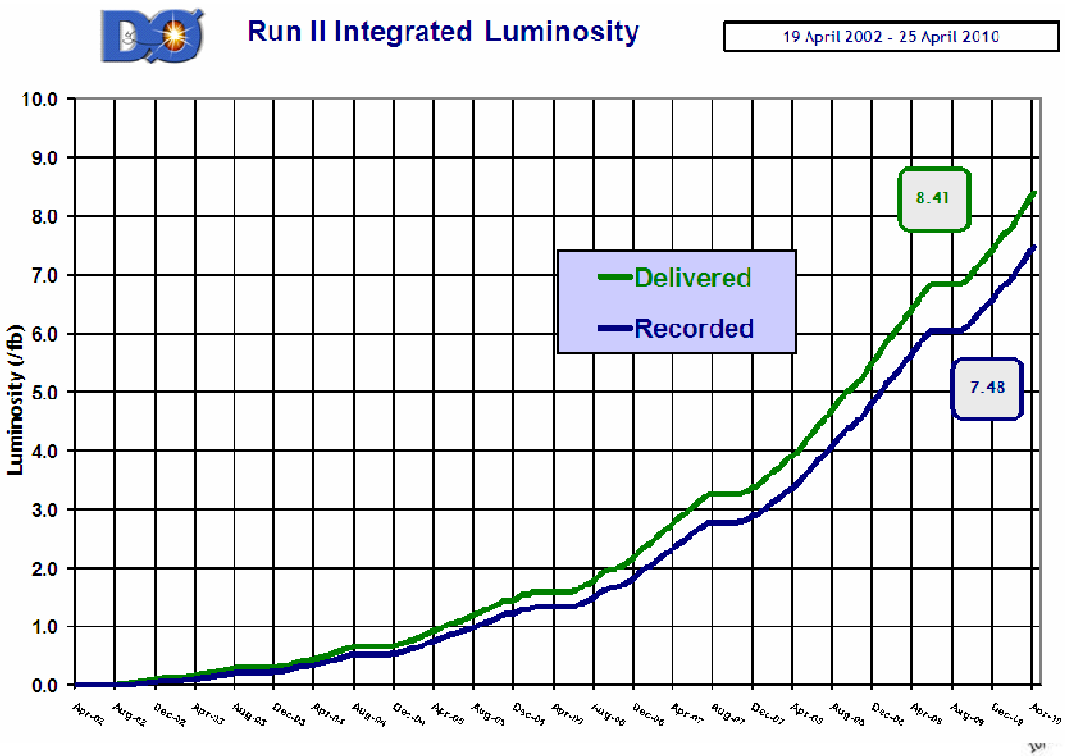


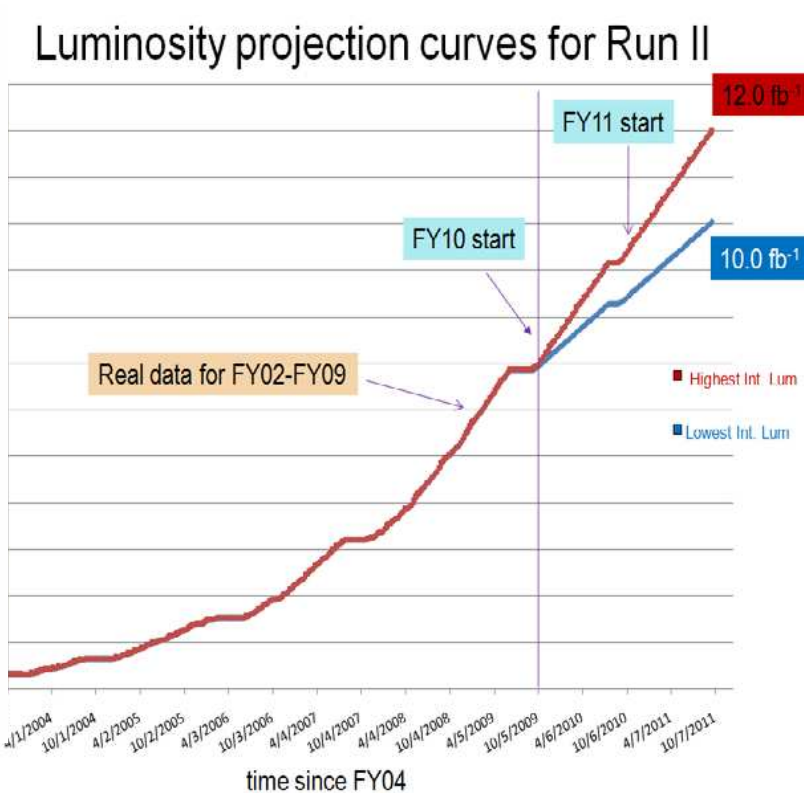


The next steps are

1) to disentangle WW and WZ
2) to observe (Z→bb) in association with (W→lν), (Z→νν) and (Z→ll)
   (as for H→bb, this will need a combination of all channels)

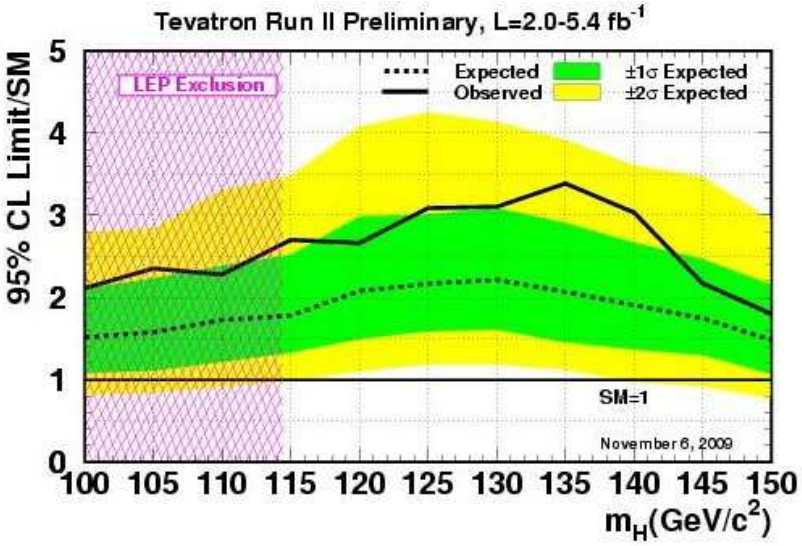
Luminosity performance and expectations





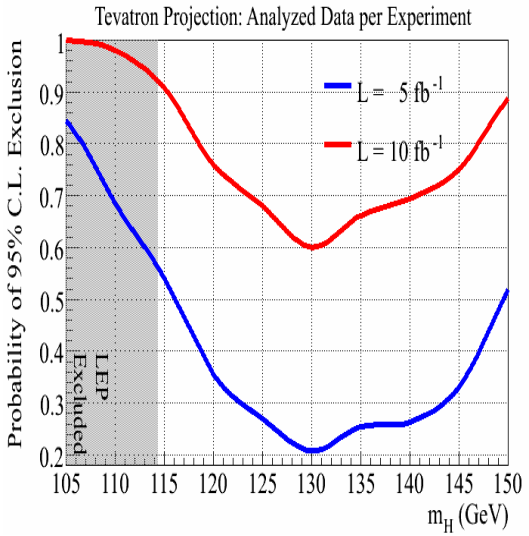
By the end of 2011, we can expect
10 fb^{-1} analyzable per experiment

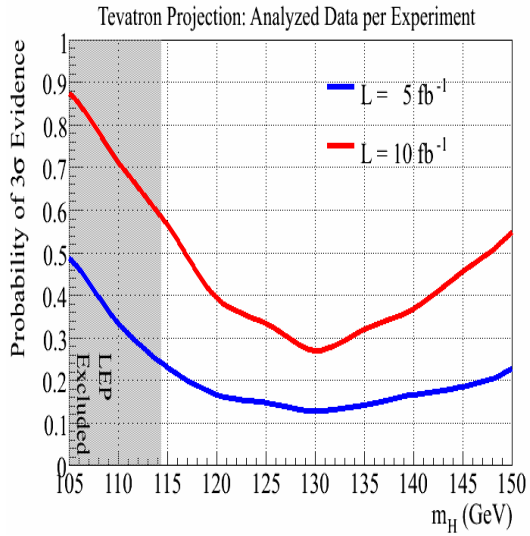
Prospects for low mass Higgs searches at the Tevatron



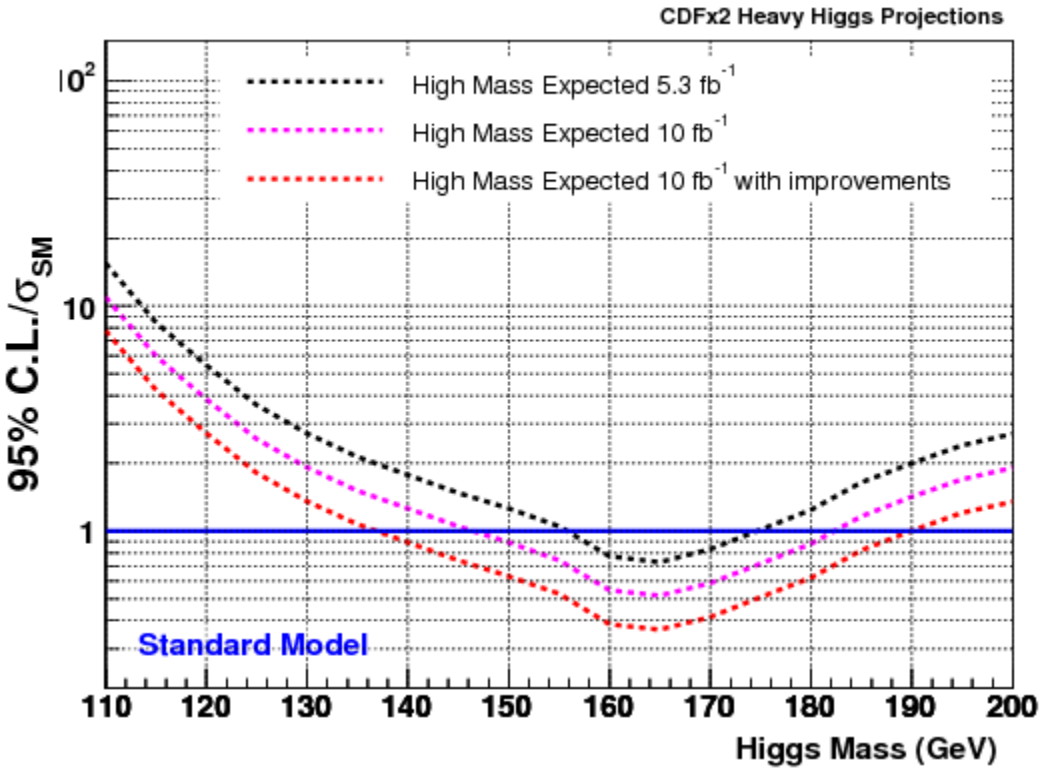
Currently:
1.78 expected @ 115 GeV
with $L_{eq} = 4.4\ fb^{-1}$
< 2 over the whole mass range

Projections with "reasonable" improvements



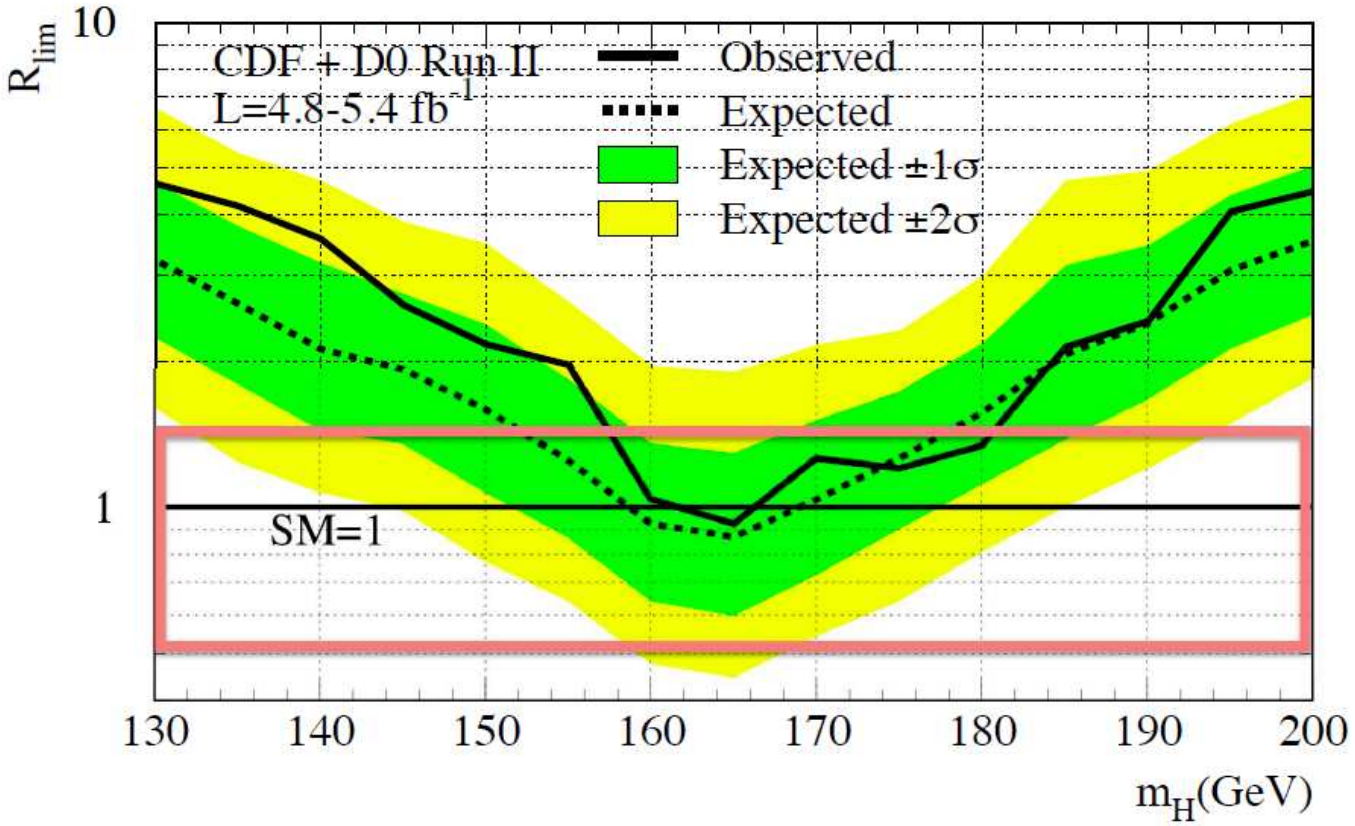


Prospects for high mass Higgs searches at the Tevatron



Competitive with 1 fb^{-1} at the LHC at 7 TeV

However…



Ongoing discussion on theoretical uncertainties.
(This is almost certainly over-pessimistic)

(Main) Higgs activities at D0-France

- Standard Model
  - Low mass ($H \rightarrow bb$)
    - ($W \rightarrow l\nu$) Paris+Strasbourg |
    - ($Z \rightarrow l\,l$) Marseille (ee channel) | ANR project
    - ($Z \rightarrow \nu\nu$) Orsay |
  - High mass
    - $H \rightarrow WW \rightarrow l\nu l\nu$ Saclay ($\mu\tau$ channel)
- BSM
  - SUSY
    - $b(H \rightarrow bb)$ Saclay
    - $b(H \rightarrow \tau\tau)$ Saclay
    - $\tau\tau$ Saclay ($e\mu$ channel)
  - Others
    - Charged Higgs (Clermont), lepton # violating (Lyon)

ICHEP Abstracts

√ 1) Search for Associated Production of W and Higgs Bosons in $l\nu bb$ Final States in ppbar Collisions at sqrt(s)=1.96 TeV
√ 2) Search for Associated Production of Z and Higgs Bosons in $\nu\nu bb$ Final States in ppbar Collisions at sqrt(s)=1.96 TeV
√ 3) Search for Associated Production of Z and Higgs Bosons in $ll bb$ Final States in ppbar Collisions at sqrt(s)=1.96 TeV.
4) Search for the Standard Model Higgs boson in the $\tau\tau q\bar q$ final state in ppbar Collisions at sqrt(s)=1.96 TeV
5) Search for the Higgs Boson in $WW^{(*)}\to l^+l'^-$ Decays in ppbar
6) Search for the Higgs Boson in $VH\toVWW^{(*)}\to ll' + X $ Decays in ppbar Collisions at sqrt(s)=1.96 TeV
7) Search for Higgs Bosons in $H \to \gamma \gamma$ Decays in ppbar Collisions at sqrt(s)=1.96 TeV
8) Search for the Standard Model Higgs in Semi-leptonic $WW^{(*)}$ decays in ppbar collisions at sqrt(s)=1.96 TeV
(√) 9) Combined Upper Limit on SM Higgs Boson Production at D0 in ppbar Collisions at sqrt(s)=1.96 TeV
(√) 10) Combined Upper Limits on Standard Model Higgs Boson Production at the Tevatron in ppbar Collisions at sqrt(s)=1.96 TeV
11) Measurement of Di-boson Production in Lepton Plus Jets Decays in ppbar Collisions at sqrt(s)=1.96 TeV
√ 12) Search for Neutral Supersymmetric Higgs Bosons in bbb(b) Final States in ppbar Collisions at sqrt(s)=1.96 TeV
√ 13) Search for Neutral Supersymmetric Higgs Bosons in di-τ Final States in ppbar Collisions at sqrt(s)=1.96 TeV
√ 14) Search for Neutral Supersymmetric Higgs Bosons in b$\tau\tau$ Final States in ppbar Collisions at sqrt(s)=1.96 TeV
(√) 15) Combined upper limits on MSSM Higgs-boson production with up to 5.4 fb-1 of data at D0
(√) 16) Combined CDF and D0 upper limits on MSSM Higgs boson production in tau-tau final states in ppbar Collisions at sqrt(s)=1.96 TeV
17) Search for the lightest neutral CP-even Higgs boson in the Next-to-Minimal Supersymmetric Standard Model in ppbar Collisions at sqrt(s)=1.96 TeV

√ = D0-France is involved