Status of operation and Physics 2011

October 3, 2011

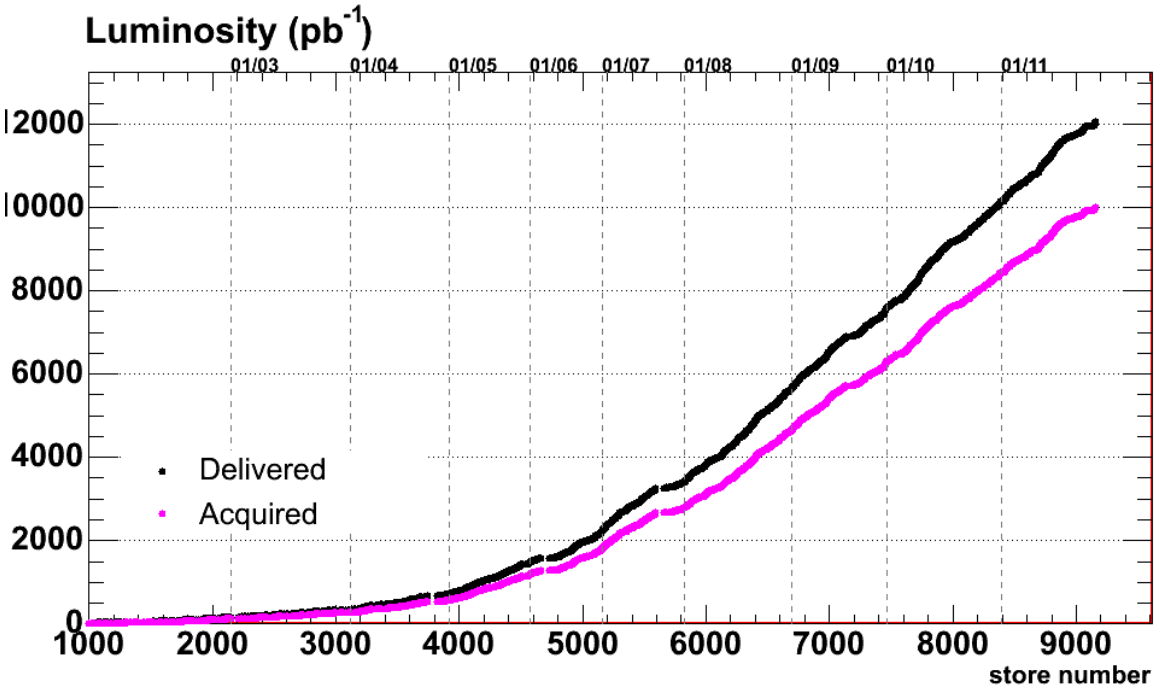
Giovanni and Rob

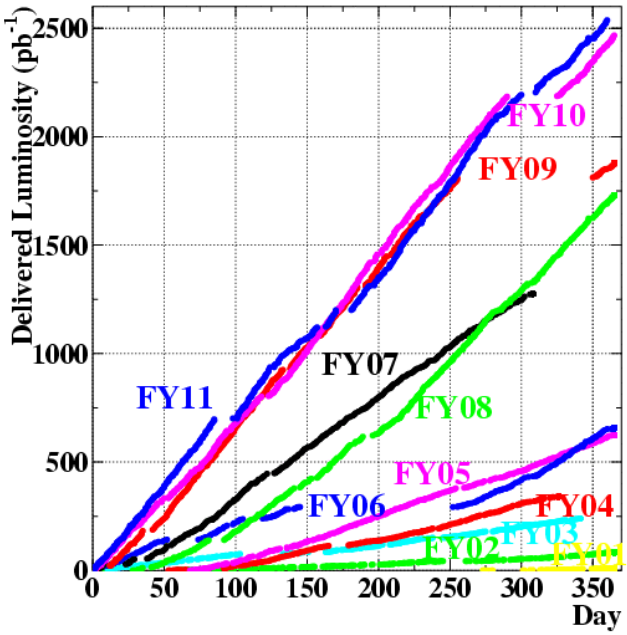
Integrated Luminosity

Final dataset close to round numbers:

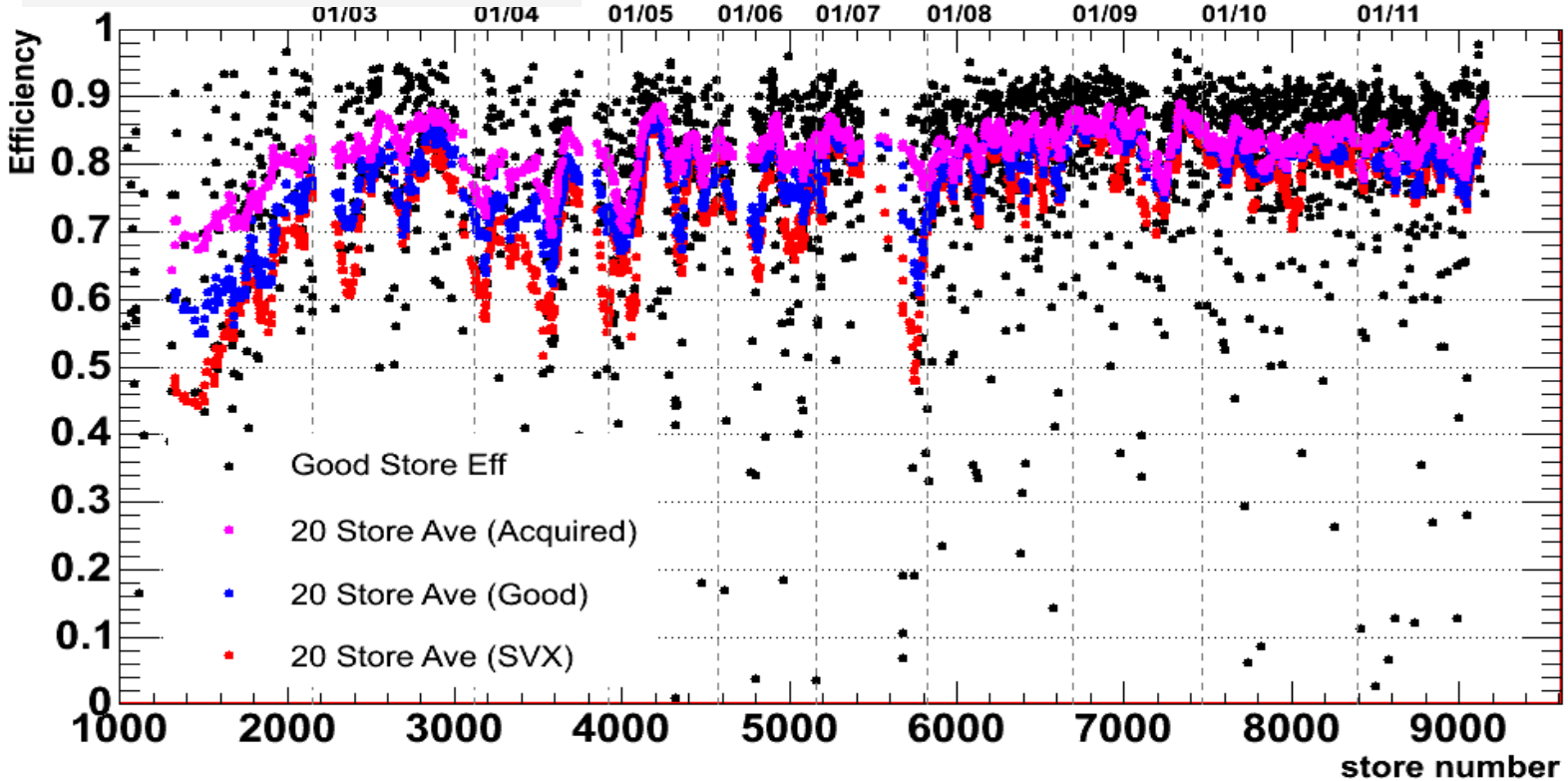
12 fb^{-1} delivered - **10 fb^{-1}** collected

Still another record year: FY11 >2.5 fb^{-1}





Data taking efficiency: High through the end



integrated luminosity (1/fb) *thru store 9153

	Run II*		FY10		FY11*	
delivered	12.0		2.5		2.5	
recorded	9.9	83%	2.1	84%	2.1	83%
good	9.5	79%	2.0	82%	2.0	79%
good w. silicon	9.2	77%	2.0	80%	2.0	78%

Store Statistics

Beat 2010 record

CDF Run II	Time (hr)	Init Lum (E30)	C:B0TLUM (pb-1)	C:B0TLIV (pb-1)	Efficiency (%)
Average	16.5	186.3	4.5	3.7	80.0
Record	62.4	441.9	12.2	10.7	98.5
Sum	44016		44065.4	11892.3	9885.2

The Last Store

Store #	Started	Stopped	Time (hr)	Init Lum (E30)	C:B0TLUM (nb-1)	C:B0TLIV (nb-1)	Efficiency (%)
9158	Thu 09/29/11 21:05	Fri 09/30/11 14:26	17.2	372.8	8754.2	7846.5	89.6
9157	Thu 09/29/11 02:46	Thu 09/29/11 19:45	16.6	387.2	8591.2	7812.0	90.9
9156	Wed 09/28/11 09:22	Thu 09/29/11 01:21	15.6	358.0	7639.6	5895.2	77.2
9155	Tue 09/27/11 17:13	Wed 09/28/11 08:54	15.4	380.1	8146.6	6741.5	82.8

Recent detector operations

- **Requested: 0.75 accesses/wk (1.4/wk total)**
- **Requested none: 3 weeks out of 16**

week or weeks ending	opportunisitic	requested	cause	
13-Jun		1	FIB fuse	
20-Jun		2	plug HV, plug ADMEM	
27-Jun		1	SVX PS fan	
11-Jul		2	COT LV, central ADMEM	
18-Jul	1			
25-Jul	1	1	central media converter	
1-Aug	2			site power glitch recovery
8-Aug	5	1	CCU	
15-Aug		1	L00 crowbars (PAK prefire)	
22-Aug	1	1	COT tracer	
29-Aug				
12-Sep	1	1	plug HV, plug ADMEM	
19-Sep				
26-Sep		1	L00 crowbars (AAK prefire)	
total	11	12		
/week	0.69	0.75		

Activity in coming weeks

SECURING PROCESS SYSTEMS	OCTOBER	NOVEMBER (after silicon testing is complete)	.....and Beyond
GAS SYSTEMS			
HV to Gas Chambers	HV locked out to chambers with A-E and Isobutane		
Flammable Gas	Inert Chambers, Mix Shed and Gas Storage Shed with N2 or Argon per JHA		
	Reclassify Collision Hall Flammable Gas Status after inerting is complete		
	Purge Inerted Chambers with Air per JHA Then isolate the pipes to CH		
Nitrogen inerting flow including COT baggies and silicon chambers	Keep all inert flows on	May stop the inerting flows after the Silicon test is done; baggies may be removed from the chamber ends	
CRYO SYSTEM			
	Warm up solenoid and cryo plant per JHA	Isolate pipes to CH	Reclassify Collision Hall ODH Status
HVAC SYSTEM			
Recirculating Fans	Turn Off		
Other Fans	Leave On - may run in Low HVAC unless this is a problem for Silicon	Continue to operate indefinitely	
WATER COOLING SYSTEMS			
LCW	Turn off and Drain/dry		
ECW	Keep On	Turn off and drain/dry	
CHW	Keep On - may isolate chillers 1, 2, & 3	Keep On indefinitely	Feb, 2012 - relocate Chiller 5
ICW	Keep On Indefinitely		
AIR COMPRESSOR SYSTEM			
Pneumatic air	Required for silicon and to operate valves during securing of various systems	Replace air compressor as convenient	
Silicon Cooling			
SVX	Keep On as required for testing	Turn off and drain/dry per JHA	
ISL	Keep On as required for testing	Turn off and drain/dry per JHA	
SUVA			
	Keep operational until Oct. 4. Recover SUVA after COT is purged with Nitrogen / Purge pipes with N2		
CONTROLS			
APACS / i-Fix	Keep operational except for High Voltage PCs - see Phil's list	Reconfigure per plan TBD	
Quadlog / Life Safety	Keep operational	Reconfigure per plan TBD	

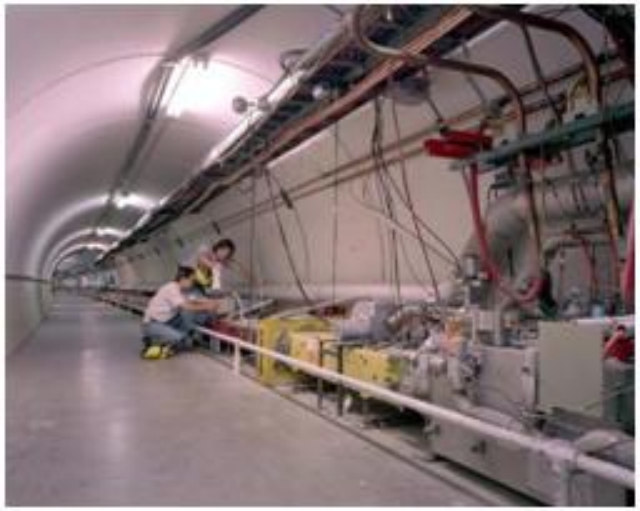
CDF tours

DOE has approved Fermilab's plan to postpone the dismantling of the CDF and DZero detectors to use them to give guided tours.

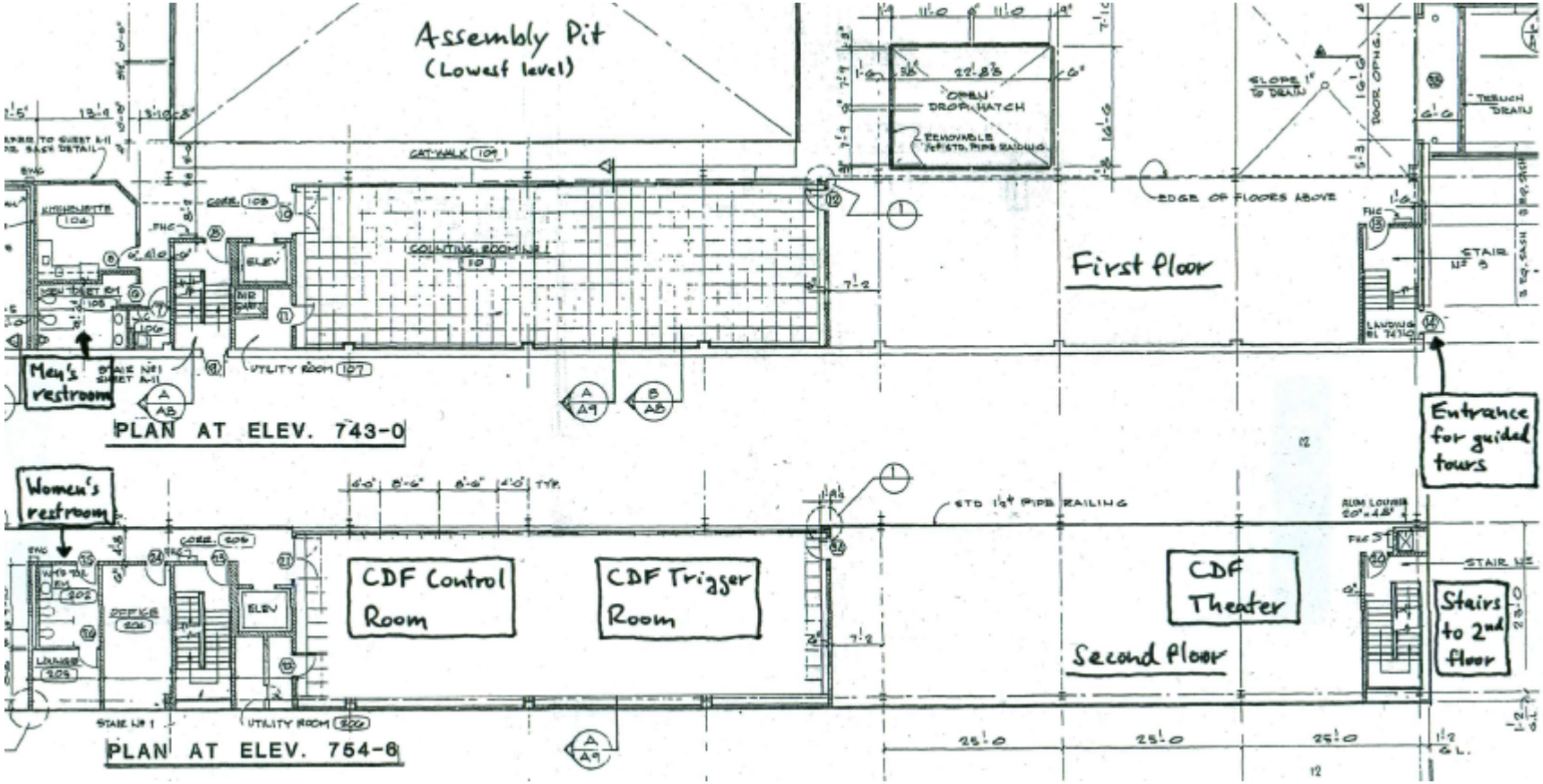
PPD has allocated enough money to make the necessary life safety improvements to take visitors into the CDF collision hall and a short section of the Tevatron tunnel, next to CDF.

A group of people from Education Office, Off. of Communication and CDF, will work on creating tours.

First tours in the summer/fall of 2012.



Proposed CDF Tour Route

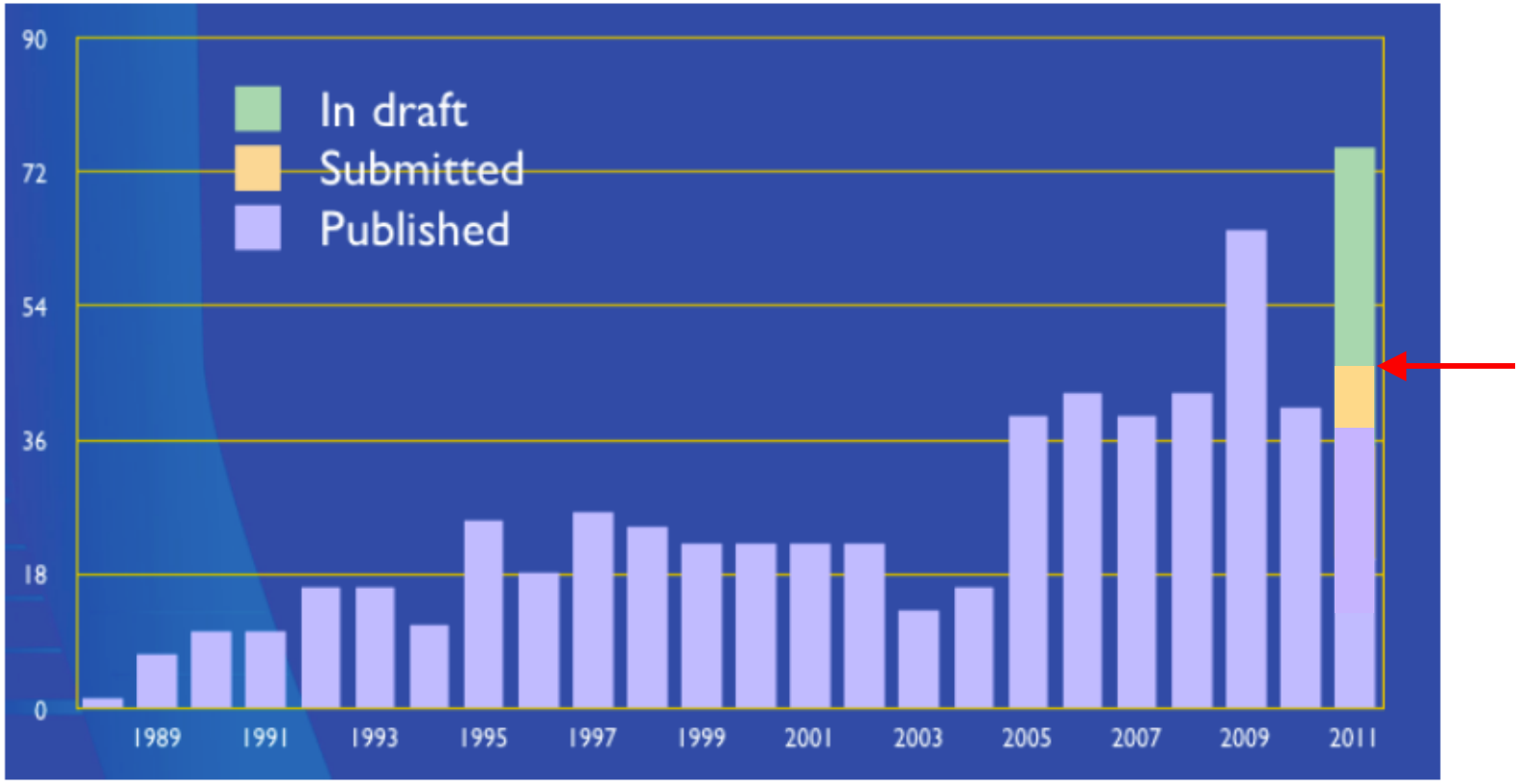


Will include collision hall and part of Tevatron tunnel

Some Special Events this year

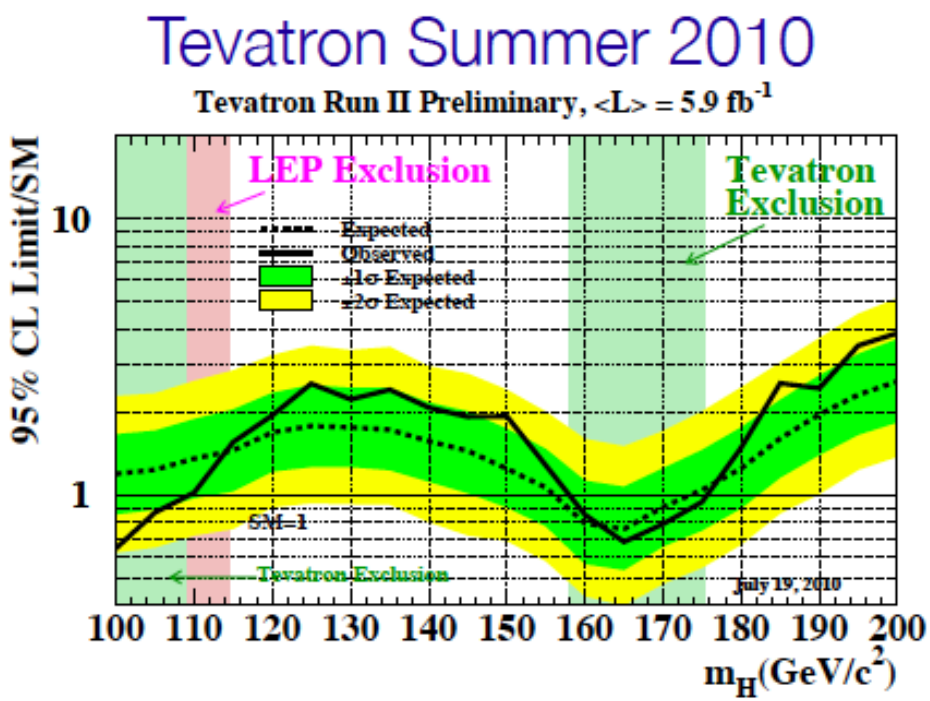
- **4 weeks of beam studies interspersed with HEP during the summer**
  - **HEP stores were normal, studies were lots of 3x3 or 1x1**
- **An extended power glitch recovery followed by an extended period with RR ecool up and down**
  - **Assortment of problems**
  - **Limited stash size to about $150*10^{10}$**
  - **A few weeks of lower-lum stores**
- **Low energy scans**
  - **Invested 7 calendar days of Tevatron running**
  - **Aim at a handful of unique papers**
  - **150 x 150 and 450 x 450 data successfully obtained**

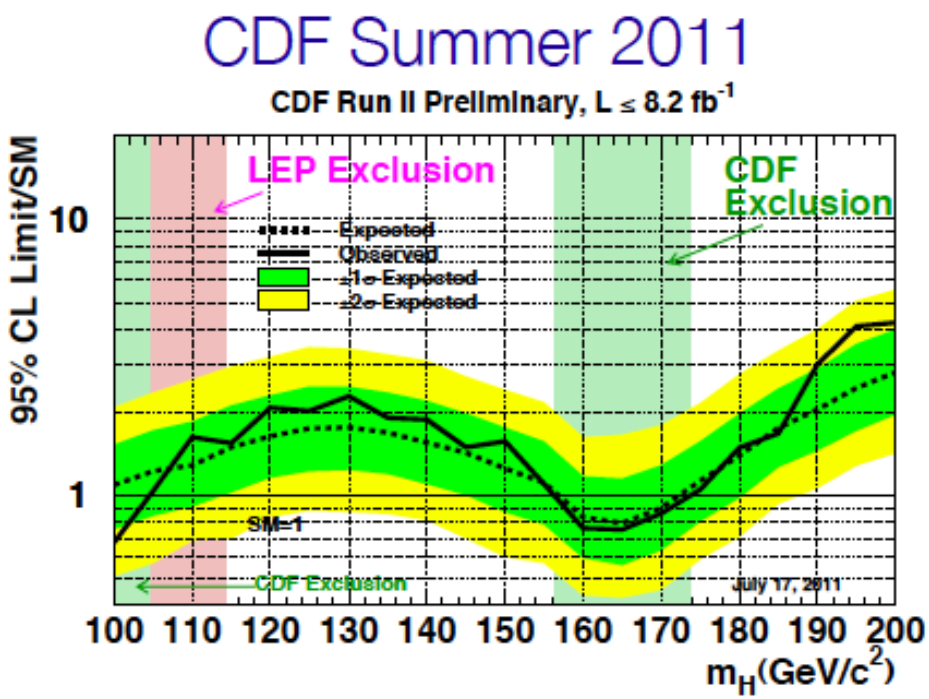
CDF Publication surge in 2011



- 46 paper seminars in CY11 so far - that is **1.3 / week**. Recent years 0.8/week. *Exceeded 550 total publications*.
- Amazing 13 out of 48 “Wine&Cheese” seminars this year !

Higgs progress in one(1) year

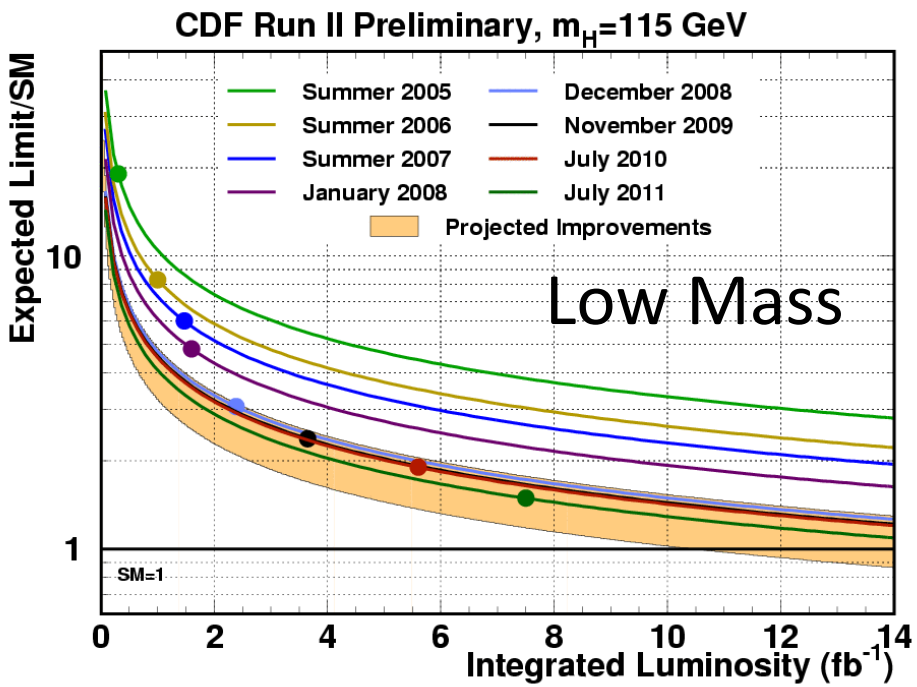


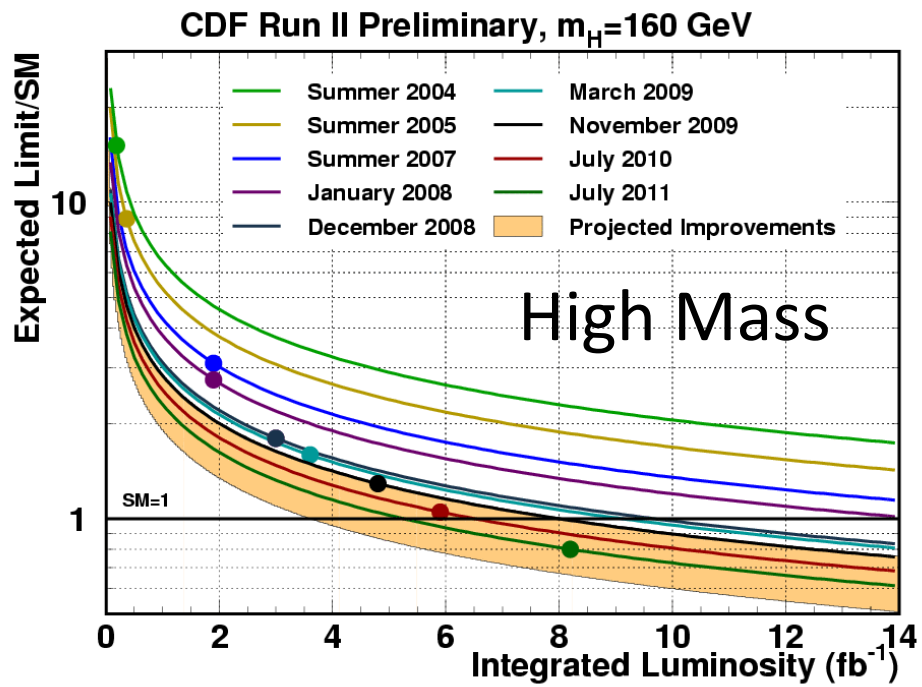


CDF result this summer = Tevatron result previous summer

And aiming at doing it again !

Still improving after so many years





- **Well into the "aggressive prediction" band**
- **EPS11 improvements from 10-160% beyond L**
- **Planned improvements exceed bottom of band !**

Still adding new channels !

New in 2011 SM Combination:

Low Mass

- TauTau analysis with leptons (~17xSM at M=115)
- ttH with leptons (11.7xSM at M=115)
- ttH no leptons (20xSM at M=115)

High Mass

- ZZ-llll (12xSM at M=150)

CDF Higgs Combination: List of channels

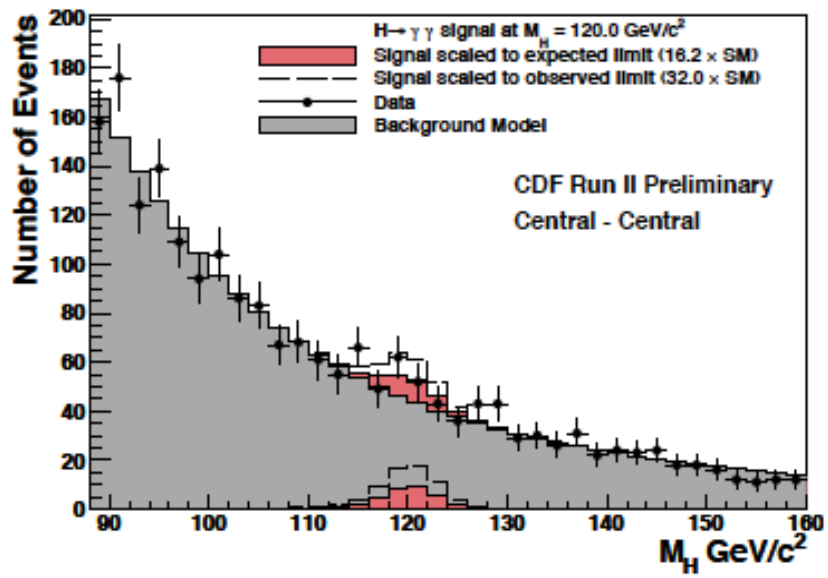
cdf15 <> CDF VH->MET bb 1S 7.8 fb-1
cdf16 <> CDF VH->MET bb SS 7.8 fb-1
cdf17 <> CDF VH->MET bb SJ 7.8 fb-1
cdf28 <> CDF HWW 8.2fb HighSB0J
cdf29 <> CDF HWW 8.2fb LowSB0J
cdf30 <> CDF HWW 8.2fb HighSB1J
cdf31 <> CDF HWW 8.2fb LowSB1J
cdf32 <> CDF HWW 8.2fb 2JOS
cdf56 <> CDF WH WWW 8.2 fb-1 like-sign
cdf57 <> CDF H->WW 8.2 fb-1 low-mll
cdf64 <> CDF WH ME 5.6 fb-1 3J SVJP
cdf65 <> CDF WH ME 5.6 fb-1 3J SVJP loose
cdf66 <> CDF WH ME 5.6 fb-1 3J SVno
cdf67 <> CDF WH 5.6 fb-1 SVno se
cdf68 <> CDF WH ME 5.6 fb-1 J SV
cdf69 <> CDF WH ME 5.6 fb-1 3J SVSV oos
cdf84 <> CDF H->WW Trilepto No 8 fb
cdf85 <> CDF H->WW Trilepton InZ 1jet 8.2 fb-1
cdf86 <> CDF H->WW etau 8.2 fb-1
cdf87 <> CDF H->WW mutau 8.2 fb-1
cdf88 <> CDF H->WW Trilepton InZ 2jet 8.2 fb-1
cdf101 <> CDF Htautau 2jets 6.0 fb-1
cdf102 <> CDF Htautau 1jet 6.0 fb-1
cdf103 <> CDF jjbb SS 4fb-1
cdf104 <> CDF jjbb SJ 4fb-1
cdf105 <> CDF jjbb VBF SS 4fb-1
cdf106 <> CDF jjbb VBF SJ 4fb-1
cdf112 <> CDF H->gammagamma 7.0 fb-1 CC
cdf113 <> CDF H->gammagamma 7.0 fb-1 CP
cdf114 <> CDF H->gammagamma 7.0 fb-1 CC Conv
cdf115 <> CDF H->gammagamma 7.0 fb-1 CP Conv

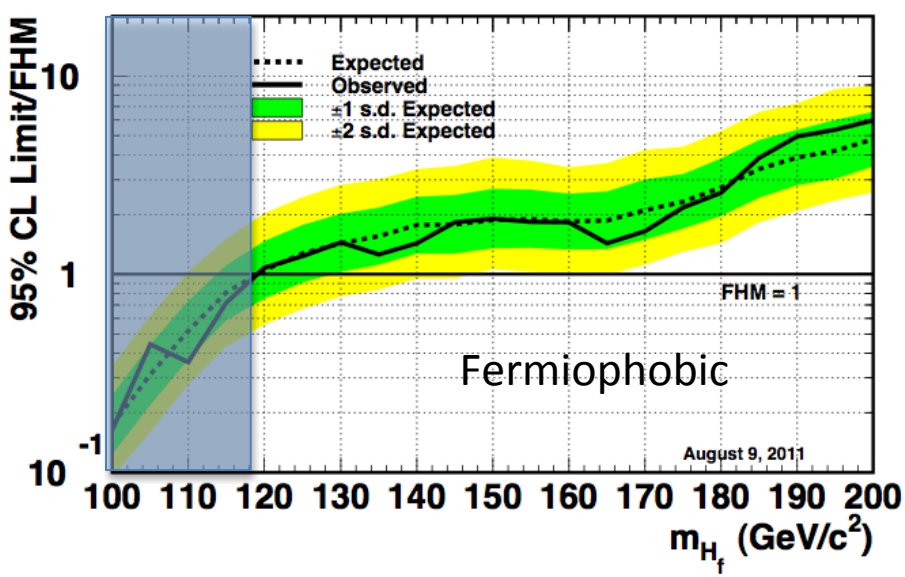
cdf117 <> CDF Vtautau lltau 6.2 fb-1
cdf118 <> CDF Vtautau emutau 6.2 fb-1
cdf119 <> CDF Vtautau ltautau 6.2 fb-1
cdf121 <> CDF ttH MET+jets 2btag 5.7 fb-1
cdf122 <> CDF ttH MET+jets 3btag 5.7 fb-1
cdf123 <> CDF ttH All 2btag 5.7 fb-1
cdf124 <> CDF ttH All 3btag 5.7 fb-1
cdf125 <> CDF mumubb ST 7.9 fb-1
cdf126 <> CDF mumubb LJP 7.9 fb-1
cdf127 <> CDF mumubb DT 7.9 fb-1
cdf128 <> CDF eebb ST 7.5 fb-1
cdf129 <> CDF eebb LJP 7.5 fb-1
cdf130 <> CDF eebb DT 7.5 fb-1
cdf131 <> CDF WHAM NN 7.5 fb-1 SVTSVT TIGHT with BNN
cdf132 <> CDF WHAM NN 7.5 fb-1 SVTJP TIGHT with BNN
cdf133 <> CDF WHAM NN 7.5 fb-1 SVTno 5Roma TIGHT with BNN
cdf139 <> CDF WHAM NN 7.5 fb-1 SVTSVT ISOTRK with BNN
cdf140 <> CDF WHAM NN 7.5 fb-1 SVTJP05 ISOTRK with BNN
cdf141 <> CDF WHAM NN 7.5 fb-1 SVTnoJP05Roma ISOTRK with BNN
cdf142 <> CDF WHAM NN 7.5 fb-1 SVTnoJP05noRoma ISOTRK with BNN
cdf155 <> CDF WH NN 7.5 fb-1 2JET SVTSVT LOOSE ISOTRK
cdf156 <> CDF WH NN 7.5 fb-1 2JET SVTJP05 LOOSE ISOTRK
cdf157 <> CDF WH NN 7.5 fb-1 2JET SVTnoJP05Roma LOOSE ISOTRK
cdf158 <> CDF WH NN 7.5 fb-1 2JET SVTnoJP05noRoma LOOSE ISOTRK
cdf159 <> CDF HZZ mLLLL 8.2 fb-1
cdf160 <> CDF ttH 1+5J STSTST 6.3 fb-1
cdf161 <> CDF ttH 1+5J STSTJP 6.3 fb-1
cdf162 <> CDF ttH 1+5J STST 6.3 fb-1
cdf163 <> CDF ttH 1+5J STJPJP 6.3 fb-1
cdf164 <> CDF ttH 1+5J STJP 6.3 fb-1
cdf165 <> CDF ttH 1+5J STSTST 6.3 fb-1
cdf166 <> CDF ttH 1+5J STSTJP 6.3 fb-1
cdf167 <> CDF ttH 1+5J STST 6.3 fb-1
cdf168 <> CDF ttH 1+5J STJPJP 6.3 fb-1
cdf169 <> CDF ttH 1+5J STJP 6.3 fb-1

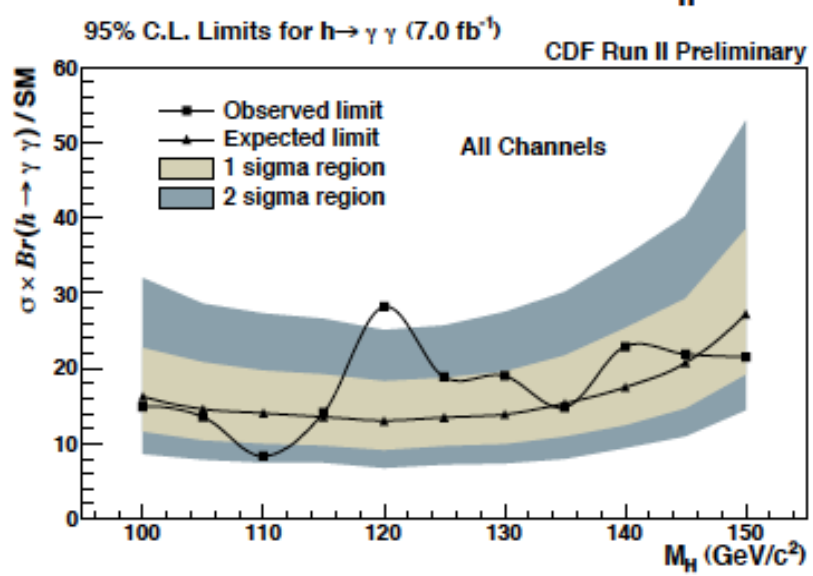
71 channels

$H \rightarrow \gamma\gamma$

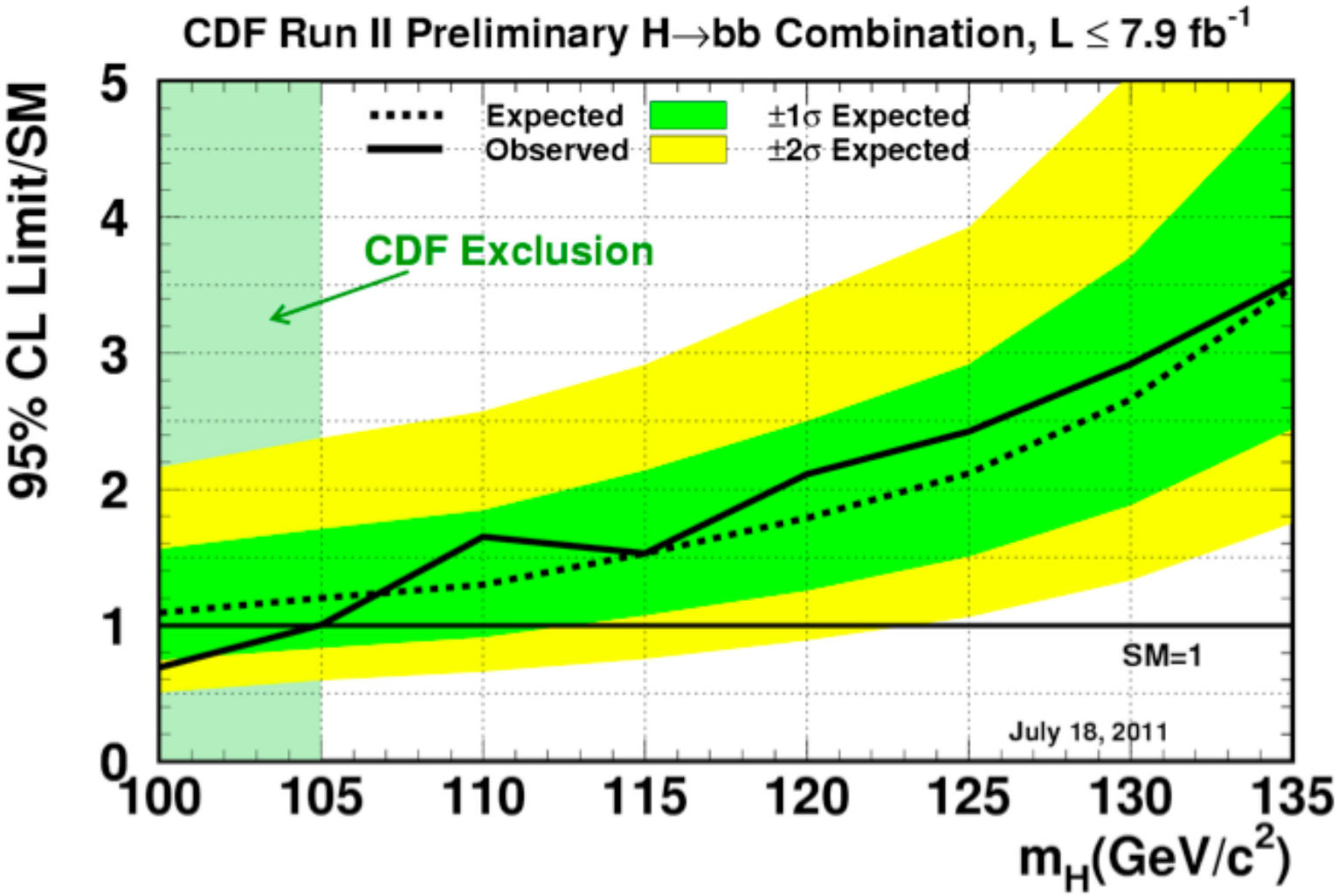
- **7 fb^{-1} result: 13xSM (M_H=115 GeV)**
- **Fermiophobic analysis:**
  - **Strongest mass limit from single experiment**
  - **Tevatron combined M_H<118 GeV**
  - **Relatively harder at LHC**
  - **Mass-based analysis**
    - **Multivariate to come**



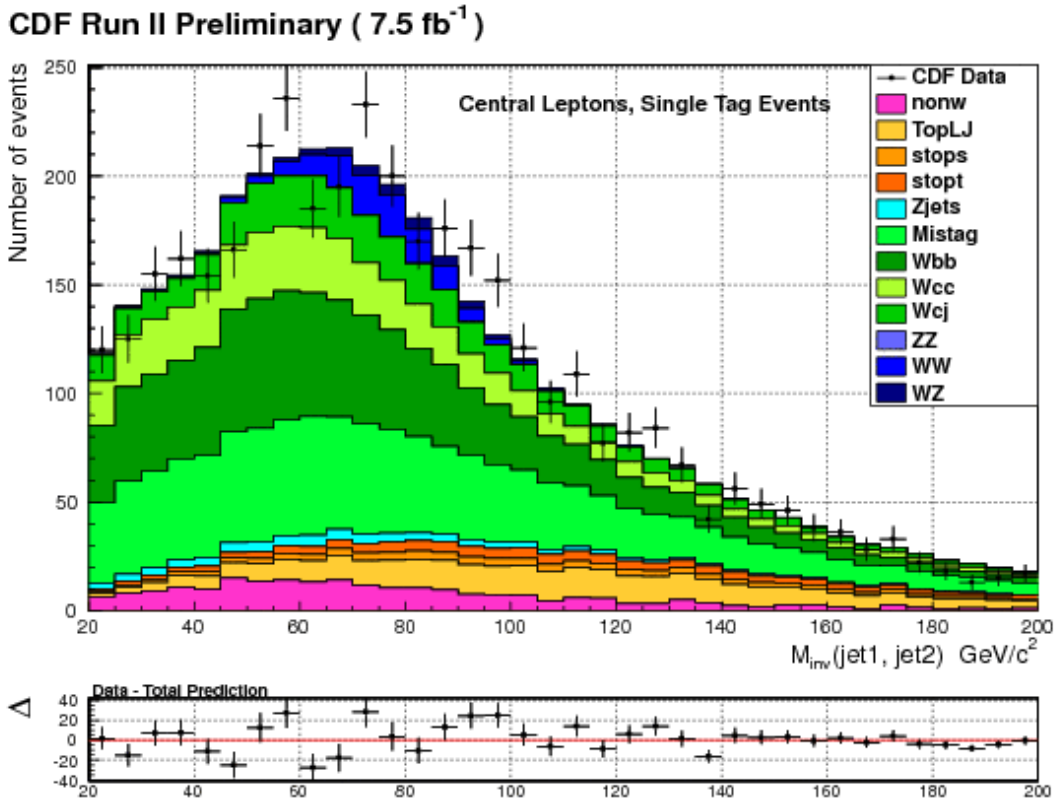




First b-bbar-specific result

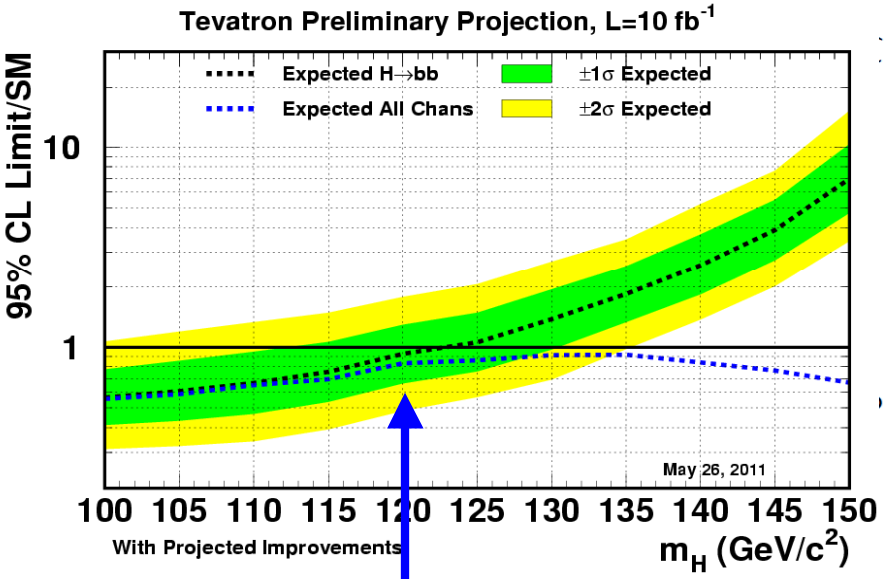


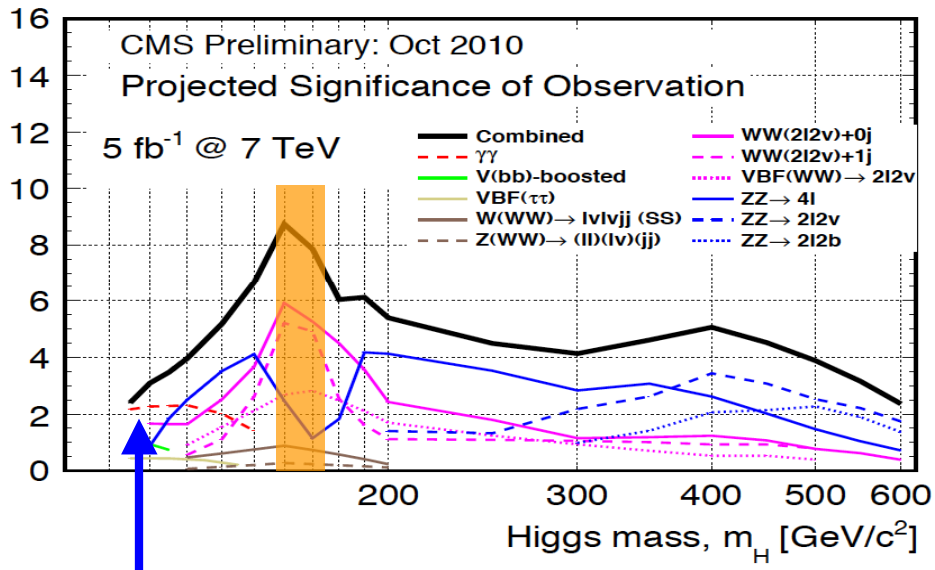
First direct crosscheck: lv+HF



- **3σ Evidence for W + Heavy Flavor (including WW as signal where a charm is tagged)**
- **Next step WZ -> lvbb…**

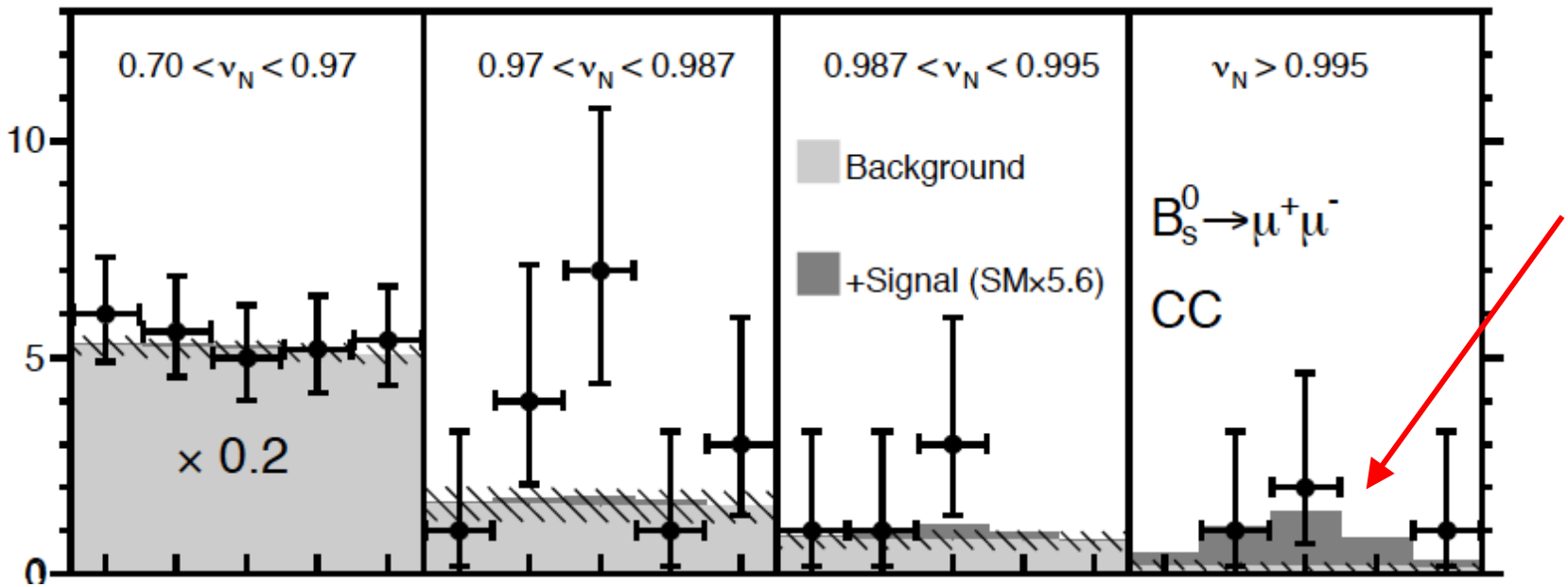
Complementarity of our Higgs search





- **Our Higgs sensitivity in the favored region is driven by b-bbar decay - at LHC, it is WW/gamma-gamma**
- **Looking at both decays very informative on the nature of Higgs**
  - **Especially if none is found**
- **Whatever information we will get on H->b-bbar, it will stay unique for quite some time.**

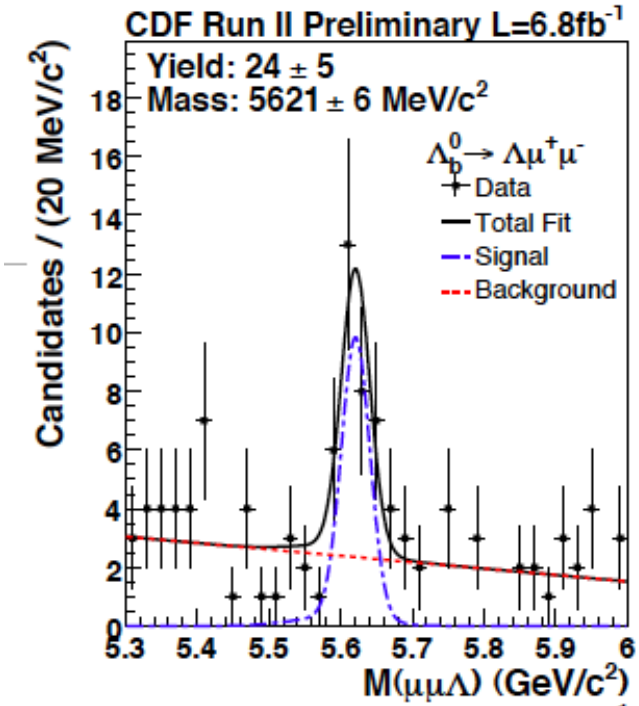
First 2-sided limits on $B_s \to \mu\mu$

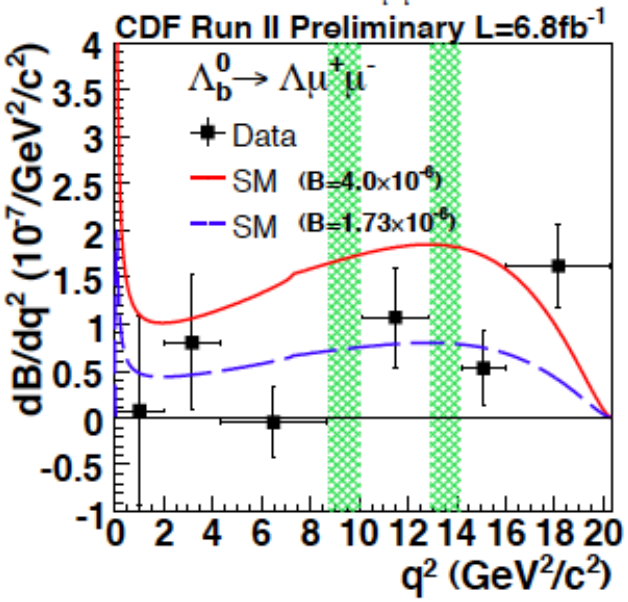


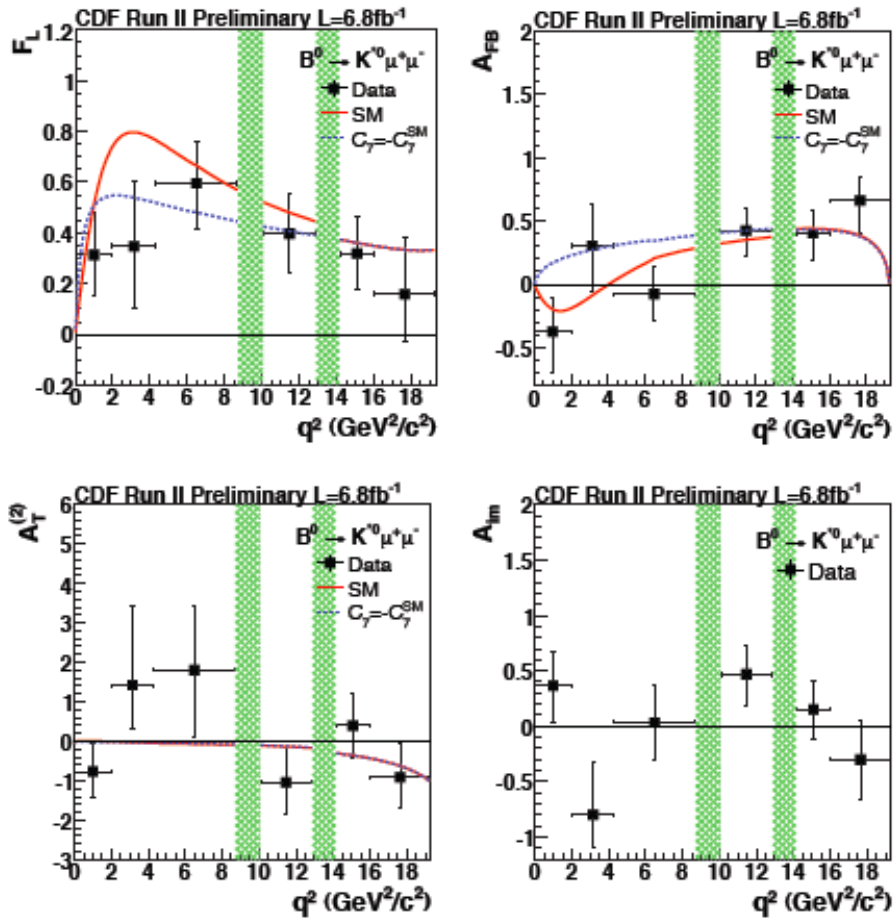
- **First indication (2.8σ) of a legendary FCNC mode**

$$BR(B_s \to \mu_+\mu_-) = (1.8\ ^{+1.1}_{-0.9}) \times 10^{-8}$$

Observation of baryonic FCNC



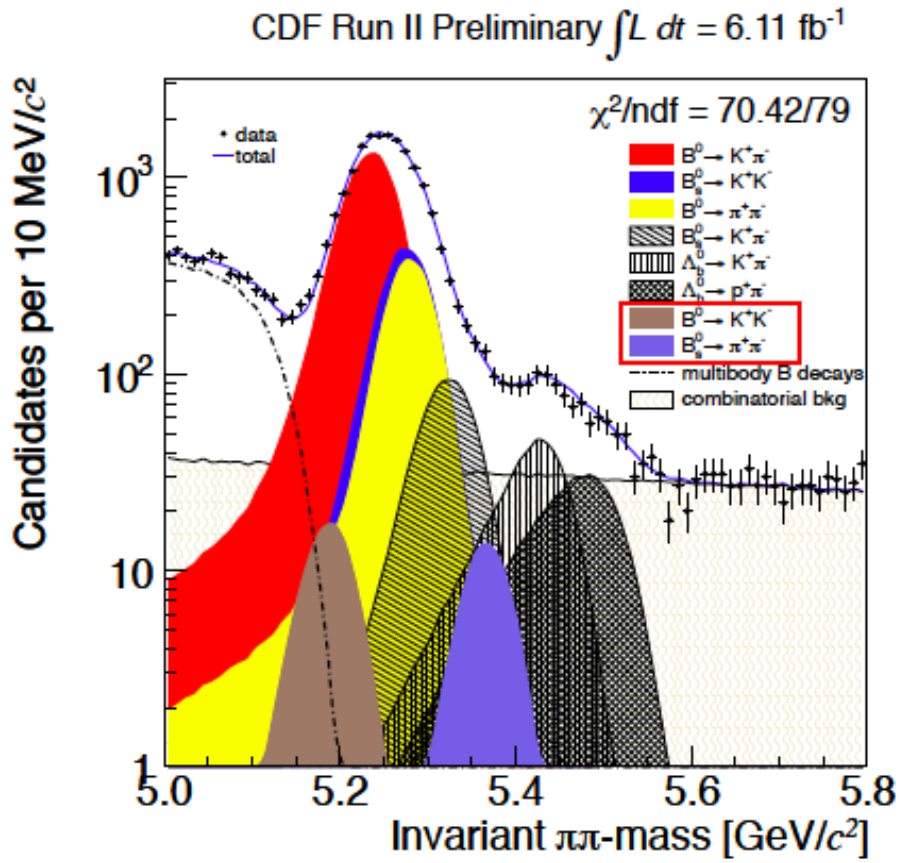




- **6σ signal of $\Lambda_b \to \Lambda\mu\mu$**
- **World best A_{FB} measurements**
- **Precision ~Belle - do not confirm 2.7σ deviation from SM**

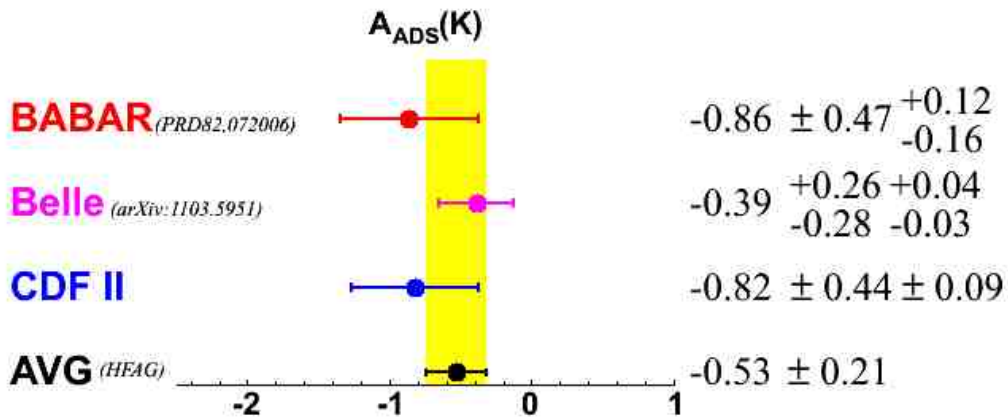
Charmless Annihilation modes

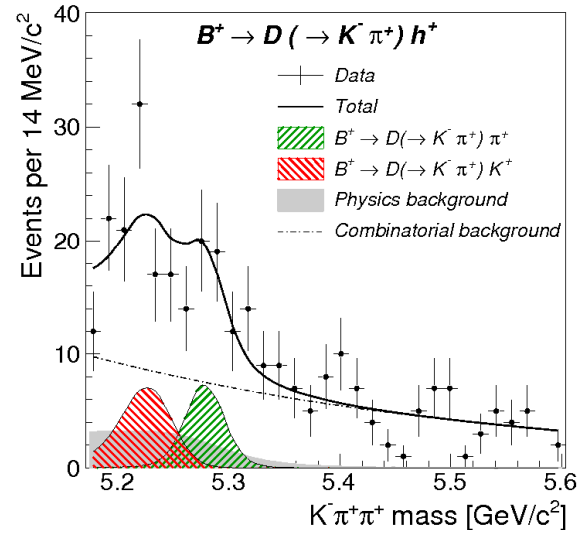
- **Evidence for Bs→ππ**



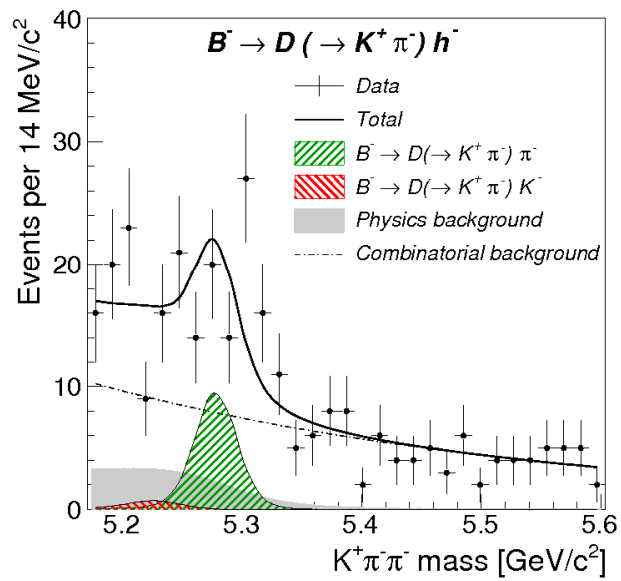
$$BR(B_s^0 \to \pi^+\pi^-) = (0.57 \pm 0.15(\text{stat}) \pm 0.10(\text{syst})) \times 10^{-6}$$
$$BR(B^0 \to K^+K^-) \in [0.05, 0.46] \times 10^{-6} \text{ at } 90\% \text{ CL}$$

ADS analysis of DK decays

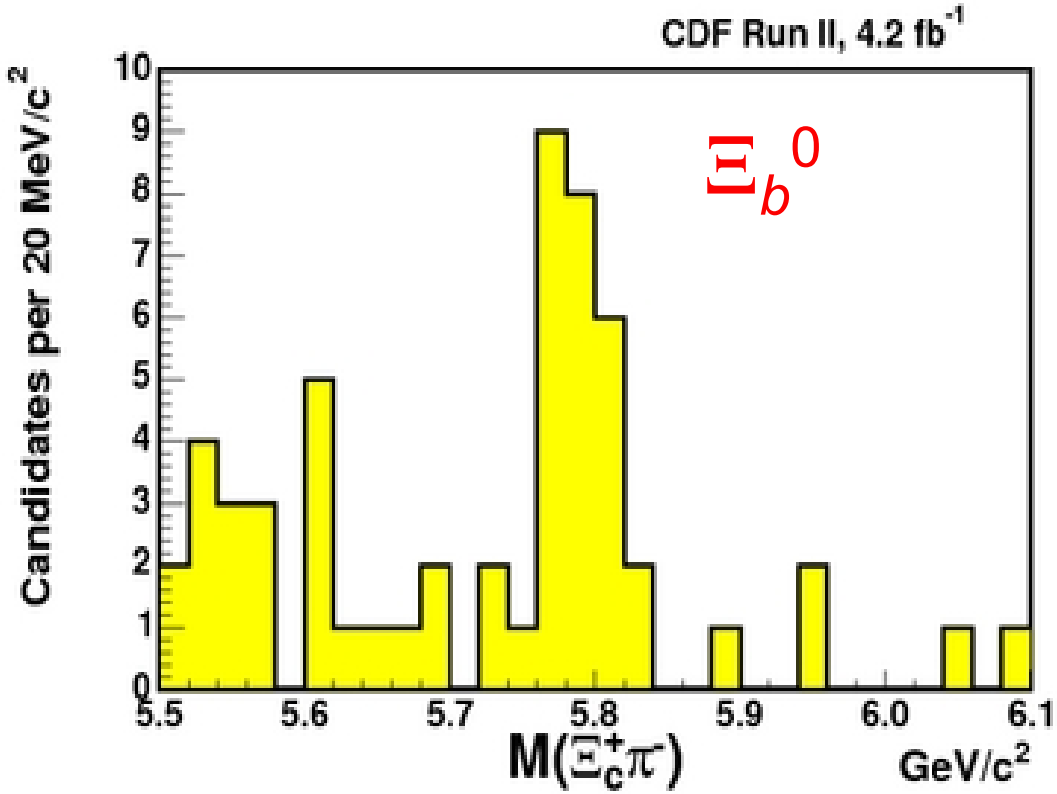


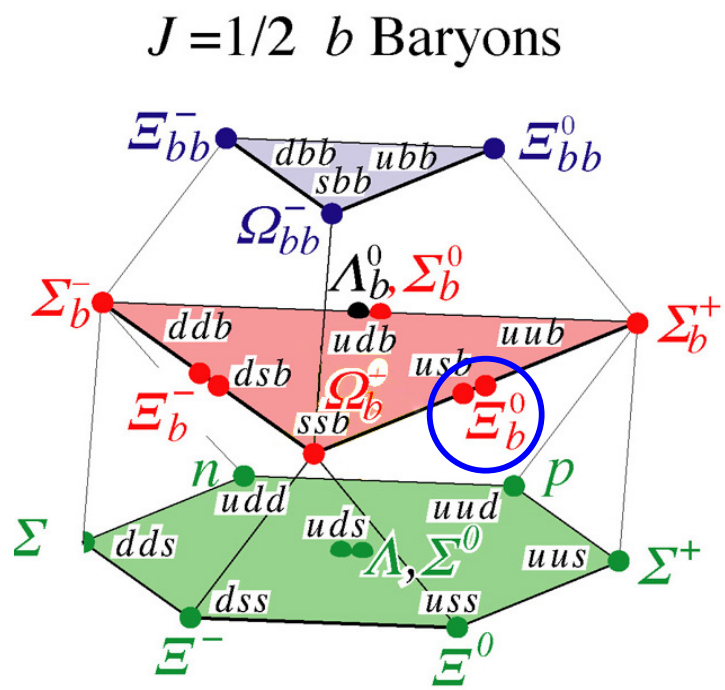


- **Updated results to 7fb^{-1}**
- **Similar to BaBar result**

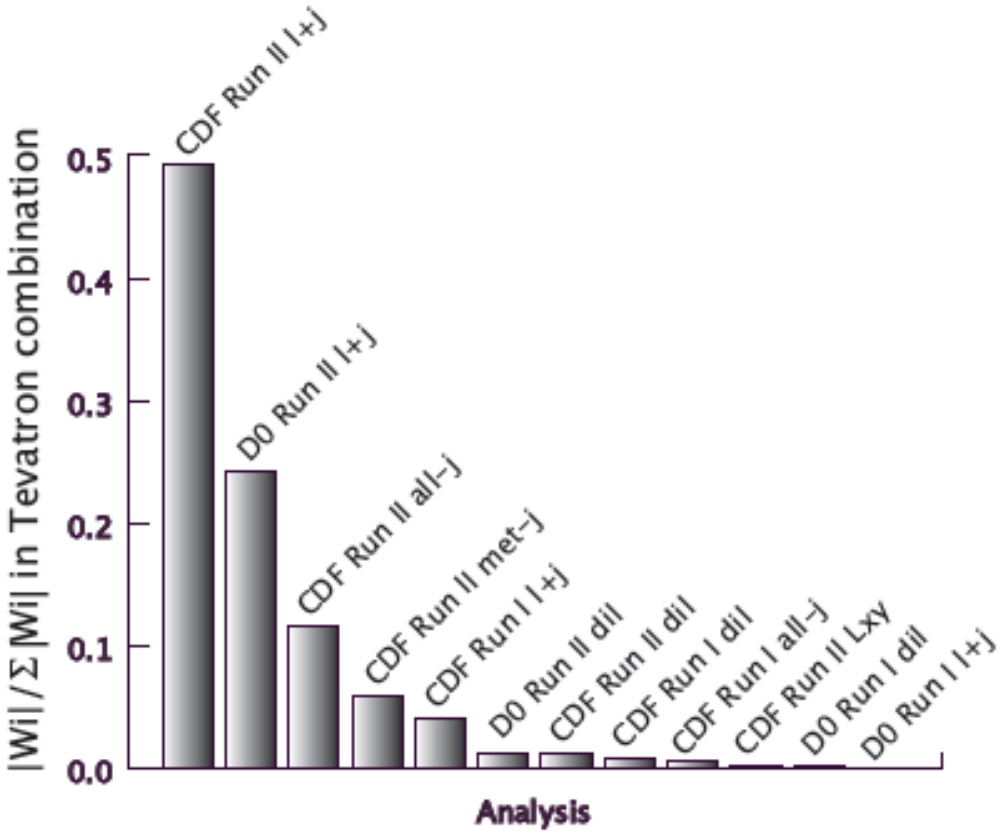


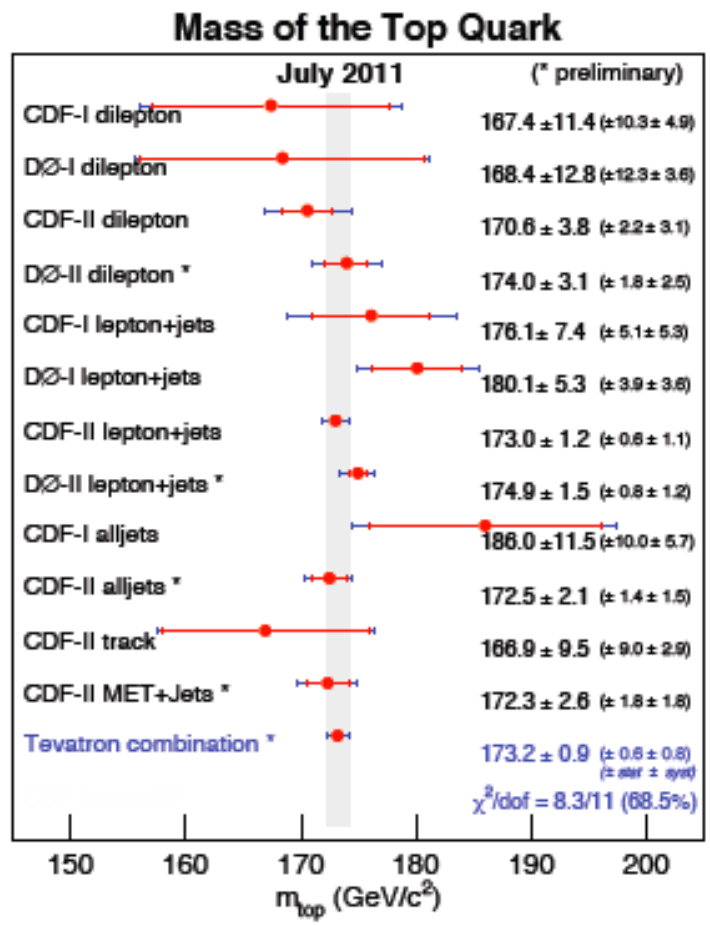
Discover yet another b-baryon !





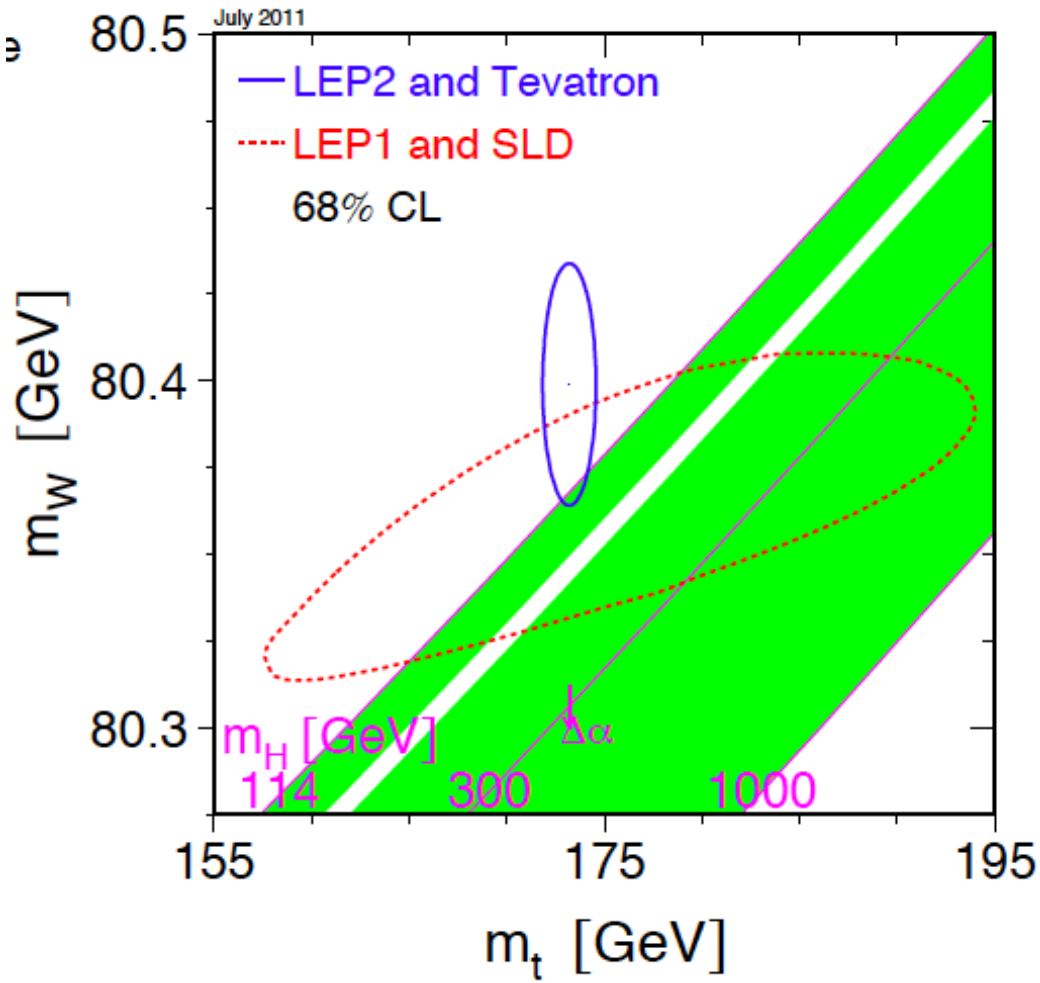
Top mass resolution <1GeV





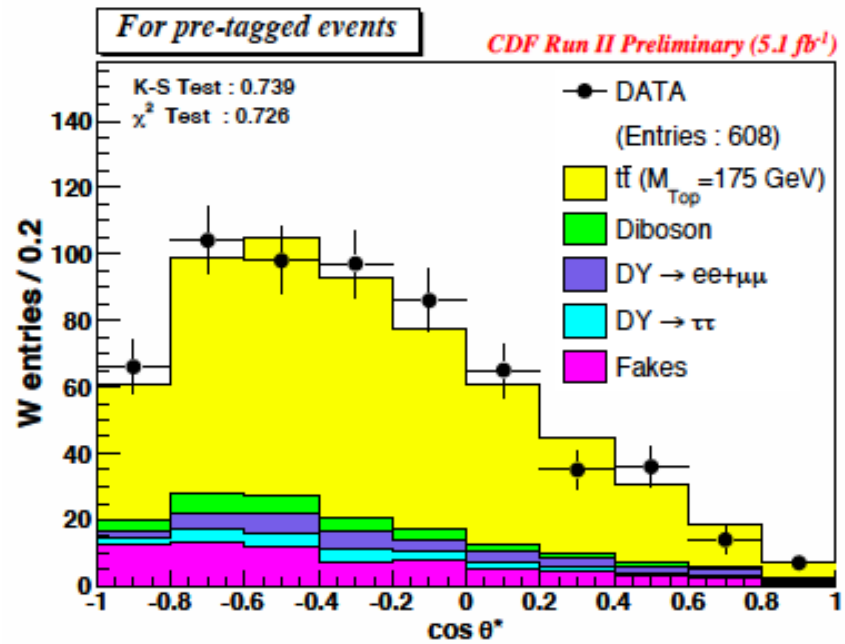
- **CDF the strongest contributor**

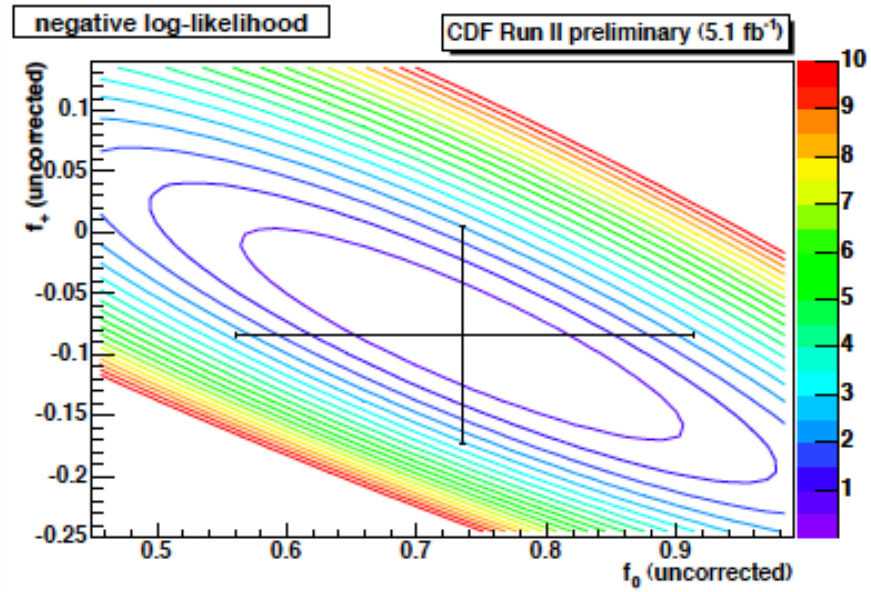
EWK fit



- **Our top and W mass measurements crucial**
- **W mass with 2fb^{-1} progressing well: unblinding of the Z mass.**

W helicity in top events

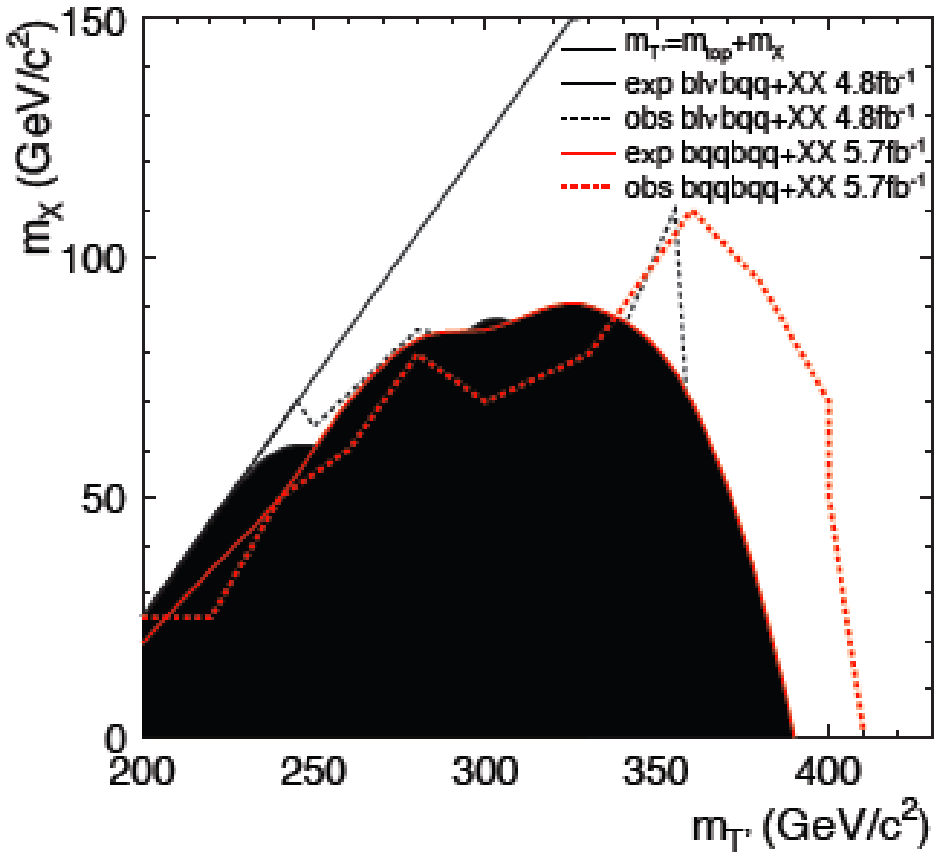




$$f_0 = 0.74^{+0.18}_{-0.17}(\text{stat}) \pm 0.06(\text{syst})$$
$$f_+ = -0.09 \pm 0.09(\text{stat}) \pm 0.04(\text{syst})$$

- **Model-independent measurement of W helicity**
- **Consistent with SM predictions**

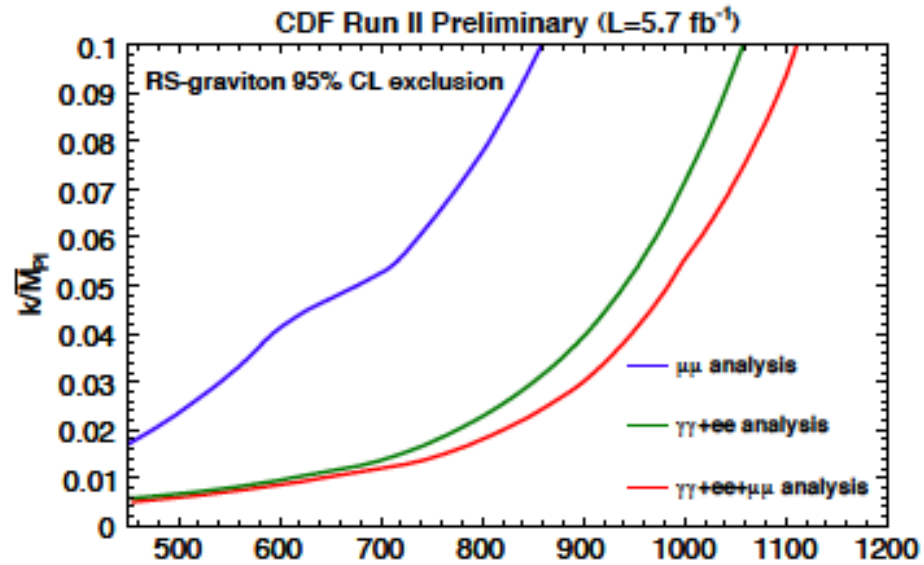
Exotic searches: dark matter

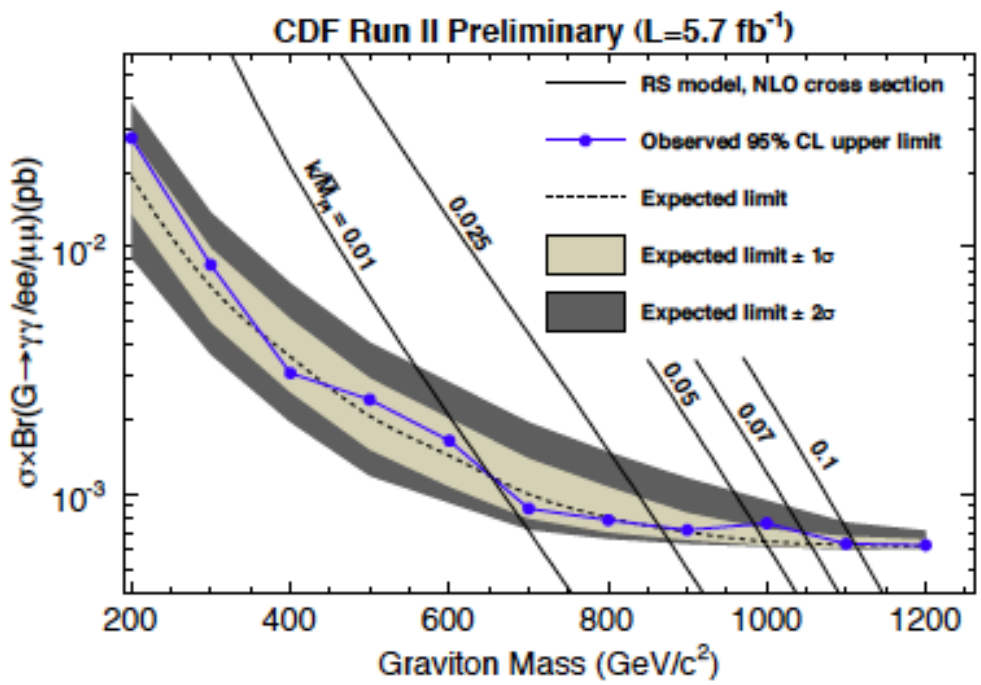


- **4th generation t' decay to top and dark matter X**

Exotic searches: RS graviton

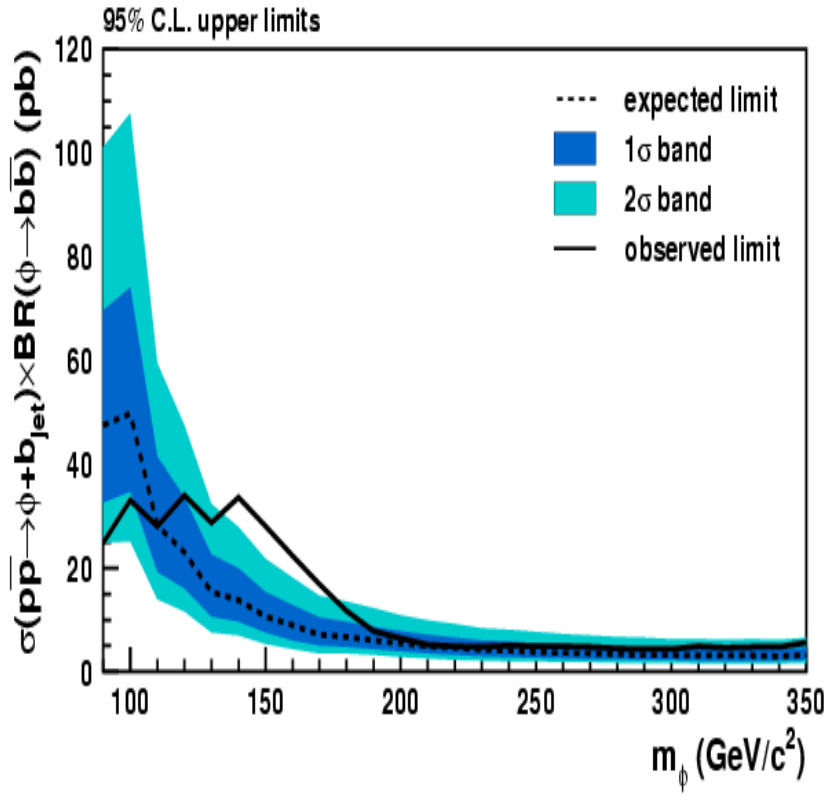
- **RS graviton**
- **ee , μμ, and γγ channels**



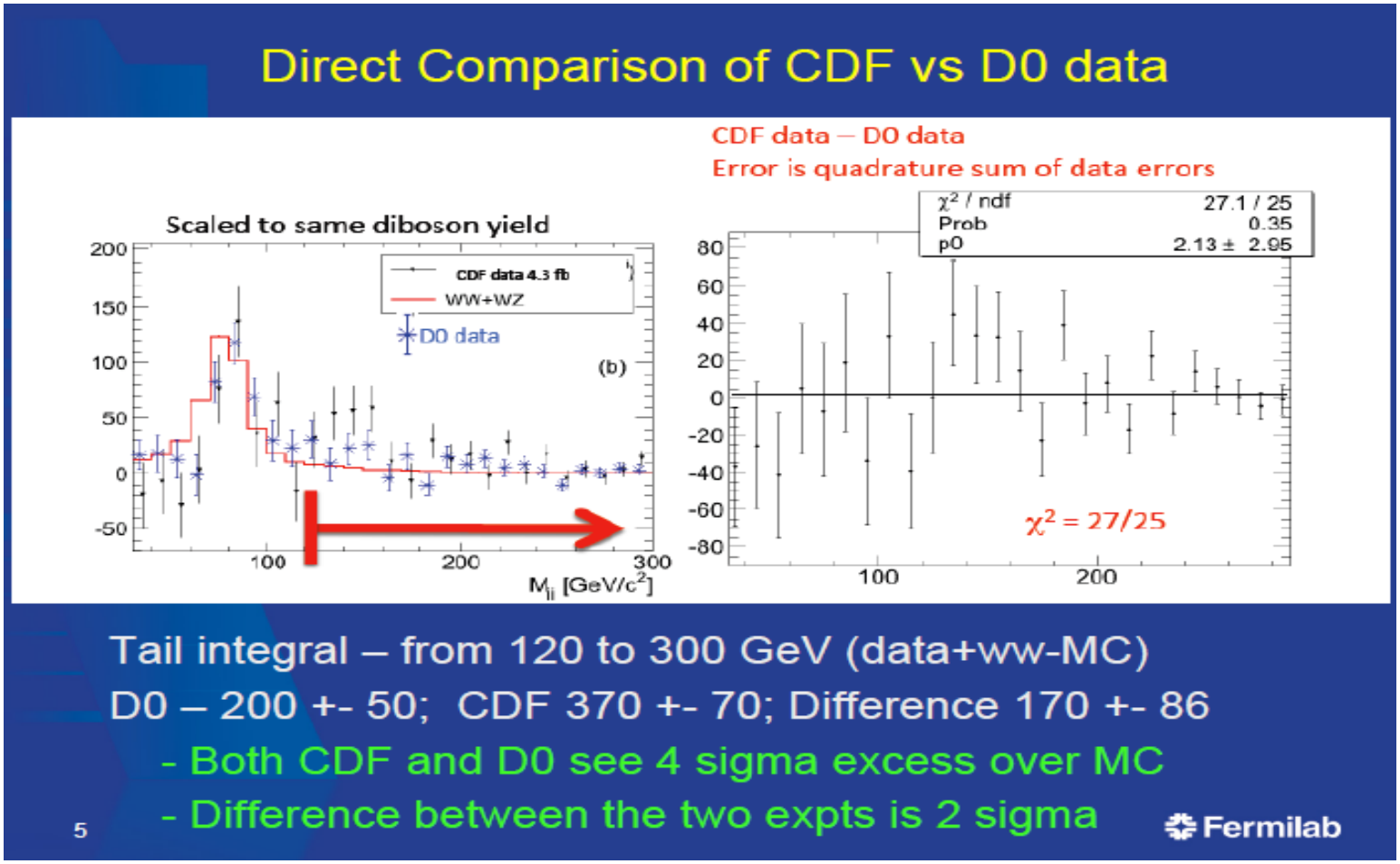


bbb

- **Sensitive to SUSY Higgs and others**
  Enhanced at high tan beta.
- **Published 2.7 fb^{-1} result in PRD**
  - **Challenging analysis for LHC**
- **Slight excess (below 3 sigma) motivating further studies**



W+2 jets production

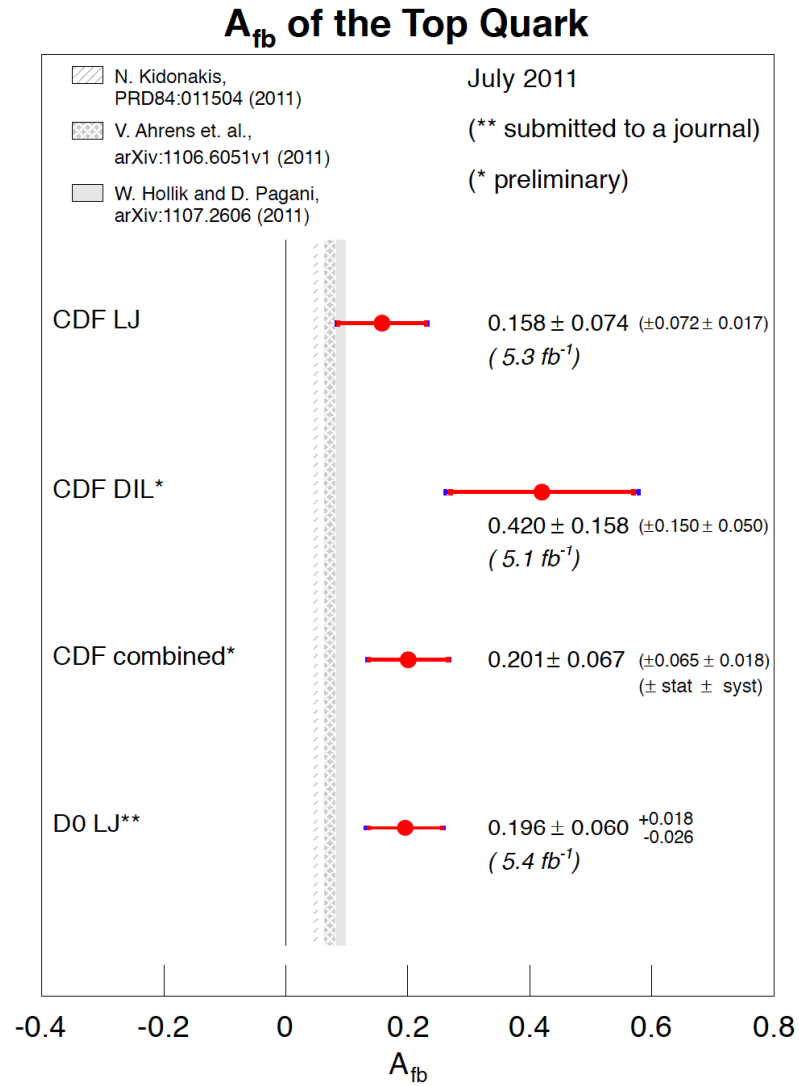


- **Data excess over ALPGEN prediction created wide interest.**
- **CDF and DZero results different by 2.5 sigma (not 4.2)**
- **Also important for Higgs analysis - updating with more statistics in special subgroup with several parallel analyses**

t-tbar asymmetry

- **CDF and D0 agree on large asymmetry - multiple channels**
- **Difficult to access at LHC**
- **Source unknown, but several ways for us to investigate further**
  - **More data**
  - **More distributions**
  - **More quarks: b, c...**

  (Innovative flavor-top hybrid analysis ideas)



OUTLOOK

- CDF not slowing down, but sprinting through the finish line.
- Now we can finally start producing our final measurements.
- Put together a plan for delivering the final sample to analyzers in record time.
- Collaboration Meeting last week: high attendance, parallel physics workshops, many ideas.
- Several measurements still valuable in the LHC era. Many analyses planning to update with $10fb^{-1}$. Continuing effort.

Our Management Team

Stepping down
NEW

- Detector Operations Heads
  - Ankush Mitra
  - Phil Schlabach
- Offline Heads
  - Aidan Robson
  - Ray Culbertson
- TDWG
  - Heather Gerberich
  - Simone Donati
- Higgs
  - Craig Group
  - Eric James
- Top
  - Tom Schwarz
  - Fabrizio Margaroli
- EXOTICS
  - Oscar Gonzalez Lopez
- EWK
  - Mark Lancaster
  - Larry Nodulman
- Flavor
  - Diego Tonelli
  - Robert Harr
- QCD
  - Mary Convery
  - Christina Mesropian