Stato di CDF

Luciano Ristori

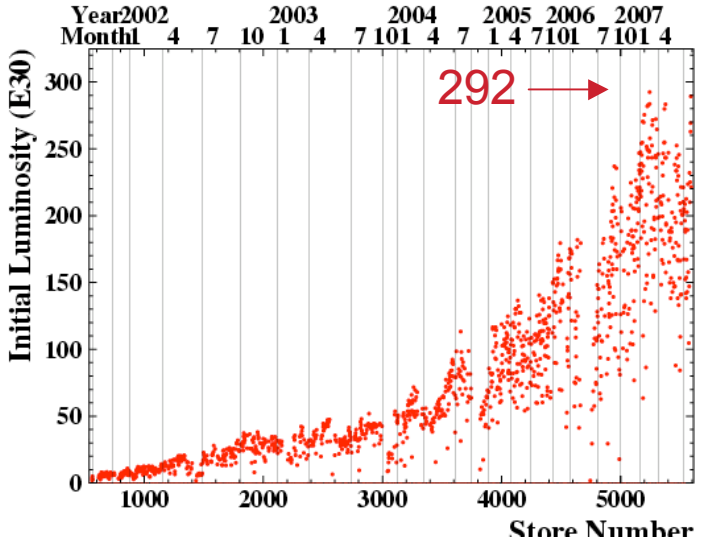
30 Agosto 2007

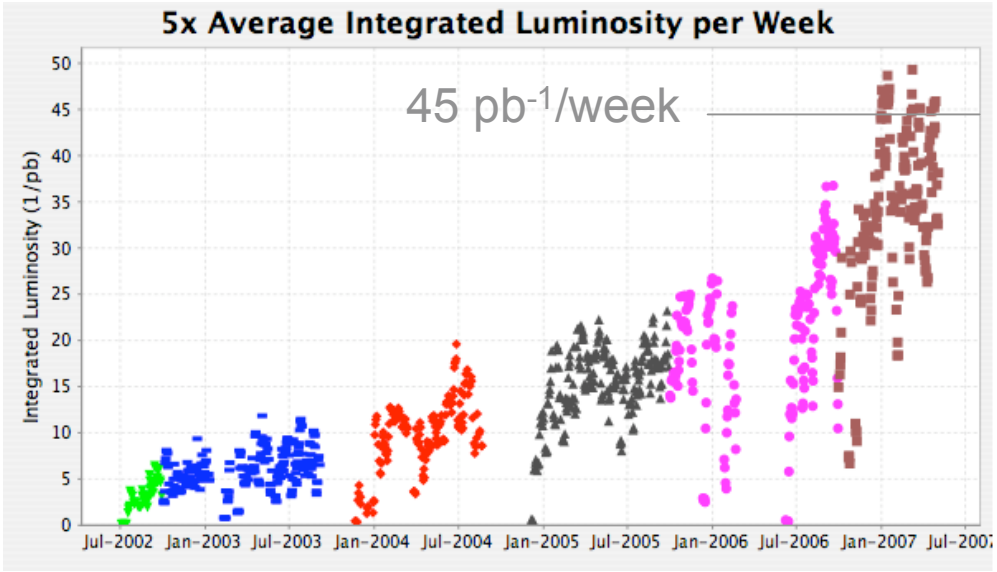
Stato di CDF in breve

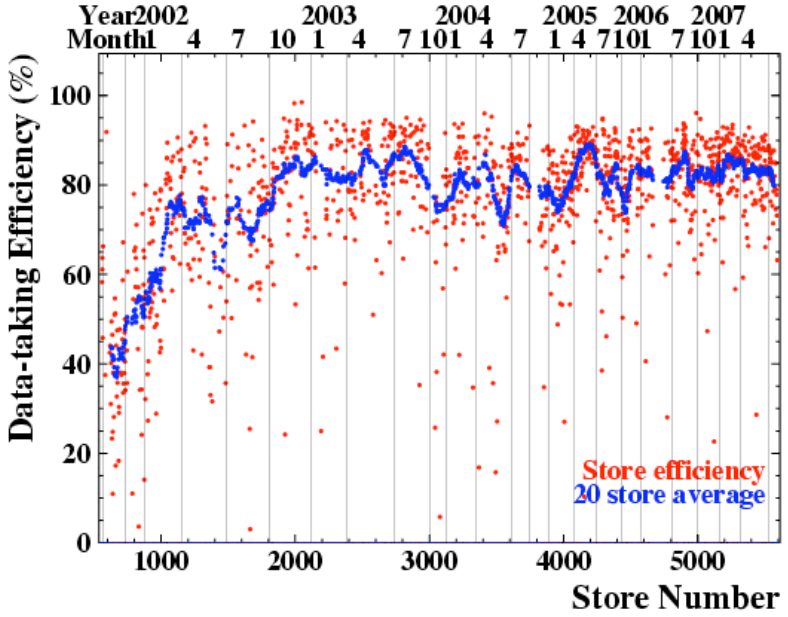
- Il Tevatron e CDF godono di ottima salute
- La luminosita' di picco ha raggiunto ~3x10^{32}
- Il Run II e' stato ufficialmente esteso fino alla fine del 2009
- Si sta considerando la possibilita' di una ulteriore estensione
- Tevatron shutdown in progress: 10 weeks + 2 weeks studies
  - Aug 6 - Oct 29
  - *"Leak in east ISL/Layer00 cooling will be repaired"*
- ~50 nuovi (*) risultati presentati a Lepton-Photon 2007
- I recenti upgrades del trigger e studi specifici in corso migliorano le prospettive di CDF nella ricerca del bosone di Higgs

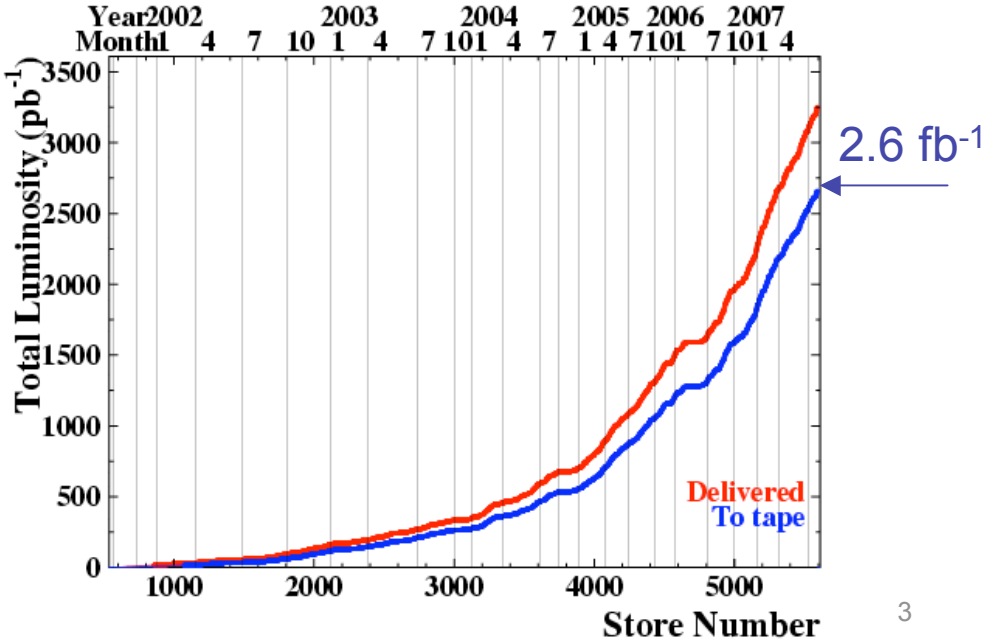
(*) post winter 07 conferences

CDF and Tevatron performance









Fisica: nuovi risultati

Ultimo aggiornamento sulla fisica di CDF in
Commissione I a Maggio
(vedi talk di Tommaso Dorigo)

51 nuovi risultati presentati da CDF alle conferenze estive
sono listati e documentati in questa pagina pubblica:

http://www-cdf.fnal.gov/physics/S07CDFResults.html

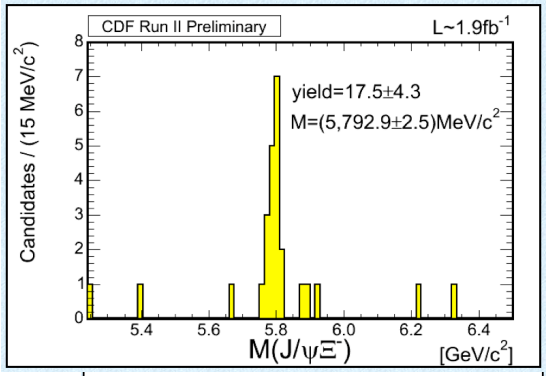
CDF Physics at Lepton-Photon 2007

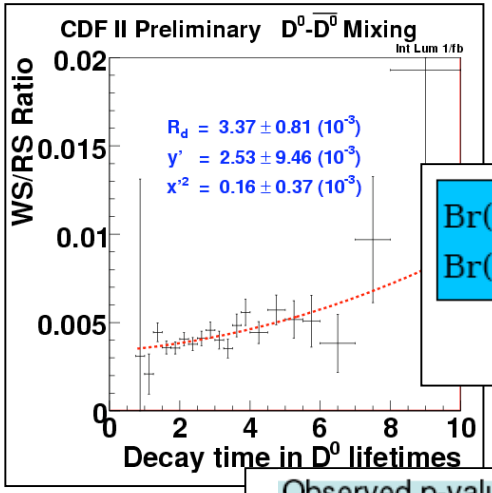
- Per Lepton-Photon 2007 la CDF ha prodotto:
  - **~50 nuovi risultati da Aprile 07**
  - ~30 usano tutti i dati disponibili (~2 fb-1)
- Questo risultati coprono tutto lo spettro della fisica di CDF
  - QCD/Jets
  - Heavy Flavors (bottom e charm)
  - Electroweak
  - Top
  - Higgs
  - Ricerca di Nuova Fisica

LEPTON-PHOTON 2007
XXIII International Symposium on Lepton and Photon Interactions at High Energy Aug 13-18, Daegu, Korea

http://chep.knu.ac.kr/LP07/

New CDF results: highlights

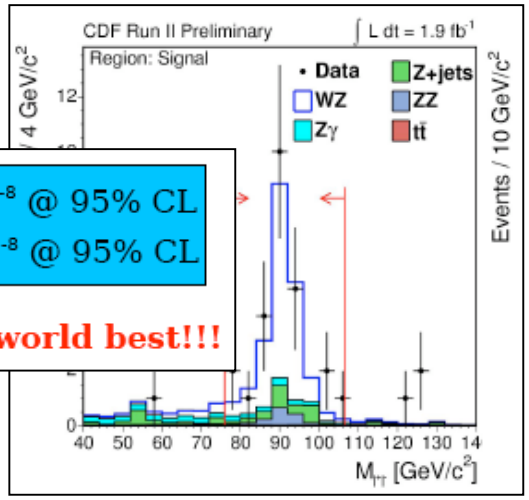


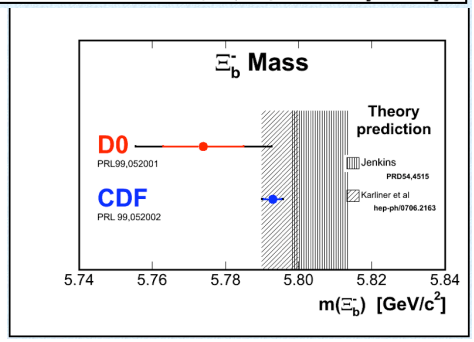


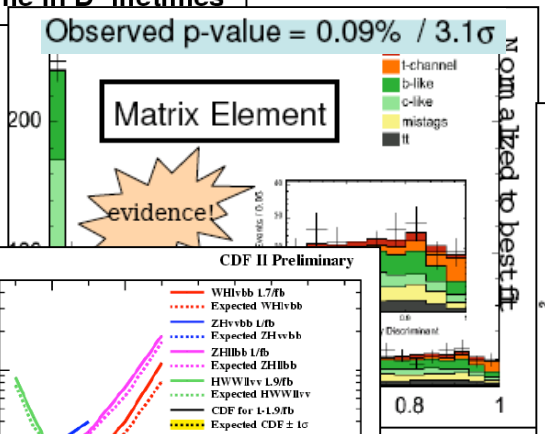
$Br(B_s \to \mu\mu) < 5.8 \times 10^{-8}$ @ 95% CL

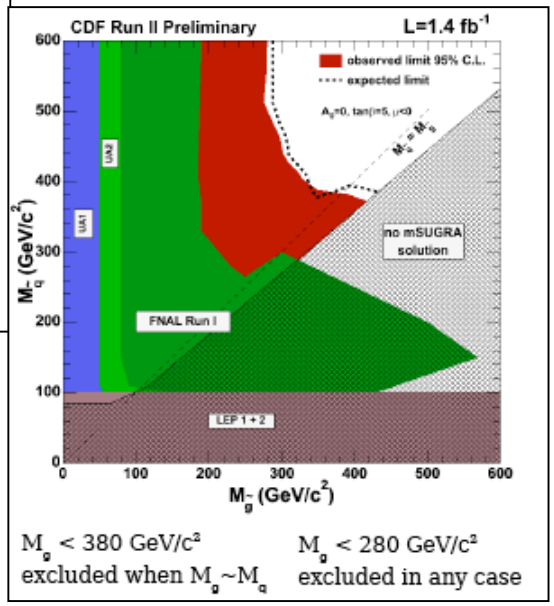
$Br(B_d \to \mu\mu) < 1.8 \times 10^{-8}$ @ 95% CL

Both limits are world best!!!





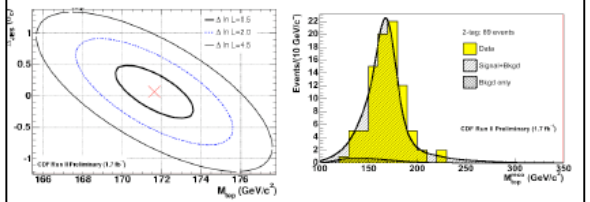




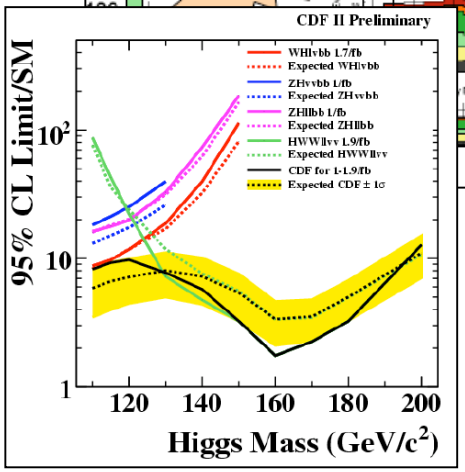
$M_g < 380$ GeV/c² excluded when $M_g \sim M_q$

$M_g < 280$ GeV/c² excluded in any case

most precise lepton + jets channel:

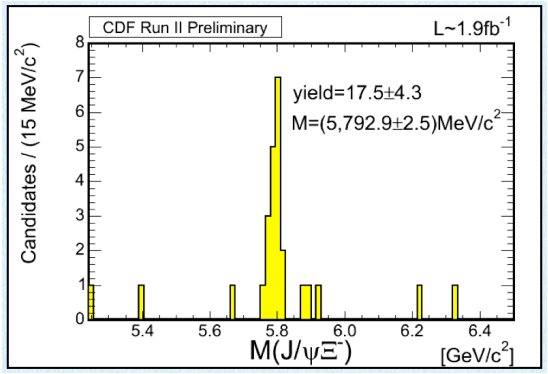


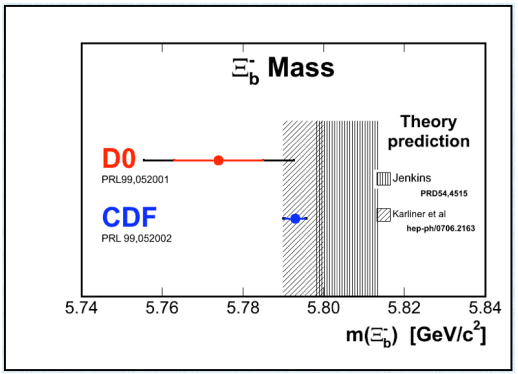
$M_{top} = 171.6 \pm 2.4$ (stat+syst) GeV/c²



Highlights (1)

- Observation of Cascade b



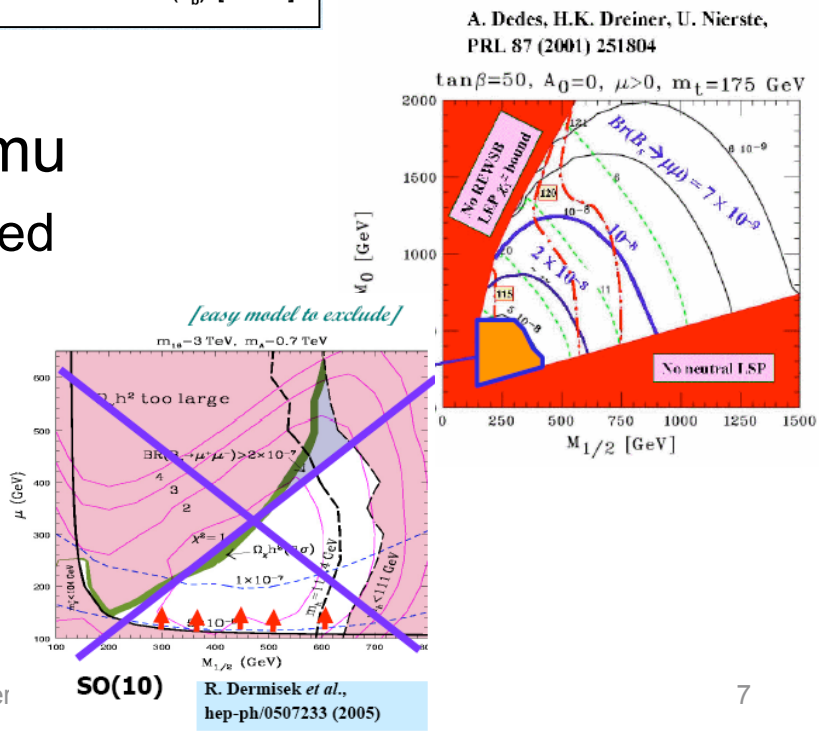


- Limits on Bs and Bd to mu mu
  - mSUGRA phase space reduced
  - SO(10) model now excluded

$Br(B_s \to \mu\mu) < 5.8 \times 10^{-8}$ @ 95% CL

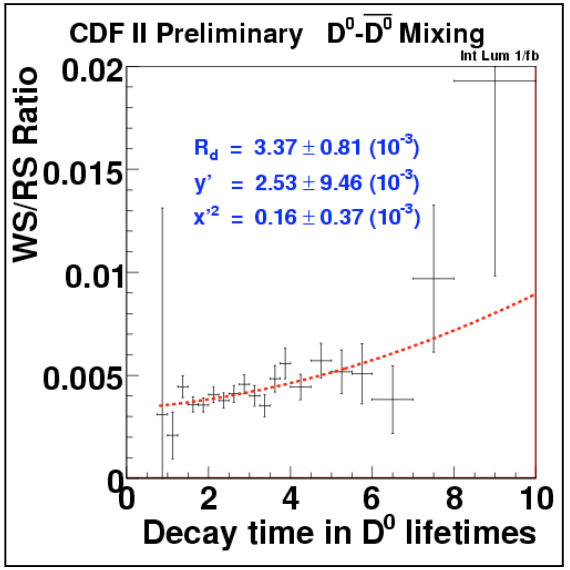
$Br(B_d \to \mu\mu) < 1.8 \times 10^{-8}$ @ 95% CL

Both limits are world best!!!



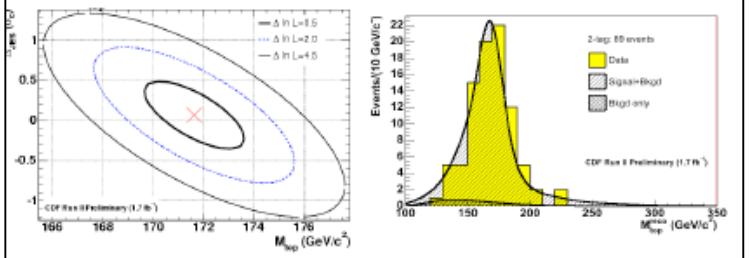
Highlights (2)

- D-Dbar mixing confirmed



- Improved Mtop

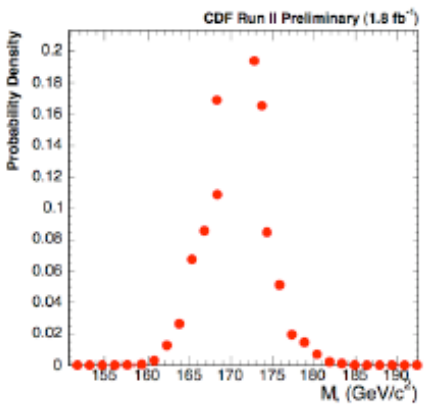
most precise lepton + jets channel:



M_{top}=171.6 ± 2.4 (stat+syst) GeV/c^2

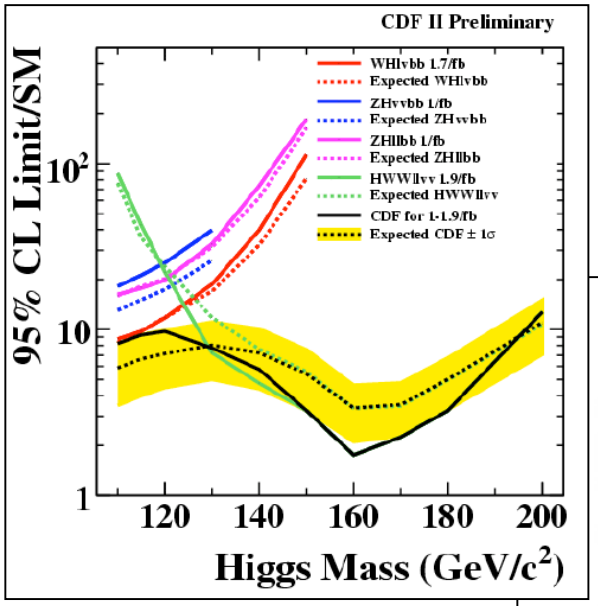
most precise dilepton channel:

ME analysis



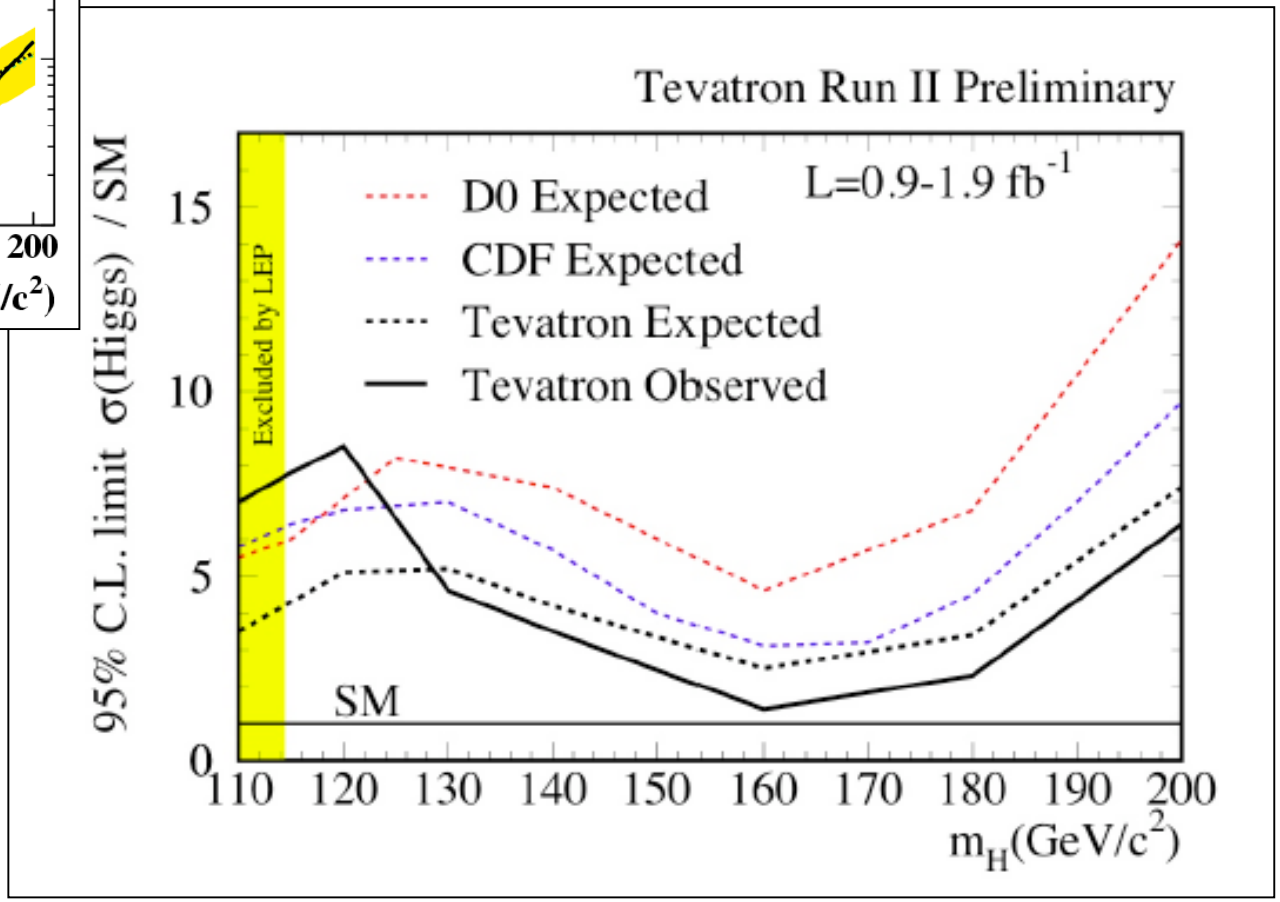
M_t=170.4 ± 3.1(stat) ± 3.0(sys)GeV/c^2

Higgs Limits



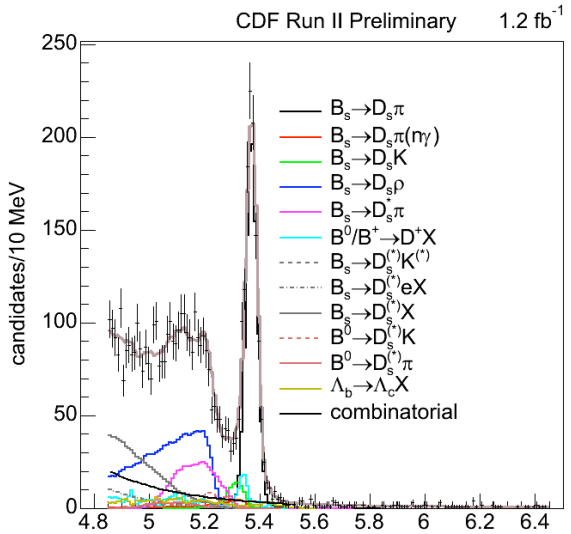
CDF

CDF/D0 combined



Promising analyses

- Observation of $B_s \rightarrow D_s K$
  - measurement of angle gamma?

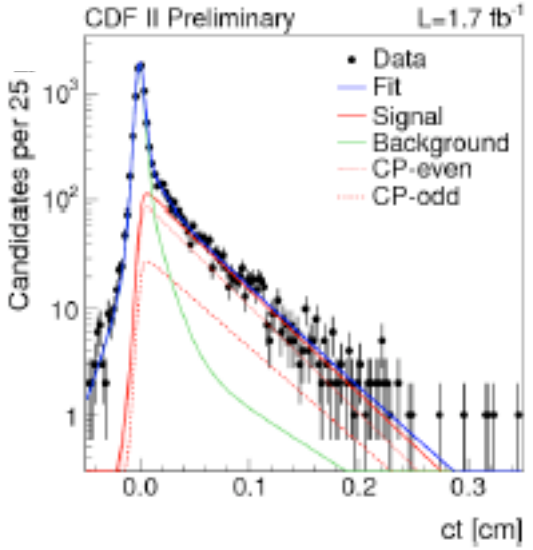


- B_s lifetime difference

  Standard model: $\Delta\Gamma_s \approx 0.1$ ps^{-1}, $\phi_s \approx 0$

  $\Rightarrow$ *large* $|\phi_s|$ *would indicate new physics!*

  Separation of B_{sL}(CP even) and B_{sH}(CP odd) by angular analysis of $B_s \rightarrow J/\psi\phi$



Assuming no CP violation:

- $\Delta\Gamma_s = 0.076\ ^{+0.059}_{-0.063}$ (stat) $\pm$ 0.006 (syst) ps^{-1}

Higgs Trigger Task Force

CDF/ANAL/HIGGS/CDFR/8875
June 27, 2007
Version 1.0

Report of the Higgs Trigger Task Force

S. Amerio, A. Anastassov, A. Annovi, A. Apresyan, V. Boisvert, D. Bortoletto, A. Buzatu, S. Camarda, F. Canelli, A. Canepa, E. Cartman, B. Casal, M. Casarsa, G. Chiarelli, M. Convery, G. Cortiana, G. De Lorenzo, J. Donini, S. Donati, R. Erbacher, C. Ferrazza, G. Flanagan, R. Forrest, I. Furic, J. Garcia, P. Giannetti, D. Glenzinski, O. Gonzalez, C. Group, A. Heijboer, B. Heinemann, M. Herndon, A. Ivanov, E. James, M. Jones, T. Junk, B. Kilminster, Y.-K. Kim, N. Krumnack, M. Kruse, K. Lannon, S. Leone, J. Lewis, A. Lister, T. Liu, R.-S. Lu, D. Lucchesi, T. Maruyama, A. Mitra, O. Norniella, C. Neu, E. Nurse, S. Pagan Griso, E. Pianori, K. Pitts, L. Ristori, V. Rusu, R. St.Denis, L. Sartori, M.A. Schmidt, F. Sforza, A. Sidoti, A. Soha, A. Taffard, S. Torre, P. Totaro, V. Veszpremi, M. Vidal, S.-M. Wang, A. Warburton, D. Waters, P. Wilson, T. Wright, A.M. Zanetti, X. Zhang

Abstract

This report outlines a strategy on how to trigger on the Higgs boson in the most optimal way for the remainder of CDF Run II. Taking advantage of the CDF Run 2b trigger and data acquisition upgrades, we find that we can improve the purity of our triggers and significantly improve our acceptance for the Higgs.

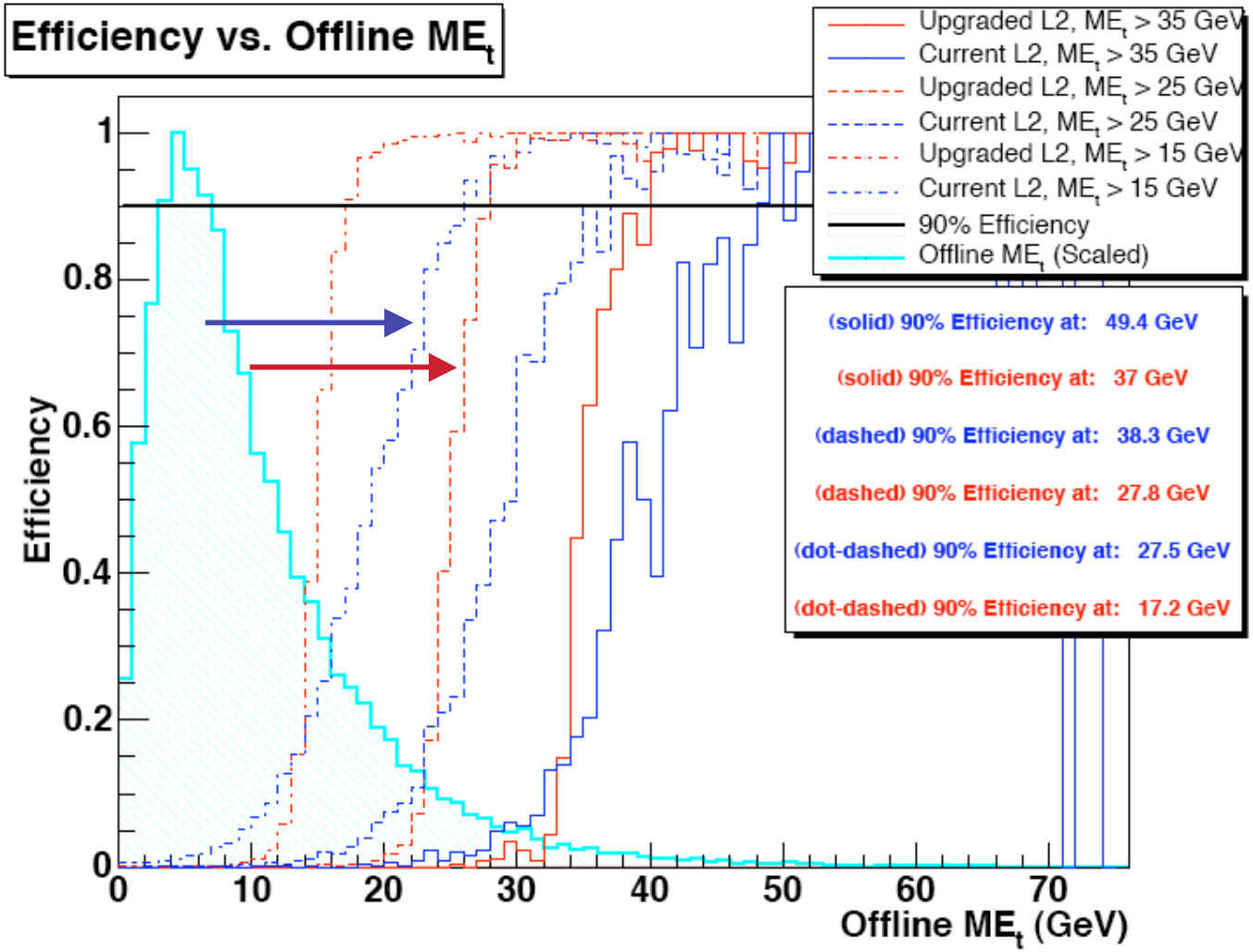
"This report outlines a strategy on how to trigger on the Higgs boson in the most optimal way for the remainder of CDF Run II. Taking advantage of the CDF Run 2b trigger and data acquisition upgrades, we find that we can improve the purity of our triggers and significantly improve our acceptance for the Higgs"

mode	current acceptance	proposed acceptance
$WH \to e\nu_e b\bar{b}$	45%	89%
$WH \to \mu\nu_\mu b\bar{b}$	42%	88%
$ZH \to e^+e^- b\bar{b}$	71%	90%
$ZH \to \mu^+\mu^- b\bar{b}$	60%	96%
$ZH \to \nu\bar{\nu} b\bar{b}$	74%	96%
$H \to l\nu l\nu$	66%	82%

Esempi di studi di trigger

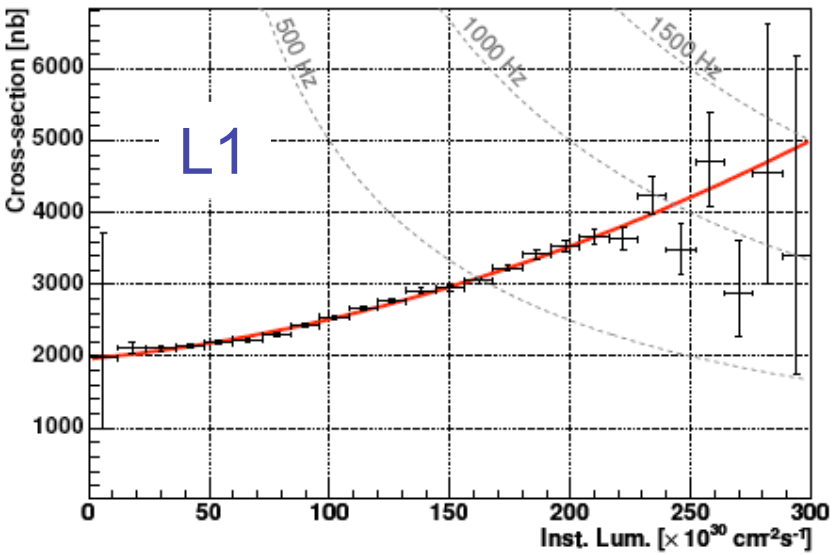
- Missing Et + 2 jet *(MET_JET)*
  - Per produzione associata WH e ZH
- SVT b-tag
  - Higgs to b-bbar
- Muon b-tag
  - Higgs to b-bbar

Post-upgrade MET turn-on curves



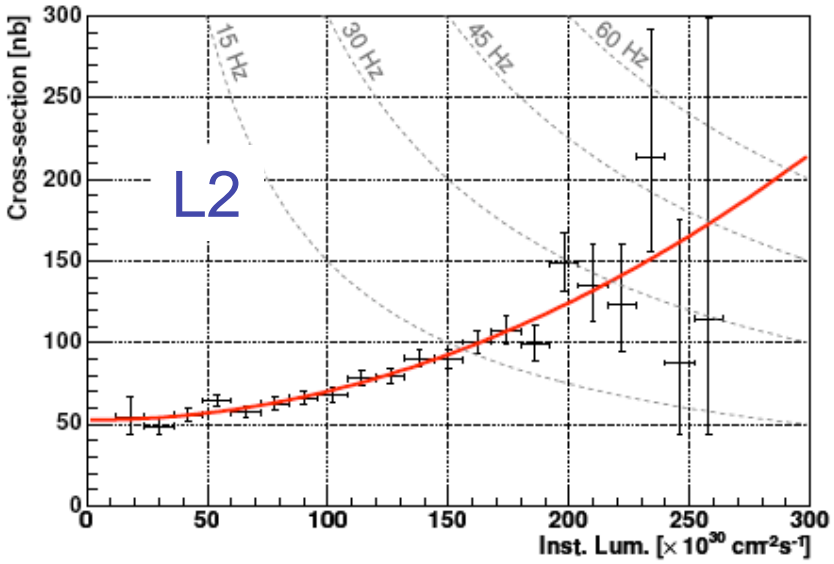
New MET threshold is much sharper!

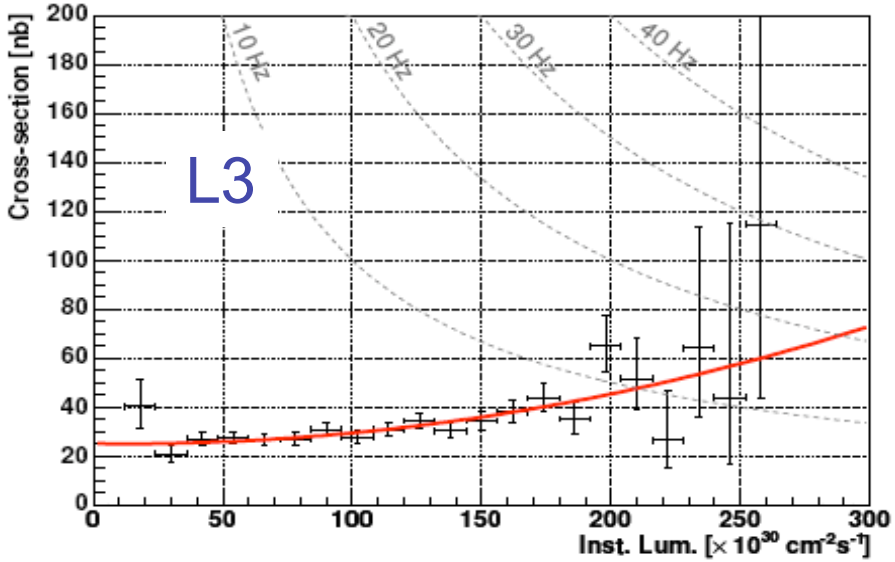
MET_JET trigger: rates



Cross sections as a function of instantaneous luminosity

	MET (GeV)	JET1 (GeV)	JET2 (GeV)	Rate @300E30
L1	15	10		1.5 KHz
L2	26	24	3	60 Hz
L3	28	28	10	20 Hz





MET_JET trigger: efficiencies

	WH			ZH	
	$\to e\nu_e b\bar{b}$	$\to \mu\nu_\mu b\bar{b}$	$\to \tau\nu_\tau b\bar{b}$	$\to \nu\nu b\bar{b}$	$\to \mu\mu b\bar{b}$
L1 eff. [%]	91.8	85.5	84.5	87.3	85.8
L2 eff. [%]	78.2	72.7	69.2	75.9	73.1
L3 eff. [%]	67.9	61.1	58.5	63.5	61.8
num. of Higgs in 5 fb^{-1}	37	34	32	44	7

Table 1: MET_JET cumulative trigger efficiencies for $M_H = 120 GeV$.

	$M_H = 110$	$M_H = 115$	$M_H = 120$	$M_H = 130$
L1 eff. [%]	86.2	87.0	87.3	88.8
L2 eff. [%]	71.9	72.9	73.4	75.7
L3 eff. [%]	59.7	61.7	62.5	65.2
num. of Higgs in 5 fb^{-1}	143	120	103	65

Table 2: MET_JET cumulative trigger efficiencies for $WH \to \ell\nu_\ell b\bar{b}$ and for different Higgs mass hypotheses.

B-tag trigger

Motivation

Extend physics reaches for **SM H->bb** and for **MSSM phi->bb**

(4 b-jets in the final state)

Goal

Develop b-tag trigger exploiting **new trigger capabilities**

(L2CAL and L2XFT upgrades)

Proposed triggers

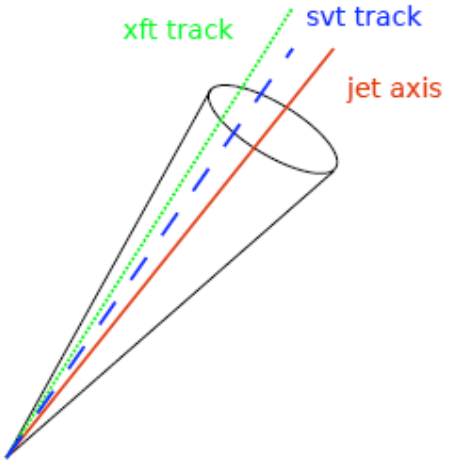
SVT b-tag trigger

displaced tracks matched to energetic jets

Muon b-tag trigger

soft muons from b decay matched to energetic jets

SVT b-tag trigger

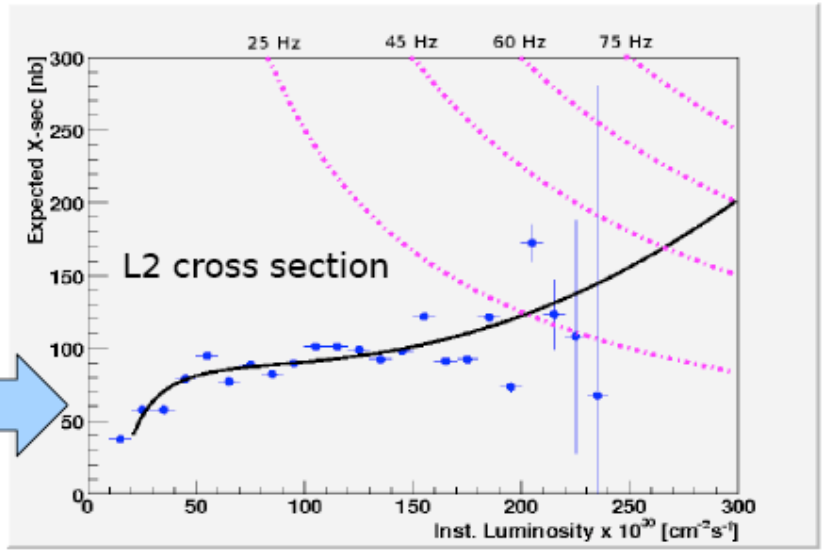


1) match SVT track – XFT track
2) match track – central energetic jet
3) further selection on b-jet decay length and track impact parameter

- more precise jet axis estimate (L2 cal upgrade)
- 3D track at L2 (XFT upgrade)

EFFICIENCIES on Signal:
hbb -> 12%
phibb -> 11%

rates under control
up to high luminosity!



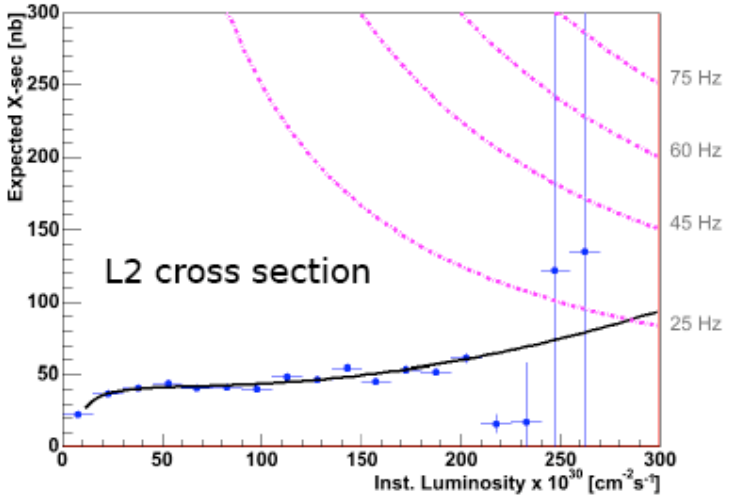
Muon b-tag trigger

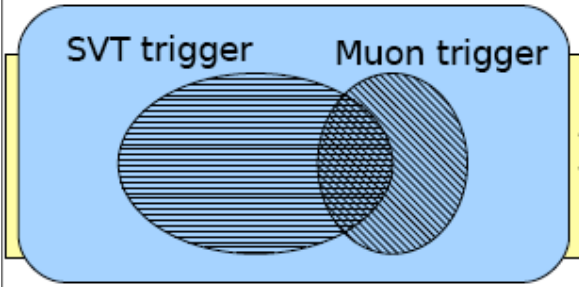
- match central energetic jet to low Pt muon

3D track at L2 -> great rejection of fake muons

EFFICIENCIES on Signal:
hbb -> 5%
phibb -> 6%

rates under control
up to high luminosity!





cumulative efficiency on signal = 15%

signal overlap = 10%

- *“The Tevatron and CDF are alive and well!”*
- Il gruppo italiano e’ in prima linea sia nella analisi dei dati che nei continui miglioramenti al rivelatore necessari per affrontare le alte luminosita’ ed estendere la sensibilita’ di CDF a sezioni d’urto sempre piu’ piccole
- L’Higgs SM non appare piu’ una meta irraggiungibile

“It’s harvest time for CDF”

Harvest Time by Mirja Clement