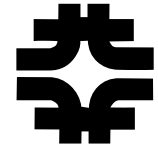
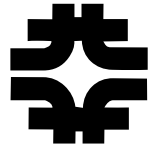


CDF Operations

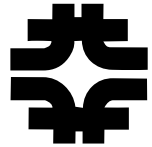
Carl Bromberg + Rob Roser
Fermilab
March 17, 2004

CDF Operations Department



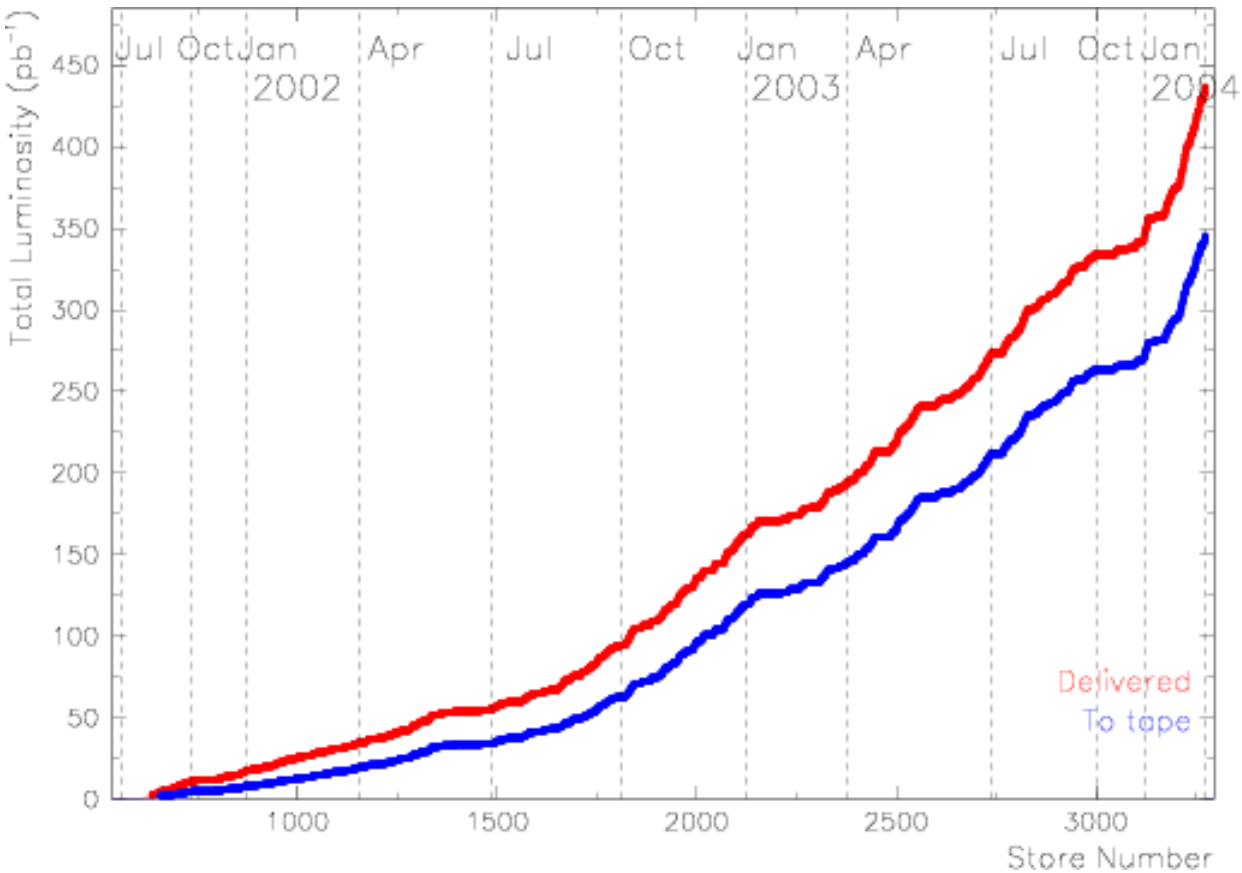
- Mission
  - Responsible for operating the CDF detector by directing Fermilab and collaboration wide personnel to achieve the goal of efficient, safe, and reliable detector operation.
  - Our goal is to collect data with >90% efficiency with a detector that is stable, calibrated, aligned, and well understood.

Context of Operating a Detector



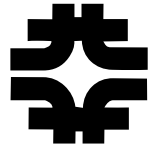
- CDF and D0 are the two most complicated HEP experiments to operate to date
  - 850k channels read out every 396ns
  - Communicating with >800 collaborators from 62 institutions, 12 countries
- Substantial resources must be available and organized to collect data
  - 16 physicists on shift every day
  - 60 experts on call daily via pagers
- Training is a major operational effort. Each year we train
  - 52 DAQ experts
  - 100 Emergency Response Experts
  - 200 Detector Monitors
  - 6 Control room chiefs
  - Once trained, they work between 1 week to 6 months in that capacity. Doubtful we ever get to use them twice in that capacity
- Organize multi-week accesses each year for maintenance, repair and upgrades of existing systems

Data Taking History

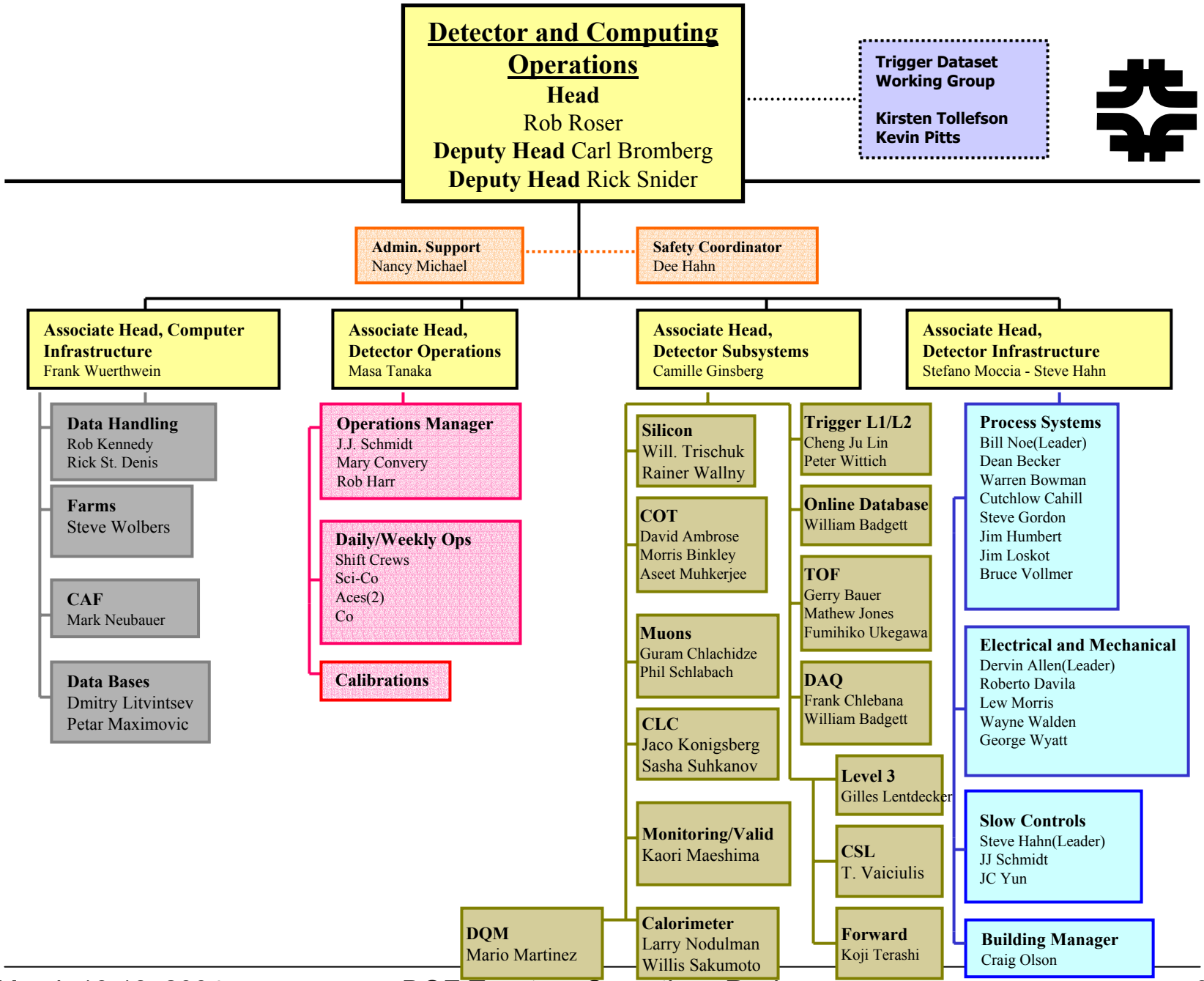


- Accelerator has delivered ~425 pb-1 of luminosity
- CDF has written 325 pb-1 of data to tape
- ~300 pb-1 of which will be used for physics analysis

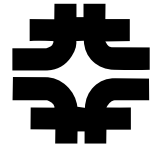
CDF Operations Organization



- Organized into 4 branches
  - Detector Subsystems (Collaboration physicists) responsible for operation of individual components
  - Detector Support – (Fermilab technical staff) responsible for process systems, engineering, rigging
  - Detector Operations (Collaboration physicists) – responsible for the control room and daily activities
  - Computing infrastructure – (Collaboration Physicists) – responsible for the hardware/infrastructure necessary to write the data to tape

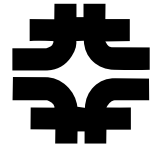

Detector and Computing Operations
Head
Rob Roser
Deputy Head Carl Bromberg
Deputy Head Rick Snider
Trigger Dataset Working Group
Kirsten Tollefson
Kevin Pitts
Admin. Support
Nancy Michael
Safety Coordinator
Dee Hahn
Associate Head, Computer Infrastructure
Frank Wuerthwein
Associate Head, Detector Operations
Masa Tanaka
Associate Head, Detector Subsystems
Camille Ginsberg
Associate Head, Detector Infrastructure
Stefano Moccia - Steve Hahn
Data Handling
Rob Kennedy
Rick St. Denis
Farms
Steve Wolbers
CAF
Mark Neubauer
Data Bases
Dmitry Litvintsev
Petar Maximovic
Operations Manager
J.J. Schmidt
Mary Convery
Rob Harr
Daily/Weekly Ops
Shift Crews
Sci-Co
Aces(2)
Co
Calibrations
Silicon
Will. Trischuk
Rainer Wallny
COT
David Ambrose
Morris Binkley
Aseet Muhkerjee
Muons
Guram Chlachidze
Phil Schlabach
CLC
Jaco Konigsberg
Sasha Suhkanov
Monitoring/Valid
Kaori Maeshima
DQM
Mario Martinez
Calorimeter
Larry Nodulman
Willis Sakumoto
Trigger L1/L2
Cheng Ju Lin
Peter Wittich
Online Database
William Badgett
TOF
Gerry Bauer
Mathew Jones
Fumihiko Ukegawa
DAQ
Frank Chlebana
William Badgett
Level 3
Gilles Lentdecker
CSL
T. Vaiciulis
Forward
Koji Terashi
Process Systems
Bill Noe(Leader)
Dean Becker
Warren Bowman
Cutchlow Cahill
Steve Gordon
Jim Humbert
Jim Loskot
Bruce Vollmer
Electrical and Mechanical
Dervin Allen(Leader)
Roberto Davila
Lew Morris
Wayne Walden
George Wyatt
Slow Controls
Steve Hahn(Leader)
JJ Schmidt
JC Yun
Building Manager
Craig Olson

Collaboration Support



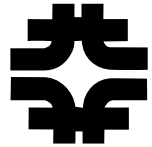
- Universities provide the lion share of the manpower needed to operate the experiment
- They are a transient, and all-volunteer “army”
  - Post-doc’s have a finite career. When they leave, they take knowledge with them
  - Laboratory resources are needed to provide the “glue”
- Transfer of knowledge is difficult. Universities typically don’t hire a new post doc until current one departs
  - Lack of overlap hurts
- CDF Operations Dept. spends a substantial time enlisting resources from the collaboration
  - Tension between operational activities and physics analysis
  - LHC turn-on will only add to the difficulty

Engineering and Technical Support



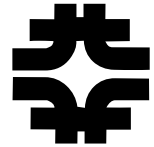
- Technical team consists of a project engineer, a process systems engineer, and 14 mechanical/electrical technicians
  - We are running “lean” with this size crew. We are not doing everything I want to do
- Resources are assigned via a matrix organization – not in the line management of CDF Operations Dept.
- Only 4 technicians provide professional 24x7 coverage of the process systems and insure the safe operation of the detector
- Because we are such a small group, we are not 100% self-sufficient. We require additional lab resources during times of detector access

On-going need for PPD Technical Support



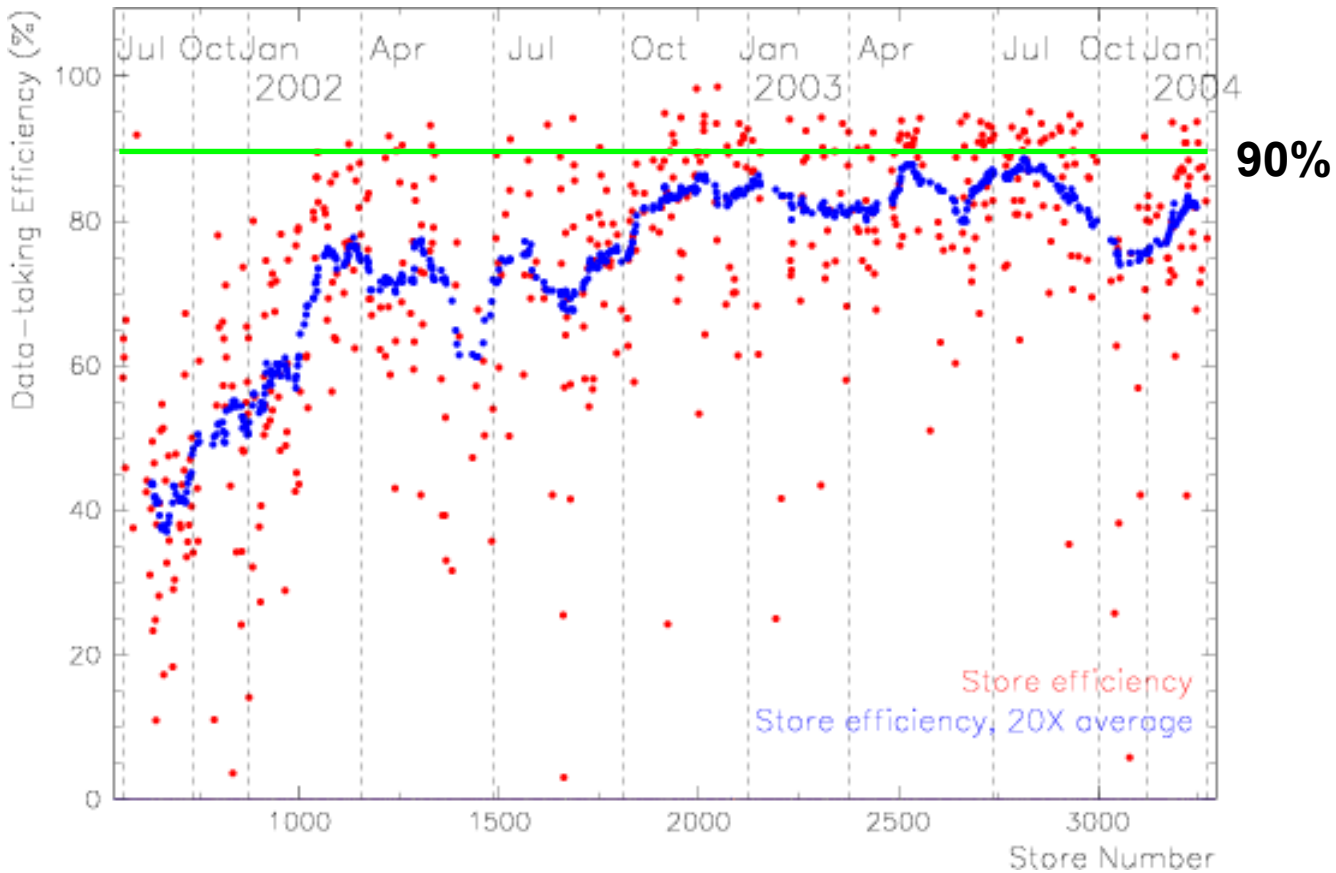
- Constant tension between the experiment and PPD Division office as to what resources are required.
- Direct correlation between resources and data taking efficiency. CDF can operate with less resources, but at the cost of reduced data taking efficiency and reduced safety
- We will need additional resources to solve problems that we had not anticipated two years ago
  - Premature COT aging
  - Extending the lifetime of our silicon detector by 2X its designed lifetime (more necessary as confidence in luminosity increases)

Data Taking Efficiency

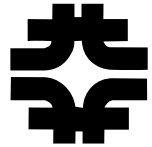


- A good measure of how well we are operating
- Goal is to operate consistently above 90%
- We are not there yet
- Need to improve documentation, automated diagnostics, and make a concerted effort obtain higher efficiencies consistently
- Significant remaining sources of downtime include
  - Trigger dead-time
  - Beam conditions (high beam losses, abort gap problems, etc) where we have to turn off to allow adjustments
  - Operator error

Data Taking Efficiency vs Store



Budget Process



- CDF Requested $1.6M in M&S Funds to operate in FY04
- ~$1.0M of this are fixed costs (gas, cryogens, computer licensing, maintenance contracts, T&M labor, etc)
- $600k of funds remaining for which we have some control. Forces difficult decisions. Difficult to predict all of our expenses.
- Visitor budget is insufficient. Handicaps our ability to acquire additional collaboration resources

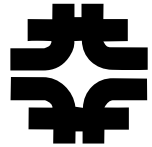
2004 budget breakdown

Category	Explanation	Budget
Computing	On-line DAQ, Level 3, Licensing maintenance, slow controls…	$500k
Consumables	Argon, Ethane, LN2, He, Alcohol	$400k
T&M	Electrical, Rigging, HVAC Personnel	$75k
Infrastructure Maint	HVAC, Compressors, Engines, Pumps…	$200k
General Operating	Office Supplies, phones, pagers, vehicles, misc. catch-all	$200k
Mech Support	Pipes, Fittings, bolts, tools, safety	$100k
Run IIB	L2 Trigger, Scaffolding, etc.	$150k
Total		$1,600k

Example of budget detail

		Category	FY03	Detailed Itemization	FY04 Est
40.11.01.0	**CBO**	**Gas Consumables/cryogens**	306	Based on Rob's estimate for a full operating year	**335**
		gas analysis & special gases			
		Argon/Ethane & cryogens			
				ethane -- 16k/trailer 52/5 trailers/year -- 200k	
				Ar-Co2 -- 20k	
				Argon -- 632k SCF/year -- 20k	
				Isobutane --	
				LN2 -- 500k liters/year 0.10/liter -- 50k	
				Suva -- 1 fill or 12k	
				alcohol 150 bottles/year 55/bottle or 8k	
				Premixed Ar-Eth gas for 50% of system for 6 weeks -- 15k	

Risks(1)

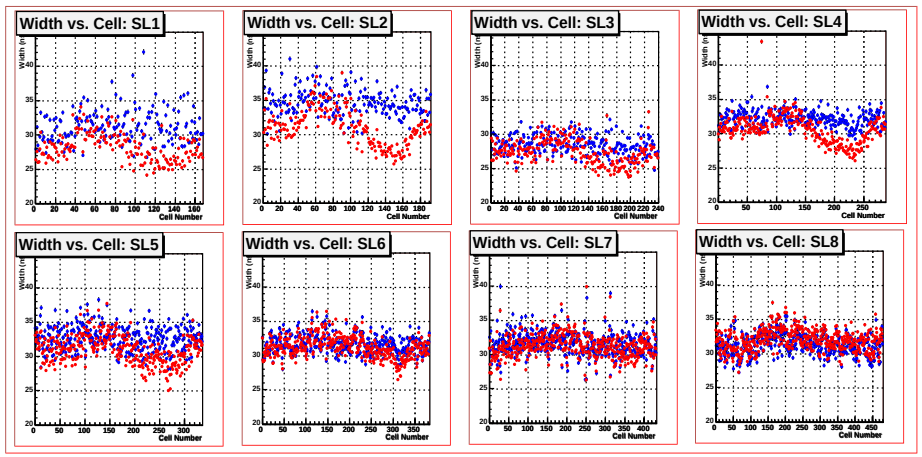


- Damage to CDF detectors from abnormal beam aborts
    - Kicker prefires
    - Devices accidentally moving into the beam (roman pots, vacuum valves, collimators…)
    - Beam position at the abort location (A0)
    - Abort gaps containing too much beam
  - Monitor accelerator conditions closely for instabilities
  - Installed additional collimators to help shield experiment from beam related losses
  - Working with AD on re-engineering beam abort system
- Trying to minimize the risk – but it will never be zero.

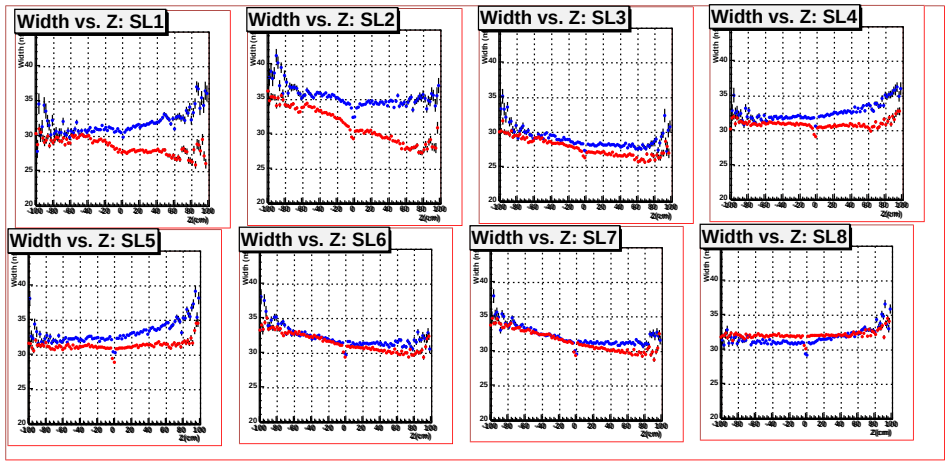
Risks(2)

- CDF Tracker
  - Experiencing premature aging
  - Cause of this degradation has not yet been identified
  - The low Pt physics program will suffer if this problem is not mitigated

Pulse Width vs Phi for each SL

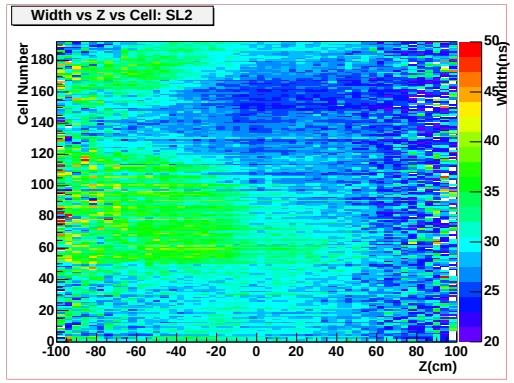


Pulse Width vs Z for each SL

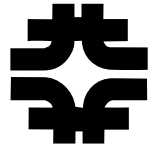


Mitigation of COT Aging

- Formed an internal/external review committee to provide guidance
  - http://www-cdf.fnal.gov/upgrades/cot/aging_committee.html
- Projects to increase gas flow underway
- Measurements of gas quality have been made
- Turning off parts of the chamber to prevent additional aging while plan is being developed
- Wire planes being removed and will be sent for analysis

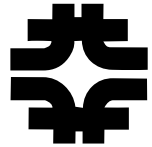


Risks(2)



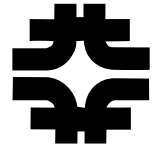
- There are single point failures from which we would have difficulty recovering
  - Ground fault inside the solenoid
    - Hardwired and PLC based interlock systems in place to monitor solenoid behavior and remove power prior when any slight imbalance is detected
  - A fire near the “cable plant” or other critical area
    - Cables spec’d to meet fire codes – plenum rating when possible
    - Signal, HV, and power cables all run separately. No AC power in cable runs carrying signal cables
    - Halon and smoke detection systems in place to deal with problems early

Communication



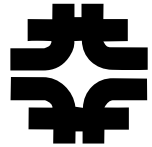
- Substantial effort and resources are spent communicating with the collaboration, accelerator division, PPD and directorate
  - Hold daily planning meeting
  - Participate in AD daily planning meeting
  - Participate in 2 lab sponsored PMG's each month – one for Run2 operations and one for Run2 accelerator upgrades
  - Maintain web pages with daily/weekly plans, task lists, current problems/issues
  - Report to collaboration weekly
  - Utilize project planning software to schedule work

ES&H



- CDF is a potentially hazardous environment. High current sources, High voltage, high magnetic fields, cryogens, radioactive sources and large volumes of flammable gas are just a few of the potential hazards.
- Written procedures are in place for all routine operations on the detector
- Job Hazard Analyses are written and reviewed for any non-standard operation
- Employ a full time safety coordinator for the experiment
- We have had 3 injuries since the beginning of Run II at CDF. Only one resulted in lost work days
- Safe operation is our first priority.
  - It does not come for free. It requires a significant portion of our limited resources

Summary



- CDF is operating well but we have many challenges ahead of us
- There is more to operations than just data collection. – worry about budgets, planning, safety, training, communication, upgrades, etc
- While the collaboration is and must continue to carry the burden of detector operations, laboratory resources and personnel play a vital role
- CDF department needs to maintain at least its current levels of staffing to have a critical mass
- CDF and D0 are the flagship experiments at the lab. The lab resources should reflect this.