Risultati di Fisica dal Tevatron

Giovanni Punzi
Universita’ & INFN Pisa

IFAE 2007

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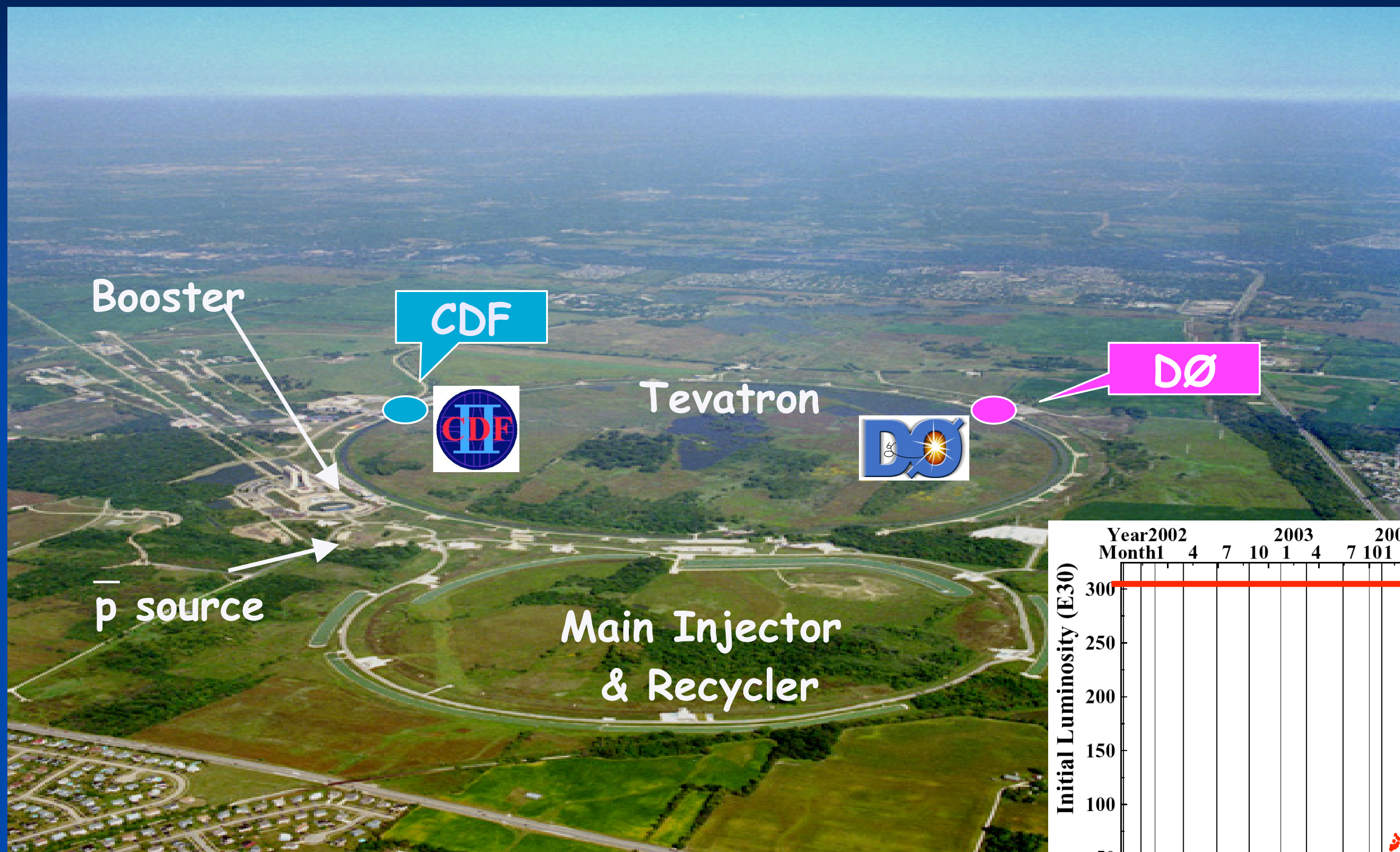
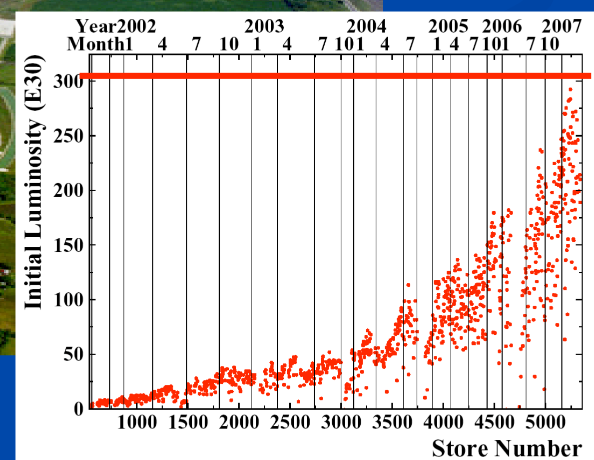
Il Tevatron oggi

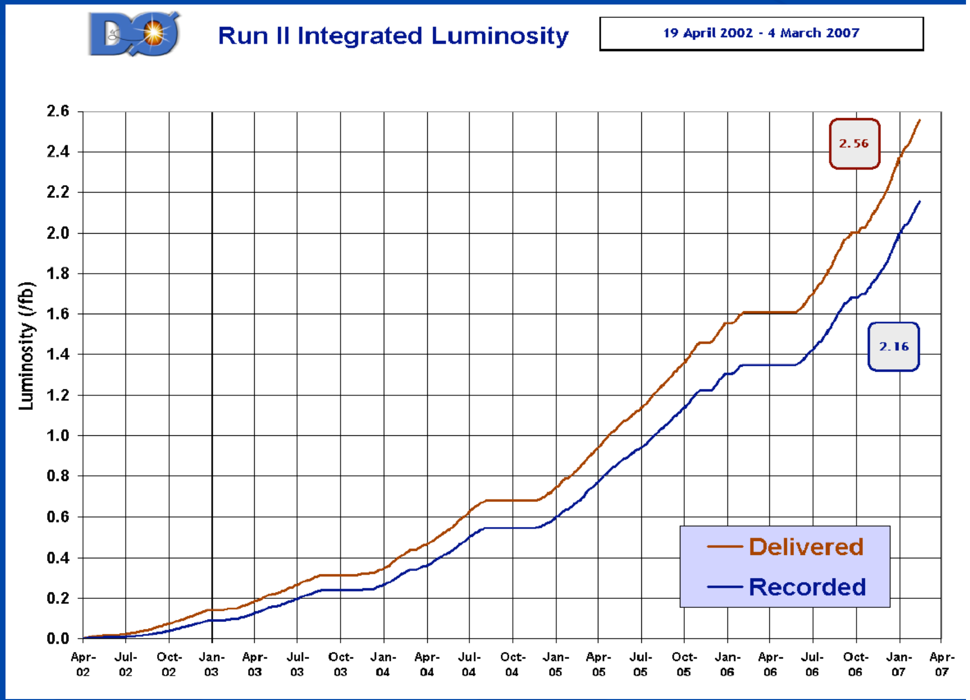




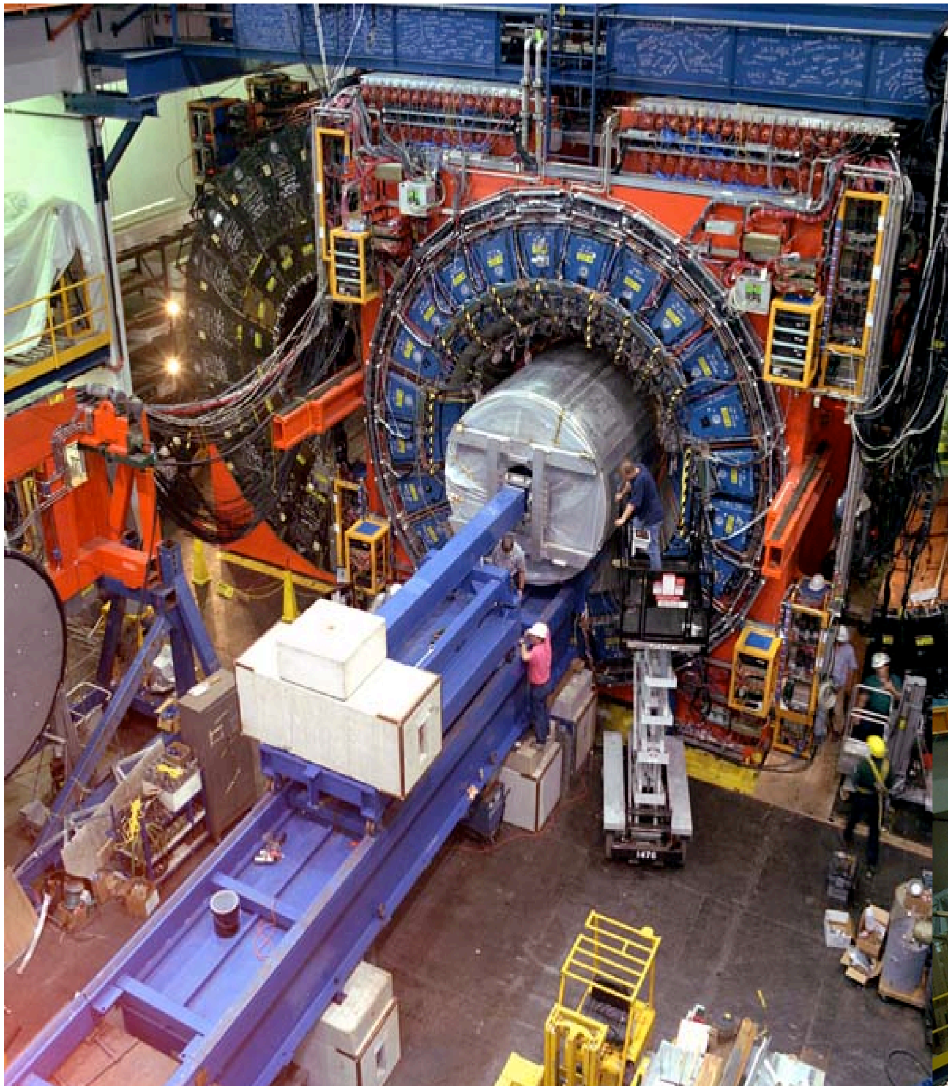
- p-pbar collisions at 1.96 TeV
- rate 1.7MHz (396 ns bunch spacing)
- Luminosita' in crescendo: record 2.9 x10^{32}cm^{-2}s^{-1} !!
- Prevista 3x10^{32}cm^{-2}s^{-1}
- ~5-6 interazioni per bunch crossing

Luminosita’ integrata

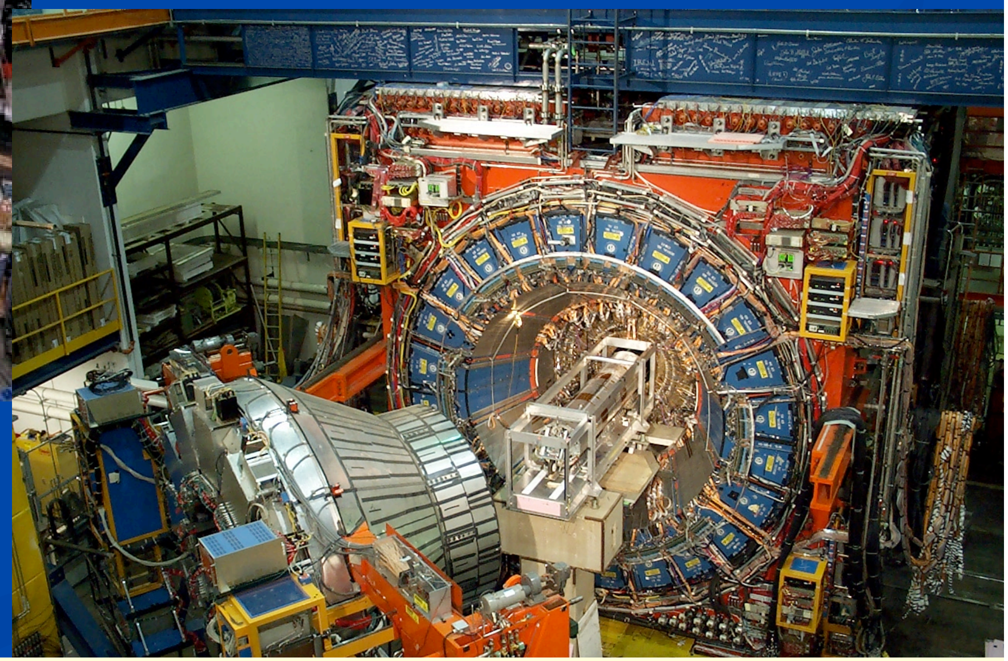
- > 2.5 fb^{-1} delivered, ~2 fb^{-1} on tape/experiment
- Entrambi gli esperimenti hanno analizzato ~1fb^{-1}
- Molti risultati nuovi, alcuni recentissimi (marzo 2007)
  - Grande varieta’ di fisica: esperimenti davvero “*general purpose*”
- Overview in questo talk, dettagli nelle sessioni parallele:
  - P. Mastrandrea: W,Z
  - F. Margaroli: top
  - S. Amerio: Higgs
  - M. Rossi: New Physics
  - S. Pagan Griso: Δm_s and $\Delta\Gamma_s$
  - D. Tonelli: rari e charmless
  - S. Torre: B production



CDF Detector



- Strong central tracking in B=1.5 T
- Silicon vertex detector
- Good lepton identification
- Particle ID (TOF and dE/dx)
- Excellent mass resolution

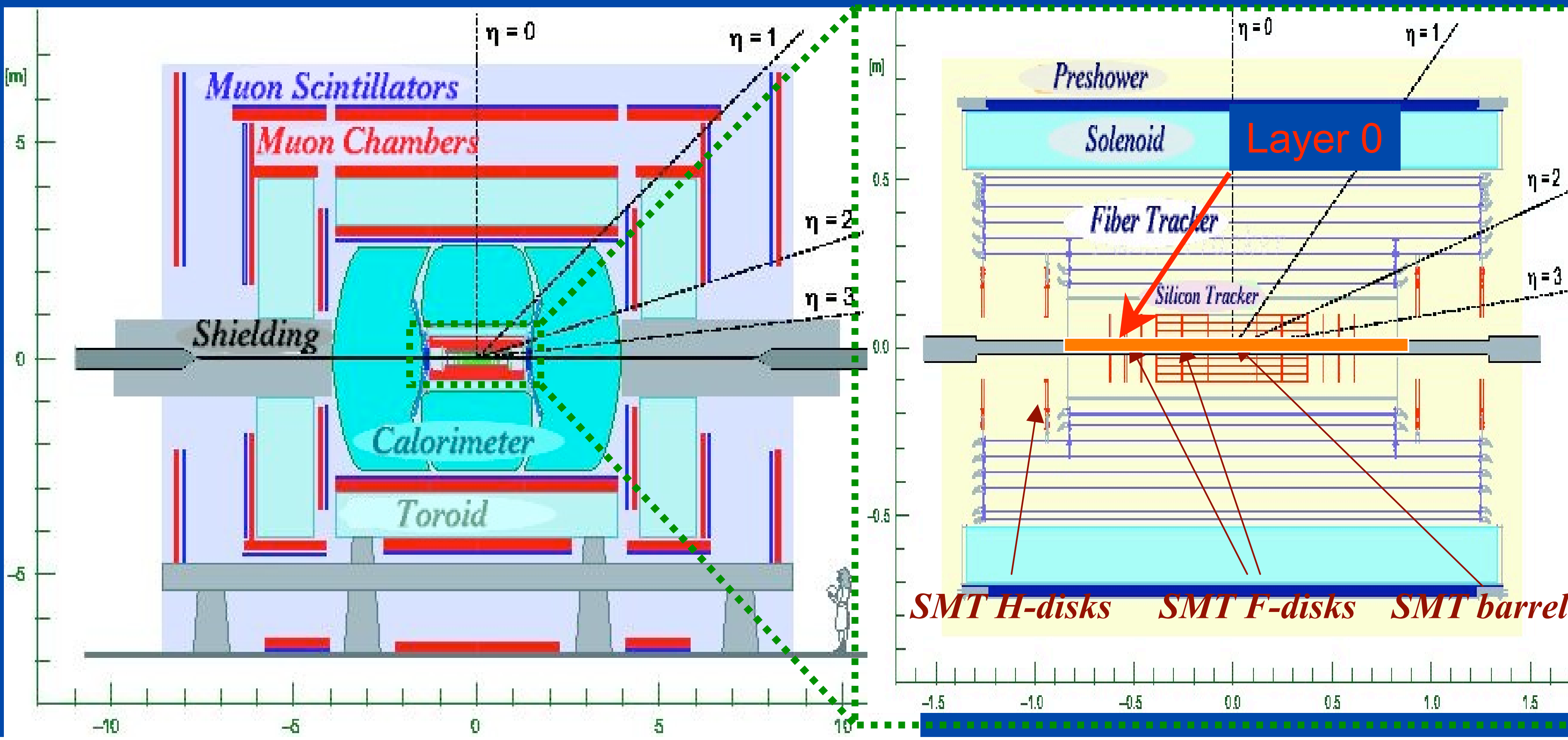


- High rate trigger/DAQ system
- Silicon vertex trigger on long-lived particles

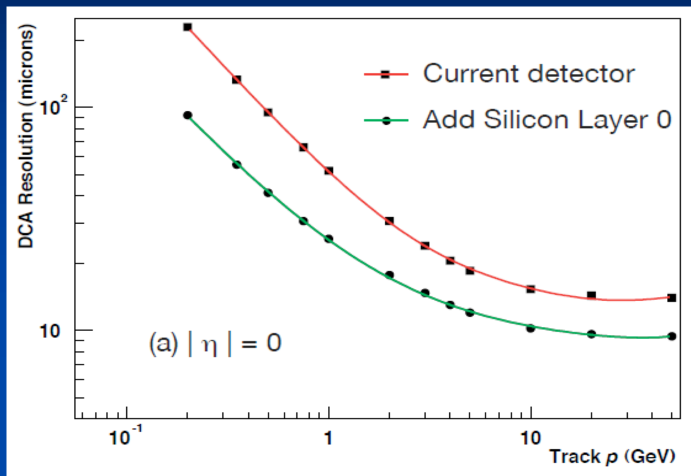
CDF silicon detector installation

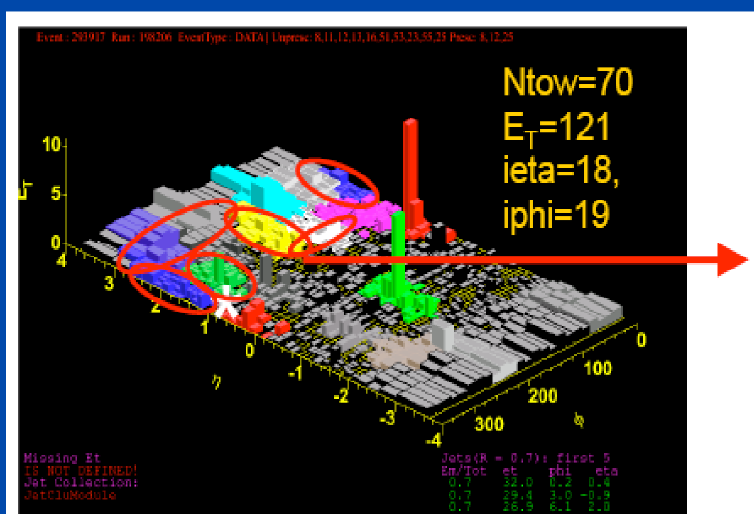
DØ Detector

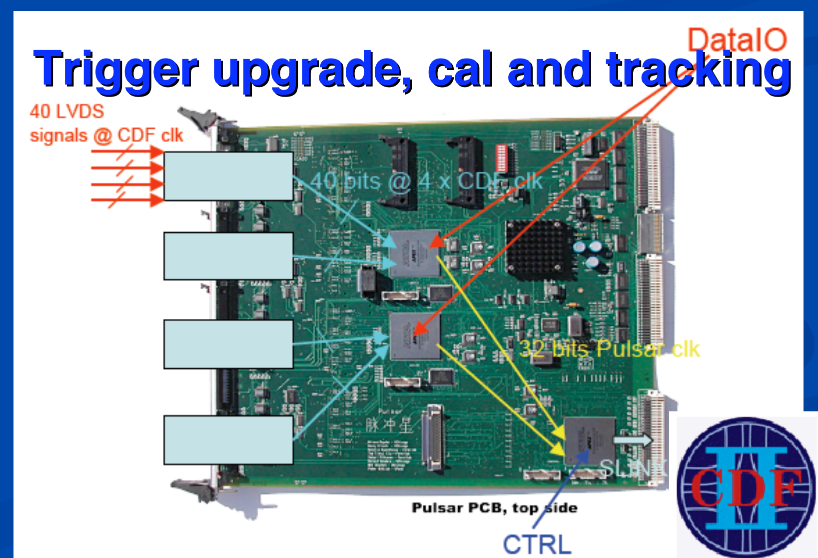
- Excellent coverage of Tracking and Muon Systems
- Excellent calorimetry and electon ID
- 2 T Solenoid, polarity reversed weekly
- High efficiency muon trigger with muon p_T measurement at Level1 by toroids



Gli upgrades non finiscono mai…

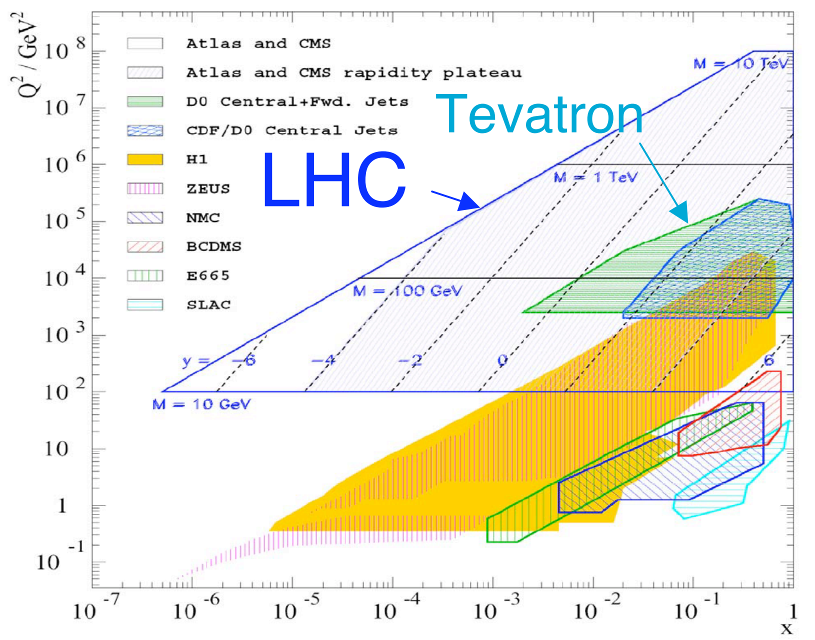


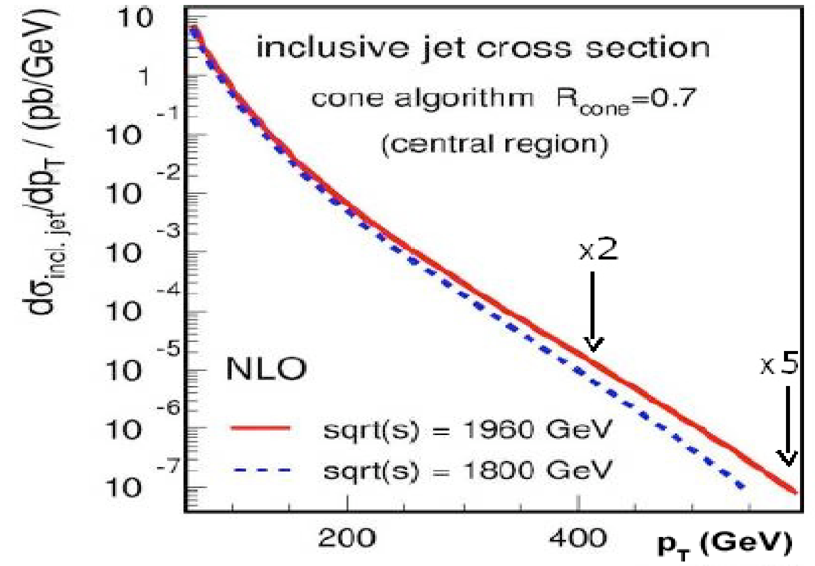




QCD al Tevatron

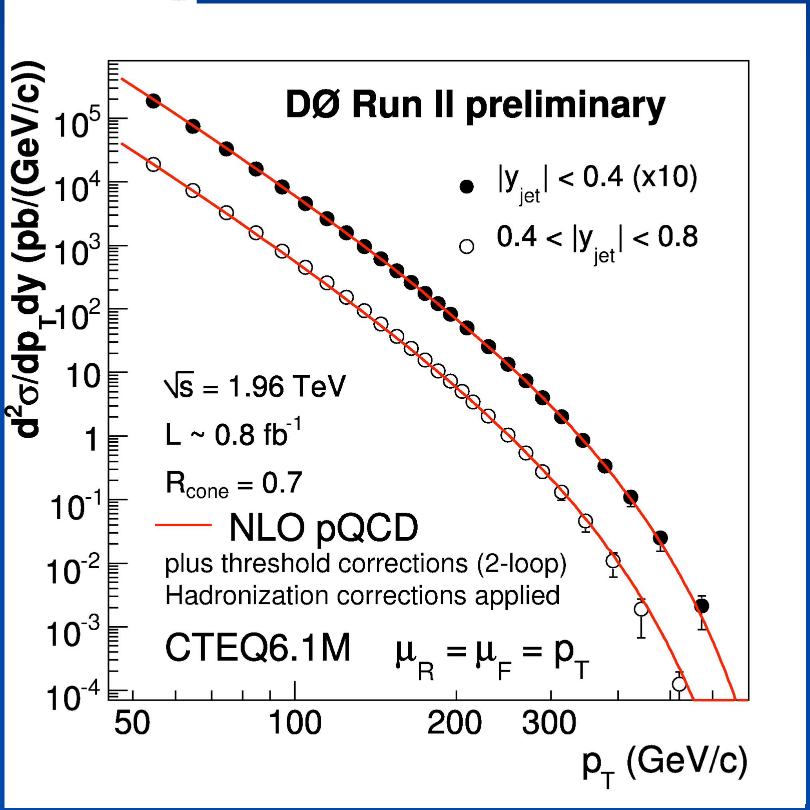
- Tevatron covers a region of (x, Q^2) higher than any other existing experiment
- It is part of the region that will be of interest at LHC.
- Important to measure, and can search for new phenomena (quark compositeness, new interactions, heavy objects…)
- Impact on determination of gluon PDF at high x.
- Recent updates: L= 1fb-1 (5x run I) AND x5 increase of cross-section at 600GeV due to increase of √s to 1.96 TeV (from run I √s=1.8 TeV) ⇒ greater sensitivity



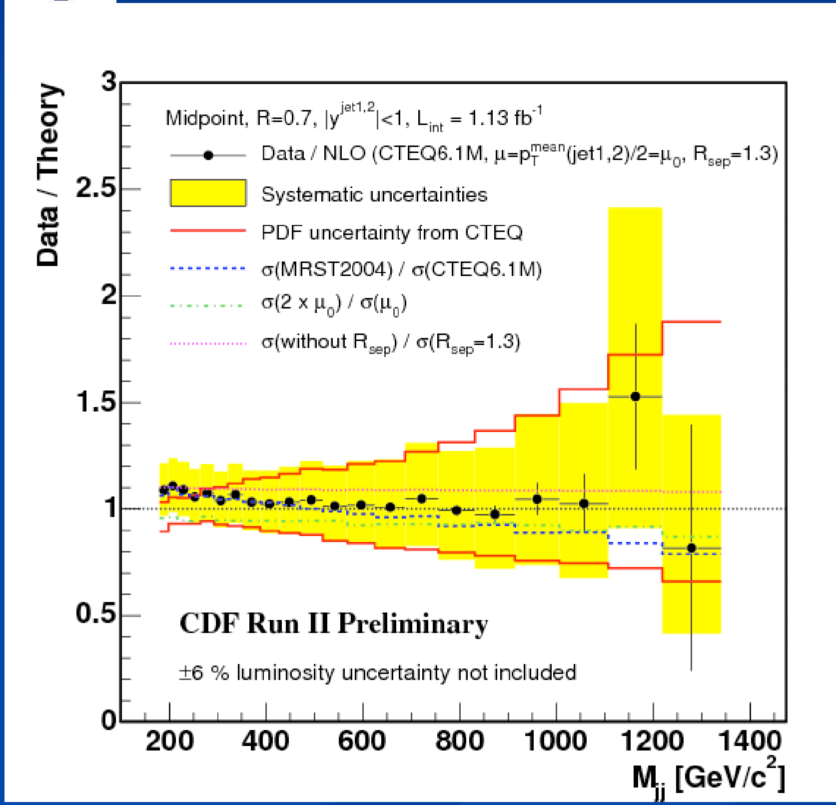


New Jet measurements

Inclusive Jet pt

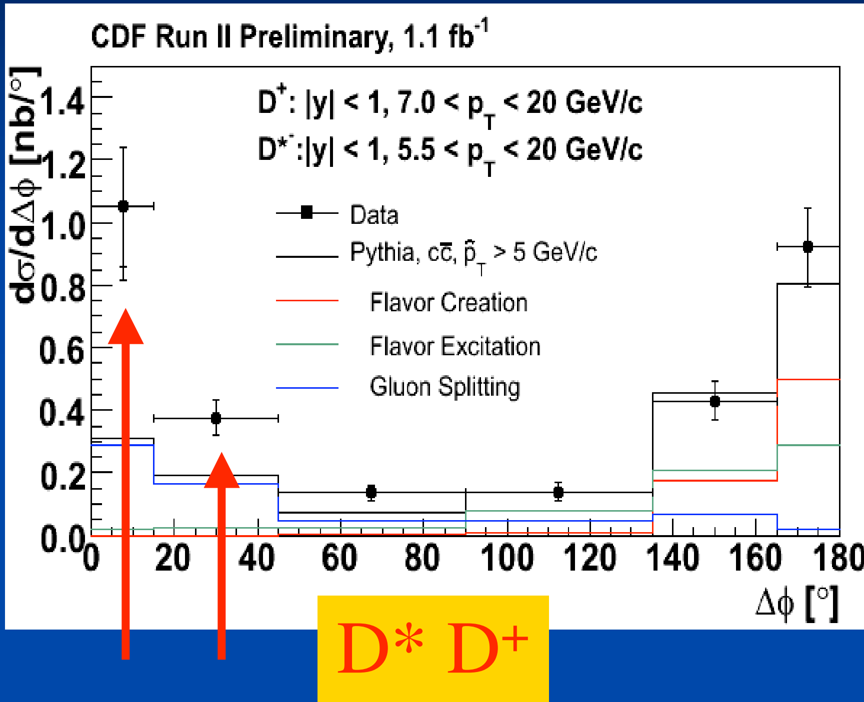


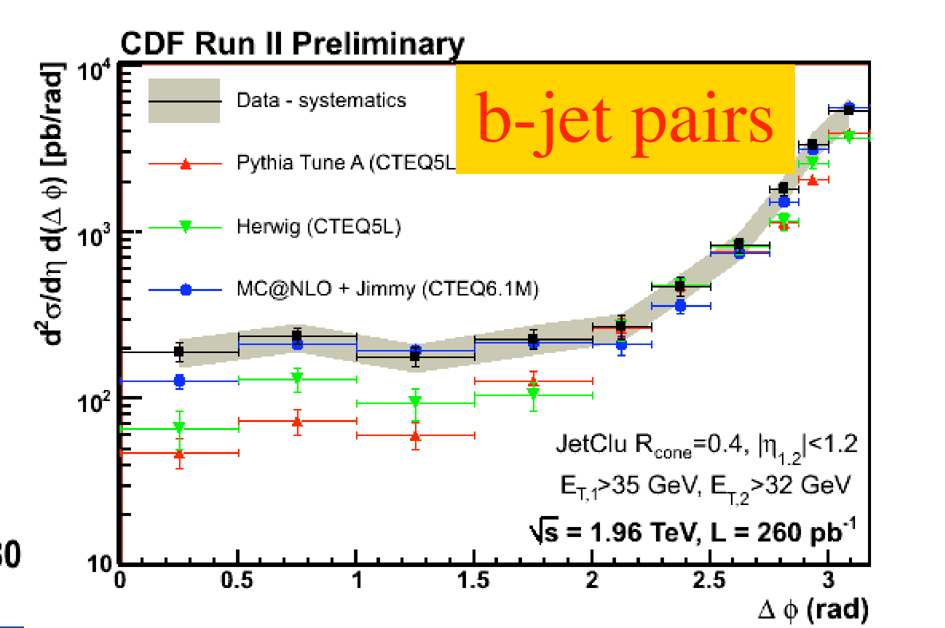
Di-jet mass distribution

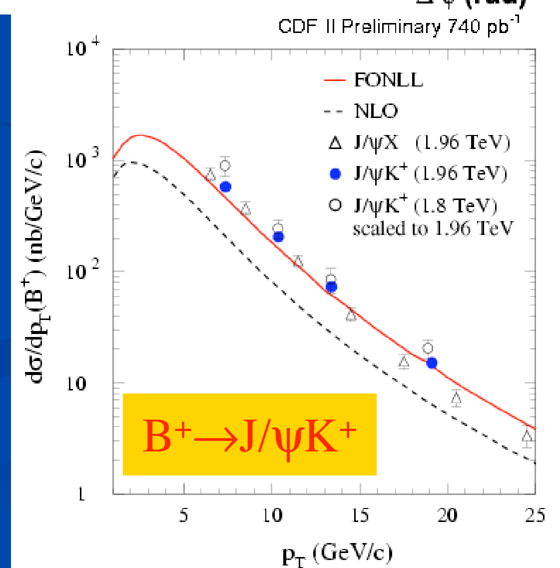


- Latest updates ($1fb^{-1}$) in agreement with pQCD NLO over >8 orders of magnitude in x-section. Up to M_{jj} =1.3 TeV

Heavy flavor production



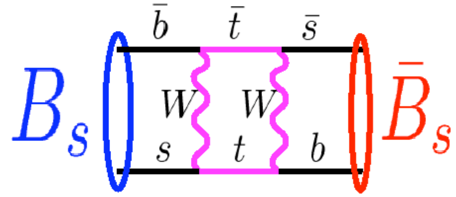




- Ricca produzione di quarks pesanti
- Nuove recenti misure
- Predizione quantitativa della produzione di heavy flavors rimane challenging
- See S. Torre talk on b-production

Flavor physics

Il sistema del Bs



B_s transforms into $\bar{B}_s$

$$i\frac{\partial}{\partial t}\left|\begin{array}{c}B_s\\ \bar{B}_s\end{array}\right\rangle = \begin{pmatrix} m_{11}-\frac{i}{2}\Gamma_{11} & m_{12}e^{-i\phi}-\frac{i}{2}\Gamma_{12} \\ m_{21}e^{-i\phi}-\frac{i}{2}\Gamma_{21} & m_{11}-\frac{i}{2}\Gamma_{11}\end{pmatrix}\left|\begin{array}{c}B_s\\ \bar{B}_s\end{array}\right\rangle$$

- Autostati massa: B_H , B_L
- Autostati CP: B_{even} , B_{odd}
- Osservabili:

$\Delta\Gamma_{CP} = \Gamma_{even} - \Gamma_{odd} \sim 2\,|\,\Gamma_{12}\,|$ (non sensibile a NP)

$\Delta m_s = M_H - M_L \sim 2M_{12}$ (sensibile a NP)

$\varphi_s = \arg(-M_{12}/\Gamma_{12}) \sim \arg(M_{12})$ (sensibile a NP)

$\Delta\Gamma_s = \Gamma_L - \Gamma_H = \Delta\Gamma_{CP}\,|\cos\varphi_s|$ (sensibile a NP)

$\varphi_s^{SM} = (4.2 \pm 1.4)*10^{-3}$ ma puo' diventare grande in NP

(es. φ_s = -0.5 to -0.8 [Hou,Nagashima,Soddu: hep-ph/0610385])

Accesso sperimentale

Δm_s

Oscillazioni in stati a flavor definito

$\Delta\Gamma_s$

Vita media autostati di CP (Bs->KK)

BR in autostati di CP ($D_s D_s$) : $2\, BR_{even} = (\Delta\Gamma_{CP}/\Gamma_s)/(1+ \Delta\Gamma_{CP}/2\Gamma_s)$

φ_s

asimmetria semileptonica $A_{SL} = \dfrac{N(\overline{B}_s \to l^+X) - N(B_s \to l^-X)}{N(\overline{B}_s \to l^+X) + N(B_s \to l^-X)} = \Delta\Gamma_s/\Delta m_s \tan(\varphi_s)$

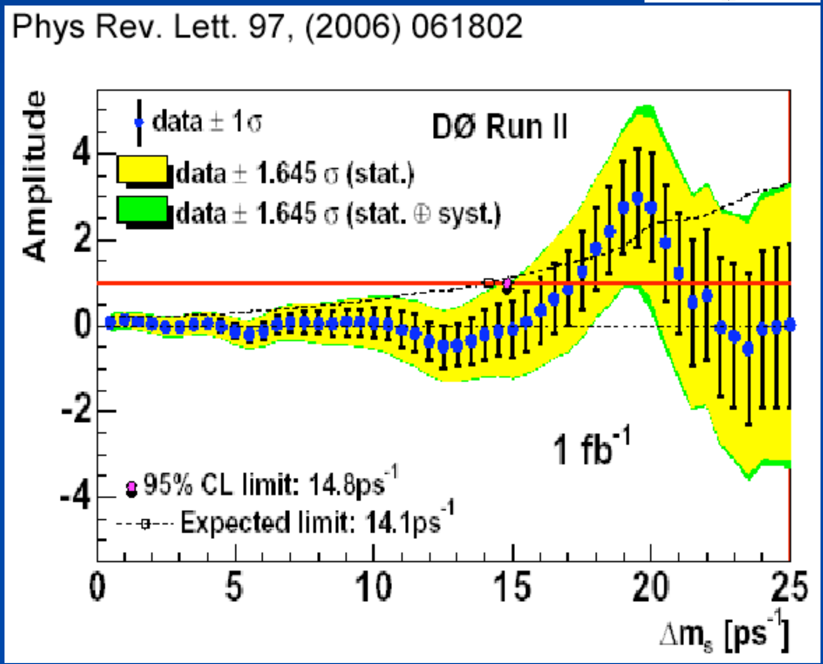
Misure simultanee nel sistema del $B_s \to J/\psi\varphi$:

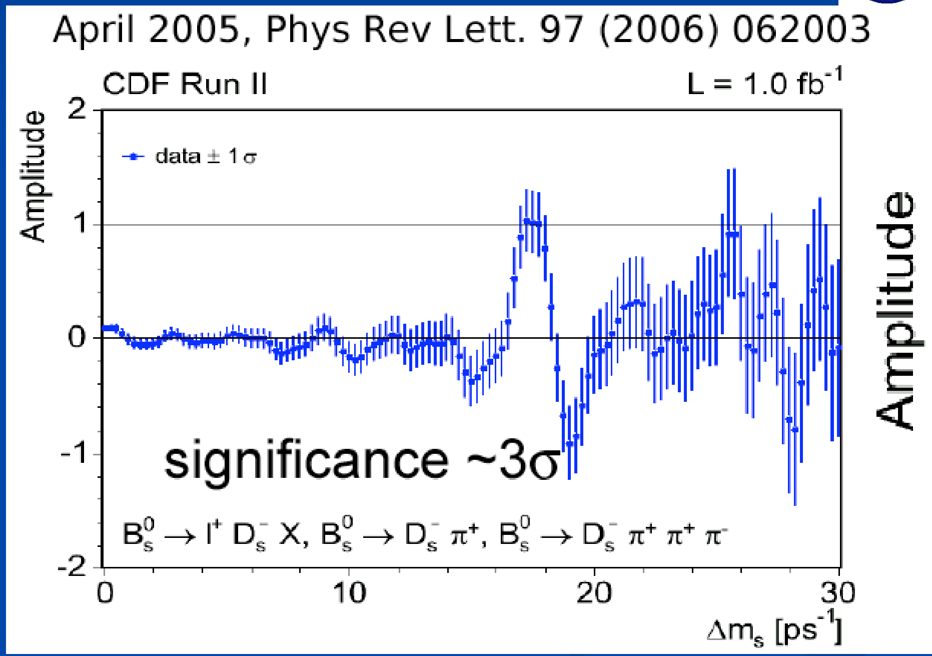
$$\Gamma(t) \propto e^{-\Gamma_s t}\left\{\cosh\frac{\Delta\Gamma_s t}{2} - \eta_f \cos\phi_s \sinh\frac{\Delta\Gamma_s t}{2} + \eta_f q D \sin\phi_s \sin(\Delta M_s t)\right\}$$

η_f autovalore CP, q carica alla produzione, D diluizione del tag

Misura dal terzo termine richiede il tagging

Bs oscillation. From evidence…





… to 5-sigma observation

- Stessa luminosita', analisi migliorata:
  - Selezione basata su NN e PID
  - Aggiunta modi parzialmente ricostruiti
  - Migliore combinazione di b-taggers

- Oscillazioni del Bs definitivamente stabilite:

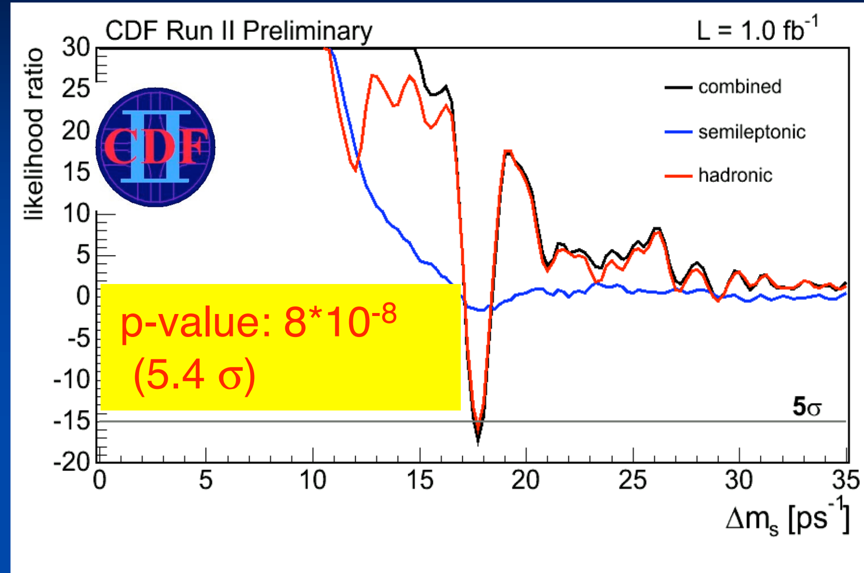
$\Delta m_s = 17.77 \pm 0.10 \pm 0.07\ ps^{-1}$

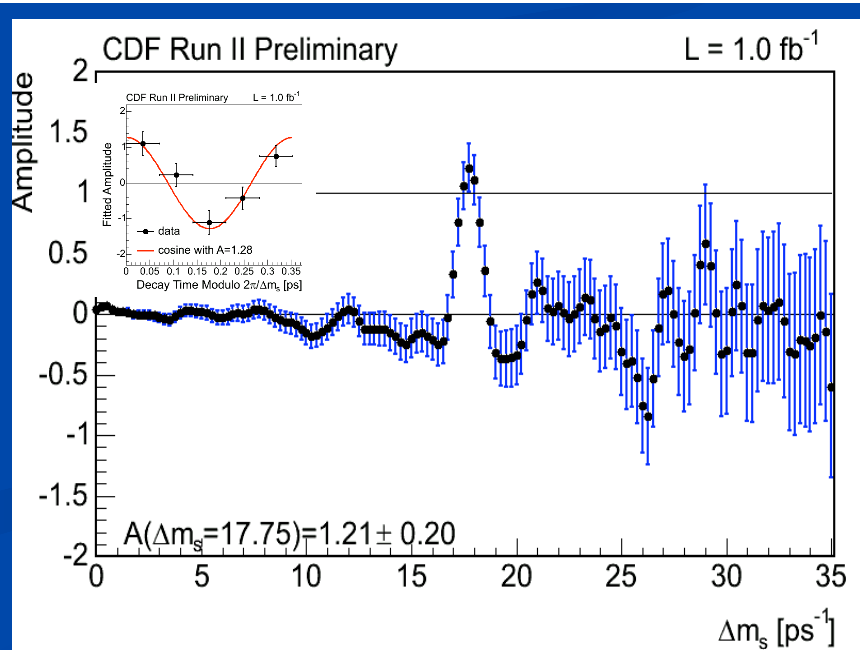
$|V_{td}|/|V_{ts}| = 0.2060 \pm 0.0007(exp)\ ^{+0.0081}_{-0.0060}(th)$

- La parola ai teorici:
  Risultato non migliorabile finche' l'incertezza teorica non diminuira' notevolmente (lattice QCD)

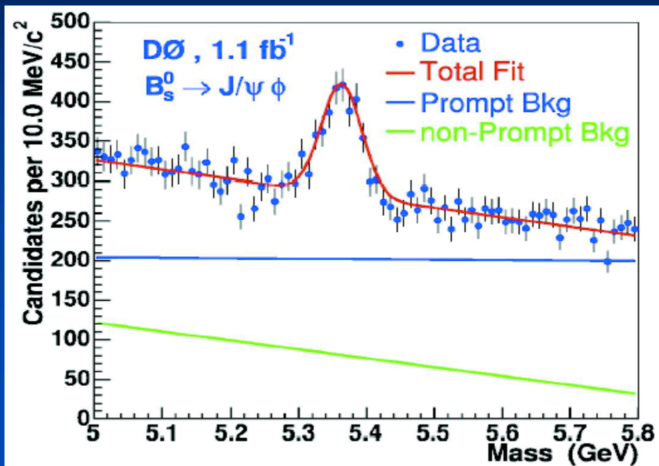
JLQCD 03 $\Delta m_s = 16.1 \pm 2.8\ ps^{-1}$

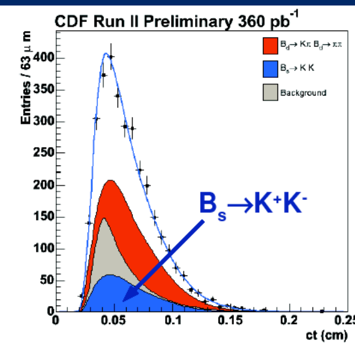
HPQCD 03 $\Delta m_s = 21.3 \pm 3.2\ ps^{-1}$



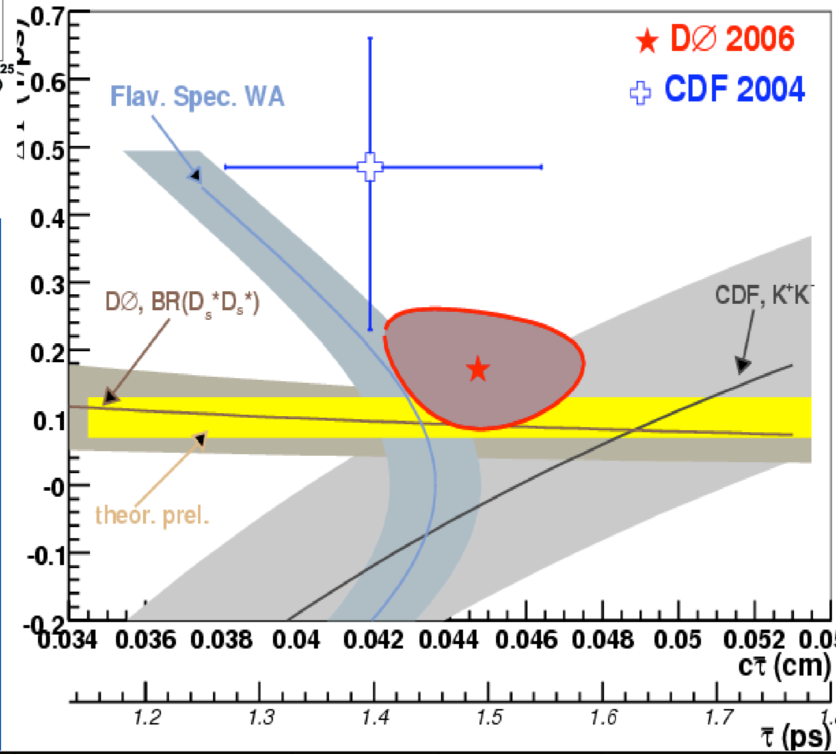


$\Delta\Gamma_s$





$$\tau_{CP-even} \sim \frac{1}{\Gamma_s}\left[\frac{1}{1+(\Delta\Gamma_{CP}/2\Gamma_s)}\right]$$



- Il piu' recente aggiornamento e' di D0 con 1fb-1 di $B_s \to J/\psi\varphi$

  Fit insieme a vita media.
  Separazione dei due autostati di CP dalla distribuzione angolare

  $\Delta\Gamma_s = (0.17 \pm 0.08 \pm 0.02)\ ps^{-1}$

- Predizione piu' recente (non in figura)

  $\Delta\Gamma_s^{SM} = (0.088 \pm 0.017)\ ps^{-1}$

[Lenz,Nierste, hep-ph/0612067]

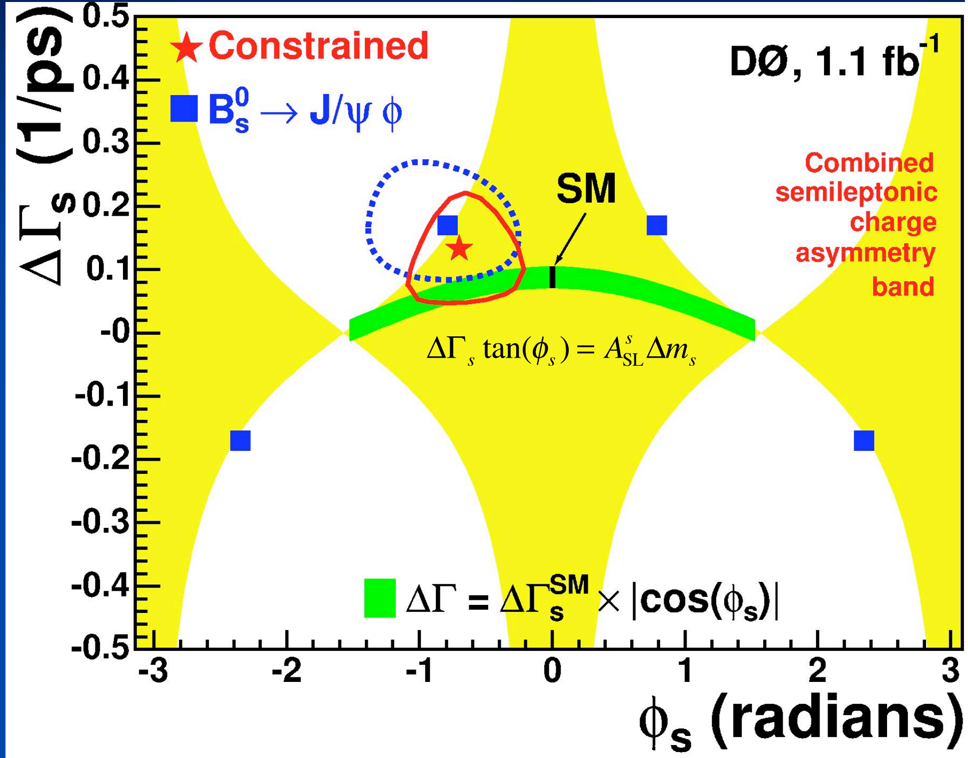
Exp	Mode	Lumi	N(signal)	$\Delta\Gamma_{CP}/\Gamma_s$
CDF [30]	$B_s \to K^+K^-$	360 pb-1	718 ± 55	–0.08 ± 0.23 ± 0.03
CDF [29]	$B_s \to D_s^+(\phi\pi)\,D_s^-(\phi\pi)$	355 pb-1	23.5 ± 5.5	diff b/c non-inclus.
D0 [28]	$B_s \to D_s^{(*)}(\phi\pi)\,D_s^{(*)}(\mu\phi X)$	1.3 fb-1	11.4 ± 6.5	$0.079^{+0.038+0.031}_{-0.035-0.030}$
ALEPH 2000				$0.26^{+0.30}_{-0.15}$

φ_s - $\Delta\Gamma_s$

- Fit combinato di:
  - Parametri $B_s \to J/\psi\varphi$ (D0)
  - Δm_s (CDF)
  - B_s lifetime (PDG)
  - A_{SL} (B_s) (D0)

$\Delta\Gamma_s = (0.13 \pm 0.09)\ ps^{-1}$

$\varphi_s = -\ 0.70\ ^{+0.47}_{-0.39}$



- Adding theoretical input on A_{SL} (B_d) (reduces uncertainty on A_{SL} (B_s) :

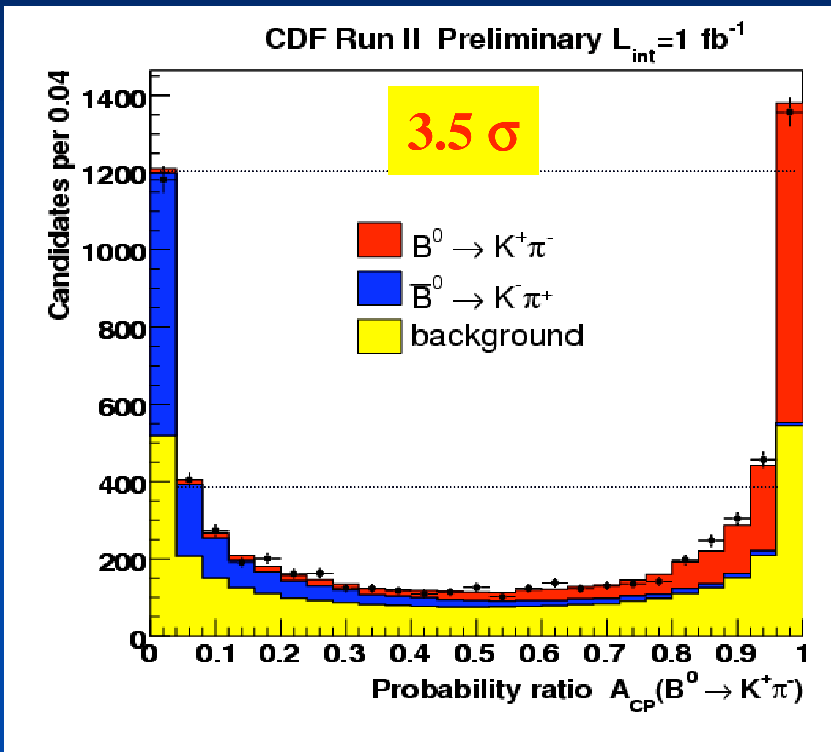
$\varphi_s = -\ 0.77 \pm 0.34$(exp) $\pm\ 0.04$(th)

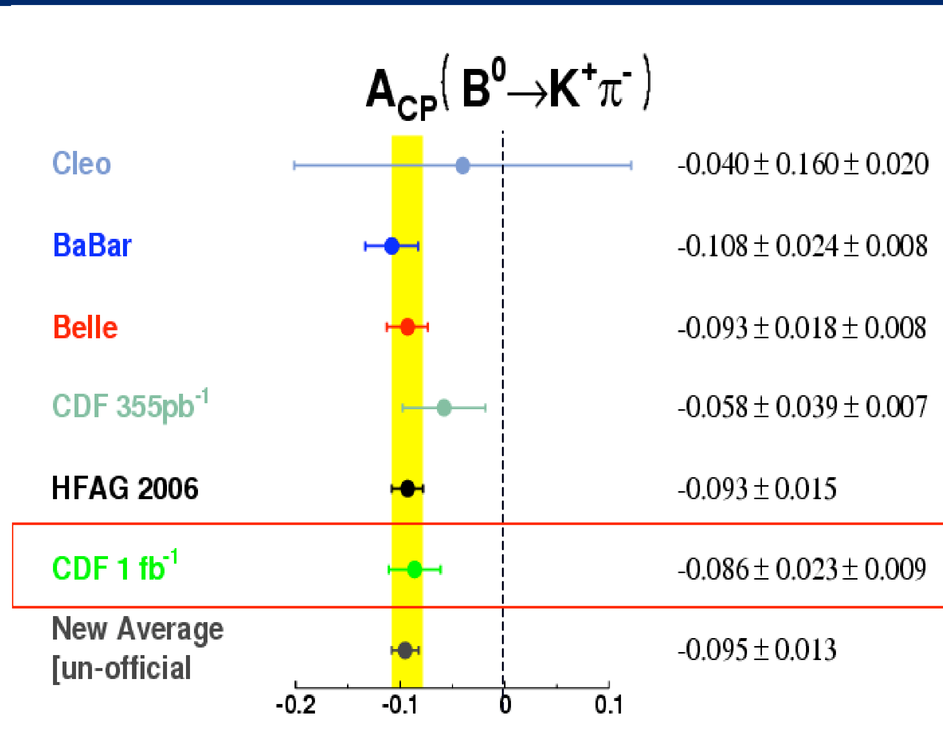
2σ from SM

[Lenz,Nierste, hep-ph/0612067]

New Physics ?
Wait for more data
(CDF 1fb^{-1} update soon)

A_{CP} in charmless B modes





(As of BEAUTY 2006)

- Grandi campioni di B charmless dal trigger su parametro d'impatto a CDF
- 1 fb^{-1} update di **$A_{CP}(B^0 \to K^+\pi^-)$: - 0.086 ± 0.023 ± 0.009**

⇒ stessa precisione di e^+e^- . Aumenta significativita' di media mondiale.

- Sistematica piccola - Estrapola a risoluzione 1% in run II

  ⇒ CDF probabile migliore singola misura in futuro

oltre il B^0 e B^+

- CDF molto lontano dall'efficienza di Babar e Belle sui neutri. In compenso sensibile a canali inaccessibili a Y(4s):
  3 nuovi modi charmless osservati:

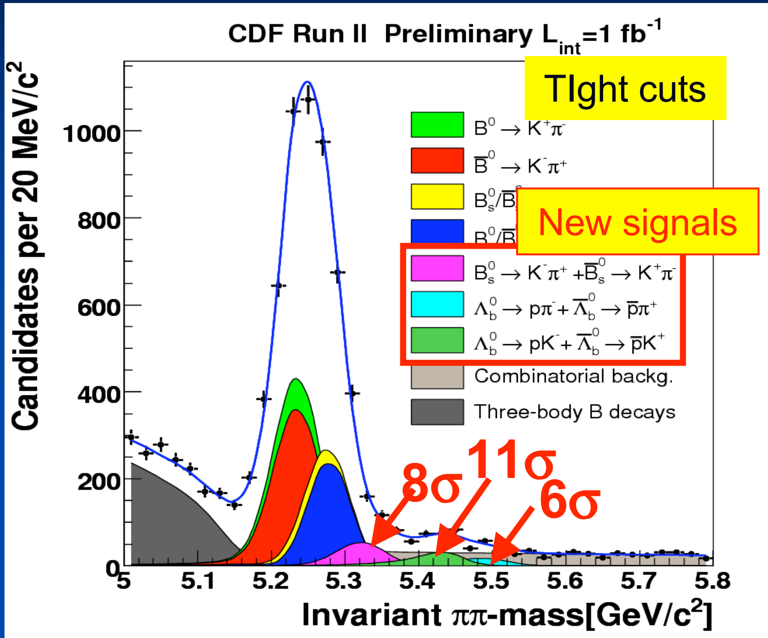
  $B_s \to K^-\pi^+$, $\Lambda^0_b \to p\pi^-$, $\Lambda^0_b \to pK^-$

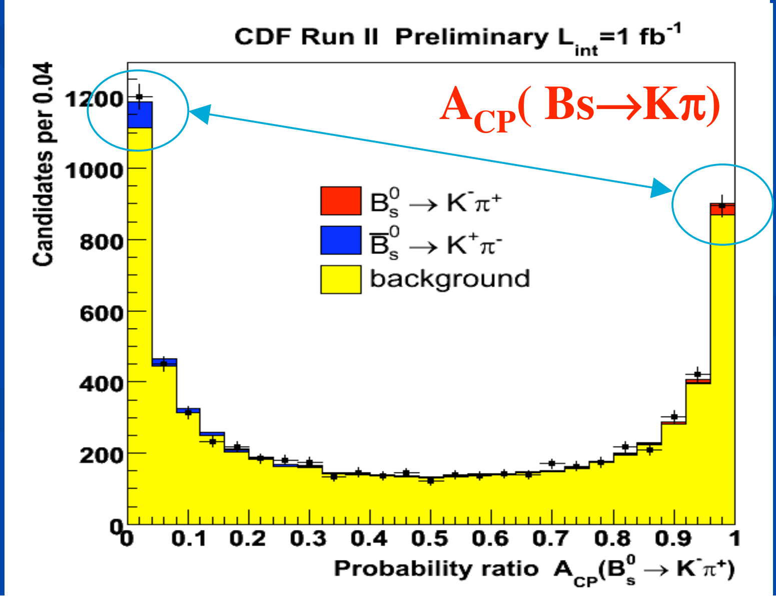
- IF $A_{CP}(B_d \to K^+\pi^-)$ is SM
  $\Rightarrow A_{CP}(B_s \to K^-\pi^+) = 40\%$ (large !)

Prima DCPV del Bs "facilmente osservabile":

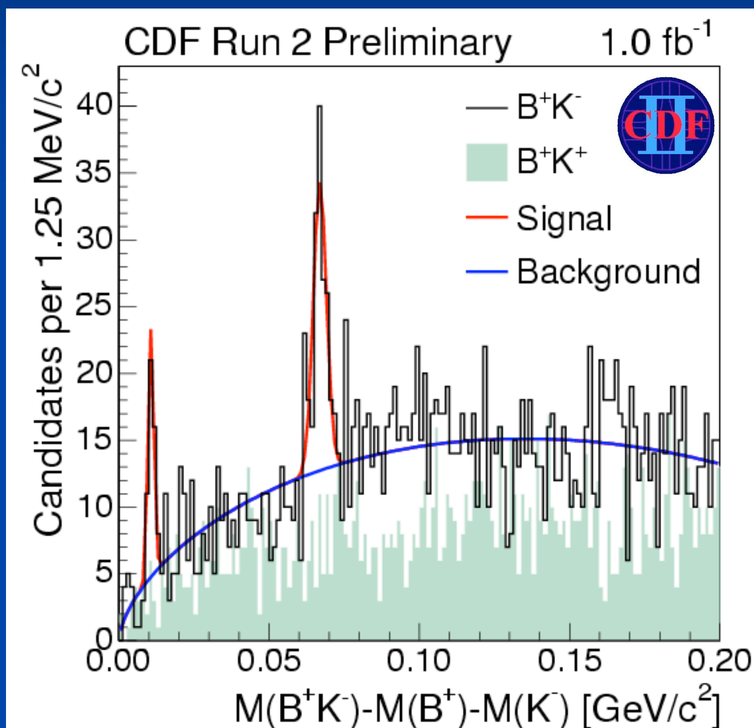
$A_{CP}(B_s \to K\pi) = 0.39 \pm 0.15 \pm 0.08$
$\Rightarrow$ no evidence for non-SM CPV

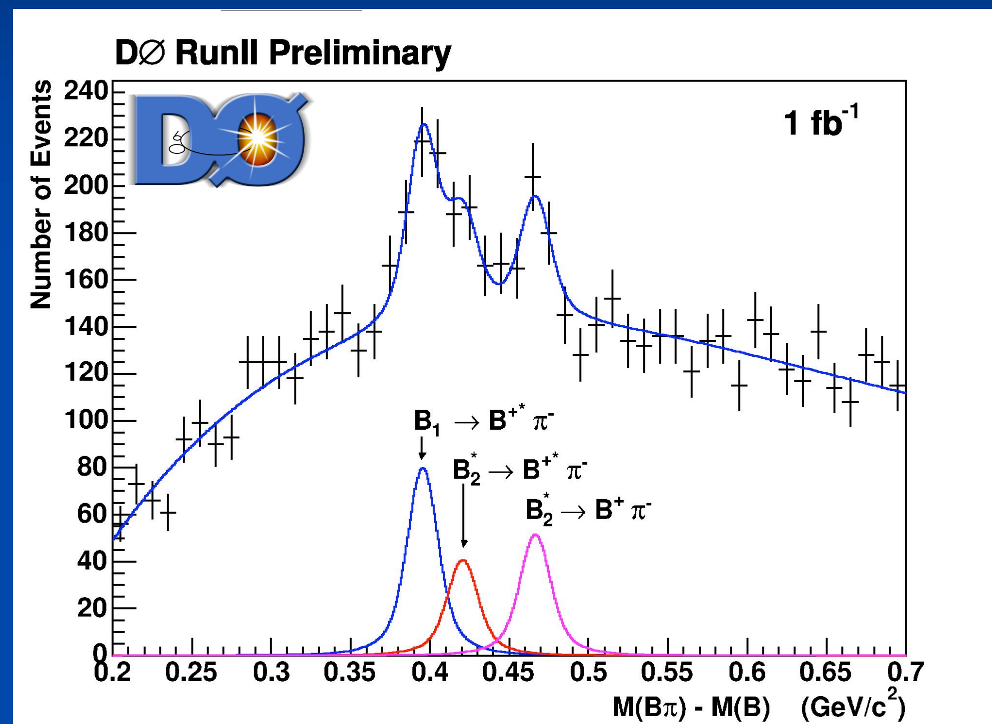
Much better test with more data:
observe a large DCPV **or** find NP





Observation of excited B mesons





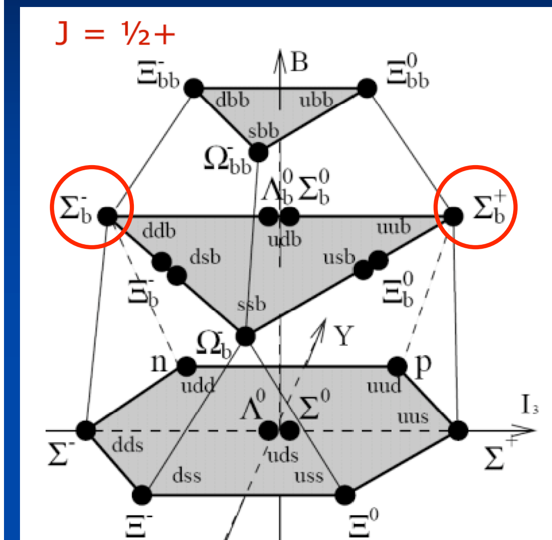
B_s^{**}

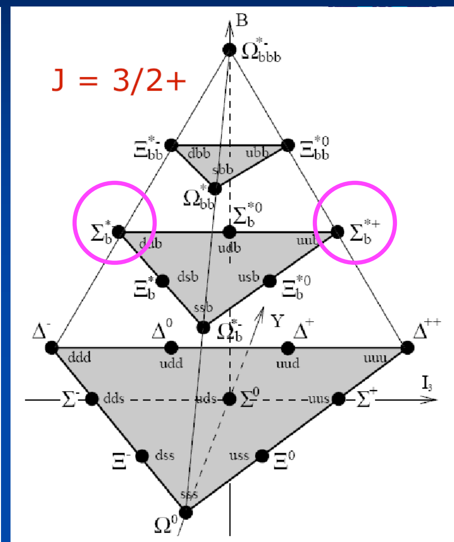
m(Bs1) = 5829.41 ± 0.21 ± 0.14 ± 0.6 (PDG) MeV/c2
m(Bs2*) = 5839.64 ± 0.39 ± 0.14 ± 0.5 (PDG) MeV/c2

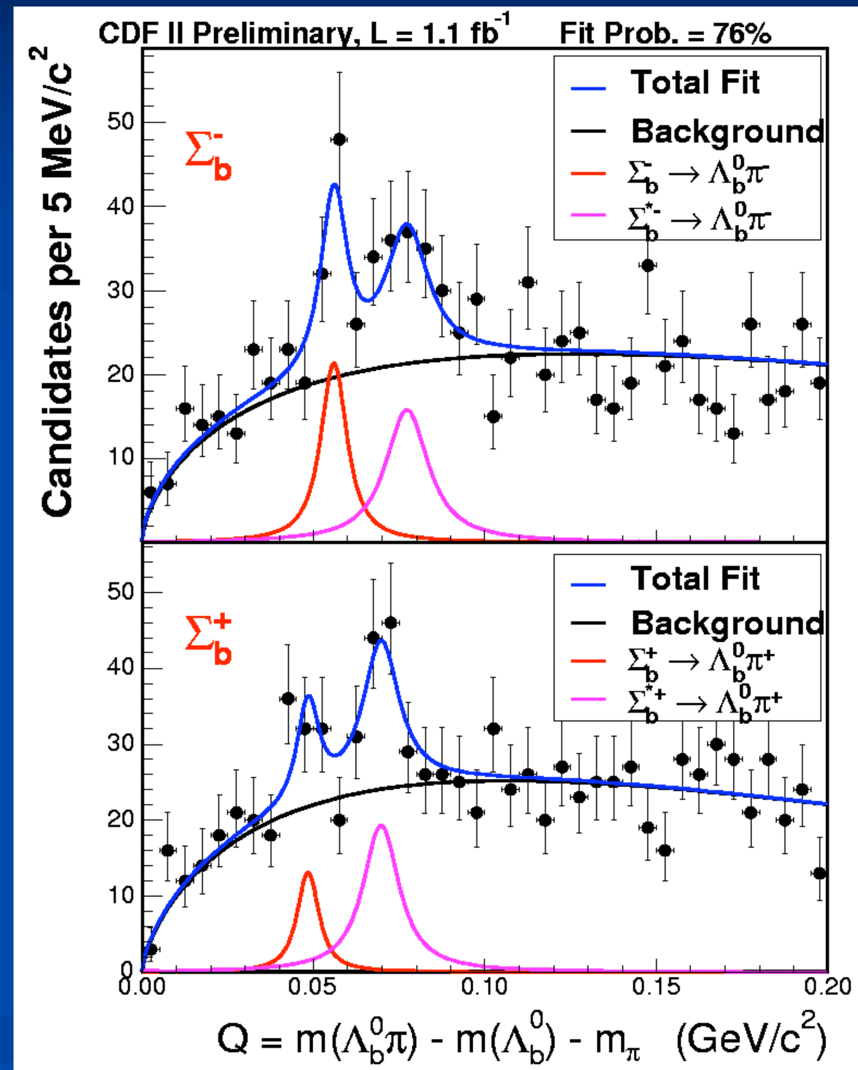
B^{**}

m(B1) = 5720.8 ± 2.5 ± 5.3 MeV/c2
m(B2*)-m(B1) = 25.2 ± 3.0 ± 1.1 MeV/c2

Observation of Σ_b , Σ_b^*







- Λ_b (*udb*) **only** established *b* baryon
- Next accessible baryons: *uub* and *ddb* with J^P =1/2(Σ_b) and 3/2 (Σ_b*)
- Look at *Λ_b + track:* Observe signals consistent with lowest lying Σ_b states

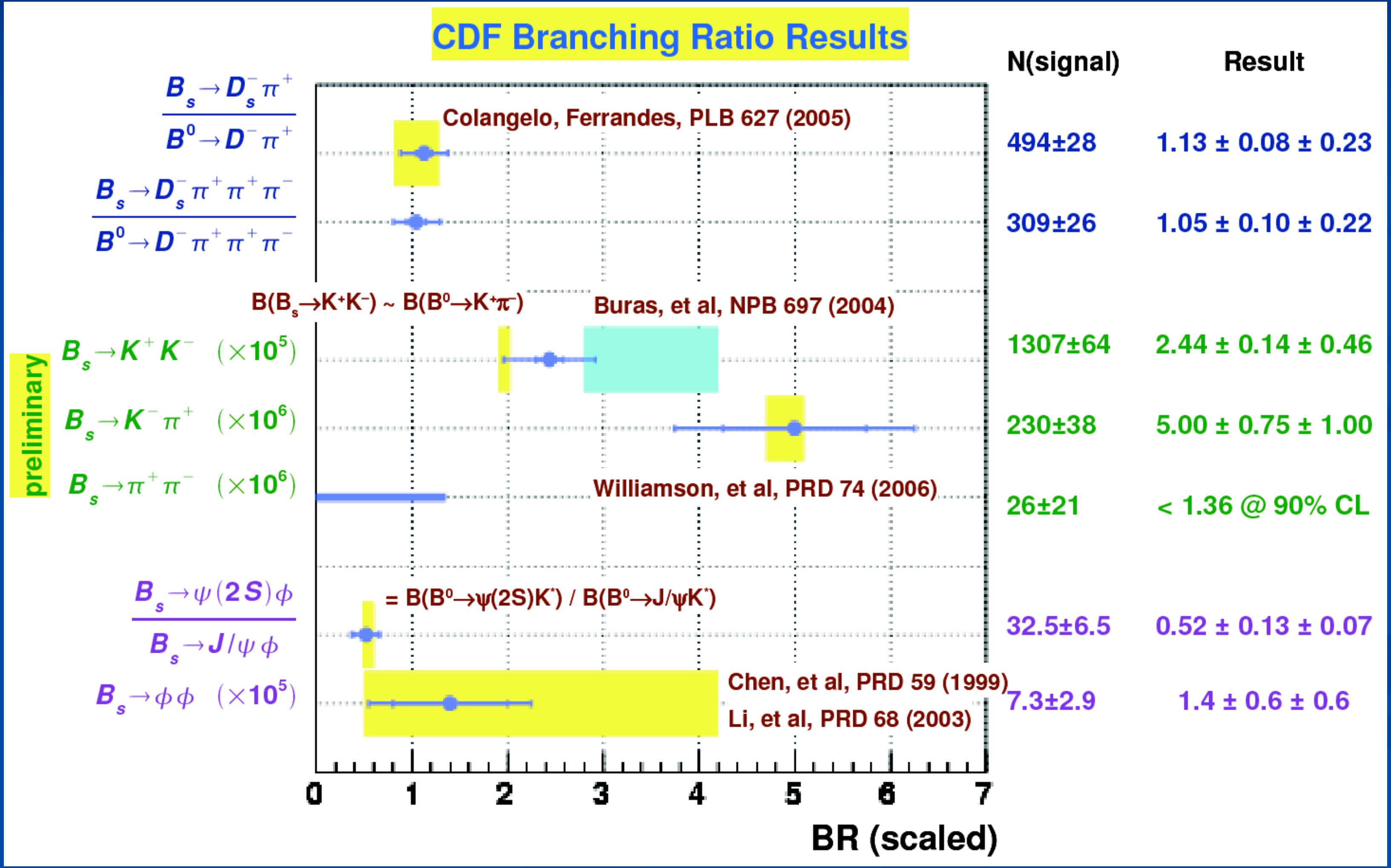
$$m(\Sigma_b^-) = 5815.2 \pm 1.0\ (\text{stat}) \pm 1.7\ (\text{syst})\ \text{MeV/c}^2$$

$$m(\Sigma_b^+) = 5807.7^{+2.0}_{-2.3}\ (\text{stat}) \pm 1.7\ (\text{syst})\ \text{MeV/c}^2$$

$$m(\Sigma_b^{*-}) = 5836.5^{+2.1}_{-1.9}\ (\text{stat}) \pm 1.7\ (\text{syst})\ \text{MeV/c}^2$$

$$m(\Sigma_b^{*+}) = 5829.0^{+1.6}_{-1.8}\ (\text{stat}) \pm 1.7\ (\text{syst})\ \text{MeV/c}^2$$

Collezione di BR del B_s …



Precision charm measurements

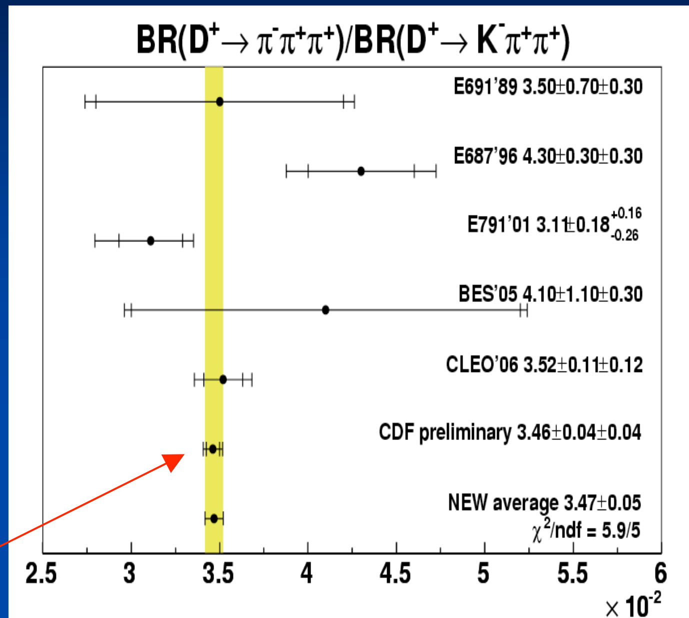
- A CDF grandi campioni di charm dal trigger sul parametro d'impatto

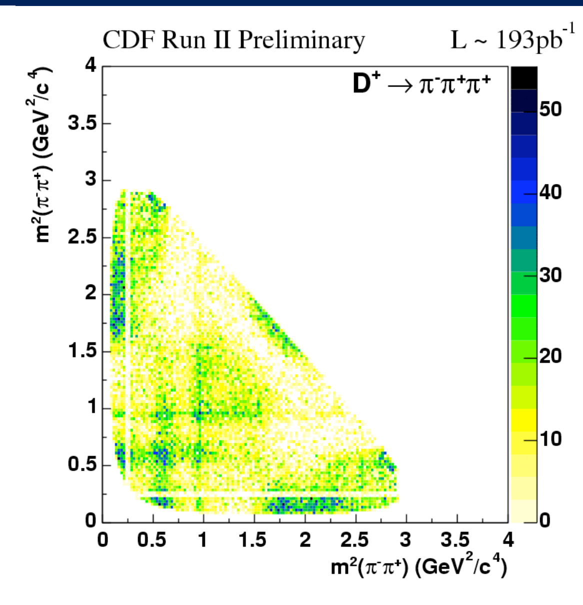
$\Rightarrow$ possibili molte misure di precisione

Esempio recente $D^+ \to \pi\pi\pi$

NEW

BR($D^+ \to \pi\pi\pi$)/BR($D^+ \to K\pi\pi$) ($0.2 fb^{-1}$)



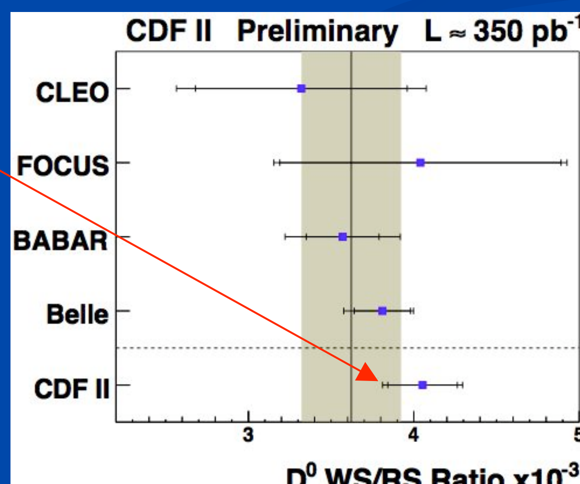


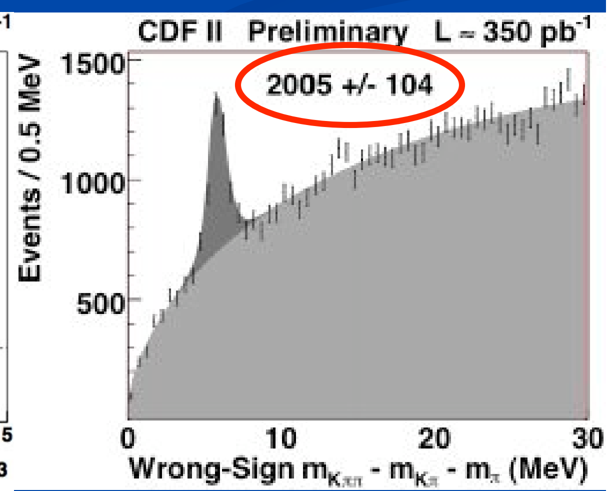
PUBLISHED

$D^0 \to K\pi$ DCS fraction

2000 eventi / 350 pb^{-1}

Sensitivity to D^0 oscillations)

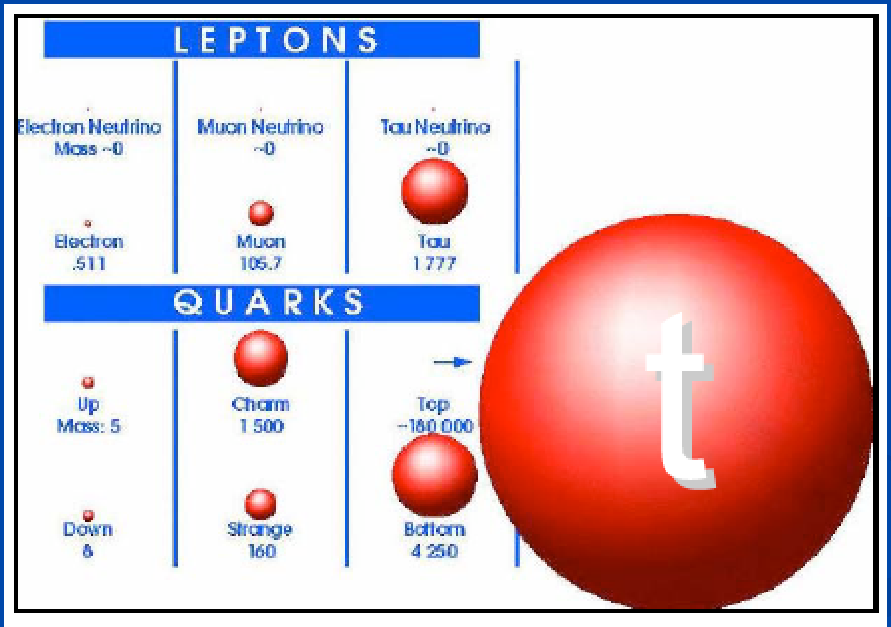




Molte altre misure di precisione eseguite solo su piccoli campioni:

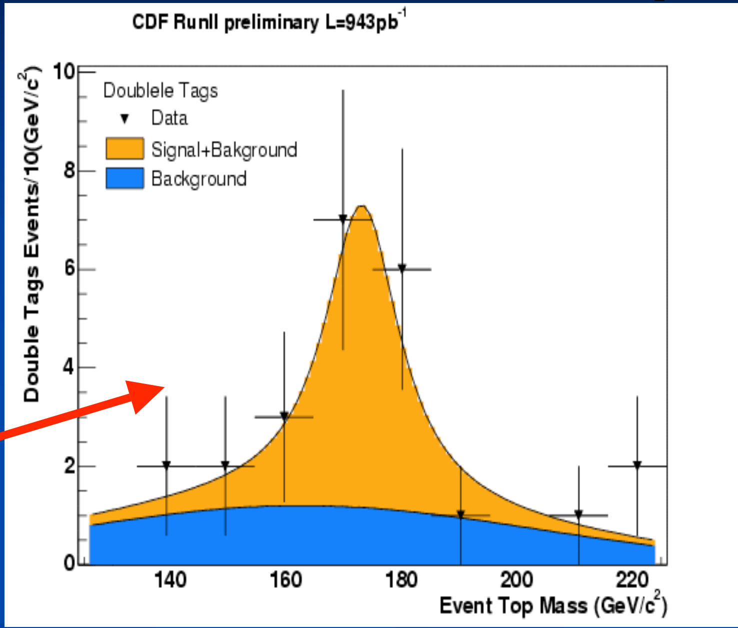
- $A_{CP}(D^0 \to hh)$ ($0.12 fb^{-1}$)
- BR($D^0 \to \mu\mu$) ($0.07 fb^{-1}$)

Top quark


LEPTONS
Electron Neutrino
Mass ~0
Muon Neutrino
~0
Tau Neutrino
~0
Electron
.511
Muon
105.7
Tau
1 777
QUARKS
Up
Mass: 5
Charm
1 500
Top
~180 000
Down
8
Strange
160
Bottom
4 250
t

Improved measurements of m_{top}

- Metodi di analisi piu' potenti:
  - Matrix-Element method: assegna a ogni evento una Likelihood invece di una stima individuale di m_{top}
  - In-situ jet calibration: fit Jet Energy Scale and m_{top} simultaneamente
  - ME - assisted Templates
- Buoni risultati persino per all-hadronic
- Il canale migliore e' pero' lepton+jets



Combined Likelihood JES (or 1/JES) vs M_{top}

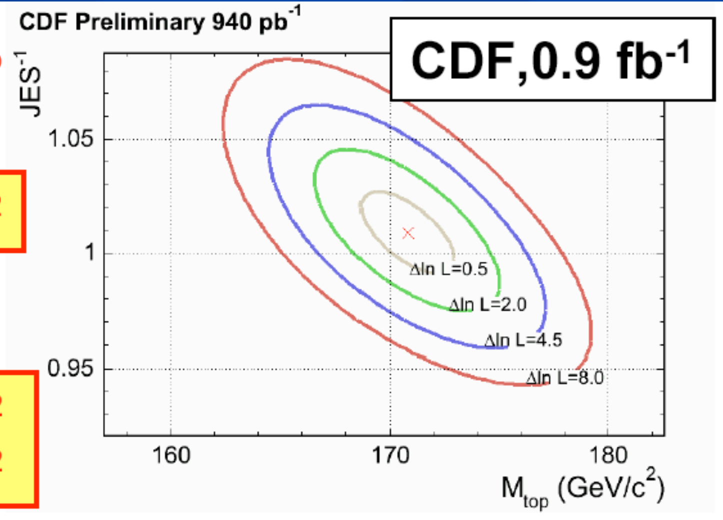
Simultaneous fit of m_{top}, JES, and f_{top}:

CDF :M_{top}=170.9±2.2(stat.+JES)±1.4(syst.)GeV/c^2

NEW

untagged ⇓

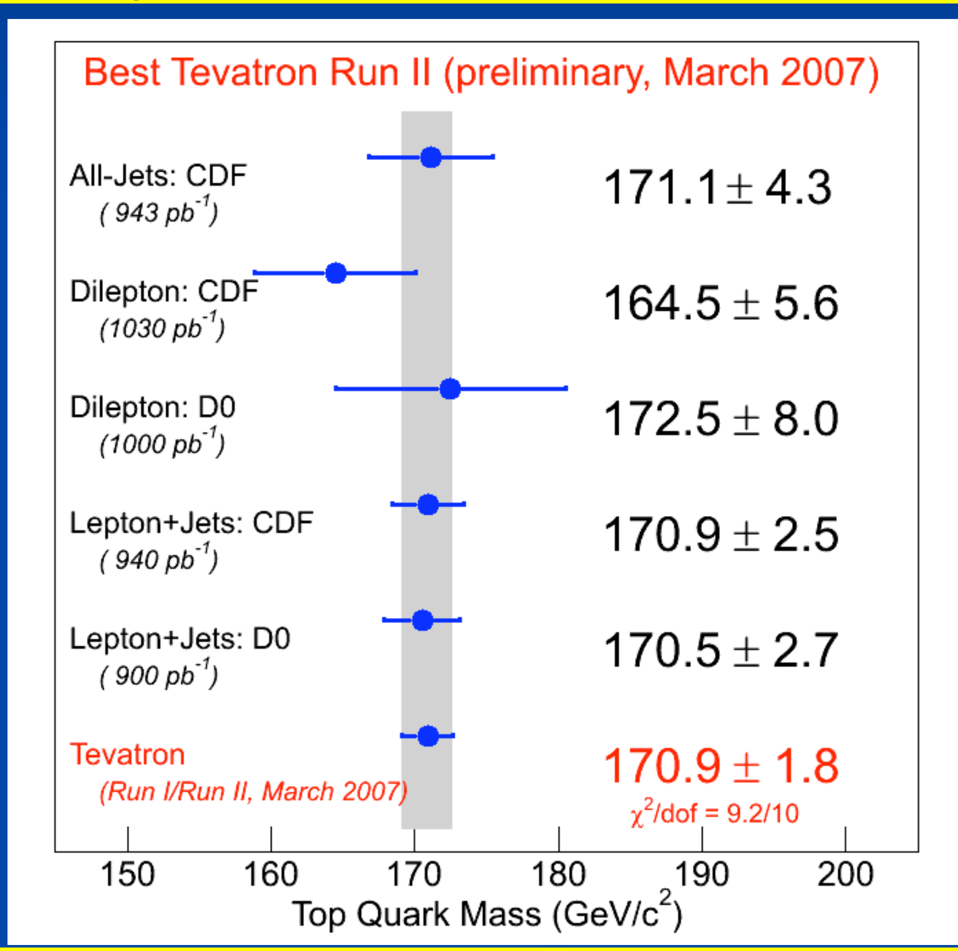
DØ :M_{top}=170.5±2.5 (stat.+JES)±1.4 (syst.)GeV/c^2
DØ :M_{top}=170.5±2.4 (stat.+JES)±1.2 (syst.)GeV/c^2



top quark mass *(new 3/07)*

New Tevatron average (1 fb^{-1})

$m_{top} = 170.9 \pm 1.1 \pm 1.5$ GeV/c

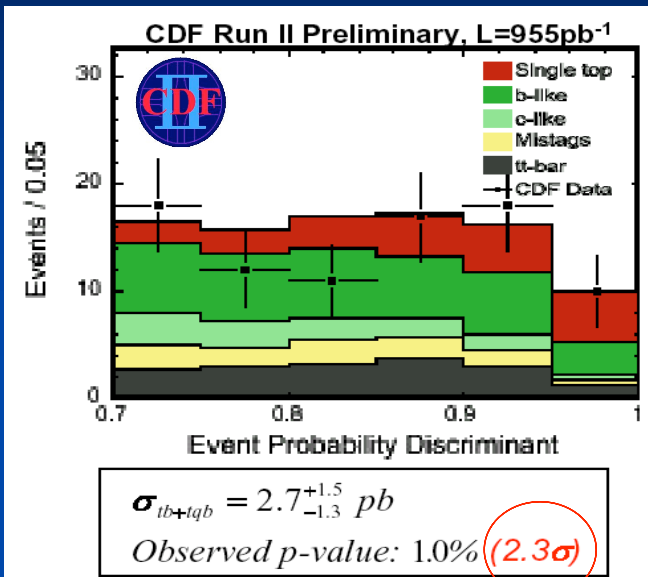


1 %

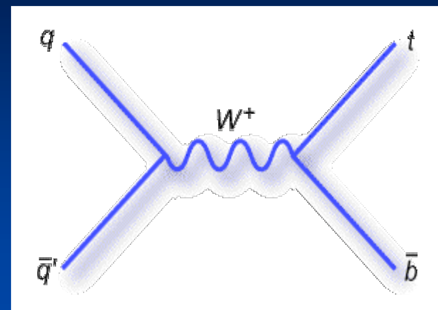
…and can still improve with more data

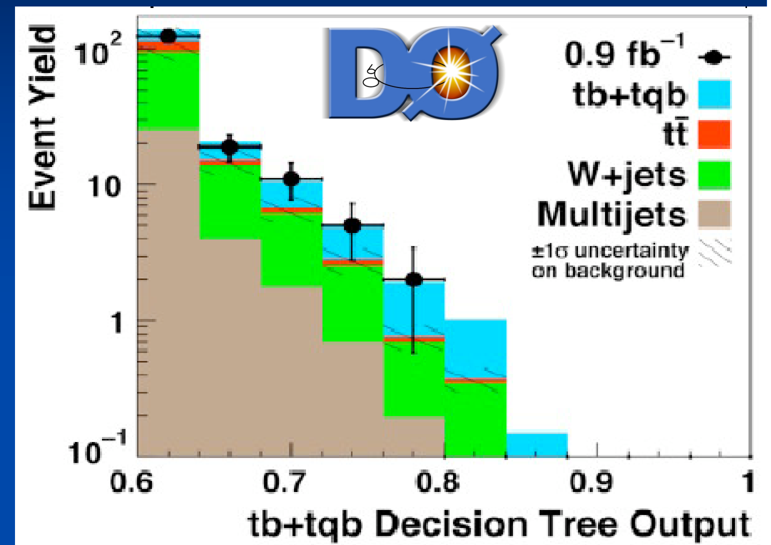
IFAE 2005: the goal was "2 – 3 GeV/exp. by *end* of Run II"

3.4σ evidence for single-top

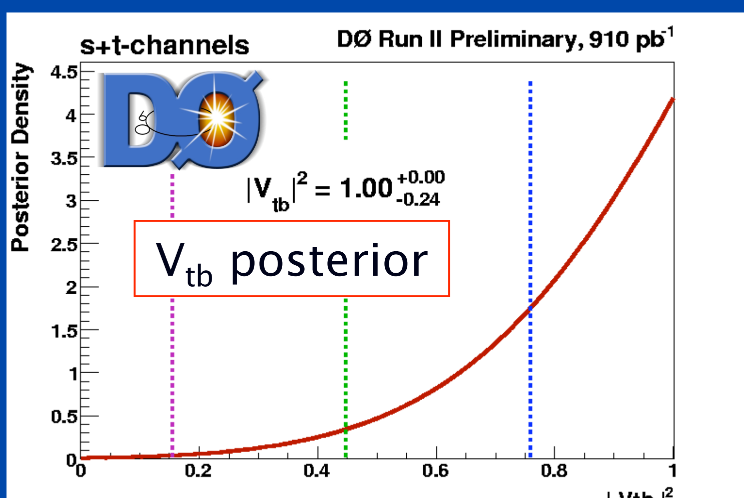


insufficient evidence at CDF





σ(1-top) = 4.9 ± 1.4 pb
from Boosted Trees Method
(2 other methods agree, but only BTM shows sufficient evidence)



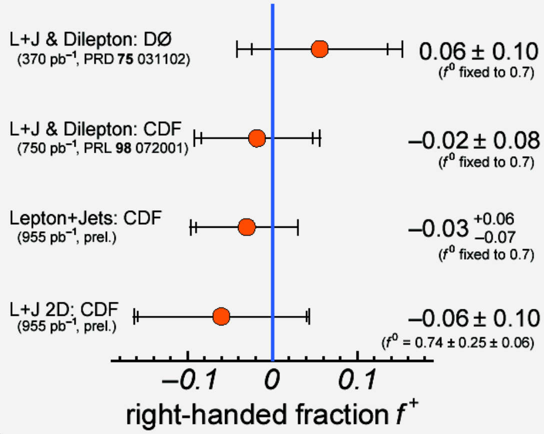
⟹ Direct measurement of CKM element V_{tb} (expected 0.99)

$0.68 < |V_{tb}| \leq 1$

(95% Bayesian prob.)

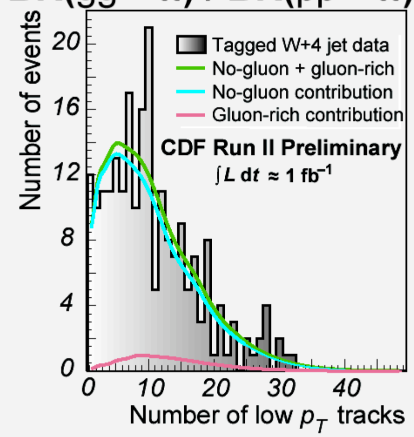
12 anni dopo la scoperta, vari test dicono di si'

W Helicity: t → Wb Decay Shows SM *V–A* Structure

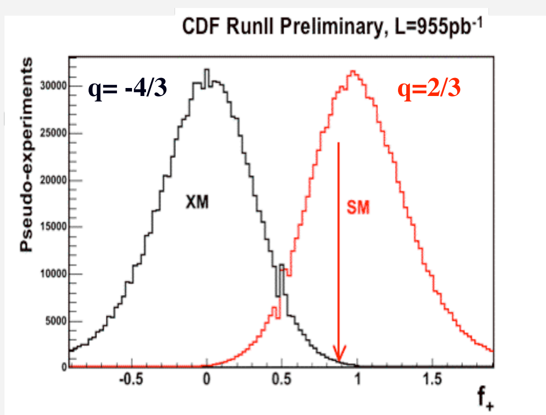


Is the Top really the Standard Model Top?

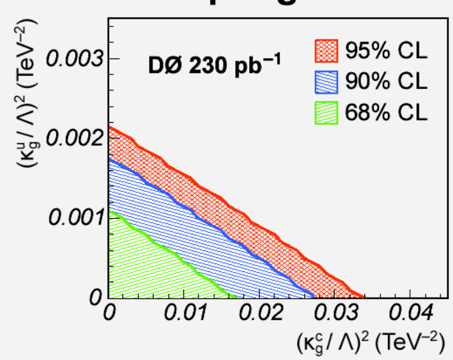
First Measurements of BR(gg→$t\bar{t}$) / BR($p\bar{p}$→$t\bar{t}$)



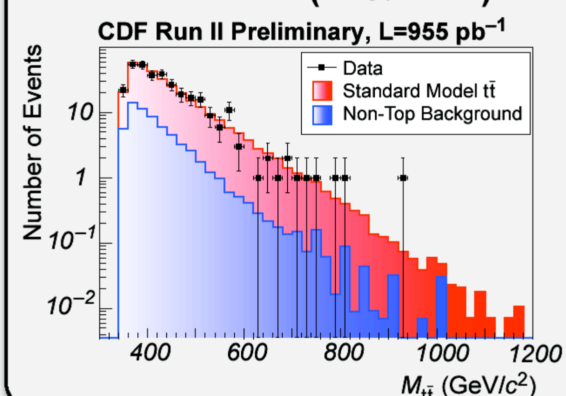
Top Charge: Standard Model Value 2/3e Favored



Single Top FCNC: New Limits on Anomalous Top Couplings

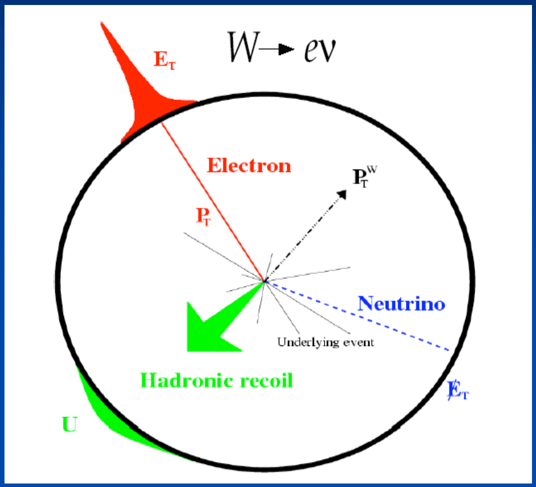


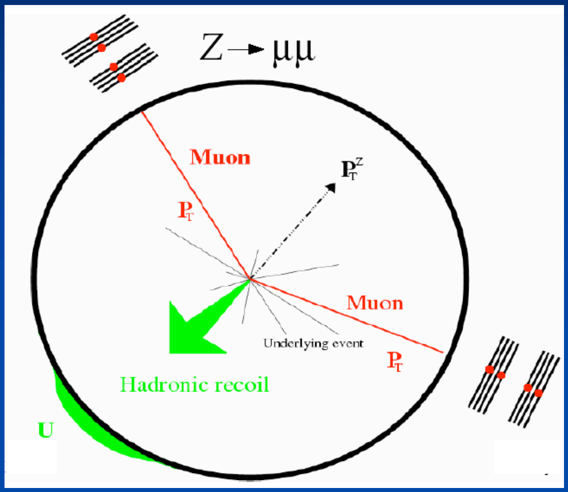
$t\bar{t}$ Resonance Production: Leptophobic Z' excluded up to 725 GeV (95% C.L.)



Gauge bosons: W, Z

Gauge bosons: W, Z

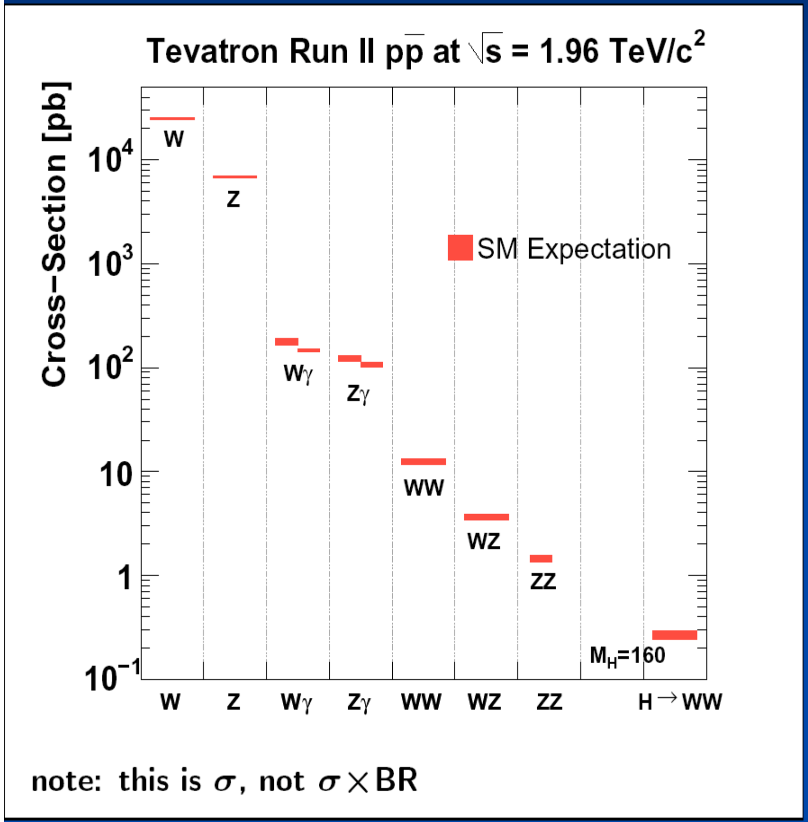


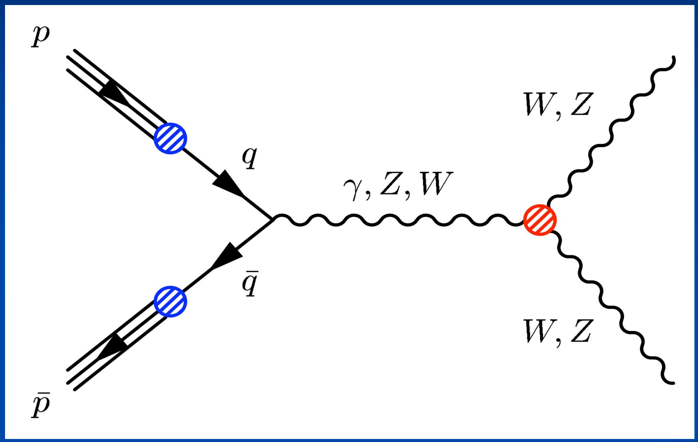


- Clear signature at Tevatron: hi-p_t leptons, MET
- Study couplings -> precision EWK test, find BSM effects
  - Double-boson production particularly interesting
- High rate of single production allows studying properties
  - Z well known from LEP, but:
    no better place than Tevatron to study the W

Several new results

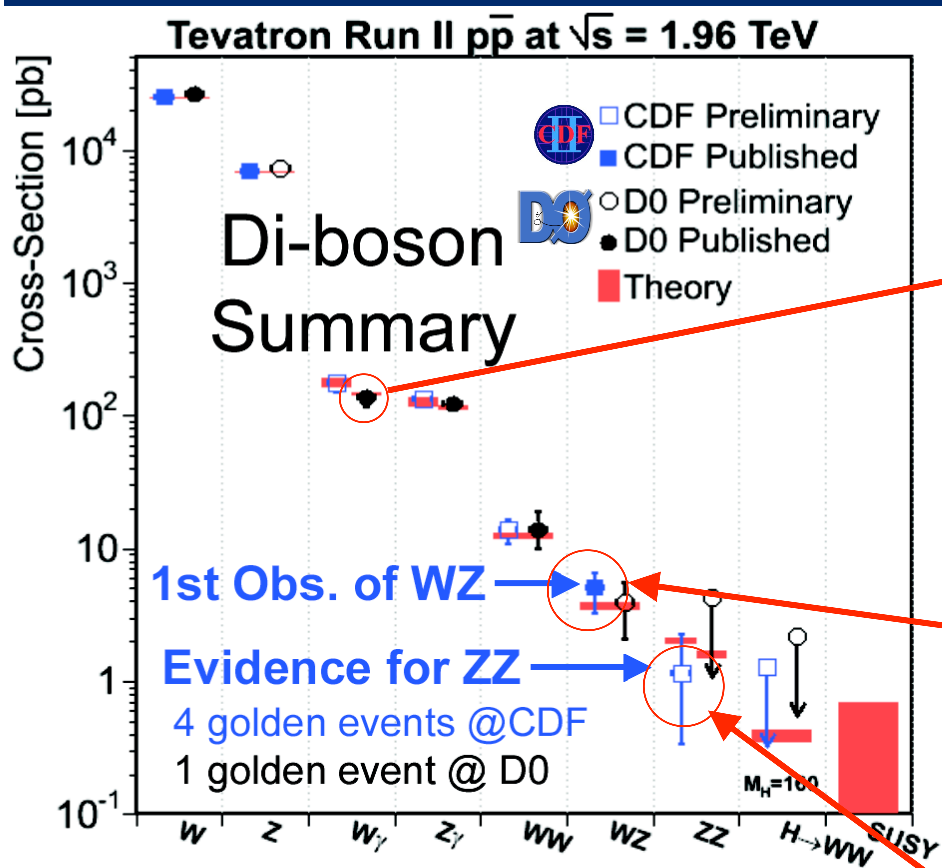
2-boson production: test of 3-boson couplings (TGC)

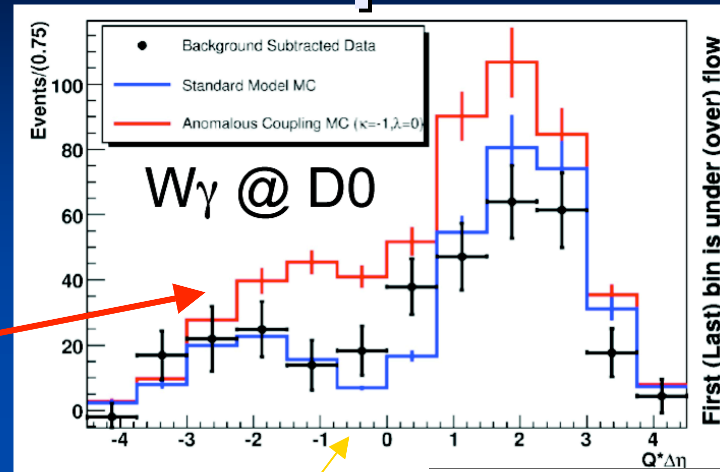




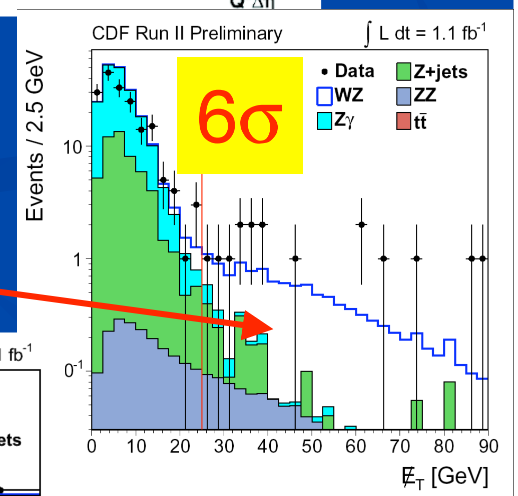
- Different s and different configurations from LEP
  - Es WZ: tests WWZ coupling separately from WWγ
- ZZ final state tests SM-forbidden ZZZ and ZZγ (only proceeds in t-channel)

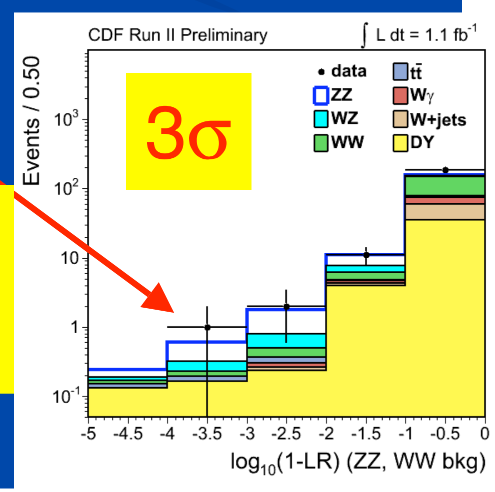
New results in 2-boson production





Zero-amplitude

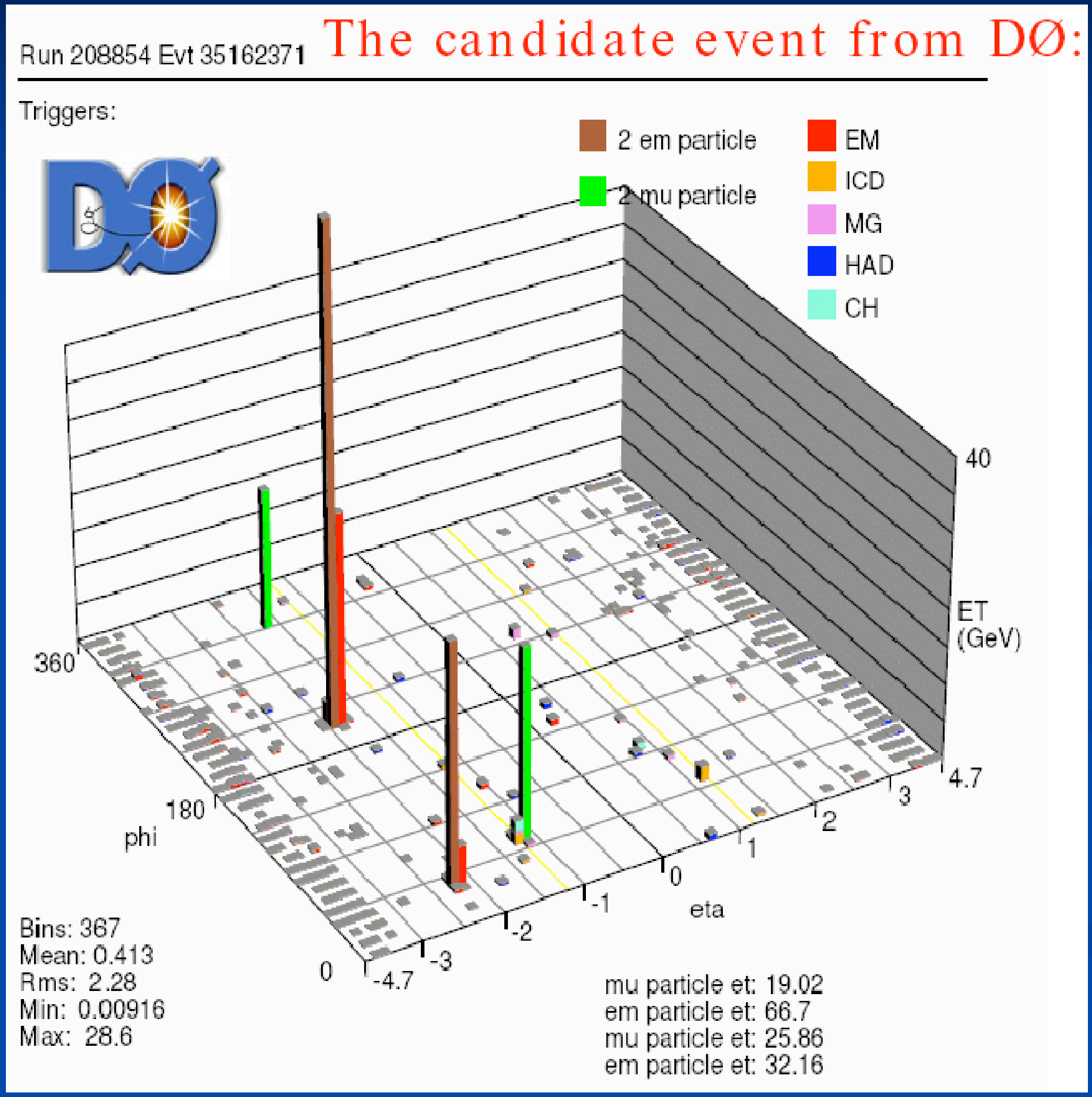


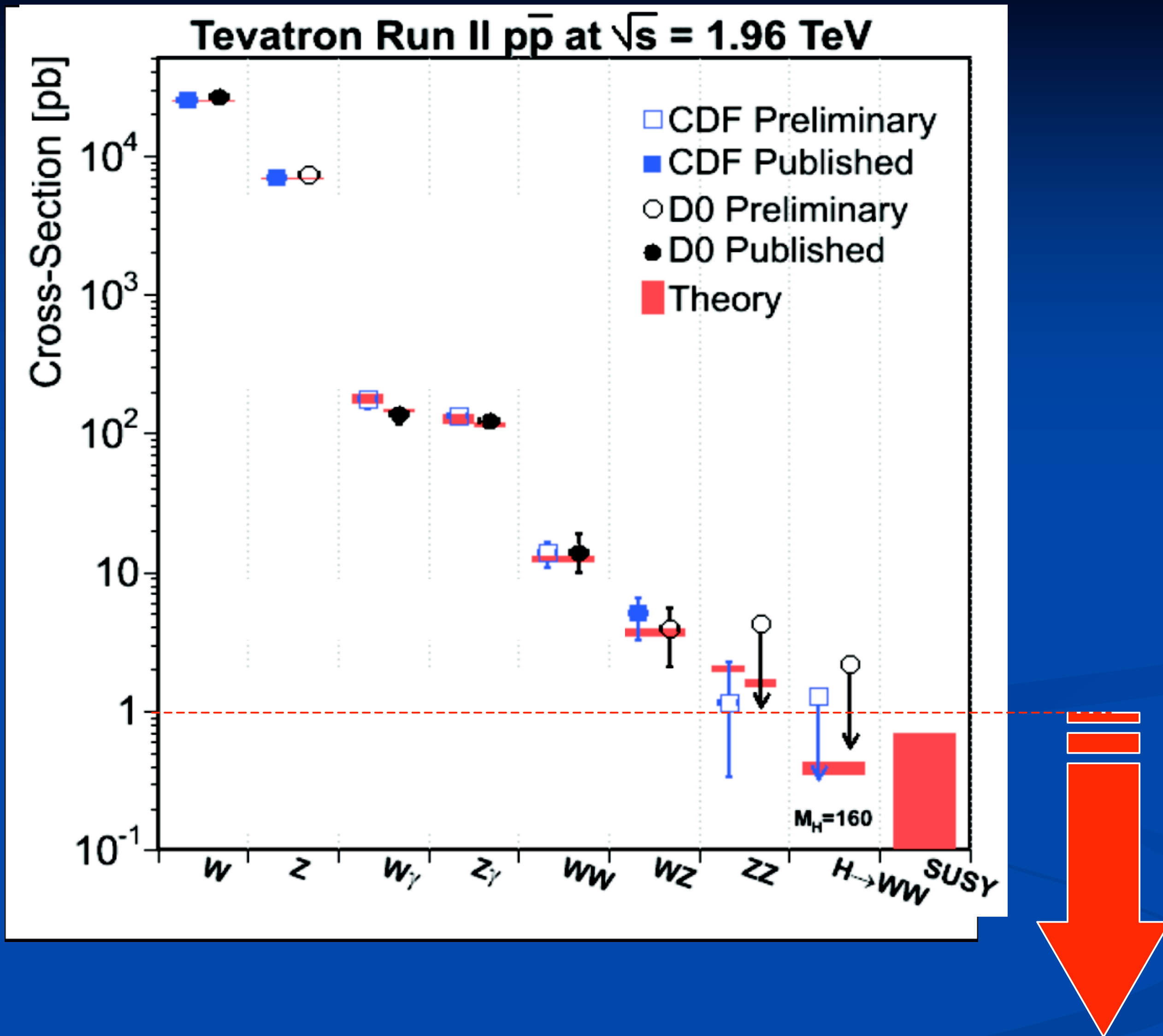


Probing down to ~1pb…
still find agreement with SM

Segnali oggi, fondi domani

ZZ → 4 leptons candidate





Probing even deeper:
Higgs ,SUSY, ...?...

Loop contributions to m_W

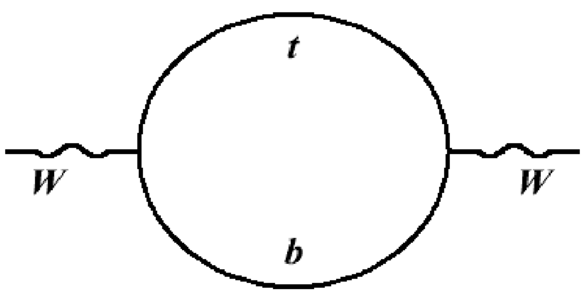
W Boson Mass

Given precise measurements of m_Z and $\alpha_{EM}(m_Z)$, we can predict m_W:

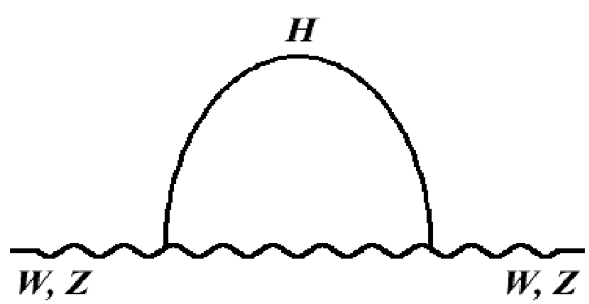
$$m_W^2 = \frac{\pi \alpha_{EM}}{\sqrt{2} G_F (1 - m_W^2/m_Z^2)(1 - \Delta r)}$$

("on-shell scheme")

Δr: O(3%) radiative corrections dominated by *tb* and Higgs loops



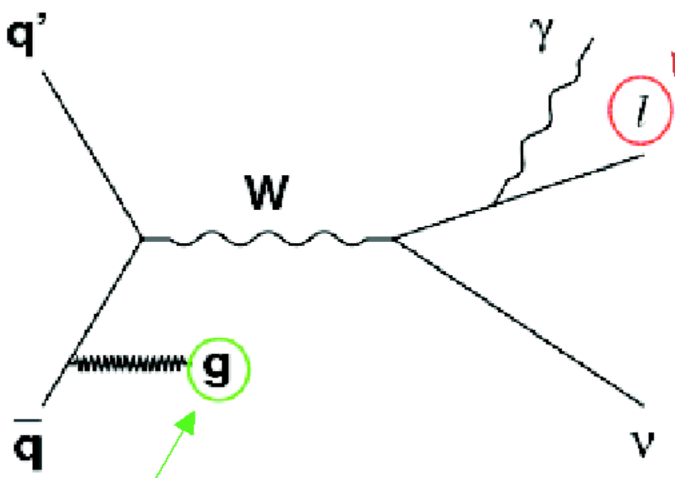
$\Delta m_W \propto m_t^2$



$\Delta m_W \propto ln\,(m_H/m_Z)$

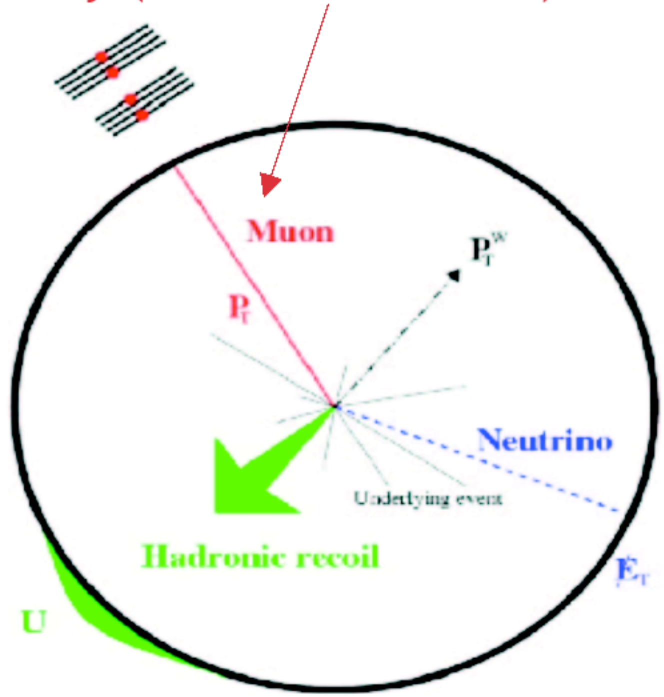
A precision business

Quark-antiquark annihilation dominates (80%)



precise charged lepton measurement is the key (achieved ~0.03%)

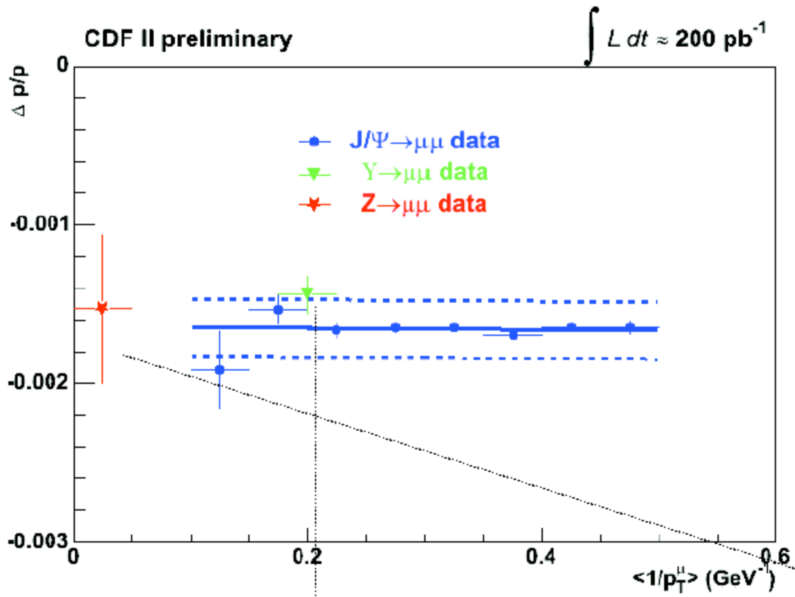
Recoil measurement allows inference of neutrino E_T (restricted to u<15 GeV)



Combine information into transverse mass: $m_T = \sqrt{2 p_T^{\,l} p_T^{\,\nu} (1 - \cos\phi_{l\nu})}$

Use Z→μμ and Z→ee events to derive recoil model

Momentum scale calibration

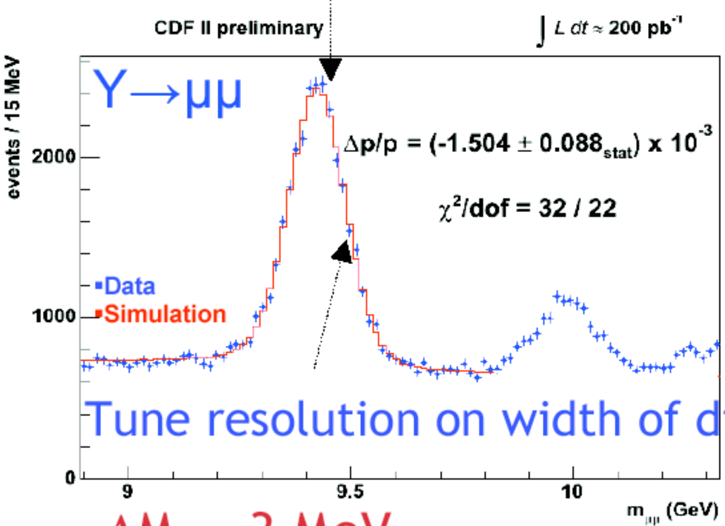


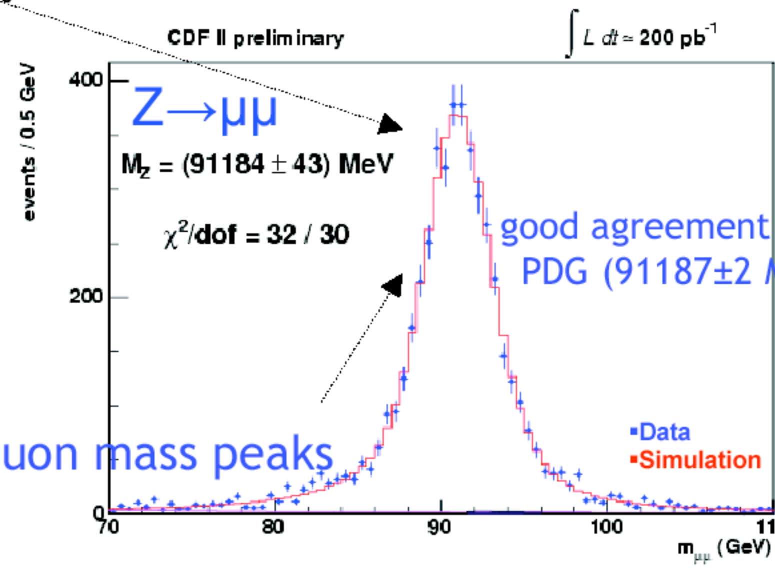
Exploit large J/ψ and Upsilon datasets to set tracker scale

Tune model of energy loss
→ J/ψ independent of muon p_T

$\Delta M_W = 17$ MeV

Apply momentum scale to Z's



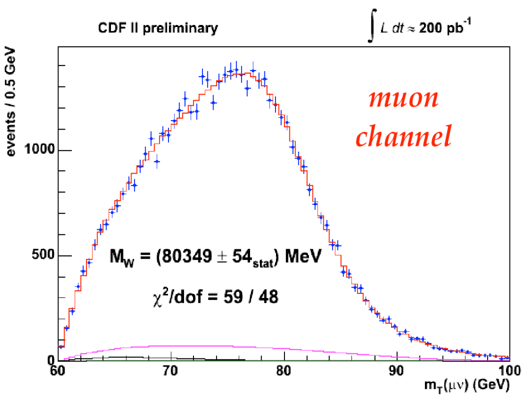


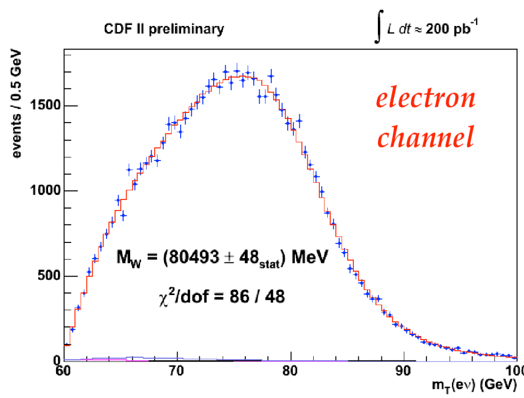
good agreement with PDG (91187±2 MeV)

Tune resolution on width of di-muon mass peaks

$\Delta M_W = 3$ MeV

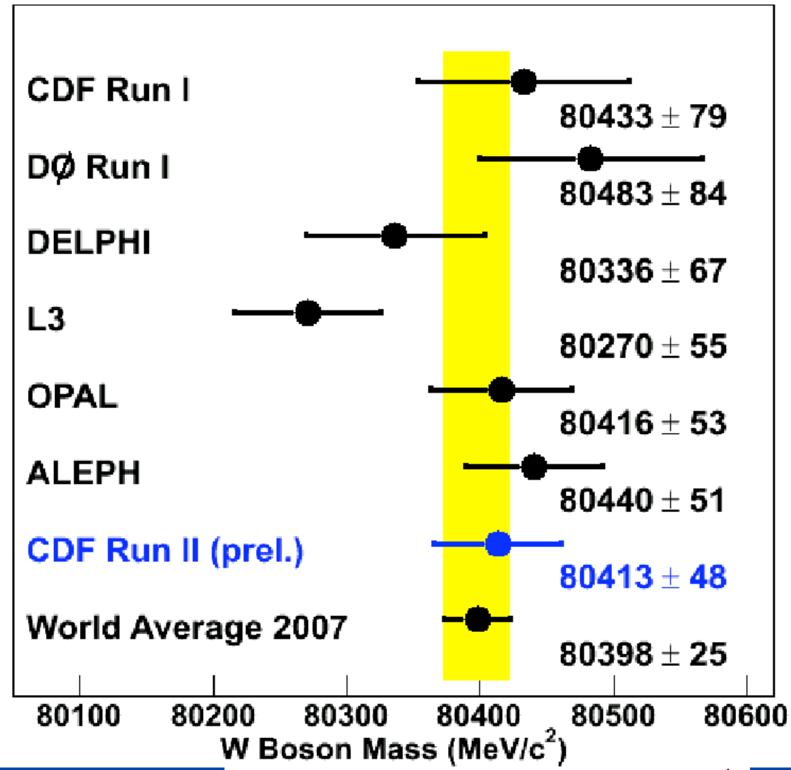
New W mass results (03/07)





m_W = 80417 ± 48 MeV (stat + sys)

for $e + \mu$ combination ($P(\chi^2)$ = 7%)



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

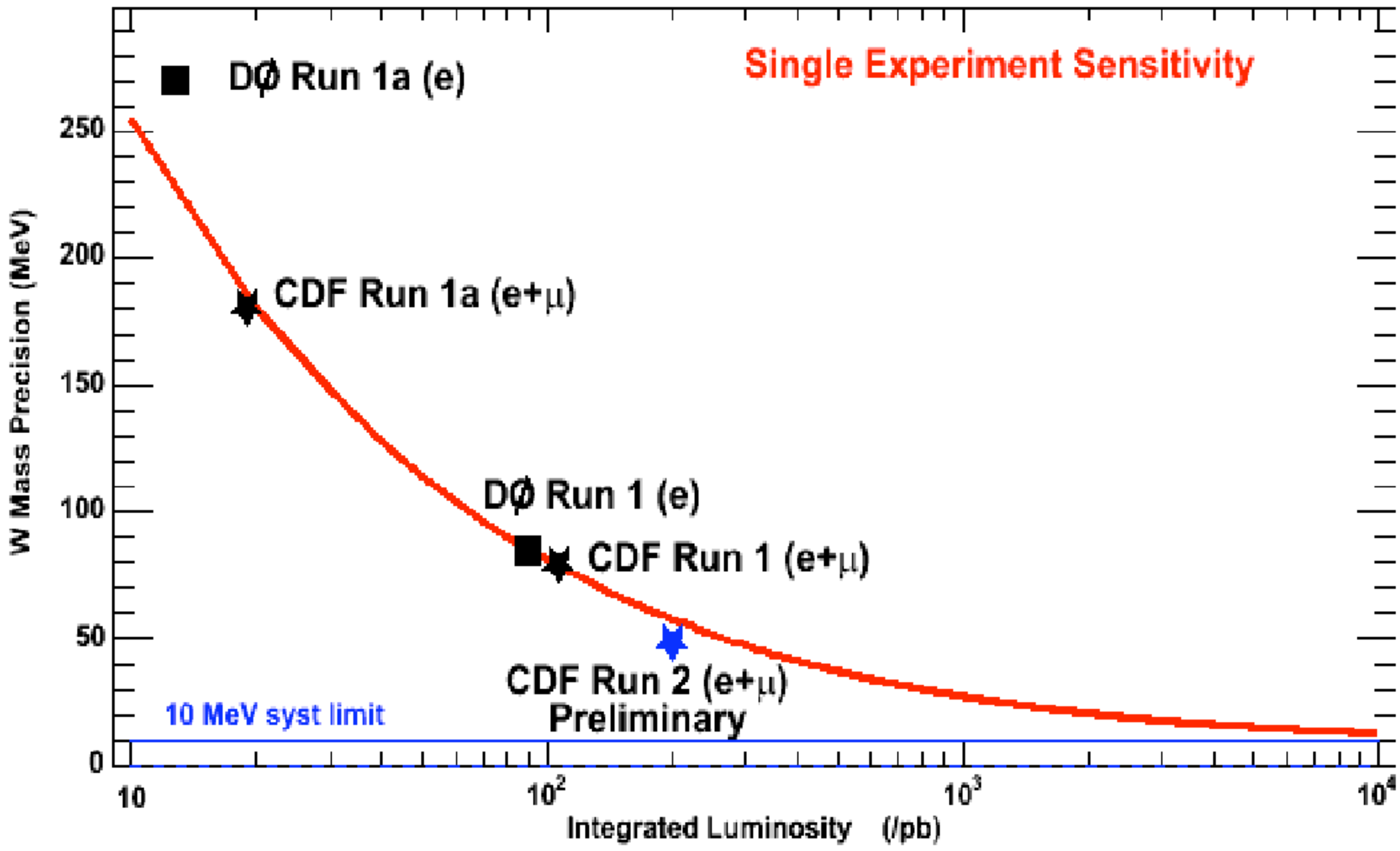
m_T Uncertainty [MeV]	Electrons	Muons	Common
Lepton Scale	30	17	17
Lepton Resolution	9	3	0
Recoil Scale	9	9	9
Recoil Resolution	7	7	7
$u_{\parallel}$ Efficiency	3	1	0
Lepton Removal	8	5	5
Backgrounds	8	9	0
$p_T(W)$	3	3	3
PDF	11	11	11
QED	11	12	11
Total Systematic	39	27	26
Statistical	48	54	0
Total	62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

Best single measurement (0.2fb^{-1})

m_W = 80417 ± 48 MeV/c

W.A: **m_W = 80398 ± 25 MeV/c**

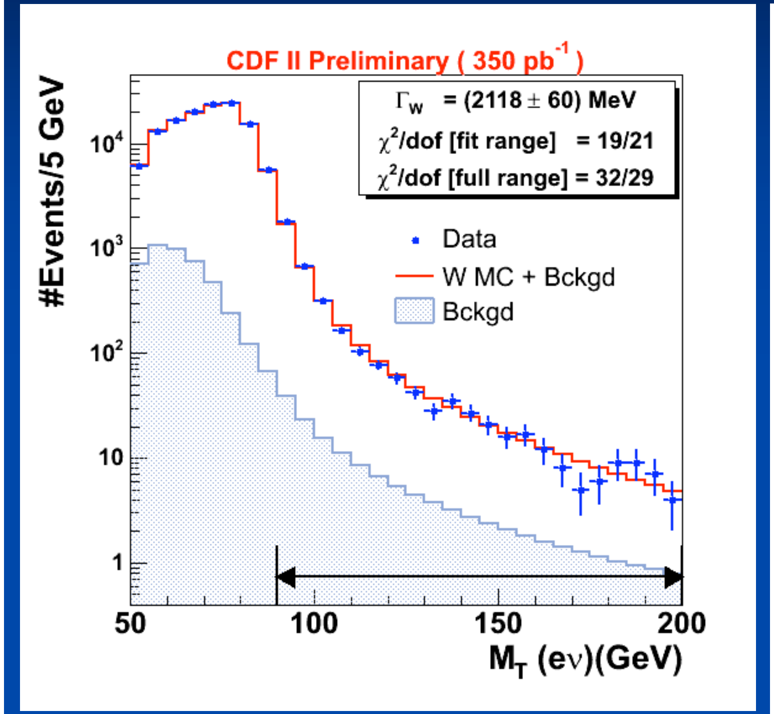
W mass prospects

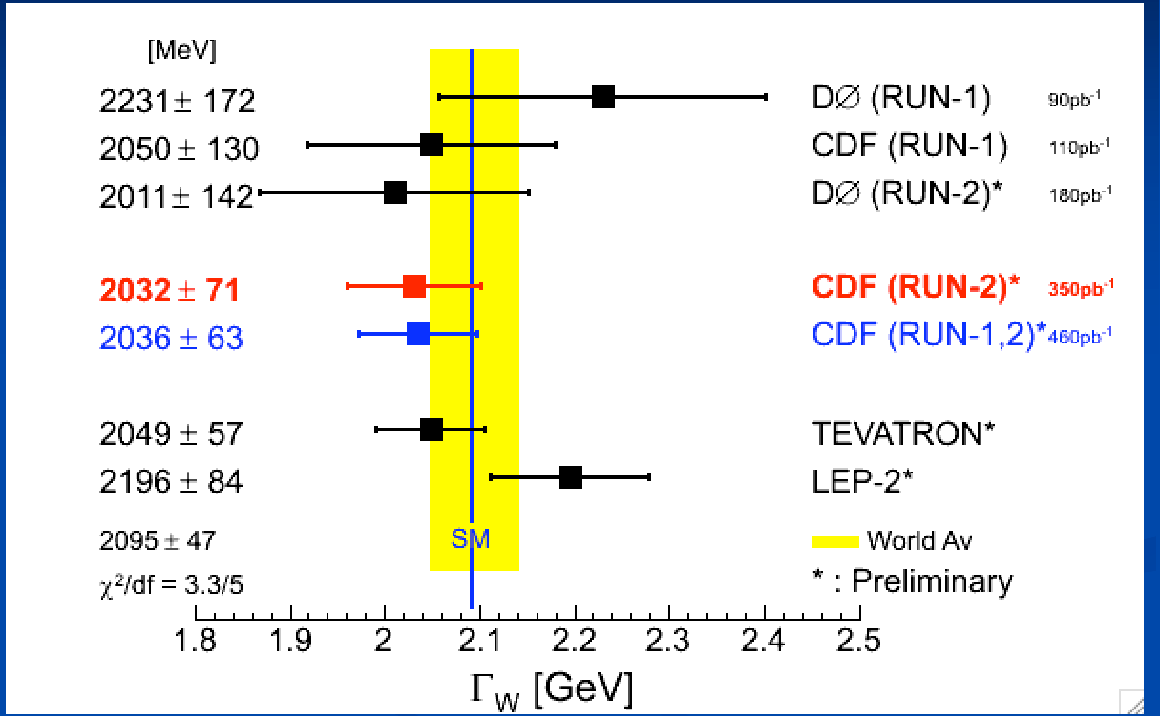


New projection with 1.5 fb^{-1} of data:

$\delta m_W < 25$ MeV with CDF

New W width result (03/07)



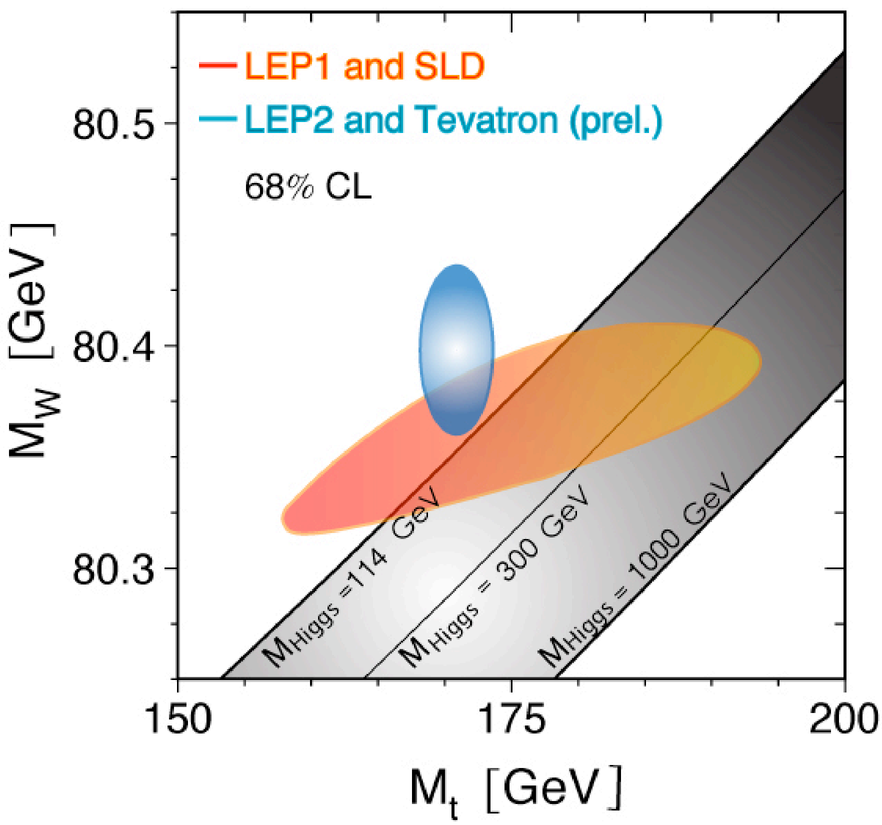


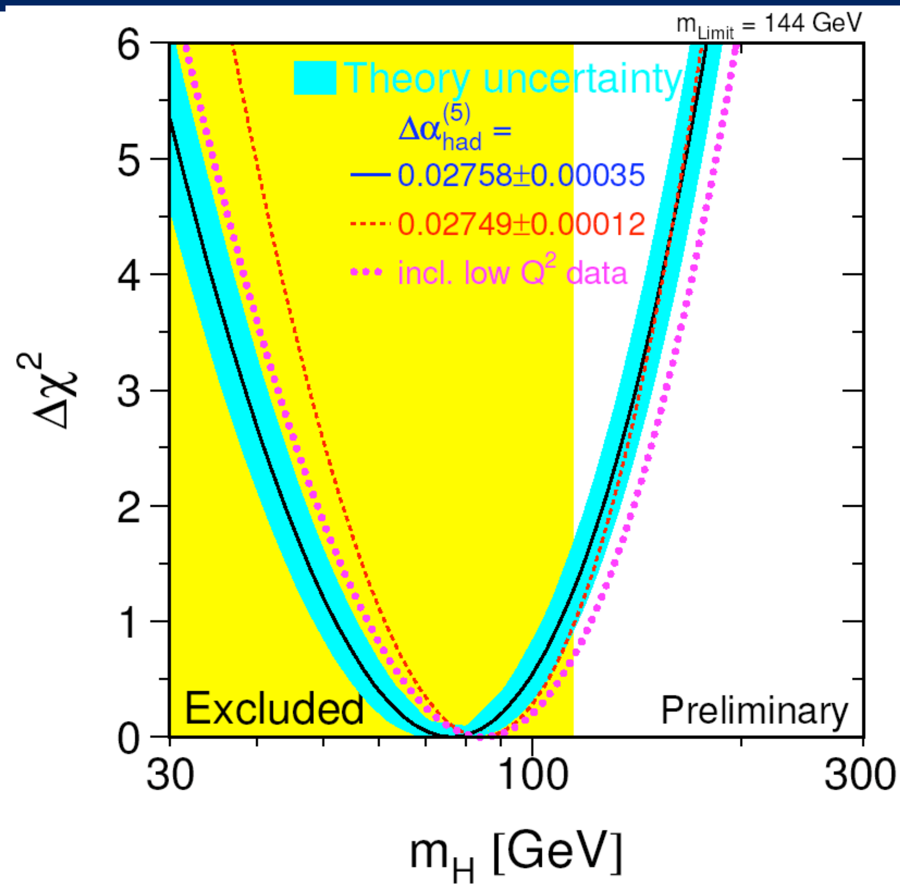
Best single measurement (0.35fb^{-1})

Γ_W = 2032 ± 71 MeV/c

(World Average ±60 to ±47 MeV/c)

Indirect measurement of M_{Higgs}

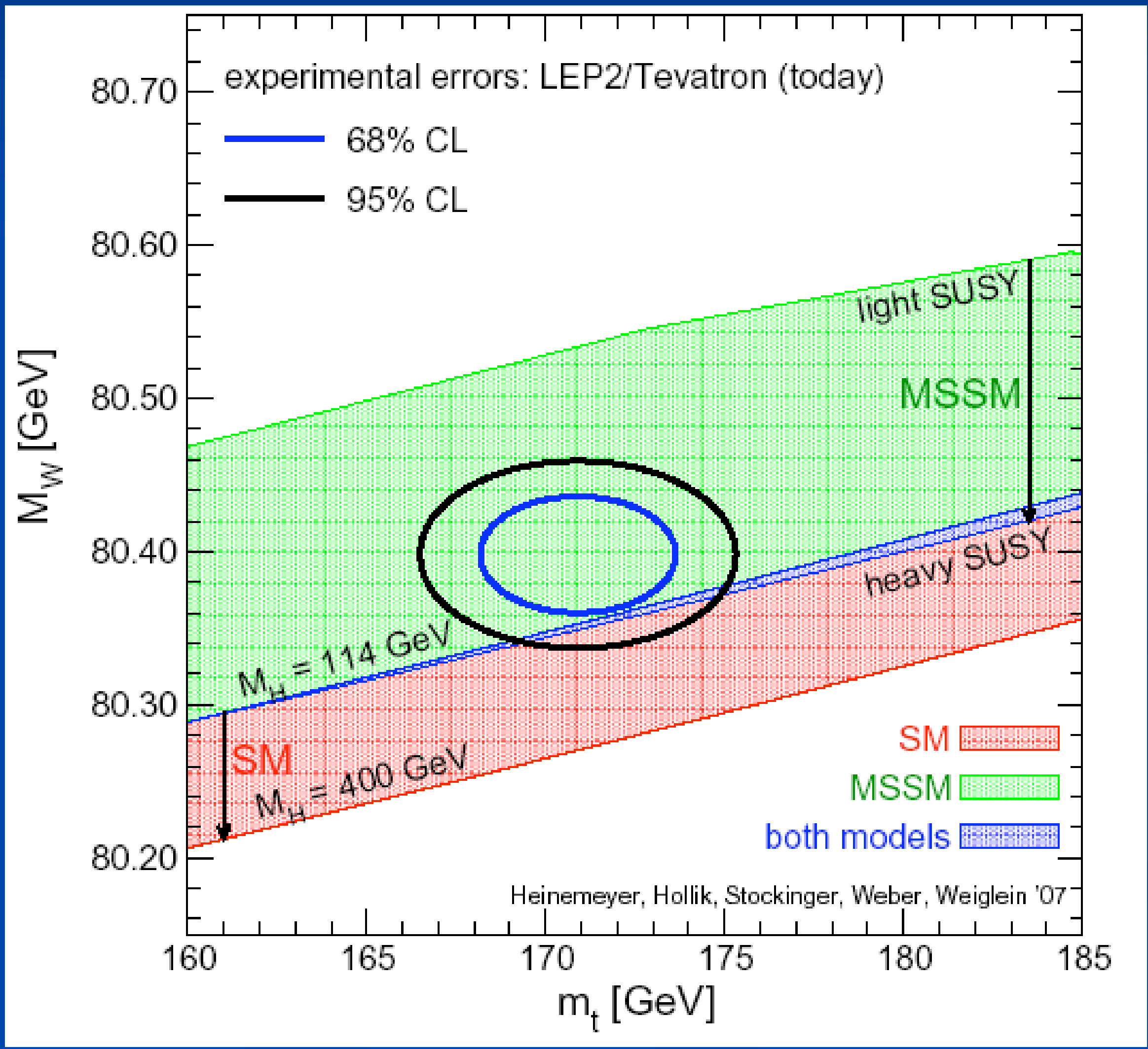




$$m_H = 76^{+33}_{-24} \quad (<144@95\%CL)$$

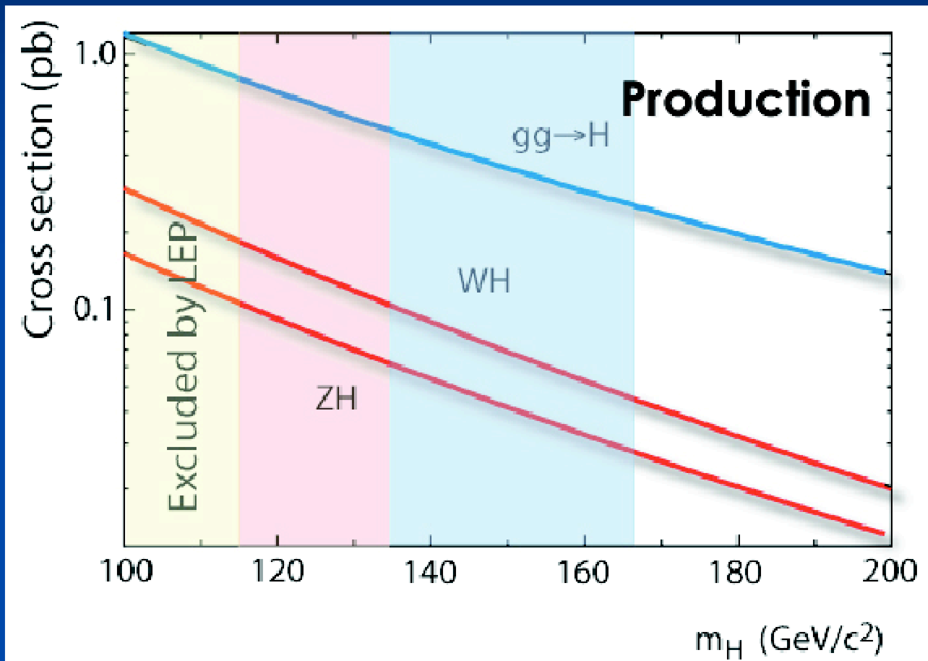
Previous: $m_H = 85^{+39}_{-28}$ (<166@95%CL)

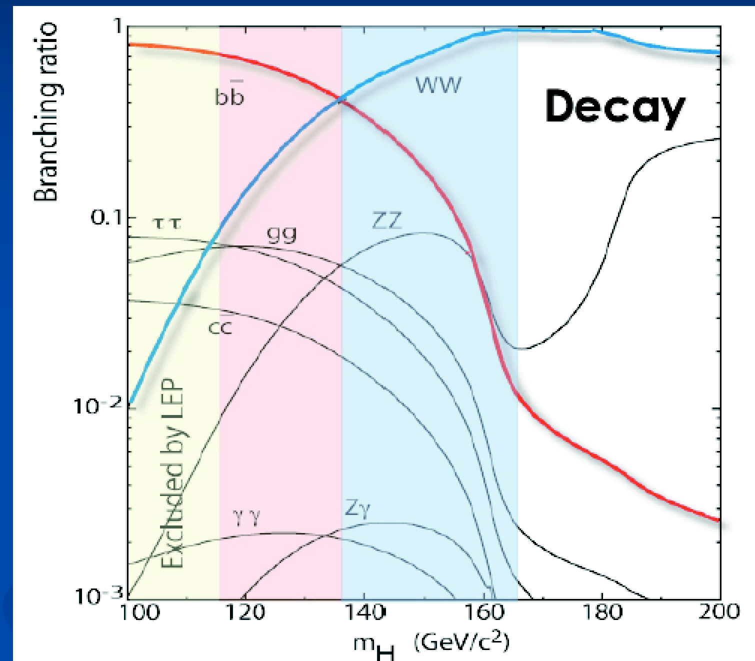
Hint of MSSM ?



experimental errors: LEP2/Tevatron (today)
68% CL
95% CL
light SUSY
MSSM
heavy SUSY
M_H = 114 GeV
SM
M_H = 400 GeV
SM
MSSM
both models
Heinemeyer, Hollik, Stockinger, Weber, Weiglein '07
80.70
80.60
80.50
80.40
80.30
80.20
M_W [GeV]
160
165
170
175
180
185
m_t [GeV]

Direct search for SM Higgs





- Al Tevatron i canali piu' sensibili sono:
  - $m_H < 135$ GeV: (W/Z) H → (W/Z)$b\bar{b}$
  - $m_H > 135$ GeV: *gg* → H → WW
- Sezioni d'urto < 1pb

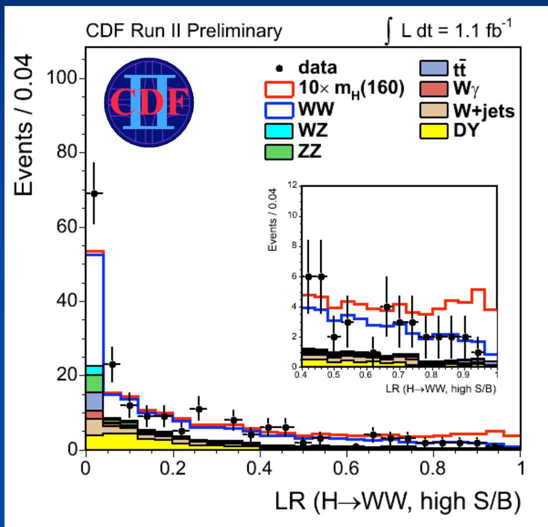
Ingredienti sperimentali: in continua evoluzione

- b-jet tagging
  - Cruciale per basse M_H . Uso di NN per migliorare separazione S/B
- Trigger
  - Leptoni: estensione accettanza (Si-only tracking)
  - Jets, MET: CDF electronics upgrade $\Rightarrow$ miglioramento soglie, efficienza
  - b-jet trigger development
  - Sforzo globale di ottimizzazione algoritmi
- Tecniche di analisi:
  - Matrix Element, splitting into subsamples
  - Discriminant variables: LR, NN, Fischer, trees ….

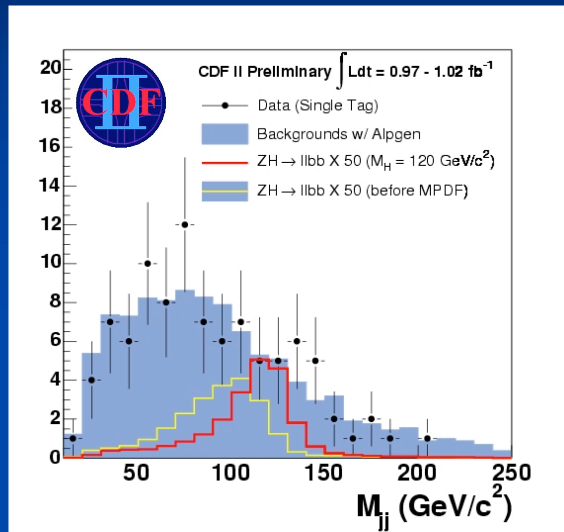
Conseguenze di notevole aumento di attenzione e di sforzo…

…impossibile al momento predire le prestazioni finali

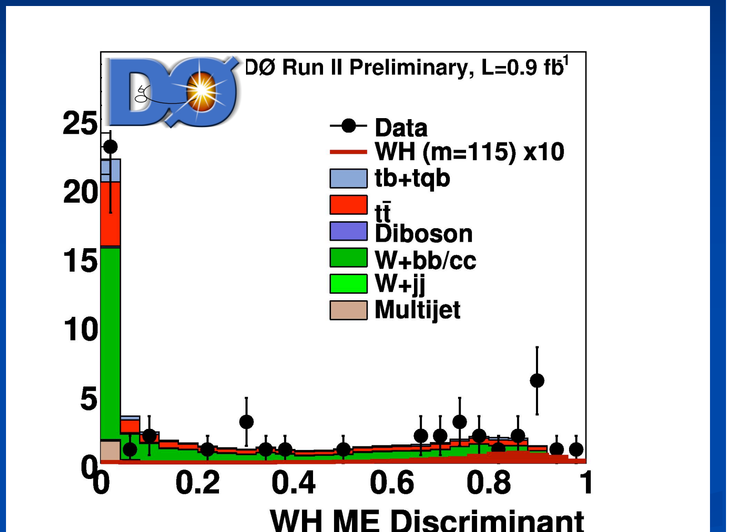
3 very recent results !



CDF H→WW
(Likelihood ratio)



CDF ZH→llbb
(Improved kinematics)



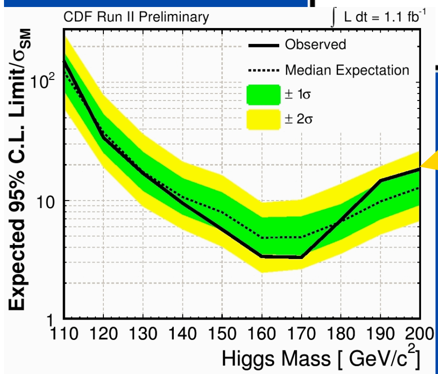
D0 WH→lνbb
(Matrix Element)

- Sfruttano tecniche di analisi piu' sofisticate
- Risultati migliorano molto piu' rapidamente che 1/Sqrt(L) !
- See S. Amerio talk for details

Summary table

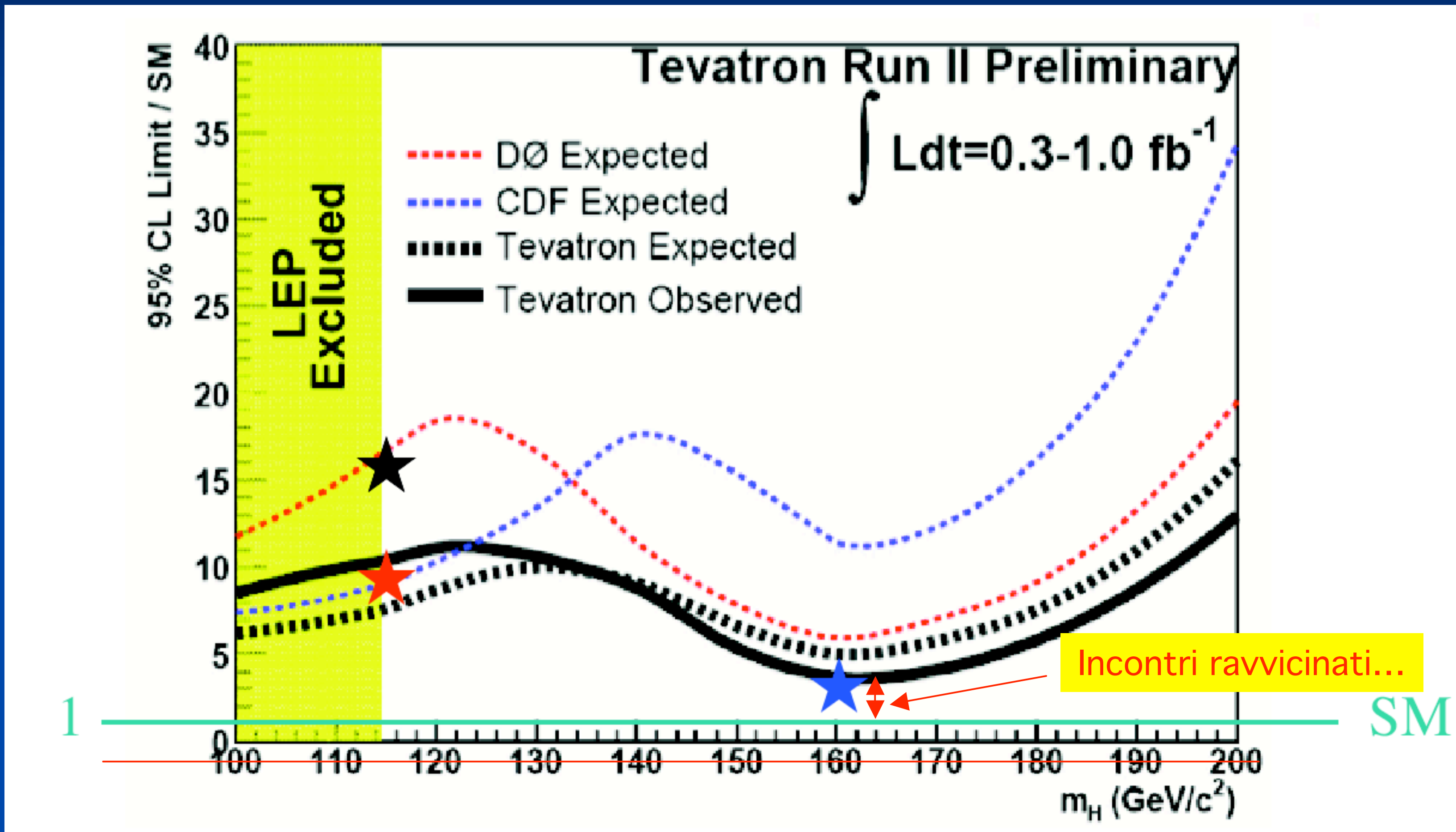
Analysis	CDF limit ($1fb^{-1}$) factor above SM observed (expected)	D0 limit ($1fb^{-1}$) factor above SM observed (expected)
ZH → νν bb @ 115 Technique: M_{jj}	16 (15)	40 (34)*
WH → lν bb @ 115 Technique: M_{jj} Technique: ME	26 (17)	★ 10 (9) ★ 13 (10)
ZH → llbb @ 115 Technique: NN2D	★ 16 (16)	33 (34)
H → WW → lνlν @ 160 Technique: ΔΦ (l,l) Technique: ME	9 (6) ★ 3.5 (5)	4 (5)

B.Kilminster, Moriond QCD '07



Closest to SM

Combinando tutto…



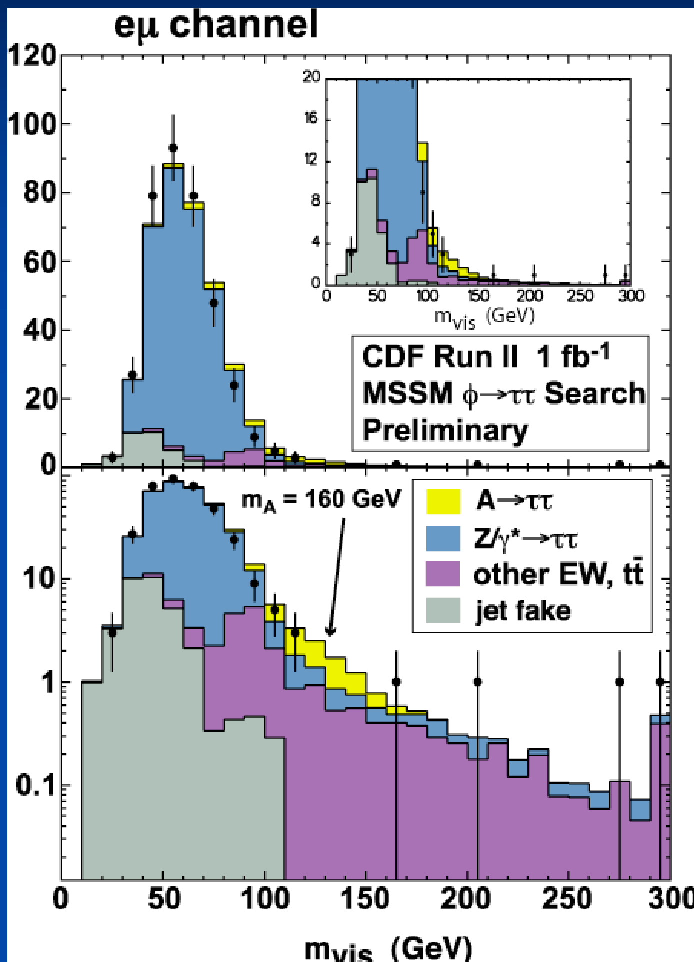
- Mancano alla combinazione i risultati recentissimi (stars)
- Meno di un ordine di grandezza dallo SM in tutto il range 100÷200 GeV

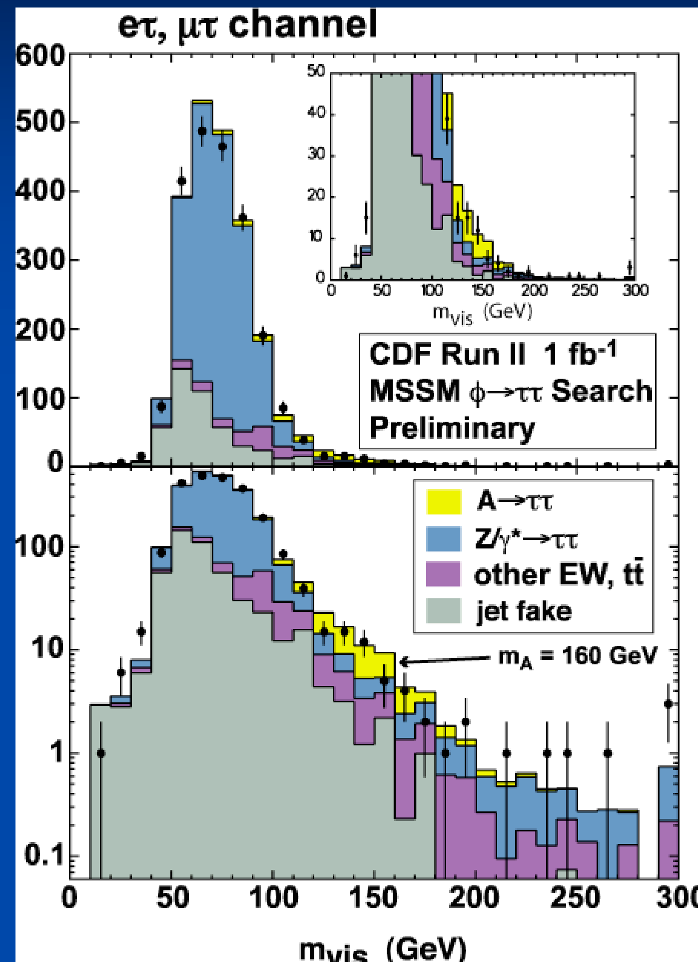
(Intanto a CDF lo "Higgs working group" cambia nome in "Higgs discovery group")

Higgs & SUSY

Non-SM searches

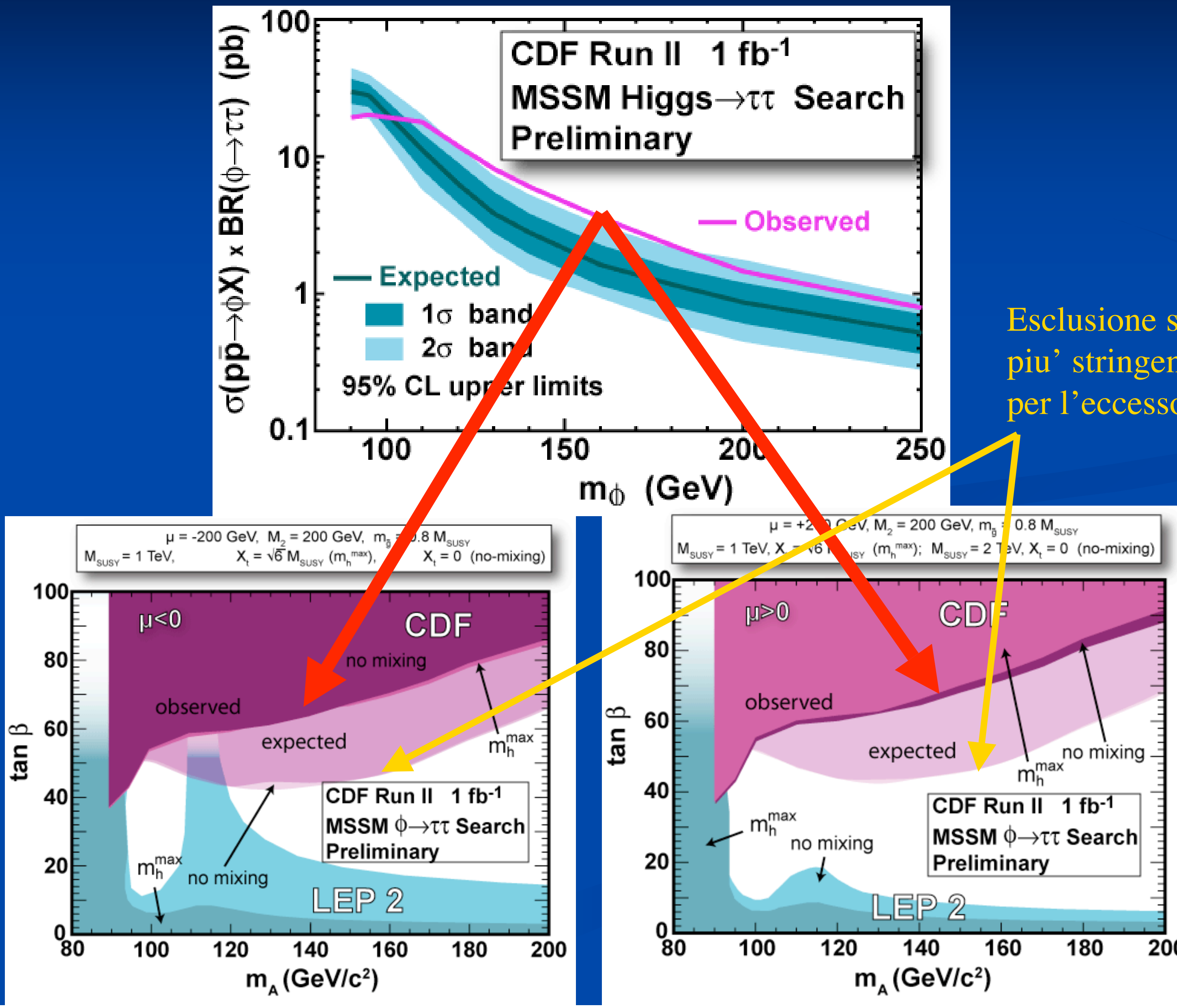
φ→ττ search





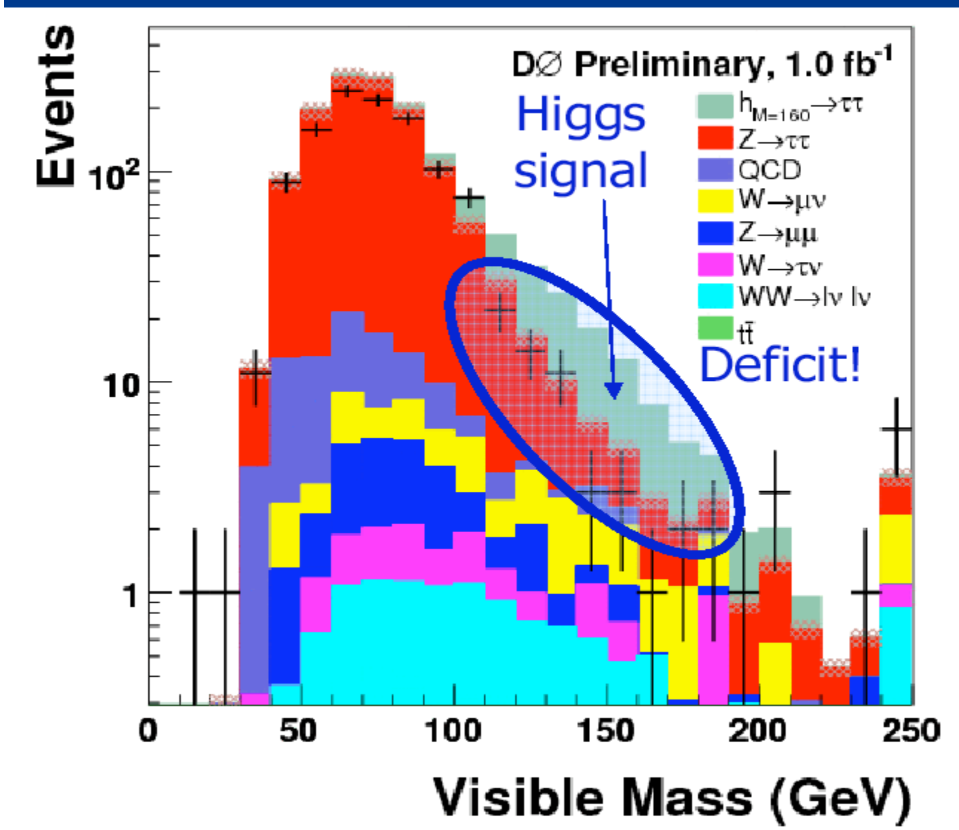
- Il leggero eccesso a 160 GeV non e' significativo (per ora)
- Quello che ***e' significativo*** e' che occorre farsi questo tipo di domande

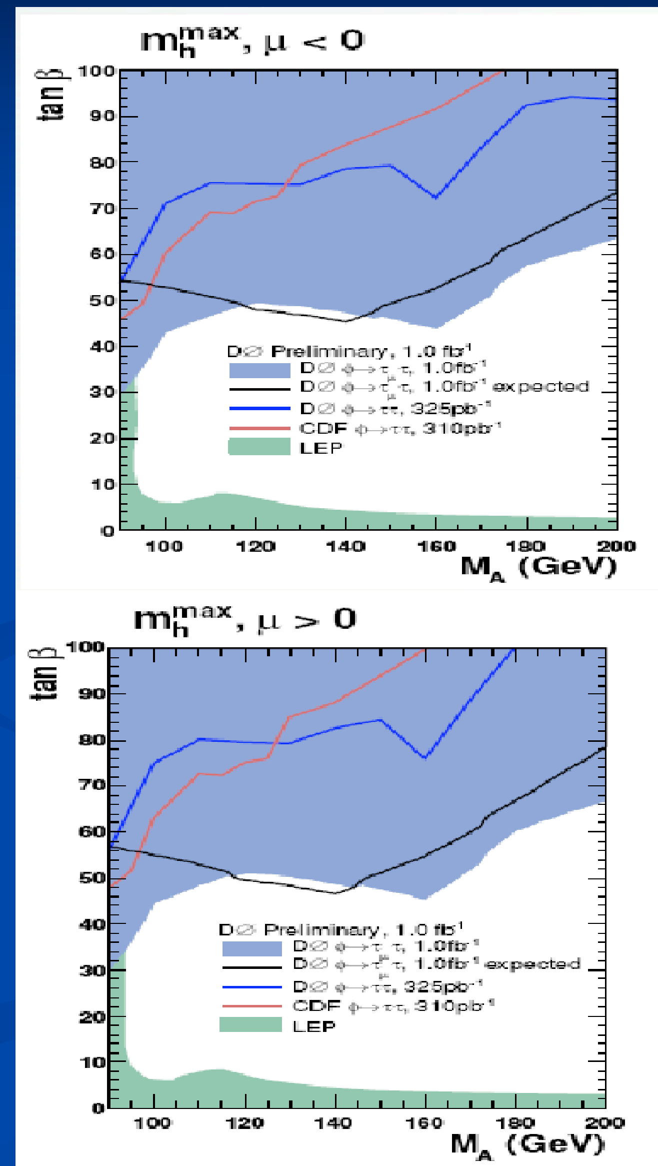
Exclusion regions



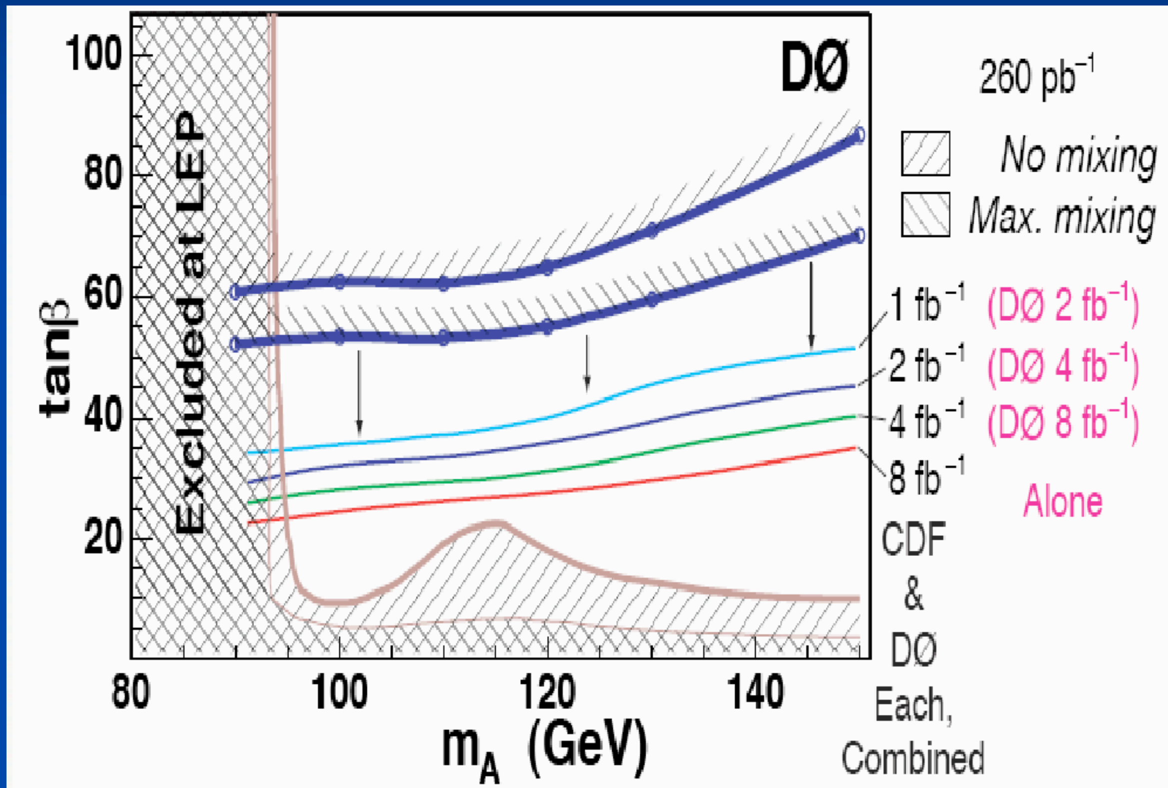
Esclusione sarebbe
piu' stringente se non fosse
per l'eccesso osservato

E dall'altra parte dell'anello ?



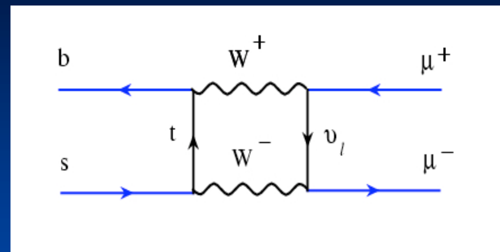


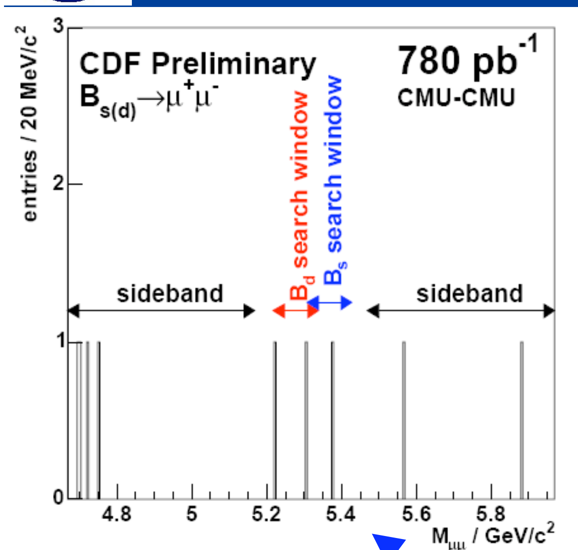
Anche per il MSSM lo spazio si restringe….



- Risultati di altre searches non ancora inclusi (es. $A \to bb$, sensibilita' simile a $\tau\tau$)
- Gruppo di lavoro per produrre risultati combinati Tevatron

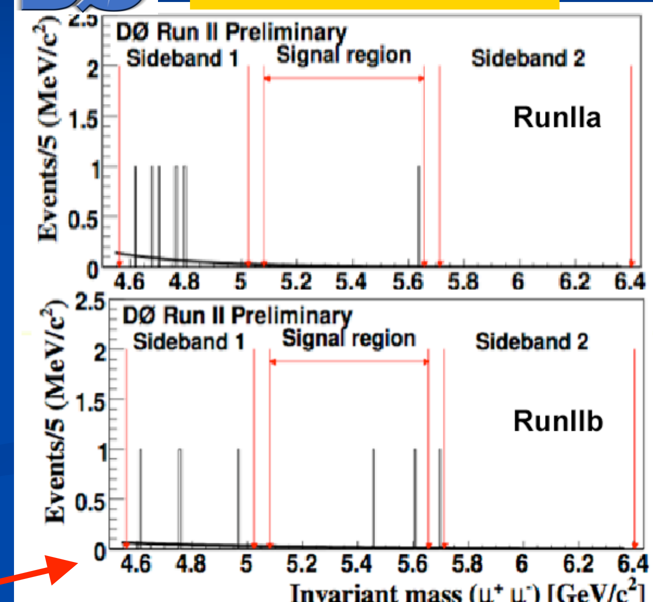
SUSY via FCNC : $B_s \to \mu\mu$





- CDF e D0 usano una selezione basata su un LR a molte variabili, e un taglio attentamente ottimizzato. Poco fondo anche con $1 fb^{-1}$
- Continui raffinamenti delle analisi: prossima versione probabilmente non un semplice counting

NEW result (first with 2fb-1)

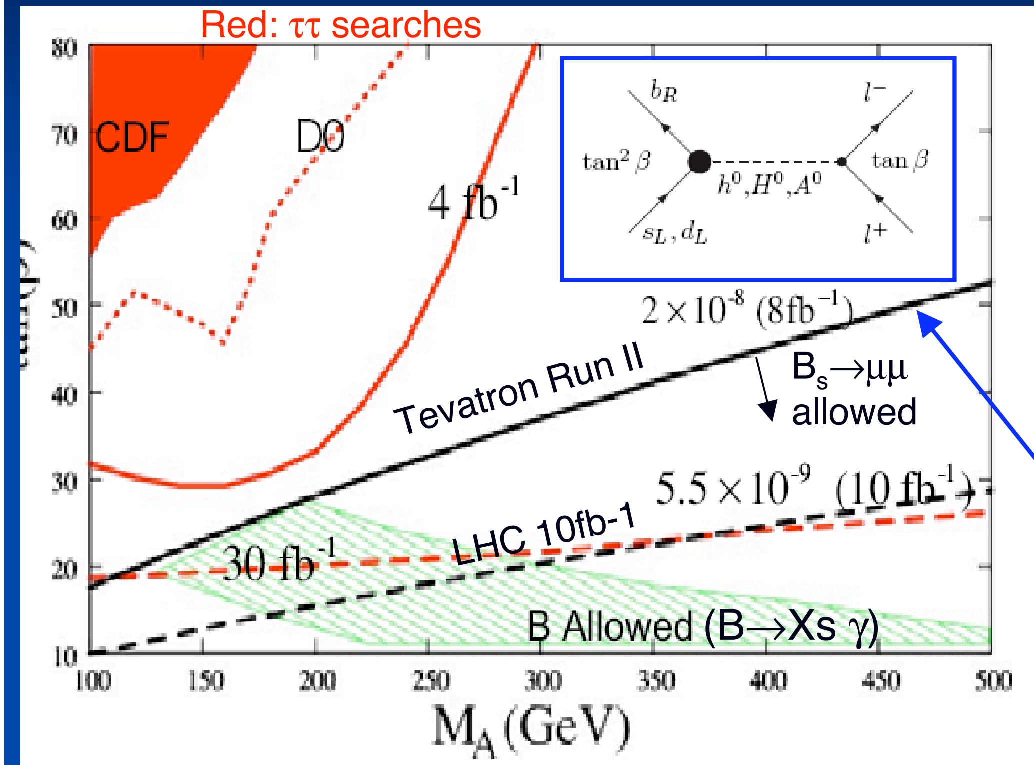


Summary

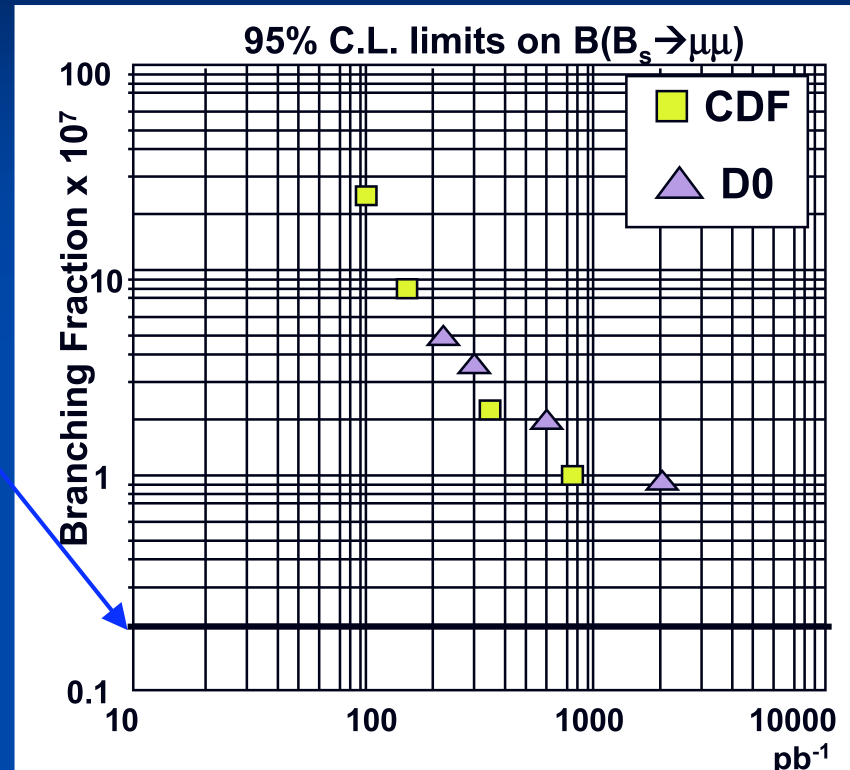
Exp	Mode	Lumi [fb^{-1}]	Evts	Bgrd Pred	BR Limit (95% CL)
DØ	$B_s \to \mu^+\mu^-$	2	3	2.3 ± 0.5	< 0.93 x 10^{-7}
CDF	$B_s \to \mu^+\mu^-$	0.78	1	1.27 ± 0.37	< 1.0 x 10^{-7}
	$B_d \to \mu^+\mu^-$	0.78	2	2.45 ± 0.40	< 0.3 x 10^{-7}

$$\frac{Br(B_s)\text{ limit}}{Br(B_s)\text{ SM}} \approx 20 \qquad \frac{Br(B_d)\text{ limit}}{Br(B_d)\text{ SM}} \approx 300$$

$B_s \to \mu\mu$ prospects



[M. Carena, Moriond 2007]



- Sensitive to SUSY as $\tan(\beta)^6$
- $B_s \to \mu\mu$ puo' vedere un effetto SUSY prima delle direct searches (ma e' insensibile per grandi μ, quindi entrambe sono necessarie)

Direct SUSY search

- New limits from MET+jets analysis at D0:

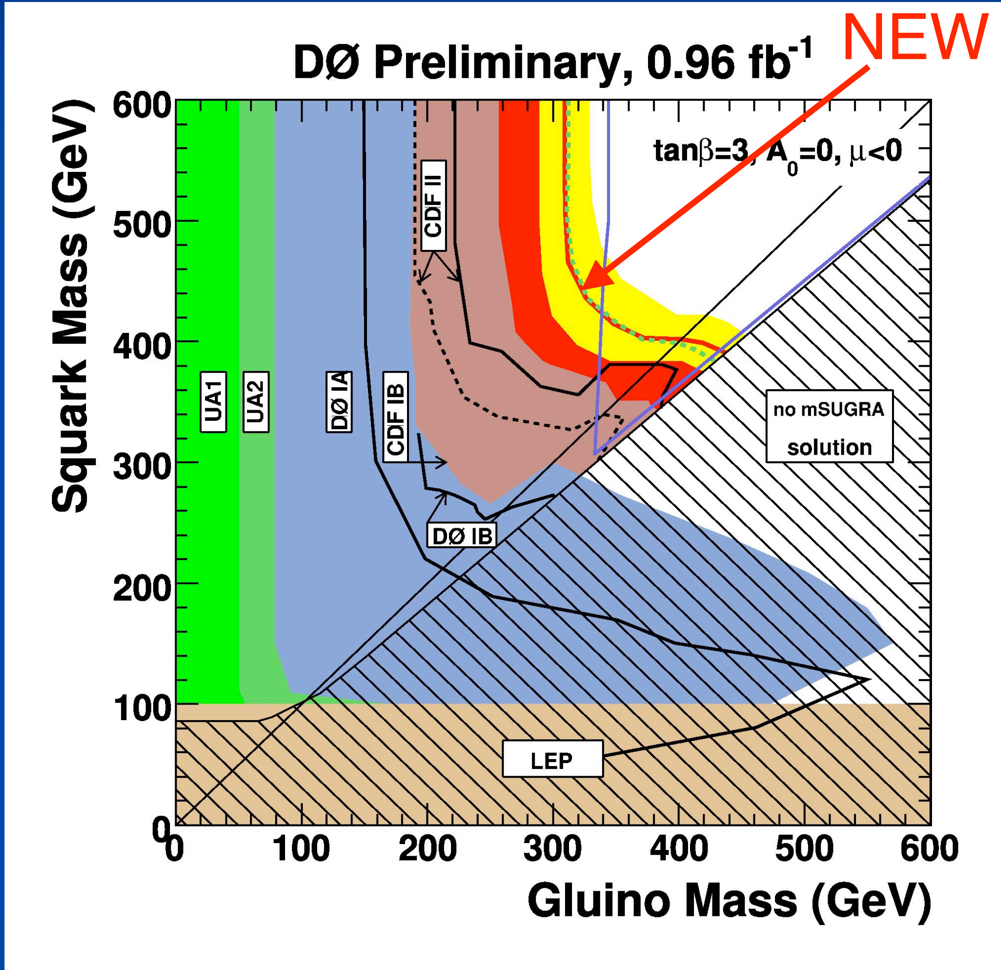
$$M(\tilde{g}) > 309 \text{ GeV};\ M(\tilde{q}) > 391 \text{ GeV}$$

$$M(\tilde{g}) > 402 \text{ GeV (when } M(\tilde{g}) \sim M(\tilde{q}))$$

(mSUGRA)

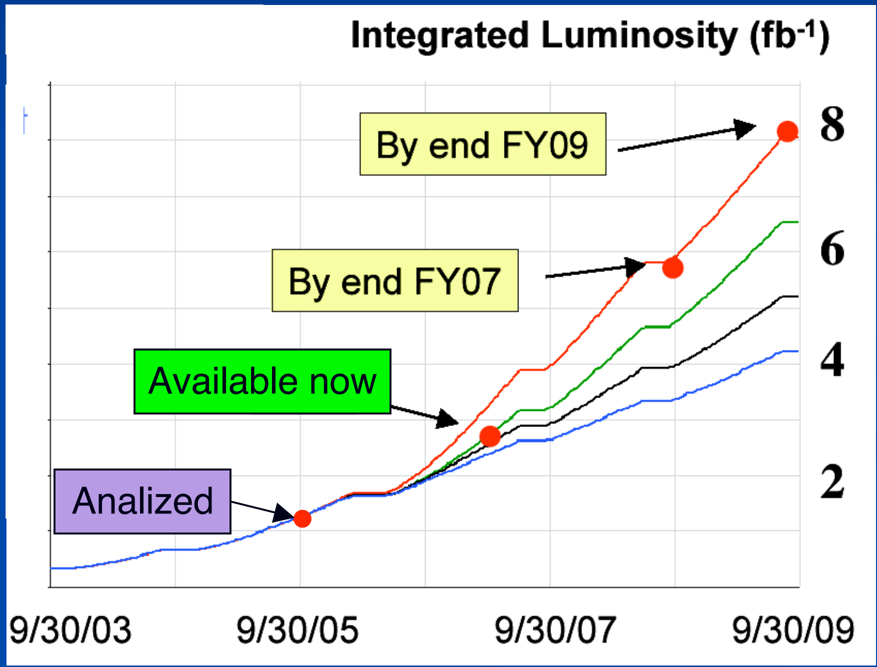
- Similar update from CDF soon

- *Molte* altre searches sono o stanno per essere aggiornate: Z', W' , stop, CHAMPS, ecc…



Run II prospects

- Il Tevatron ha prodotto grande ricchezza di fisica con 1 fb^{-1}:
  - Discovery of the top quark
  - Observation of Bs oscillation
  - Observation of Σ_b, B_c,
    charmless modes of B_s and baryons
  - CP violation measurements
  - Most precise W mass
  - Highest QCD limits
  - Studies of the X(3872)
  - Double bosons
  - Limits on Higgs production 10xSM
  - Rare B and D modes
  - SUSY limits
  - Forntier exploration:
    compositeness, leptoquarks, W' Z'…..



- Un buon inizio per il Run II. Ma la luminosita' integrata nei prossimi due anni sara' 8x quella dei precedenti 20 anni

…what next ?