~~Resumé~~ Sélection ICHEP 2008

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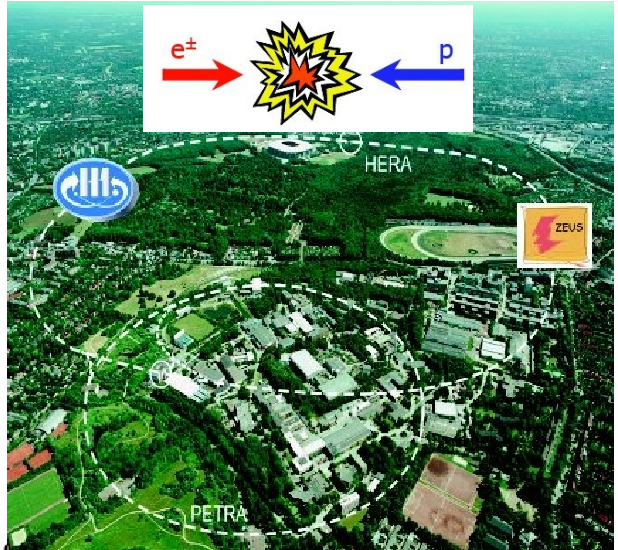
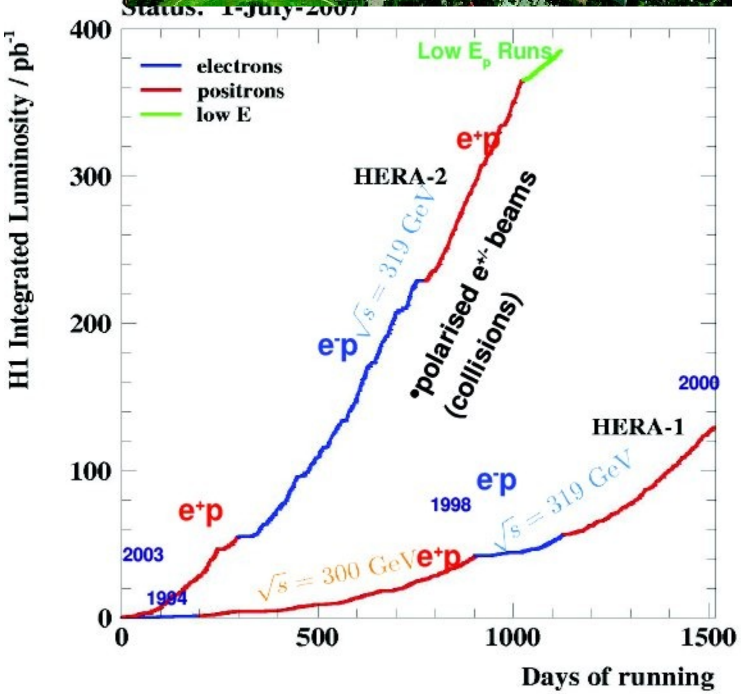
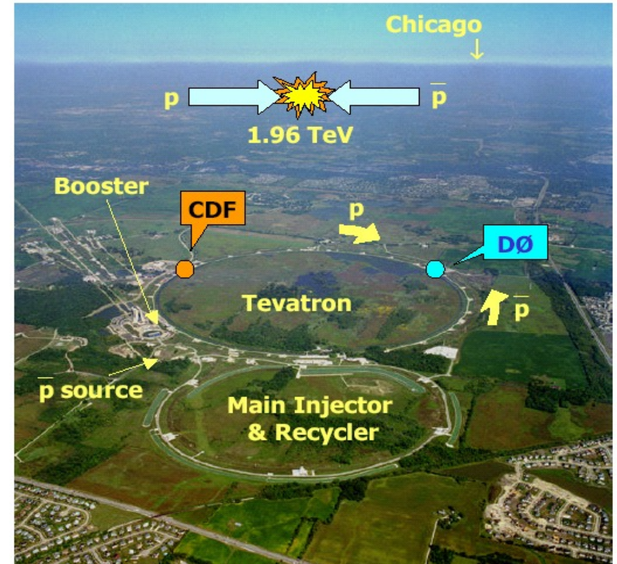
CEA-Saclay

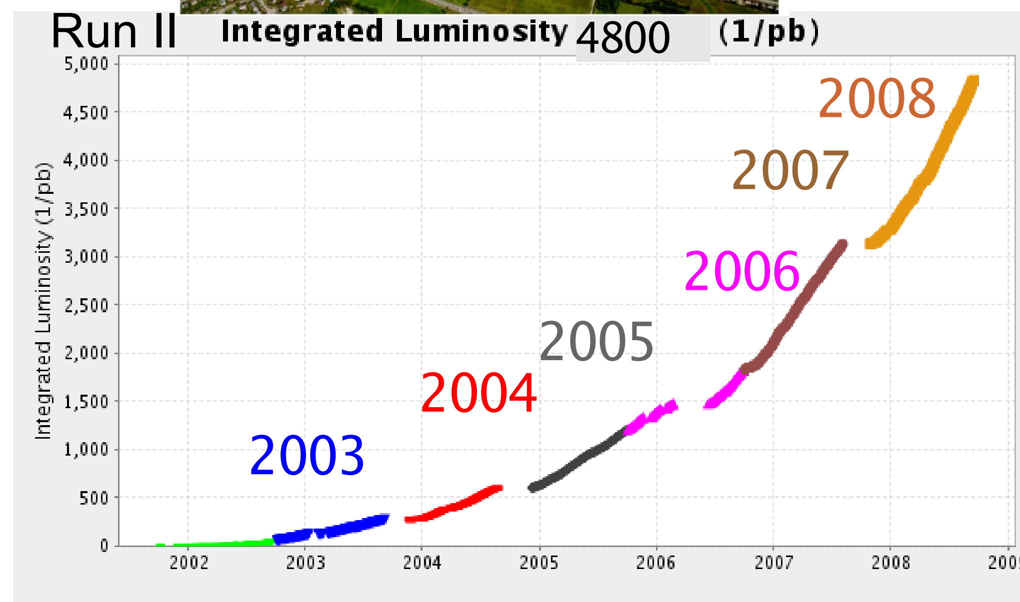
Overview:

- -Top
- - Electroweak
- -QCD modeling & PDF
- -Higgs
- -Search





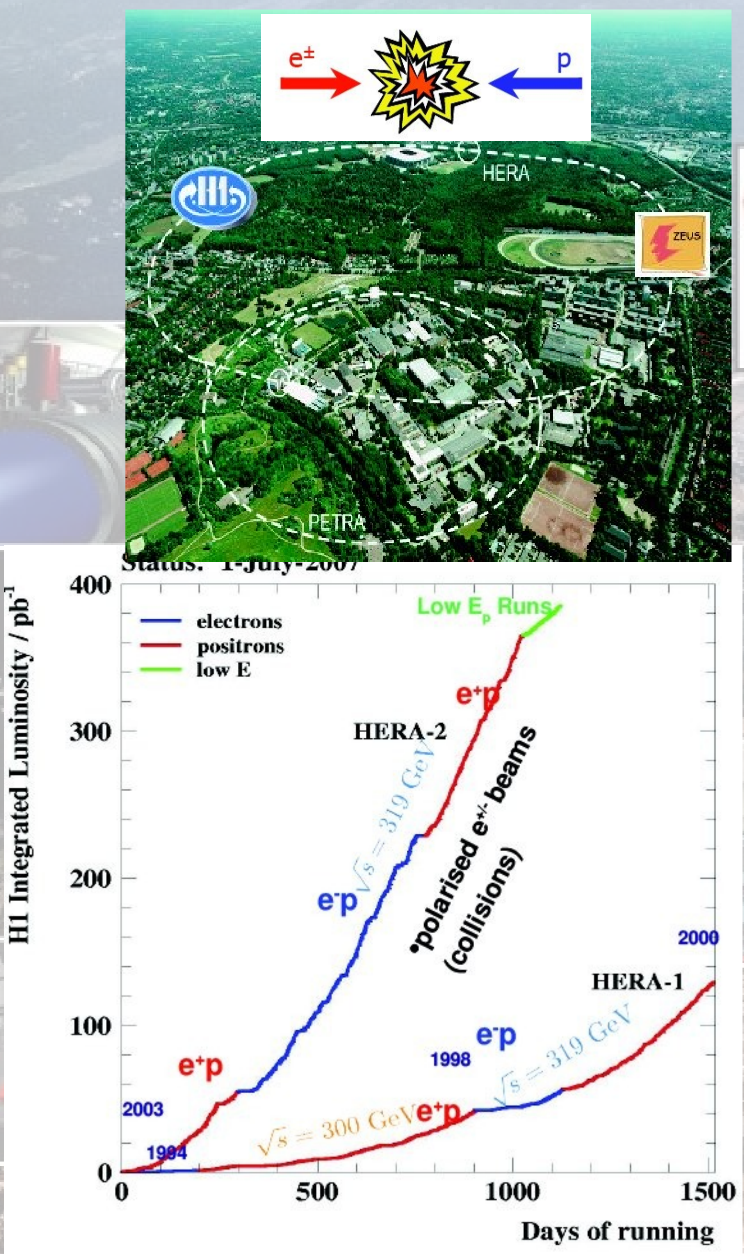




Tevatron is performing extremely well ~58 pb^{-}/week!

End of HERA July 2007

La suite est dominée par les résultats TeVatron seul à prendre des données en ce moment



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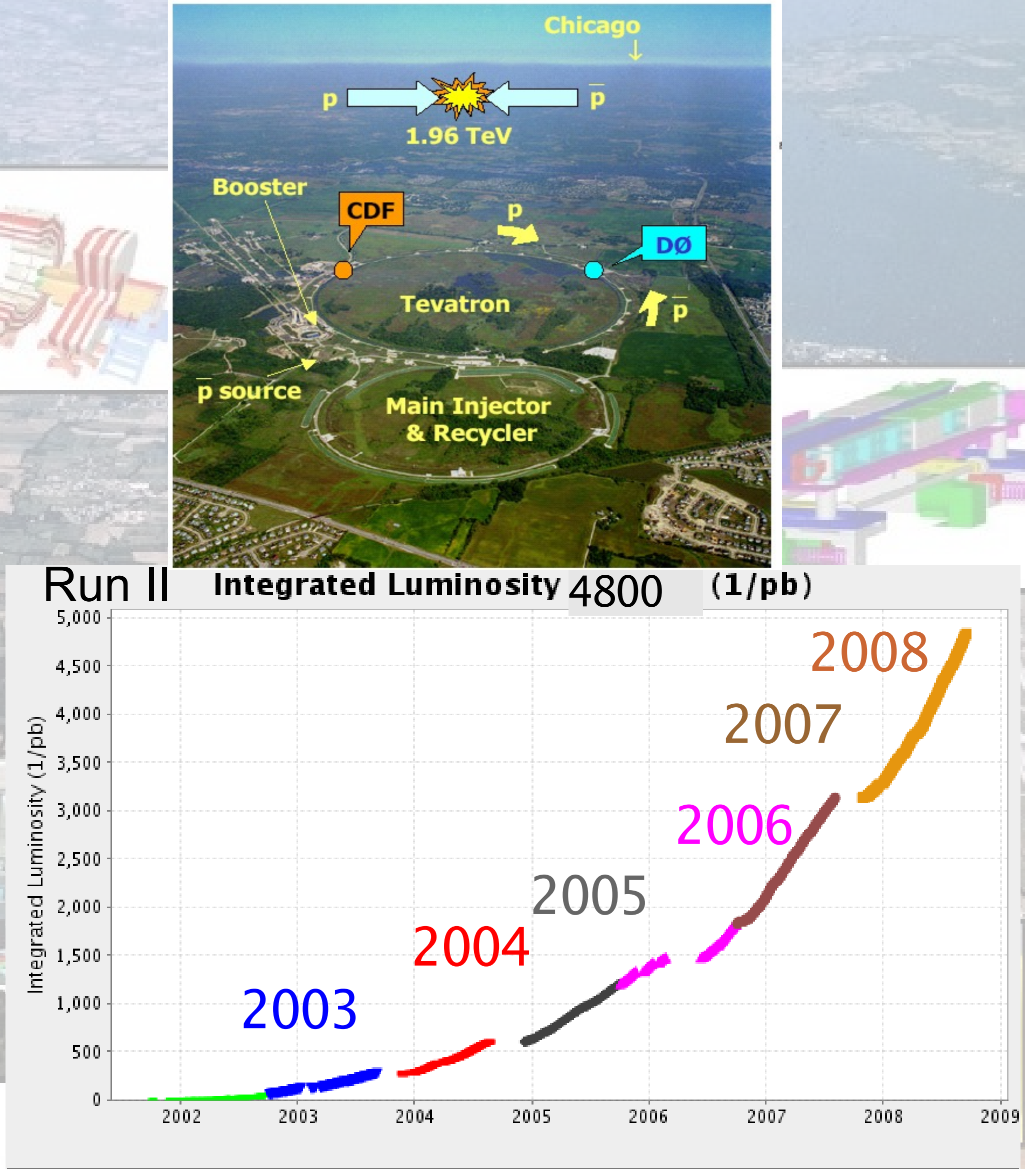

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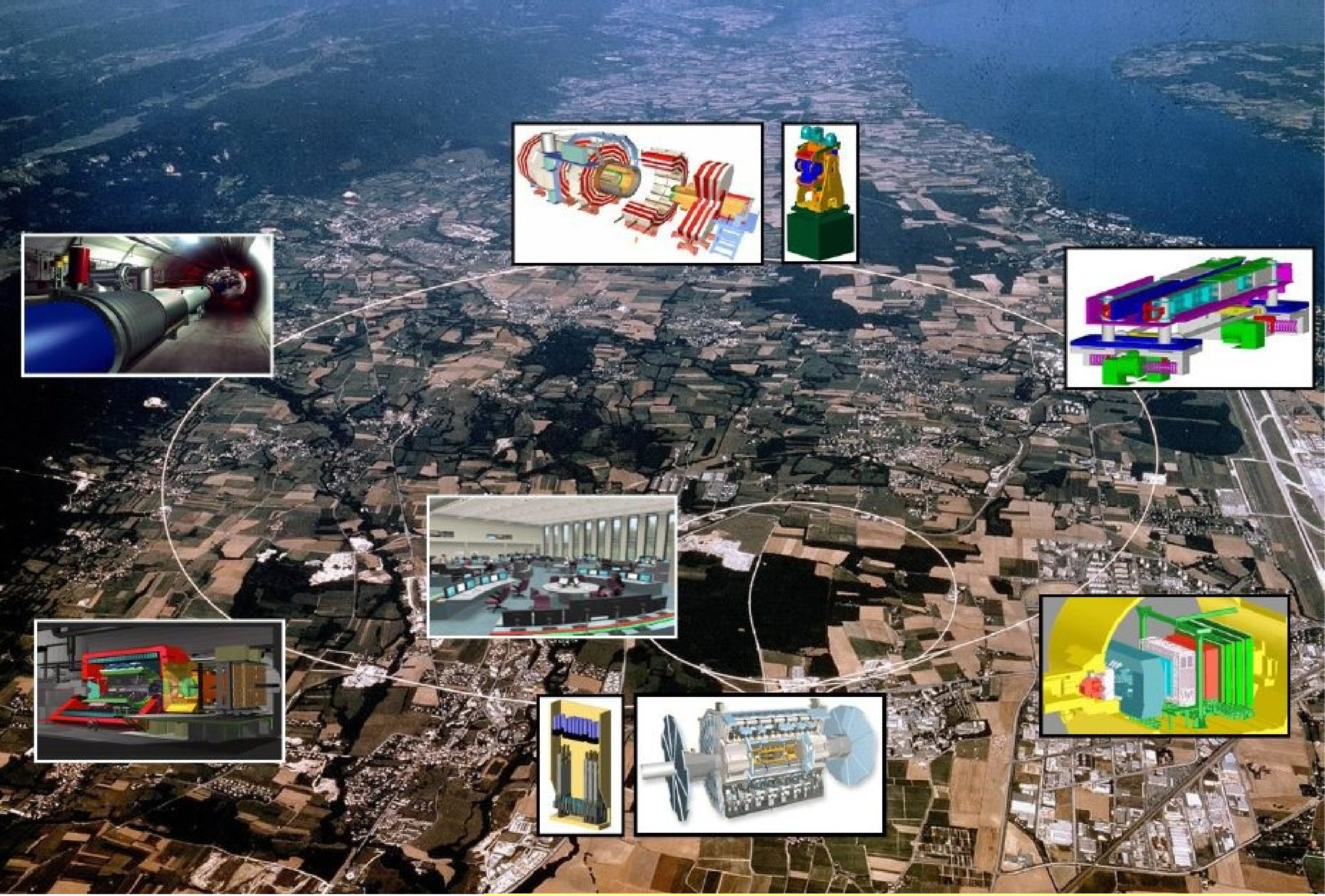
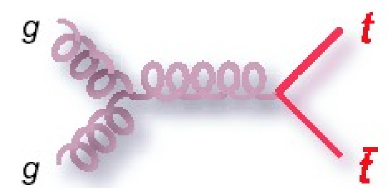
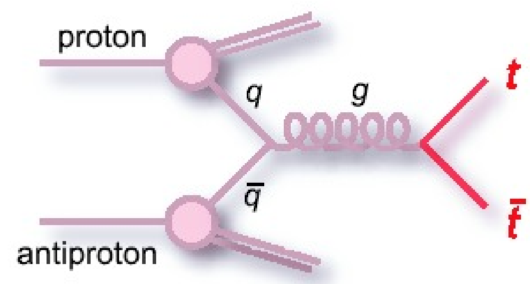
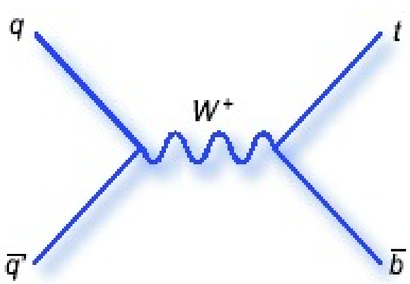


En attendant les futurs résultats du LHC

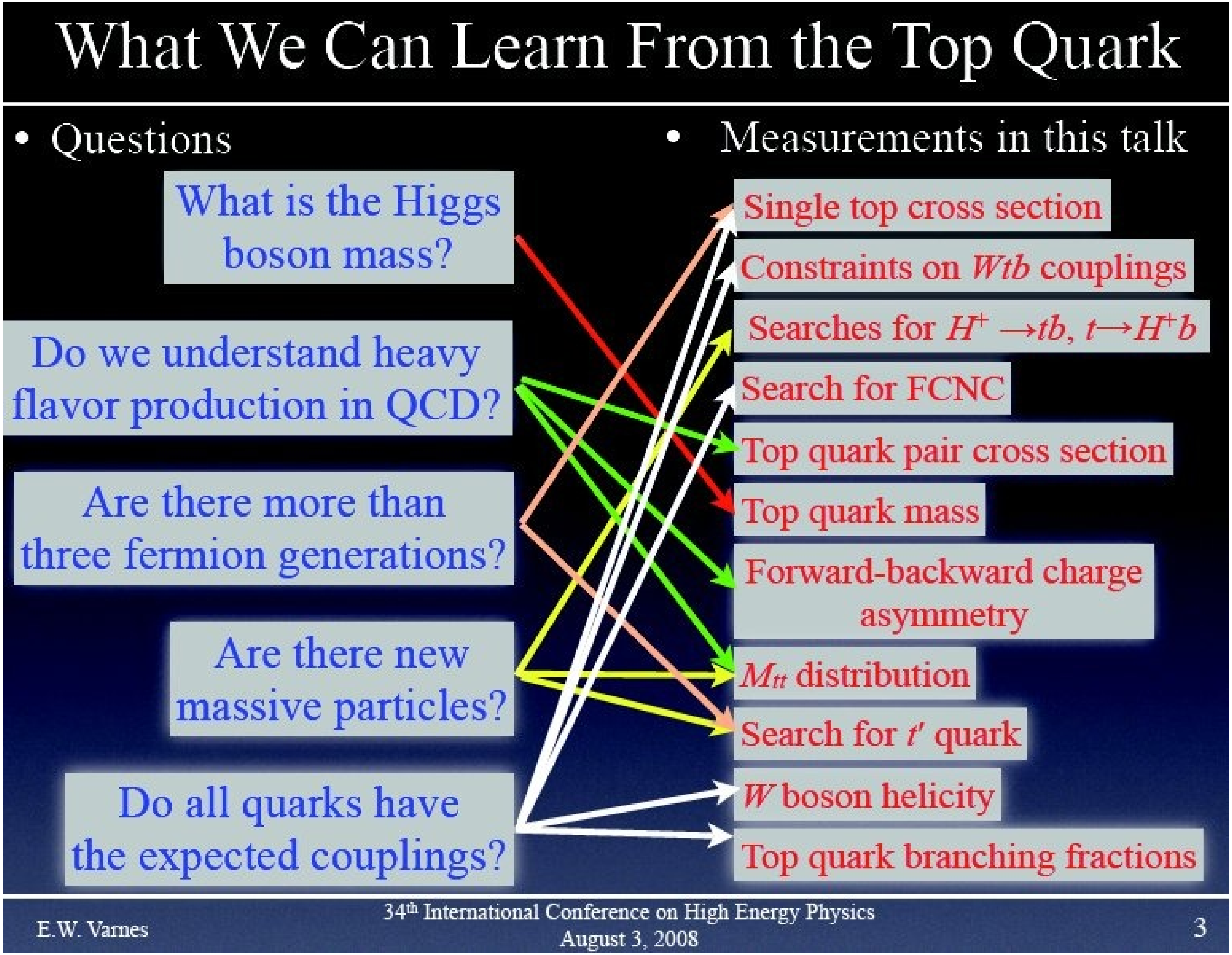
Le quark top



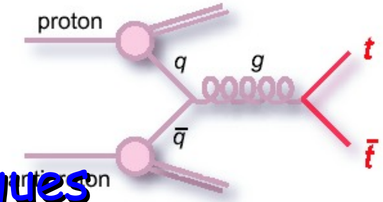




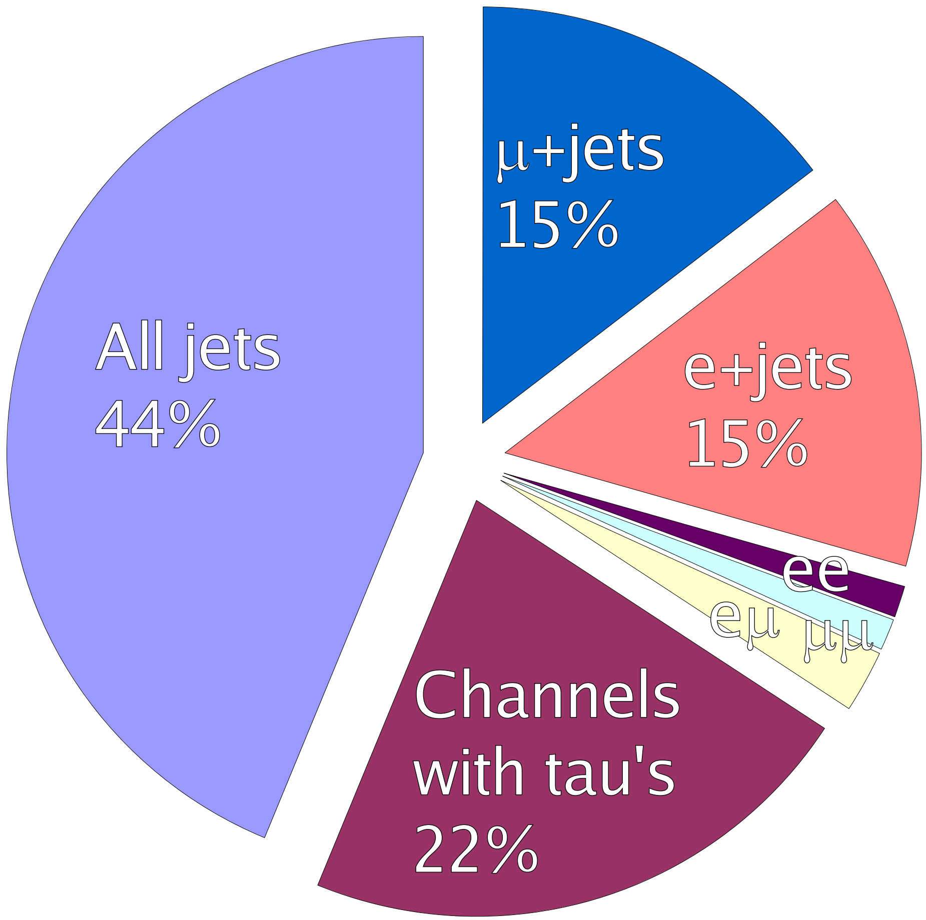
Physique avec le top: de nombreux résultats

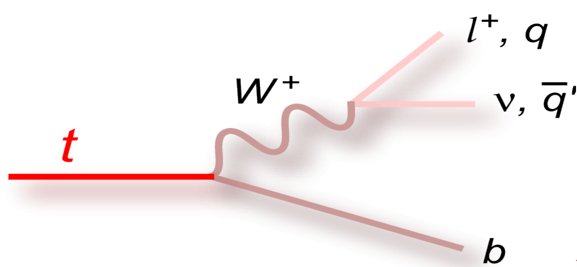


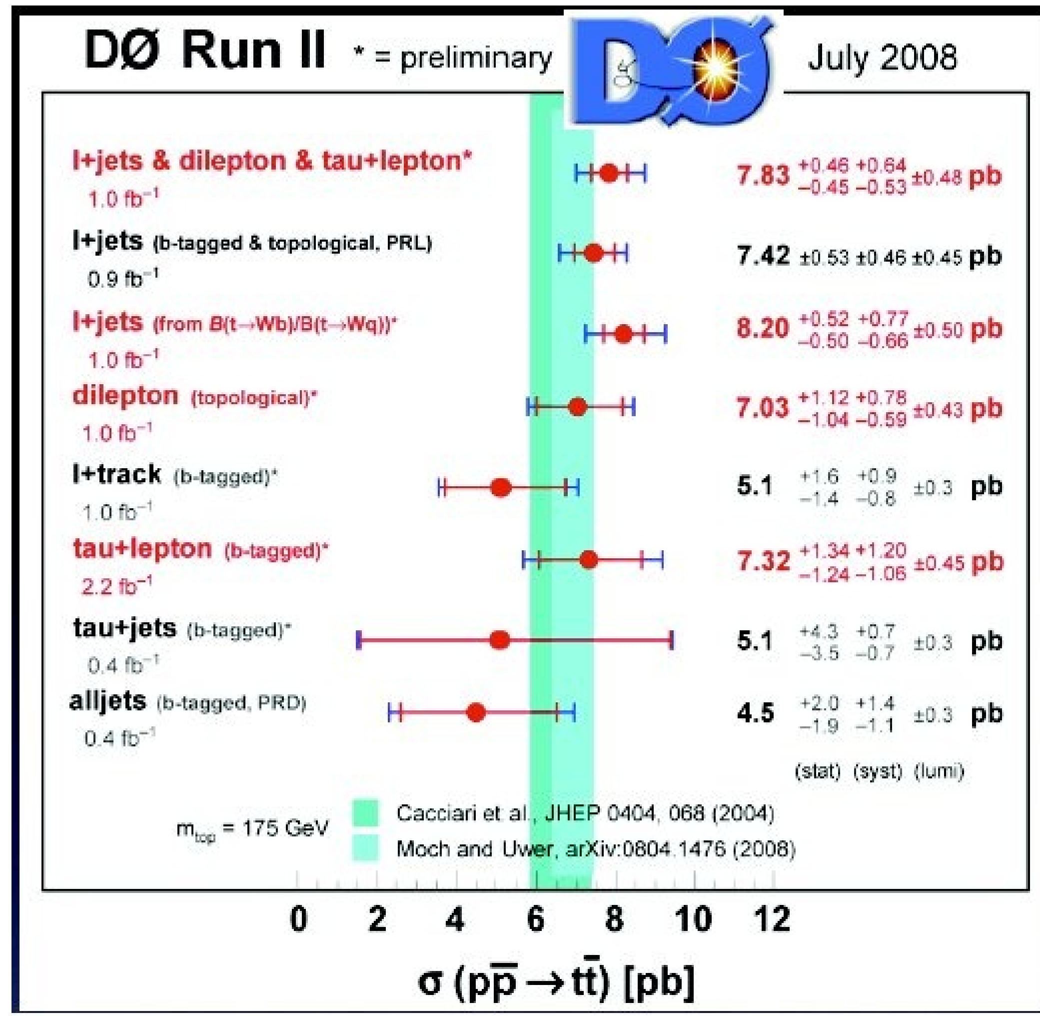
Production de paires de top



- mesure des sections efficaces dominée par les systématiques





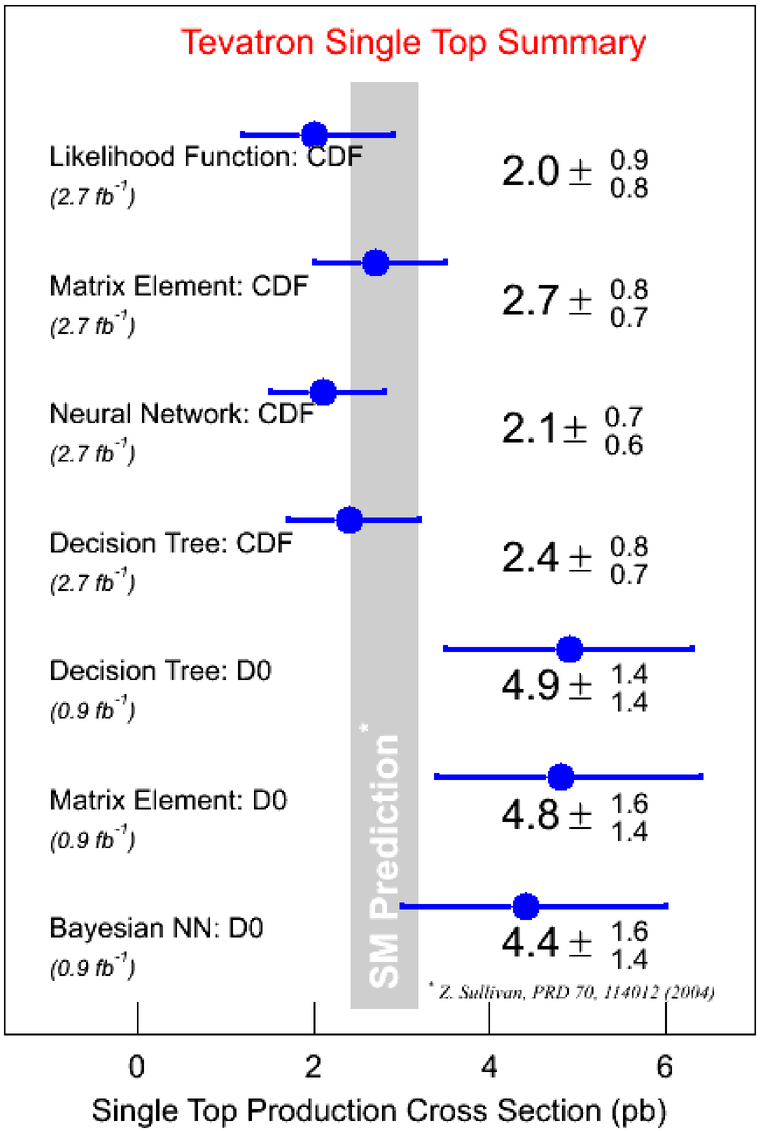


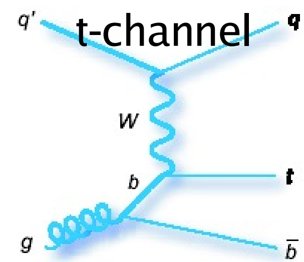
$$\sigma(p\bar{p} \longrightarrow t\bar{t}) = 7.8 \pm 0.5 \pm 0.6 \pm 0.5 \text{ pb}$$

stat. syst. lum.

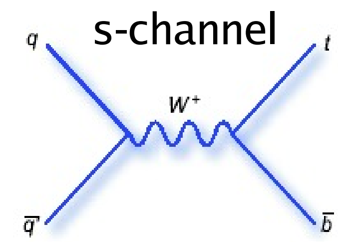
Single top

- production électrofaible: single top
  - 1ere evidence en 2007 à D0 et CDF
  - Update 2008 de CDF avec x3 de stat

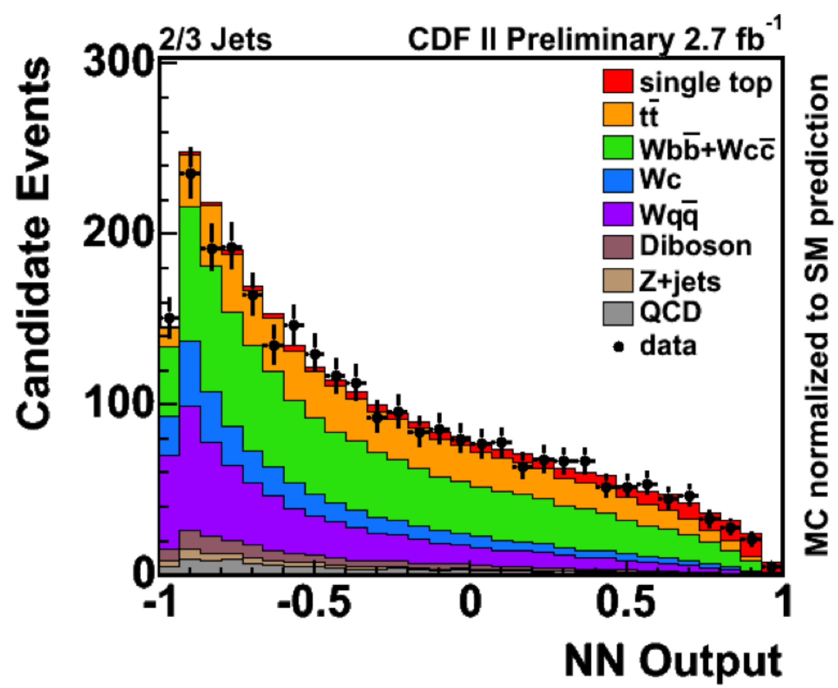




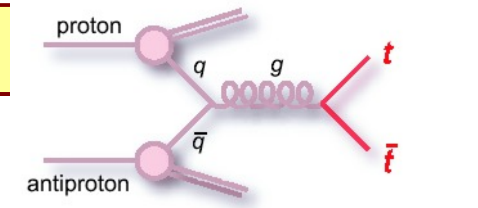
lνqb final state



lνbb̄ final state

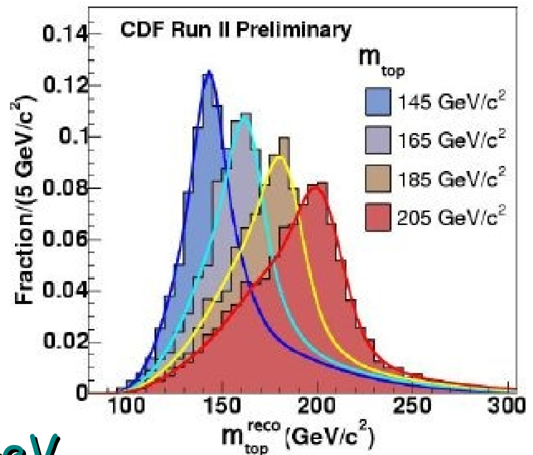


Mesure de la masse



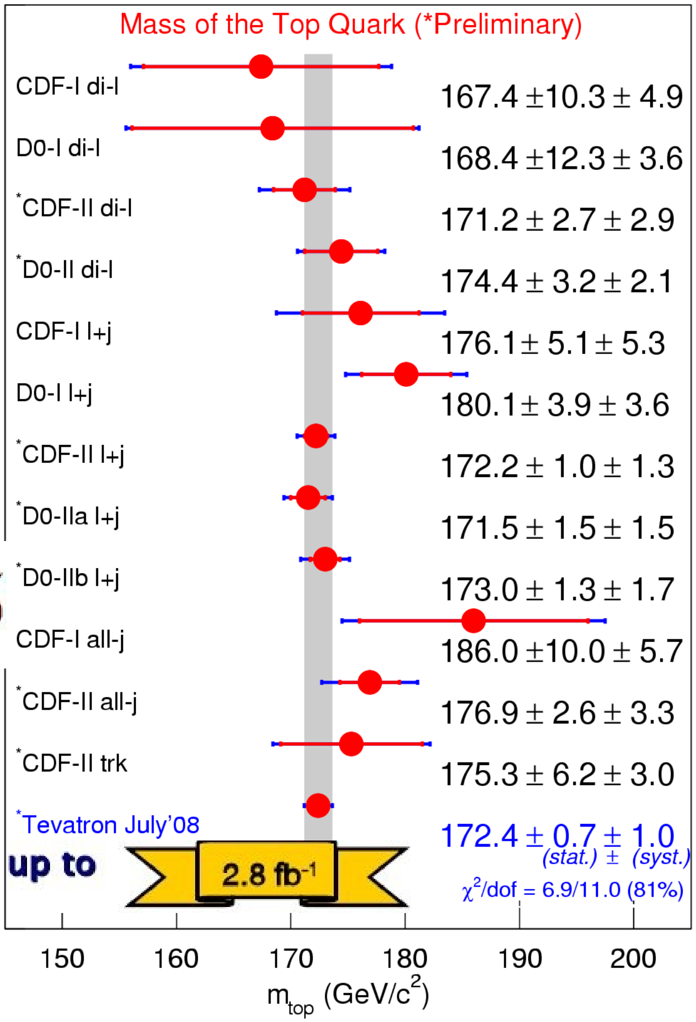
- Méthodes « classiques »
  - Matrix Element $P(\vec{x}, M_t, JES) = \frac{1}{\sigma}\int d\sigma(\vec{y}, M_t) f(\vec{q}_1) f(\vec{q}_2) W(\vec{x}, \vec{y}, JES) d\vec{q}_1 d\vec{q}_2$

    Differential cross section | Proton PDF | Transfer function from true y to measured x
  - Template sur des quantités cinématiques naturelles



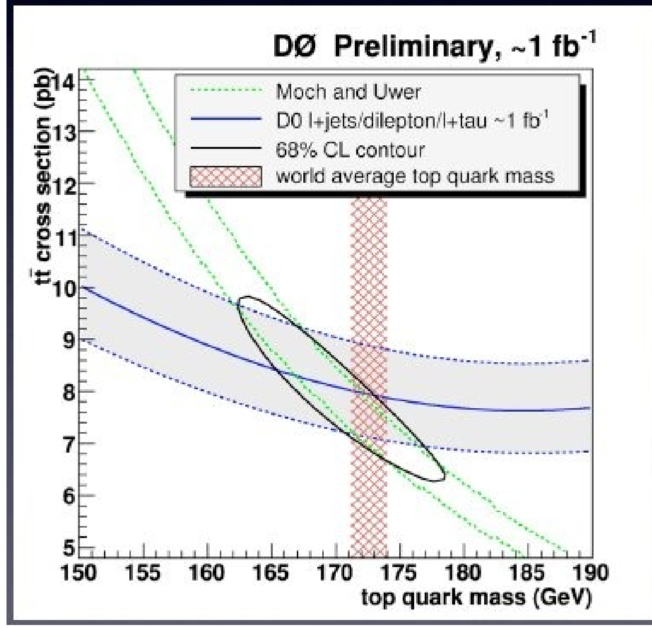
- Historique:
  - Hiver/été 2007: $\Delta M_t = \pm 1.8$ GeV
  - Hiver 2008: $\Delta M_t = \pm 1.4$ GeV
- Eté 2008
  - plus de stat
  - meilleure compréhension des systématiques grâce à la stat
  - mais difficile d'aller plus loin dans le futur.
    - Jet Energy Scale
    - b-Jet Energy Scale

$$M_{top} = 172.4 \pm 1.2 \text{ GeV}$$ ±0.7%



méthodes alternatives

Mass from cross-section



NLO+NLL cross section:

M. Cacciari *et al.* (2008)

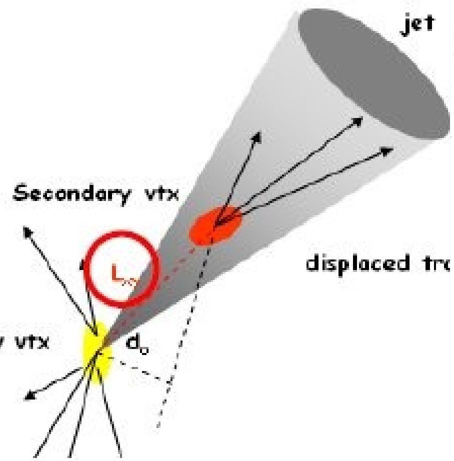
$$m_t = 167.8 \pm 5.7 \text{ GeV}$$

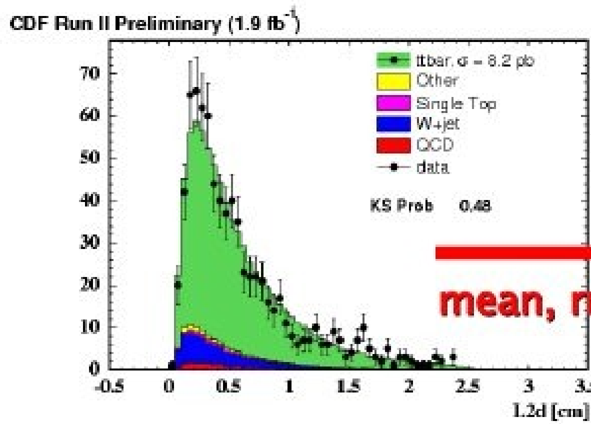
Approx NNLO cross section:

S. Moch and P. Uwer (2008)

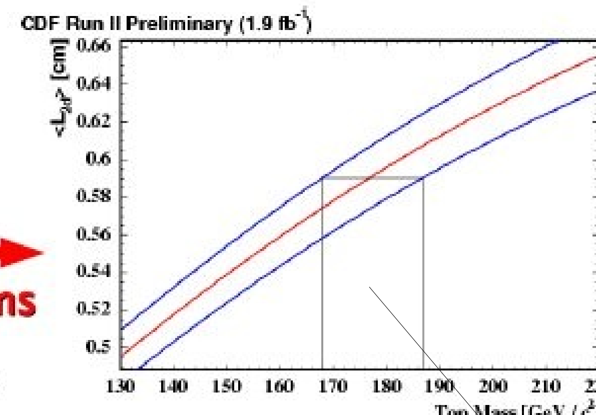
$$m_t = 169.6 \pm 5.4 \text{ GeV}$$

b decay length



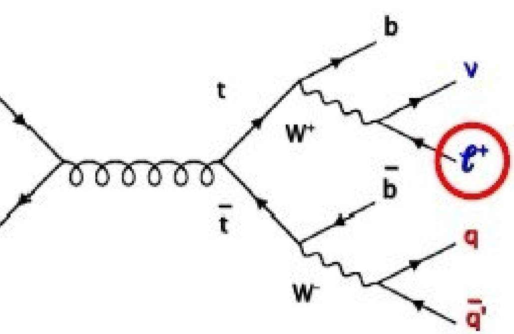


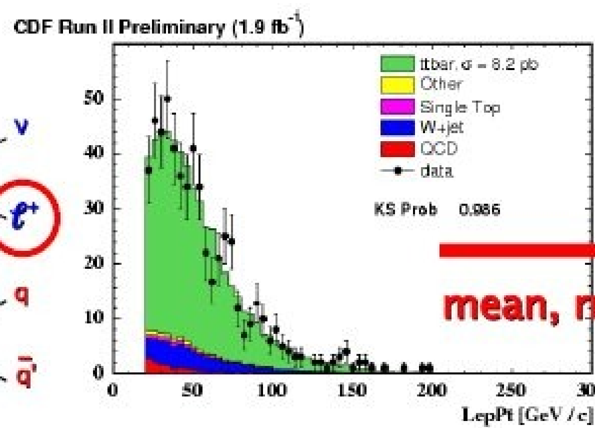
mean, rms



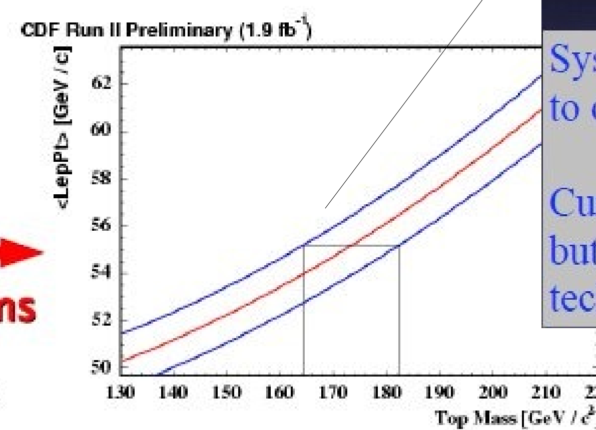
$$m_t = 175.3 \pm 6.2 \pm 3.0 \text{ GeV}$$

Lepton Pt





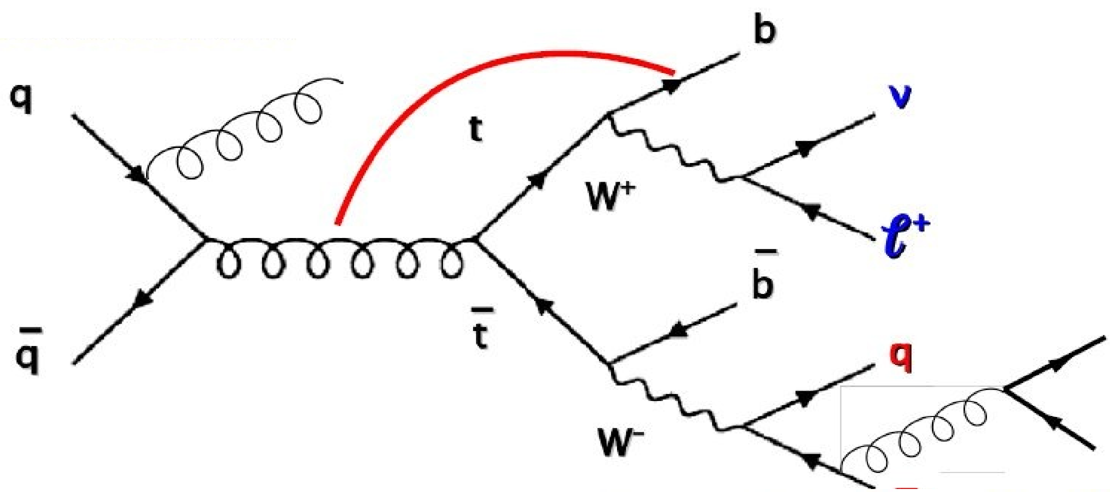
mean, rms



Systematics largely orthogonal to other measurements

Currently statistics-limited, but will be an important technique at the LHC

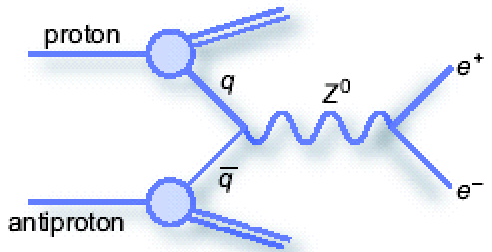
La question de la masse du top, toujours d'actualité

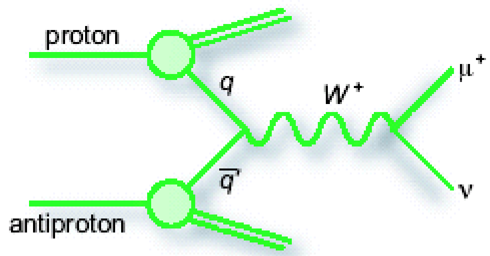


High precision mass measurements require theoretically stable mass definitions in a suitable renormalization scheme.

- Since the top quark mass is extracted from kinematic reconstruction of events, ie invariant mass of single top from jets, lepton, missing energy, m_t^{exp} is usually identified with the pole mass.
- Is this still justified after non-perturbative effects such as hadronization, color reconnection, and underlying event modeling have been taken into account ?
- Moreover, when including higher-order corrections, the pole mass is not stable, since it receives large corrections from low energy scale physics ("renormalon problem").

Z, W, WW, WZ,.....





Tevatron Experiments Channel	Events/1fb^{-1}
$W \to l\nu$	5M
$Z \to ll$	500k
$W\gamma \to l\nu\gamma$	32000
$Z\gamma \to ll\gamma$	8000
$WW \to l\nu l\nu$	600
$WZ \to l\nu ll$	50
$ZZ \to ll\nu\nu$	40
$ZZ \to llll$	6

$\times\ \varepsilon \sim$ 5- 20%

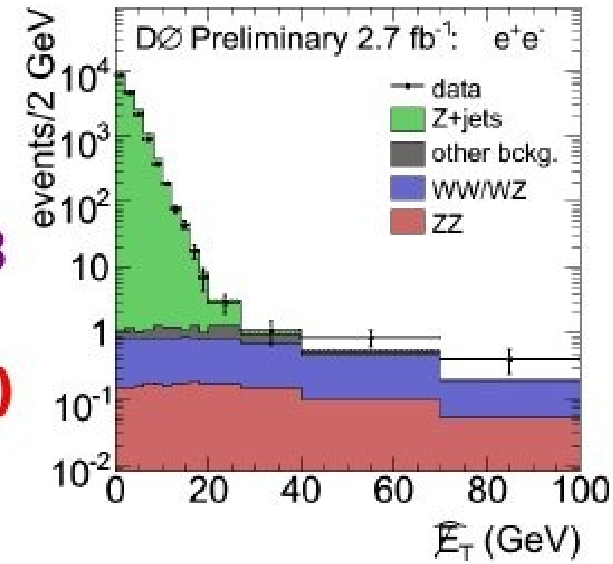
Z Pair Production @ DØ (1.7-2.7 fb^{-1})

$ZZ \to ll\nu\nu$ channel: new missing E_T estimator, likelihood to separate WW background (S/B=0.25)

$ZZ \to llll$: no candidate in first 1 fb-1, then 3 candidates in 1.7 fb^{-1}

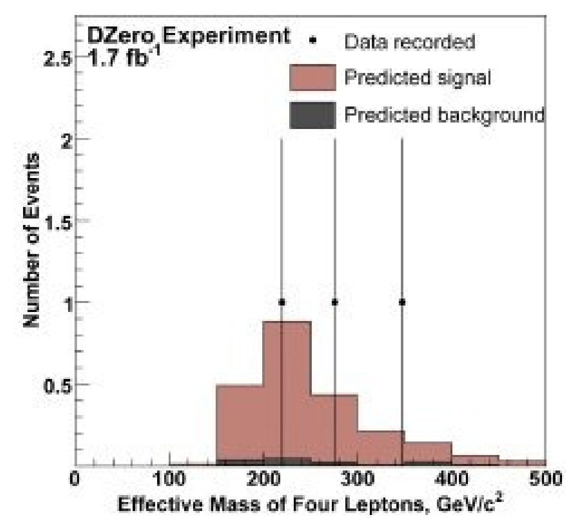
Result $\sigma = (1.48 \pm 0.59^{+0.17}_{-0.19})$ pb (stat+syst)

Observation



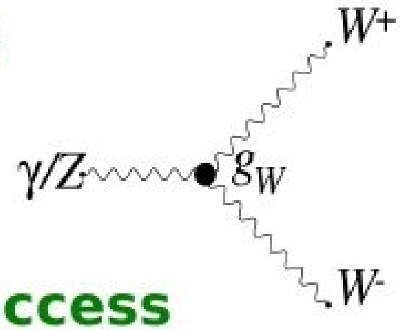
Channel	$ZZ \to ll\nu\nu$	$ZZ \to llll$*	Combined
Observed Results			
p-value	$4.0 \cdot 10^{-3}$	$4.3 \cdot 10^{-8}$	
significance	2.7σ	5.3σ	5.7σ

* 1.7fb^{-1}

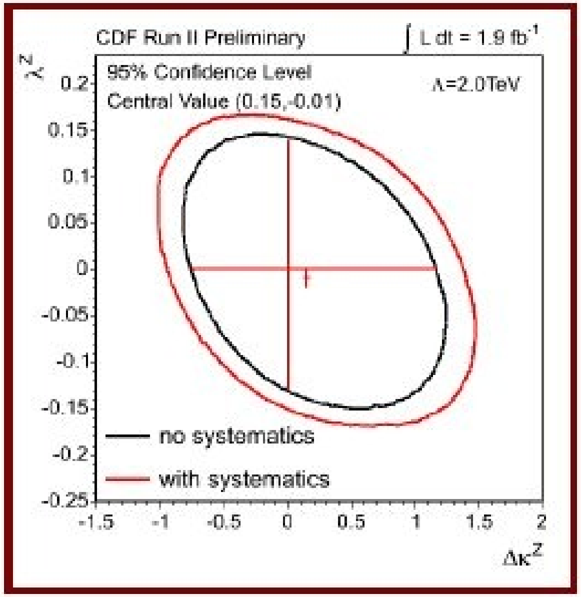


Triple Gauge Couplings

Fits to total cross sections and differential distributions for $W\gamma$, WW, WZ, $Z\gamma$, ZZ final states

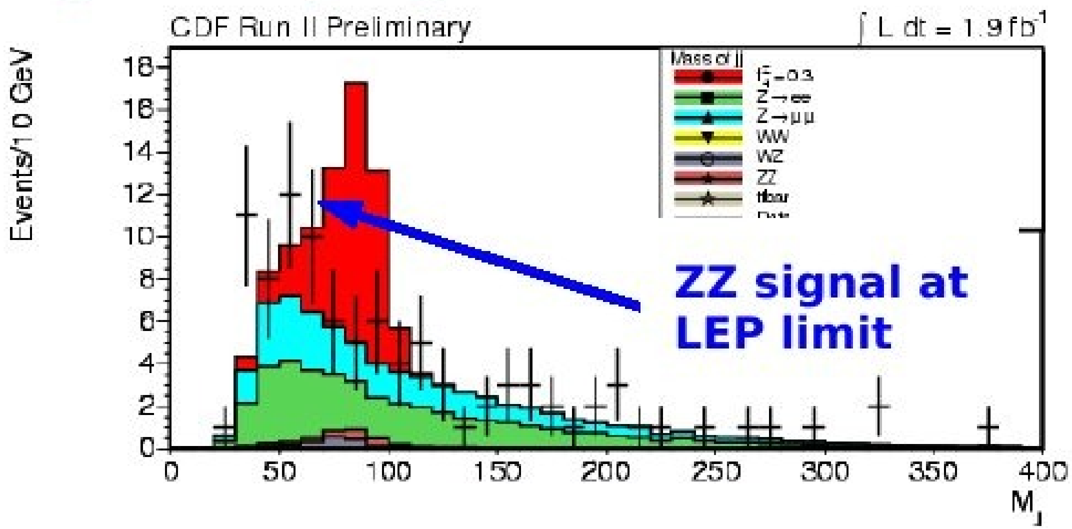


Unique to hadron colliders: access WWZ vertex independently from $WW\gamma$ vertex (WZ $\rightarrow$3 leptons final state)



LEP better sensitivity to charged couplings

Tevatron improves on neutral couplings TGC (0 in the SM), higher dimension operators have stronger energy dependence



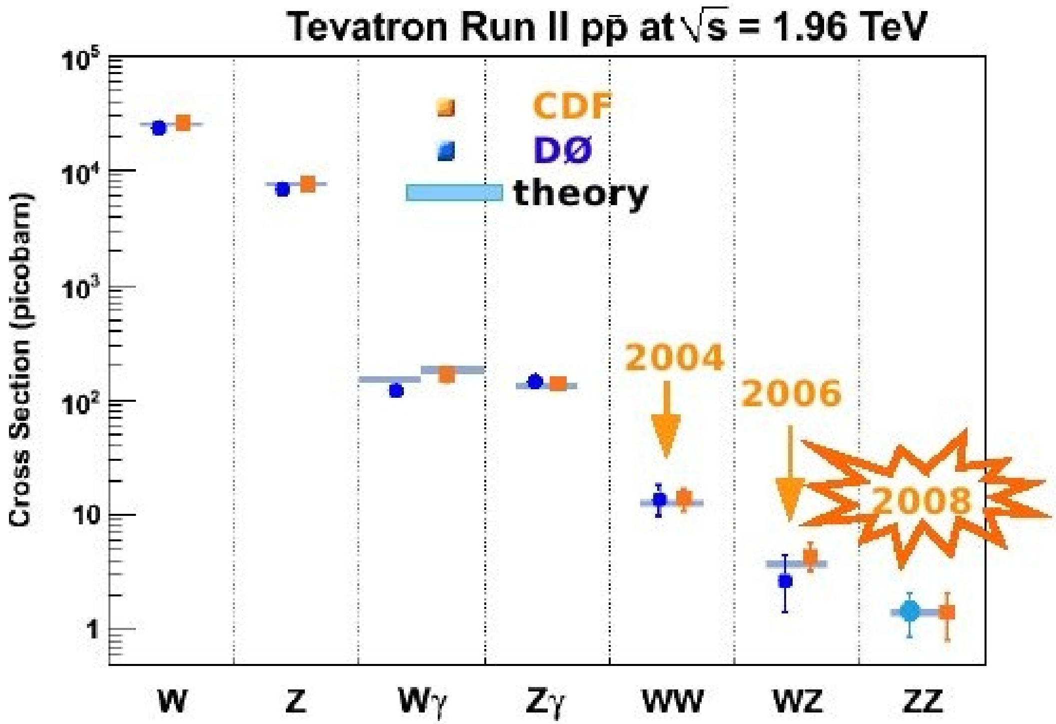
Z, W, WW, WZ, ZZ......

Cross Sections Summary

All diboson processes involving W/Z/γ observed at Tevatron .....

..... but only in the fully leptonic decay channels

Both experiments working on selecting diboson processes with W/Z→jets, large W/Z+jets background



Proving ground for analysis techniques for Higgs searches and theory calculations / Montecarlos

Z Invisible Width (CDF 1 fb^{-1})

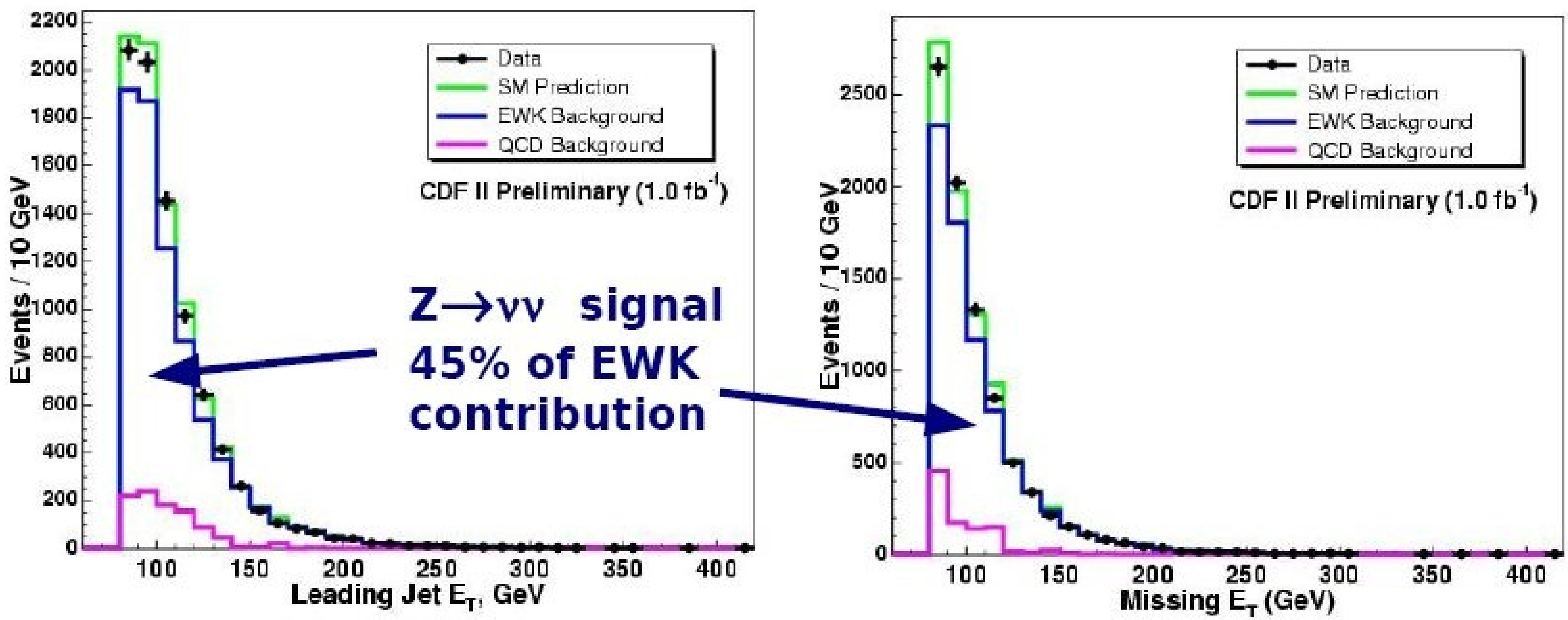
Electroweak fits: $\Gamma_Z(inv) = (500.8 \pm 2.6)$ MeV

Direct measurement at LEP: $\Gamma_Z(inv) = (503 \pm 16)$ MeV

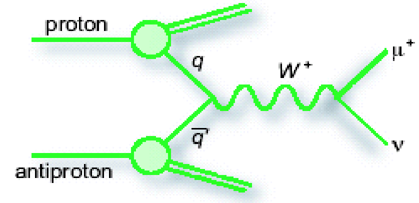
Use monojet events with large missing E_T

CDF measures ratio $\sigma(Z+1jet)*BR(Z \to inv)/\sigma(Z+1jet)*BR(Z \to ll)$

Obtain $\Gamma_Z(inv) = (466 \pm 42)$ MeV (statistics dominated)



W mass at Tevatron



statistique de Z, Y, J/ψ

D0

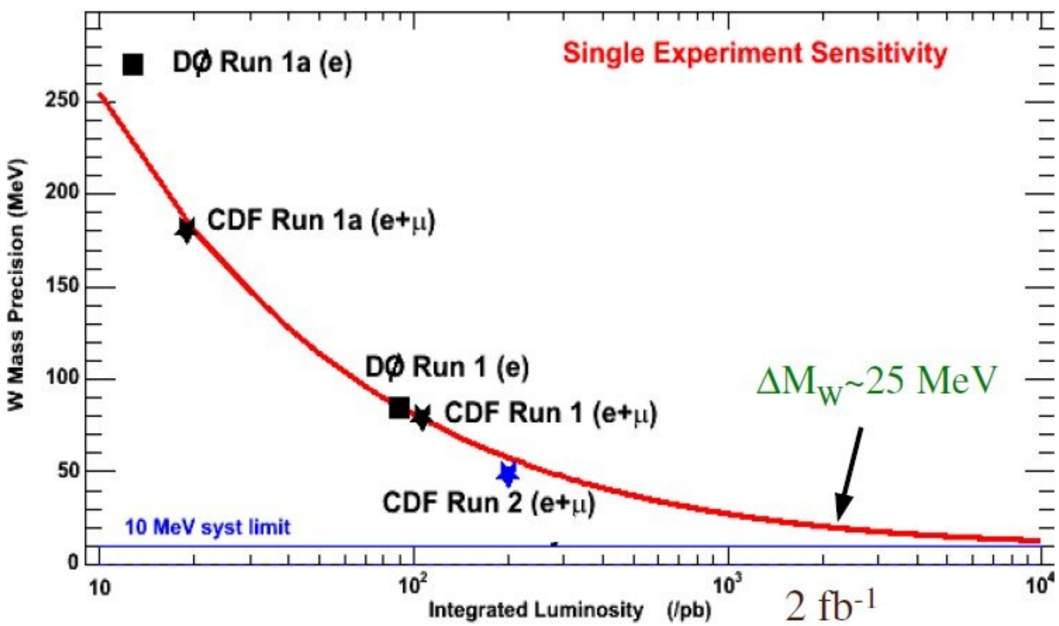
- bientôt (!) mesure dans le canal electron avec $1 fb^{-1}$

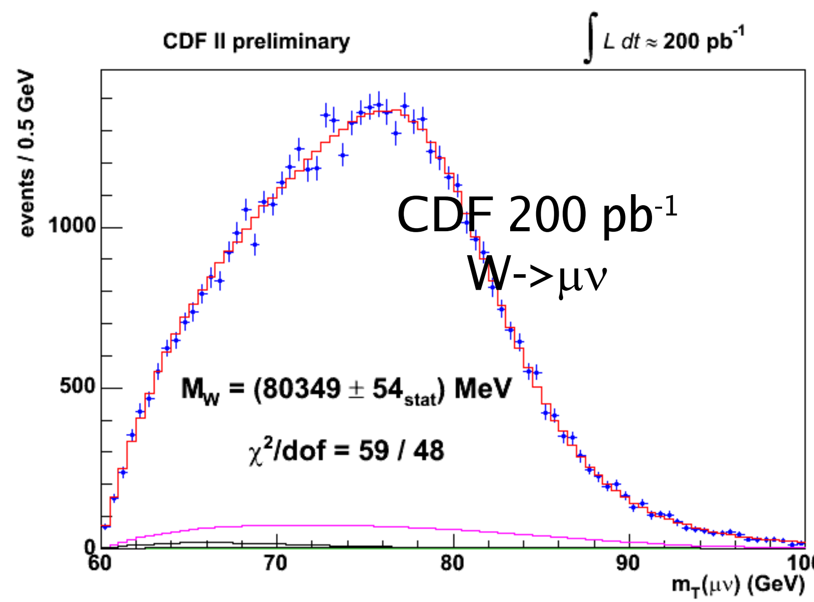
CDF

- 80413±48 MeV janvier 2007 0.2 fb^{-1}
- Prospects: $\Delta M \sim 25$ MeV avec 2.4 fb^{-1}

CDF II preliminary L = 200 pb^{-1}

m_T Uncertainty [MeV]	Electrons	Muons	Common
Lepton Scale	30	17	17
Lepton Resolution	9	3	0
Recoil Scale	9	9	9
Recoil Resolution	7	7	7
$u_{\parallel}$ Efficiency	3	1	0
Lepton Removal	8	5	5
Backgrounds	8	9	0
$p_T(W)$	3	3	3
PDF	11	11	11
QED	11	12	11
Total Systematic	39	27	26
Statistical	48	54	0
Total	62	60	26



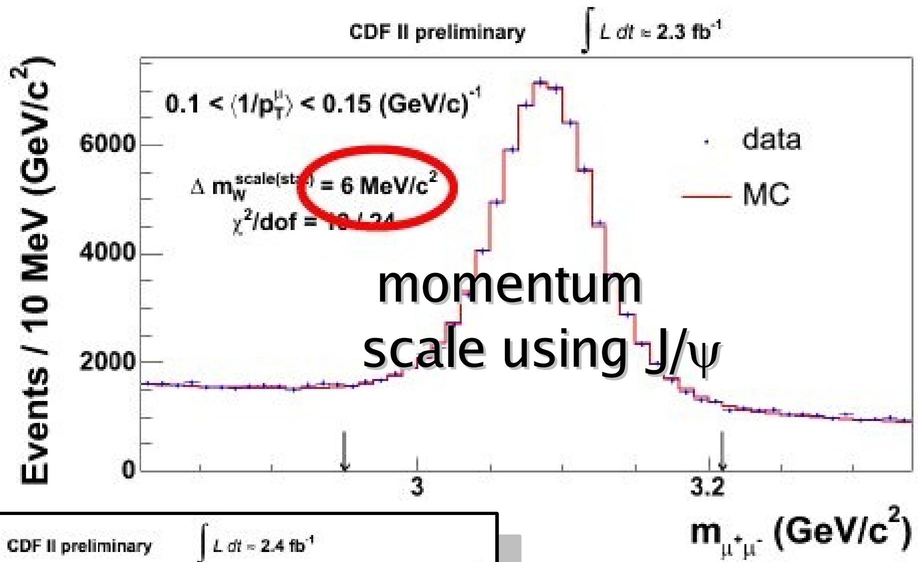


NB:
moyenne mondiale actuelle
LEP+TeV => ΔM_W=25 MeV

W mass à CDF

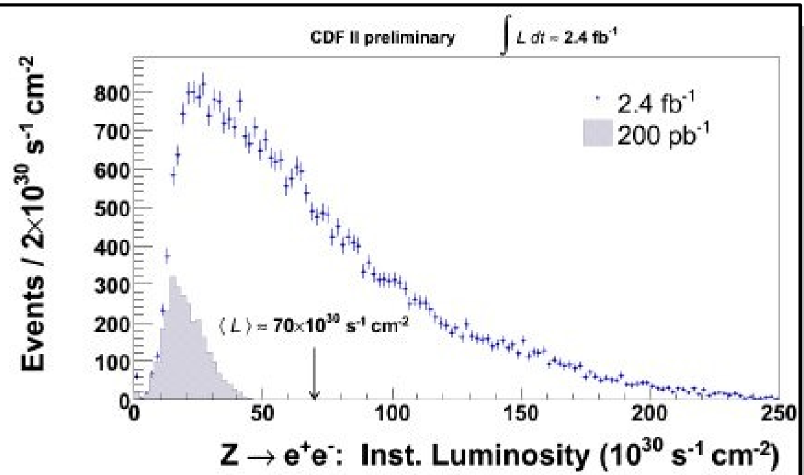
objectif $\Delta M \sim 25$ MeV avec 2.4 fb^{-1}

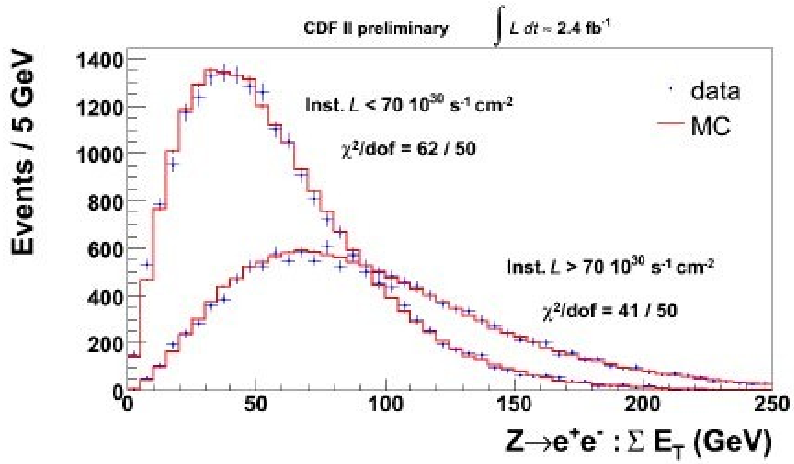
ok pour la stat et le momentum scale



MAIS

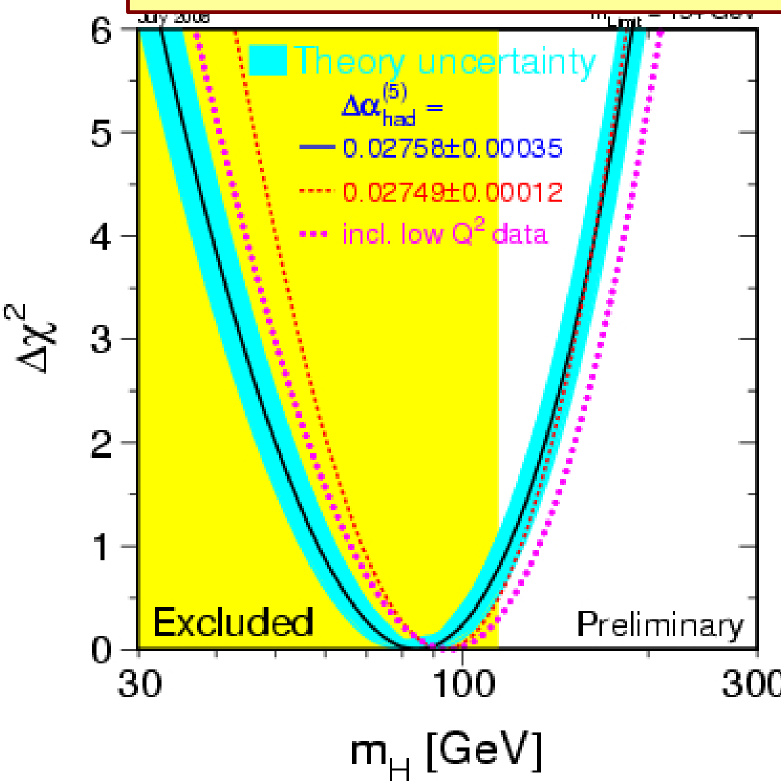
New challenge: higher instantaneous luminosities and larger spread





Understanding energy deposits in calorimeter (affect missing E_T determination through hadronic recoil)

Fit electrofaible



$$m_H = 84^{+34}_{-26} \text{ GeV}$$
$$< 154 \text{ GeV @ 95\% cl}$$

what if ?

	today	$m_H = 84^{+34}_{-26}$ GeV	< 154 GeV @ 95% cl
A	δM_t 1.2 → 1.0 GeV	$m_H = 84^{+34}_{-26}$ GeV	< 153 GeV @ 95% cl
B	δM_W 25 → 15 MeV	$m_H = 71^{+25}_{-20}$ GeV	< 119 GeV @ 95% cl
C	for both A and B	$m_H = 71^{+24}_{-19}$ GeV	< 117 GeV @ 95% cl

assumes central values unchanged

maybe possible with Tevatron

also important to reduce error on $\Delta\alpha^{(5)}_{had}(M_Z)$

ICHEP08 Global Electroweak fits and the Higgs Boson Mass Pete Renton Jul/Aug 2008

Conclusions :

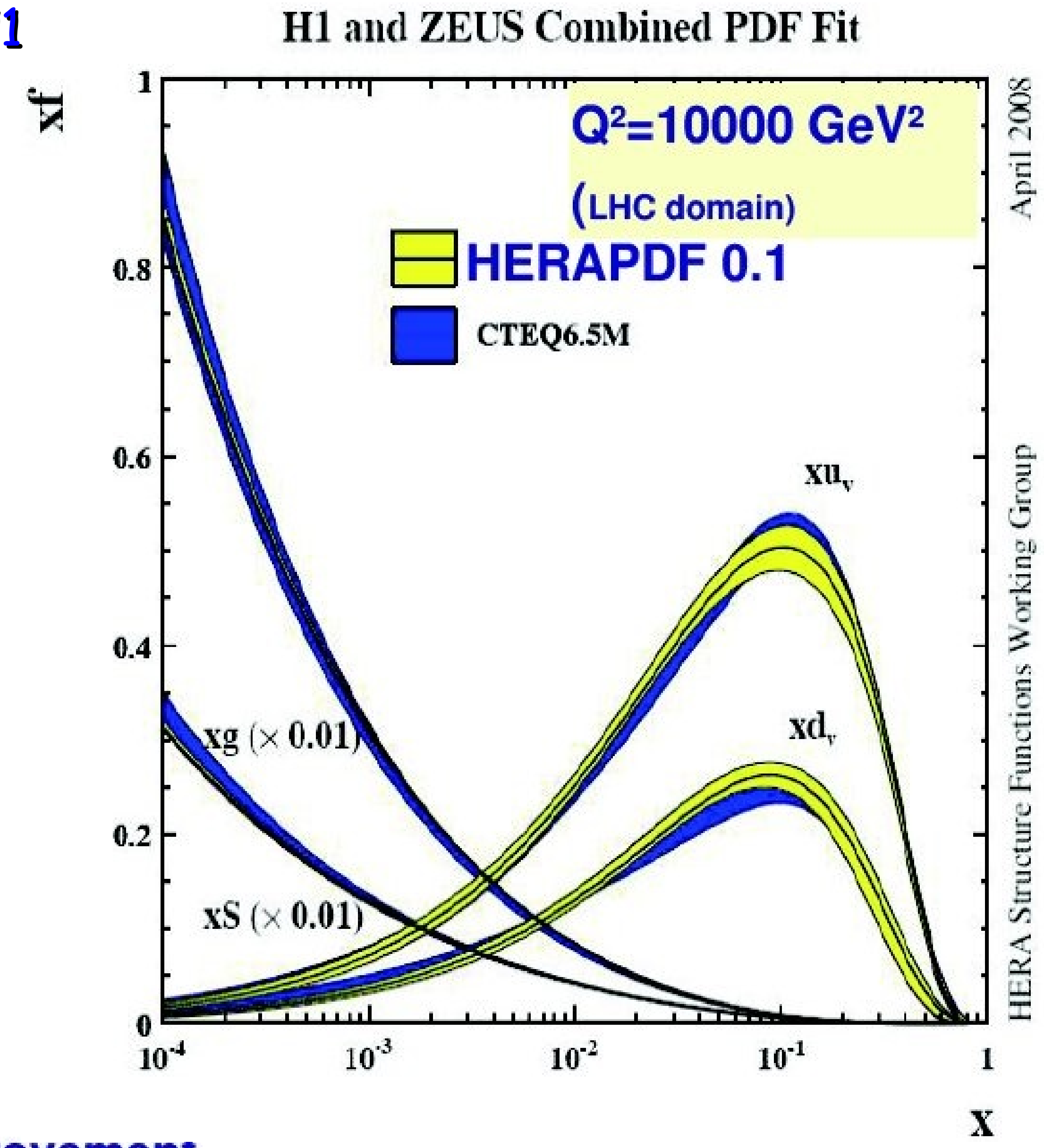
Mesure du W au TeVatron très attendu

Mesure de $\Delta\alpha$ à améliorer

modeling QCD

PDF from Hera

Combinaison des données Zeus + H1



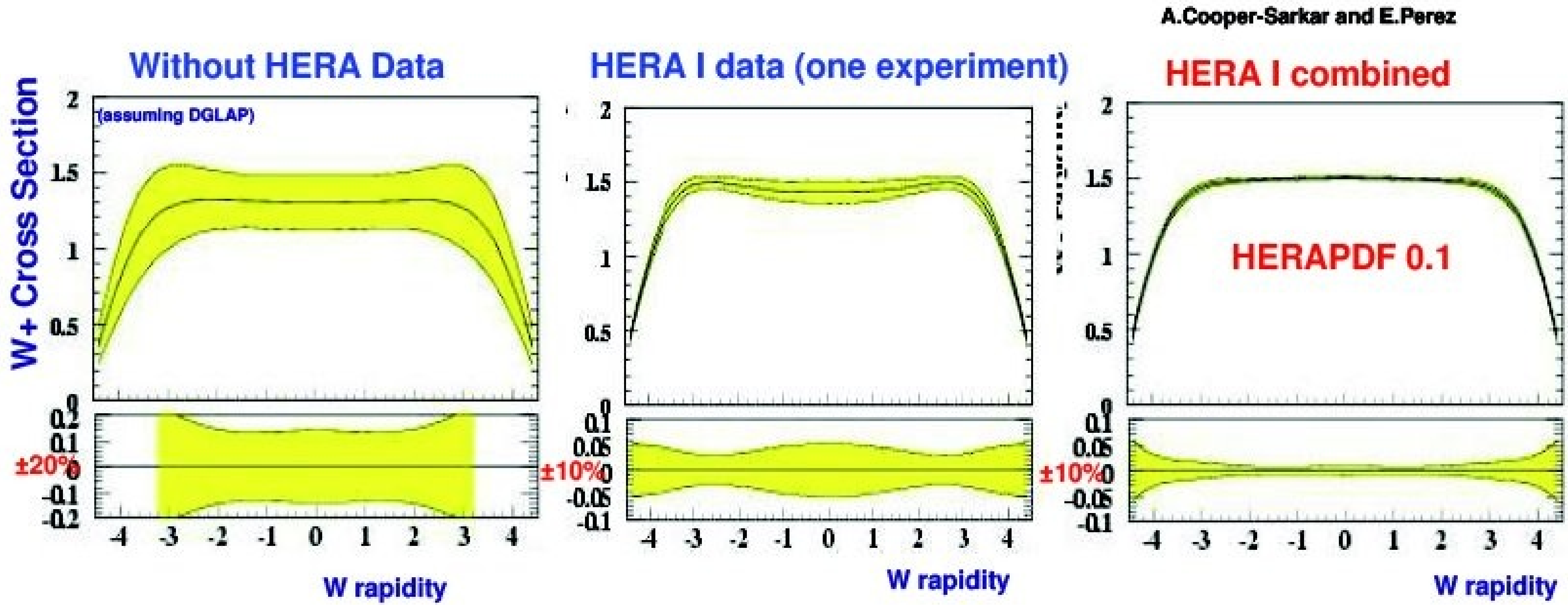
Improvement most notably at low x

The data precision is driving the improvement

Treatement of errors and parametrisation issues

PDF from HERA (2)

Predictions for W/Z boson production at LHC



Only the fit uncertainty shown here, no model variations

The step in experimental precision is significant ~2%

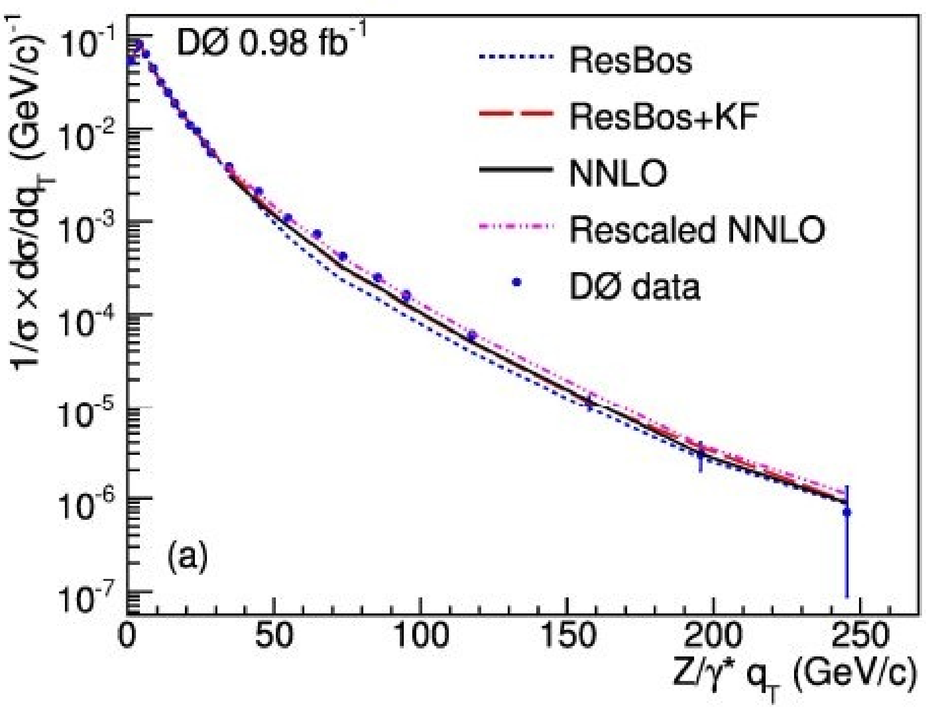
More HERA data to be included:

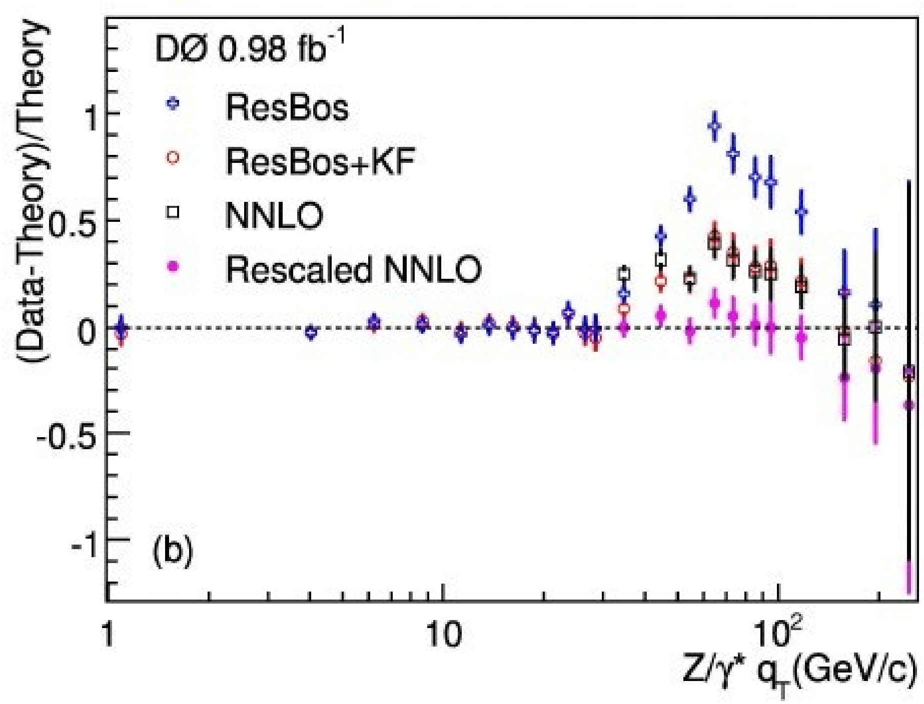
low Q2, HERA II data high x/Q², jets => ultimate precision

DØ: Zp_T Distribution Comparison with NNLO

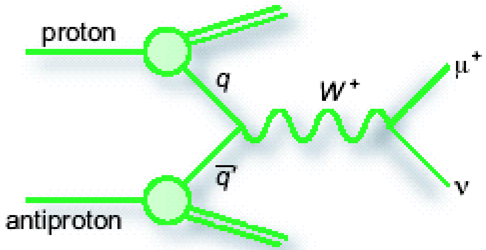
Above 30 GeV Z p_T distribution perturbative calculations describe the data better than the form factor approach used in the Resbos generator

NNLO calculation describes the shape, but not the normalization (rescale cross section by 25%)



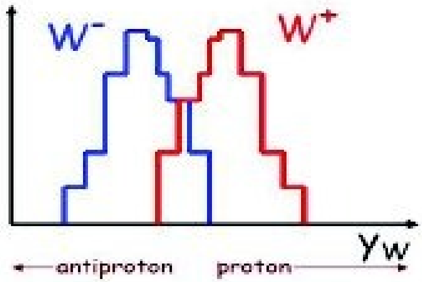


PRL 100, 102002 (2008)



W asymmetry at Tevatron

$d\bar{u} \rightarrow W^-$ $u\bar{d} \rightarrow W^+$

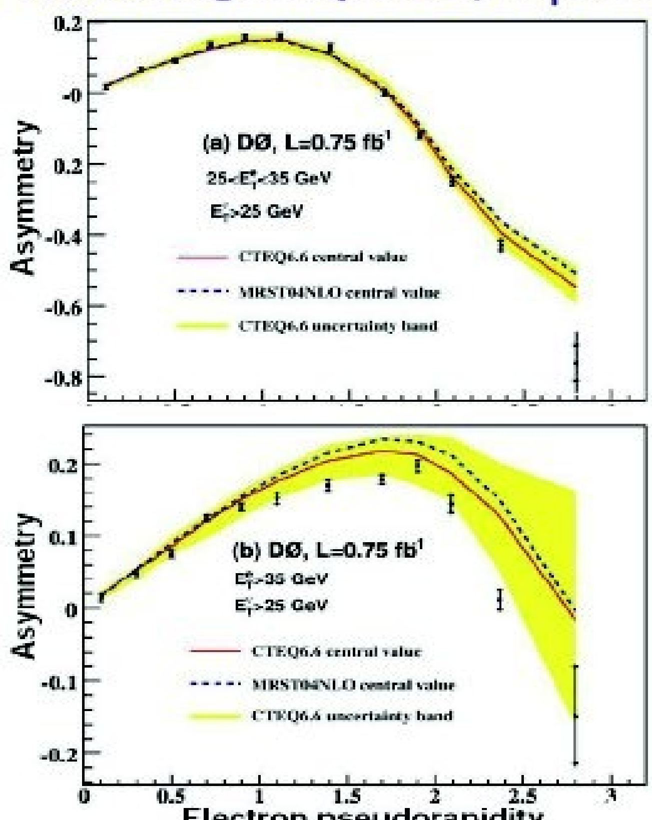


$$A_W(y) = \frac{\sigma^{W^+} - \sigma^{W^-}}{\sigma^{W^+} + \sigma^{W^-}} \sim \frac{d}{u}$$

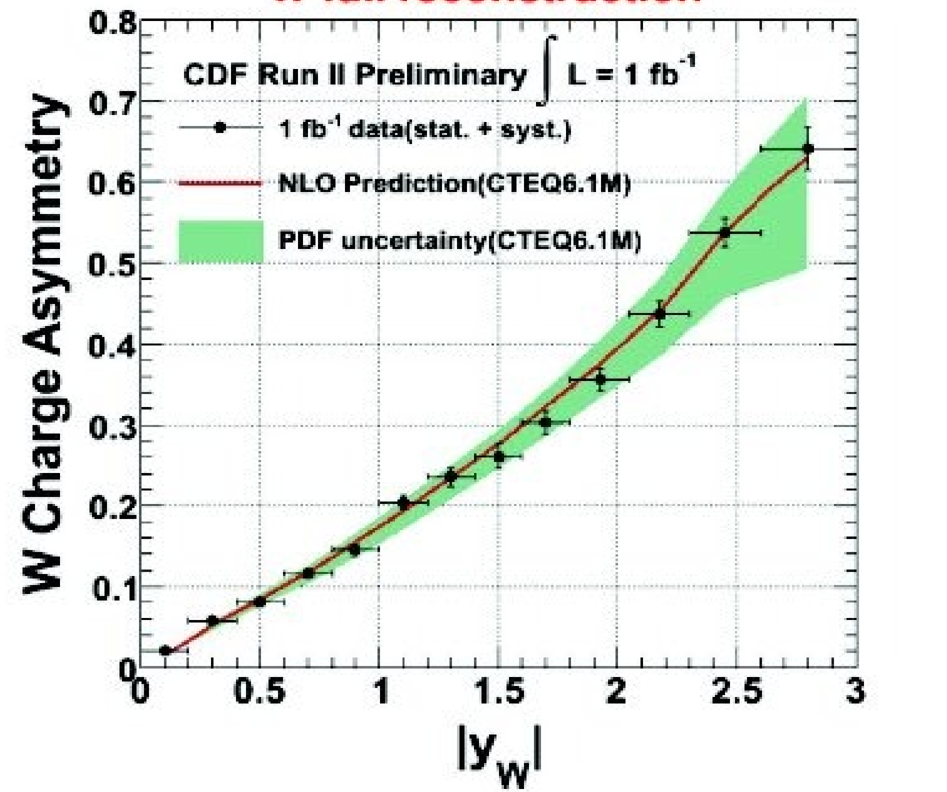
$$Q^2 = M_W^2 \quad x = \frac{M_W}{\sqrt{s}} e^{y_W}$$

$$0.002 < x < 0.8(1)$$

Use charged leptons (2 E_T bins)



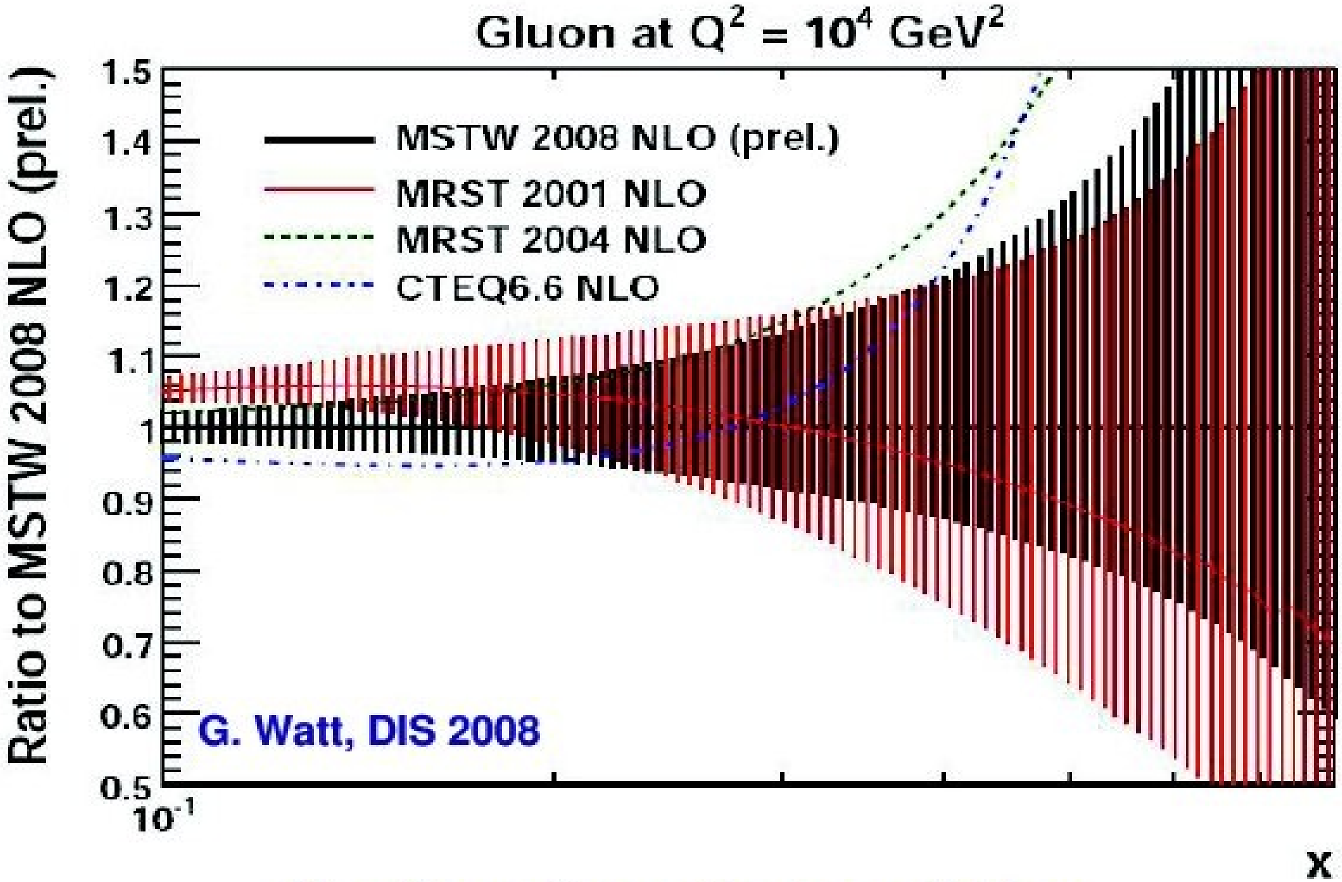
W full reconstruction



Expect to improve PDFs improvements at high x

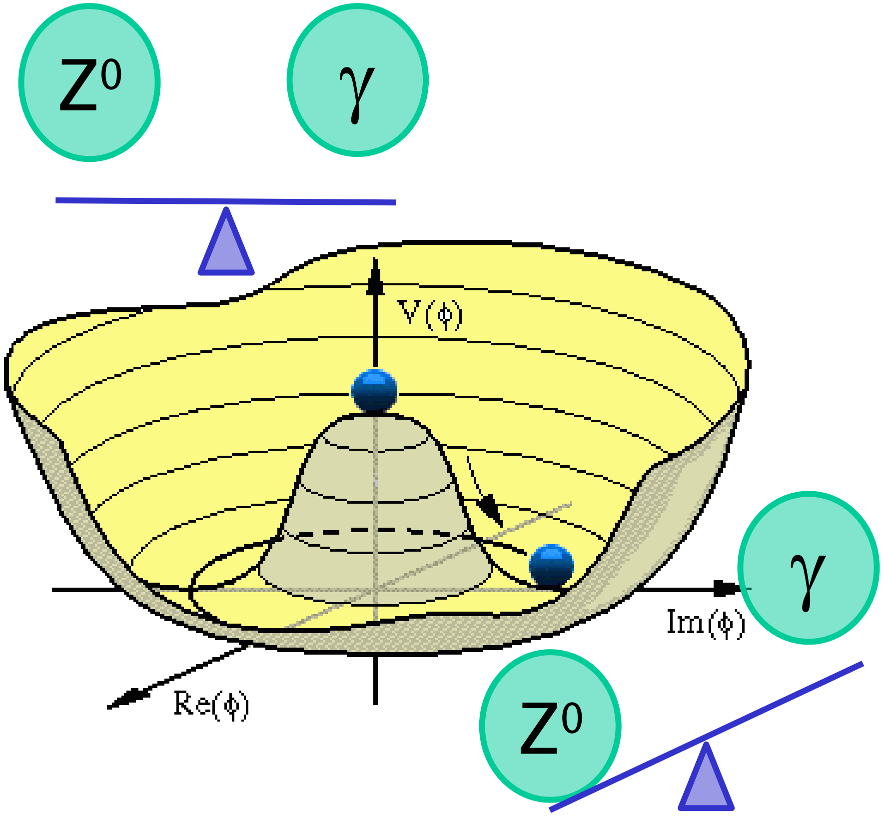
The gluon at high x

MSTW 2008 analysis (including CDF and D0 run II data jets, W/Z asymmetries)



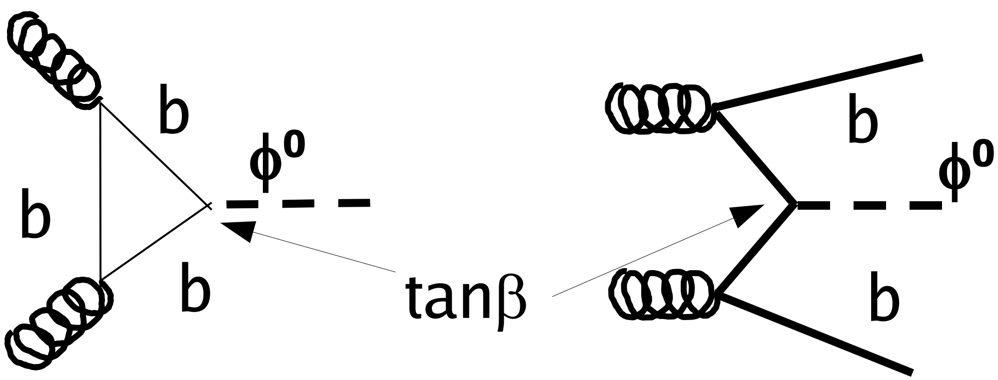
New data prefer smaller gluon at high x

HIGGS



SUSY Higgs at large tan(β)

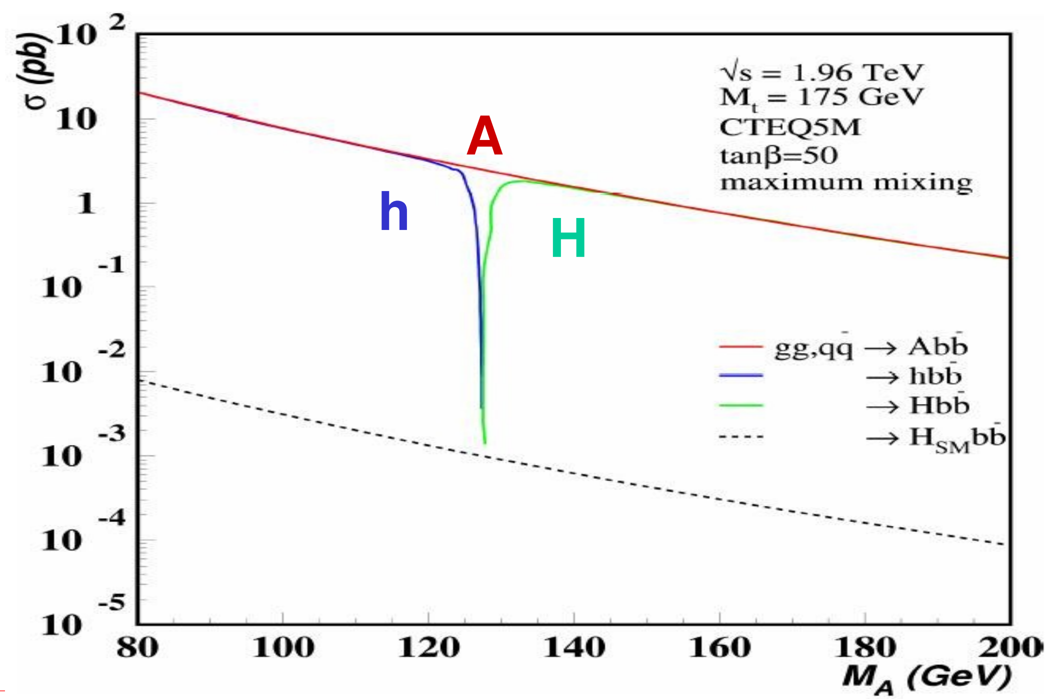
- In MSSM 2 Higgs doublets
  - tanβ= v2/v1 ratio of vev's
  - 5 Higgs : 3 neutral (h,H,A) and 2 charged (H^+,H^-)
- At large tan(β) : 2 neutral ~degenerated in mass with coupling ~tan(β)
- cross-section enhanced by $\tan^2\beta$ wrt SM
  - decays to $b\bar{b}$ (90%) or $\tau^+\tau^-$ (~10%)



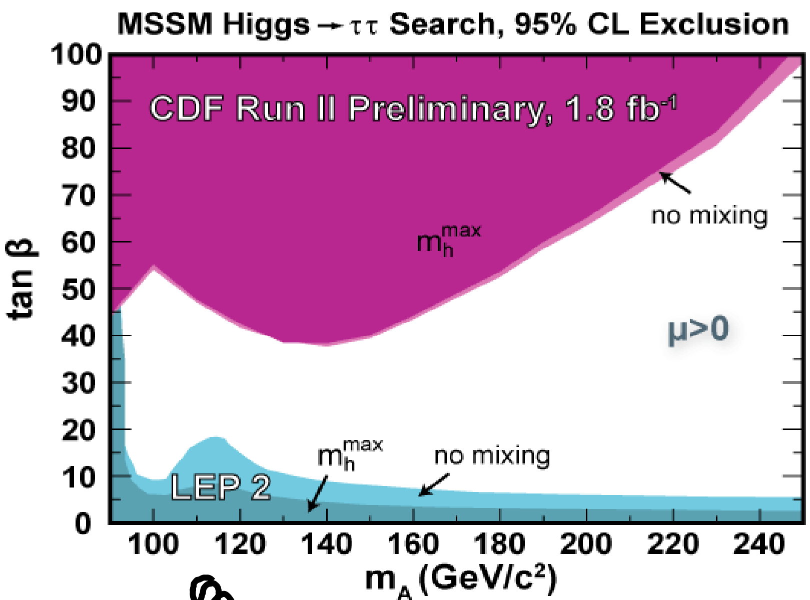
channel: $\tau^+\tau^-$

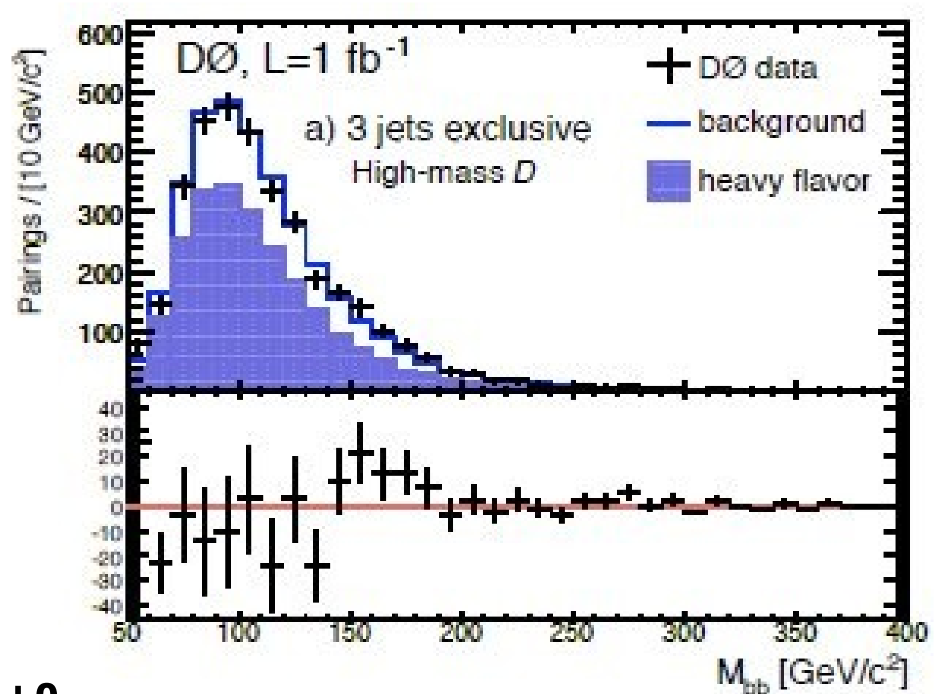
channels: $b\bar{b}b\bar{b}$

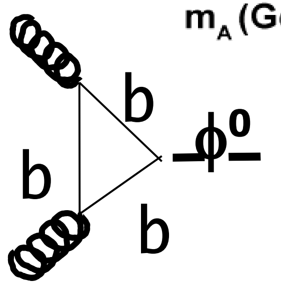
$b\bar{b}\tau^+\tau^-$

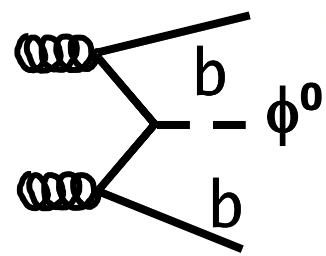


SUSY Higgs à grand tan(beta)



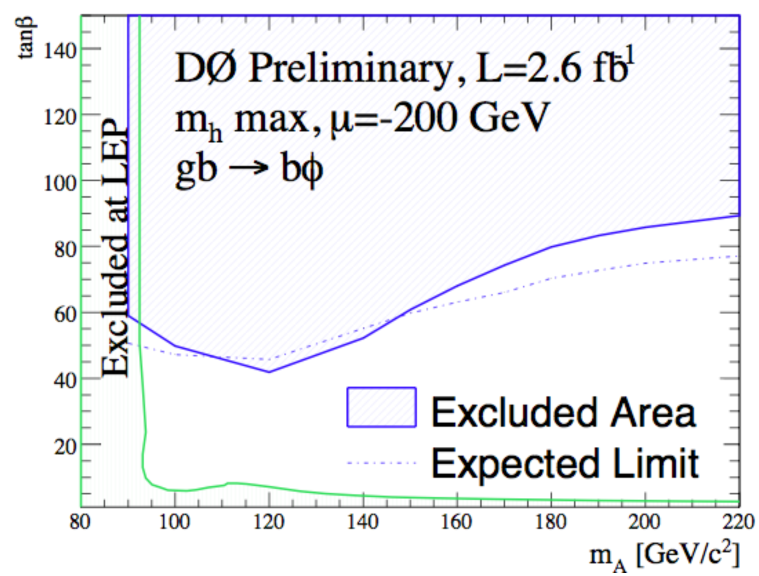






channel:
$\tau^+\tau^-$

channels:
$b\bar{b}b\bar{b}$



- Commence à exclure des zones interessantes: tan(beta)~ 40 ~ M_b/M_{top}

La physique du B à la recherche du Higgs

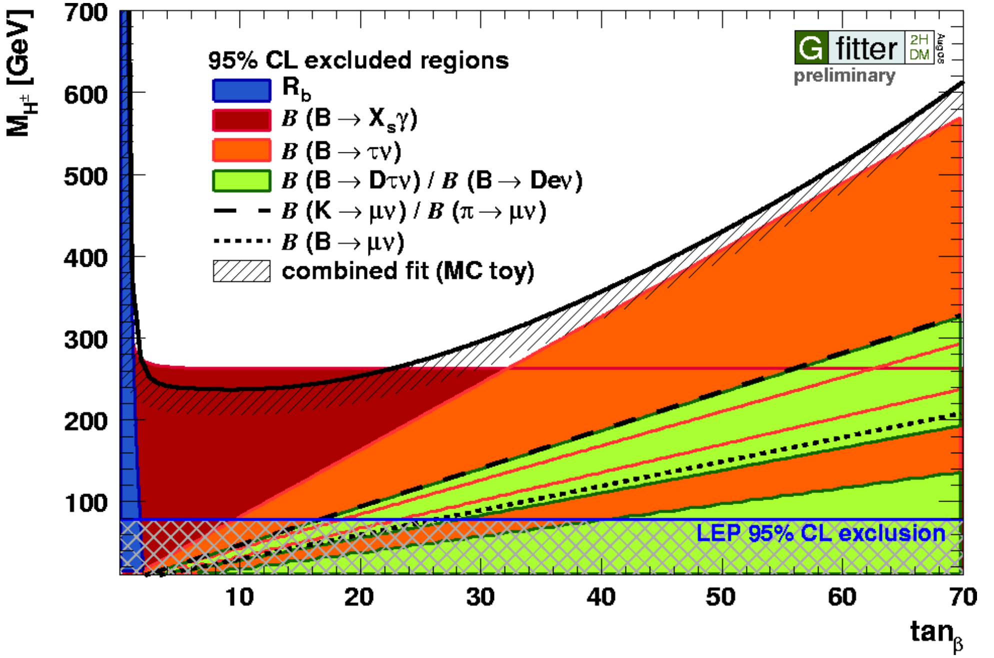
- Implementation of 2HDM (Type-II) as first extension of SM
- 2HDM (Type-II)
  - additional Higgs doublet
  - one doublet couples to u-type, one doublet couples to d-type quarks
  - 6 free parameters $\rightarrow M_{H\pm}$, M_{A0}, M_{H0}, M_h, $\tan\beta$, $|\alpha|$
- so far: only looked at processes sensitive to charged Higgs

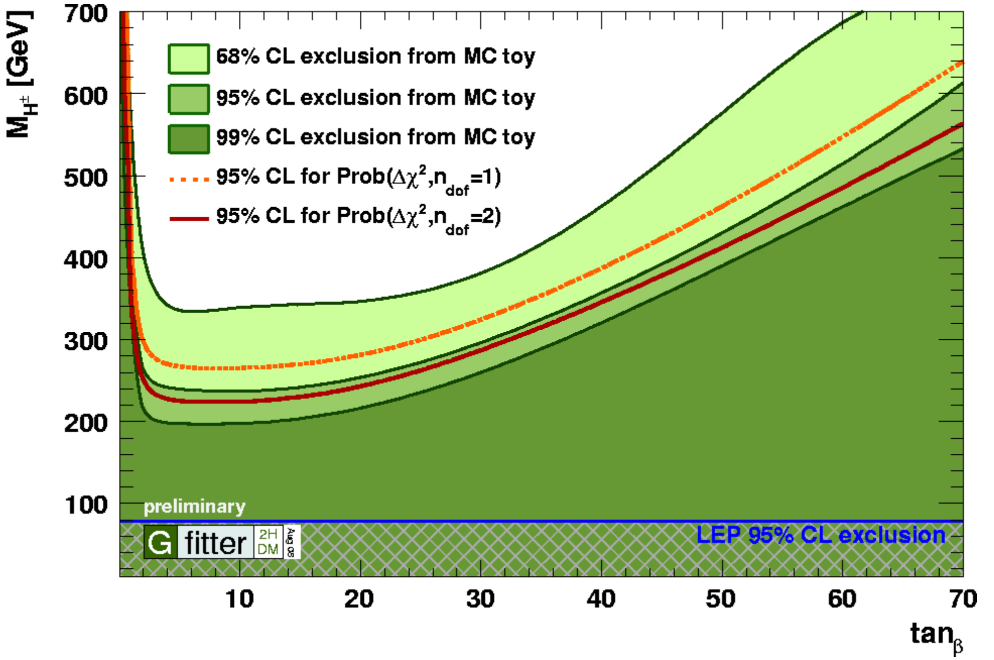
$\rightarrow M_{H\pm}$, $\tan\beta$

observable	input value	exp. ref	calculation
R_b^0	0.21629 ± 0.00066	[ADLO, Phys. Rept.427, 257 (2006)]	[H. E. Haber and H. E. Logan, Phys. Rev. D62, 015011 (2000)]
BR ($B\rightarrow X_s\gamma$)	$(3.52\pm0.23\pm0.09)\cdot10^{-4}$	[HFAG, latest update]	[M. Misiak et al., Phys. Rev. Lett. 98, 022002 (2007)]
BR ($B\rightarrow\tau\nu$)	$(1.41\pm0.43)\cdot10^{-4}$	[HFAG, latest update]	[W. S. Hou, Phys. Rev. D48, 2342 (1993)]
BR ($B\rightarrow\mu\nu$)	$>1.7\cdot10^{-6}$ at 90% CL	[HFAG, arXiv:0704.3575]	[W. S. Hou, Phys Rev. D48, 2342 (1993)]
BR ($K\rightarrow\mu\nu$)/ BR($\pi\rightarrow\mu\nu$)	1.004±0.007	[FlaviaNet,, arXiv:0801.1817]	[FlaviaNet, arXiv:0801.1817]
BR($B\rightarrow D\tau\nu$)/ BR($B\rightarrow De\nu$)	0.416±0.117±0.052	[Babar, Phys. Rev. Lett 100, 021801 (2008)]	[J. F. Kamenik and F. Mescia, arXiv:0802.3790]

2HDM fit: fit results

- Overlay of individual 95% CL excluded regions
  - assuming n_{dof}=1 and 2-sided limits
- Combined fit:
  - excluded area depends on assumptions (n_{dof}=1, n_{dof}=2)
  - resolved by MC toy study
  - 2-sided limits
  - χ^2_{min}=2.3 at M_H=850 and tanβ=10
- Excluded at 95% CL:
  - small tanβ
  - for all tanβ
    - M_H< 240 GeV
    - M_H< (8.6 tanβ) GeV

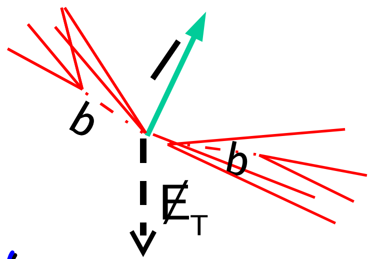




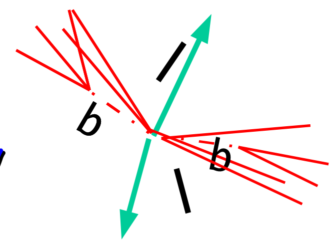
Standard Model Higgs at the Tevatron: main channels

For $M_H < 130$ GeV

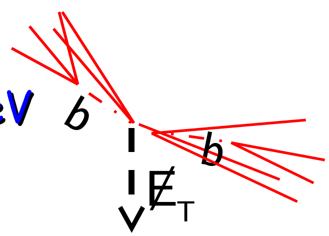
- pp->WH -> Wbb
  - eν bb, μν bb:
    - 2 b-jets ~ 40 GeV
    - 1 lepton ~ 40 GeV $\not{E}_T$ ~40 GeV



- pp->ZH-> Zbb
  - ee bb, μμ bb
    - 2 b-jets ~ 50 GeV
    - 2 leptons ~ 40GeV

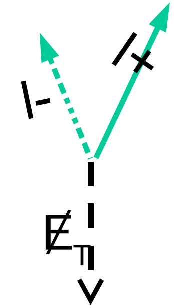


  - νν bb:
    - 2 b-jets ~ 50 GeV
    - $\not{E}_T$ ~60 GeV

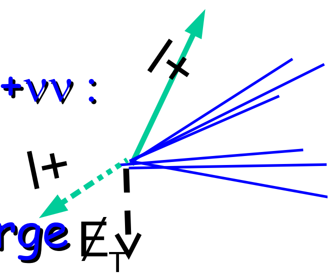


For $M_H > 130$ GeV

- gg->H->WW*
  - eνeν, μνμν, eνμν
  - 2 leptons ~ 40 GeV
  - $\not{E}_T$ ~60,
  - small Δφ(l+,l-) (H is scalar)

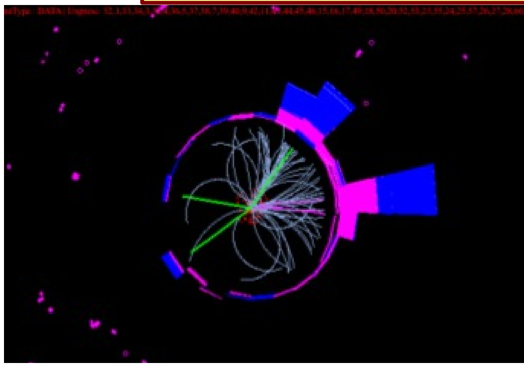


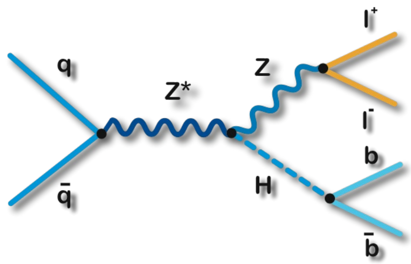
- pp->WH -> WWW*
  - ee+jj+νν , eμ+jj+νν, μμ+jj+νν :
    - $\not{E}_T$ ~40 GeV
    - 2 leptons of same charge



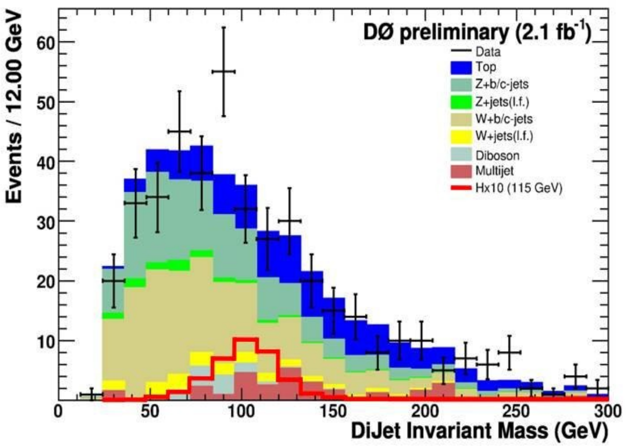
Analyses Higgs de plus en plus sophistiquées:
1. multivariate discriminant(s):
   Neural Net, Decision Tree, Matrix Element
2. contenus en quarks b
3. multiplicités en jets

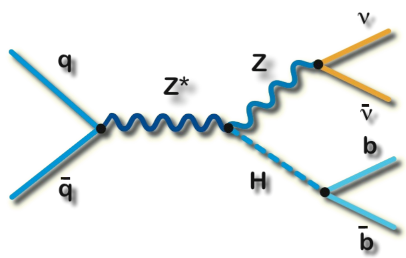
Low Mass Higgs M_H<130 GeV



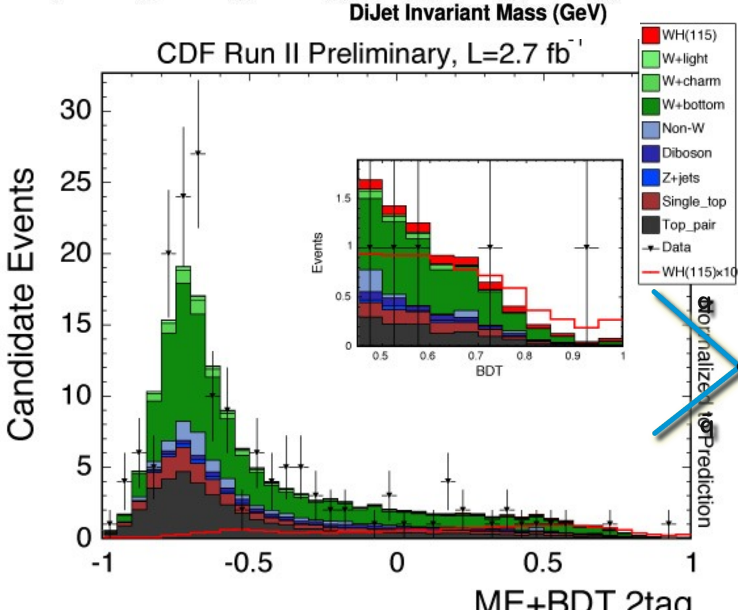


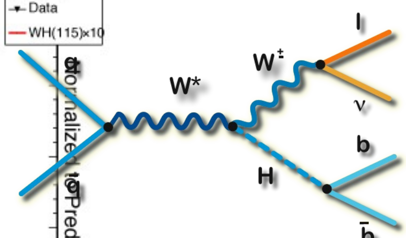
Analysis	Lum (fb^{-1})	Higgs Events	Exp. Limit	Obs. Limit
CDF NN	2.4	1.8	11.8	11.6
CDF ME(120)	2.0	1.4	15.2	11.8
DØ NN,BDT	2.3	2.0	12.3	11.0





Analysis	Lum (fb^{-1})	Higgs Events	Exp. Limit	Obs. Limit
CDF NN	2.1	7.3	6.3	7.9
DØ BDT	2.1	3.7	8.4	7.5

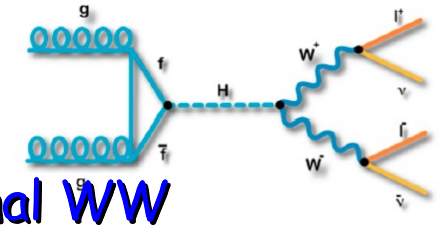




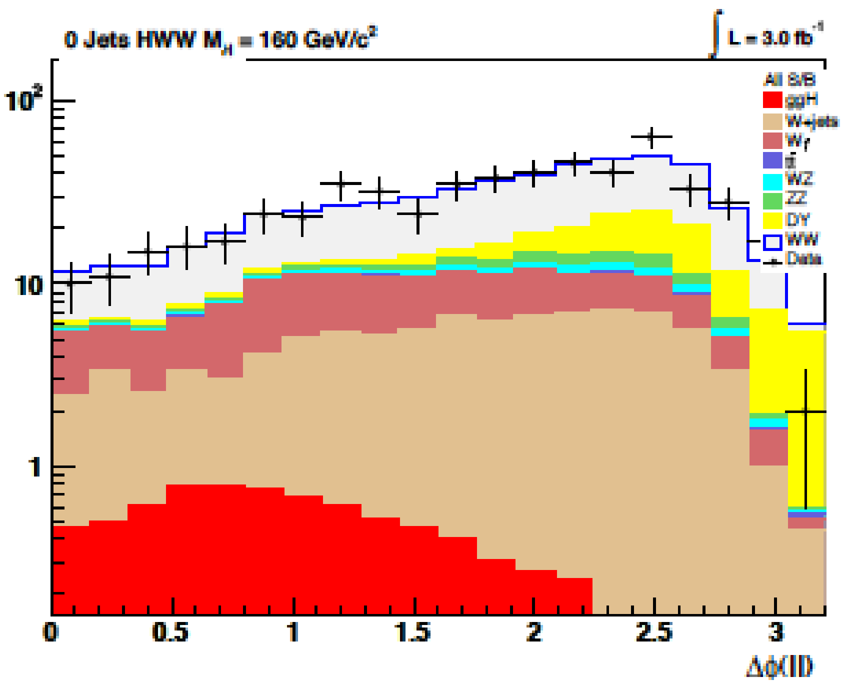
Analysis	Lum (fb^{-1})	Higgs Events	Exp. Limit	Obs. Limit
CDF NN	2.7	8.3	5.8	5.0
CDF ME+BDT	2.7	7.8	5.6	5.7
DØ NN	1.7	7.5	8.5	9.3

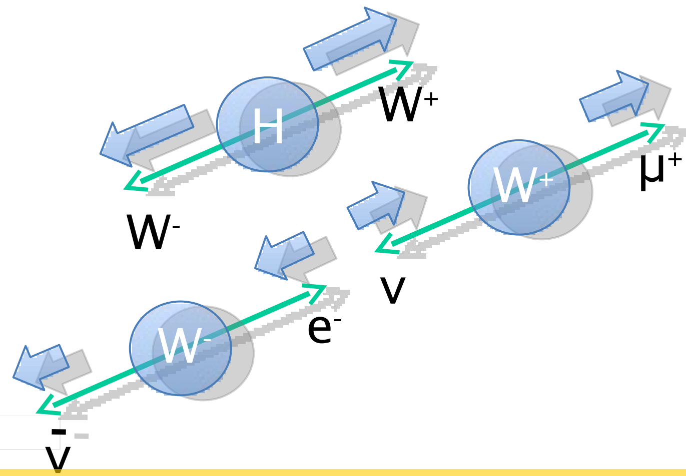
NB: limit=σ(excluded @95%)/σ (SM)

High mass Higgs M_H>130 GeV



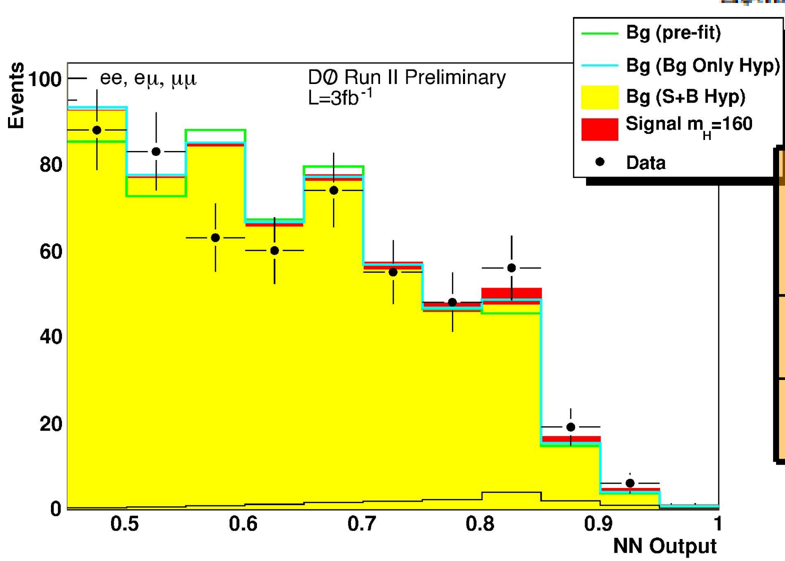
- Mise à jour avec le maximum de stat = 3fb^{-1} du (golden) canal WW



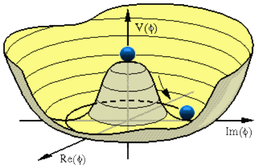


Spin correlation: Charged leptons go in the same direction

Both experiments Approaching SM sensitivity!

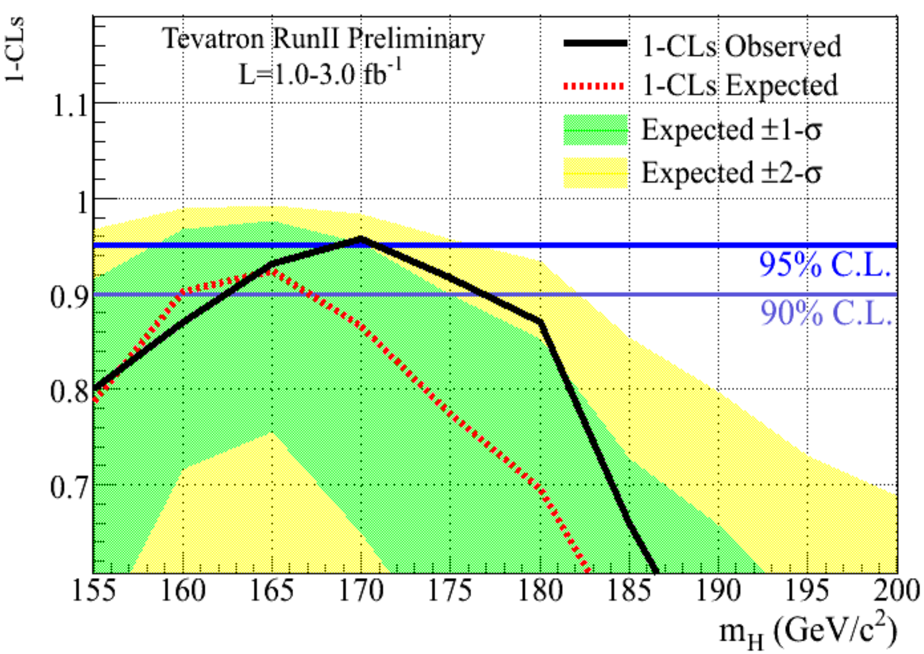


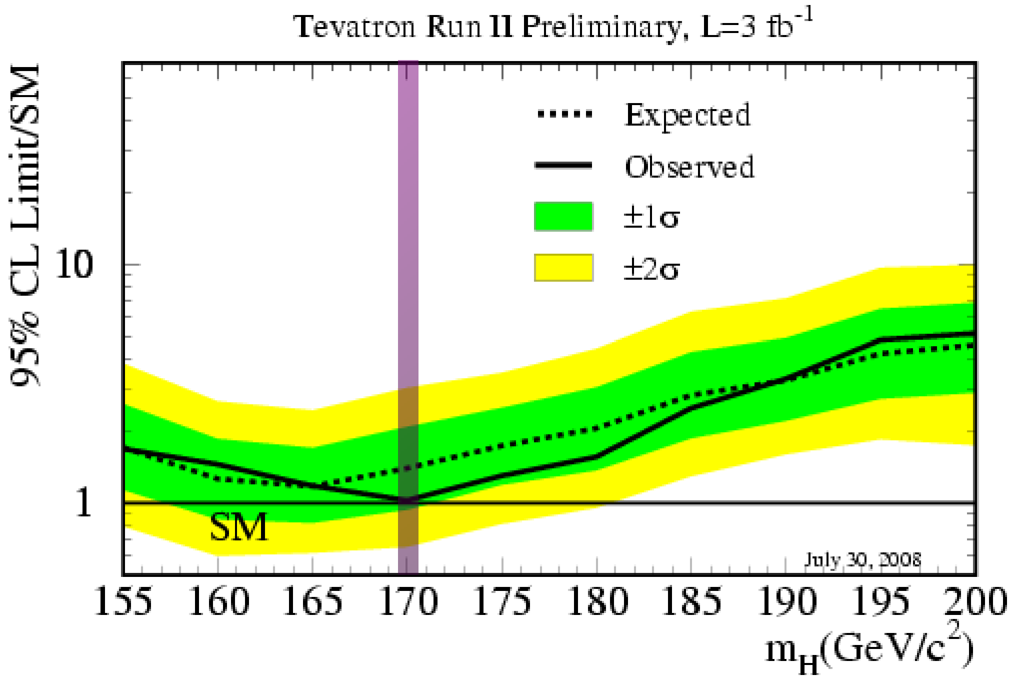
Analysis	Lum (fb^{-1})	Higgs Events	Exp. Limit	Obs. Limit
CDF ME+NN	3.0	17.2	1.6	1.6
DØ NN	3.0	15.6	1.9	2.0



Combinaison SM Higgs du Tevatron

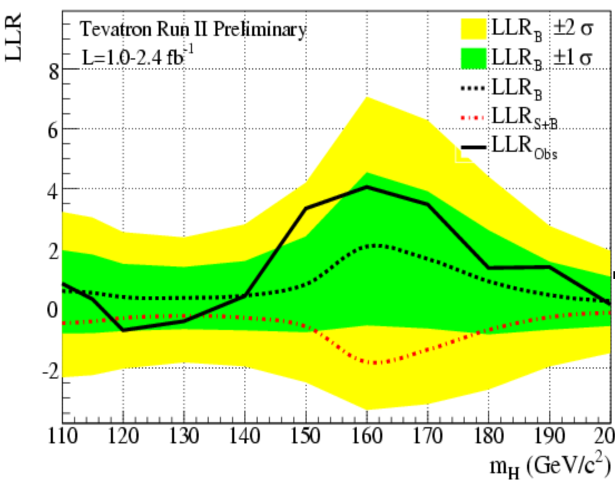
- Low mass combination difficult due to ~70 channels
  - Expected sensitivity of CDF/DØ combined: <3.0xSM @ 115GeV
- seule la combinaison haute masse mise à jour:
  - Premiere fois que le TeVatron est sensible au Higgs standard.
  - Exclusion de la masse 170 GeV @95% CL, . Pas d'intervalle exclu.
  - A 90% CL exclusion de 163-177 GeV.





Directe+indirecte

- La recherche directe de Higgs au TeVatron* peut être combinée aux mesures électrofaibles



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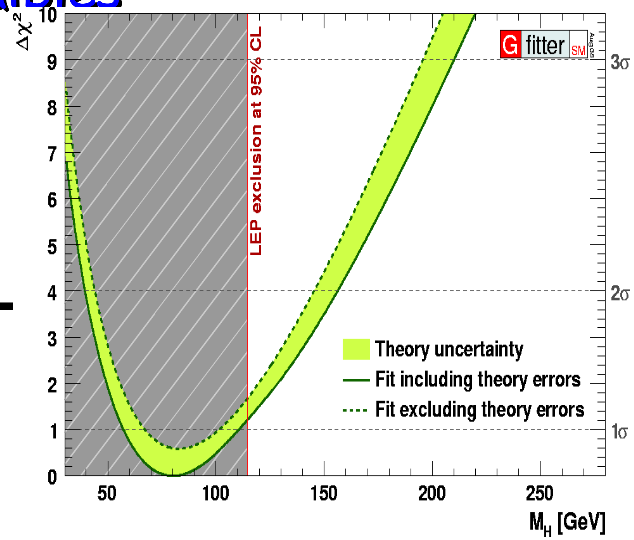

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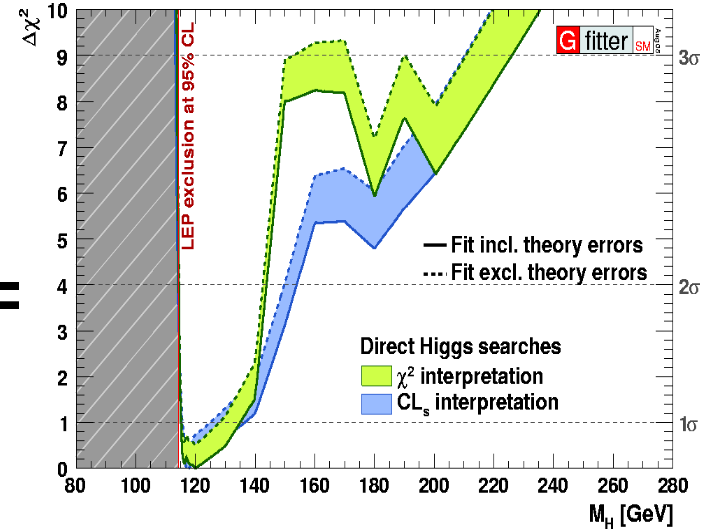
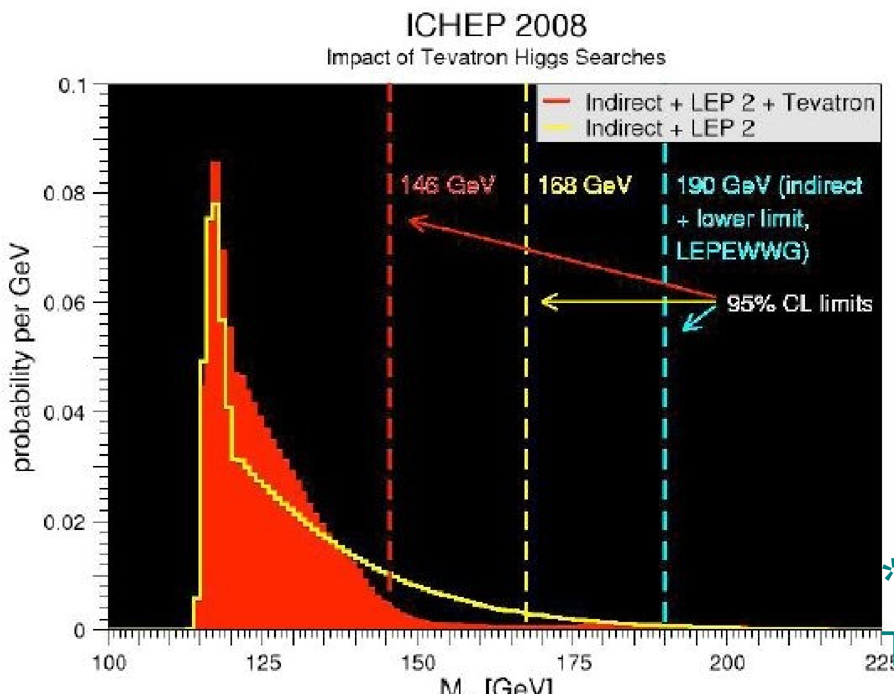


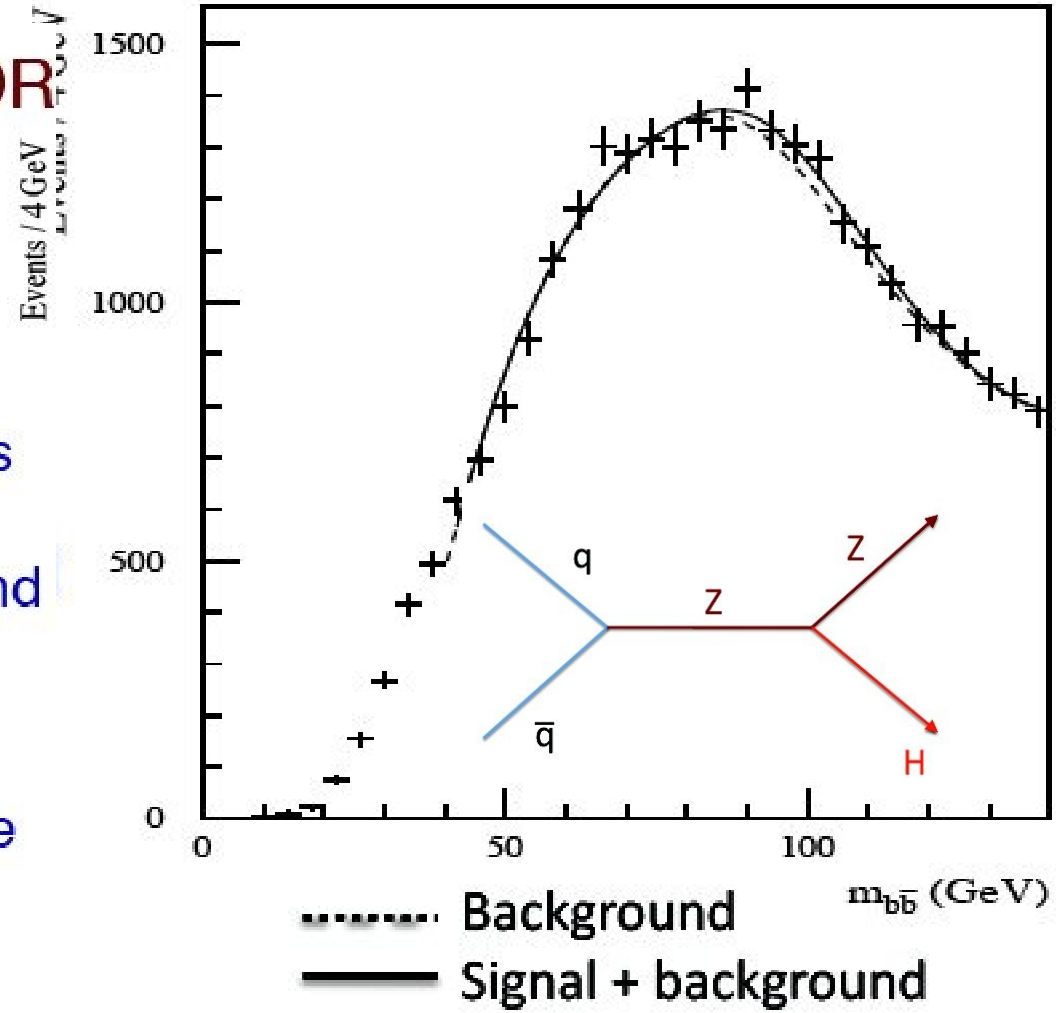


traduction en probabilité

- La recheche directe au TeVatron contraint les hautes masses.
- M_H < 146 GeV @ 95% CL

* résultats du Tevatron du printemps 2008

- Example: ATLAS Physics TDR (1999)
  - Poor acceptance
  - Cuts introduce artificial mass scale into the background
  - Top anti-top has a similar mass scale
  - Large combinatorial background
- Signal swamped by backgrounds
  - "very difficult … even under the most optimistic assumptions"

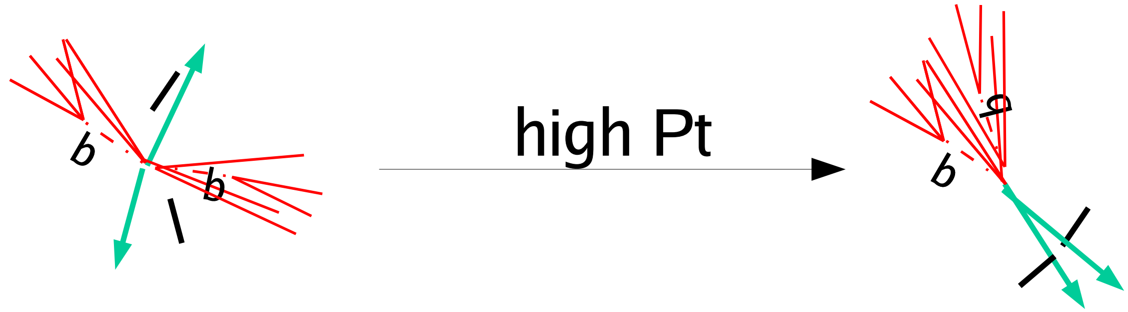


- **L'astuce**

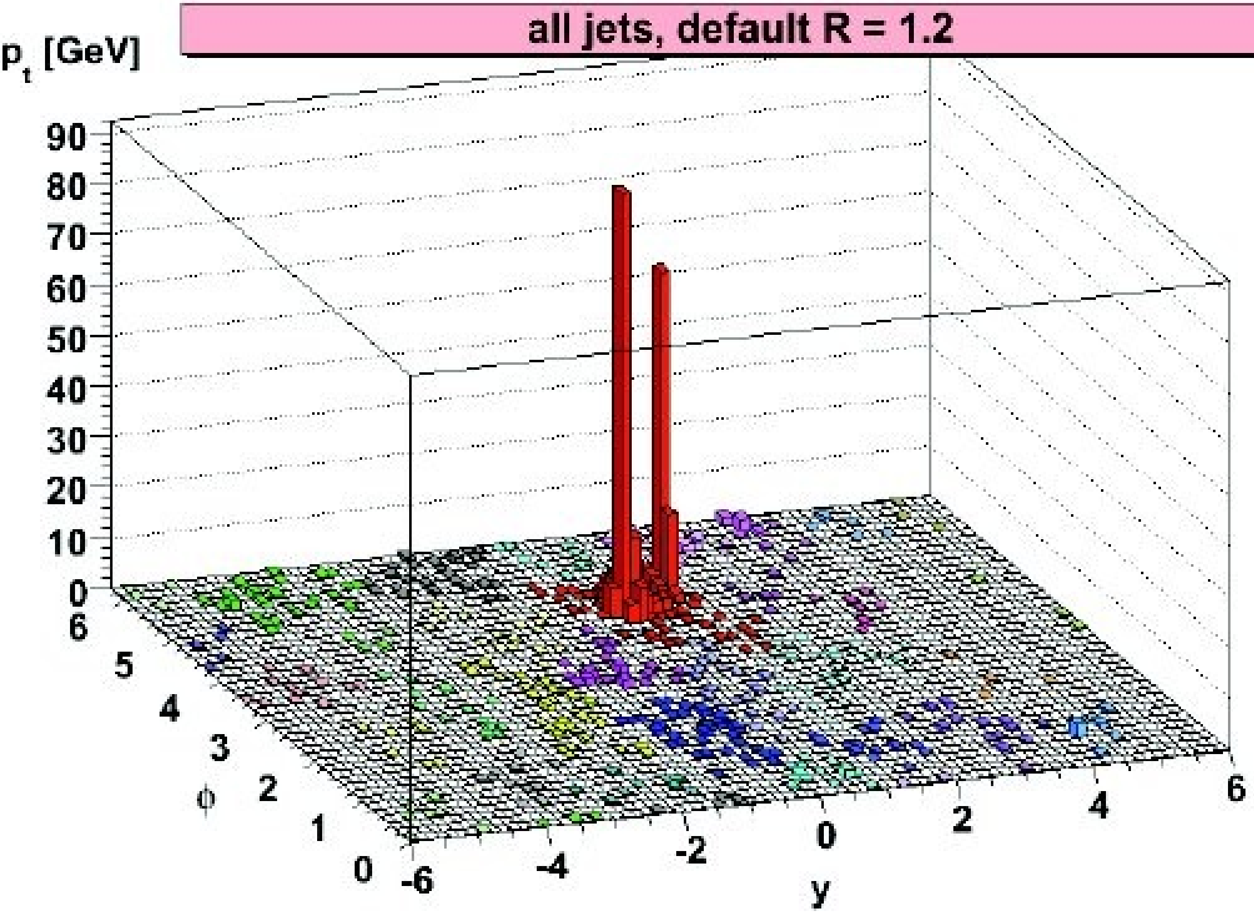
By requiring that the Higgs and Vector Boson have a high transverse momentum, we lose a factor of ~20 in cross section

  - However, much of this would have failed other analysis cuts anyway
  - Background cross sections fall by a bigger factor (typically t-channel not s-channel)

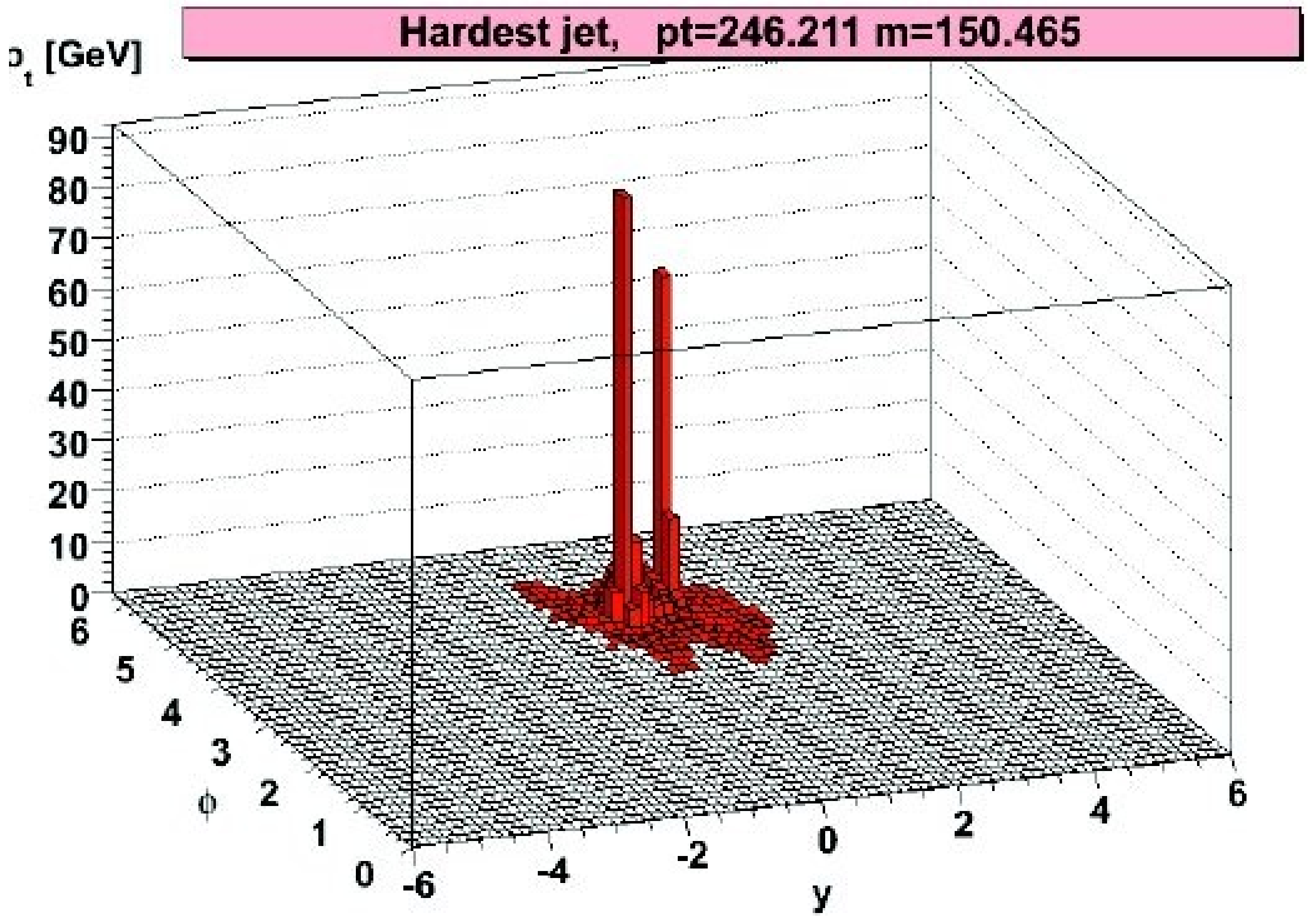
- **Le problème : La reconstruction standard ne voit qu'un seul jet**

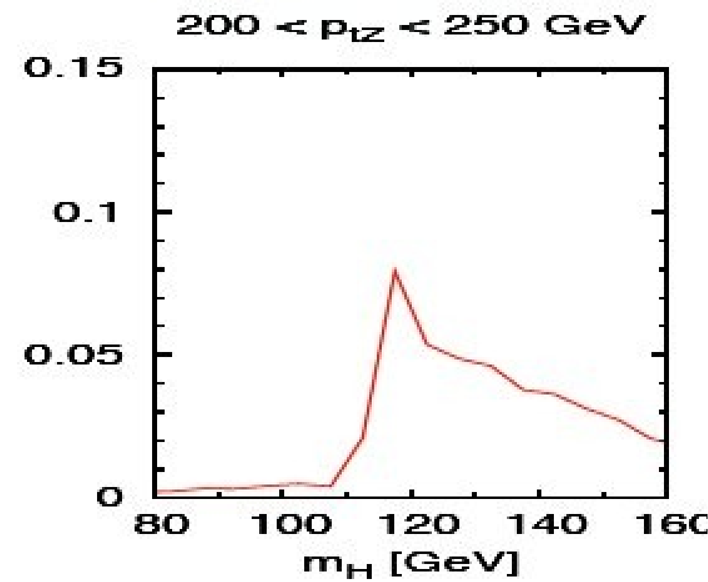


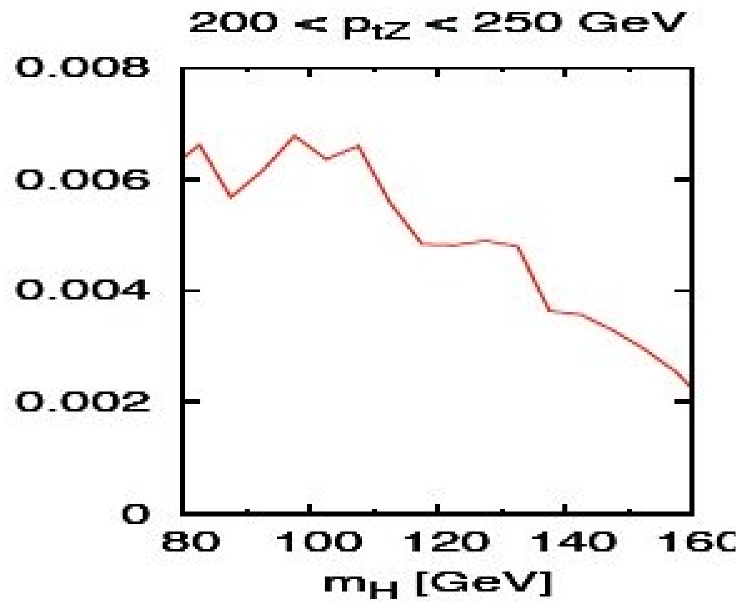
Improved subjet analysis



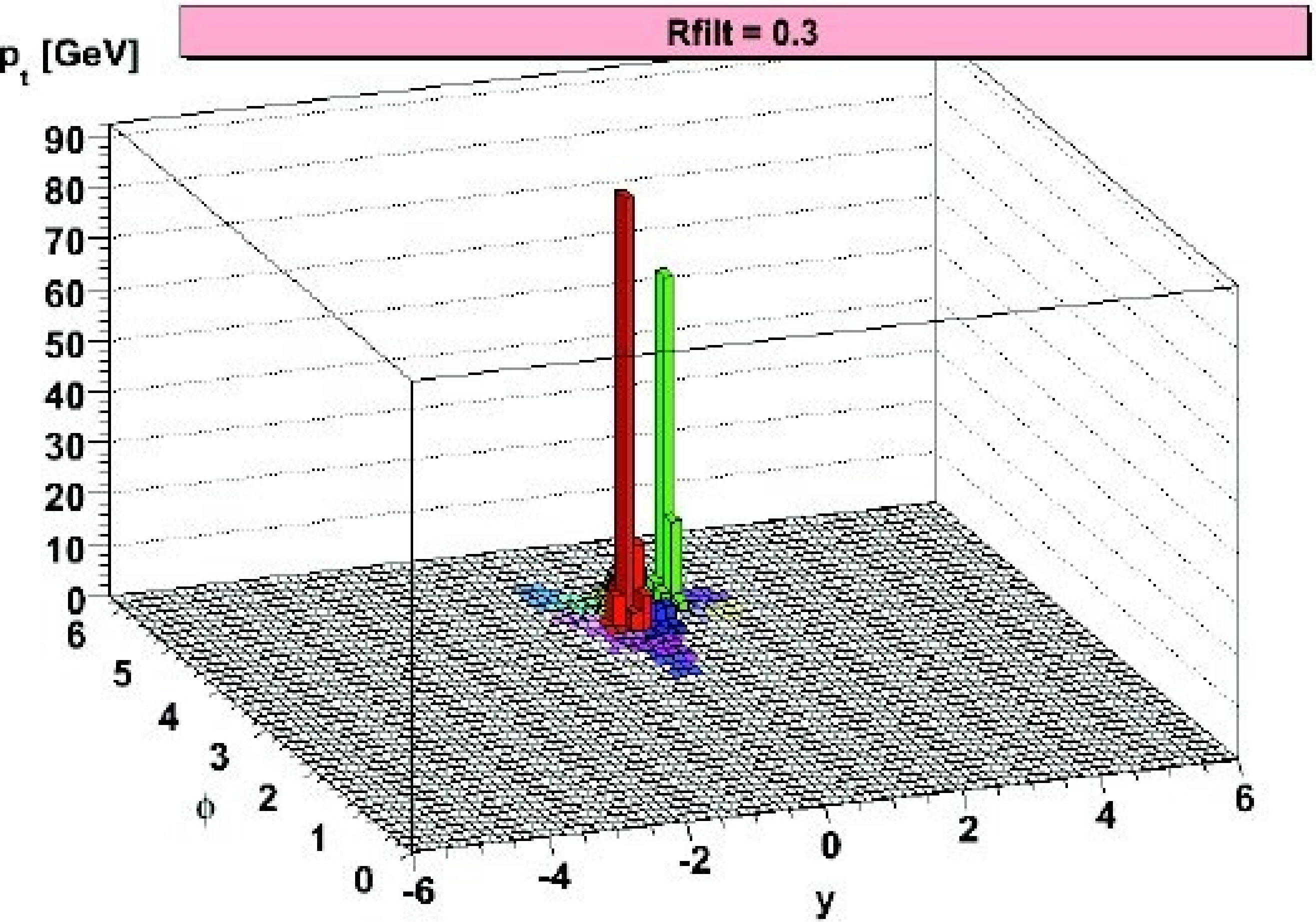
Improved subjet analysis

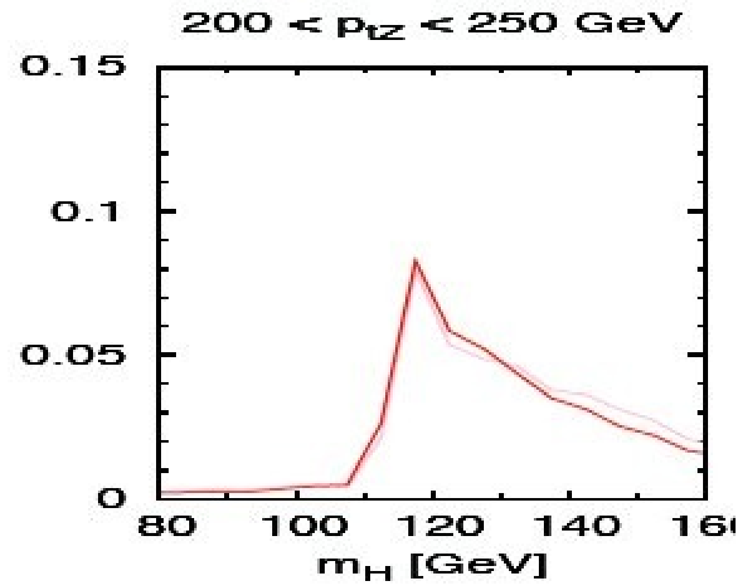


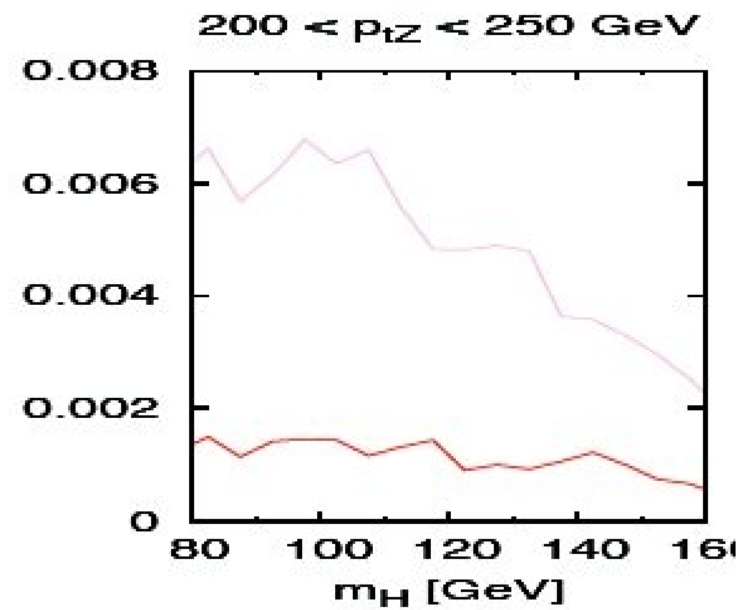




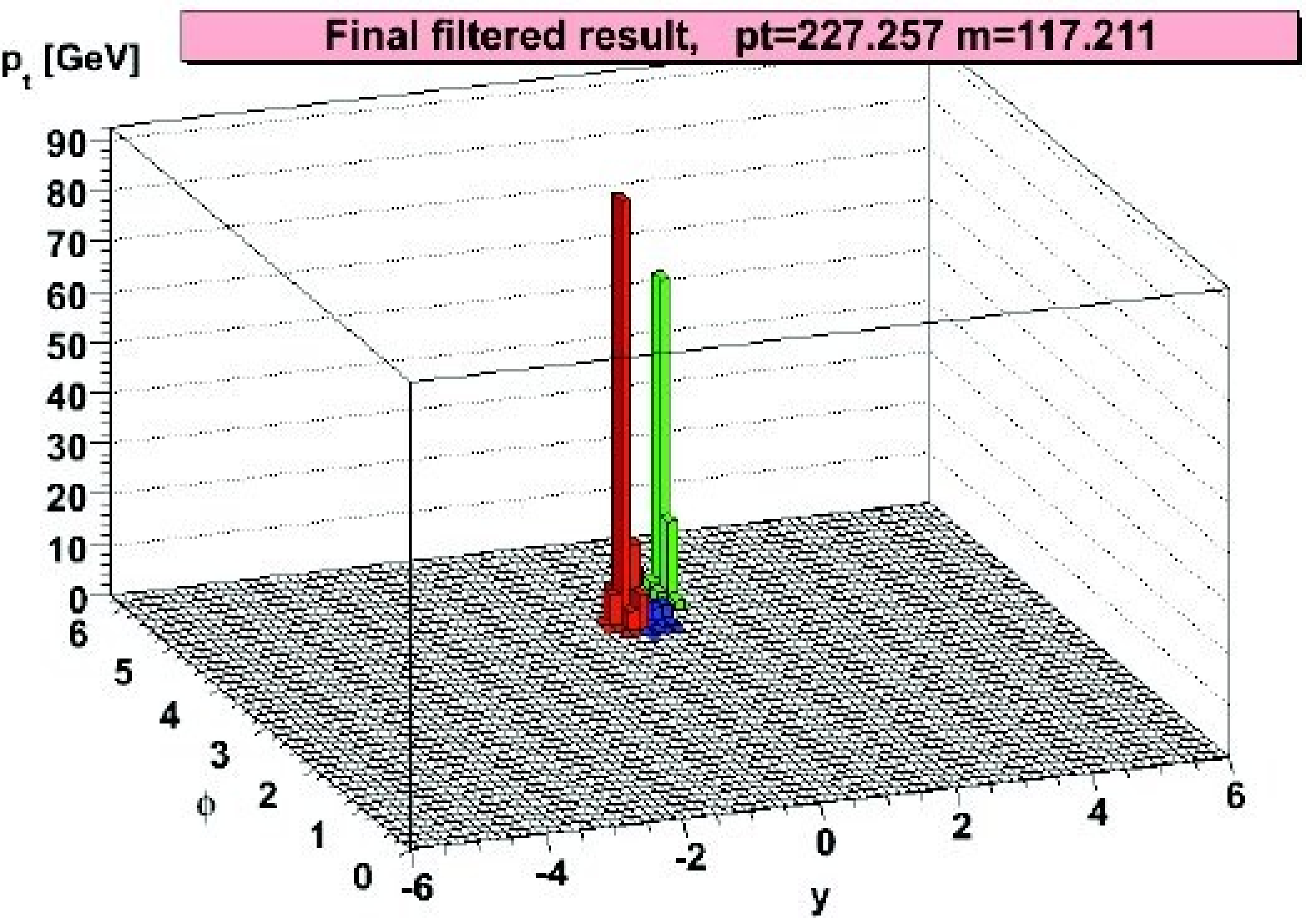
Improved subjet analysis

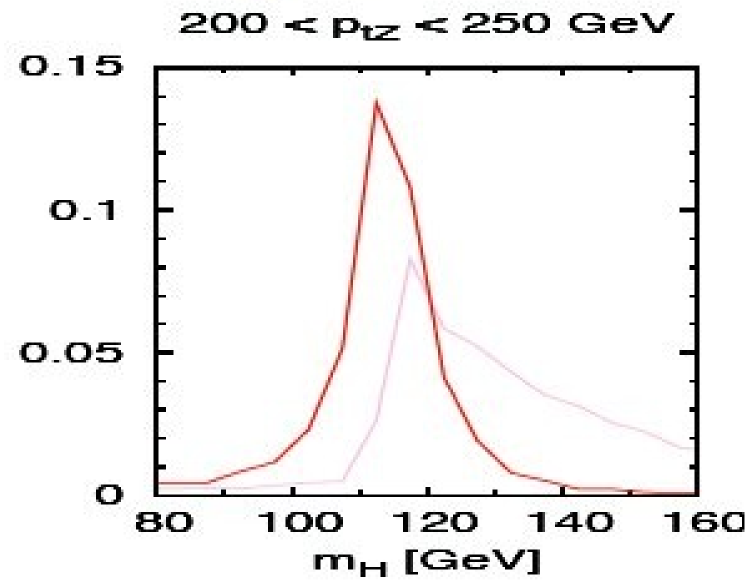


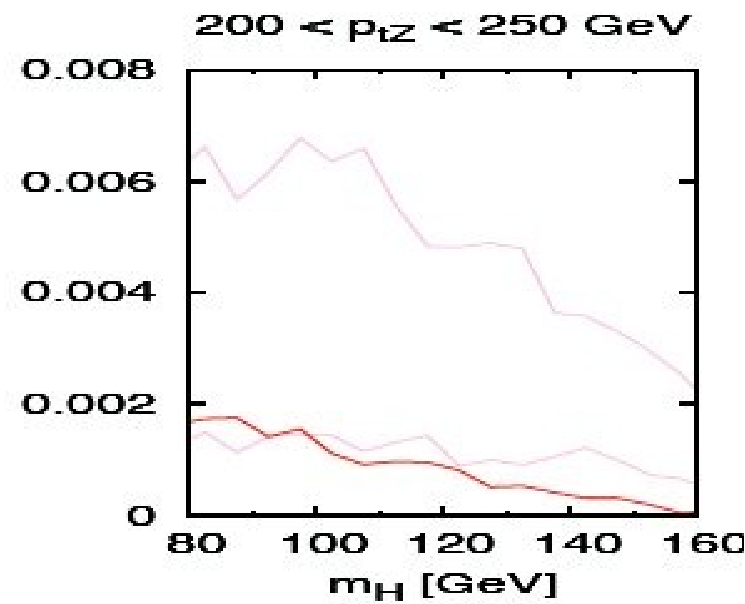




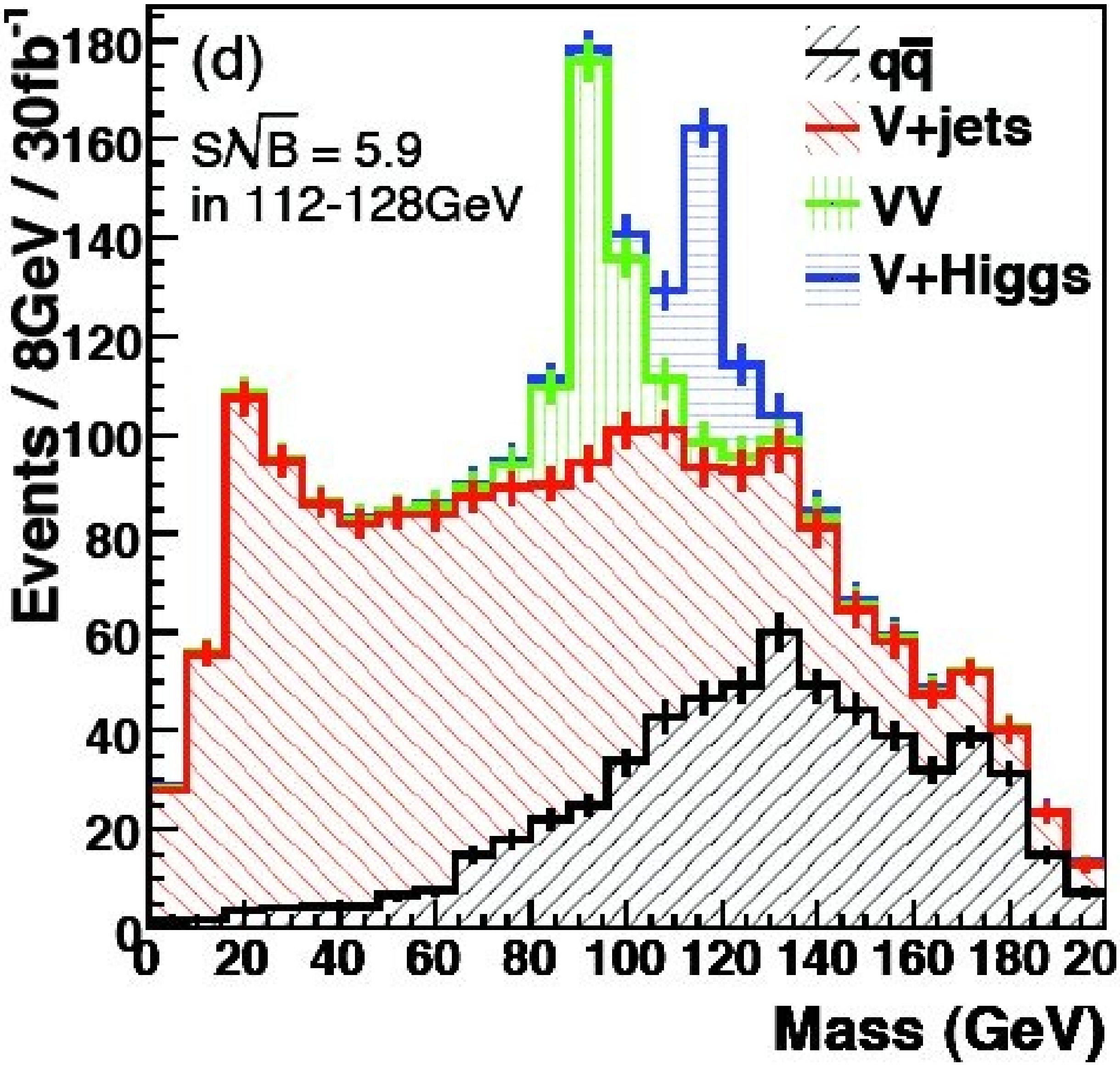
Improved subjet analysis







Combined result



- Note excellent Z peak for calibration
- 5.9 σ; potentially very competitive
- Also, unique information on relative coupling of H to Z and W.

sensibilité équivallente à VBF H-> $\tau\tau$

Beyond SM

Beyond the Standard Model…

The Standard Model:

The Poincaré group

In a 4-dimensional space-time

$SU(3)_c \times SU(2)_L \times U(1)_Y$
The Higgs mechanism

Three generations of quarks and leptons

Beyond the Standard Model:

Extend Poincaré ⇒ Supersymmetry
and include gravitation (Supergravity)

Increase the number of space dimensions

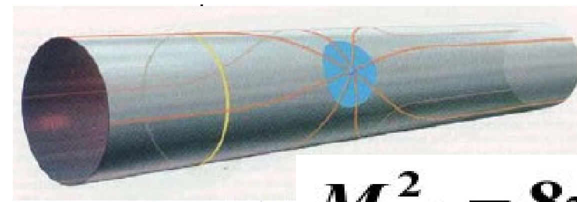
Enlarge the gauge group ⇒ Z', W'

Alternative EWSB mechanisms
(TC, little Higgs, Higgsless)..

Relate quarks and leptons ⇒ Leptoquarks
Additional generations
Excited quarks and leptons
Compositeness…

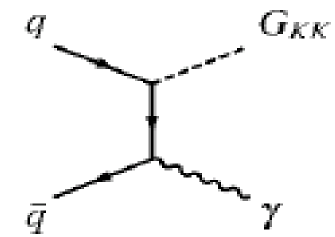
Large Extra Dimensions (ADD):

- 2 to 7 large (sub mm) EDs
- gravity propagates freely in the bulk
- KK excitations cannot be resolved



$$M_{pl}^{2} = 8\pi\ M_{D}^{n+2} R^{n}$$

Monophoton signature

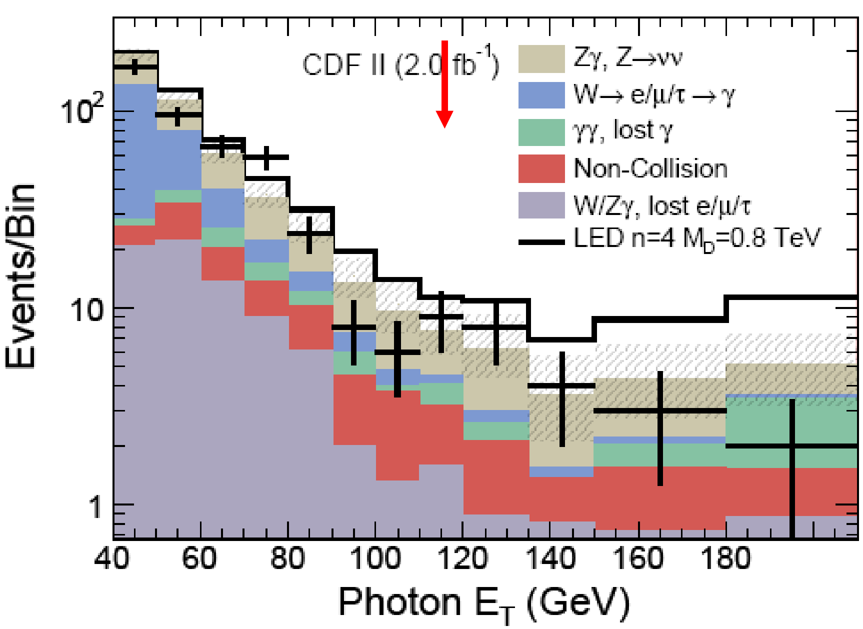


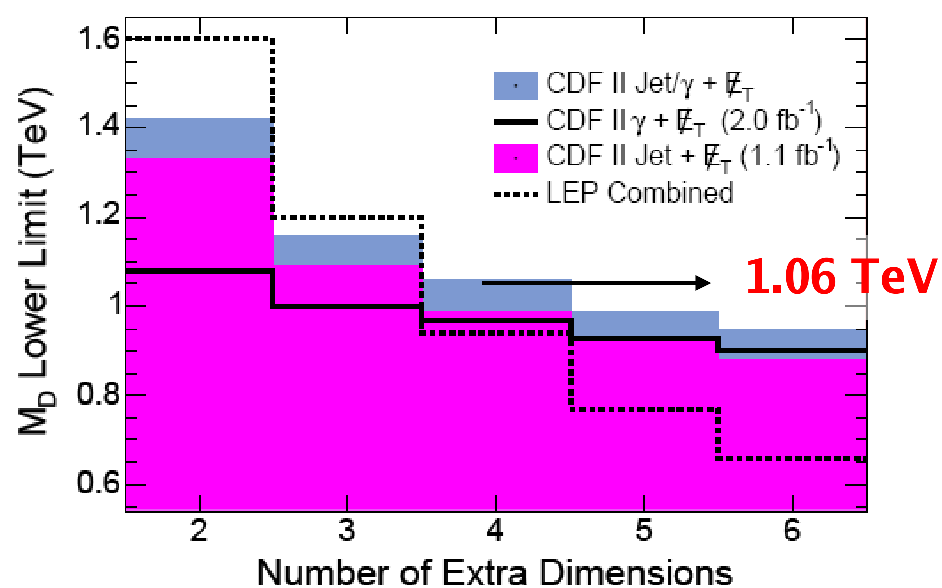
In addition to topological & kinematic cuts,
CDF uses timing in the calorimeter, and
DØ uses "photon pointing"

CDF: **40 events observed**
46.7 ± 3.0 expected

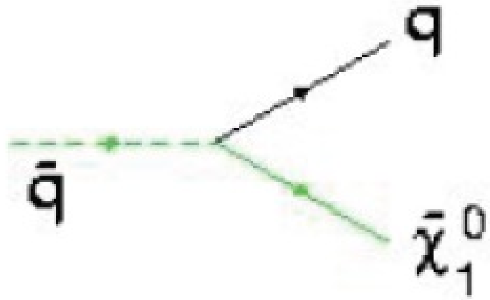
Main backgrounds:

- **Beam halo, cosmics**
- **$(Z \rightarrow \nu\nu) + \gamma$**

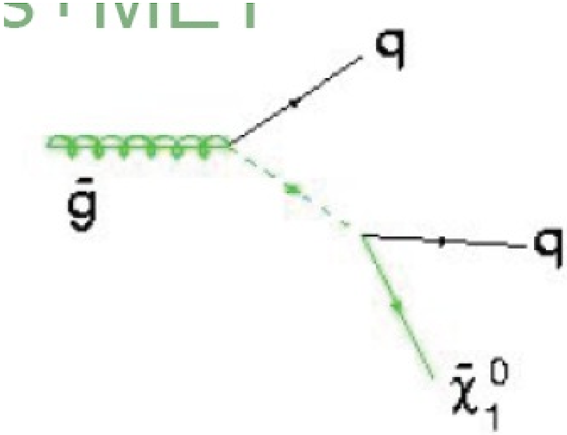




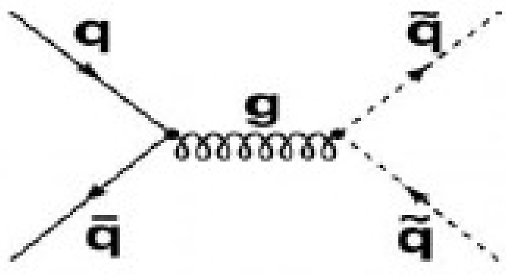
CDF jet & γ combination

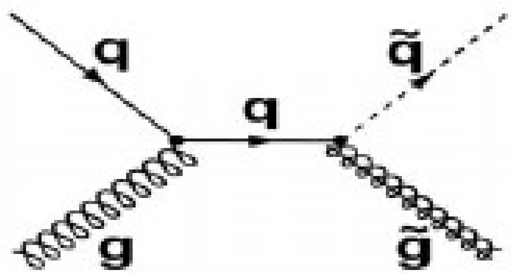


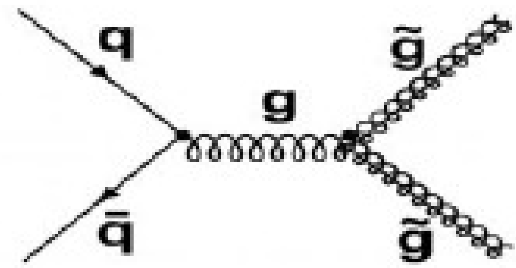
SUSY
Squarks and gluinos



Strong production ⇒ Large cross sections







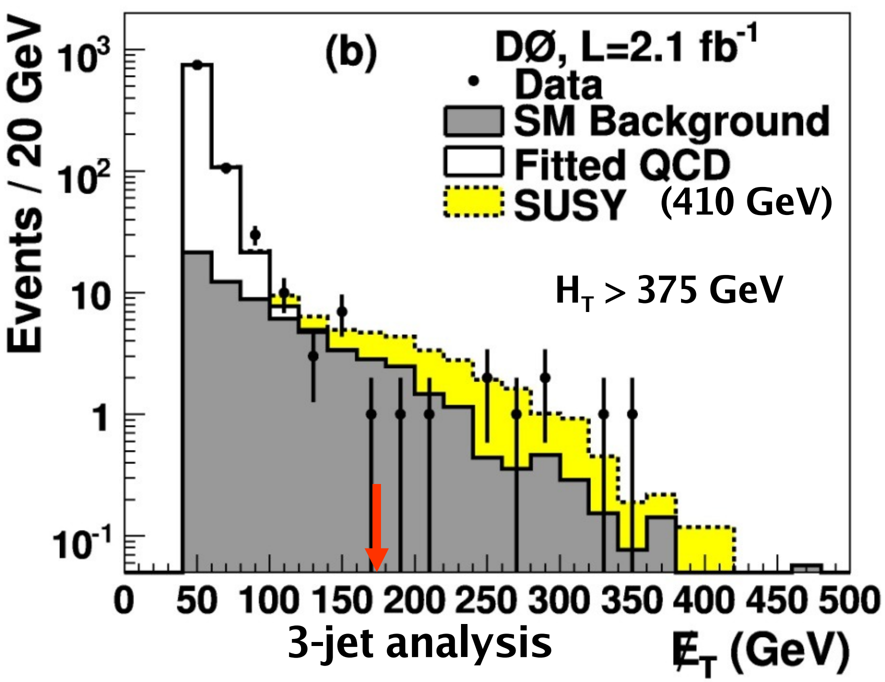
m(gluino) >> m(squark)	m(gluino) ~ m(squark)	m(gluino) << m(squark)
2 jets + MET	3 jets + MET	4 jets + MET

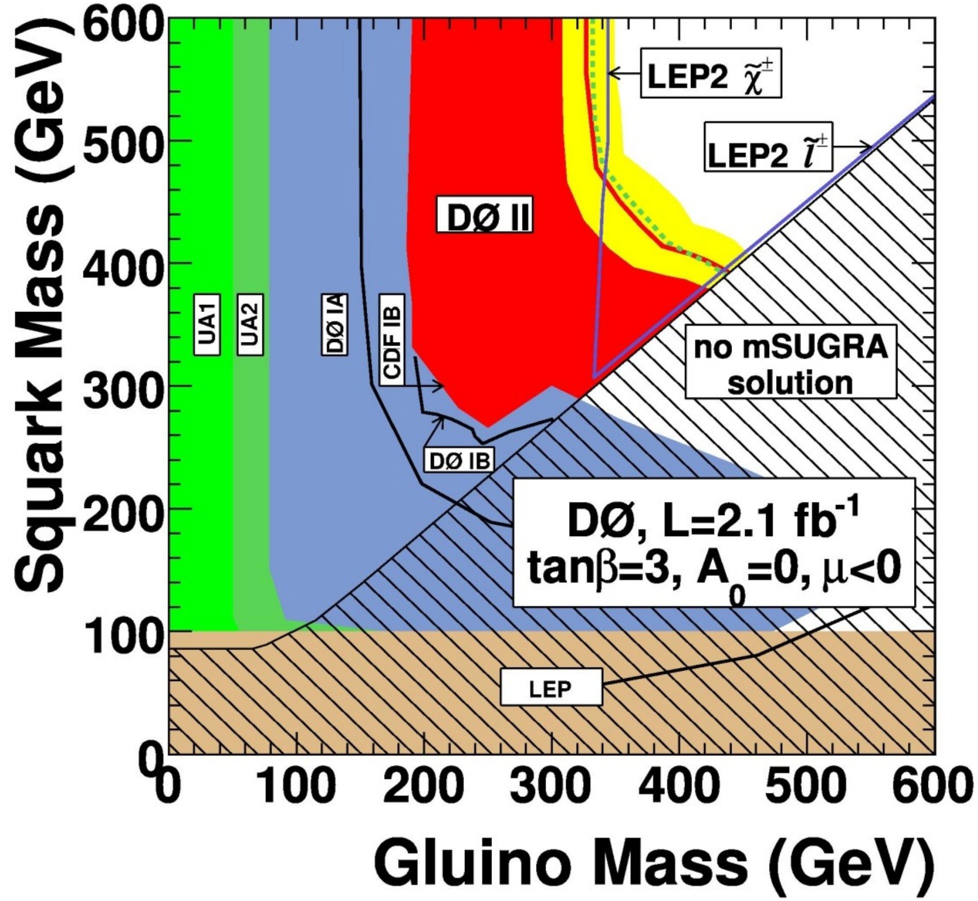
Analyses optimized for each of these topologies

Cascade decays complicate the picture
⇒ a model is needed for the interpretation: mSUGRA

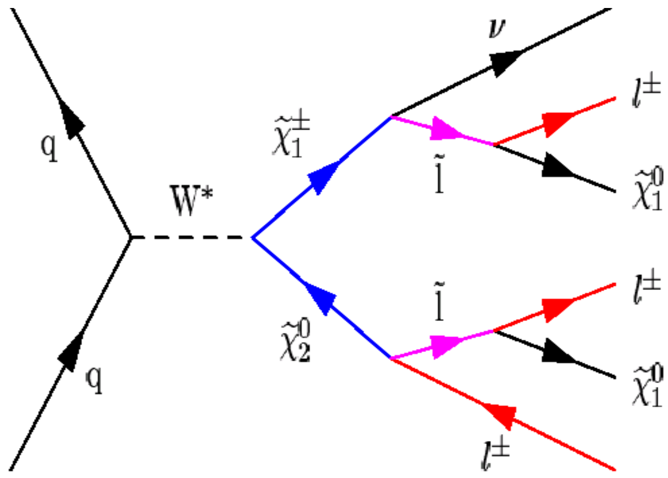
Main backgrounds:

- Instrumental (QCD multijets with fake missing E_T)
- ($W \to$ lepton+ν) +jets (also from ttbar)
- ($Z \to \nu\nu$) +jets (irreducible)



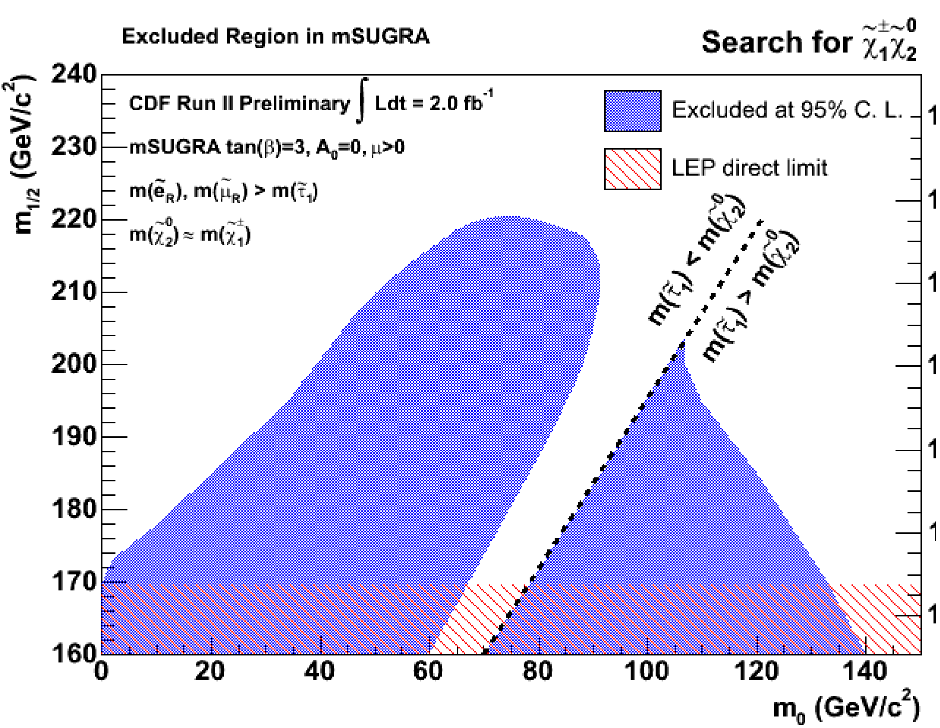


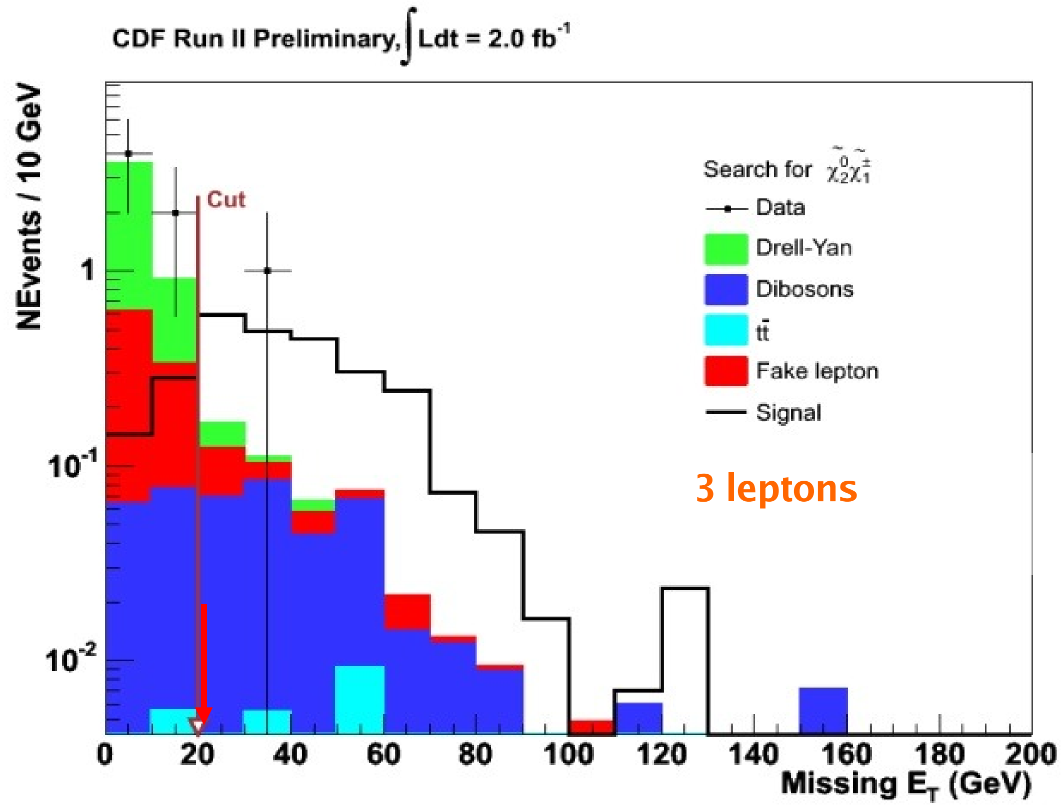
SUSY Trileptons



- Arise from chargino-neutralino associated production
- "Golden" SUSY signature but:
  - low cross sections (× BR)
  - soft leptons
  - taus (at large tanβ)

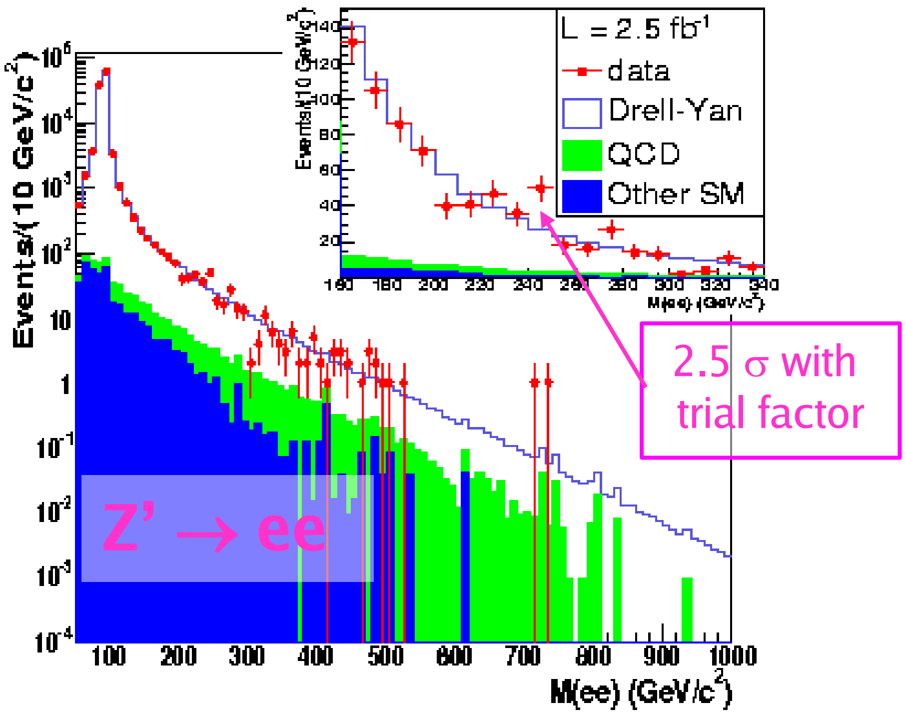
⇒ Combine many final states

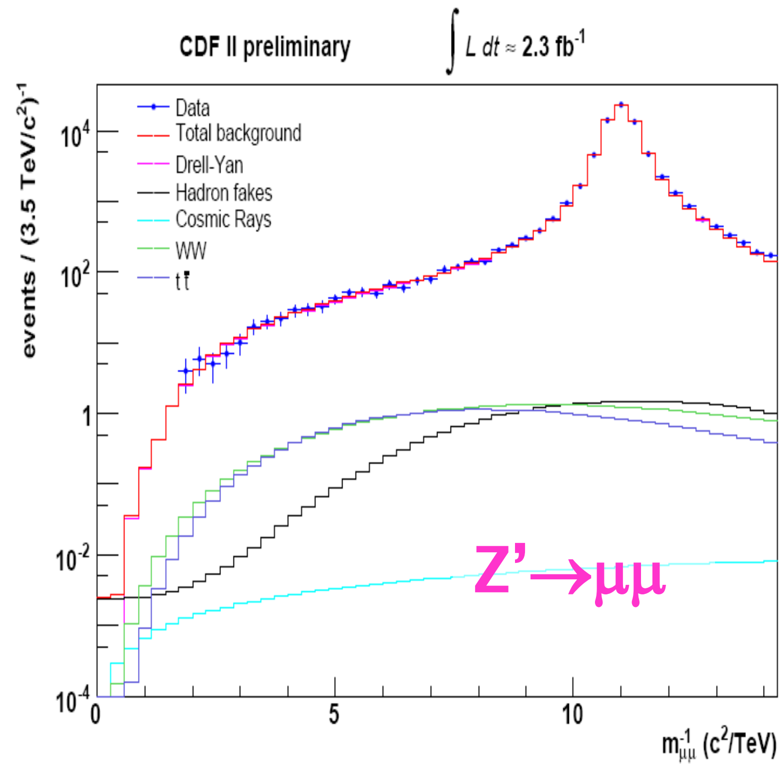




Extra gauge bosons: Z’

CDF Run II Preliminary





M(Z’-seq.) > 966 GeV

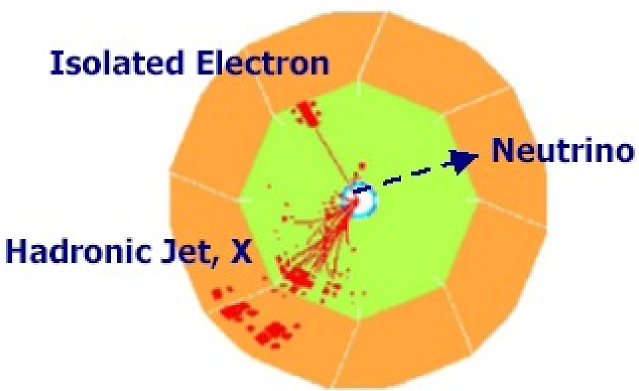
(somewhat lower limits in canonical E(6) models)

Plot in $1/m_{\mu\mu}$ (consistent with Gaussian resolution in $1/p_T$)

M(Z’-seq.) > 1030 GeV

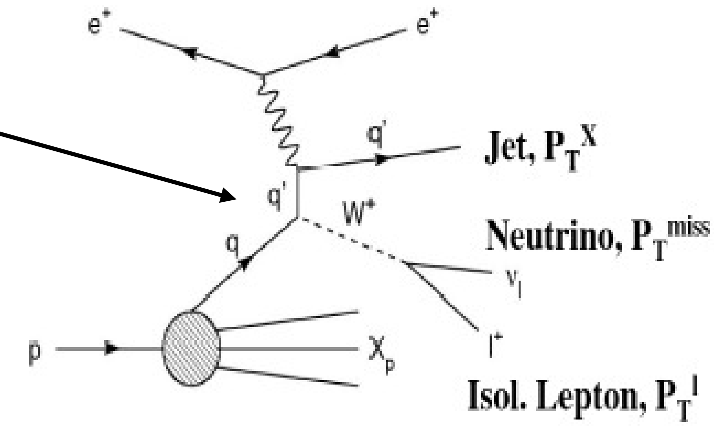
Reminder: **M(W’-seq) > 1000 GeV** (DØ in 1 fb^{-1})

Isolated leptons at HERA



H1 HERA I e + P_T^{miss} event

SM process: W+jet



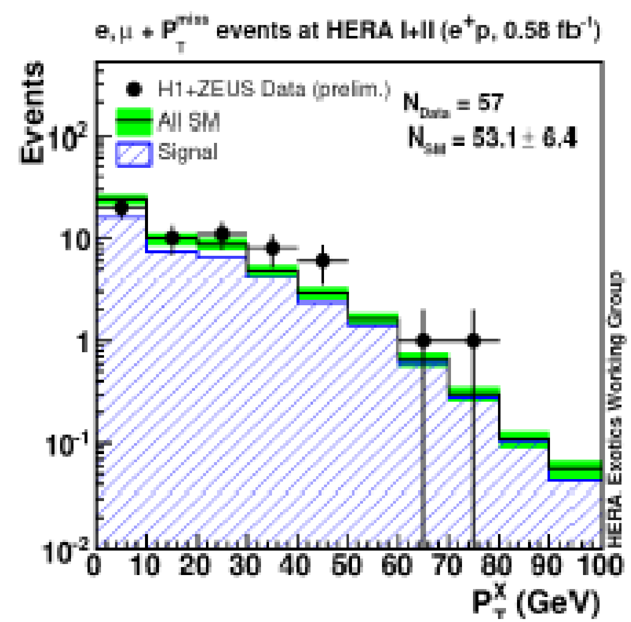
Excess seen by H1 in HERA-I e^+p data at high p_T^X (> 25 GeV)

Not seen by ZEUS (≠ selection)

Now with the full HERA-I+II statistics and two experiments with identical selections:

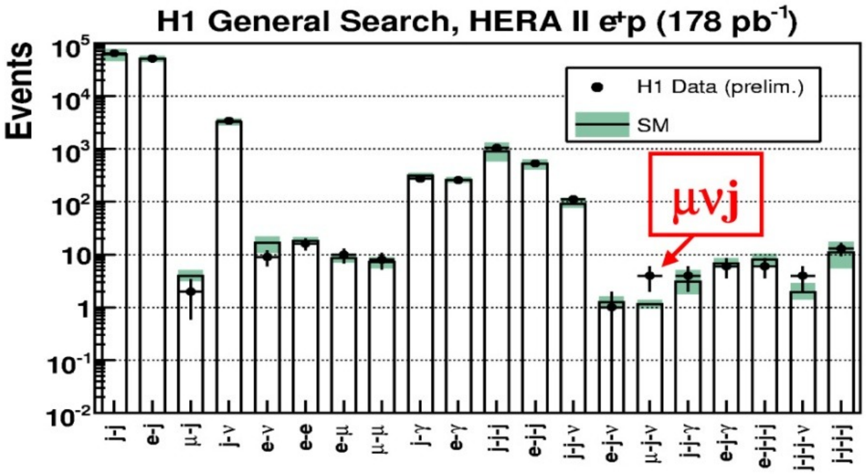
e^+p data	H1	ZEUS	H1+ZEUS
P_T^X>25 GeV	**17/7.1±0.9**	**6/7.5 ±1.1**	**23/14.6±1.9**

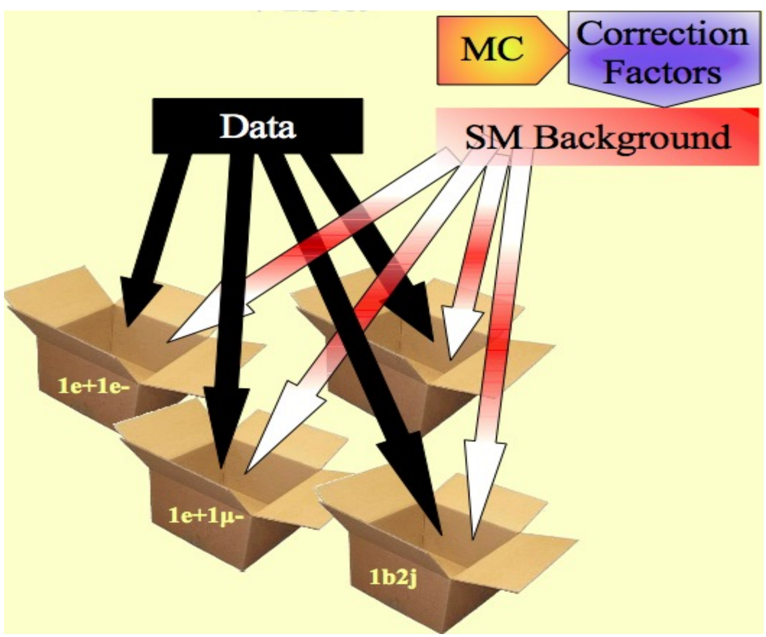
H1 – ZEUS consistency: 2σ
Combined significance: 1.8σ



Global (model-independent) analysis

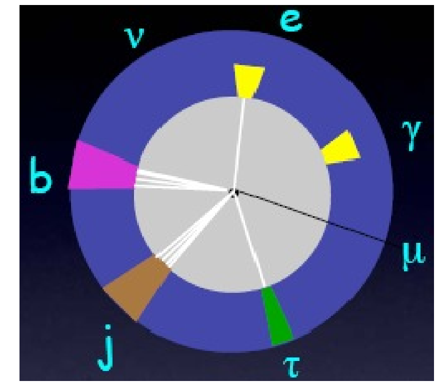
Initially at H1



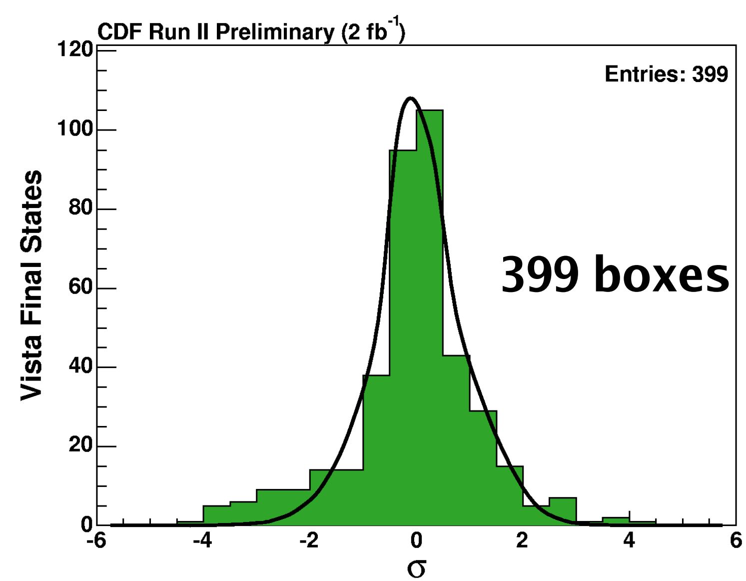


Now also CDF: “VISTA”

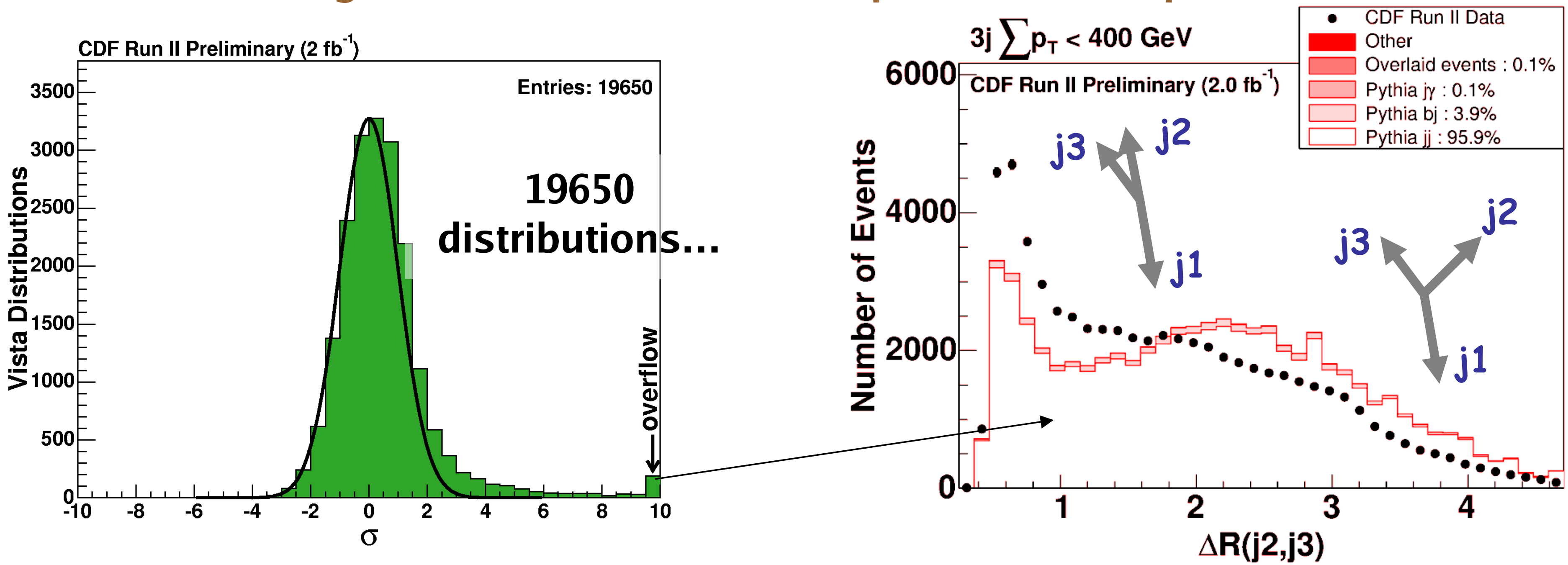
Categorize in terms of physics objects
(above some pT threshold)
and put events in exclusive boxes
(ej, μjj, γγ+MET, bbj,…)
as demanded by data



Improve SM description by adjusting a number of correction and normalization factors



Then look at a large number of distributions, and perform Kolmogorov-Smirnov tests to find possible discrepancies.



There are some, but very few, and not suggestive of "new physics", rather of an inadequate modeling of soft QCD

Once the bulk of the distributions is under control, look specifically at the high Σp_T tails ("Sleuth"), and check for mass bumps.

No more deviations than expected from statistics are found in 2 fb^{-1}
(taking into account the number of trials).

A similar conclusion was reached by H1

This exercise can be useful in case something was forgotten. Otherwise, dedicated searches are (as expected) more sensitive

Conclusion

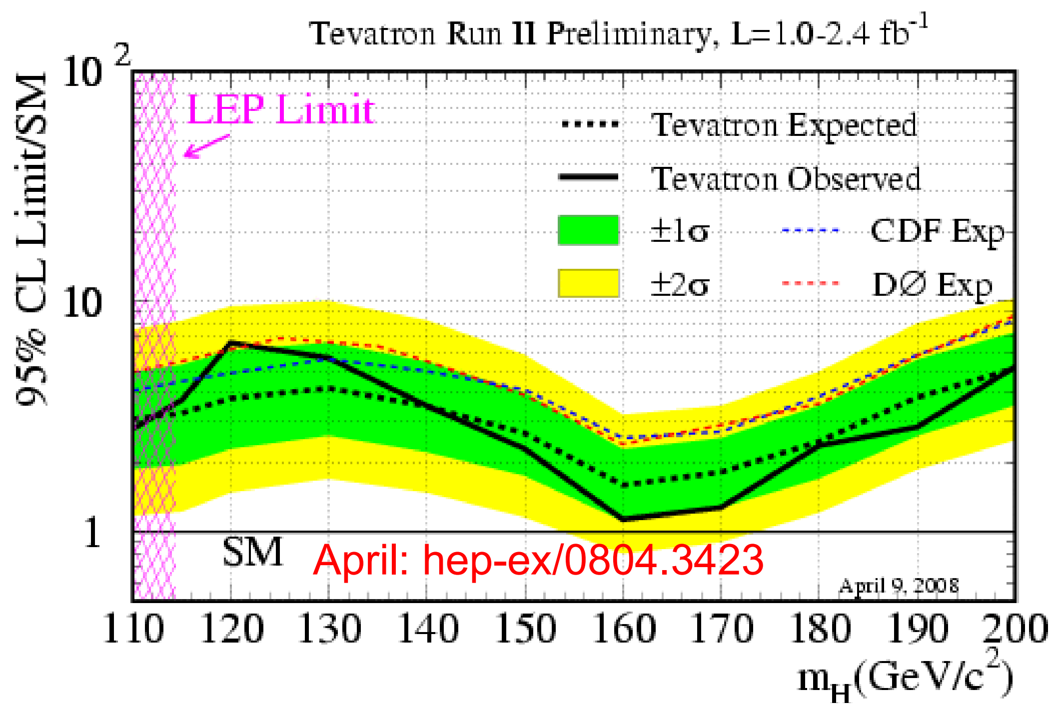
- Foisons de résultats provenant du TeVatron. Notamment:
  - Physique avec les tops
  - Masse du top mesurée avec très grande précision
  - Masse du W très attendue
  - Recherche directe de Higgs exclue 170 GeV
  - Recherche de nouvelles particules
- Le modèle standard se porte plutôt bien.
  - Les contraintes (directes+indirectes) sur le Higgs sont très fortes
- Activité de la communauté pour la préparation au LHC.
  - dans cette présentation:
    - Tevatron: modèle pour le Pt du Z, asymétrie du W
    - amélioration de la précision des PDF
    - La définition des jets

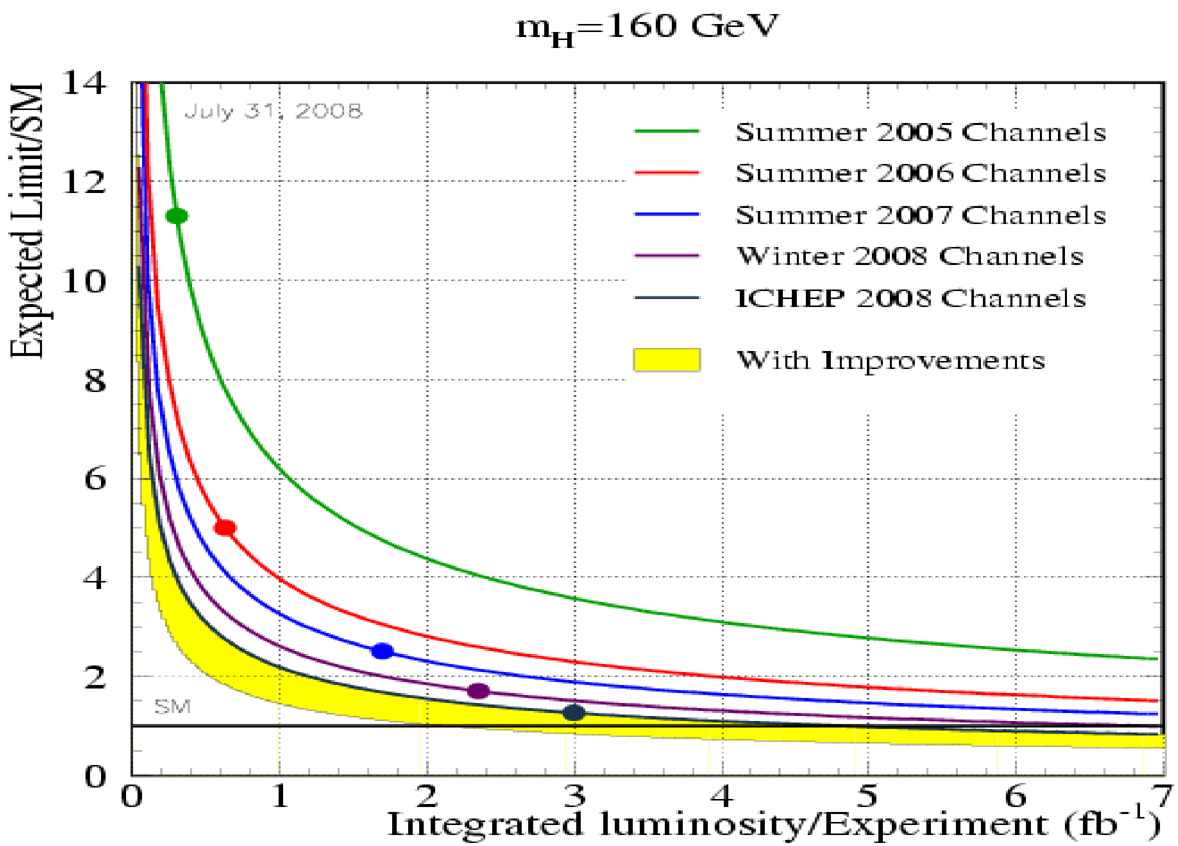
backup

SM Higgs Combined Limits

- Limits calculating and combination
  - Using Bayesian and CLs methodologies.
  - Incorporate systematic uncertainties using pseudo-experiments (shape and rate included) (correlations taken into account between experiments)
  - Backgrounds can be constrained in the fit

- Low mass combination difficult due to ~70 channels
  - Expected sensitivity: <3.0xSM @ 115GeV

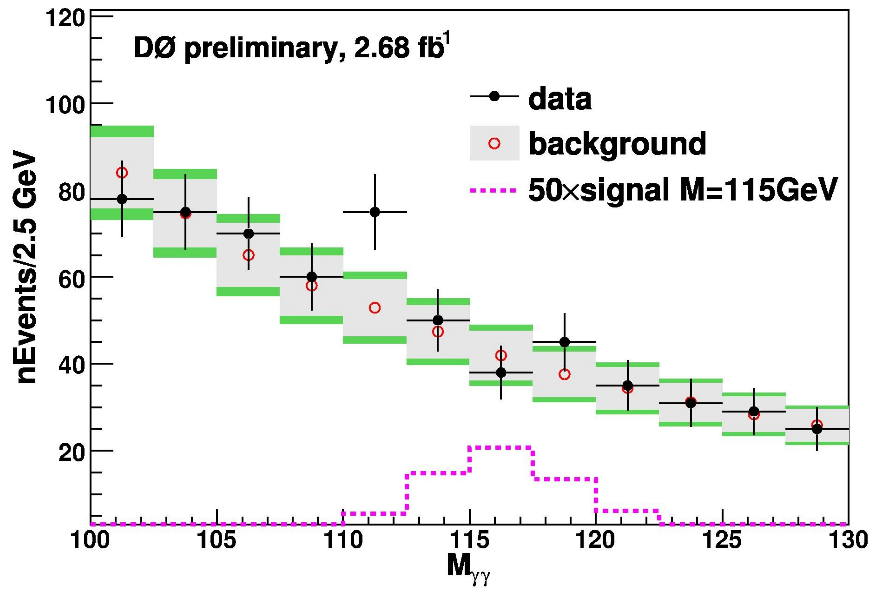




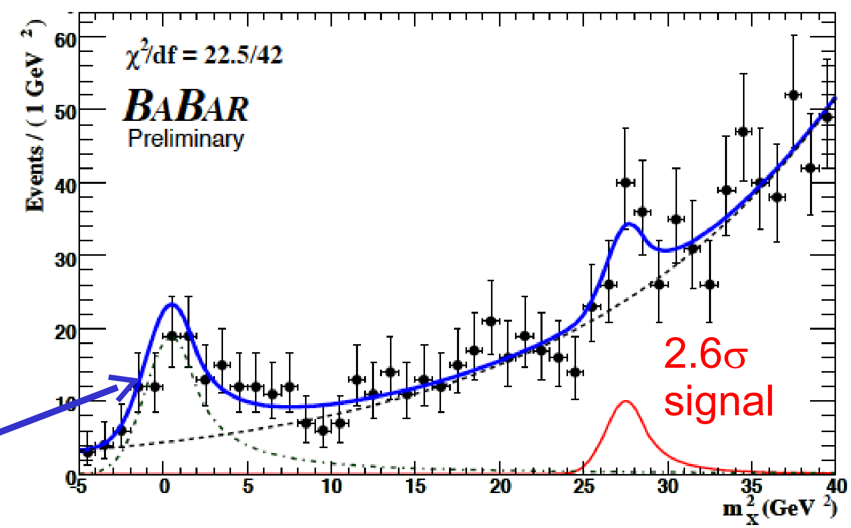
m_H=160 GeV
Expected Limit/SM
14
12
10
8
6
4
2
0
July 31, 2008
Summer 2005 Channels
Summer 2006 Channels
Summer 2007 Channels
Winter 2008 Channels
ICHEP 2008 Channels
With Improvements
SM
0
1
2
3
4
5
6
7
Integrated luminosity/Experiment (fb^{-1})

Other BSM Higgs Searches

- DØ: H→γγ benchmarked as SM search
  - Fermiophobic Higgs
  - At lower mass large BR(H→γγ) ~10%
  - Key issue: understanding QCD background: uses excellent calorimeter



- Other BSM Higgs Searches
  - WH→WWW (also SM), charged Higgs, decays to and from top…
- Babar: $A^0 \to \chi\chi$, invisible light Higgs decay
  - Photon+Missing energy in Y(3S) decays
  - Key issue: e+e-→γγ background
  - For m_A<7.8GeV



BR(Y(3S)→γA^0 → χχ) < 0.7-31x10^{-6}

Models: up to x10^{-4}

Prospects

So far sensitivity scales better than √L thanks to analysis improvments

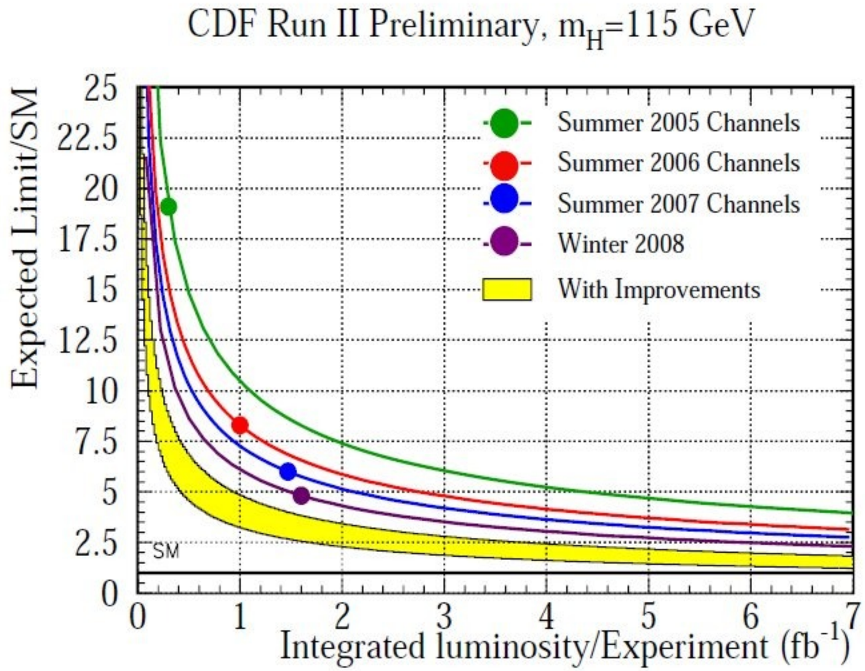
Including data taking efficiency expect

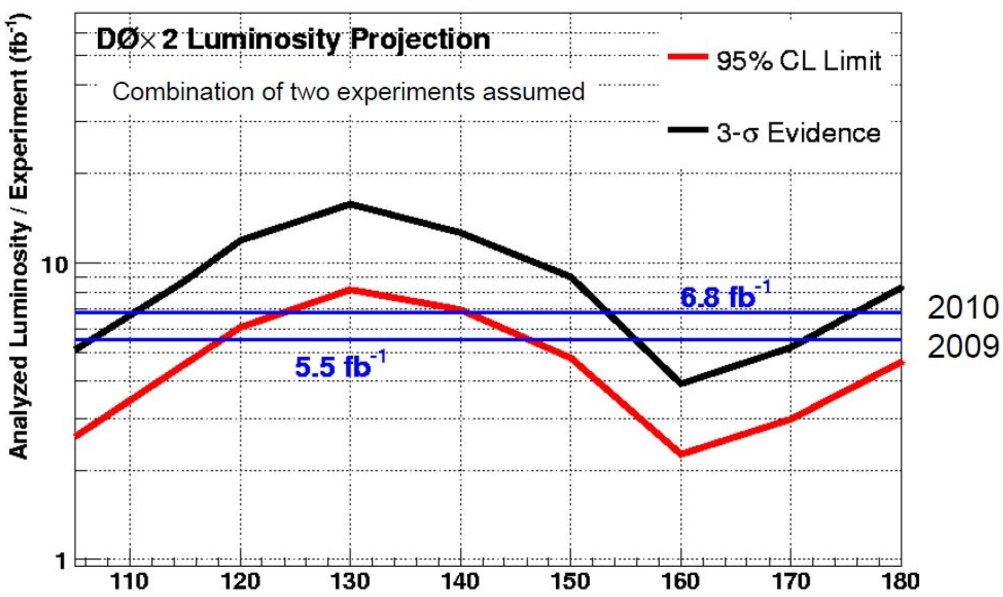
- 5.5 fb^{-1} by 2009 per experiment
- 6.8 fb^{-1} by 2010 per experiment

Further improvements forseen

- improved lepton identification and acceptance
- improved trigger acceptance
- better di-jet mass resolution
- improved b-tagging
  - layer 0 (D0)
  - lepton tag
  - multivariate technics
- tau channels
- ....

Should be able to cover entire [110-180] range but [120-145] by 2009





$\alpha(M_Z)$

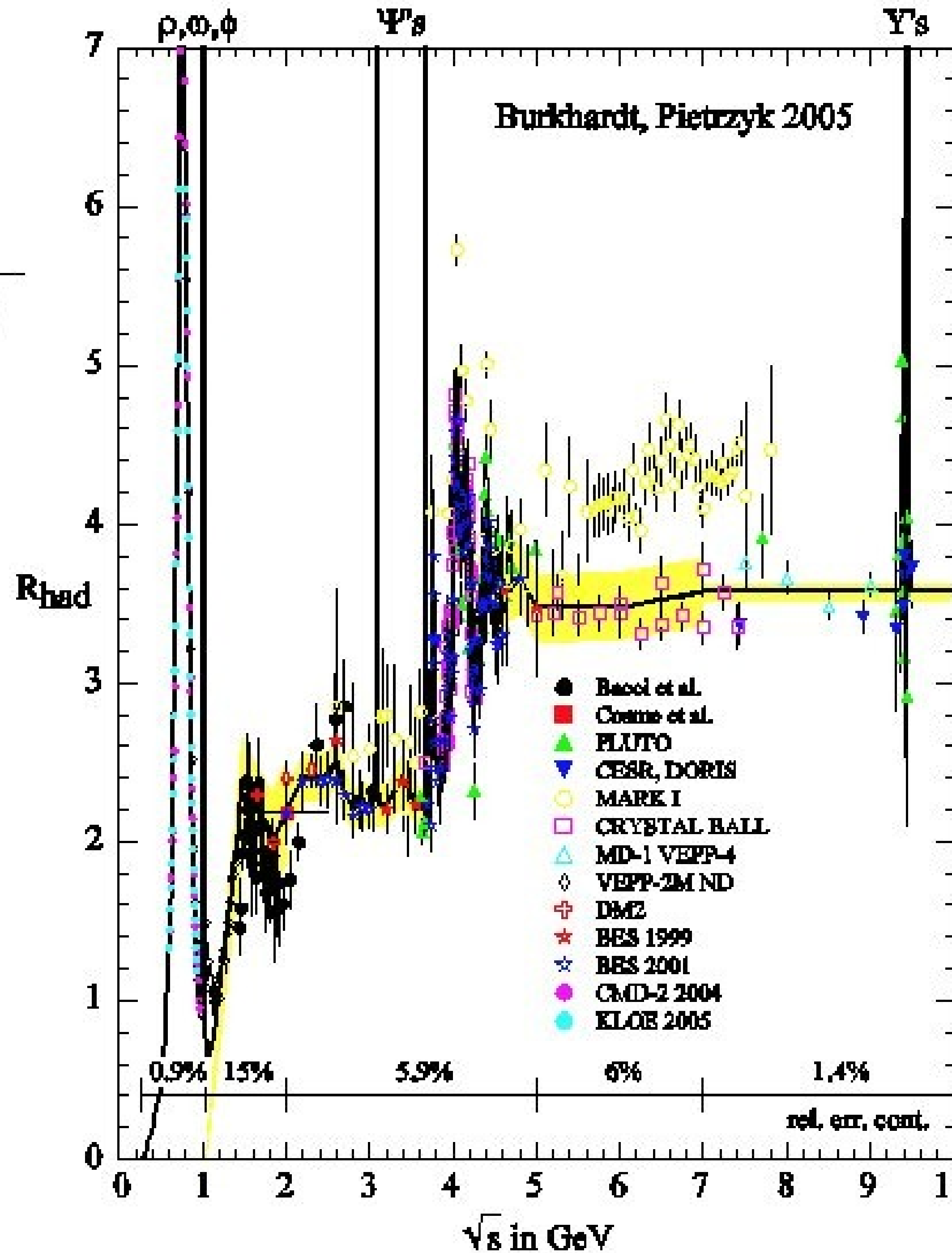
$$\alpha(s) = \frac{\alpha(0)}{1 - \Delta\alpha_l(s) - \Delta\alpha^{(5)}_{\text{had}}(s) - \Delta\alpha_{top}(s)}$$

$$\Delta\alpha_{\text{had}} = -\frac{\alpha s}{3\pi} \, \mathrm{P} \int_{4m_\pi^2}^{\infty} \frac{R_{\text{had}}(s')}{s'(s'-s)} ds'$$

$$\Delta\alpha^{(5)}_{\text{had}} = 0.002758 \quad \pm \; 0.00035$$

EWWG default value – 'data' driven
Burkhardt & Pietrzyk (2005)
also use a more 'theory' driven value
-Troconiz & Yndurain (2005)

$$\Delta\alpha^{(5)}_{\text{had}} = 0.002749 \quad \pm \; 0.00012$$

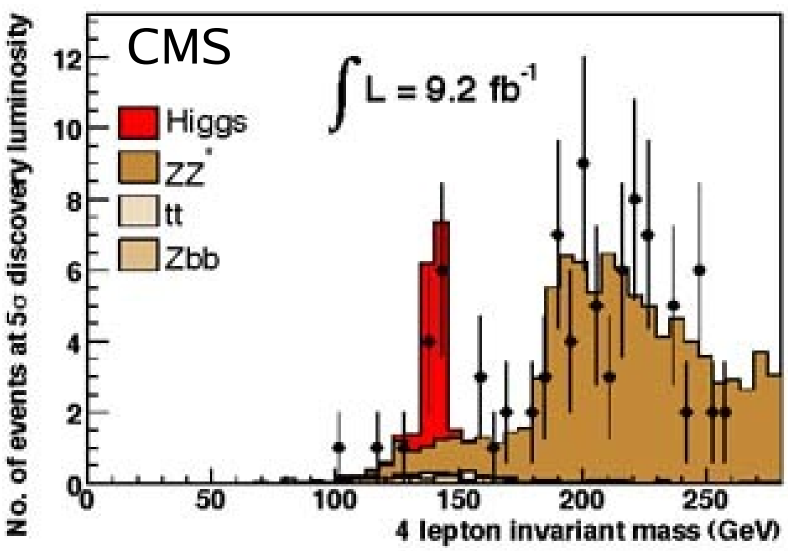


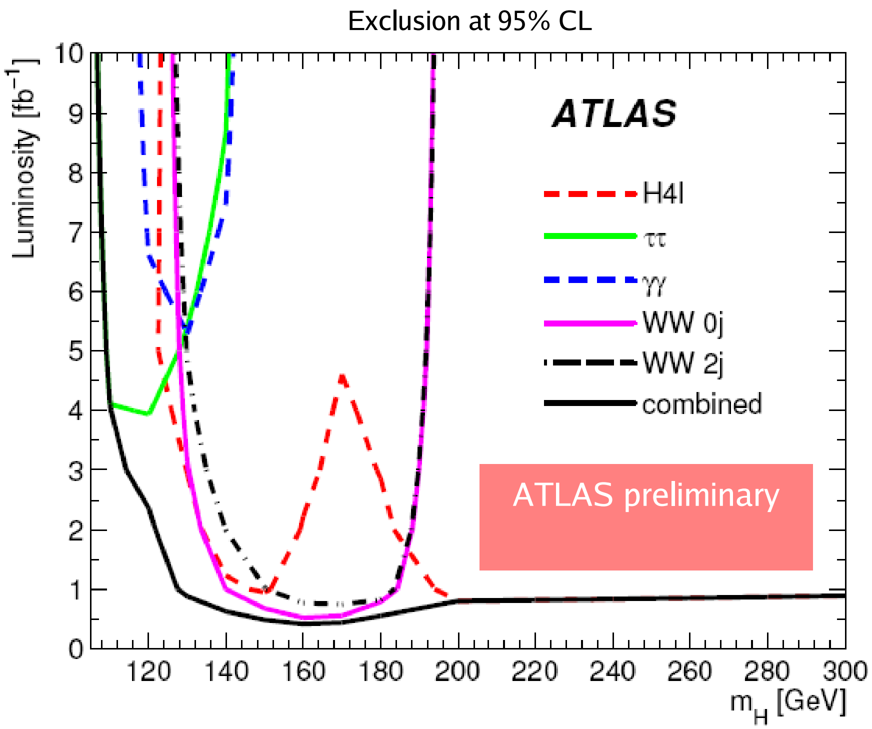
NB equiv. to $\delta m_H / m_H \sim 20\,\%$

LHC Prospects: SM Higgs

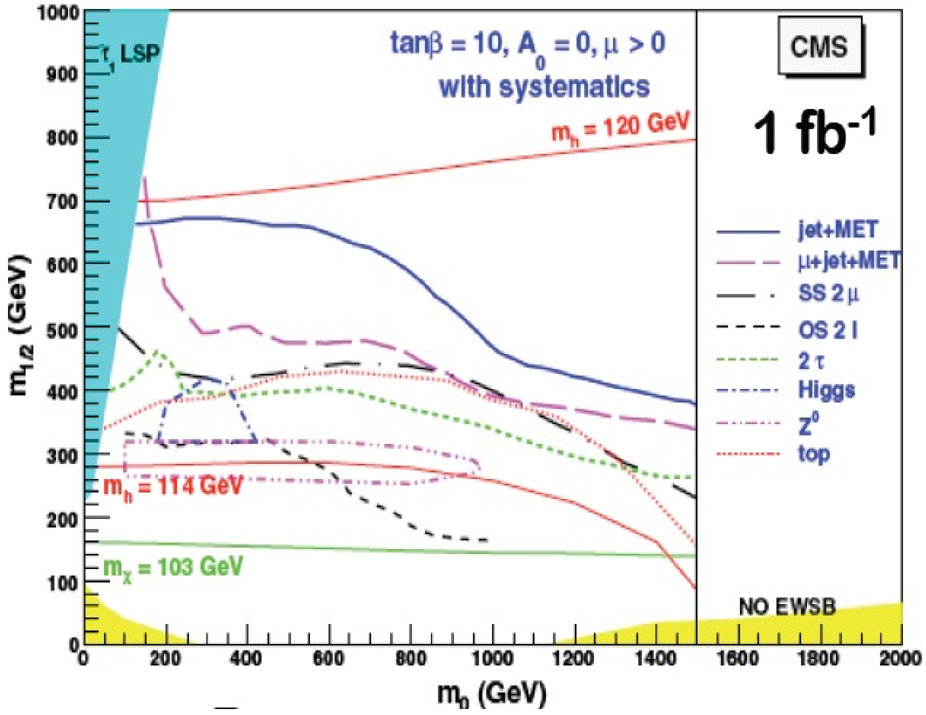
- LHC experiments have the potential to observe a SM Higgs at 5σ over a large region of mass
  - Observation: $gg \rightarrow H \rightarrow \gamma\gamma$, VBF $H \rightarrow \tau\tau$, $H \rightarrow WW \rightarrow l\nu l\nu$, and $H \rightarrow ZZ \rightarrow 4l$
  - Possibility of measurement in multiple channels
- Measurement of Higgs properties
  - Yukawa coupling to top in ttH
  - Quantum numbers in diffractive production

All key channels explored

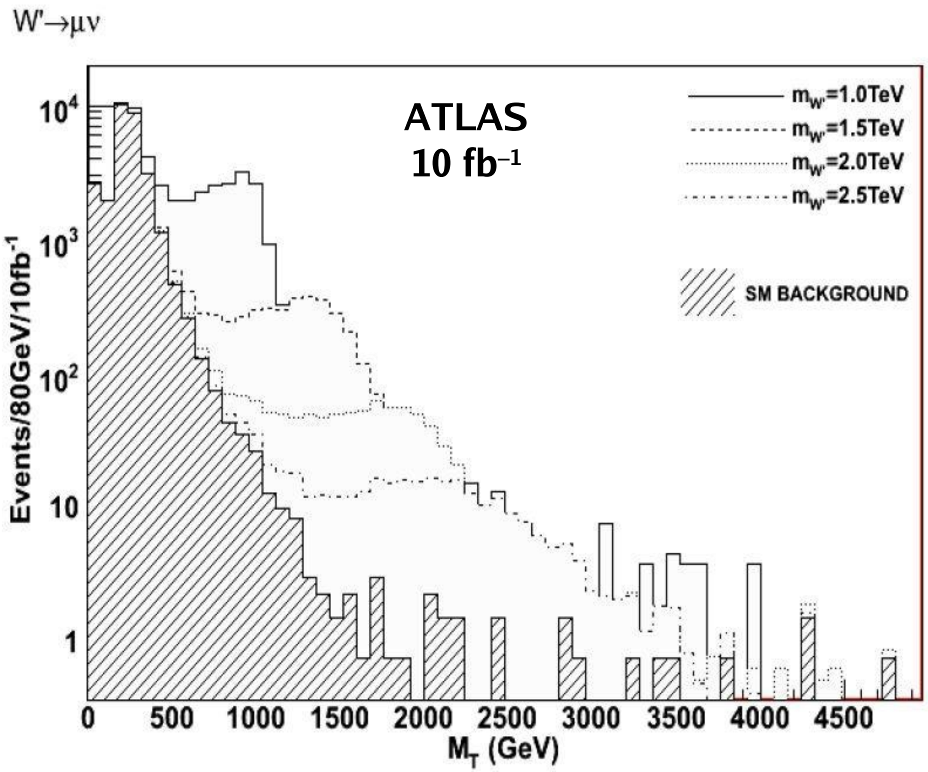




…and time is running short…



SUSY



W'