Nuovi risultati sulla ricerca del bosone di Higgs a CDF e DZero

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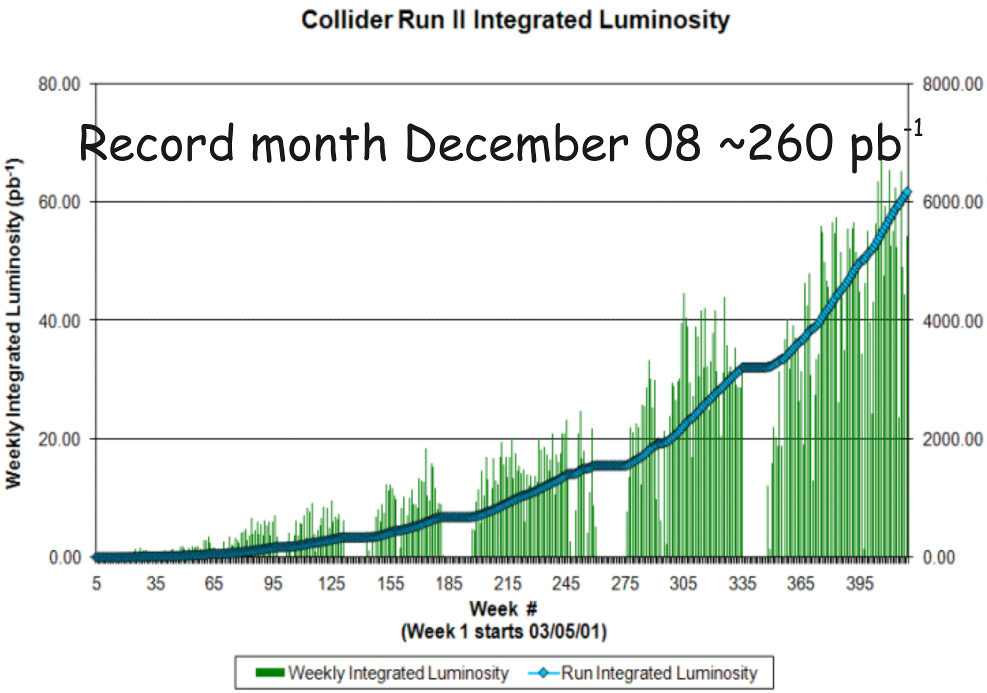
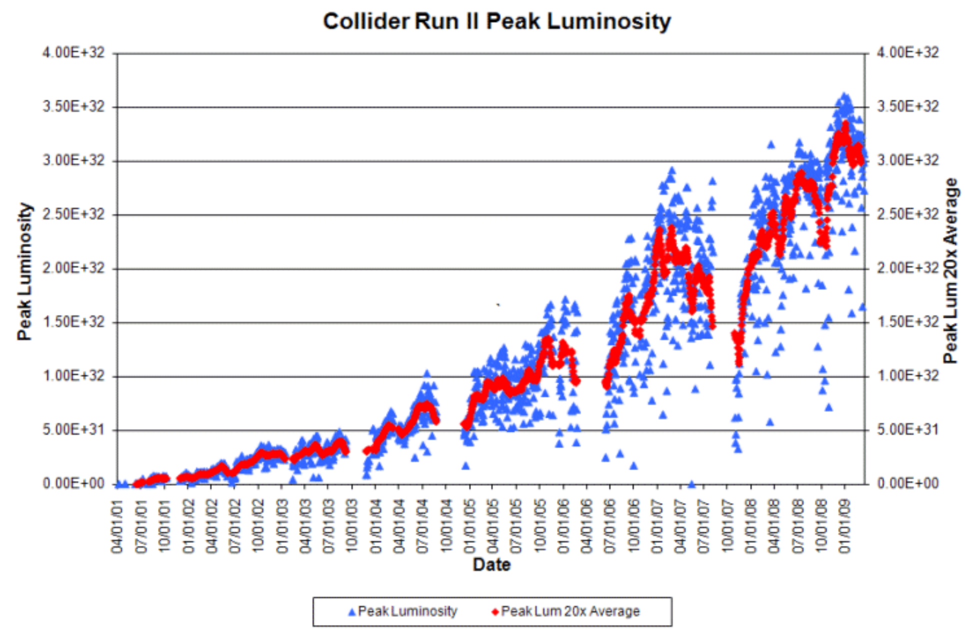
Tevatron Status





- Improved stacking rate
- Faster transfer to recycler
- Improved reliability:

  store-hours/week:110 now

  100 2004

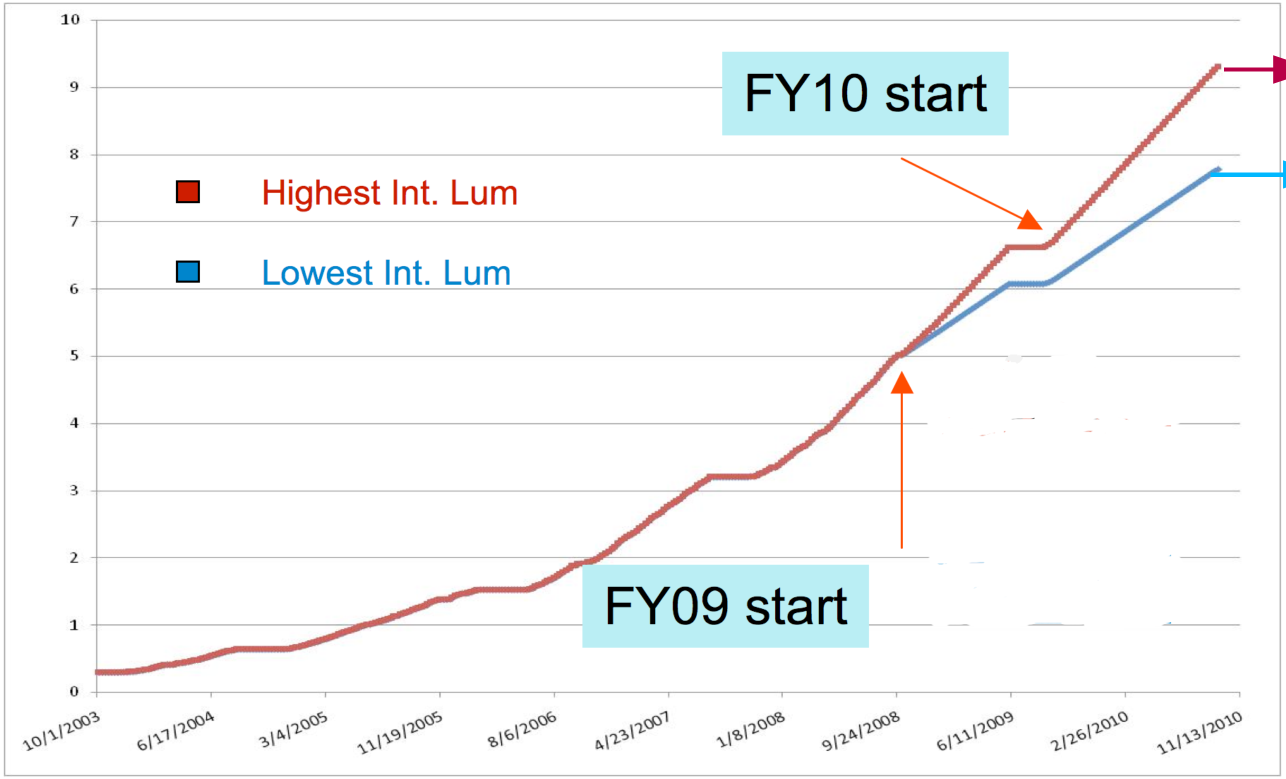
Exceptionally performing machine in terms of luminosity:

>60pb^{-1}/week, >2fb^{-1}/year

>350E30cm^{-2}s^{-1} instantaneous

~6 fb^{-1} delivered so far

Tevatron Projections



$9.32\ fb^{-1}$

$7.78\ fb^{-1}$

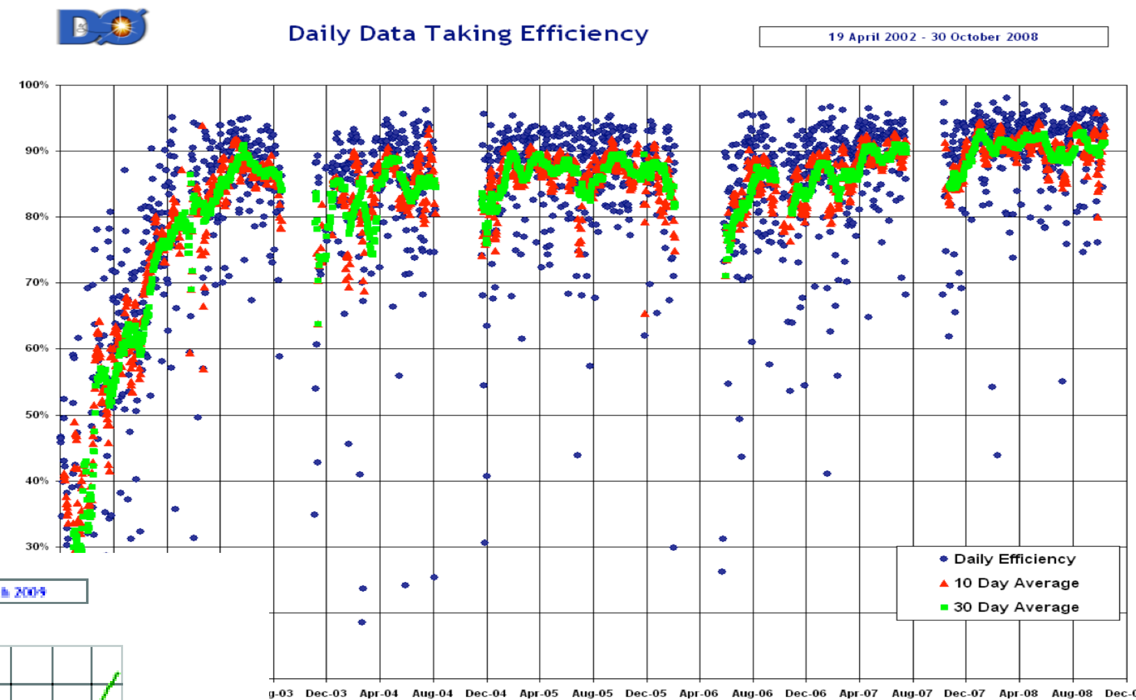
Estimated delivered luminosity at the end of 2010

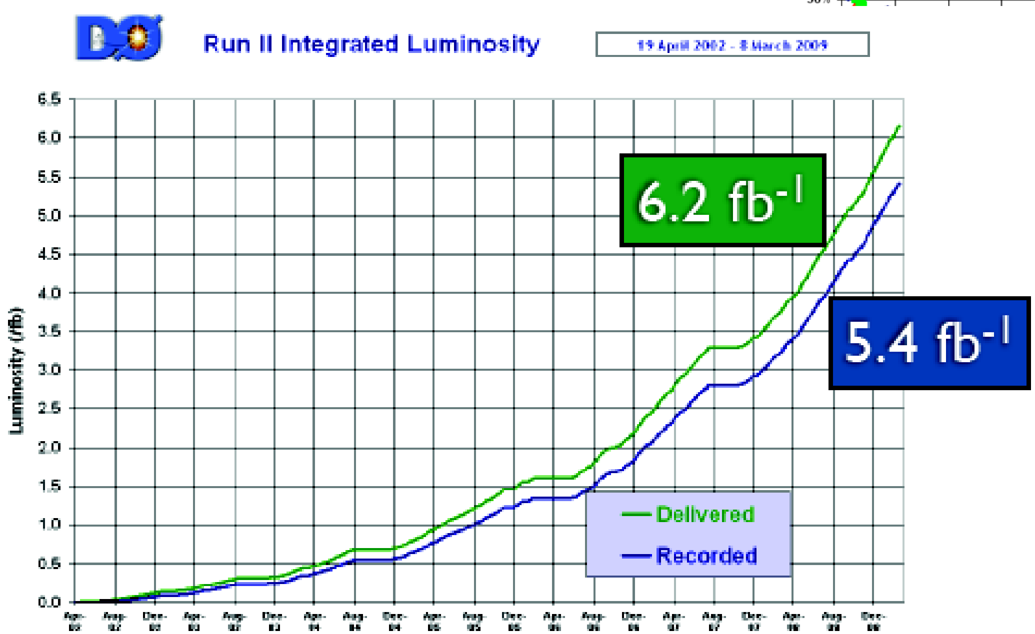
- Based on data FY02-FY08, assuming 2 months of shutdown FY09
- Until end of 2010, 12 months: $+2.5fb^{-1}$ total $9.3fb^{-1}$
- If running FY11:$+2.5fb^{-1}$ total $11..8fb^{-1}$ or more

Expect at least doubled delivered luminosity by the end of FY11

Detectors Status: DZero

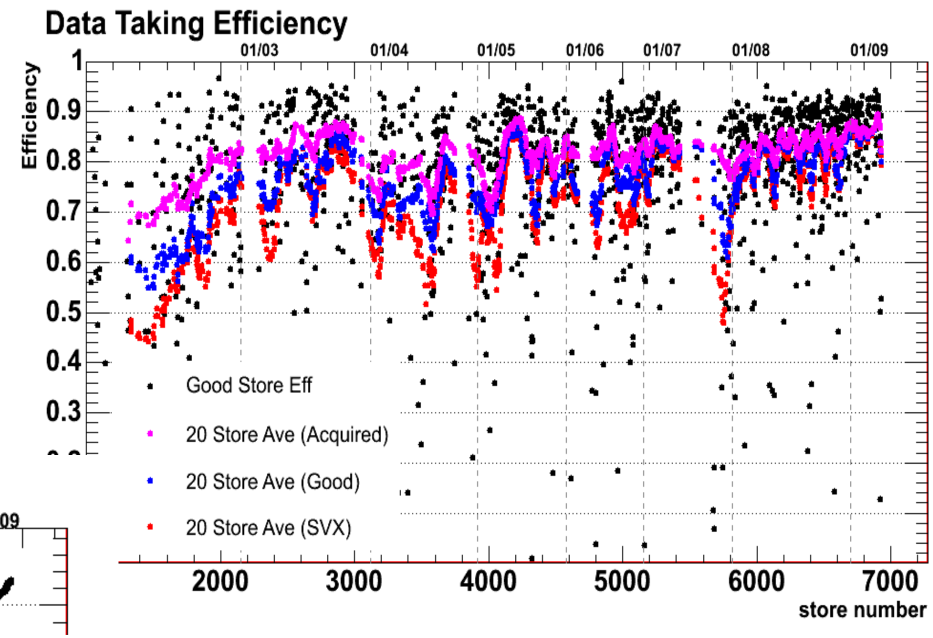
Stable operations
~90% efficiency
Up to now on tape $5.4 fb^{-1}$

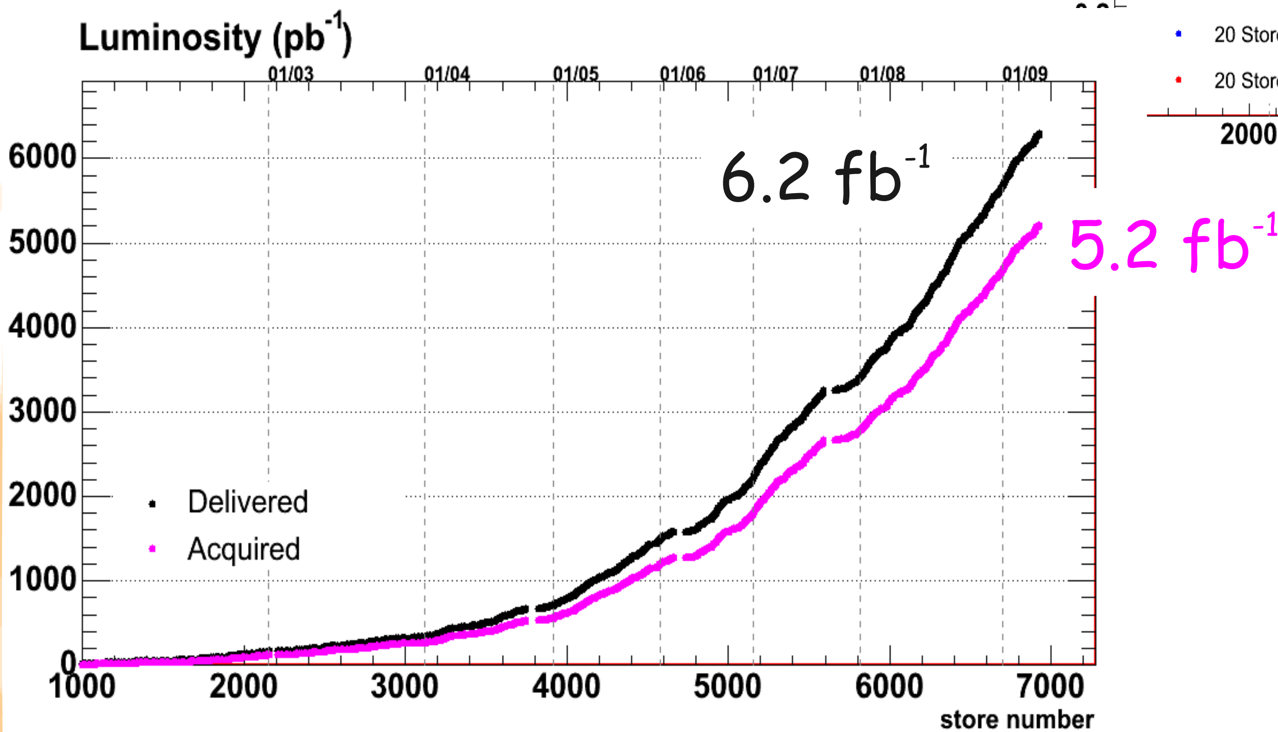




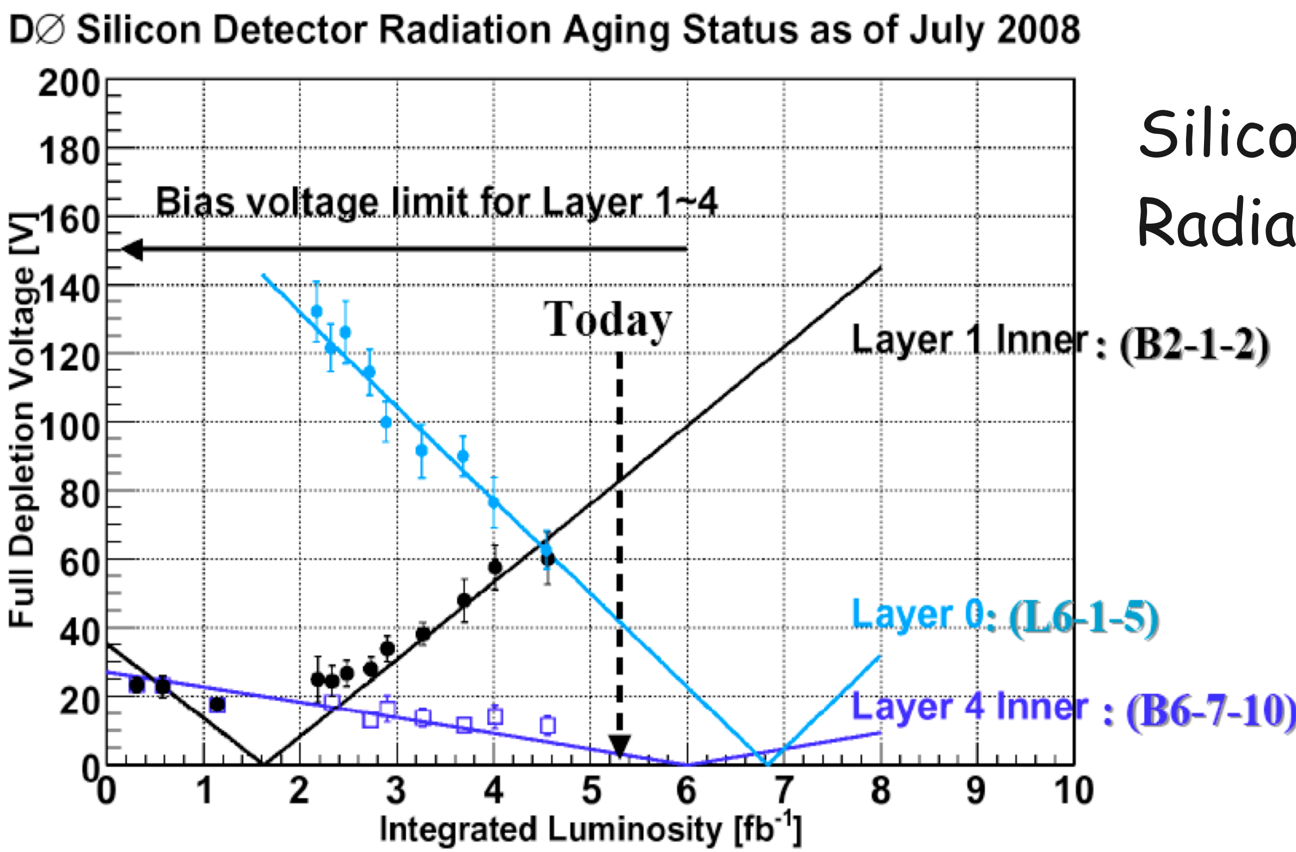
Detector Status: CDF

Stable operations
~85% efficiency
Up to now on tape 5.2fb^{-1}





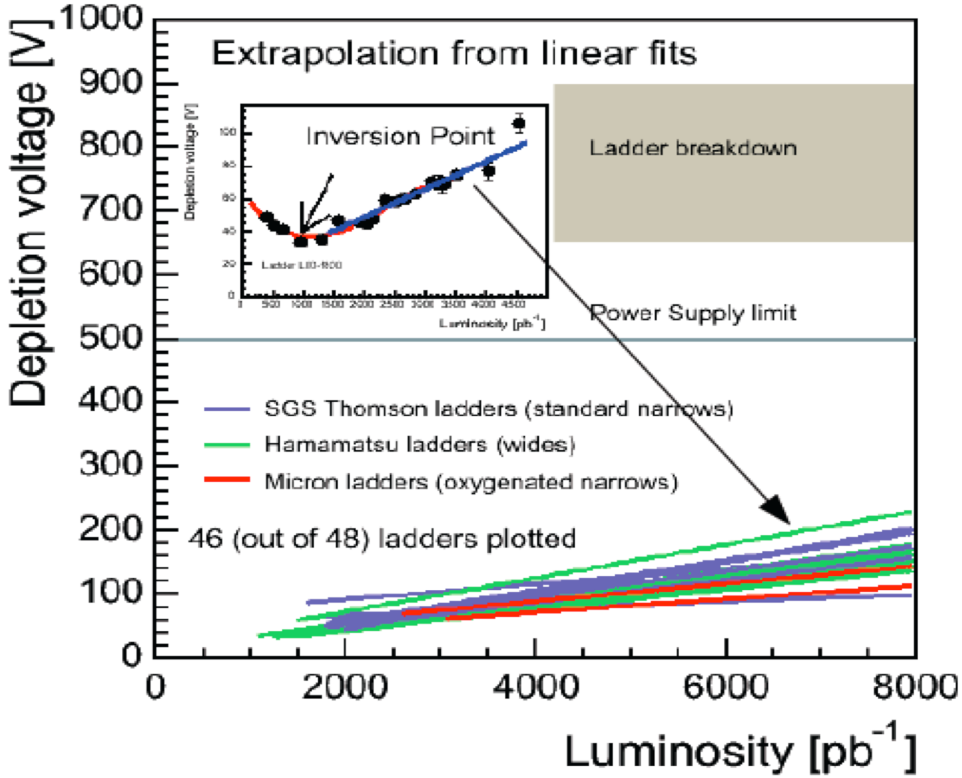
Detectors health: DZero

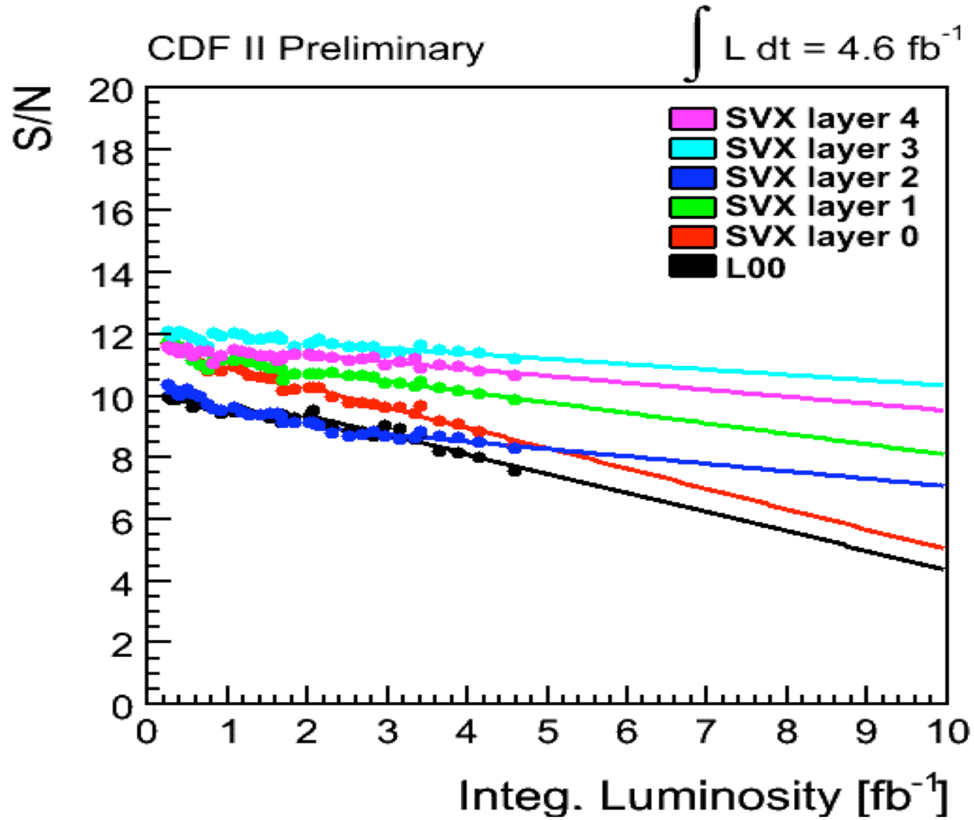


Silicon Microstrip Tracker Radiation Projections

- Layer 0 and outer layers will be fine through the end of Run II
- A few sensors in Layer 1 might reach the bias voltage limit
  - Layer 0 was added to compensate for this possibility
- Continue to monitor the impact of radiation on the silicon detector
  - Adjust bias voltages as necessary

Detectors health: CDF





- Is radiation damage going to limit the operational lifetime of SVX?
  - Study performed recently and answer: NO
- ~ 5-6 (S/N) good for physics
- ~ 3 (S/N) Run I able to do high P_T b-tagging

On the way to the Higgs: Di-bosons

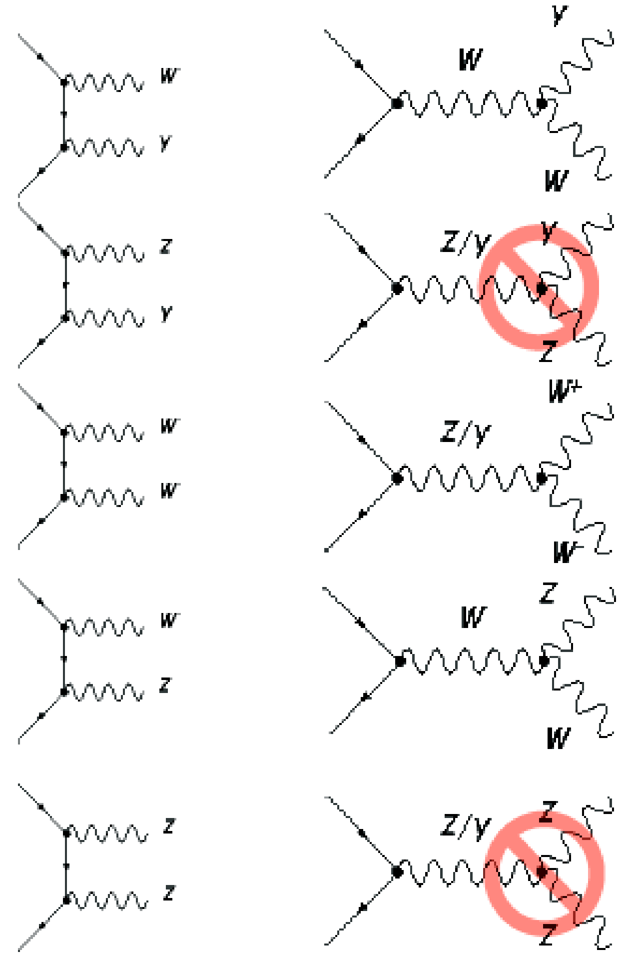
Diboson final states:

- Test Standard Model production predictions
- Look for anomalous coupling
- Cross sections similar to Higgs

CDF & D0 published results on:

- $W\gamma$
- $Z\gamma$
- WW
- WZ
- ZZ

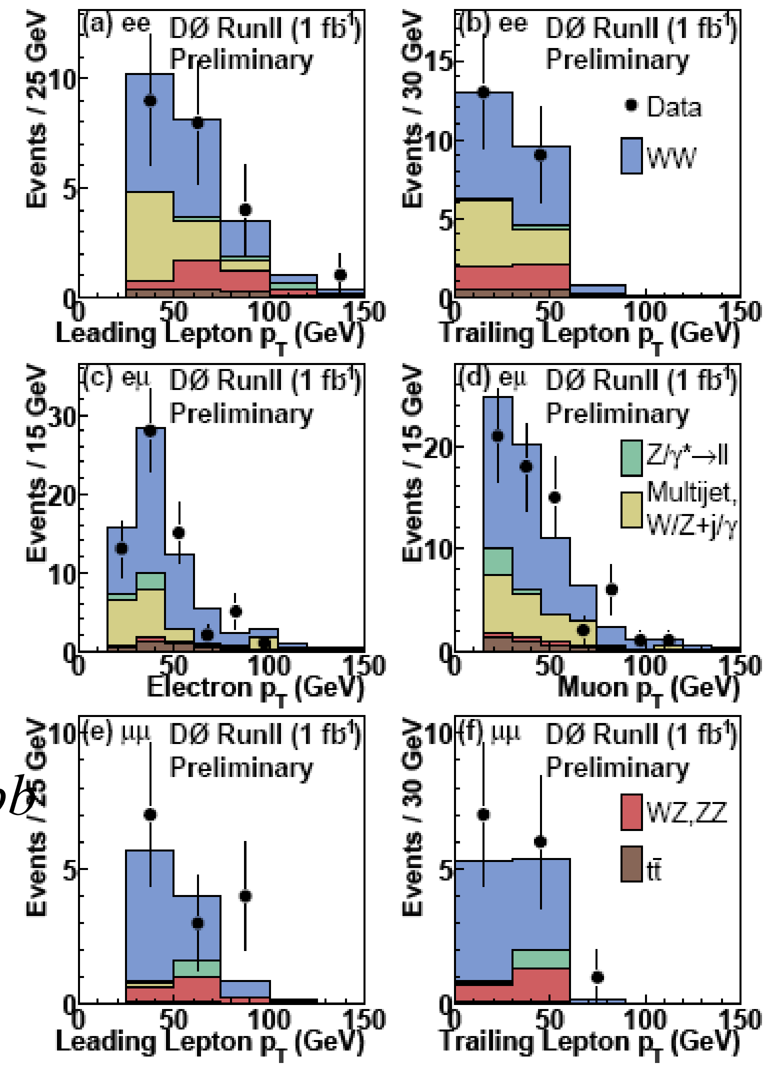
New D0 measurement using 1fb^{-1}



On the way to the Higgs: WW

Final states: ee, μμ, eμ

Process	ee	$e\mu$	$\mu\mu$
$WW \to \ell\ell$	10.98 ± 0.59	39.25 ± 0.81	7.18 ± 0.34
$WW \to \ell\tau \to \ell\ell$	1.40 ± 0.20	5.18 ± 0.29	0.71 ± 0.10
$Z/\gamma^* \to ee/\mu\mu + X$	0.27 ± 0.20	2.52 ± 0.56	0.76 ± 0.36
$Z/\gamma^* \to \tau\tau$	0.26 ± 0.05	3.67 ± 0.46	—
$t\bar{t}$	1.10 ± 0.10	3.79 ± 0.17	0.22 ± 0.04
WZ	1.42 ± 0.14	1.29 ± 0.14	0.97 ± 0.11
$W\gamma$	0.23 ± 0.16	5.21 ± 2.97	—
ZZ	1.70 ± 0.04	0.09 ± 0.01	0.84 ± 0.03
W + jet	6.09 ± 1.72	7.50 ± 1.83	0.12 ± 0.24
Multijet	0.01 ± 0.01	0.14 ± 0.13	—
Background sum	11.07 ± 1.75	24.21 ± 3.58	2.91 ± 0.45
Data	22	64	14



Cross section

$$\sigma(p\bar{p} \to WW) = 11.5 \pm 2.1(stat + syst) \pm 0.7(lumi)\ pb$$

One dimensional 95% C.L. improved limits on anomalous trilinear gauge couplings

On the way to the Higgs: ZZ

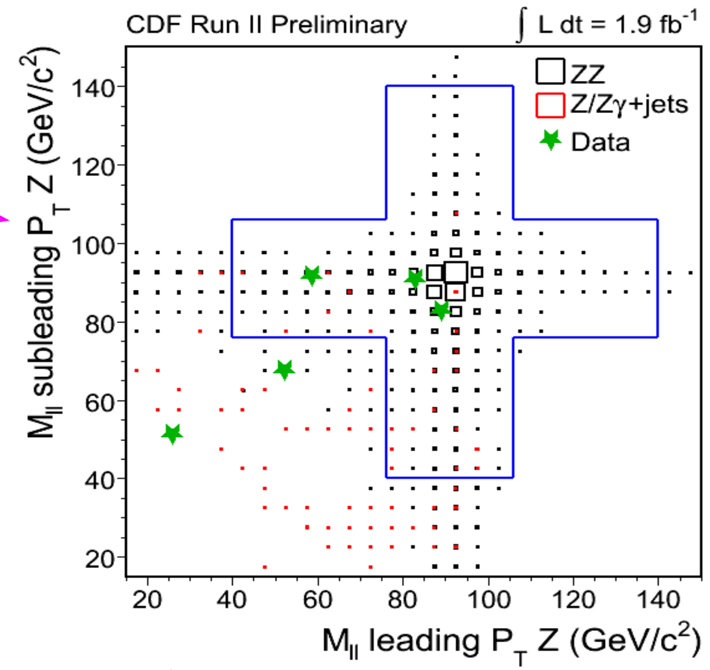
Results using final states with:

4 leptons

2 leptons and 2 ν

ZZ Fit Region

Category	WW	WZ	ZZ	$t\bar{t}$	DY	$W\gamma$	W+jets	Total	Data
$e\ e$	43.7	4.8	5.4	2.7	8.7	24.8	19.3	109 ±10	118
$e\ \mu$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0 ± 0	0
$\mu\ \mu$	33.7	3.7	4.4	2.4	7.0	0.0	2.7	54 ± 5	45
e trk	35.3	2.3	2.2	2.4	3.8	5.9	9.9	62 ± 5	69
μ trk	19.2	1.5	1.5	1.4	1.5	1.1	5.2	31 ± 3	44
Total	131.8	12.3	13.5	9.0	21.1	31.7	37.1	256 ±21	276



Combining the two channels D0 (2.7 fb^{-1}) signal has 5.7σ significance

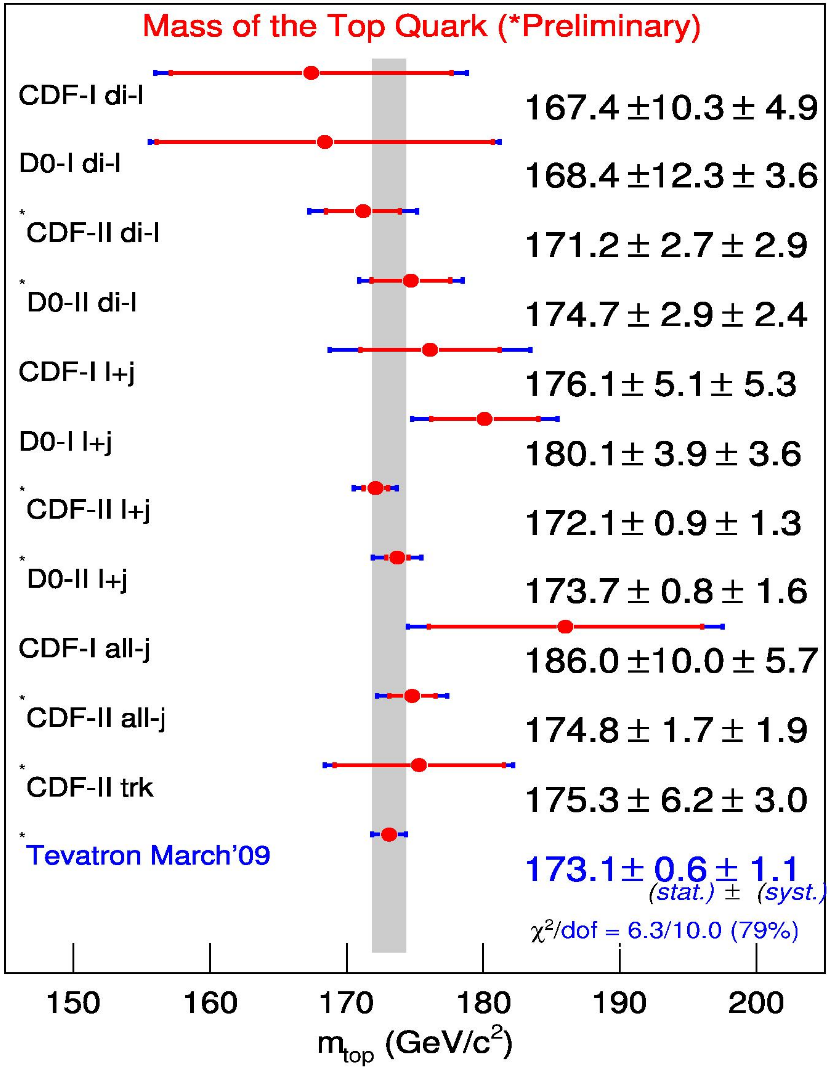
The cross section $\sigma(ZZ)=1.60\pm0.63(stat)^{+016}_{-0.17}(syst)$

Combining the two channels CDF signal has 4.4σ significance

The cross section $1.4^{+0.7}_{-0.6}(stat.+syst.)$ pb

Matteo is looking at 4 leptons channel

Top Mass

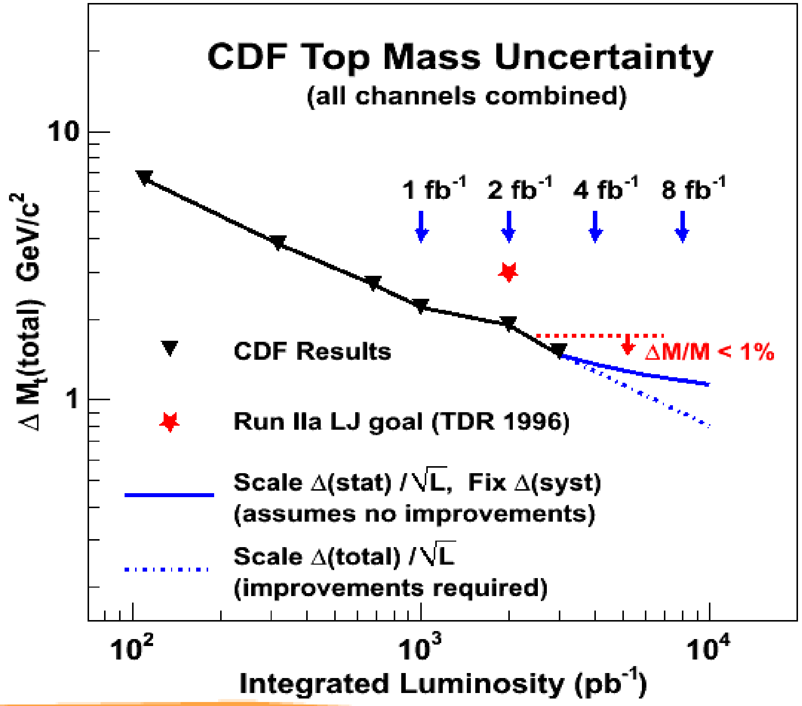


Use up to 3.6 fb^{-1} of data

CDF and D0 combined:

M_t=173.1±0.6(stat)±1.1(syst)GeV/c^2

Total uncertainty 1.3 GeV/c^2 --> relative precision of 0.75%

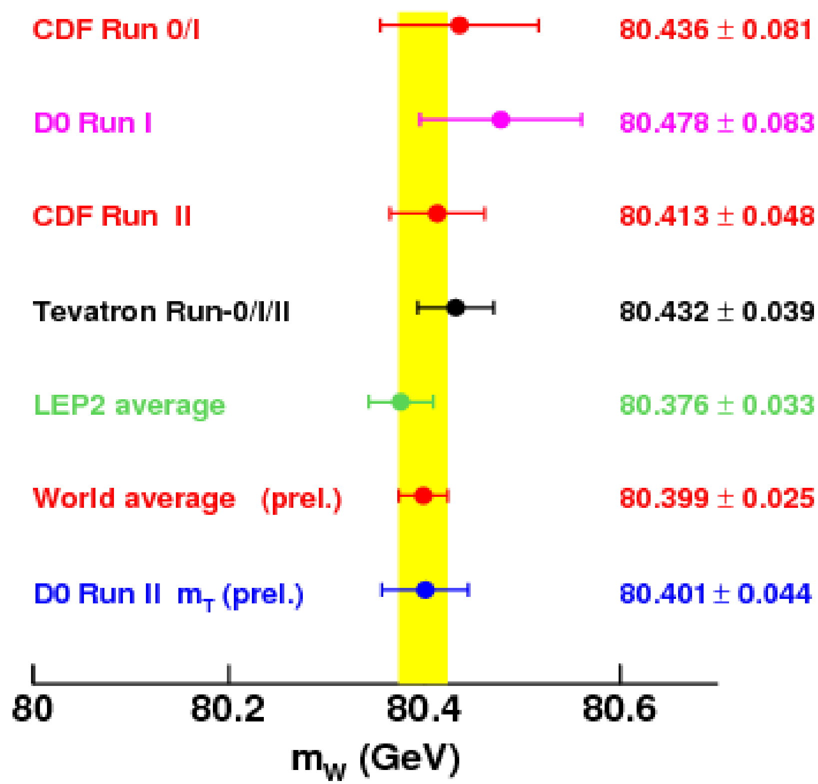


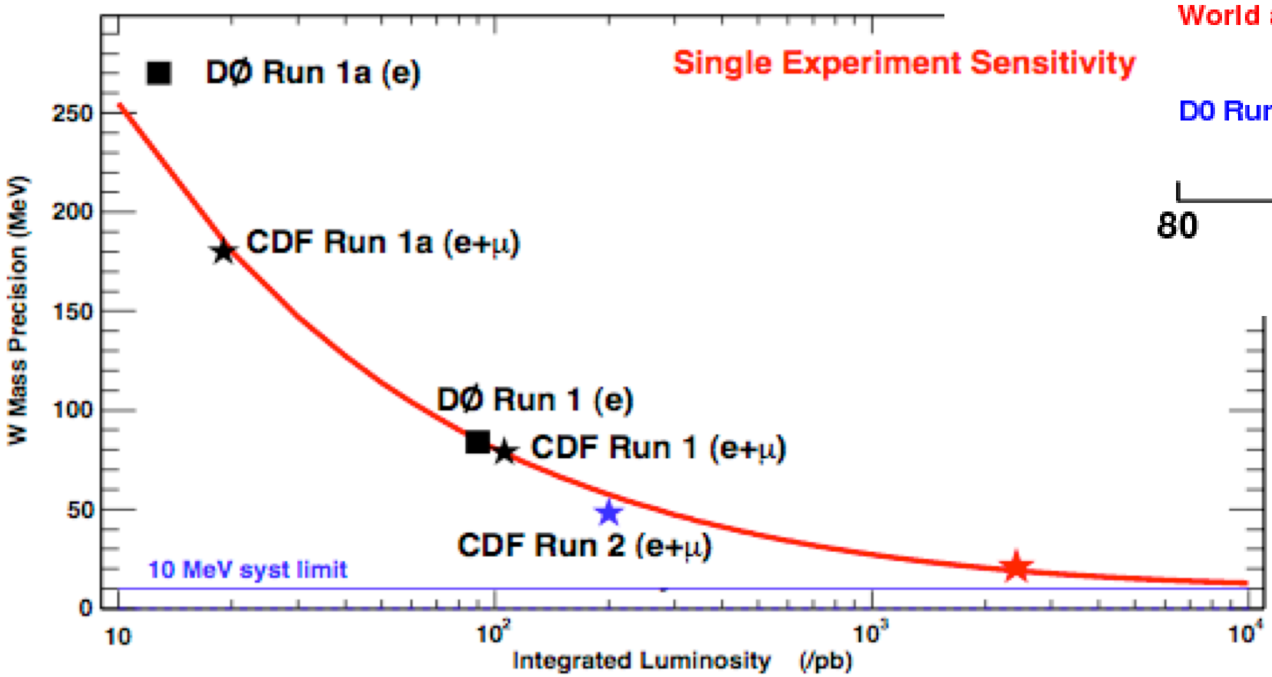
W Boson Mass

Latest results D0:

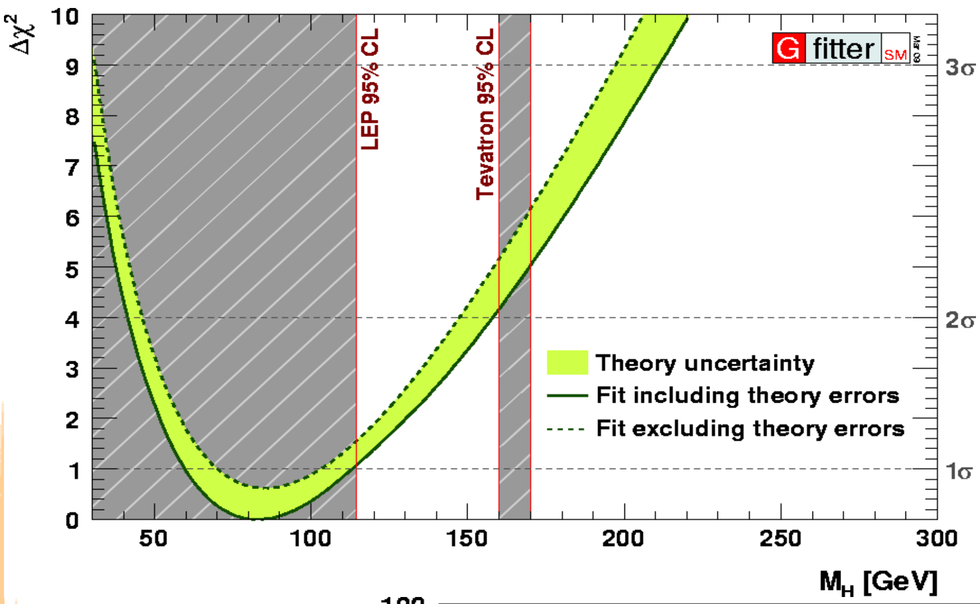
M_W 80.401±0.044 GeV

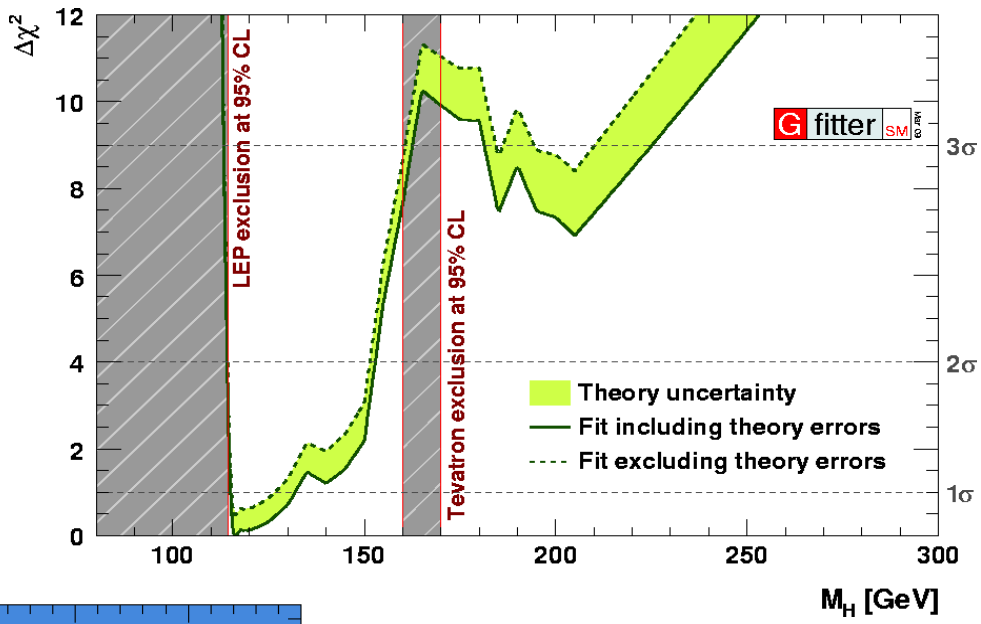
CDF has in progress the analysis on $2.4 fb^{-1}$ the expected statistical error is ~15 MeV

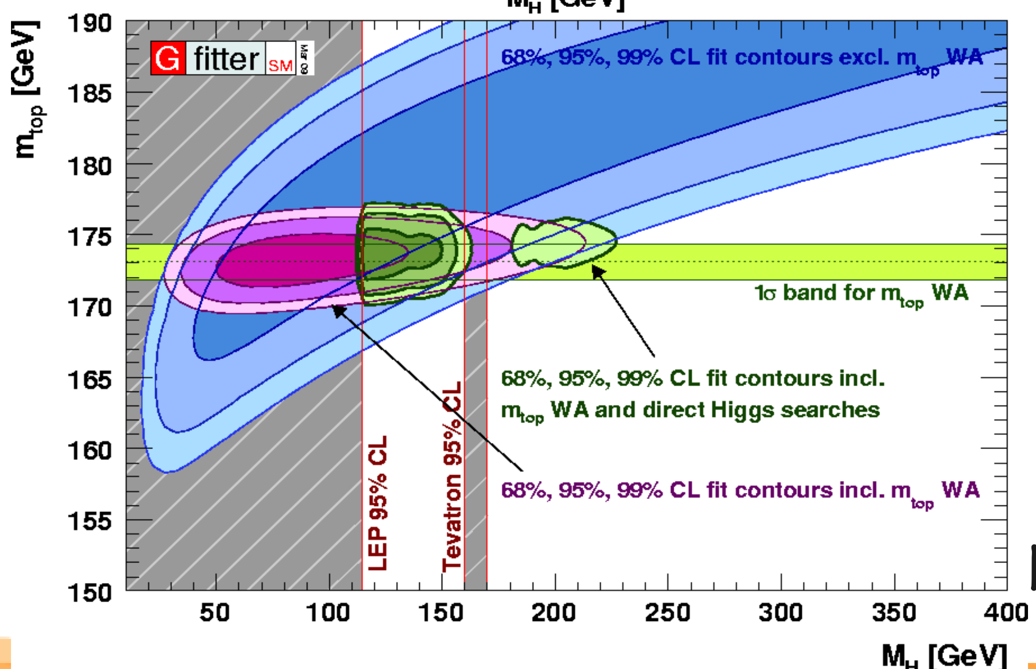




Cornering the Higgs

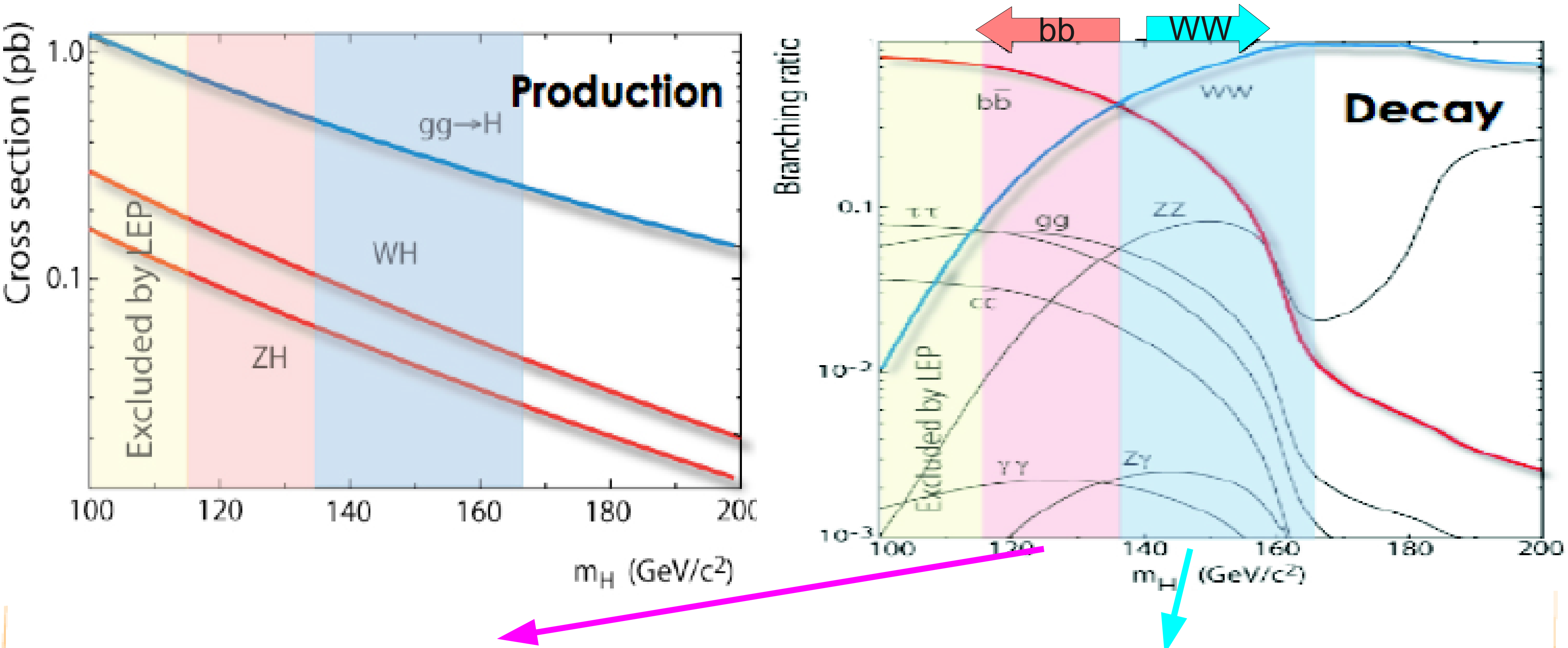






http://gfitter.desy.de/

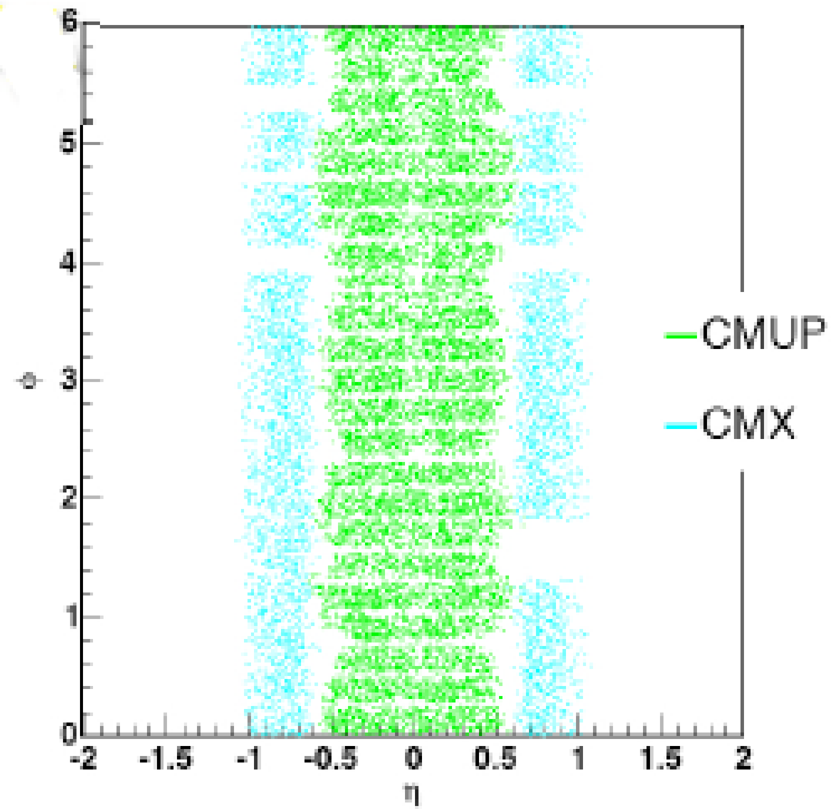
Direct Higgs searches @Tevatron



Low Mass: M_H<135 GeV/c²   High Mass: M_H>135 GeV/c²

Analysis Tools: Lepton Identification

- Identify the decay of W/Z
  - electrons: tracks matched to ECAL
  - muons: tracks matched to muon chambers
  - taus: tracks matched to calorimeter cluster
- Expand lepton coverage:
  - interplay between sub-detectors to cover holes
  - include forward detectors



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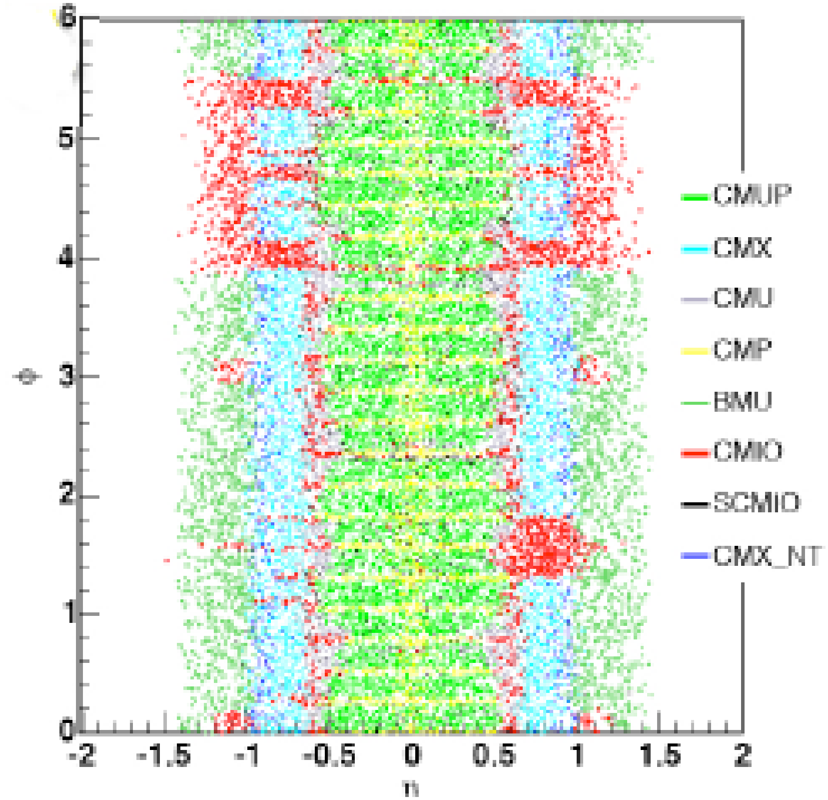

Analysis Tools: Lepton Identification

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  - electrons: tracks matched to ECAL
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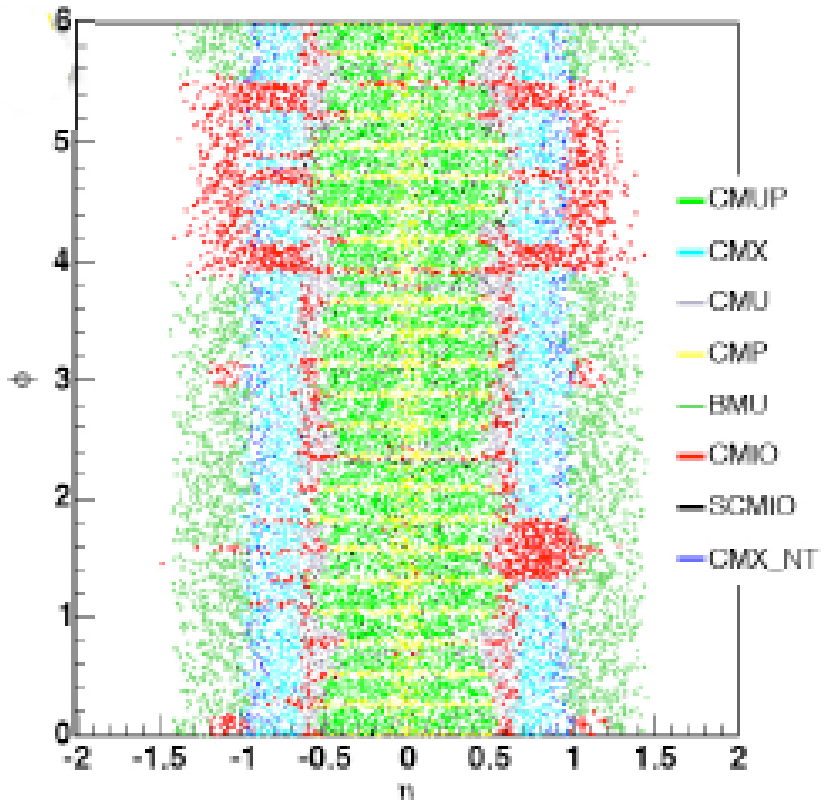
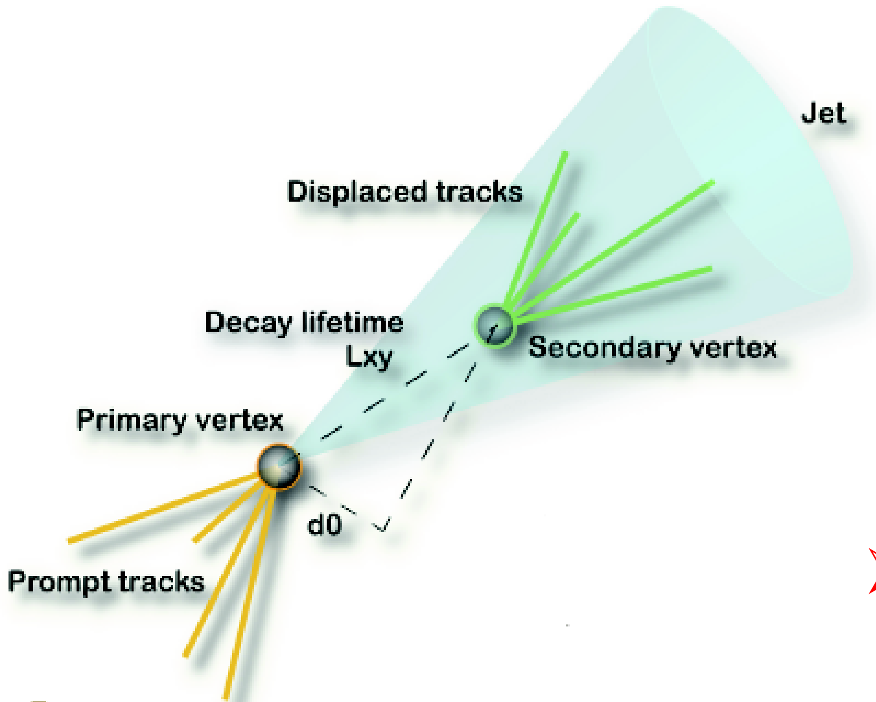
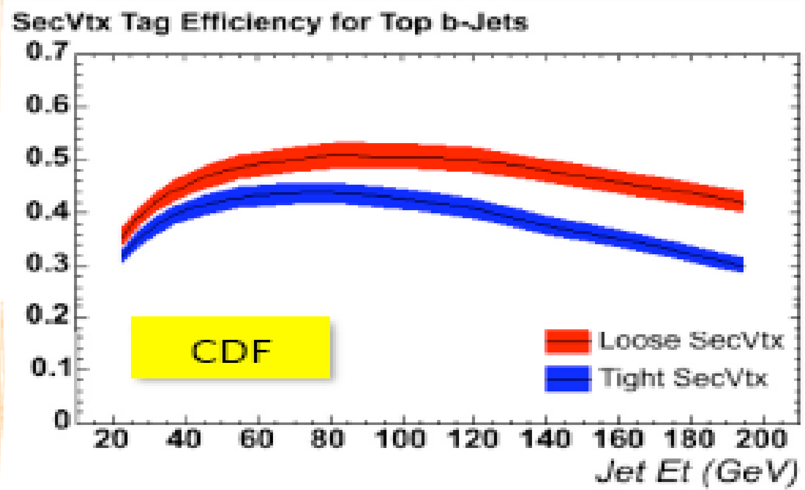
  - taus: tracks matched to calorimeter cluster
- Expand lepton coverage:
  - interplay between sub-detectors to cover holes
  - include forward detectors
- Good Missing E_T (MET) trigger :
  - select events with neutrinos and charged lepton that fail ID
  - remove events with fake MET



Analysis Tools: b-jet identification





- B-tagging:
  - ✔exploit long lifetime of b-hadrons
  - ✔Suppress light flavor background
  - ✔ Improves S/B
- Various algorithms used by CDF/D0
  - ✔ Identify displaced vertex
  - ✔ Exploit multiple feature of b-jets
  - ✔ Probability that tracks come from primary vertex
  - ✔ b-tagging efficiency: 40-70%
- D-jet invariant mass

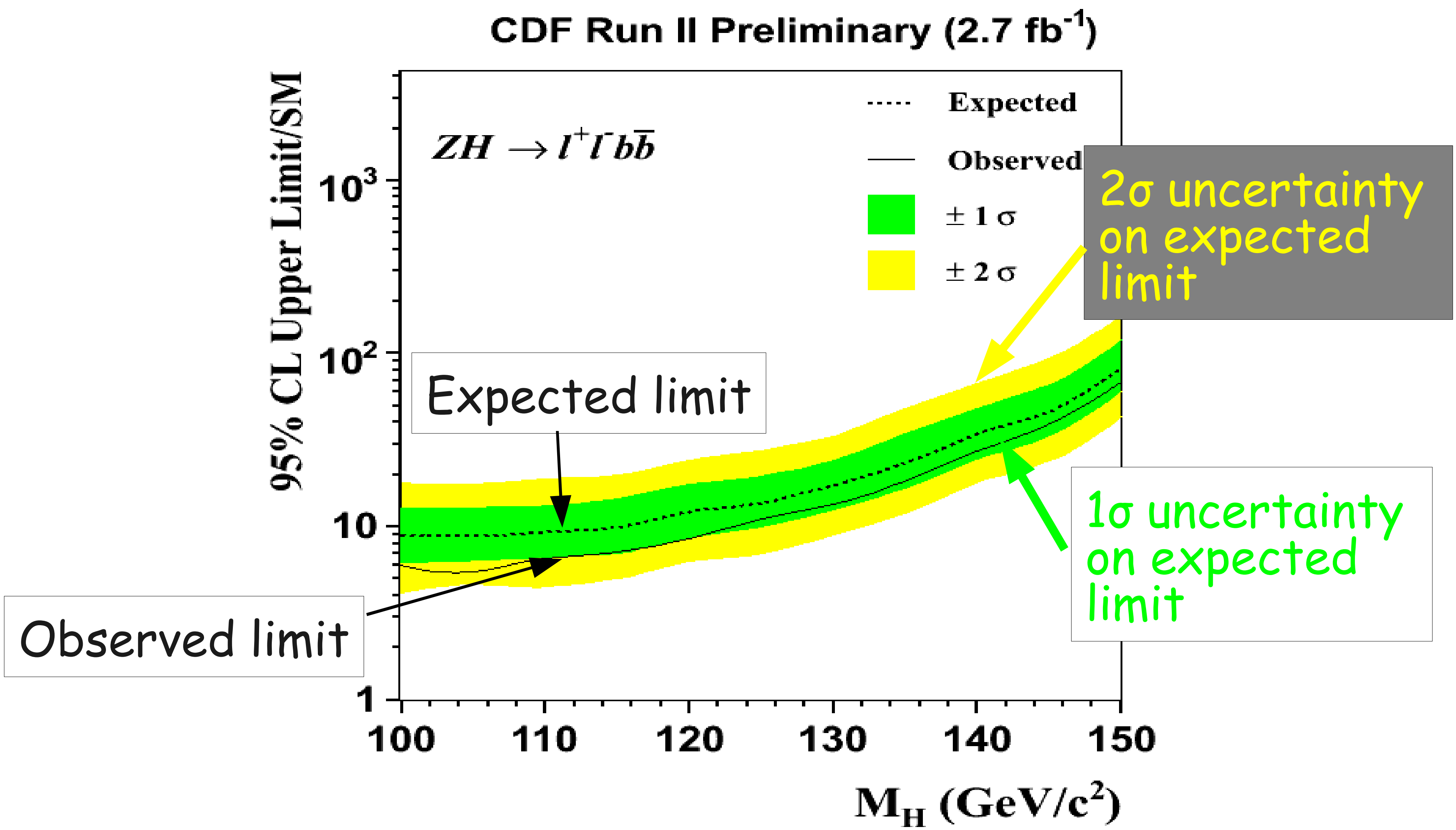
Analysis Tools: Multivariate techniques

- Maximize discriminating power using global kinematics of signal and background
  - ✔ Machine learning techniques: Neural Network and Boost Decision Tree (BDT)
  - ✔ For each event calculate the probability to come from signal from LO Matrix Element

- Multivariate techniques help to improve sensitivity

- Used already in many many analysis

Reminder: Limit Plots



Low Mass Higgs searches

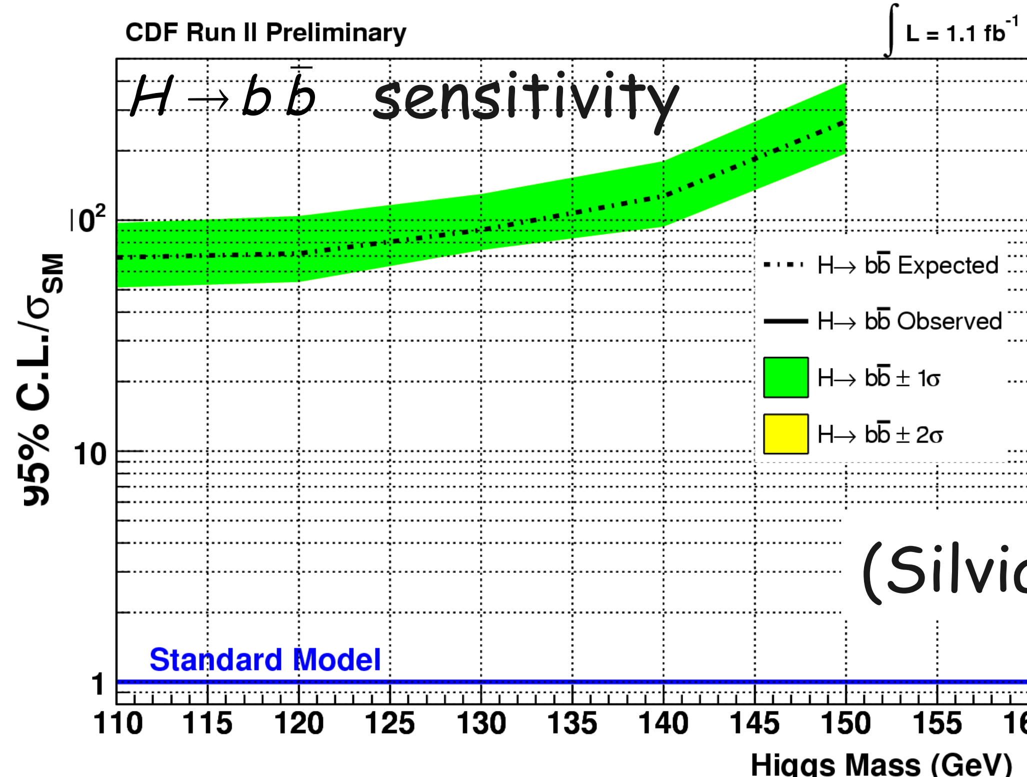
Decay channels

- Look for as many final states as possible with $H \rightarrow b\bar{b}$, highest BR
- gg-> $H \rightarrow b\bar{b}$ dominant production mode not available right now due to background.

These data are collected with b-tag trigger designed and implemented by "us"

Trigger algorithms	$\epsilon(H \rightarrow bb)$	$\epsilon(\phi \rightarrow bb)$	$\epsilon(Z \rightarrow bb)$
Vertex b-tag	13%	11%	4%
Muon b-tag	5%	6%	2%

Table 1: Trigger efficiencies for H, ϕ and Z decays

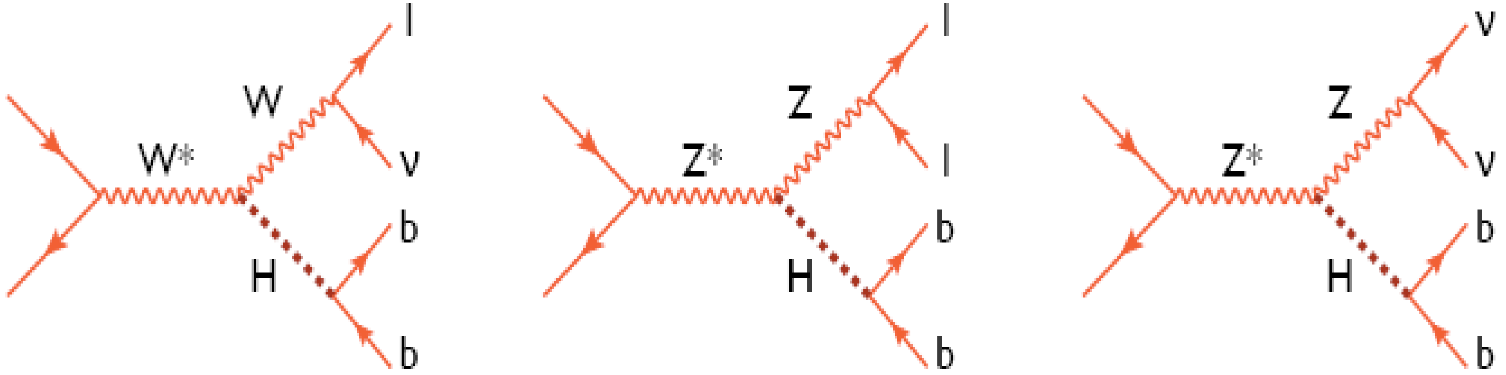


(Silvia)

Useful for Z->bb, b-jet energy study

Low Mass Higgs searches cont'd

- Look for VH and ZH associated production:
  - Higgs decays in two high pT b-jets
  - Leptonic decays of W/Z reduce QCD background and allow easy trigger strategy



- Reconstruct also H->γγ and H->ττ with gluon-gluon fusion, associated production and Vector Boson Fusion

Low Mass Higgs: Strategy

- Efficient trigger to keep most of potential Higgs candidates
  - high pt charged leptons: e μ to select W/Z
  - missing Et+jets to select HZ, Z->νν or HW W->lν (l not identified)
  - lepton+track for ττ modes
- Increase signal yields
  - increase lepton acceptance improving e/μ ID
  - more efficient b-tag algorithms
  - better understanding of calorimeter response
- Look for a resonance in dijets mass
  - large backgrounds with large uncertainties
  - use multivariate techniques to separate signal from background

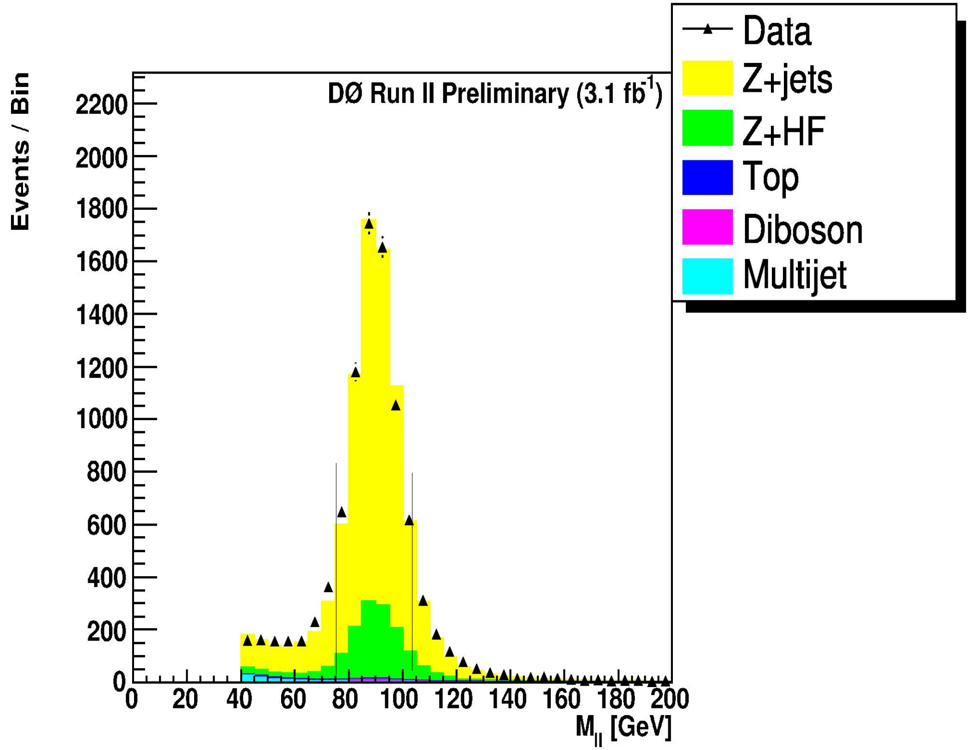
Low Mass Higgs: $ZH \to \ell^+\ell^- b\bar{b},\ \ell = e,\mu$

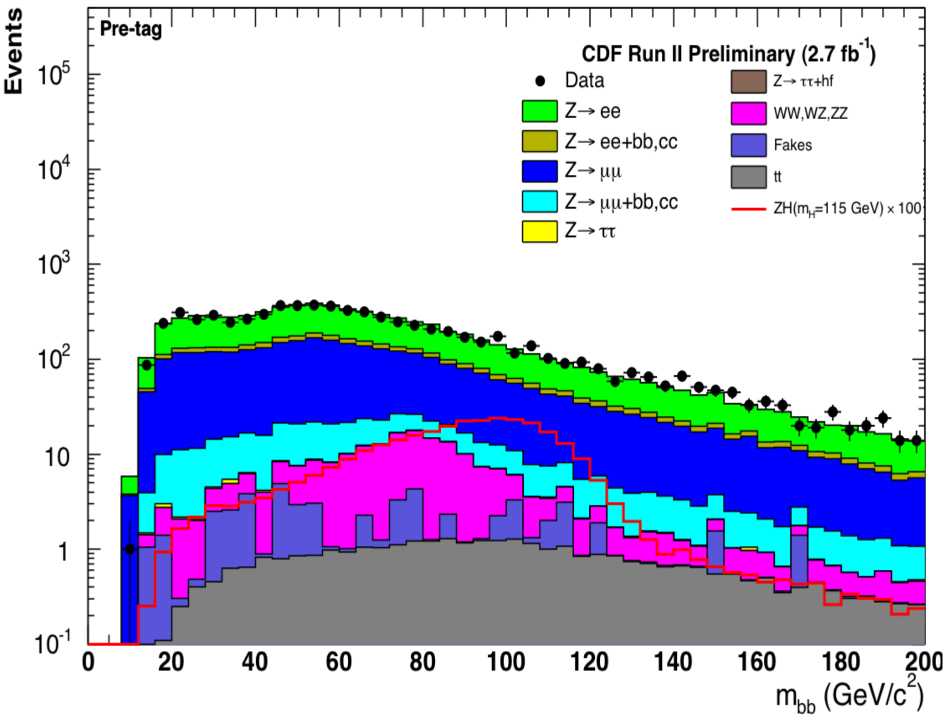
Signature: 2 high Pt leptons and 2+ b-jets

CDF: 2.7 fb^{-1} D0: 3.1 – 4.2 fb^{-1}

Major backgrounds: Z + jets/hf, top, dibosons

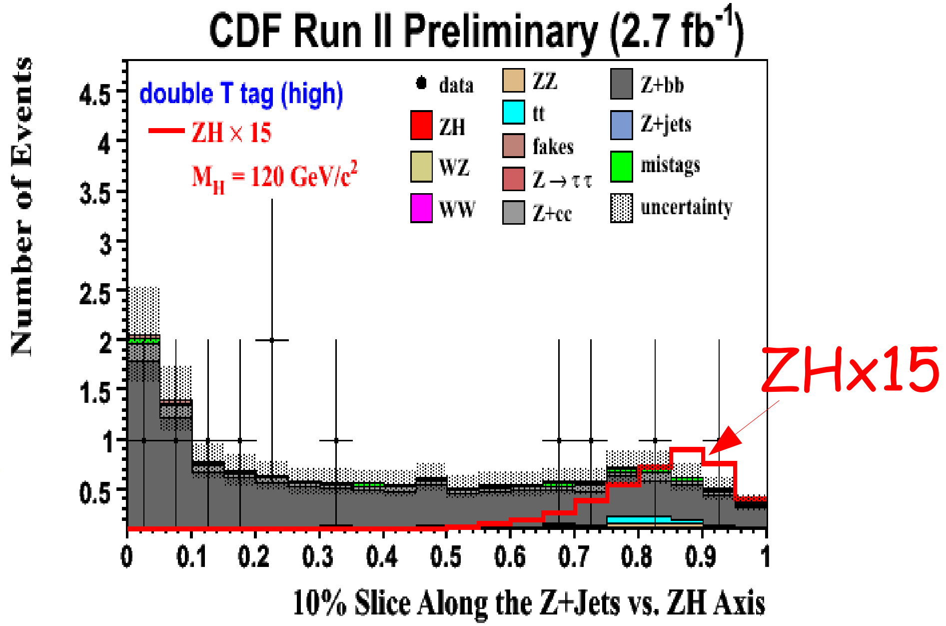
Small σxBR ~ 1 event/fb^{-1} Important to increase acceptance

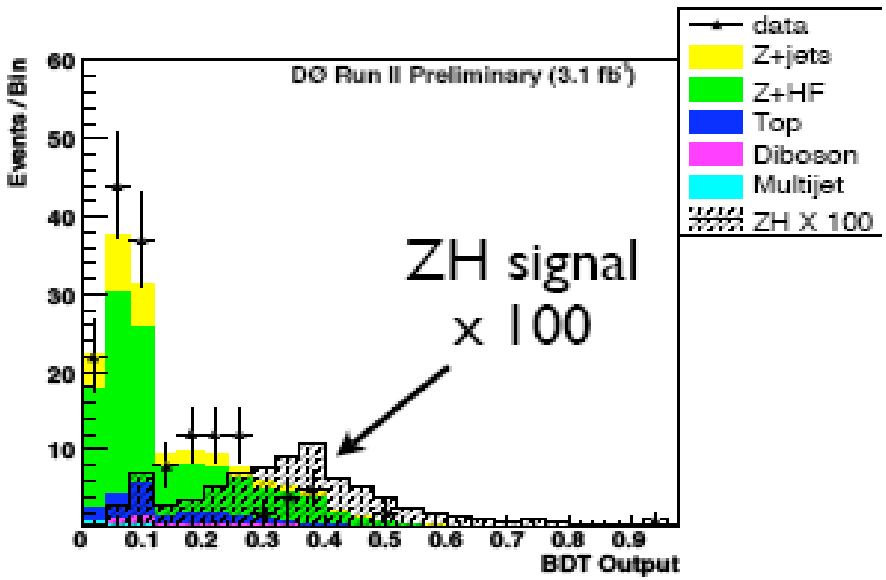




Low Mass Higgs: $ZH \to \ell^+\ell^- b\bar{b},\ \ell = e,\mu$

Use multivariate techniques to improve S/B





Analysis 115	Lumi fb^{-1}	Expected limit	Observed limit
CDF ME	2.7	12.3	7.8
CDF NN	2.7	9.9	7.1
D0 BDT	3.1	8	9.1

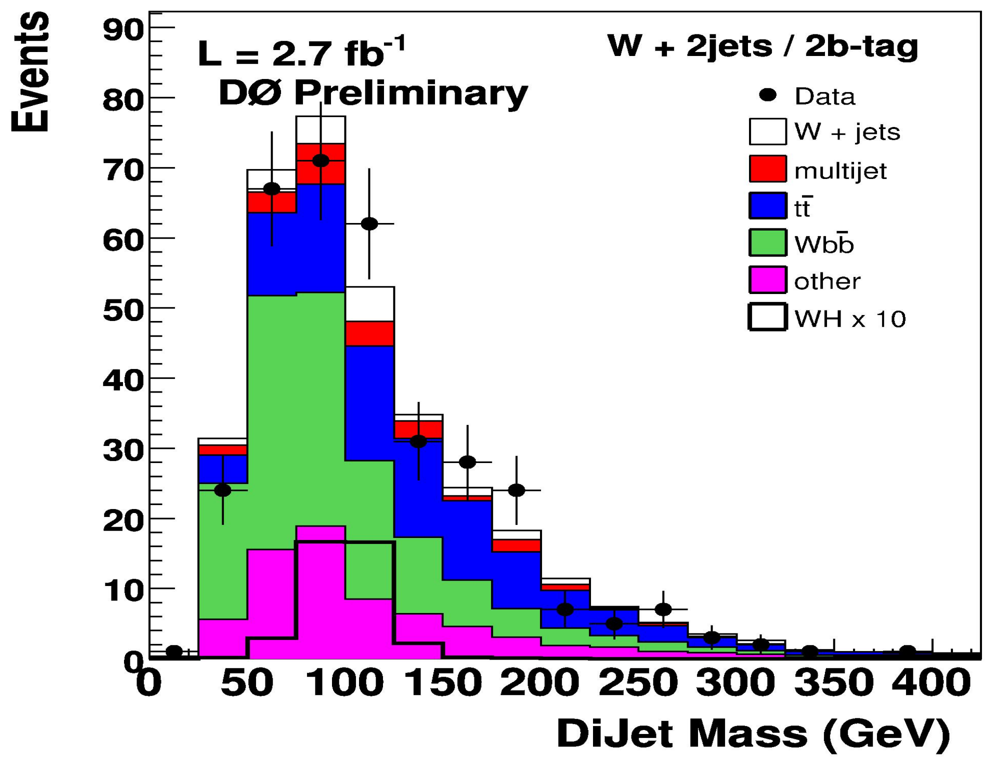
Low Mass Higgs: $WH \to \ell\nu b\bar{b},\ \ell = e, \mu$

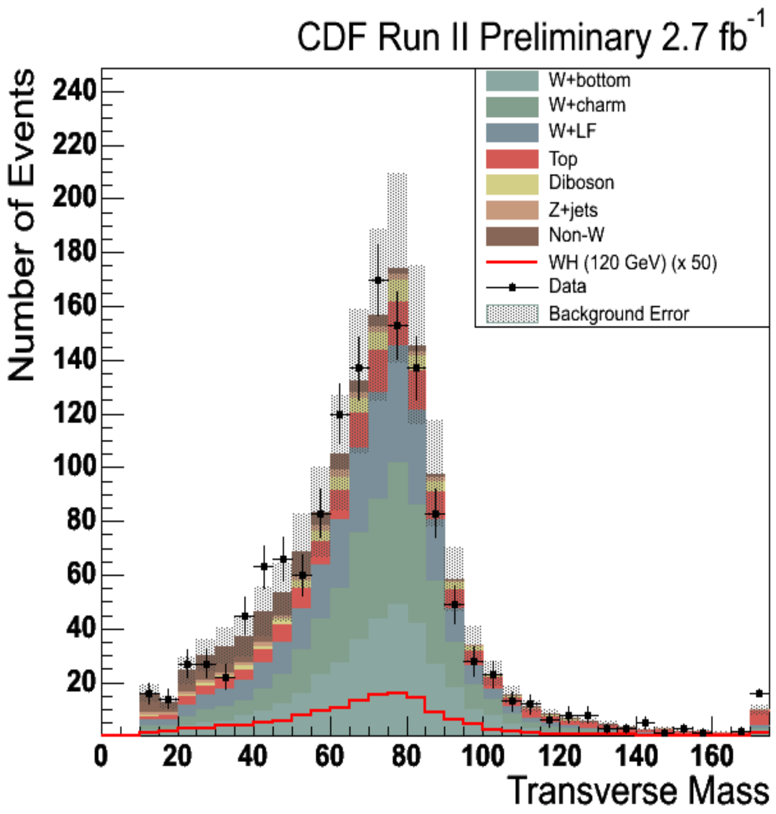
Signature: 1 high Pt lepton large MET and 2+ b-jets

CDF and D0 : 2.7 fb^{-1}

Major backgrounds: W+bb-jets, top, multijets

"Large" σxBR ~ 3-4 event/fb^{-1}



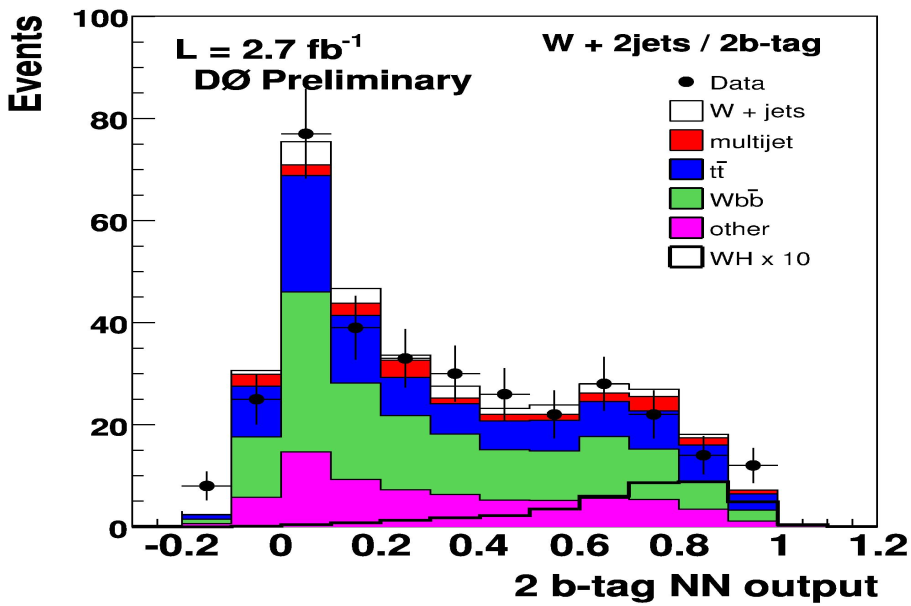


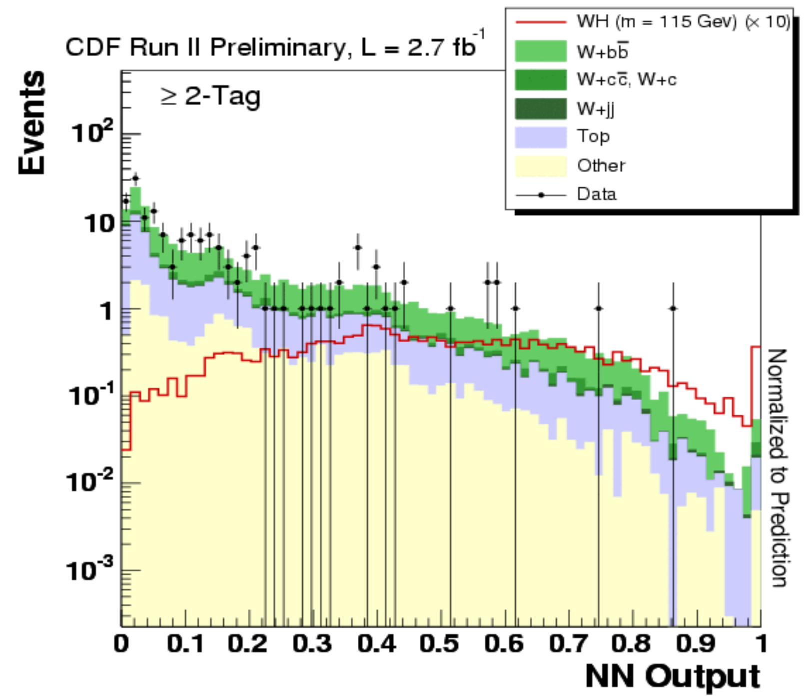
Low Mass Higgs: $WH \rightarrow \ell\nu b\bar{b},\ \ell = e, \mu$

Multivariate techniques to improve S/B:

D0: NN

CDF: NEAT=BDT+NN+ME





Analysis M_H=115	Lumi fb^{-1}	Expected limit	Observed limit
CDF NEAT	2.7	4.8	5.6
D0 NN+ME	2.7	6.4	6.7

Low Mass Higgs: $VH \to \not\!\!E_T b\bar{b}$

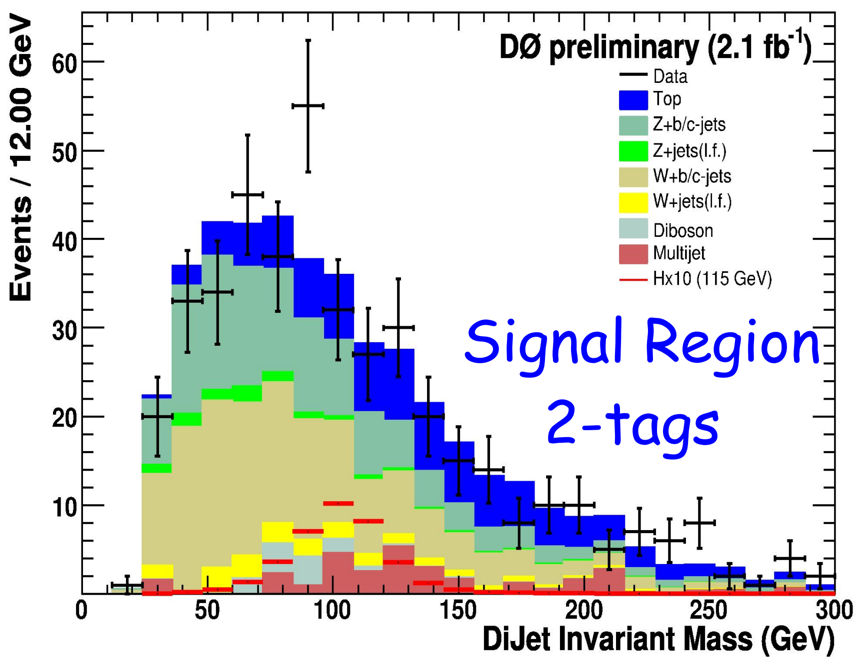
Signal acceptance ZH->vvbb and WH->~~l~~vbb (l missed)

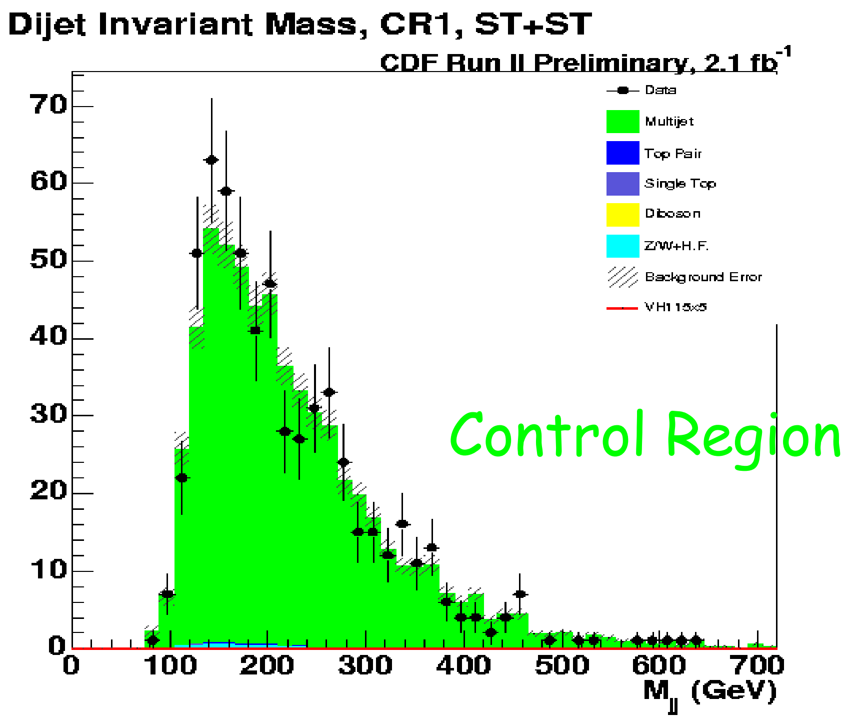
Signature: large MET and 2+ b-jets

CDF and D0 : 2.1 fb^{-1}

Major backgrounds: QCD with fake MET,W/Z+bb-jets, top,diboson

Background modeled using data



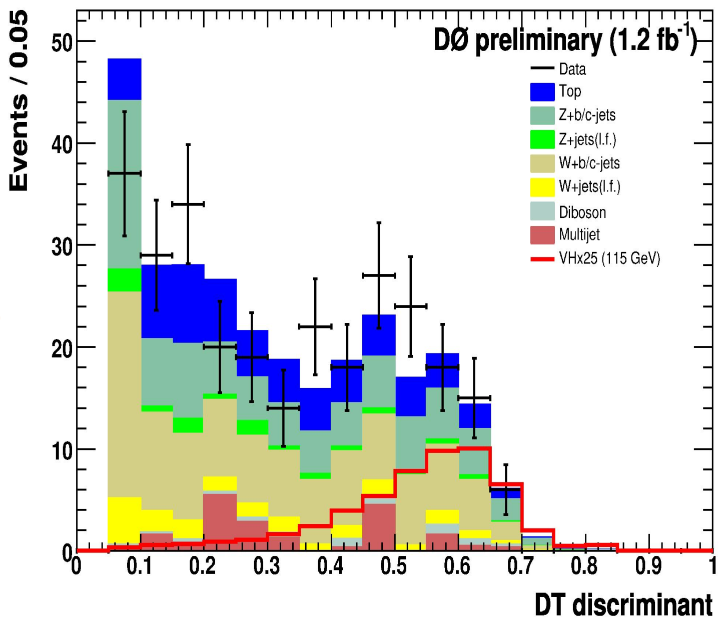


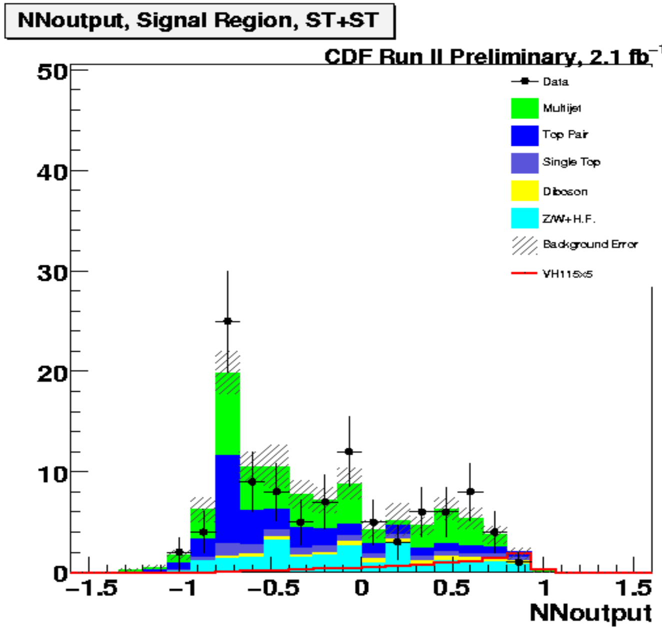
Low Mass Higgs: $VH \to \not{E}_T b\bar{b}$

Multivariate techniques to improve S/B:

D0: BDT on double tagged sample

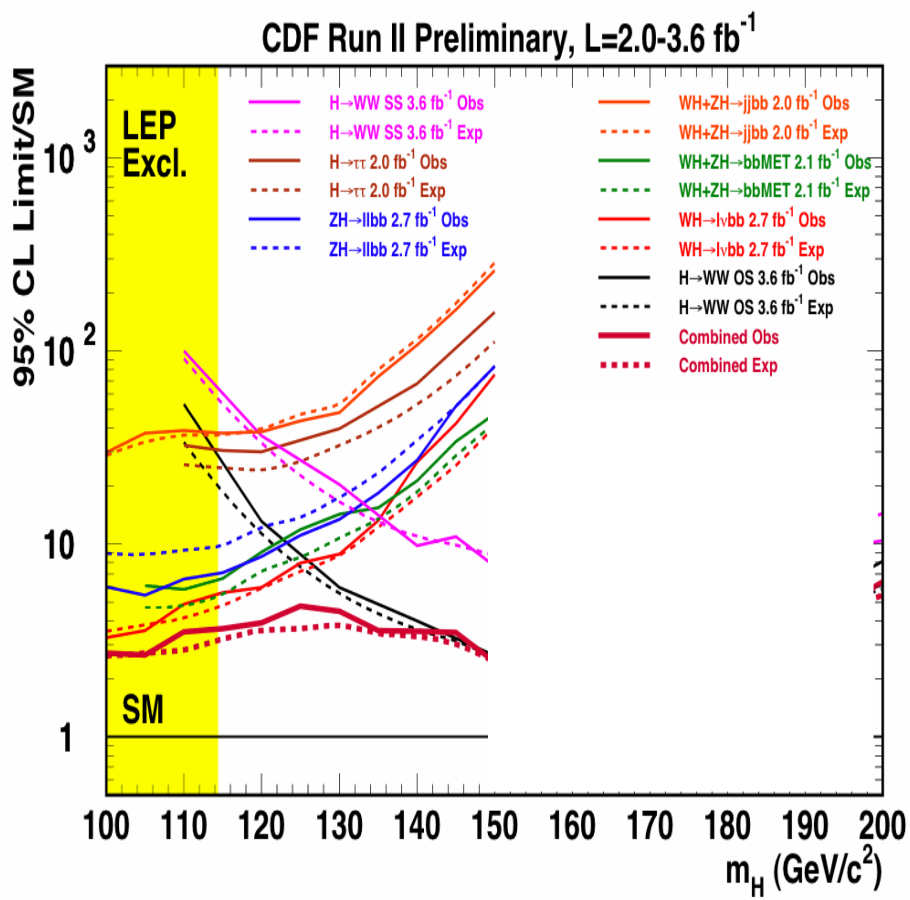
CDF: NN with separate training for 2 and 3 jets

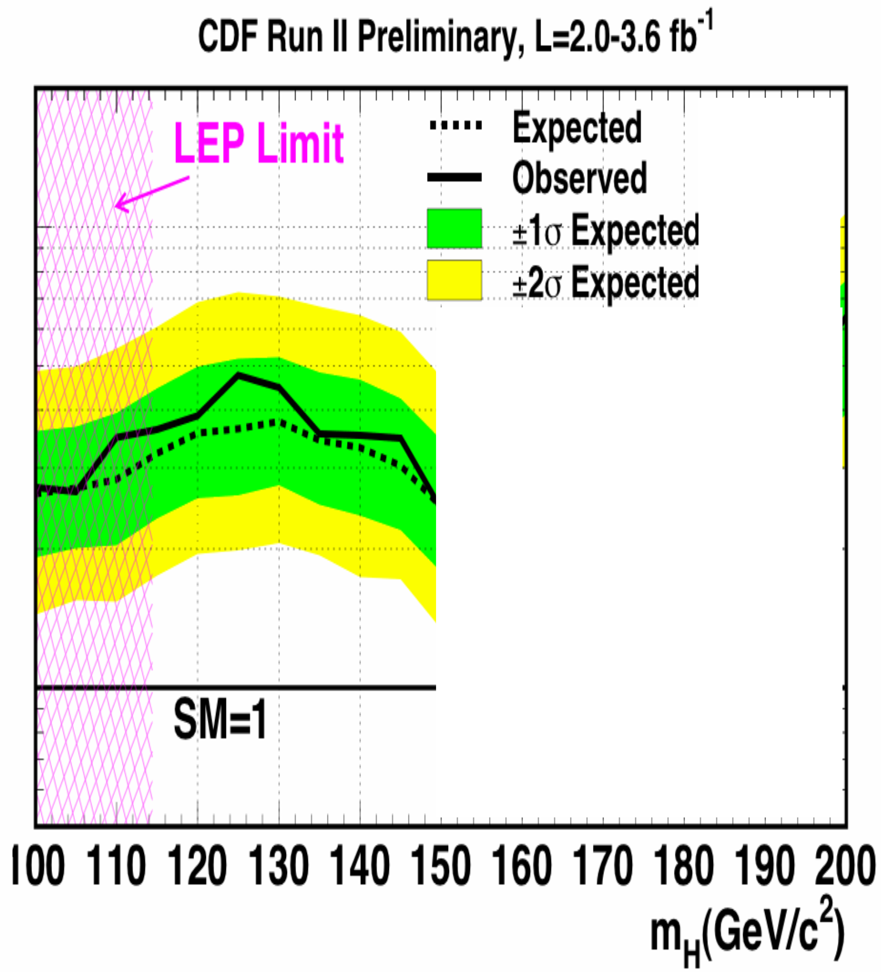




Analysis M_H=115	Lumi fb^{-1}	Expected limit	Observed limit
CDF NN	2.1	5.6	6.9
D0 BDT	2.1	8.4	7.5

Low Mass Higgs Combination

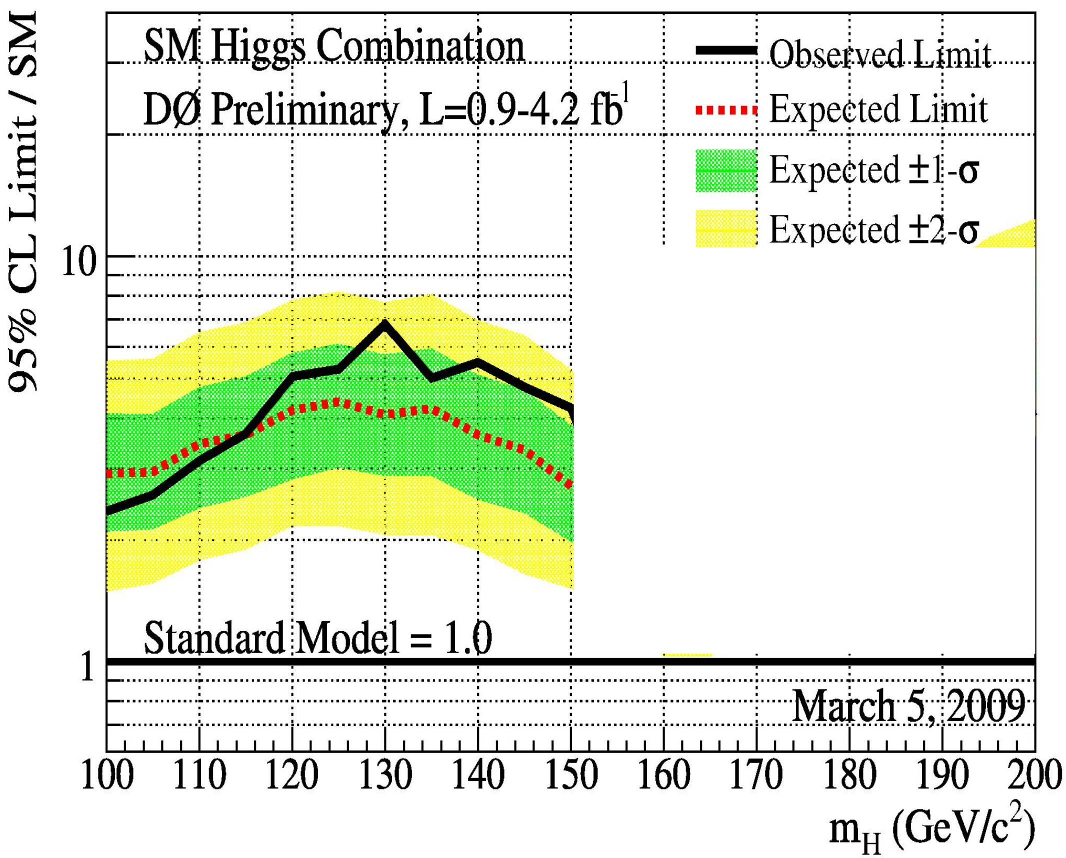




M_H=115 Expected limit 3.22

Observed limit 3.64

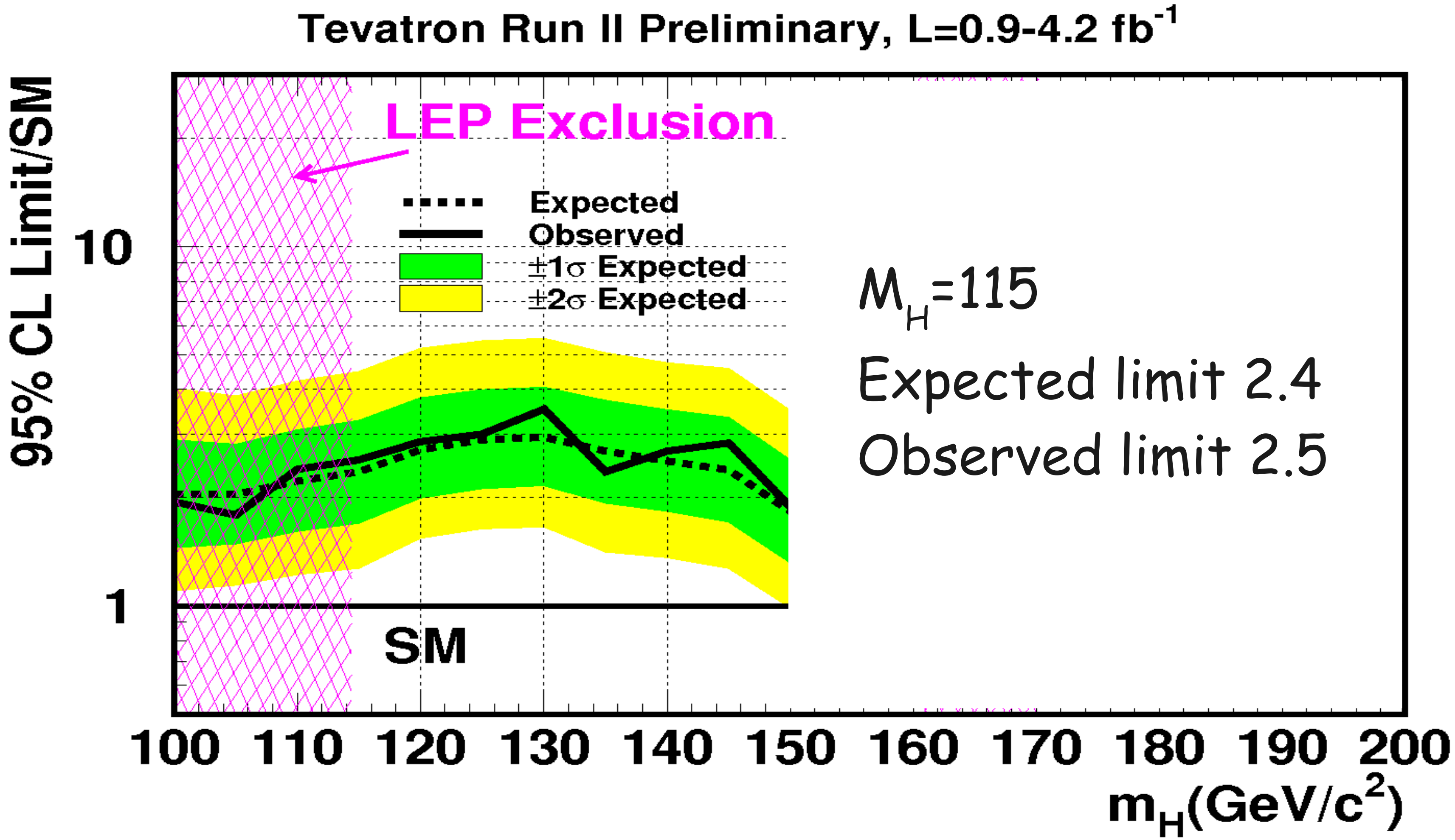
Low Mass Higgs Combination



M_H=115 Expected limit 3.80

Observed limit 3.60

Low Mass Higgs Tevatron Combination



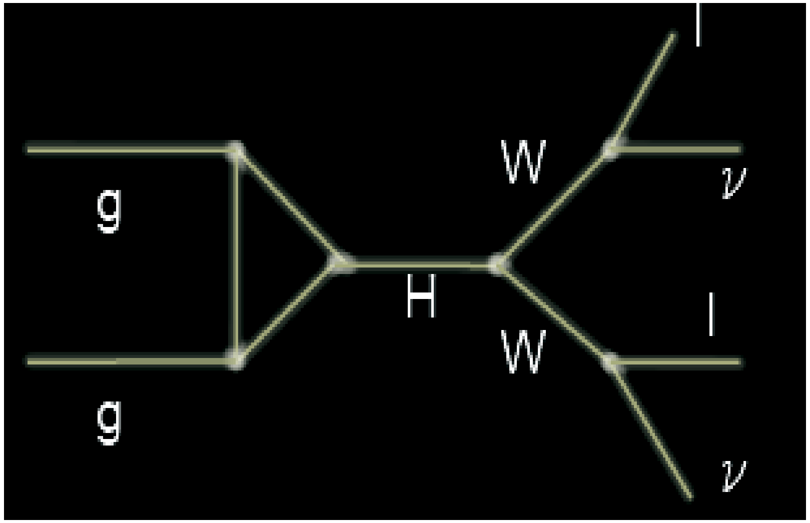
M_H=115

Expected limit 2.4

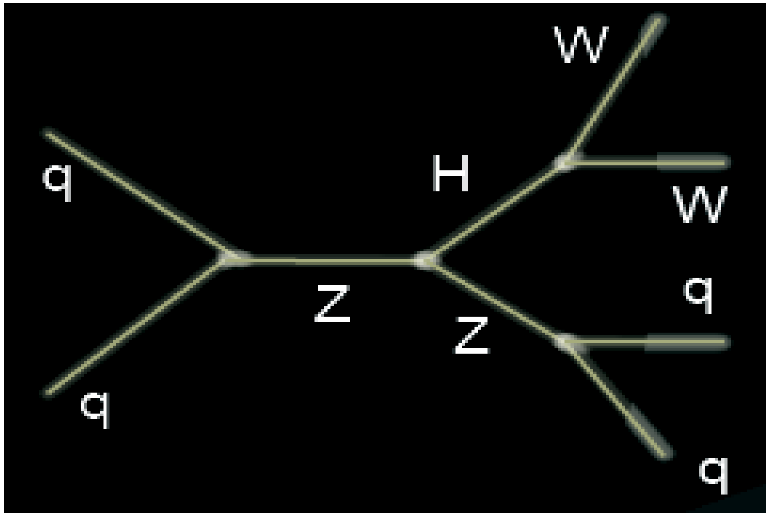
Observed limit 2.5

High Mass Higgs: $H \rightarrow WW$

Signal:



0 jets at LO (gg->H)

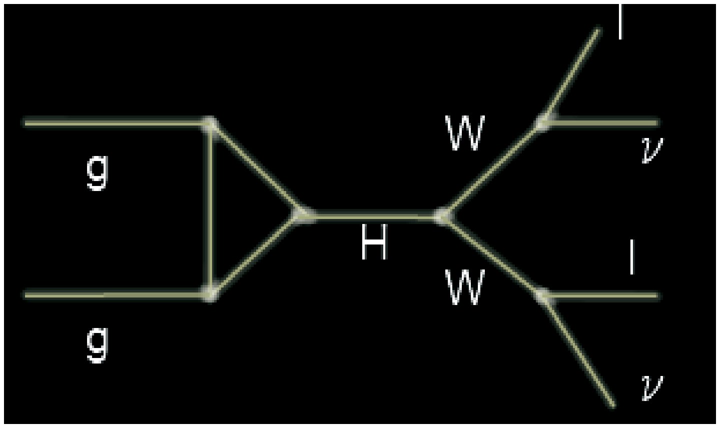


2 jets at LO (ZH/WH/VBF)

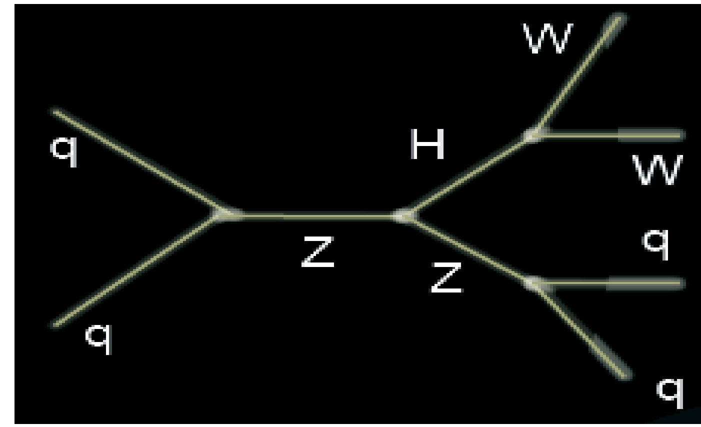
Separate in 0, 1, 2+ jets bin because of different backgrounds

High Mass Higgs: $H \rightarrow WW$

Signal:

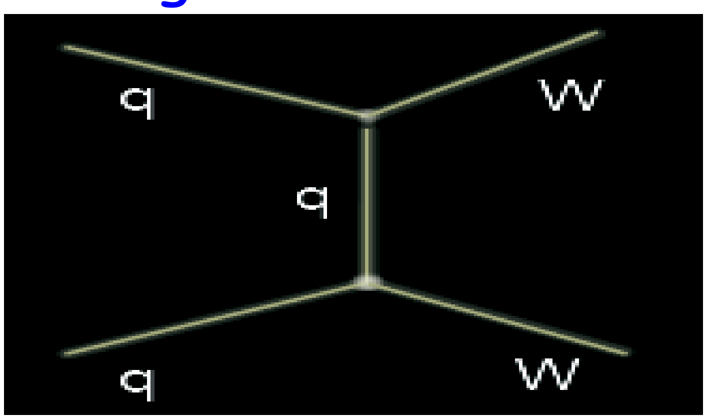


0 jets at LO (gg->H)

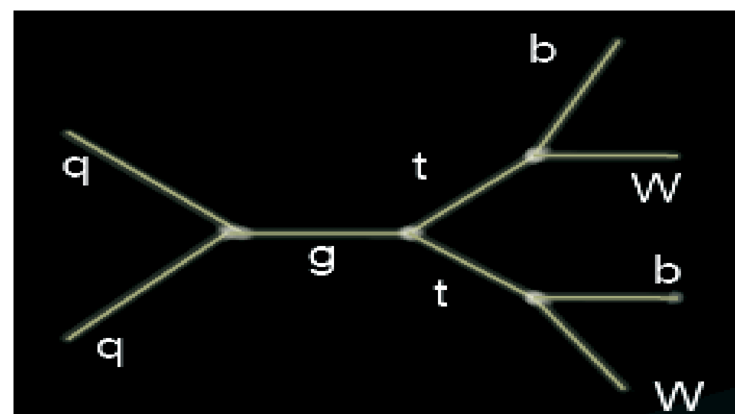


2 jets at LO (ZH/WH/VBF)

Background:



LO: WW, Drell Yan, W+γ



LO: WZ, ZZ, tt

High Mass Higgs: $H \rightarrow WW$

0 jets:
Good use of LO ME
majority of signal gg fusion
background from WW

1 jet:
ME not so powerful
extra signal: VH and VBF ~20%

2 jets:
tt main background
extra signal: VH and VBF ~60%

CDF Run II Preliminary	$\int \mathcal{L} = 3.6\ \mathrm{fb}^{-1}$		
$M_H = 160\ \mathrm{GeV}/c^2$			
$t\bar{t}$	1.35	$\pm$	0.21
DY	80	$\pm$	18
WW	318	$\pm$	35
WZ	14	$\pm$	1.9
ZZ	20.7	$\pm$	2.8
W+jets	113	$\pm$	27
$W\gamma$	92	$\pm$	25
Total Background	637	$\pm$	67
$gg \rightarrow H$	9.5	$\pm$	1.4
Total Signal	9.5	$\pm$	1.4
Data	654		

OS 0 Jets

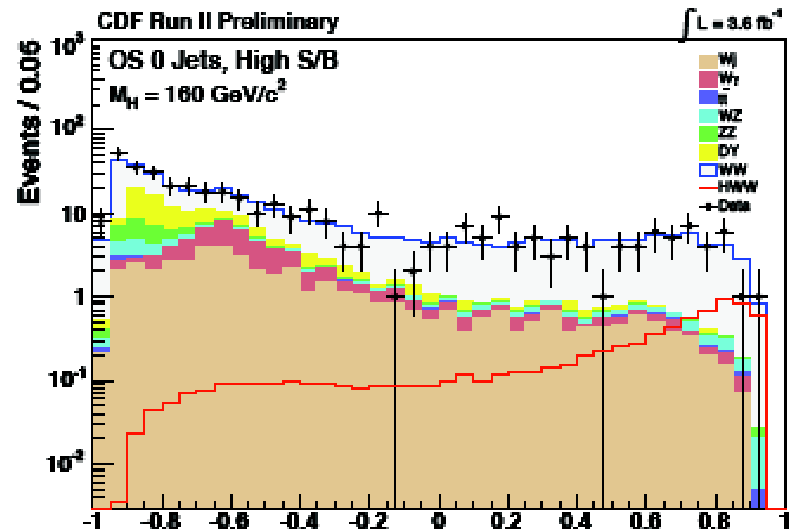
CDF Run II Preliminary	$\int \mathcal{L} = 3.6\ \mathrm{fb}^{-1}$		
$M_H = 160\ \mathrm{GeV}/c^2$			
$t\bar{t}$	100	$\pm$	17
DY	33	$\pm$	11
WW	17.6	$\pm$	4.0
WZ	3.76	$\pm$	0.52
ZZ	1.62	$\pm$	0.22
W+jets	14.7	$\pm$	4.0
$W\gamma$	2.12	$\pm$	0.70
Total Background	173	$\pm$	23
$gg \rightarrow H$	1.75	$\pm$	0.30
WH	1.39	$\pm$	0.18
ZH	0.693	$\pm$	0.090
VBF	0.70	$\pm$	0.11
Total Signal	4.53	$\pm$	0.52
Data	169		

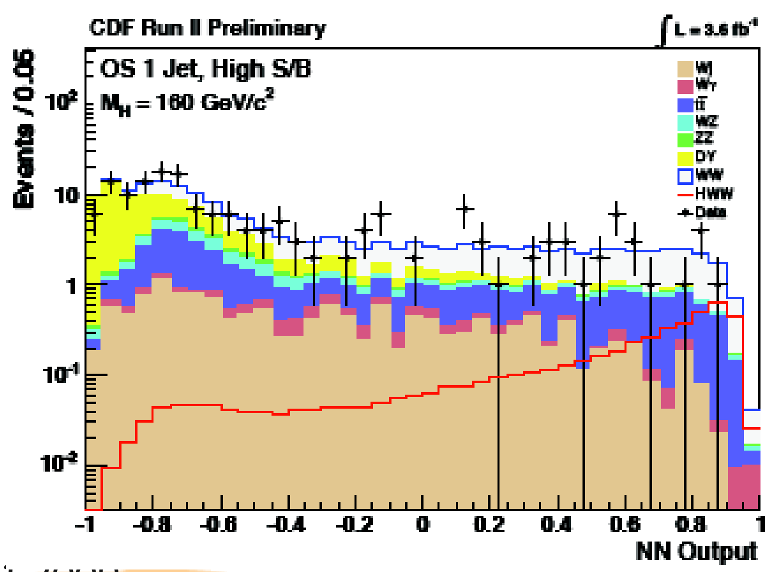
OS 2+ Jets

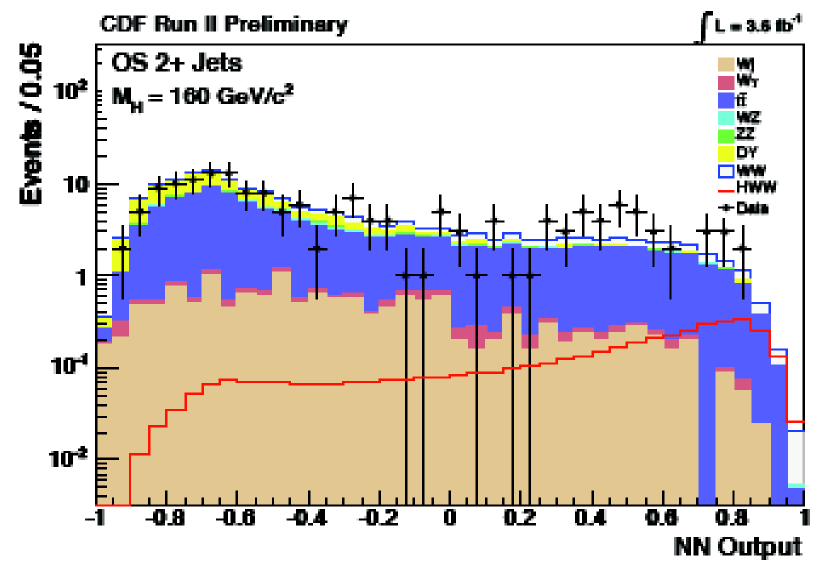
High Mass Higgs: $H \rightarrow WW$

Apply selection cut:
- 2 opposite sign isolated leptons
- di-lepton opening angle
- significant MET

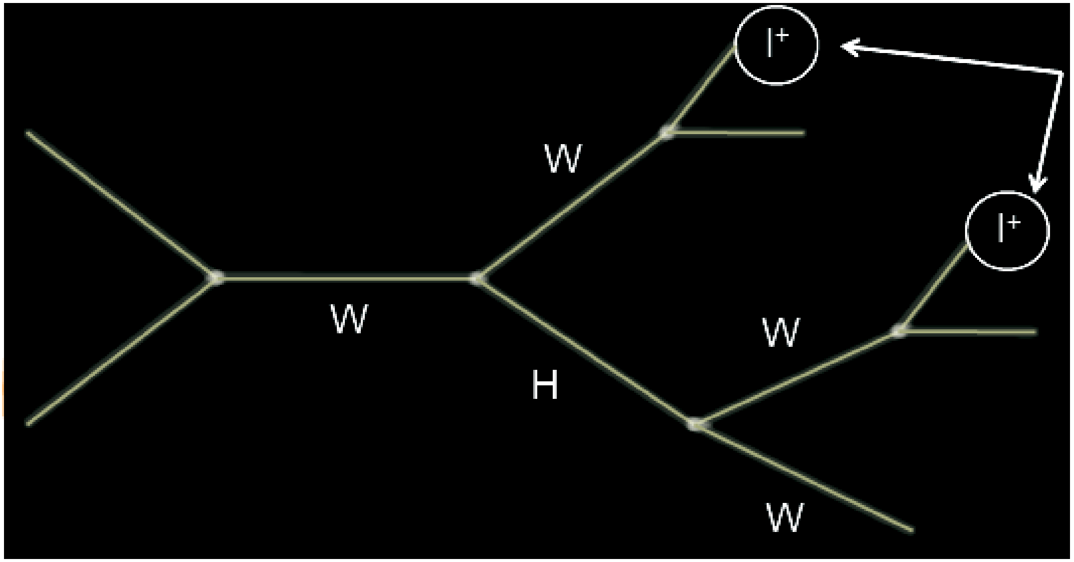
Then use combinations of ME and NN depending on jet bin







High Mass Higgs: add other final states



Same sign leptons

Two lepton Pt>20 GeV
No forward electrons
Njets≥1
No MET cut

Add 5% sensitivity

CDF Run II Preliminary $\int \mathcal{L} = 3.6\ \mathrm{fb}^{-1}$

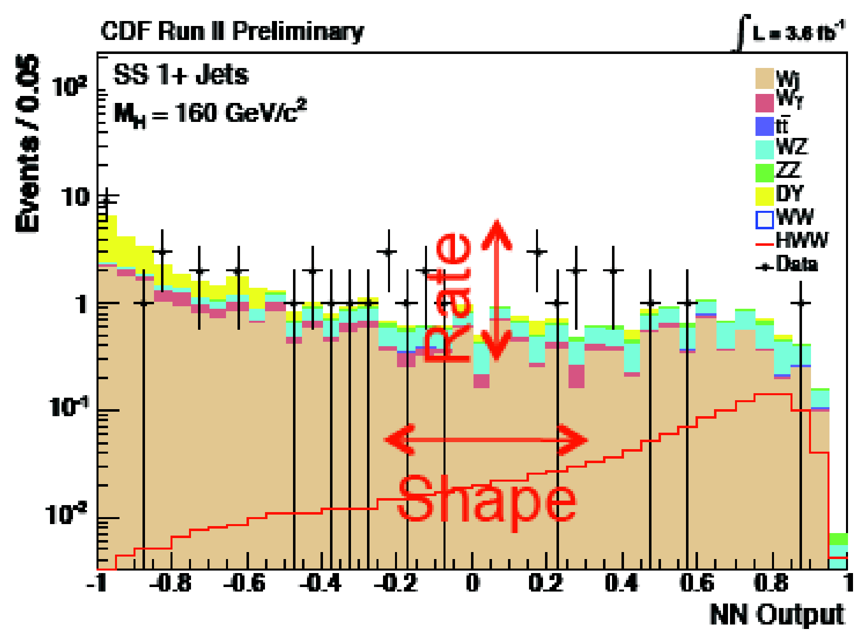
$M_H = 160\ \mathrm{GeV}/c^2$

$t\bar{t}$	0.11	±	0.03
DY	11.99	±	3.65
WW	0.020	±	0.005
WZ	6.82	±	0.93
ZZ	1.44	±	0.20
W+jets	22.45	±	6.73
$W\gamma$	3.23	±	1.00
Total Background	**46.07**	±	**8.02**
WH	1.19	±	0.16
ZH	0.19	±	0.02
Total Signal	**1.38**	±	**0.18**
Data		**41**	

High Mass Higgs: Systematics

Two classes

- Rate Systematics:
  - ✔affect only templates normalization, do not affect the shapes
  - ✔dominant theoretical cross section uncertainties, 10-30%
- Shape systematics:
  - ✔ modify the shape of NN output
  - ✔ Found negligible up to now (PDF modeling, Energy scale, Pt scale)



High Mass Higgs Combination

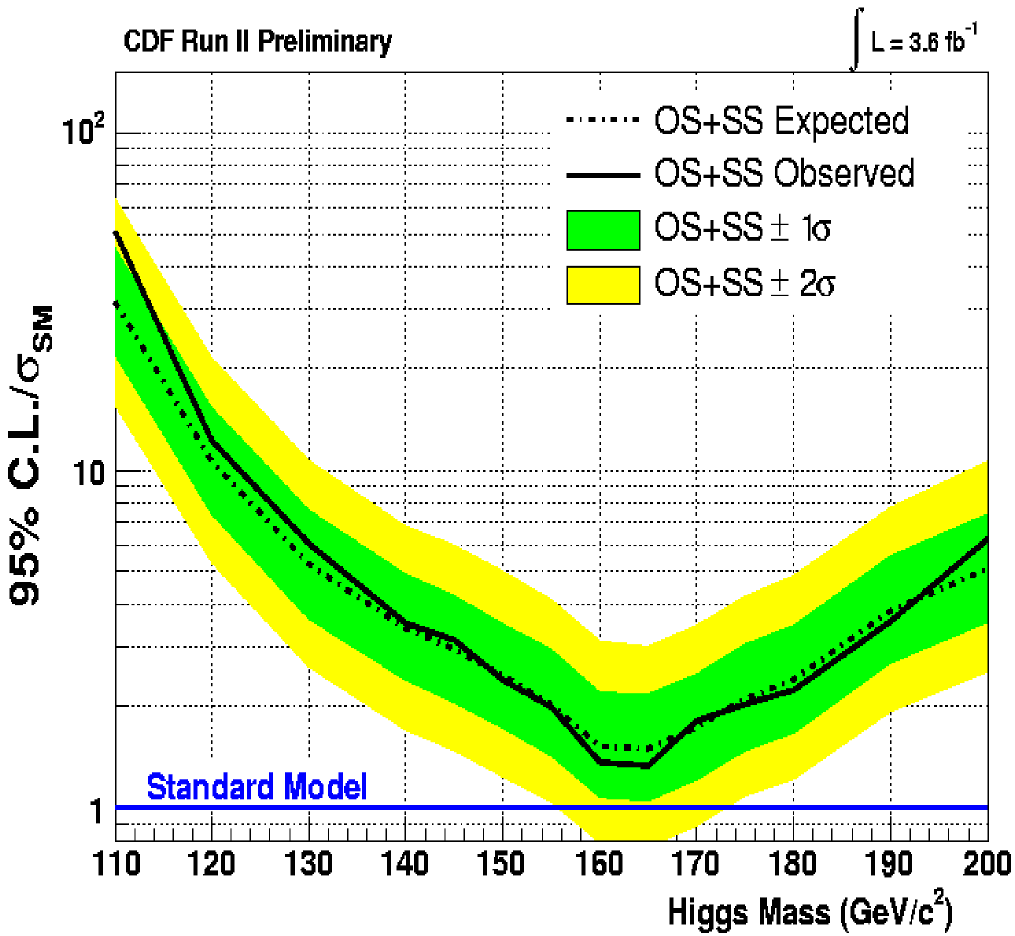
Latest gg->H cross section (Florian and Grazzini)

- ✔ Latest PDF MSTW2008
- ✔ NNLL QCD
- ✔ NLO b-quark treatment

VH from hep-ph/0406152

VBF from TEV4LHC

M_H=160	Expected limit	Observed limit
0 jets	2.39	2.35
1 jet	2.89	2
2+ jets	3.71	6.34
SS +jet	7.22	6.6
Combined	1.52	1.37



High Mass Higgs: $H + X \rightarrow ll + missing\, Et$

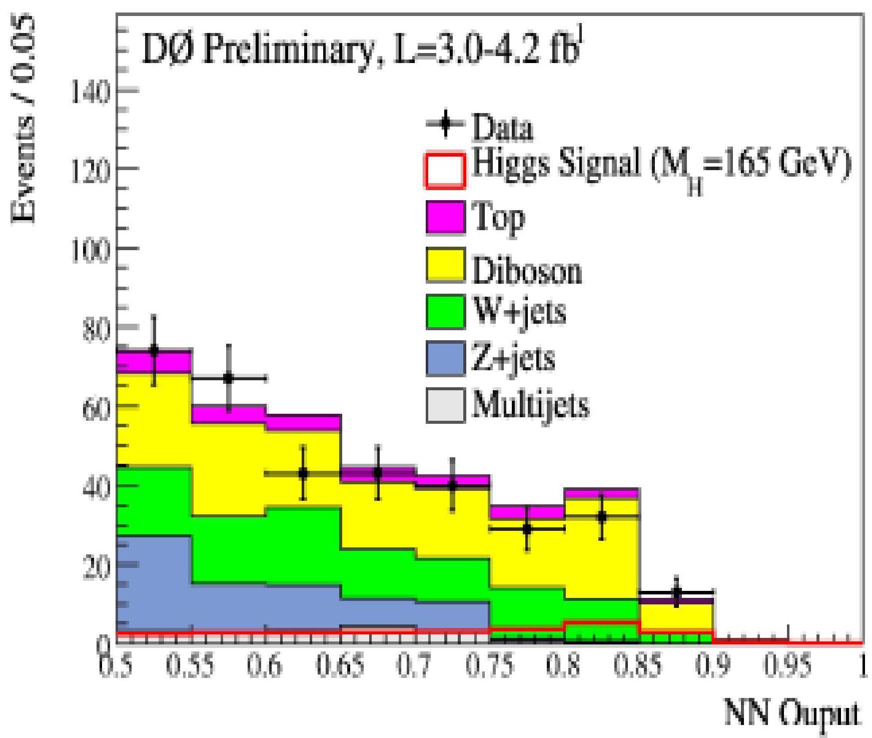
Analysis separated by lepton type: ee, μμ, eμ

Apply minimal requirements then use NN

Sample composition input to NN

Channel	ee	eμ	μμ
Luminosity (fb^{-1})	4.2	4.2	3.0
Z	108	13	3987
Diboson	84	162	127
tt	40	82	13
W+jets	98	79	134
Multijets	2	1	64
Total Background	332	337	4325
Data	336	329	4084
Signal (M_H=165 GeV)	6.1	12.2	4.9

NN output



High Mass Higgs Combination

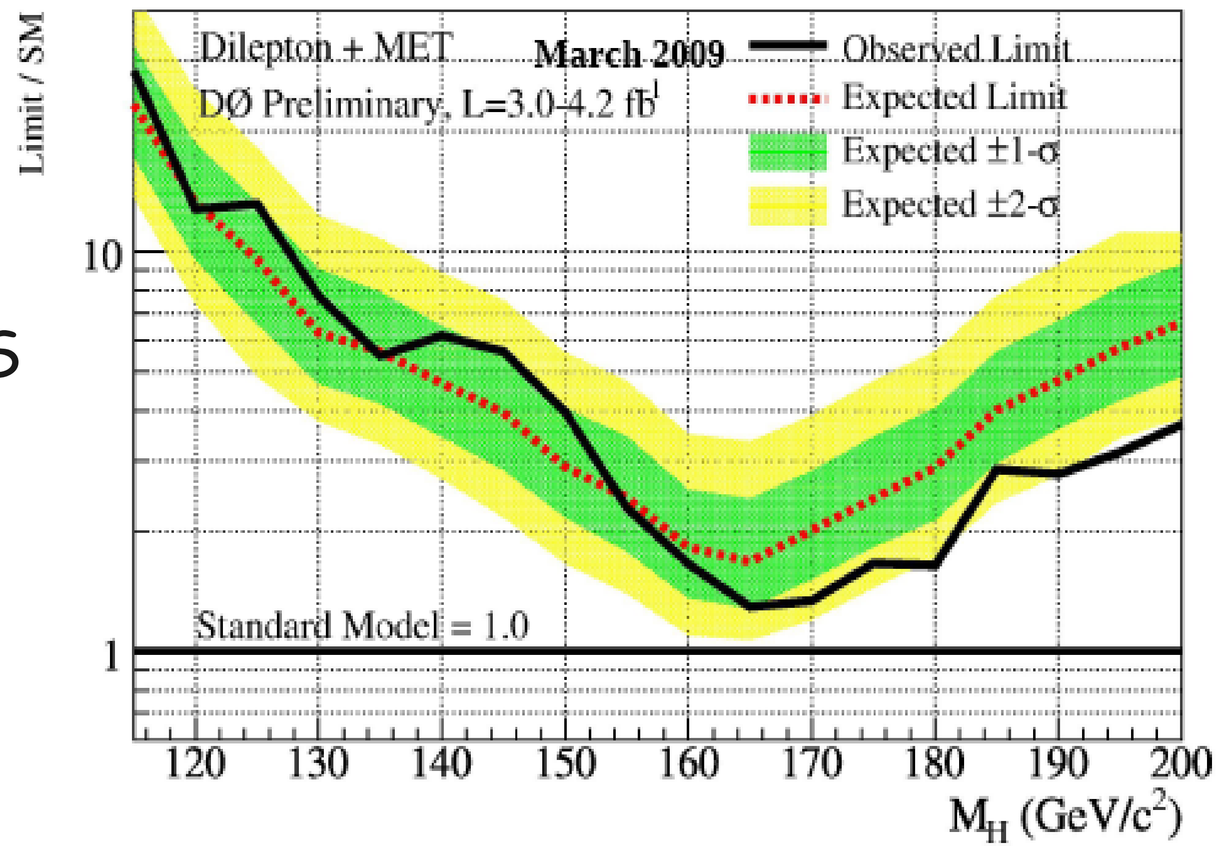
Use the same systematic of CDF, same inputs

M_H=165

expected limit 1.7

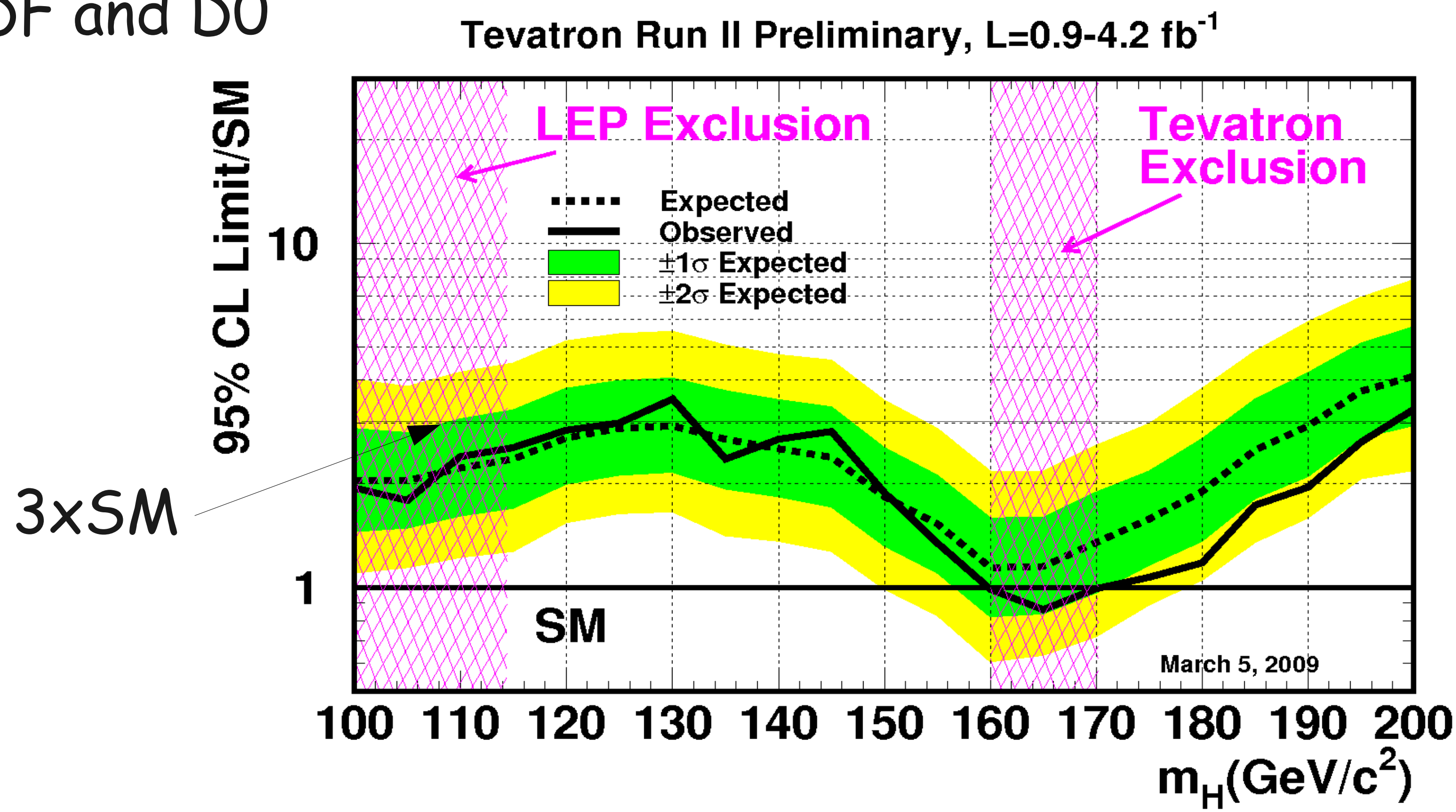
observed limit 1.3

It does not include SS



Tevatron Combination

Not just a √2 factor, many systematics are correlated between CDF and D0

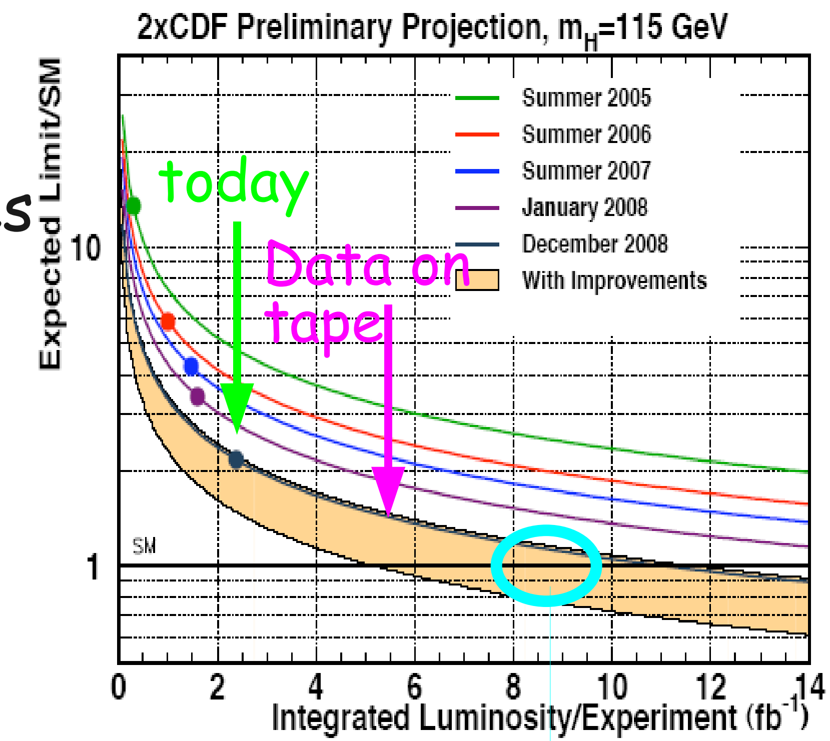


We exclude SM Higgs in a mass range 160-170 GeV at 95% CL

Future Prospects: Low Mass

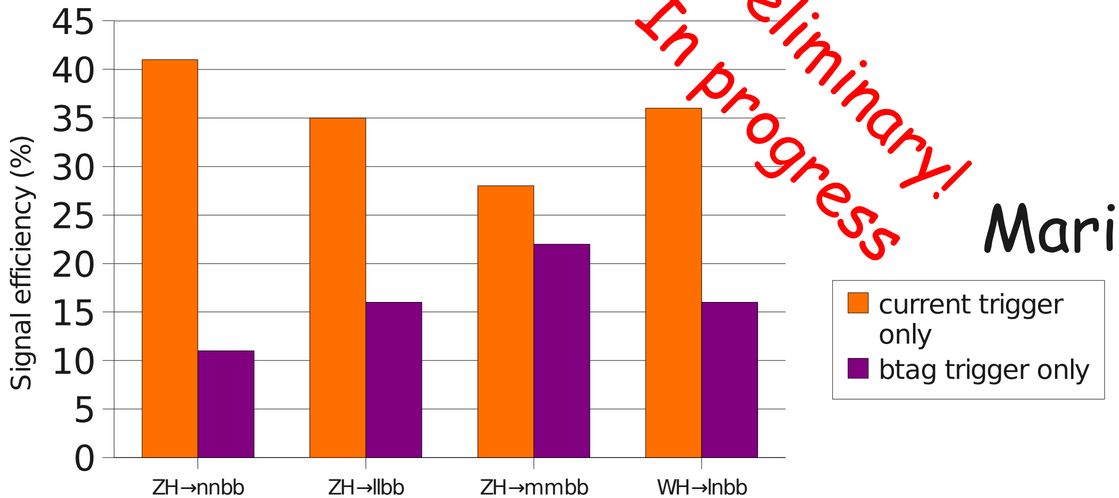
Includes "standard analysis" improvements:
- extended b-tag "a la top"
- better background understanding
- more sophisticated analysis techniques

It does not include new triggers:
- more efficient MET
- b-tag trigger (Padova)



End of 2010/2011

Preliminary!
In progress



Maria, PhD

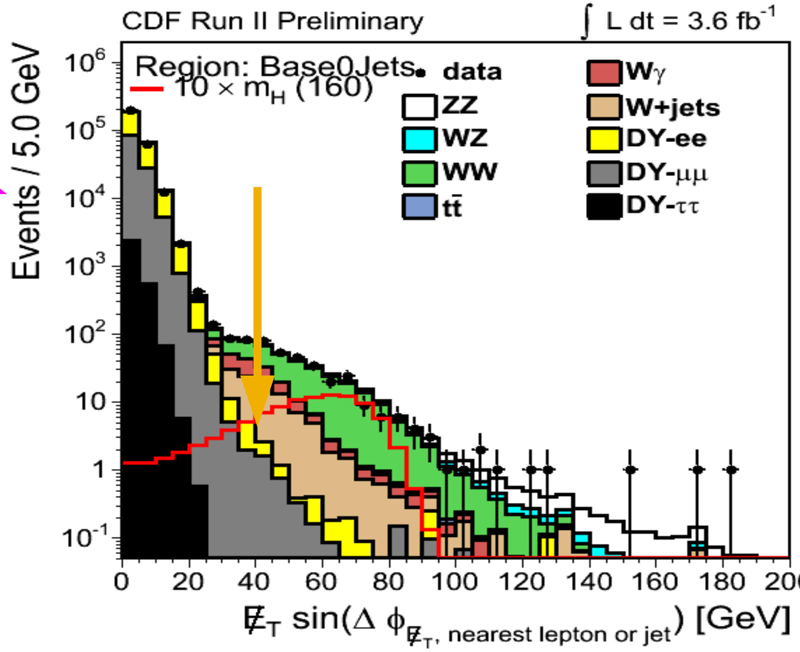
Silvia

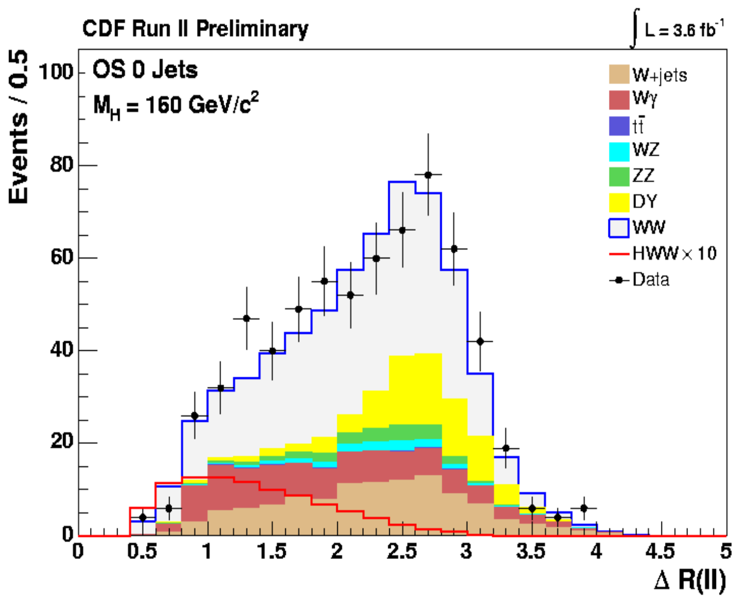
Efficiency respect to double tag events

Future Prospects: High Mass

Plan to include:

- new lepton triggers (by the summer, Simone)
- lower cut on MET (by summer, Simone)
- tri-leptons (summer)
- lepton isolation (next year)
- low di-lepton mass





Future Prospects: High Mass

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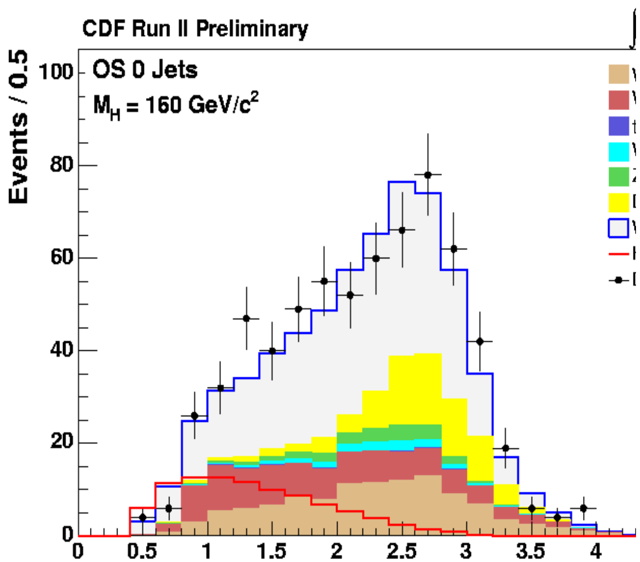
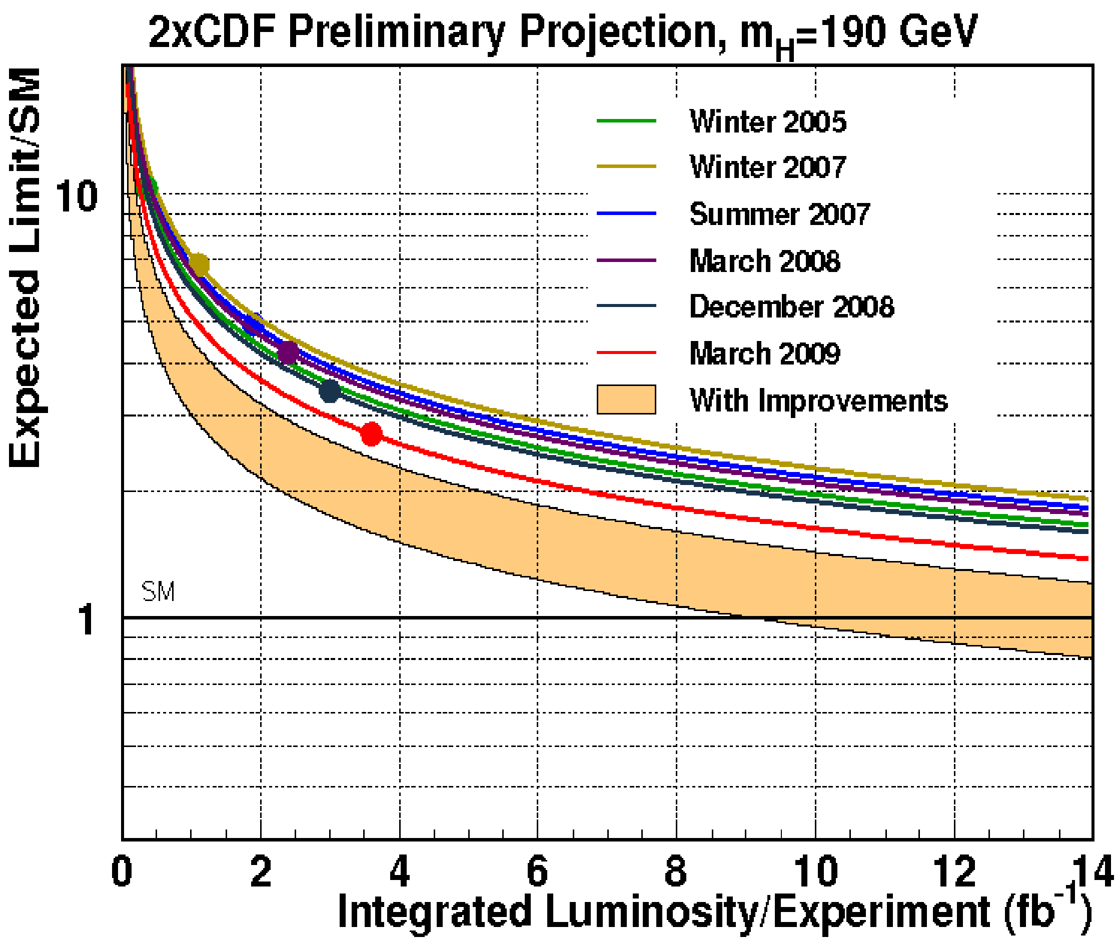




Conclusions

Se il diavolo non ci mette la coda possiamo farcela!

http://www-cdf.fnal.gov/physics/new/hdg/hdg.html

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

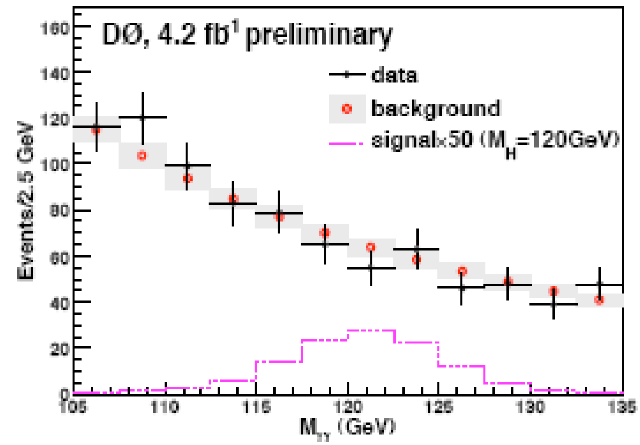
BACKUP

Low Mass Higgs: $H \rightarrow \tau\tau$ $H \rightarrow \gamma\gamma$

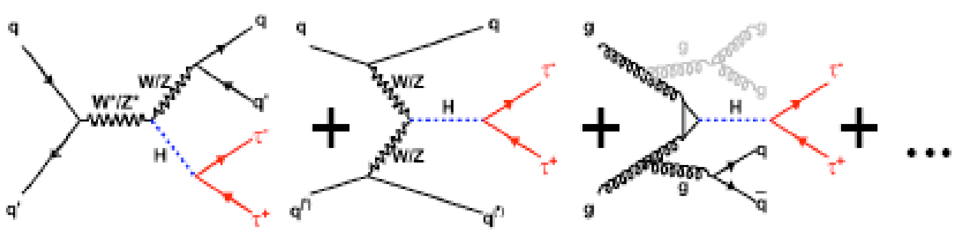
- DØ recently updated $H \rightarrow \gamma\gamma$ with 4.2 fb^{-1}.
  - ➡ QCD diphoton backgrounds modeled using data.
- Search for Higgs in ±15 GeV diphoton mass window.

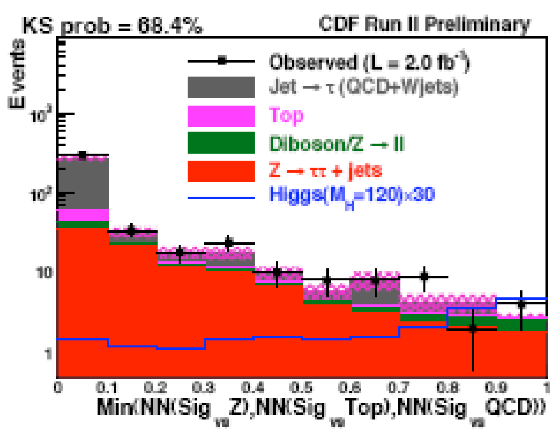
M_H = 115 GeV

Exp: 18 Obs: 13



- No excess is seen. Limit also interpreted in fermiophobic Higgs scenario.
- Both CDF and DØ have inclusive Higgs + X → tau + X searches.
  - ➡ CDF uses 2.0 fb^{-1}. DØ uses 1.0 fb^{-1}.



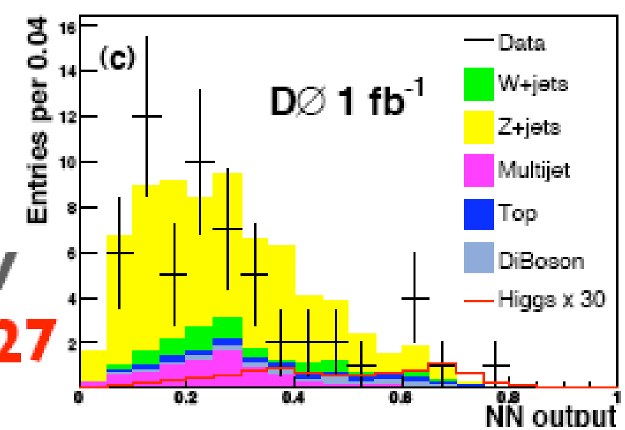


M_H = 115 GeV

Exp: 25 Obs: 31

M_H = 115 GeV

Exp: 28 Obs: 27



Higgs production x-sections

Simone Pagan Griso Moriond

New ggH signal x-sections by Florian at Grazzini (arXiv:0901.2427)

included NNLL σ(gg→H), latest MSTW2008 pdf, 2-loop ewk corrections, exact b-quark treatment @ NLO

M_H (GeV/c^2)	$\sigma_{gg\to H}$ (pb)	σ_{WH} (pb)	σ_{ZH} (pb)	σ_{VBF} (pb)	$\mathrm{Br}_{\mathrm{H\to WW}}$
110	1.413	0.208	0.124	0.084	0.044
120	1.093	0.153	0.093	0.072	0.132
130	0.858	0.114	0.071	0.061	0.287
140	0.682	0.086	0.054	0.052	0.483
145	0.611	0.075	0.048	0.048	0.573
150	0.548	0.065	0.042	0.045	0.682
155	0.492	0.057	0.037	0.041	0.801
160	0.439	0.051	0.033	0.038	0.901
165	0.389	0.044	0.029	0.035	0.957
170	0.349	0.039	0.026	0.033	0.965
175	0.314	0.034	0.023	0.031	0.951
180	0.283	0.031	0.021	0.028	0.935
190	0.231	0.024	0.017	0.024	0.776
200	0.192	0.019	0.014	0.021	0.735

H->WW Systematics 0-Jet bin

0 Jet Uncertainties	WW	WZ	ZZ	$t\bar{t}$	DY	$W\gamma$	W+jet	$gg \to H$	WH	ZH	VBF
Cross Section											
Scale								10.9%			
PDF Model								5.1%			
Total	*10.0%*	*10.0%*	*10.0%*	15.0%	5.0%	10.0%		12.0%			
Acceptance											
Scale (leptons)								2.5%			
Scale (jets)								4.6%			
PDF Model (leptons)	1.9%	2.7%	2.7%	2.1%	4.1%	2.2%		1.5%			
PDF Model (jets)								0.9%			
Higher-order Diagrams	**5.5%**	**10.0%**	**10.0%**	10.0%	**5.0%**	**10.0%**					
Missing Et Modeling	1.0%	1.0%	1.0%	1.0%	20.0%	1.0%		1.0%			
Conversion Modeling						20.0%					
Jet Fake Rates (Low S/B) (High S/B)							 21.5% 27.7%				
MC Run Dependence	3.9%			4.5%		4.5%		3.7%			
Lepton ID Efficiencies	2.0%	1.7%	2.0%	2.0%	1.9%	1.4%		1.9%			
Trigger Efficiencies	2.1%	2.1%	2.1%	2.0%	3.4%	7.0%		3.3%			
Luminosity	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%		5.9%			

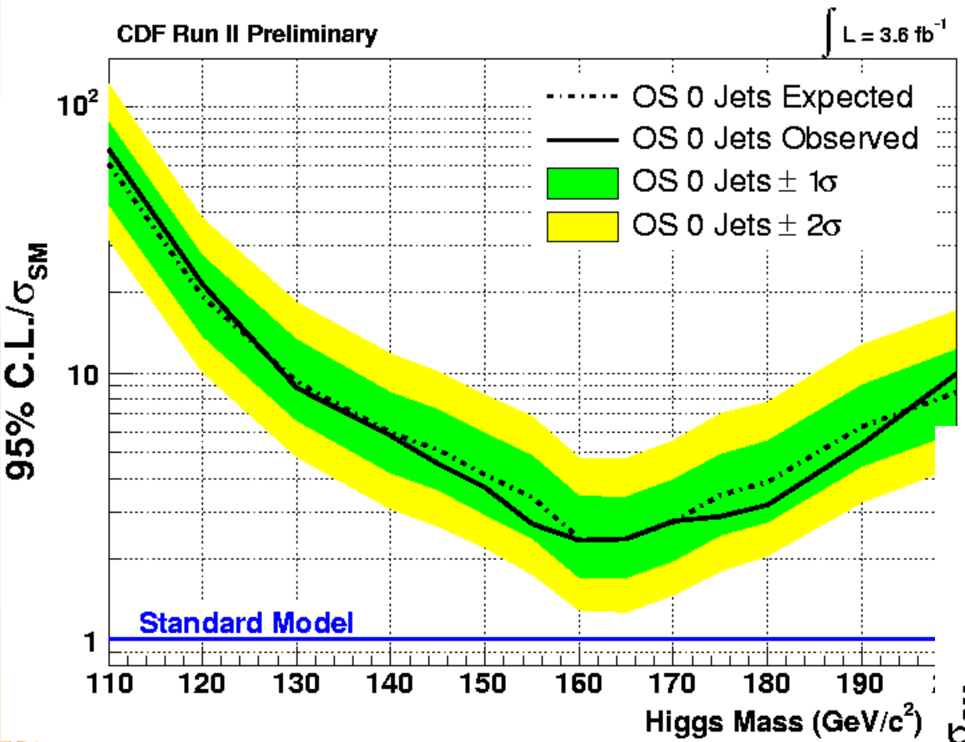
H->WW Systematics 1-Jet bin

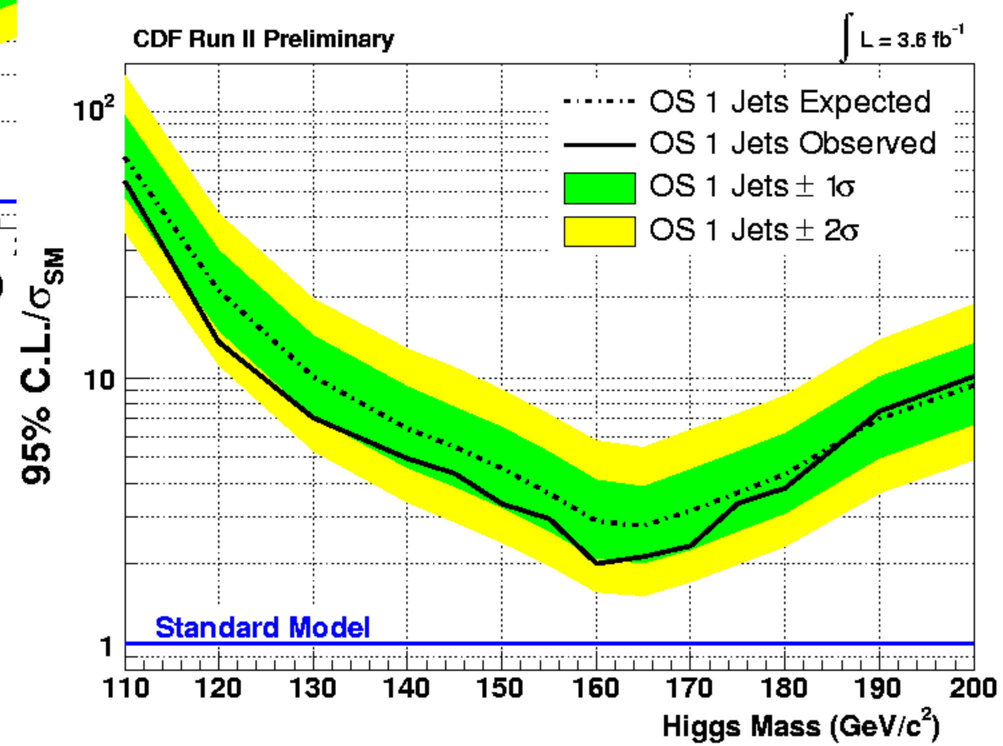
1 Jet Uncertainties	WW	WZ	ZZ	$t\bar{t}$	DY	$W\gamma$	W+jet	$gg \to H$	WH	ZH	VBF
Cross Section											
Scale								10.9%			
PDF Model								5.1%			
Total	*10.0%*	*10.0%*	*10.0%*	15.0%	5.0%	10.0%		12.0%	5.0%	5.0%	10.0%
Acceptance											
Scale (leptons)								2.8%			
Scale (jets)								-5.1%			
PDF Model (leptons)	1.9%	2.7%	2.7%	2.1%	4.1%	2.2%		1.7%	1.2%	0.9%	2.2%
PDF Model (jets)								-1.9%			
Higher-order Diagrams	**5.5%**	**10.0%**	**10.0%**	10.0%	**5.0%**	**10.0%**			*10.0%*	*10.0%*	*10.0%*
Missing Et Modeling	1.0%	1.0%	1.0%	1.0%	20.0%	1.0%		1.0%	1.0%	1.0%	1.0%
Conversion Modeling						20.0%					
Jet Fake Rates											
(Low S/B)							22.2%				
(High S/B)							31.5%				
MC Run Dependence	1.8%			2.2%		2.2%		2.6%	2.6%	1.9%	2.8%
Lepton ID Efficiencies	2.0%	2.0%	2.2%	1.8%	2.0%	2.0%		1.9%	1.9%	1.9%	1.9%
Trigger Efficiencies	2.1%	2.1%	2.1%	2.0%	3.4%	7.0%		3.3%	2.1%	2.1%	3.3%
Luminosity	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%		5.9%	5.9%	5.9%	5.9%

H->WW Systematics 2-Jet bin

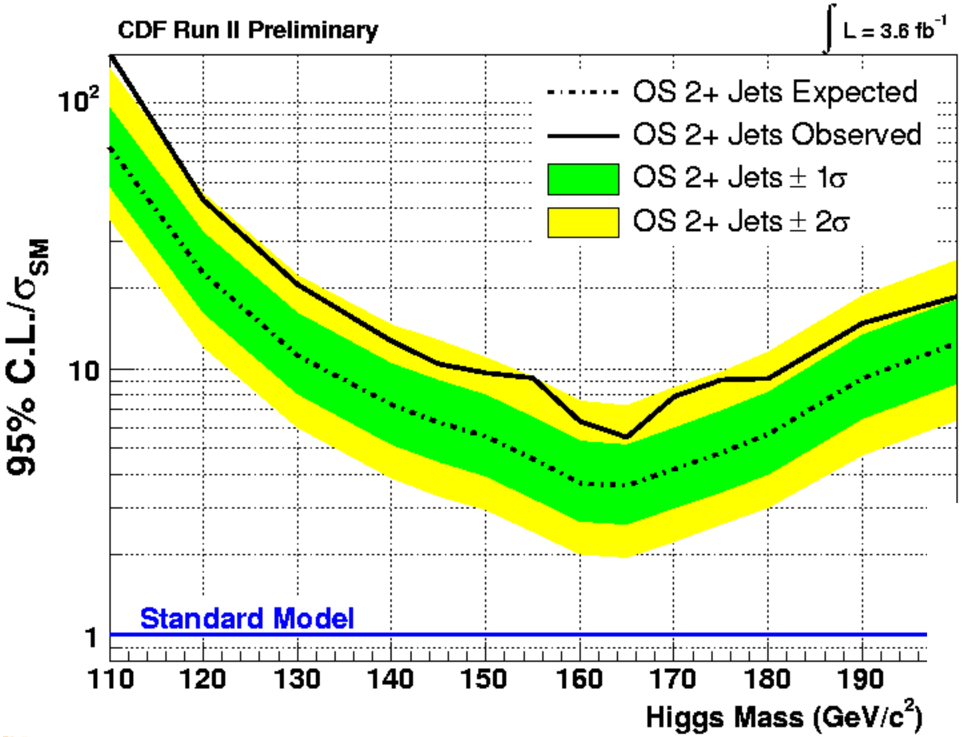
$\geq$ 2 Jets Uncertainties	WW	WZ	ZZ	$t\bar{t}$	DY	$W\gamma$	W+jet	$gg \to H$	WH	ZH	VBF
Cross Section											
Scale								10.9%			
PDF Model								5.1%			
Total	*10.0%*	*10.0%*	*10.0%*	15.0%	5.0%	10.0%		12.0%	5.0%	5.0%	10.0%
Acceptance											
Scale (leptons)								3.1%			
Scale (jets)								-8.7%			
PDF Model (leptons)	1.9%	2.7%	2.7%	2.1%	4.1%	2.2%		2.0%	1.2%	0.9%	2.2%
PDF Model (jets)								-2.8%			
Higher-order Diagrams	**10.0%**	**10.0%**	**10.0%**	10.0%	**10.0%**	**10.0%**			*10.0%*	*10.0%*	*10.0%*
Missing Et Modeling	1.0%	1.0%	1.0%	1.0%	20.0%	1.0%		1.0%	1.0%	1.0%	1.0%
Conversion Modeling						20.0%					
b-tag Veto				7.0%							
Jet Fake Rates							27.1%				
MC Run Dependence	1.0%			1.0%		1.0%		1.7%	2.0%	1.9%	2.6%
Lepton ID Efficiencies	1.9%	2.9%	1.9%	1.9%	1.9%	1.9%		1.9%	1.9%	1.9%	1.9%
Trigger Efficiencies	2.1%	2.1%	2.1%	2.0%	3.4%	7.0%		3.3%	2.1%	2.1%	3.3%
Luminosity	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%		5.9%	5.9%	5.9%	5.9%

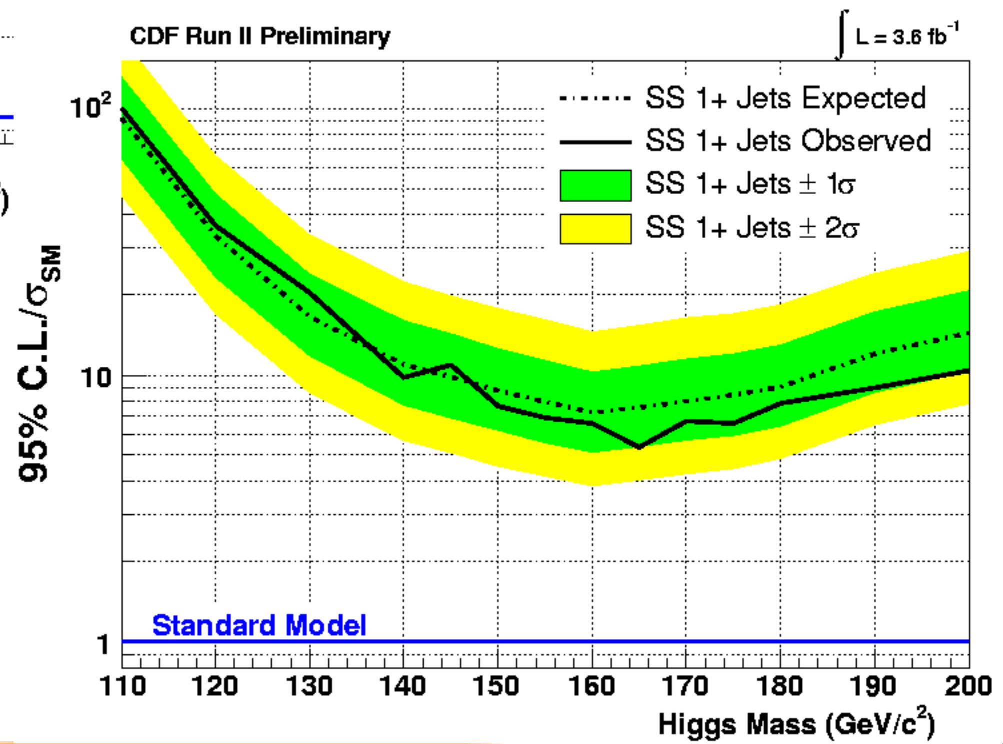
H->WW single Limits





H->WW single Limits





New/Old cross sections

New x-sec: OS+SS

OS+SS	110	120	130	140	145	150	155	160	165	170	175	180	190	200
$-2\sigma/\sigma_{SM}$	15.48	5.31	2.60	1.69	1.47	1.23	1.04	0.79	0.77	0.88	1.08	1.21	1.92	2.52
$-1\sigma/\sigma_{SM}$	21.85	7.39	3.61	2.38	2.04	1.72	1.42	1.07	1.05	1.21	1.47	1.66	2.68	3.54
Median/σ_{SM}	**31.48**	**10.62**	**5.26**	**3.40**	**2.94**	**2.46**	**2.02**	**1.52**	**1.50**	**1.73**	**2.10**	**2.40**	**3.84**	**5.11**
$+1\sigma/\sigma_{SM}$	45.61	15.32	7.61	4.92	4.26	3.51	2.95	2.19	2.18	2.49	3.05	3.47	5.59	7.43
$+2\sigma/\sigma_{SM}$	63.79	21.54	10.71	6.82	6.01	5.02	4.14	3.12	3.00	3.49	4.24	4.88	7.78	10.66
Observed/σ_{SM}	**51.05**	**12.22**	**6.06**	**3.52**	**3.14**	**2.39**	**1.99**	**1.37**	**1.33**	**1.81**	**2.02**	**2.23**	**3.56**	**6.24**

ICHEP x-sec: OS+SS

OS+SS	110	120	130	140	145	150	155	160	165	170	175	180	190	200
$-2\sigma/\sigma_{SM}$	16.26	5.45	2.62	1.71	1.44	1.23	1.00	0.75	0.74	0.85	1.00	1.17	1.82	2.39
$-1\sigma/\sigma_{SM}$	22.78	7.43	3.69	2.35	2.01	1.71	1.38	1.03	1.02	1.16	1.39	1.60	2.53	3.36
Median/σ_{SM}	**32.40**	**10.79**	**5.31**	**3.36**	**2.92**	**2.44**	**1.97**	**1.47**	**1.45**	**1.66**	**2.00**	**2.31**	**3.65**	**4.89**
$+1\sigma/\sigma_{SM}$	47.08	15.64	7.66	4.86	4.20	3.52	2.87	2.14	2.08	2.38	2.88	3.36	5.33	7.11
$+2\sigma/\sigma_{SM}$	66.21	21.71	10.63	6.91	5.89	4.96	4.03	2.96	2.95	3.36	4.09	4.76	7.49	10.08
Observed/σ_{SM}	**52.20**	**12.58**	**5.88**	**3.56**	**3.11**	**2.31**	**1.91**	**1.37**	**1.29**	**1.67**	**2.01**	**2.03**	**3.59**	**5.94**

New pdf MSTW 2008

Better treatment of b-quark

2-loop ewk corrections and NNLL x-sec already included

Tevatron 95% CL Limits

Tevatron result with CL_S method