CDF at ANL/HEP

Hadron Collider (4π) Timeline

1976 SpS turnon, pbar proposal (CERN)

1977 FNAL collider workshop

1981 SppS startup 0.5 TeV, CDF DR

1983 W, Z!   TeVatron complete, ISA→SSC

1985 demo collisions @ FNAL

1987 TeV engineering run

1988-9 4 pb^{-1} 1.8 TeV at CDF

1990 End SppS w ~10 pb^{-1}

1993 SSC terminated → LHC

1992-6 Run 1 (w D0)

1994-5 Top Quark!

2001-11? Run II (w mag. D0) 5.7 fb^{-1} so far

2008 LHC beam capture

2009-10 LHC collisions >100 pb^{-1}, 7+ TeV?

ANL/HEP very involved in bringing a collider and pbars to FNAL (Diebold, Simpson)

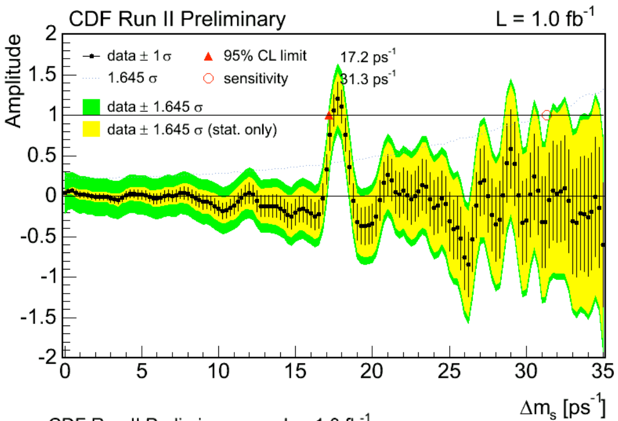
Strong participation in detectors, upgrades, electronics, operations, software and physics (QCD/photons, B physics, EWK) from the beginning through most of Run-II

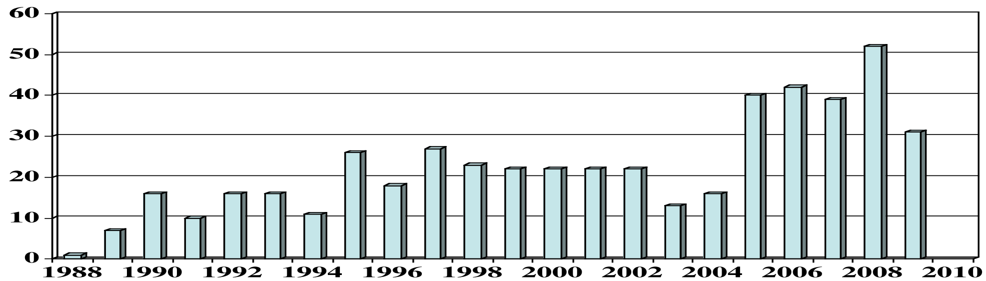
Recruited many staff to HEP to work on CDF. Most have moved on to Atlas or astrophysics. Many students and postdocs to brag about

Larry Nodulman and Barry Wicklund remain active in operations and physics management, (and hopefully coming soon a postdoc). Also many ANL consultants available, and support for electronics

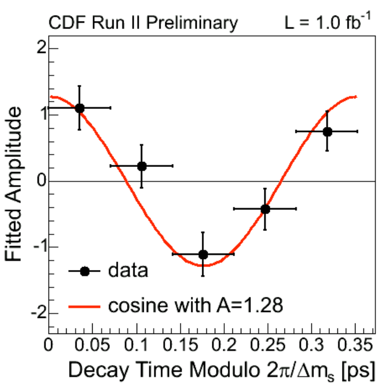
http://gate.hep.anl.gov/abw/ANL_HEP_CDF_wicklund.ppt for more details

Barry Wicklund is a b physics guru and co-head of the Spokespersons Reading Group



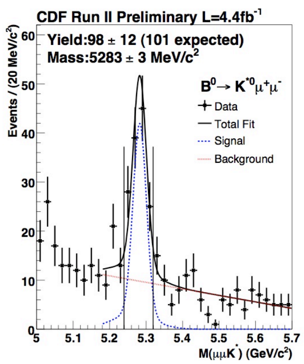


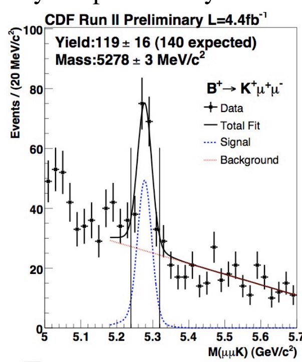
CDF publications/year: prolific, average one new draft per 2.5 working days, some well written



Observing B_S mixing was a major CKM milestone

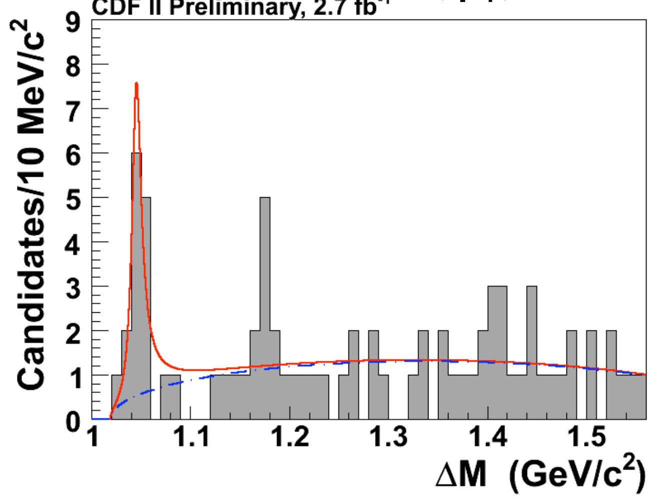
These 2, unlike others, really are preliminary



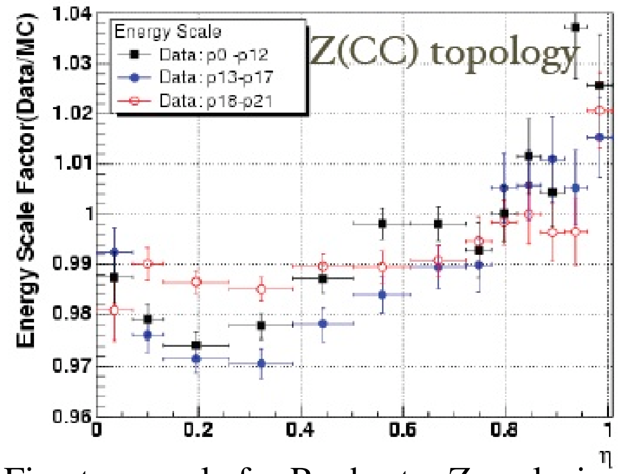


Rare decays can be interesting
Want **MORE DATA**

Lots of fun spectroscopy eg.
B→Y(4140)K →(ψφ)K

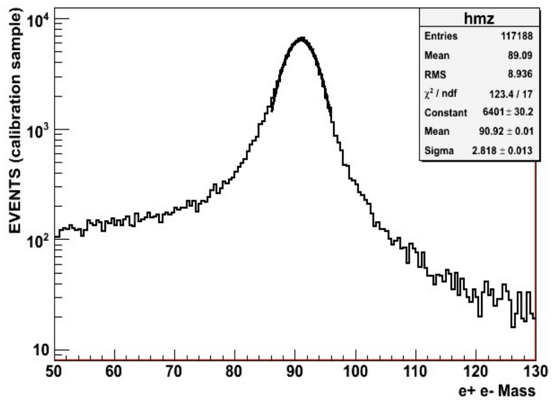


Larry Nodulman is cohead of Calorimeter ops and co-convener of EWK Physics and a W mass member



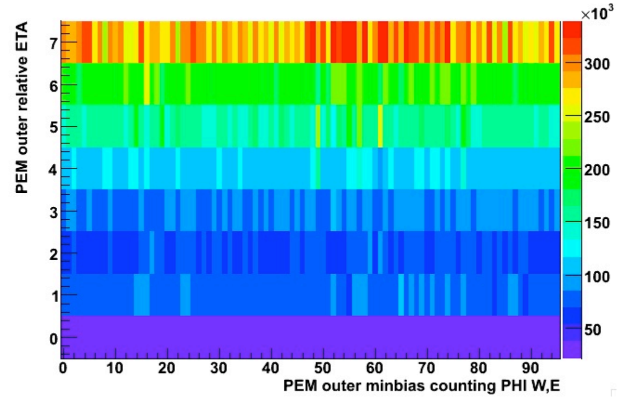
Fine tune scale for Rochester Z analysis

New Central EM calibration scheme to keep Z e (E/P) constant in eta constant (not 8 GeV "e"s) so you don't have to be expert, eg Rochester Z analysis, to get things right. The subtle change is understood in jet calibration, assumed central perfect and unchanging (truer now)

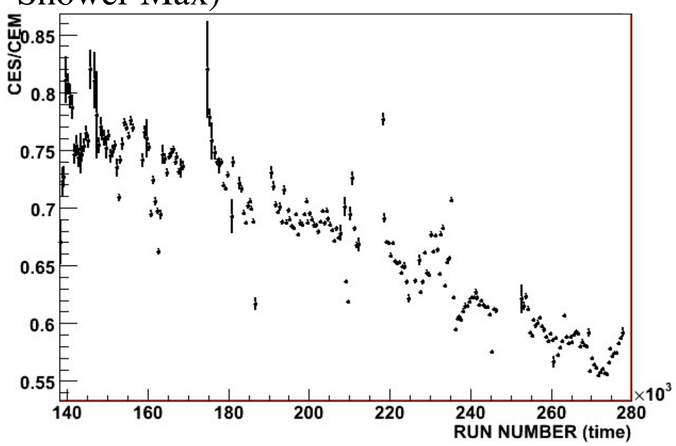


Z mass, need new calibrations every month when running

New feature: use minbias to help calibrate Plug EM where sources no longer work (10%) η vs ϕ counts:

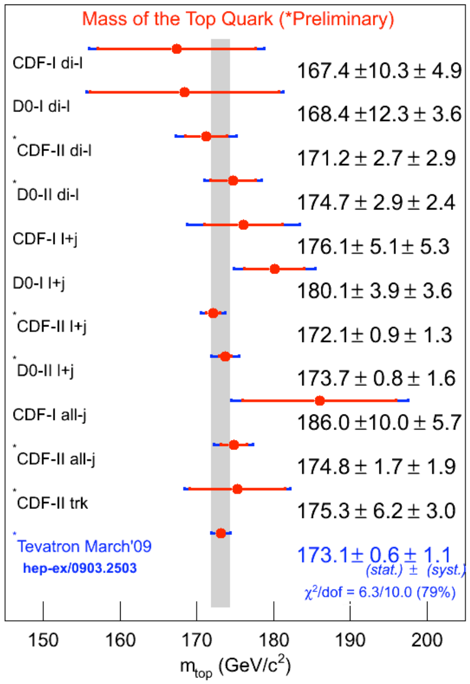


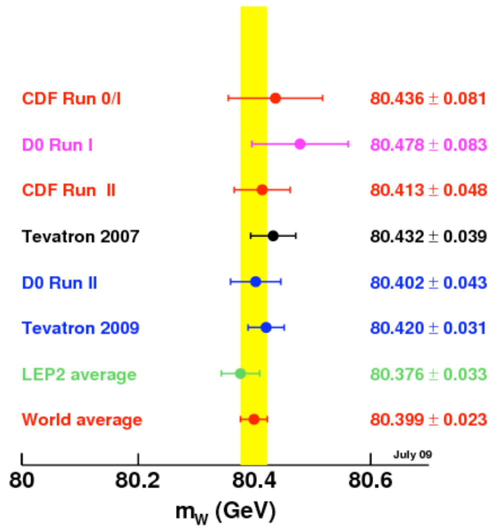
The last gas cal in CDF, which we built, should last 2 more years (Central Shower Max)

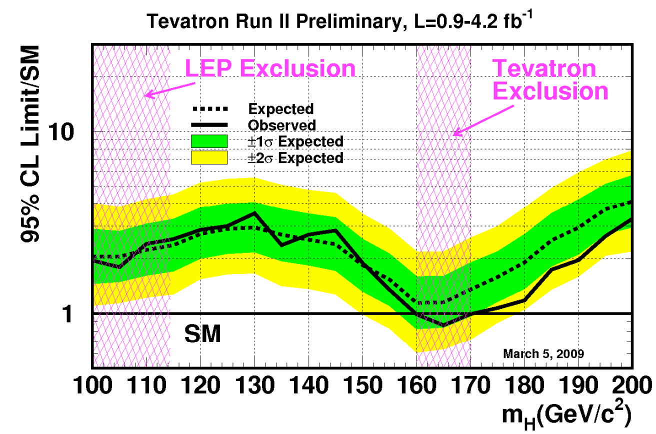


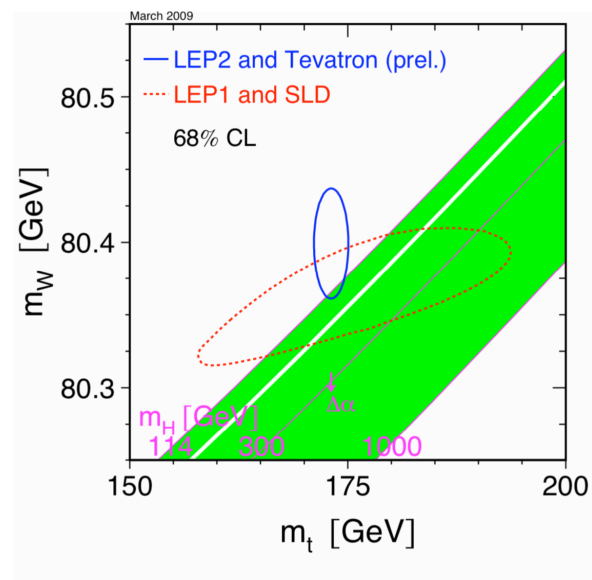
EWK convening: encouraging blessings and publications, set priorities, arranging talks. The group is still fairly active http://www-cdf.fnal.gov/physics/ewk/

Electroweak Symmetry Breaking





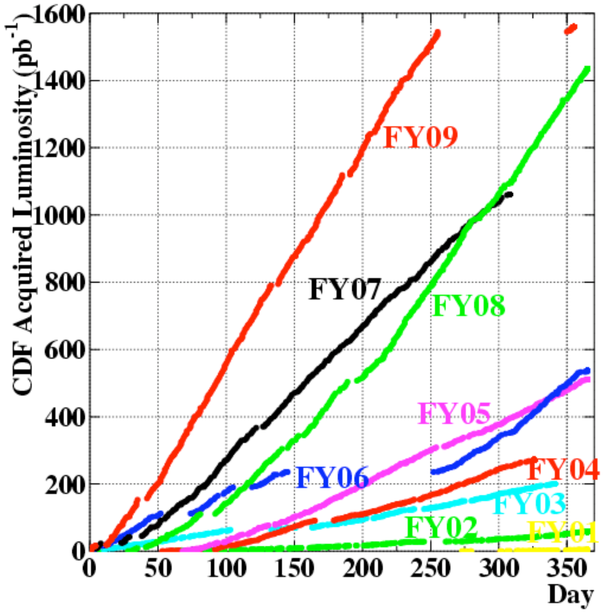




CDF (Duke, UCL, Oxford, TRIUMF, UC, ANL) hope to get mW to <±25 MeV/c^2 with 2 fb^{-1}. Systematics relatively uncorrelated to D0, floor eventually ~15 MeV/c^2 (QED/PDF)

Higgs searches (and EWK diboson studies) and top studies (not so much lepton+jets mass) want **MORE DATA!**

Prospects



Painfully slow start, but going strong now!

Reasonable expectation, add 2 fb^{-1} /year to 5.1-5.7 fb^{-1} in hand, almost double through FY11

We will do our part to keep things going! Should be good environment for one more postdoc.

Many analyses are positioned to make good use of more data, others are lying fallow

Some areas will rapidly become obsolete if LHC gets a decent sample (eg TGCs - finish & publish now!), other results will be hard to beat

Physics analysis will continue for a year or more after data taking ends

Backup: some things take time

Transverse Mass

CDF II Published 2007 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
$u_{\|\|}$ 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

An order of magnitude more data (2 fb^{-1} sample) makes tracking, material, and other systematics much more difficult

TABLE II: Systematic uncertainties of the M_W measurement.

	ΔM_W (MeV)		
Source	m_T	p_T^e	$\not{E}_T$
Electron energy calibration	34	34	34
Electron resolution model	2	2	3
Electron shower modeling	4	6	7
Electron energy loss model	4	4	4
Hadronic recoil model	6	12	20
Electron efficiencies	5	6	5
Backgrounds	2	5	4
Experimental Subtotal	35	37	41
PDF	10	11	11
QED	7	7	9
Boson p_T	2	5	2
Production Subtotal	12	14	14
Total	37	40	43

D0 1 fb^{-1} (2009) dominated by scale from Z only and material in front of EM calorimeter. Statistics overall 21 MeV