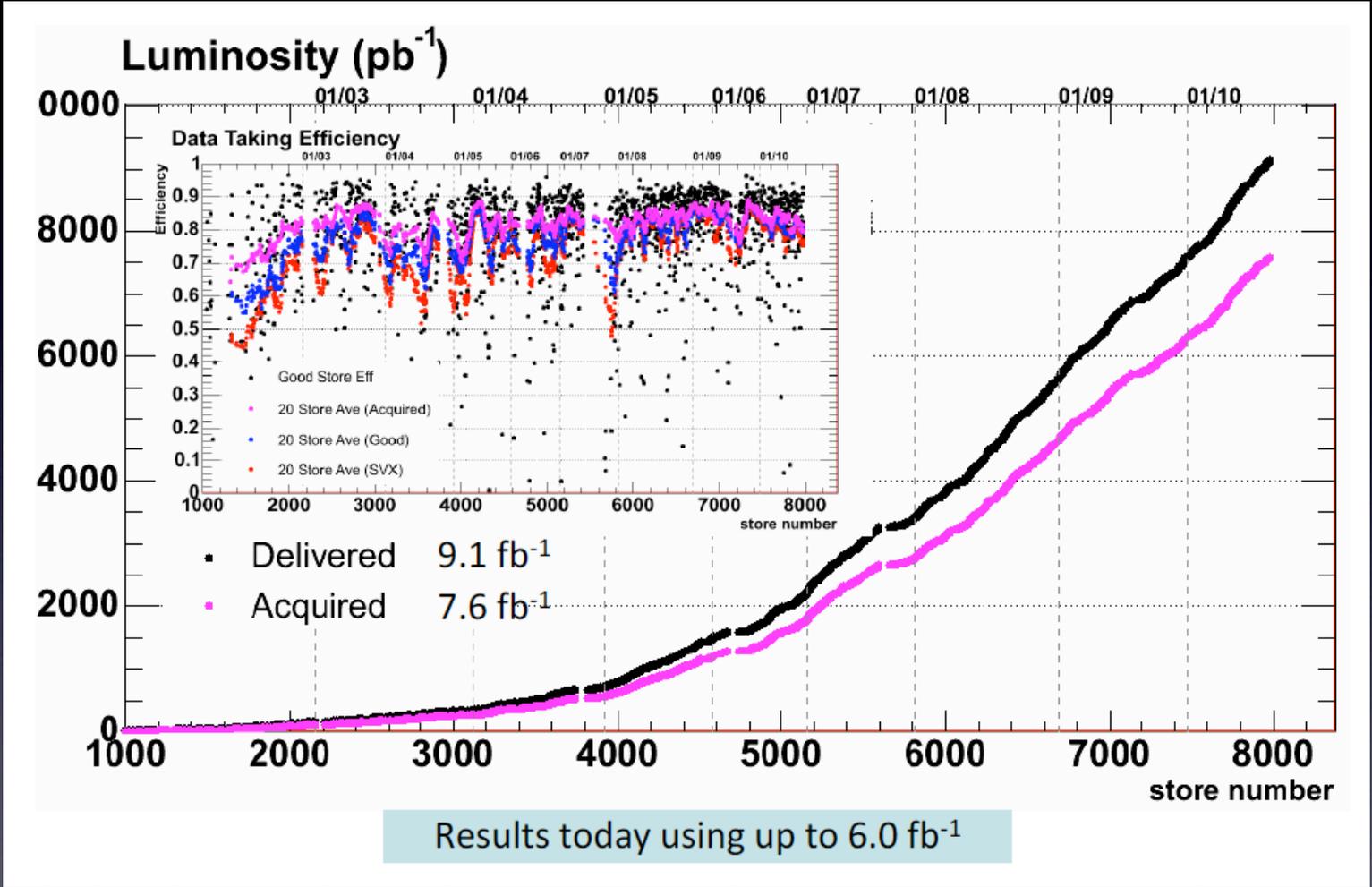


Stato di CDF e Richieste per il 2011

Luciano Ristori - 7 Settembre 2010

Tevatron Performance



Physics

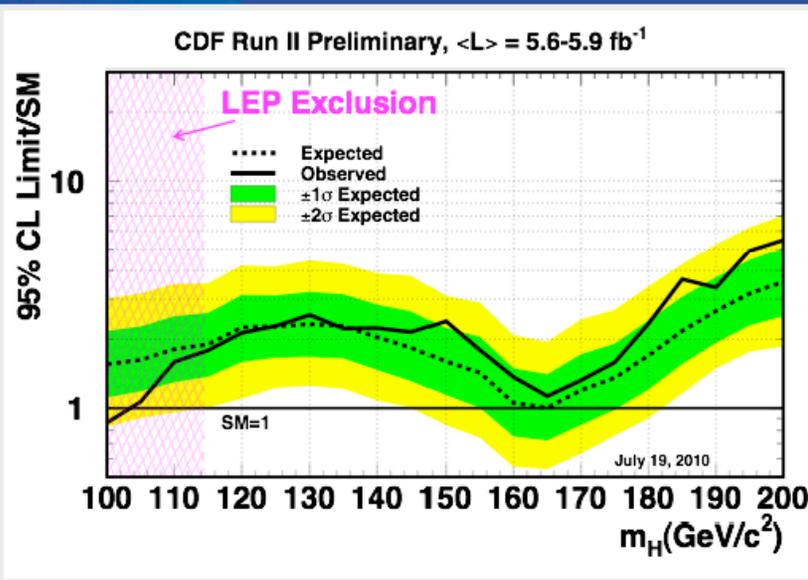
<http://www-cdf.fnal.gov/physics/W10CDFResults.html>

<http://www-cdf.fnal.gov/physics/S10CDFResults.html>

Higgs

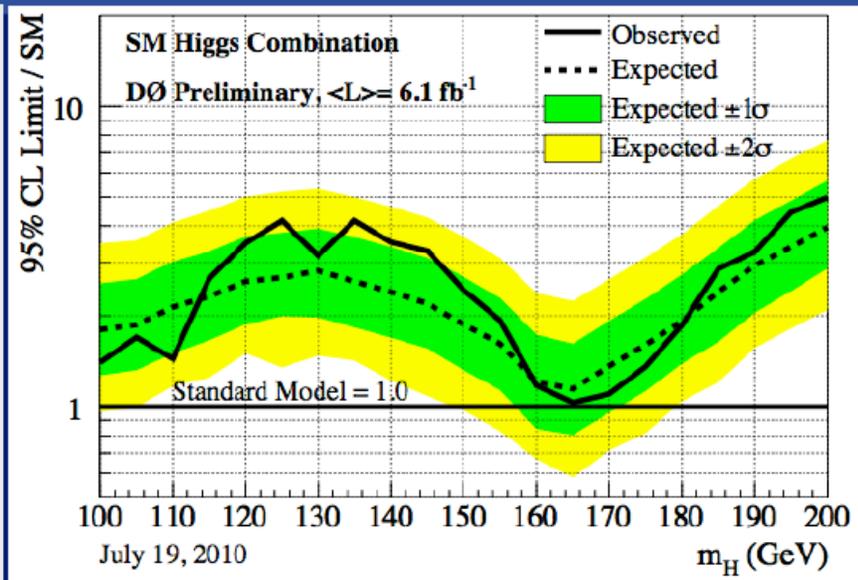
CDF & D0 Individual Combinations

- CDF's limits



CDF achieves expected exclusion at 165 GeV

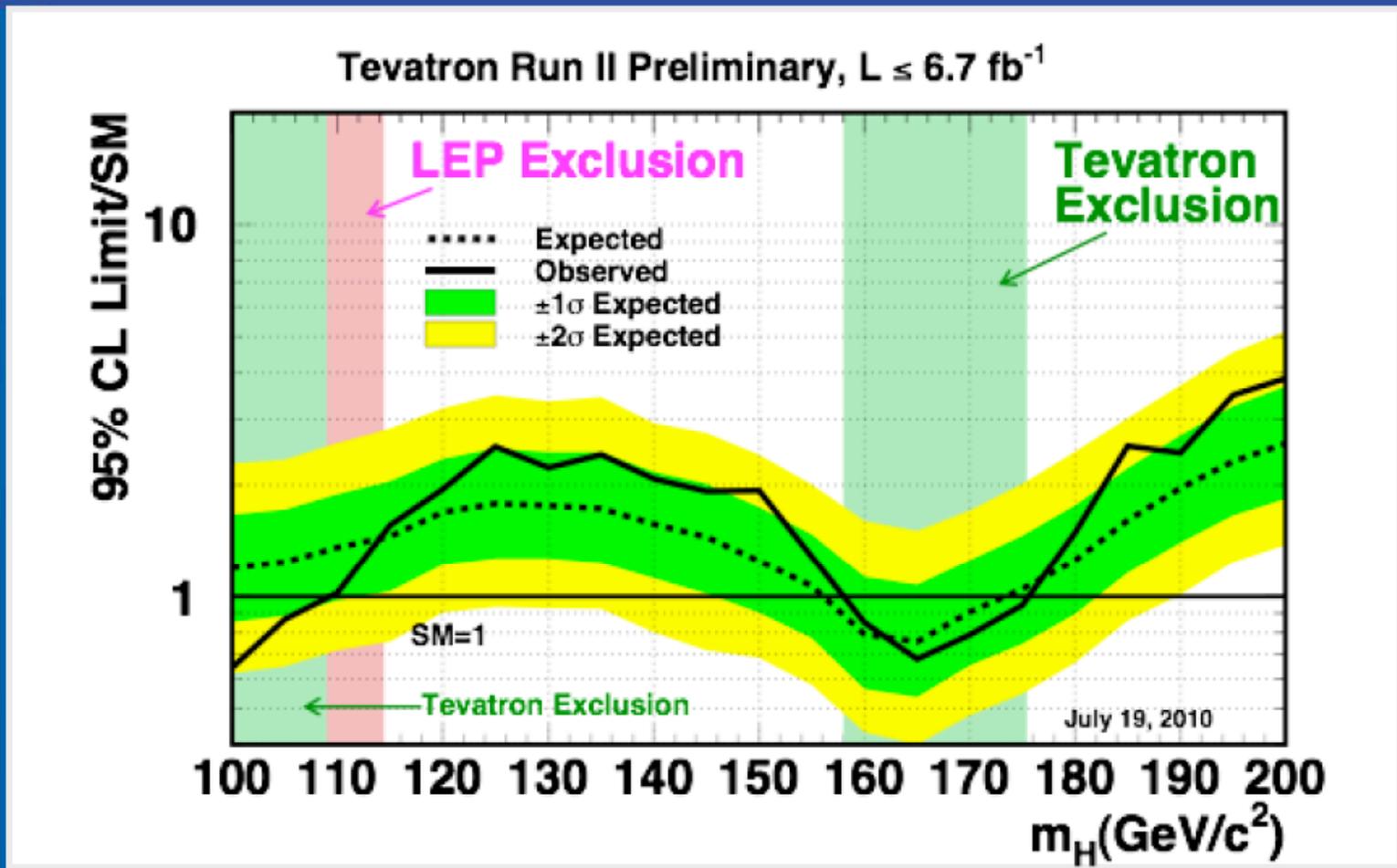
- D0's limits



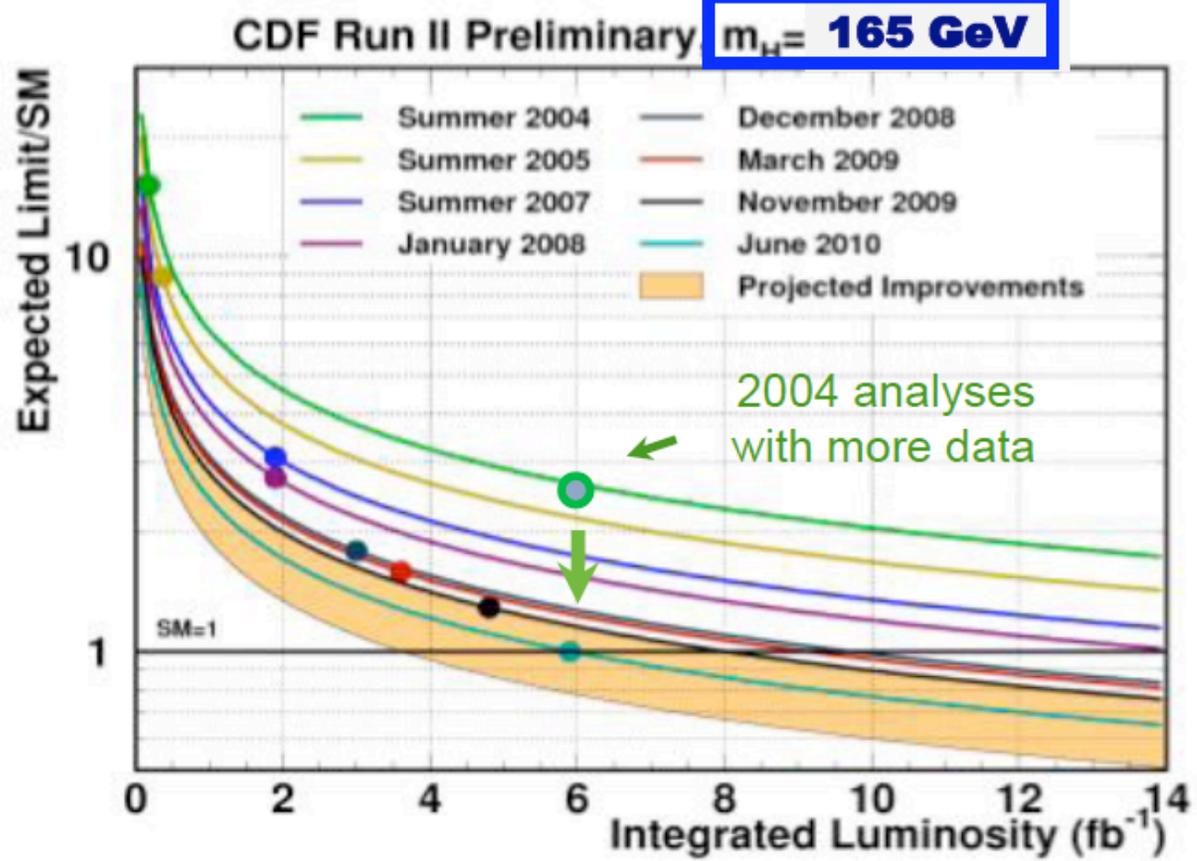
D0 almost achieves observed exclusion at 165 GeV

Tevatron combination

“Expected sensitivity”



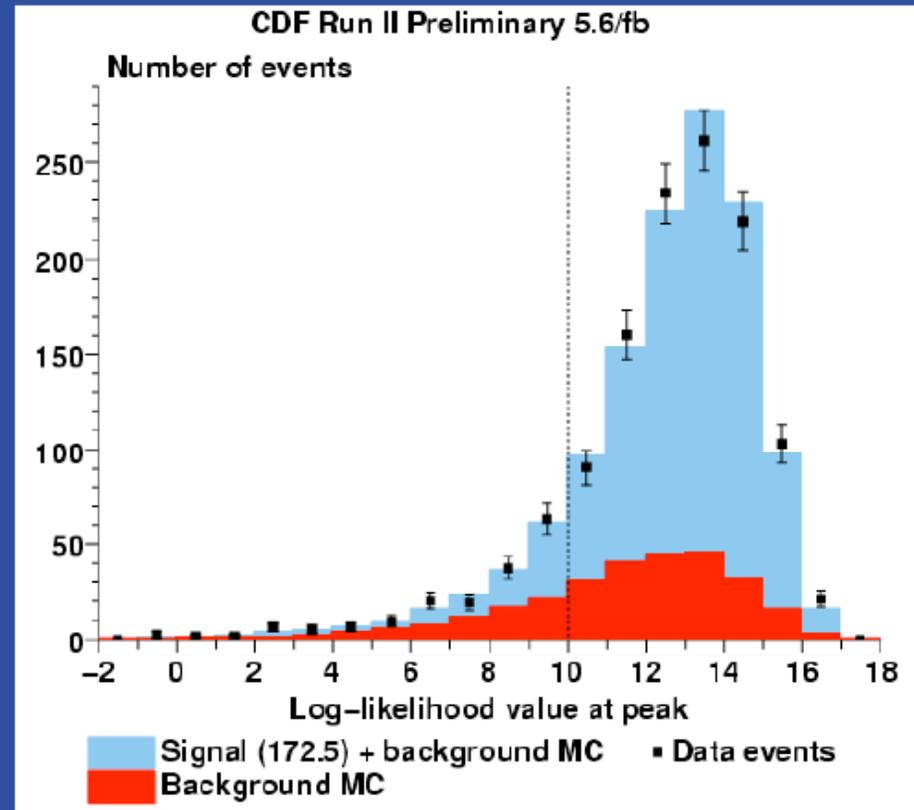
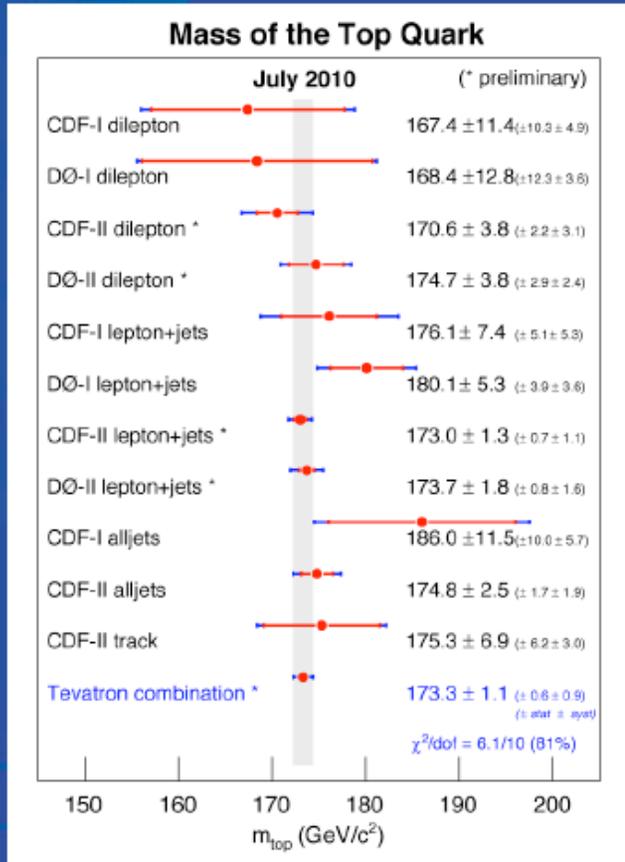
- Low mass sensitivity approaching LEP exclusion :
 - ▶ Expected $1.45 \cdot \text{SM}$ @ 115 GeV
 - ▶ Expected $1.24 \cdot \text{SM}$ @ 105 GeV
- High mass 95% CL exclusion :
 - $158 < m_H < 175 \text{ GeV}$
 - ▶ 4 times previous (162 - 166 GeV)
 - ▶ Expected ($156 < m_H < 175 \text{ GeV}$)



High mass : Summer 2010 limits already well into yellow band

Top

Future Legacy: Precision Top Mass



$$m_t = 173.0 \pm 0.7_{\text{stat}} \pm 0.6_{\text{JES}} \pm 0.9_{\text{syst}} \text{ GeV}/c^2 = 173.0 \pm 1.2 \text{ GeV}/c^2$$

current Tevatron precision: **0.7%**



Heavy Flavors

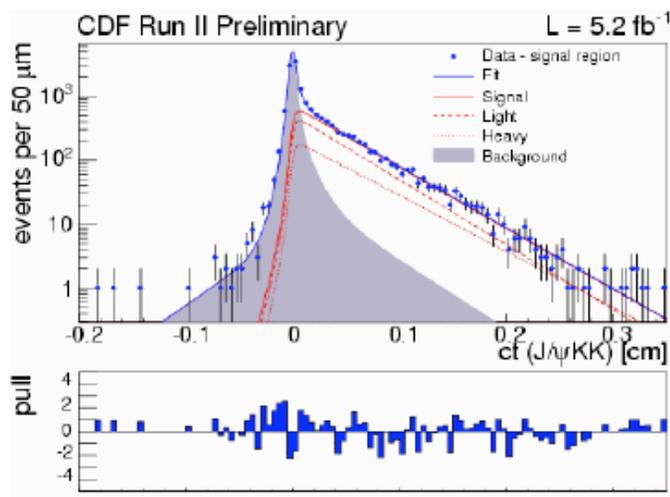
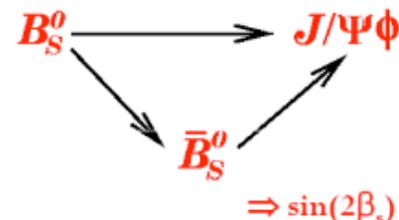


CP-Violating Phase β_s

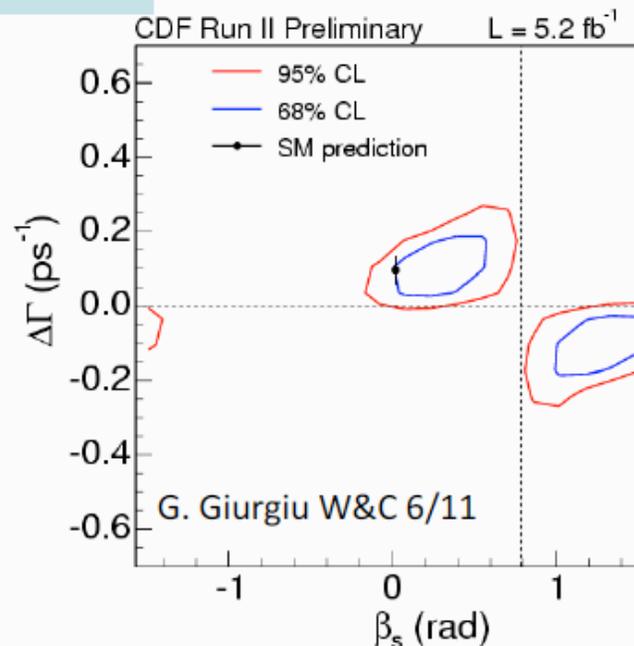
Interference of decays with/without mixing

Angular correlations of decay products to separate CP-even/CP-odd components as a function of proper time

Last summer, Tevatron combined result (2.8 fb⁻¹) consistent with SM at 3.4% level (2.1 σ)



$c\tau_s = 458.7 \pm 7.5 \text{ (stat)} \pm 3.6 \text{ (syst)} \mu\text{m}$
 $\Delta\Gamma_s = 0.075 \pm 0.035 \text{ (stat)} \pm 0.01 \text{ (syst)} \text{ ps}^{-1}$
 $|A_{||}(0)|^2 = 0.231 \pm 0.014 \text{ (stat)} \pm 0.015 \text{ (syst)}$
 $|A_0(0)|^2 = 0.524 \pm 0.013 \text{ (stat)} \pm 0.015 \text{ (syst)}$



$[0.02, 0.52] \cup [1.08, 1.55]$ at 68% CL
 SM consistency 0.8 σ (was 1.5 σ)



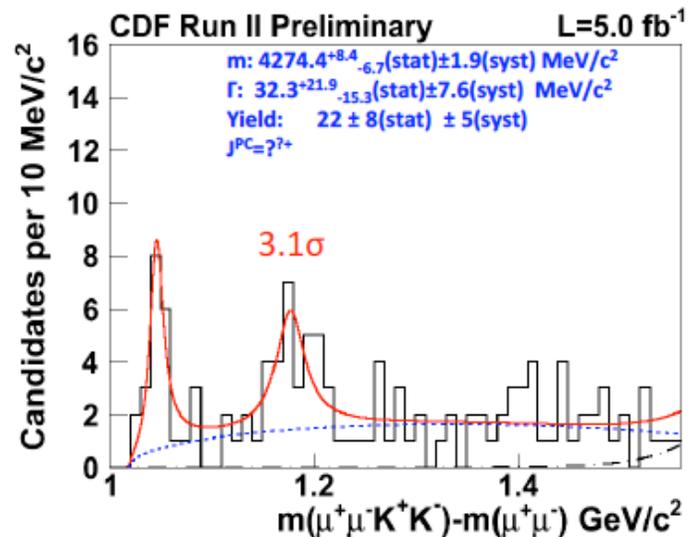
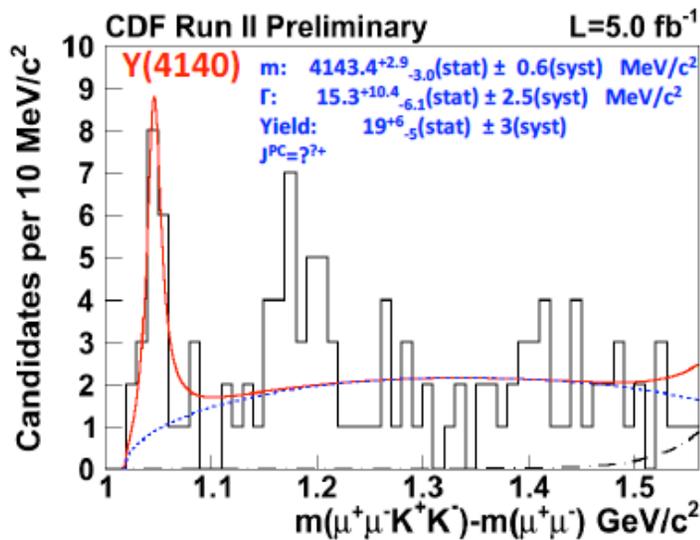
Observation of Y(4140)

7

Evidence ($>3.8\sigma$) of a new structure Y(4140) was found @CDF using 2.7 fb^{-1}
Y(4140) $\rightarrow J/\psi\phi$ through exclusive $B^+ \rightarrow Y(4140)K^+$ decay (PRL 102, 242002)

Y(4140) significance $>5\sigma$ with the same cuts as before using 5.0 fb^{-1} data

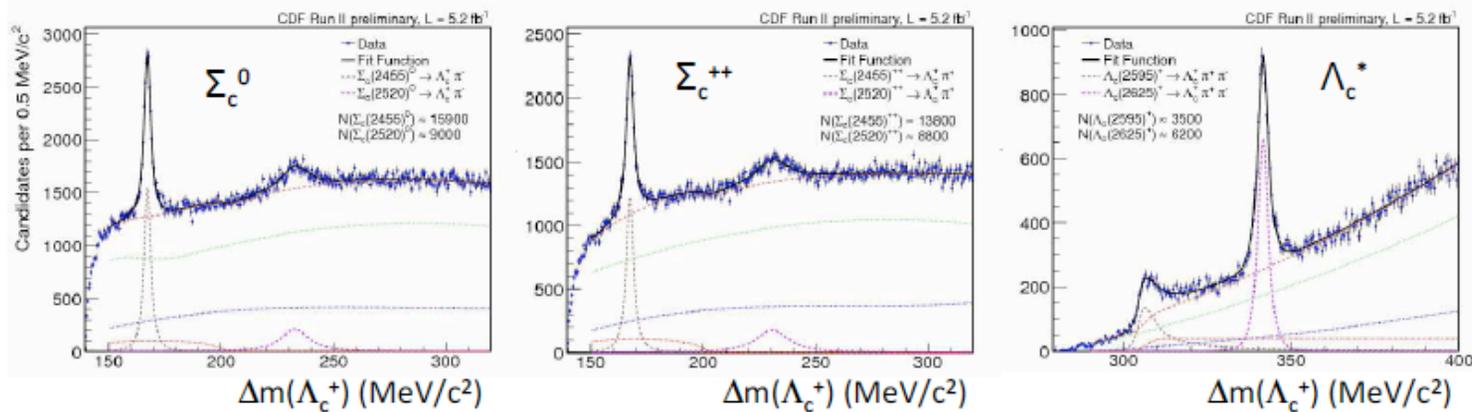
Suggestive evidence emerging for another structure at $4270 \text{ MeV}/c^2$



$$\text{Relative BF: } \frac{\mathcal{B}(B^+ \rightarrow Y(4140)K^+, Y(4140) \rightarrow J/\psi\phi)}{\mathcal{B}(B^+ \rightarrow J/\psi\phi K^+)} = 0.149 \pm 0.039(\text{stat}) \pm 0.034(\text{syst})$$



Exploit our large sample of triggered $\Lambda_c \rightarrow pK\pi$ events to study $\Sigma_c^0, \Sigma_c^{++}, \Lambda_c^*$ states
 Simultaneous analysis incorporating all cross-talk between channels and threshold effects



	$m - m(\Lambda_c^+)[\text{MeV}/c^2]$	$\Gamma[\text{MeV}/c^2]$
$\Sigma_c(2455)^0$	167.28 ± 0.12 0.11	1.65 ± 0.50 0.3
$\Sigma_c(2455)^{++}$	167.44 ± 0.13 0.11	2.34 ± 0.47 0.4
$\Sigma_c(2520)^0$	232.88 ± 0.46 0.6	12.51 ± 2.28 1.9
$\Sigma_c(2520)^{++}$	230.73 ± 0.58 0.5	15.03 ± 2.52 2.1
$\Lambda_c(2595)^+$	305.79 ± 0.24 0.6	2.59 ± 0.56 +2.0-1.3
$\Lambda_c(2625)^+$	341.65 ± 0.13 0.6	$< 0.97(90\%CL)$ <1.9

Comparable or improved precision compared to PDG uncertainties (in red)

Electroweak

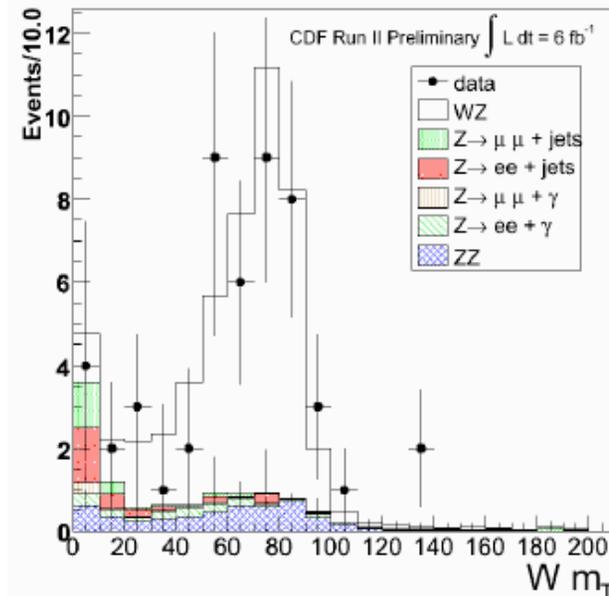
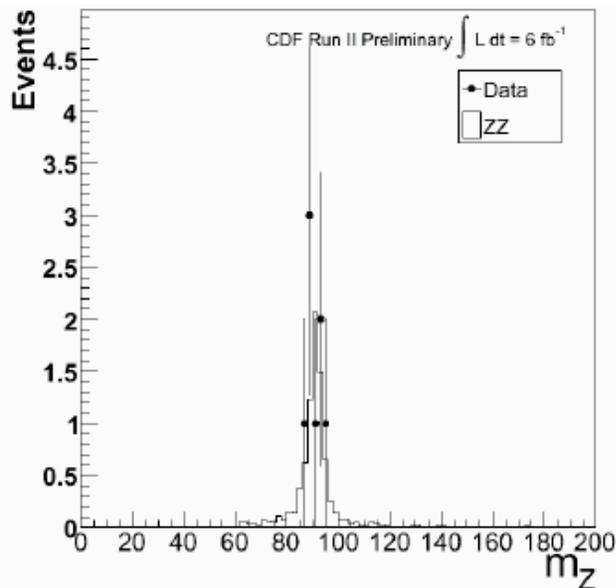


Lepton ID optimization

- Improved electron/muon isolation
- Recover central/plug transition
- Tight track quality

Selection: 3 leptons + MET > 25 GeV

Normalize to Z → ll cross section



Also select ZZ → ll ll (bkgd < 0.01 event!)
 Only M(ZZ) < 300 GeV region for now
 (high mass is a search region)

$$\sigma(p\bar{p} \rightarrow WZ) = (4.1 \pm 0.6(stat) \pm 0.4(syst))pb$$

$$\sigma(p\bar{p} \rightarrow ZZ) = (1.7^{+1.2}_{-0.7}(stat) \pm 0.2(syst))pb$$

Exotics

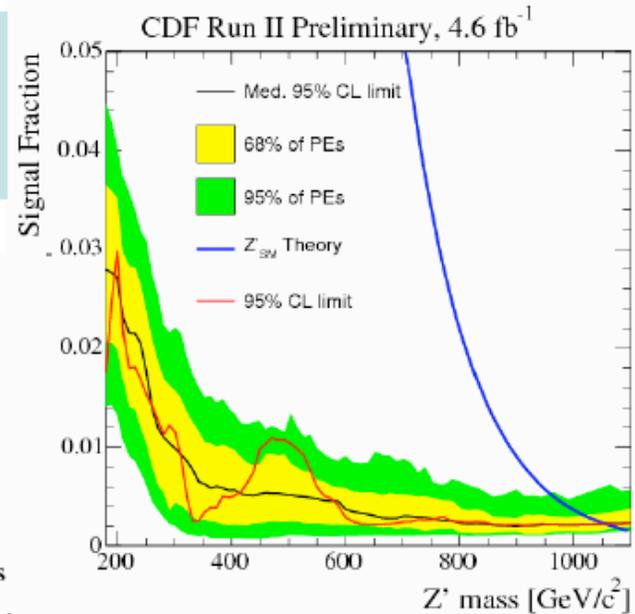
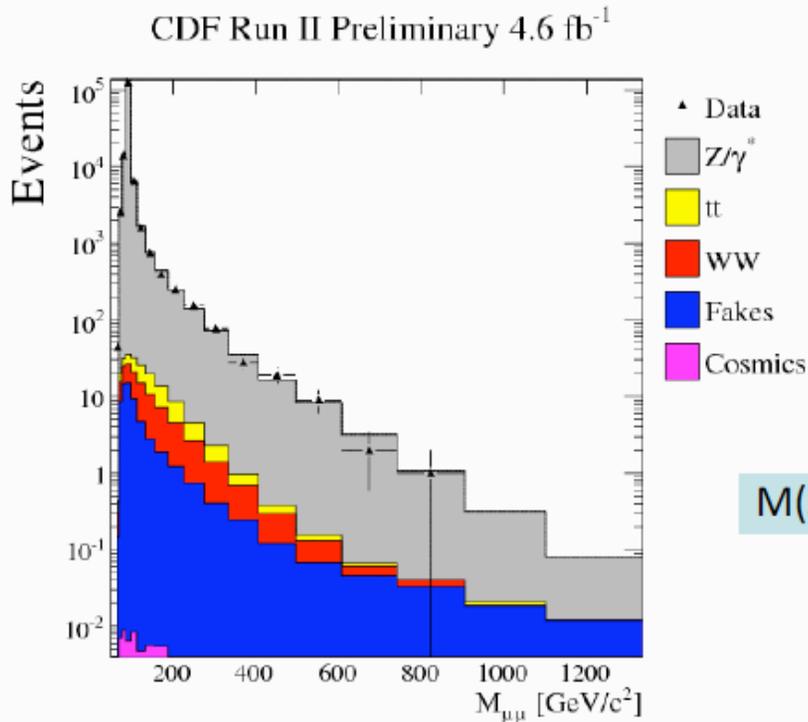


High-Mass Dimuon Resonances

30

First CDF direct exclusion above 1 TeV
PRL 102, 091805 (2009), 2.3 fb⁻¹

New: twice the luminosity, matrix element to
incorporate muon p_T resolution weighting



$M(Z'_{SM}) > 1071 \text{ GeV}/c^2$ (95% C.L.)

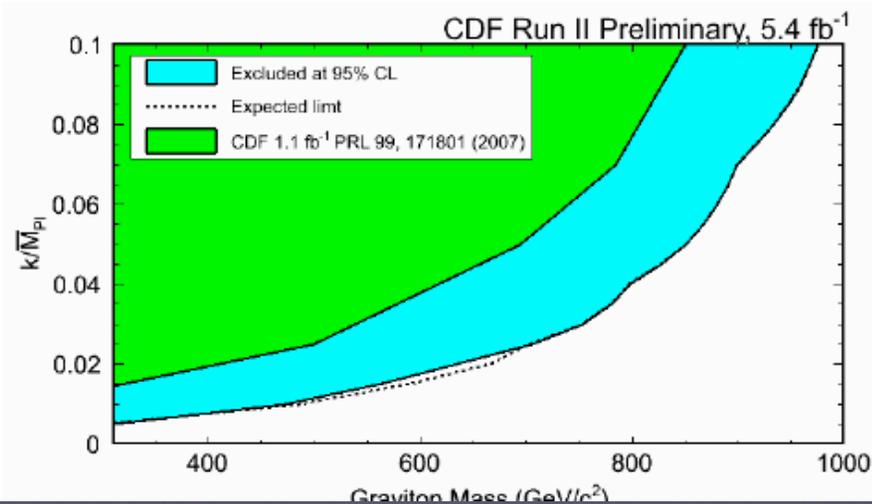
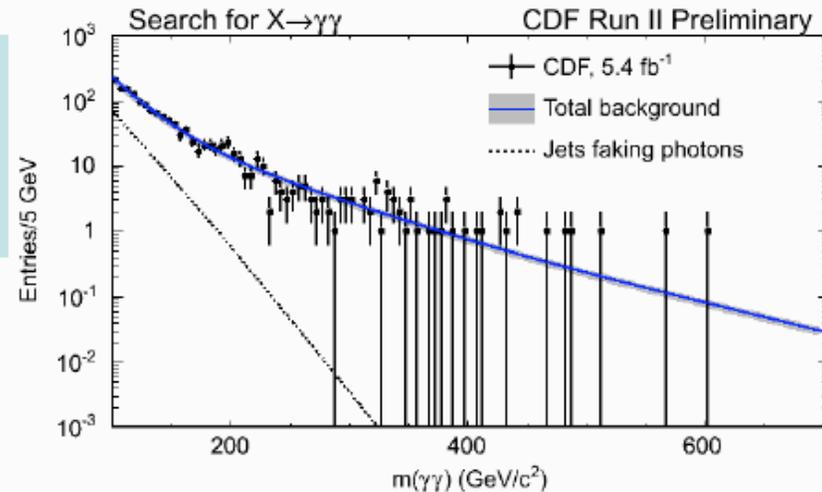


High-Mass Diphoton Resonances

31

General search, interpret in Randall-Sundrum graviton scenario

SM diphoton background: DIPHOX NLO calculation matched to Pythia



Limits on RS graviton mass and coupling parameter k/M_{pl}

Exclude up to 976 GeV/c^2 for $k/M_{\text{pl}} = 0.1$

Run III ?

Extending the Tevatron Run to 2014 ?

Charge to PAC:

“ Please consider two funding scenarios in making a recommendation:
1) No additional funding to Fermilab for the added costs of an extension; and
2) Additional funding of about \$150 M over three years to limit delays in future projects at the Laboratory.”

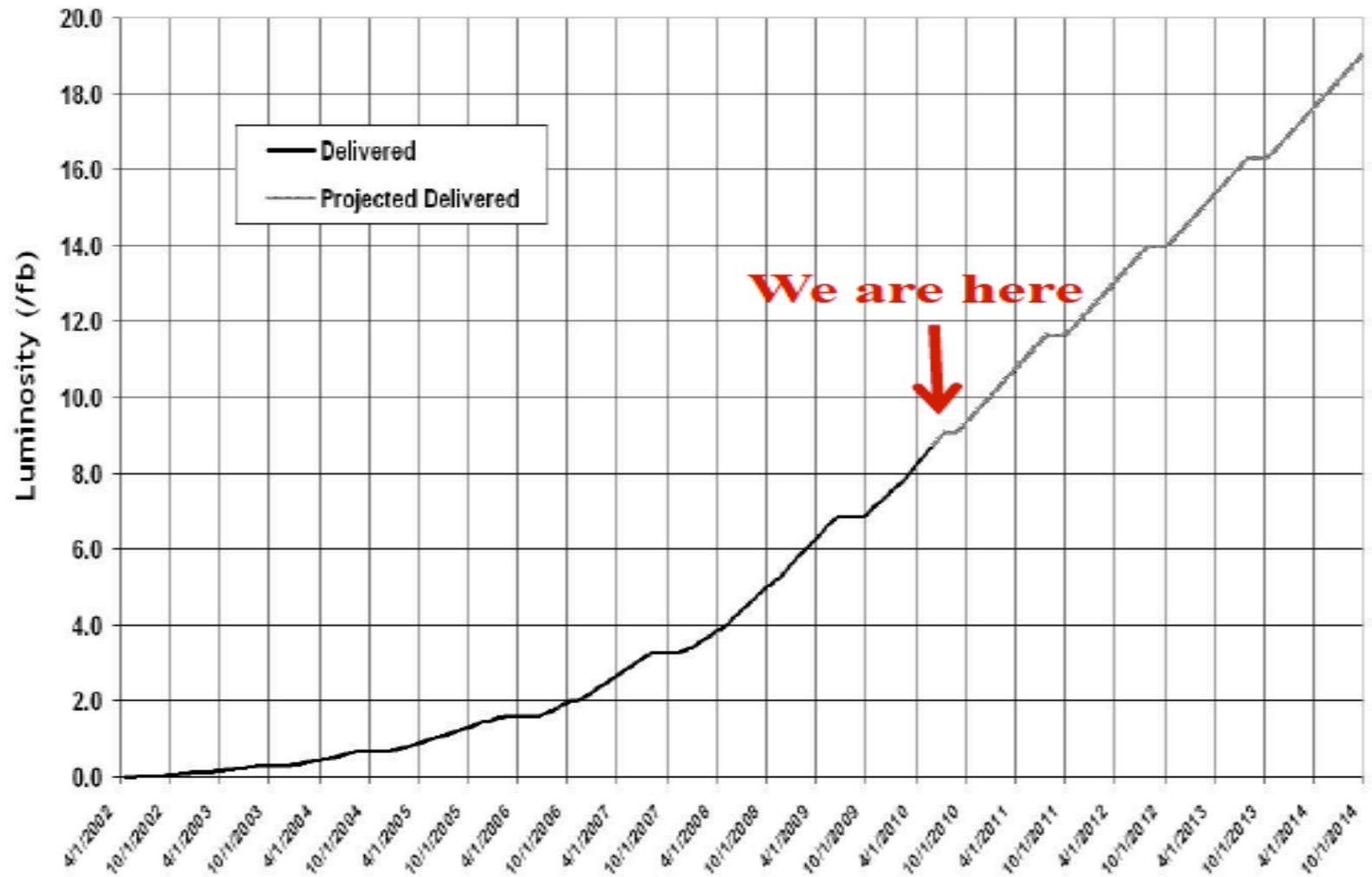
PAC Recommendation - August 31 2010:

“The Committee strongly endorses the extension of the Tevatron run for three years during 2011–2014 under either funding scenario presented in the charge”

Pier Oddone - Fermilab Today, Sep 1 2010:

“Only if we are convinced that our leadership position at the Intensity Frontier—the long-term future of our laboratory—remains viable and robust will I move forward with this recommendation”

Tevatron Run II Integrated Luminosity and Projection



Potential issues with the CDF Detector

- COT is running well : no further problem after 2003 crisis
- Accumulated radiation damage to Layer-0 of the SVX
 - Loss in efficiency - Loss in b-tag - Loss in Higgs efficiency
 - Action: evaluated impact on Higgs sensitivity
 - ▶ Overall sensitivity loss < 2% in worst case scenario
- Radiation Damage to SVX digital optical transmitters (DOIM)
 - Action: fix it by adding amplifiers

CDF COLLABORATION projections

2009 Survey/ Current Survey /Actual

“RUN III”

	2009	2010	2011	2012	2013	2014
Tot FTE	292	249/278	191	141/184	179	176
U.S.	46%	48%/51%	50%	46%	46%	46%
postdocs	71	65/72	47	29/48	46	45
students	100	77/91	51	33/60	57	55
fac. level	121	107/115	93	79/76	76	76

☀ Actual 2010 numbers turn out larger than projected in 2009, staying at 2009 level. This has always been the case in past surveys.

Notes:

- #'s are in FTE
- faculty level = teaching and non-teaching faculty + lab scientists

Effort Required to Operate CDF Today

	<u>Today</u>
Operations	40 FTE
Offline	15 FTE
Management	10 FTE
Algorithms	10 FTE
Total Effort	75 FTE

- 40% less than a few years ago. Might still shrink a bit.
- This is the effort required to do everything in CDF operations except physics analysis
- This leaves 110 FTE for physics
- **This is enough for Higgs analysis (30 FTE) and much more.**

FTE INFN

CDF: FTE PER SEZIONE			
	2009	2010	2011
<i>BO</i>	5.8	5.5	4.8
<i>LNf</i>	3.1	2.5	2.7
<i>PD</i>	4.5	4.3	5.3
<i>PI</i>	22.1	21.3	19.7
<i>TS</i>	3.7	4.2	3.2
<i>UD</i>	2.2	2	2
<i>PV</i>	1	1	1
<i>RM</i>	1.6	1.3	0.8
<i>TN</i>	0.6	0	0
Totale	44.6	42.1	39.5
		-5.61%	-6.18%
			-11.43%

Nota: Pisa = +0.9 FTE (0.4 PS Marrocchesi, 0.5 Paolo Maestro)

Richieste 2011

Richieste per il 2011

Differenze rispetto al data base

- **Pisa**
 - ▶ 0.9 FTE addizionali (0.4 : PS Marrocchesi, 0.5 : Paolo Maestro)
- **LNF**
 - ▶ 3600\$ per rimpiazzare tre desktop che si perdono per il passaggio a SL5 in cui FNAL non upgrada macchine piu' vecchie di 5 anni.

Richieste 2011

PREVENTIVO GLOBALE DI SPESA PER L'ANNO 2011

In K€

Struttura	A carico dell'I.N.F.N.											A carico di altri enti	
	interno	estero	consumo		trasporti	licenze-SW	manutenzione	inventario	apparati	spservizi	TOTALI		
BO	5.00	89.00	12.50	5.00				3.00			109.50	5.00	
CNAF									194.50		194.50		
LNF	3.00	70.00	4.00				4.00	12.00	7.50		100.50		
PD	10.00	107.00	15.00					4.00			136.00		
PI	30.00	385.00	290.00		5.00			12.00			722.00		
PV.DTZ	3.00	15.00	2.00								20.00		
RM1.DTZ	2.00	13.00	2.00					2.00			19.00		
TS	3.00	43.50	5.00					1.50			53.00		
UD	2.00	48.00	5.00		1.00			2.00			58.00		
Totall	58.00	770.50	335.50	5.00	6.00			4.00	36.50	202.00	1,412.50	5.00	

Mod. EC/EN 4

(a cura del responsabile nazionale)

Richiesta aggiuntiva di LNF: \$3600 per tre desktops