CDF Operations Budget Review

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for the CDF Operations Group

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The Year in Review….

- FY03 was a challenging year for CDF
  - Undertook a substantial low beta quad shielding project
  - Installed a new collimator at A48 to help protect us from kicker prefires
  - Completed laser work to allow us to fully utilize the ISL detector
  - Accelerator just starting to make progress in terms of instantaneous luminosity.
- Main focus of FY03 Shutdown
  - Magnet re-alignment, rolls
    - Increase dynamic aperture of machine
    - Remove machine coupling
  - Complete Tevatron level run
  - Instrumentation and vacuum work for recycler

The Start of FY04

- Rocky!!
  - Initial Luminosity was 20's e30
  - Problems with Kicker Timing and radiation damage to our silicon
  - Kicker prefires
  - Inadvertent motion of CDF roman pots damaged TeV and a week to repair
  - Vacuum problems at A48 took required long access to fix over Christmas Holidays
- CDF's Low Beta Quad Magnets
  - Collision point in CDF was not stable in FY03. At the end of FY03, beam was 3.7mm vertically off from nominal silicon center
  - AD (McGinnis) took an aggressive approach and repositioned our quads during one of the down periods above.

Ramifications

- A month into the FY04 data run, the lifetime in the recycler was measured to be in excess of 500 hours!
- Beam divergence was measured to be at spec!
  - There is life in the recycler again!
- After the realignment of low beta quads at CDF, the luminosity increased dramatically!
  - Initial Luminosity jumped to the 60's e30
  - Records started being set almost daily!
  - Machine reliability was now tremendous! Stores regularly lasted 24-30 hours which gave the pbar guys time to acquire large pbar stacks!

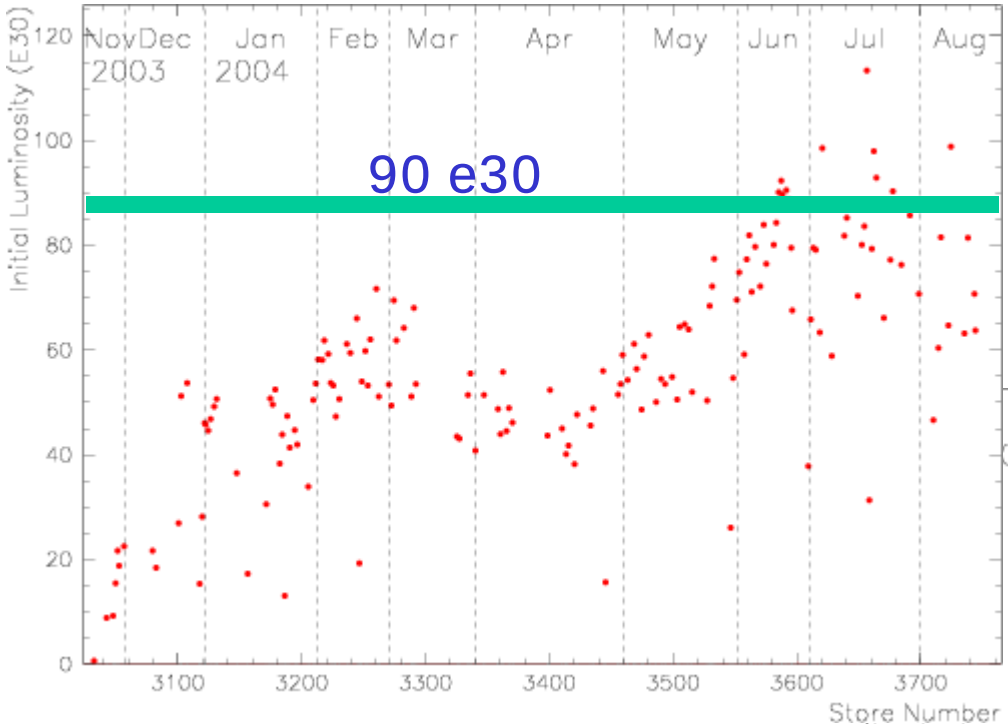
The final steps

- The new lattice!
  - 20% increase in luminosity at CDF
  - Did not come for free – growing pains as we struggled to deal with the higher losses associated with this new lattice
  - Dramatic differences in CDF/D0 initial luminosity – was it real?
- The emergence of the recycler
  - Mixed mode shots!
  - Recycler moving from an R&D effort to just another machine in the complex
  - 3 of 9 bunches from Recycler, 6 from accumulator.
    - Allows for even larger pbar stacks
    - Buys us time to cool accumulator and get more consistent pbar transfer efficiencies

The performance of the Accelerator and CDF

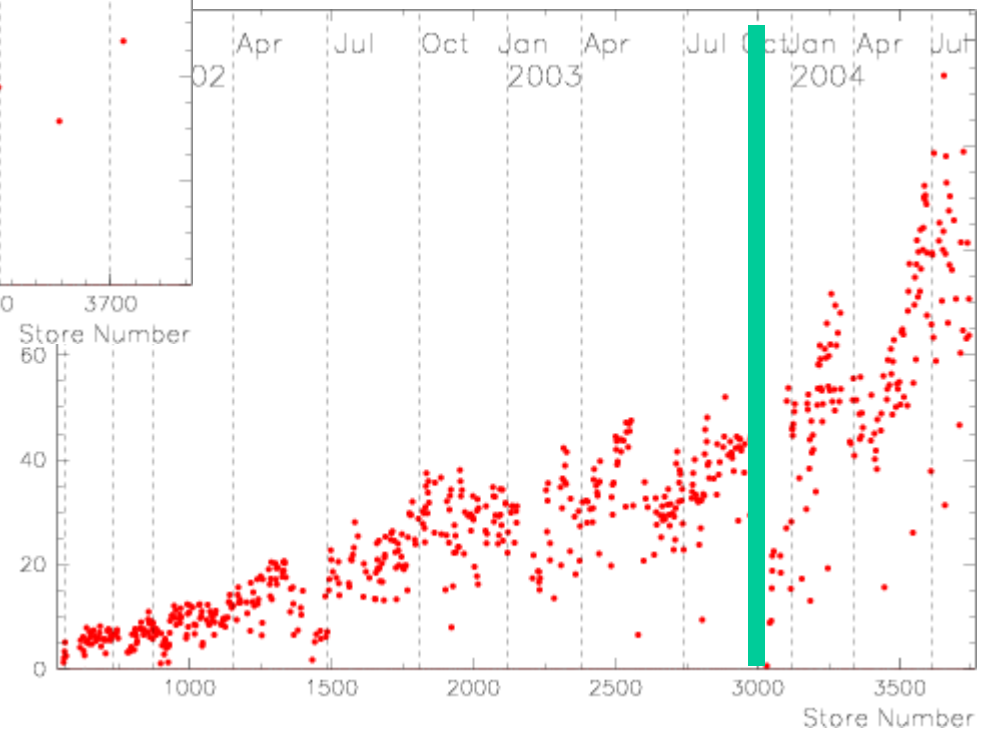
A series of plots

Instantaneous Luminosity vs Store Number

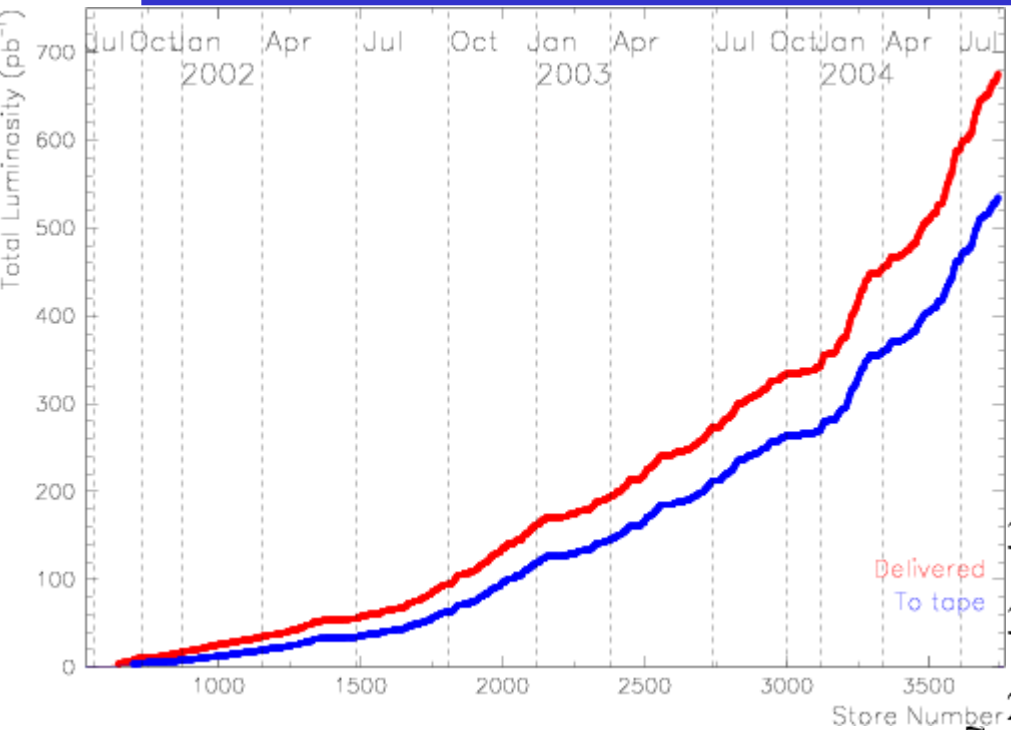


FY04

Run II



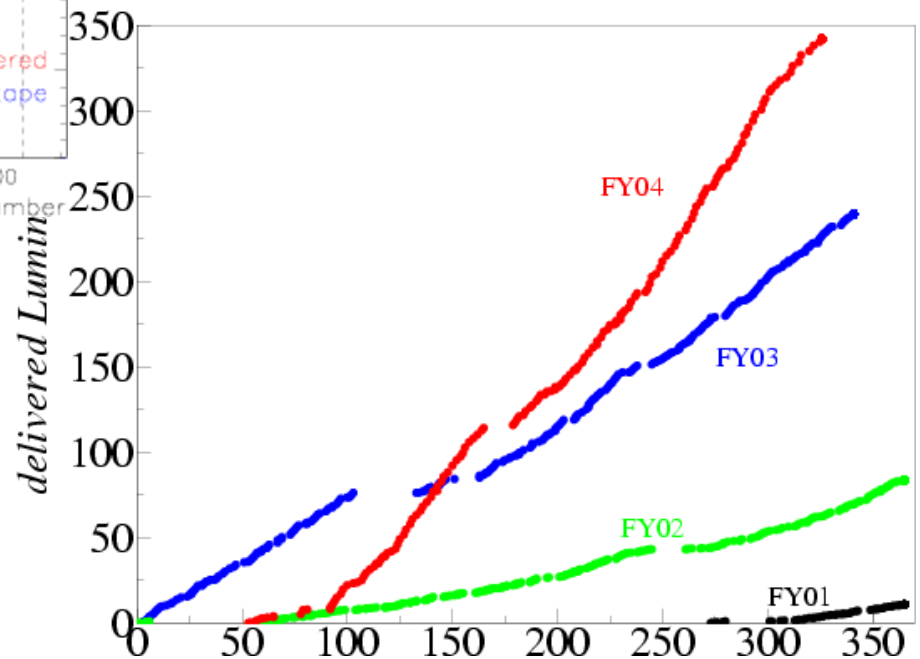
Luminosity Delivered to CDF



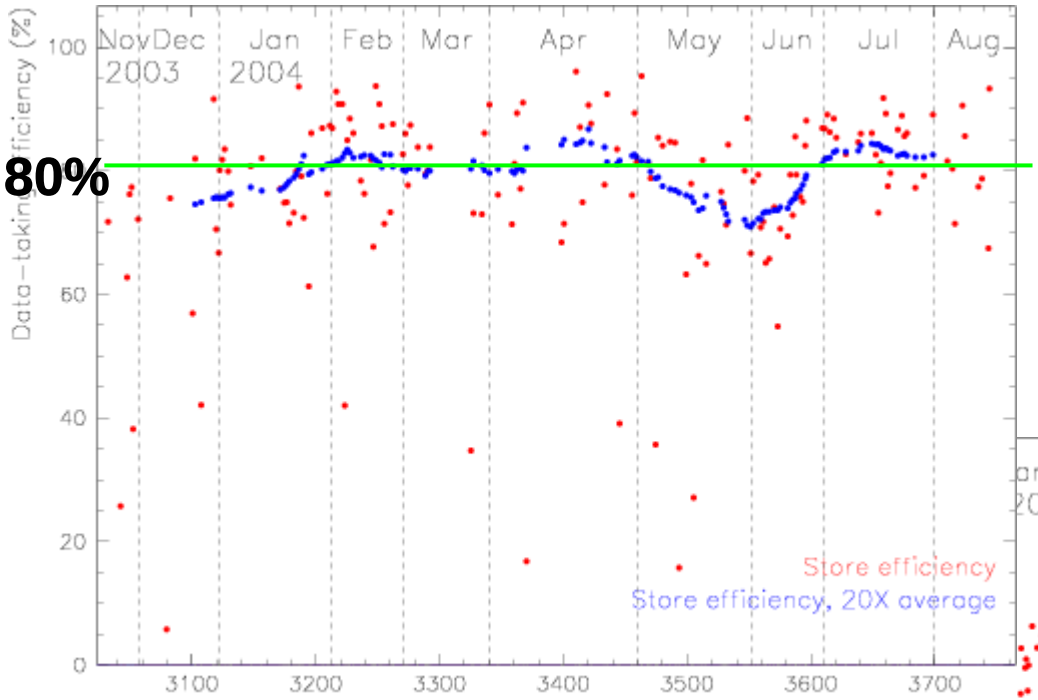
Run II

By Fiscal Year

(And FY04 had substantially fewer weeks of Acclerator operations than FY03)



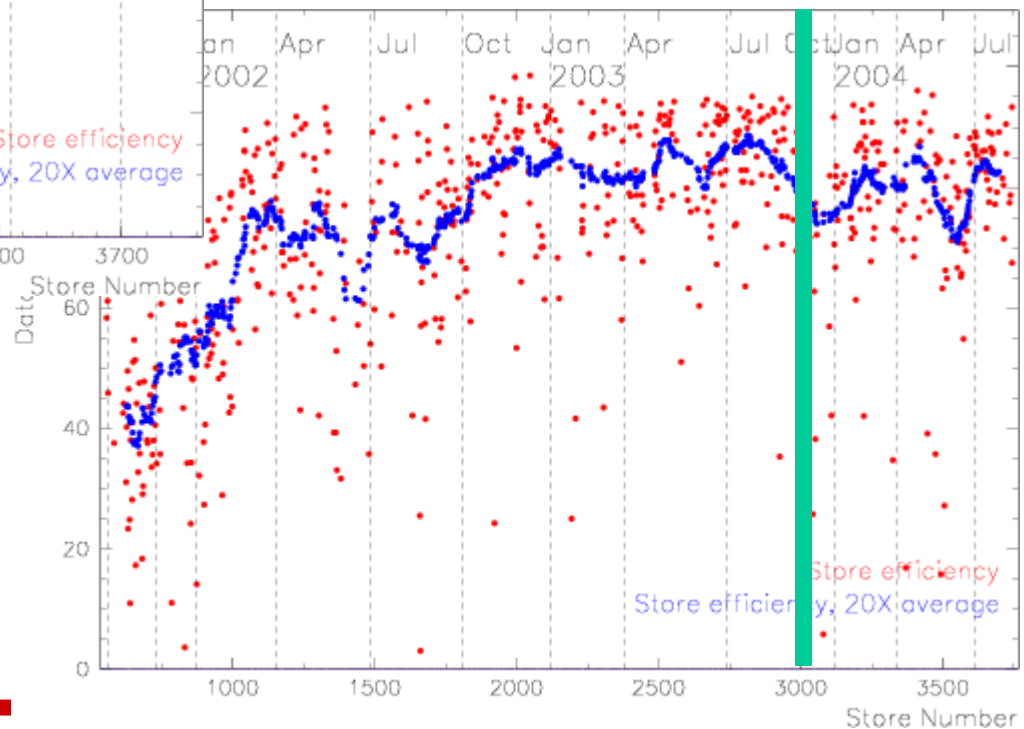
Data Taking Efficiency vs Store Number



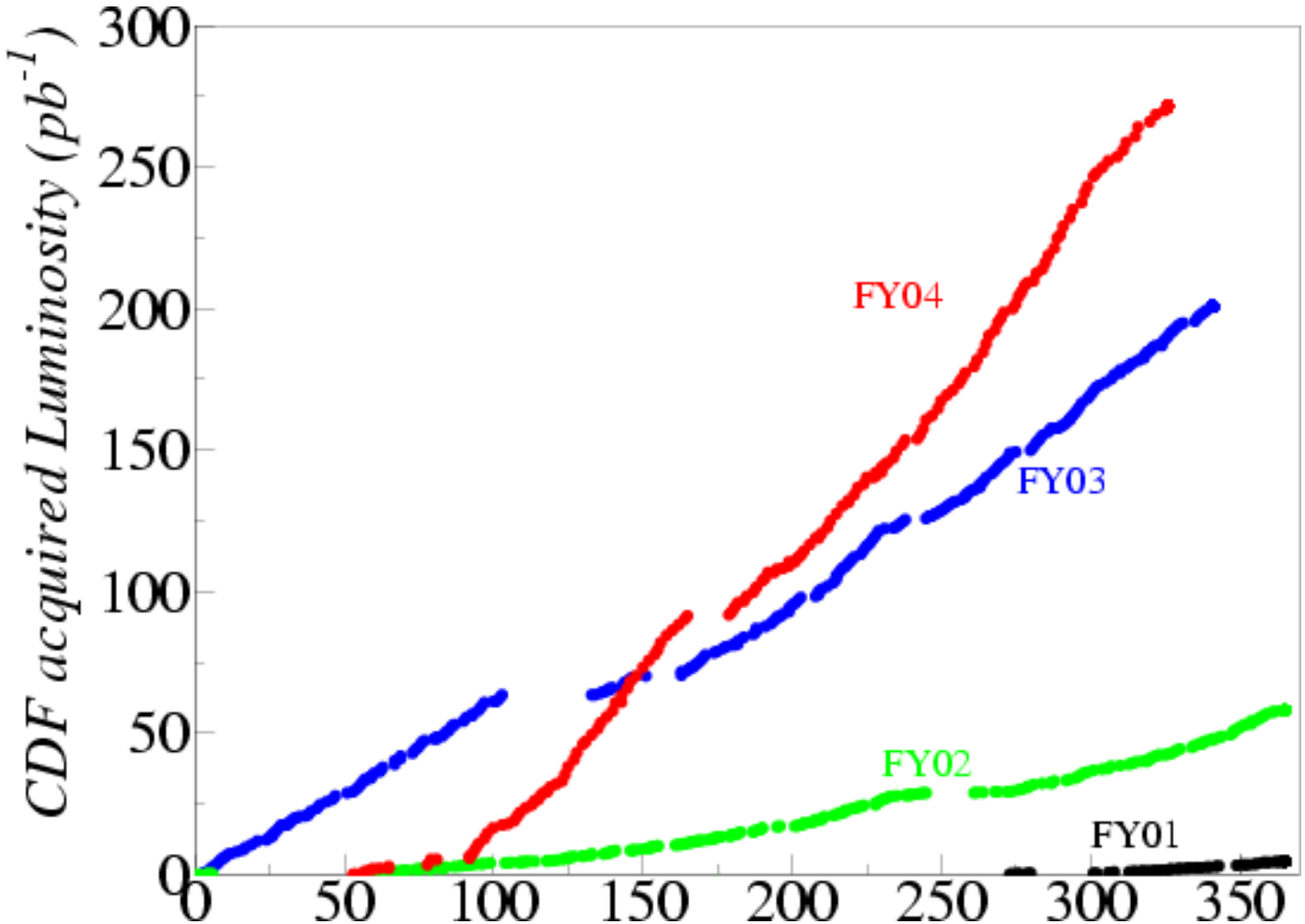
FY04

Run II

Goal is >90%



Data Written To Tape vs Days in each Fiscal Year



What is CDF Operations Up Against?

Issues CDF Faced in FY04

- Accelerator incidents damaging the silicon detector
- Aging troubles (substantial loss in gain) for our Central Outer Tracker
- High losses from accelerator – both “DC” beam as well as in the abort gaps
- Loss spikes resulting from truck traffic and changes in HVAC conditions in our collision hall
- CDF vs D0 luminosity differences at the start of stores
  - Motivated to understand this because we did not want to spend valuable beam time chasing a potential non-problem
- Extending the lifetime of our Silicon detectors by a factor of 2 longer than their designed lifetime.
  - Even more crucial now with the renewed optimism based on this years accelerator performance

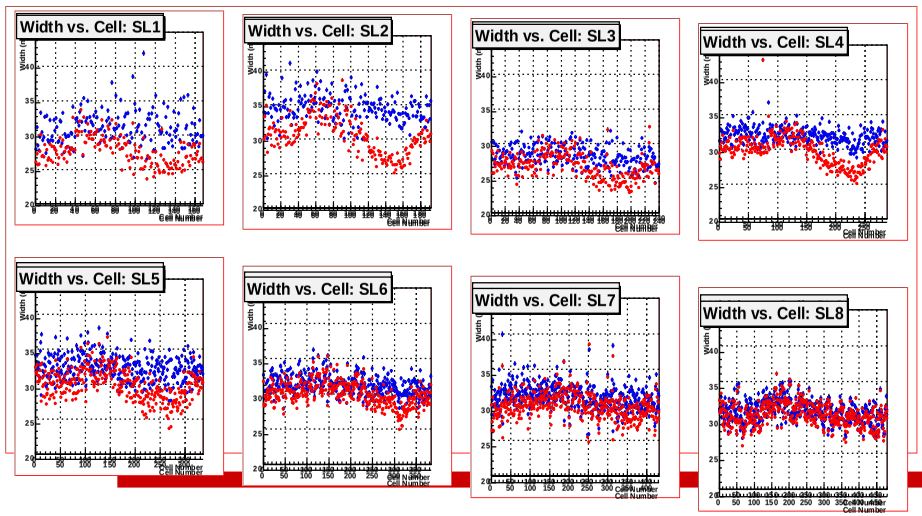
Accelerator Incidents pose a risk to our Silicon

- 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
  - ➢ Improvements to the cooling system to enable trouble shooting of problems
  - ➢ Isolation of silicon and COT inert volumes such that the silicon can remain cold during COT maintenance
- Trying to minimize the risk – but it will never be zero.

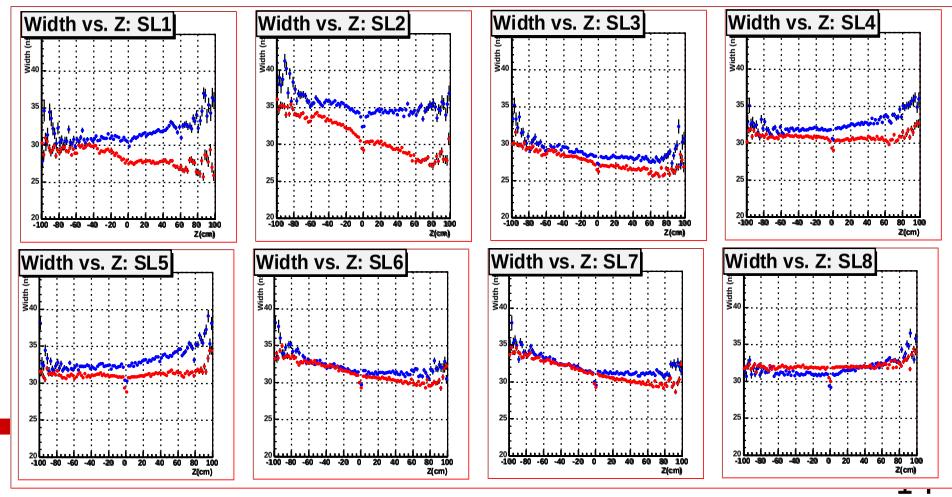
The Aging of the CDF Outer Tracker

- COT experiencing premature aging – as much as a 2x loss in gain that is both R and Phi dependent
- Source of degredation are hydrocarbons coating the “sense” wires
- Turned parts of the chamber off and reduced the gain on other sections of the chamber while we investigated the problem to prevent further chamber damage – in case the process is irreversible
- The low Pt physics program will suffer if this problem is not mitigated

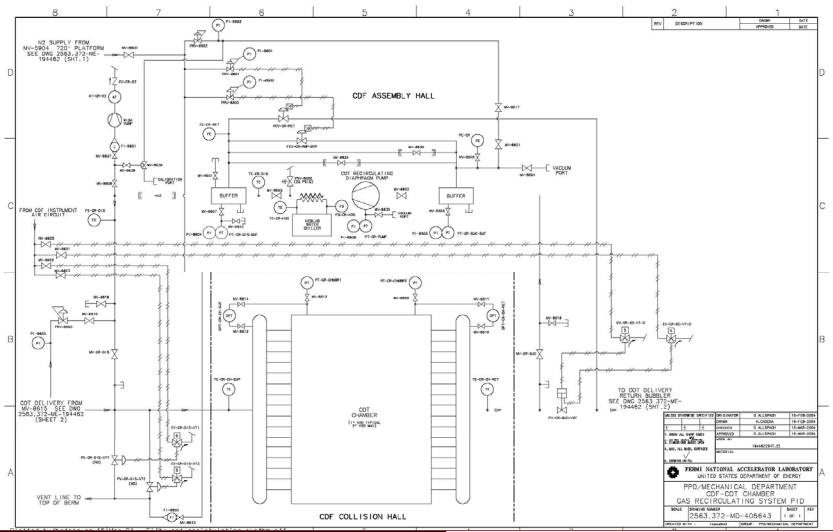
Pulse Width vs Phi for each SL

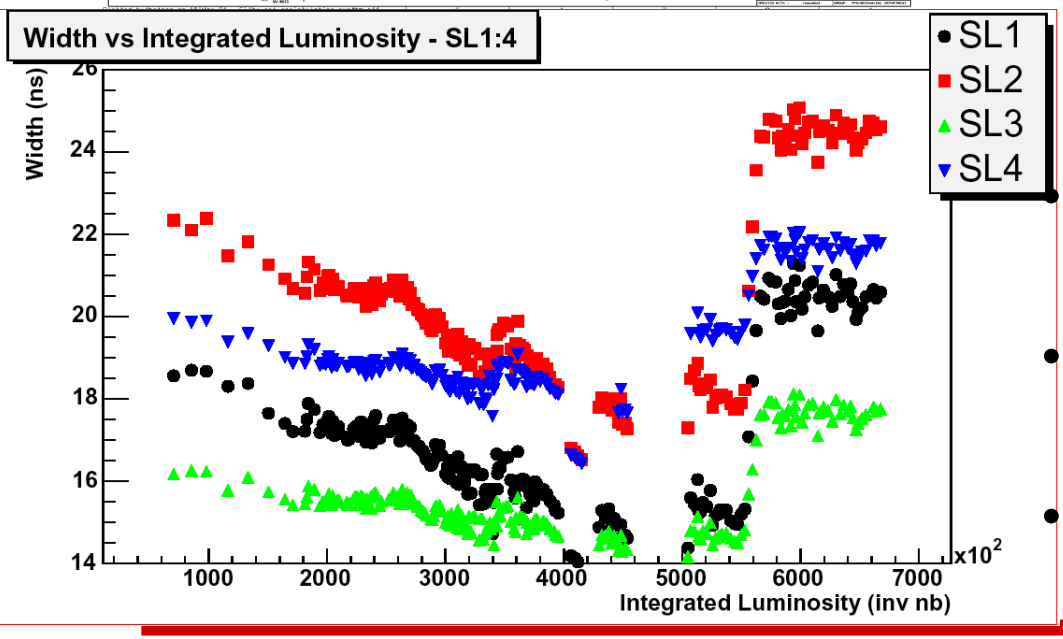


Pulse Width vs Z for each SL



COT Aging -- the solution





- Built a gas recirculation system in order to move gas through the chamber 10x faster than before
- Observed during this installation that the introduction of air into the chamber caused gain recovery long after the air was flushed from the chamber
- Used the recirculation system to add air and then oxygen.
- Chamber is now fully recovered
- 85pb^{-1} collected with compromised chamber

FY05 – Not a "Cake Walk"

- Calorimeter Energy Scale is not stable
  - Need to do a better job of correcting for it in the on-line environment
  - Radiation Damage causing degredation of plastic in the plug region
  - Need to increase our sourcing program – which means we need to do a better job automating it
- Ethane contract is up – need to renegotiate
- Monitoring of Low Beta Quad Positions may be an issue
- Deal with 25% more Initial Instantaneous luminosity by the end of FY05
- Be prepared for trigger/daq upgrades scheduled for installation this year (L2 decision, TDC modifications, XFT stereo, Faster crate processors, new crate backplanes?)
- Remain vigilant for further signs of aging with the COT. Goal is to reproduce effect in a test chamber still.
- The big problem – we get one each year but as of yet we don't know what it is…

The Budget Details

Budget Process

- CDF Requested $1.8M in M&S Funds to operate in FY04 – expect to receive $~1.5 to 1.6M
- ~$1.1M of this are fixed costs (gas, cryogens, computer licensing, maintenance contracts, T&M labor, etc)
  - I can write all of these checks now!
- $400k of funds remaining for which we have some control. Forces difficult decisions. A challenge to predict all of our expenses.
- Visitor budget is insufficient. Handicaps our ability to acquire additional collaboration resources

CDF Operations M&S Budget Breakdown

Category	Explanation	Budget Req	FY04 Budget
Computing	On-line DAQ, Level 3, Licensing maintenance, slow controls…	$500k	$500k
Consumables	Argon, Ethane, LN2, He, Alcohol	$600k	$400k
T&M	Electrical, Rigging, HVAC Personnel	$50k	$15
Infrastructure Maint	HVAC, Compressors, Engines, Pumps…	$200k	$135
General Operating	Office Supplies, phones, pagers, vehicles, misc. catch-all	$200k	$150
Mech Support	Pipes, Fittings, bolts, tools, safety	$100k	$50
Run IIB	L2 Trigger, Scaffolding, etc.	$150k	$150
Total		**$1,800k**	**$1,400**

Last Year's Budget in Review

- From the spreadsheet I gave you….
  - FY04 total cost was $2.2M
    - This is a previously agreed upon combination of salary + M&S
  - Budgeted Cost was $1.9M
  - Appears that I overspent by $300k
  - Misleading. My total M&S budget for the year was ~$1.4M. I ended the year within $50k of balancing. Labor costs did not change
  - Hence, I spent last years funds differently than I had anticipated. That's what you are seeing. I did not over spend
- Significant Unanticipated M&S Expenditures in FY04
  - Replacement of chilled water compressor ($75k)
  - Increased flammable gas usage due to higher COT flow rates ($50k)
  - Constructed a COT Recirculation system ($75k)

FY05

- New Costs that we know we have to deal with this year
  - Ethane contract is up – purity and cost are issues
  - Over-the-road trailers require recertification ($100k)
  - Run IIB trigger & DAQ installation and commissioning costs

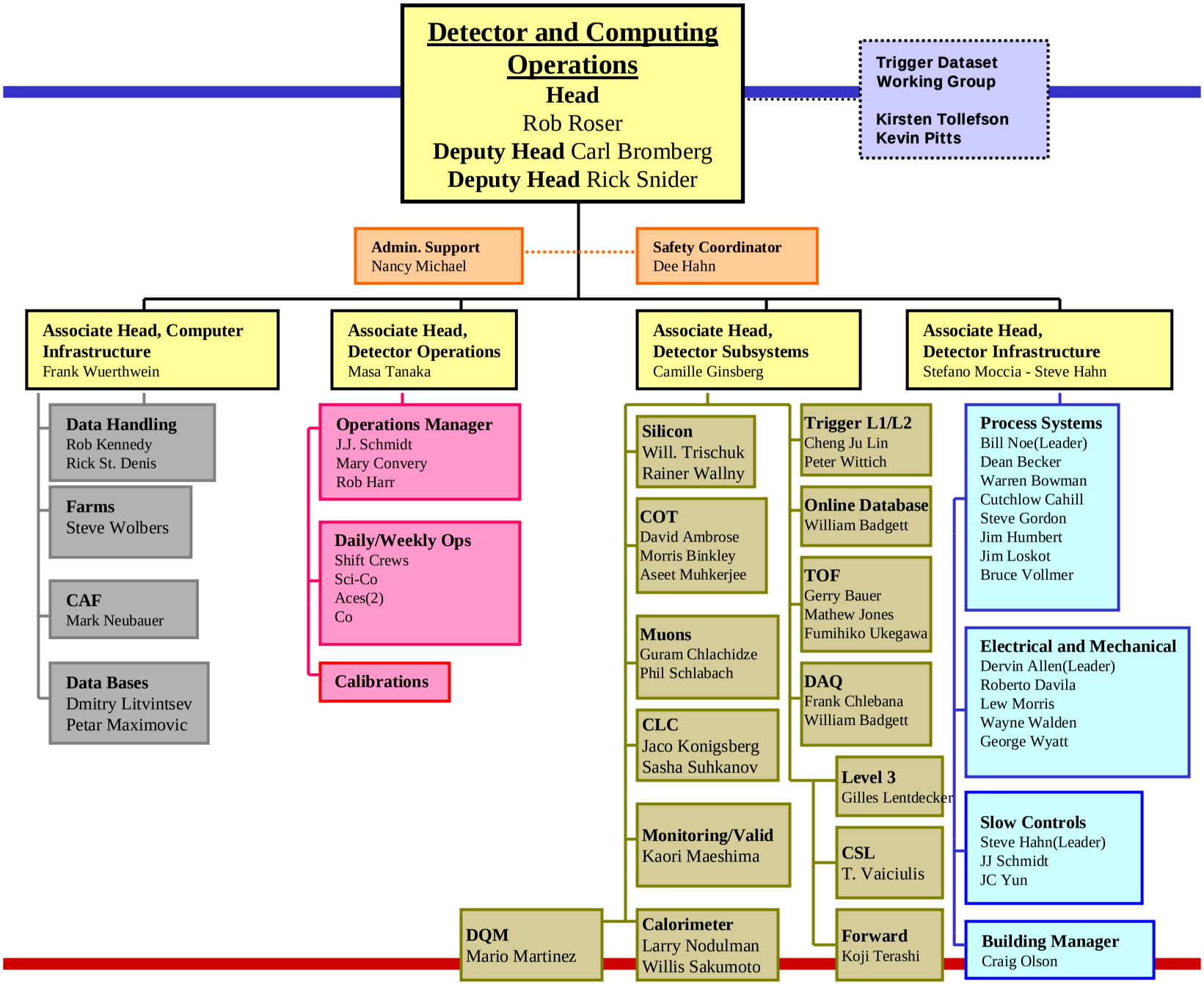
Summary

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 our ability to take data efficiently
- CDF Operations Dept. spends a substantial effort enlisting resources from the collaboration
  - Tension between operational activities and physics analysis
  - Groups are already dropping MOU responsibilities
  - LHC turn-on will only add to the difficulty

Bottom Line

- I don't just need your money – I need your peoples help!
- Each of you need to ask the question -- "Is my group doing all that it can to support CDF Operations?"
  - I summit that for most, this answer is "no"
  - I need an increase in the number of people from the foreign institutions playing more significant roles in CDF operations and taking on more responsibility
- The budget I submitted will only allow me to "maintain".
  - I can do better – with more $$$
  - Data taking efficiency and $$$ are strongly correlated!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Steve Wolbers
CAF
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Dmitry Litvintsev
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J.J. Schmidt
Mary Convery
Rob Harr
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Shift Crews
Sci-Co
Aces(2)
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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
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