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# Summer Shutdowns at CDF

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for the CDF Operations Group

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# Shutdown Philosophy

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- We will not allow work to fill entire time shutdown - significant time will be reserved for calibrations/cosmics/torture tests to ensure we are as ready for beam as possible
- Therefore, we will aim to end most jobs early in week 12 and start closing up and checking things out.
  - We believe the AD shutdown schedule requires 13.5 to 14.5 weeks
- Most of our jobs can be stopped on ~1 week timescale. Even if we run into installation issues, we will not be driving the length of the shutdown

I will focus on the immediate O4 shutdown. At the end of the talk, I will discuss current O5 shutdown plans

## Whats on our "Honey Do" list?

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### ➤ General Maintenance/Repair in the Collision Hall

- Rework Solenoid Watt Can Vacuum System
  - COT Maintenance
  - Isolate Silicon/COT "baggies" so that silicon can remain cold during COT work
  - Install hardware to remotely power cycle all calorimeter power supplies
  - Refurbish linear power supplies
  - Install new support system for low beta quad magnets
  - Install "deep rod monuments" in CDF Collision hall to facilitate alignment in the future
  - Recalibrate ODH/Flam gas heads
  - Rework building florescent lights
  - Calorimeter sourcing
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# Whats on our "Honey Do" list?

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## ➤ General Maintenance outside Collision Hall

- DAQ/online computer Maintenance/upgrades
- Database maintenance
- Silicon Chiller maintenance/installation of portable heat load
- Installation of second COT Recirculation pump for on-line spare
- Upgrade PC's and software for slow controls system - installing a web interface for remote access
- HVAC Maintenance
- Motor Generator Maintenance
- Rebuild cryo expansion engines
- Put a subset of on-line computers on diesel generator

## Whats on our "Honey Do" list?

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### Run 2B installation projects

- EM Timing Installation
- Calorimeter Crack/Preradiator installation
- 1 crate test of new TDC's
- Fiber Installation for XFT

## Schedule

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- Microsoft project file for the shutdown.
- Many of the jobs we have done before so estimates are solid
- The calorimeter/preradiator job has substantial uncertainty.
  - Based on our best knowledge, the complete installation fits with about 2 weeks of contingency
  - There are natural decision points where we can decide whether to take on the next Arch's worth of installation or whether to hold
  - This is not like installing a silicon detector (for instance) where once you start, you are committed to finish it.

# Manpower

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## ➤ Manpower Assumptions

- We are staffing our control room on day and evening shift only. Each shift will include a physicist in charge (Sci-co) and a DAQ expert.
- We are taking all of the technicians off shift rotation for the first 12 weeks of the shutdown.
  - BO will be unoccupied on the owl shift
- We will use ALL of the technicians currently assigned to CDF
- We are asking for physicist help from the collaboration - we will utilize them in two week shifts for a variety of odd jobs
- We are asking for mechanical rigging help from the mechanical support department
- We are asking for an additional mechanical technician for the duration of the shutdown.
- We will require alignment and welding support as well

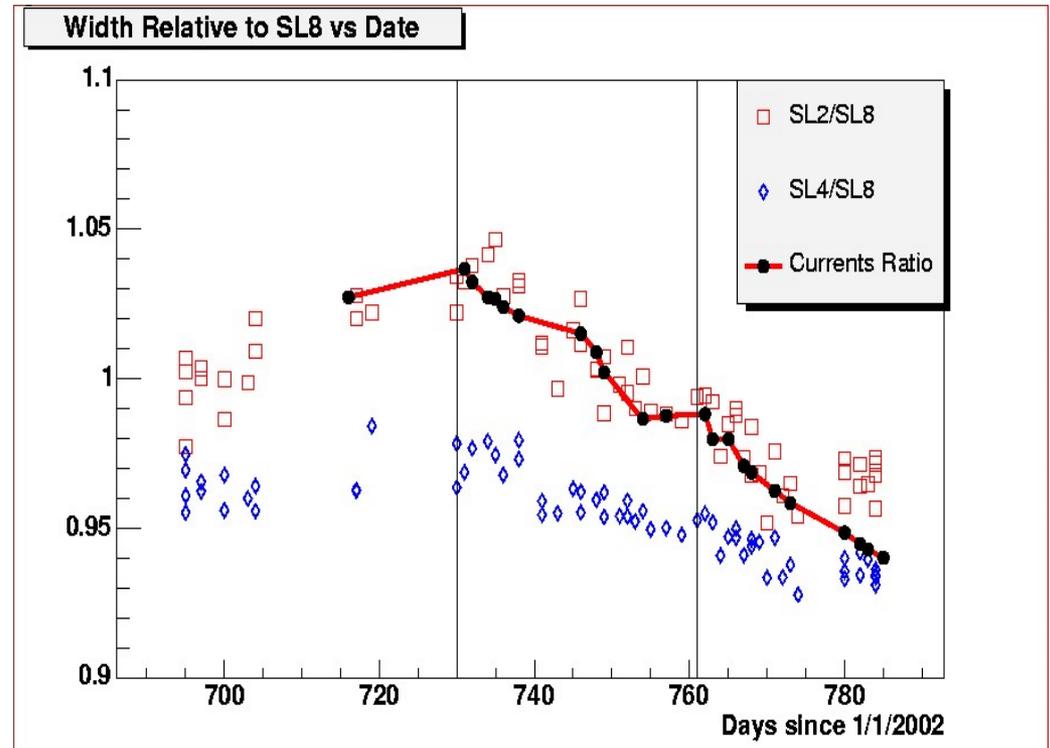
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A closer look at some of the jobs

# Degradation of COT Performance

- The COT has been experiencing "aging". That is a decrease in pulse width
- In February of this year, the worse locations were down 30-50% from nominal
- On Feb 13<sup>th</sup>, we turned part of the chamber off and lowered the gain on others to minimize aging while we came up with a plan.

## Ratio of Pulse Widths and Currents for Stores this winter



## What steps have we taken?

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- Assembled a committee of chamber experts to help brainstorm the problem
- Analysis of aged wires show that the aging material is hydrocarbons
- We have increased the flow rate of fresh gas from 20scfh to 40scfh
- We built a recirculation system to move gas through the chamber at the rate of 200scfh
- We built a controlled "leak" where by we have been adding 60-120ppm of oxygen to the Ar-Eth gas

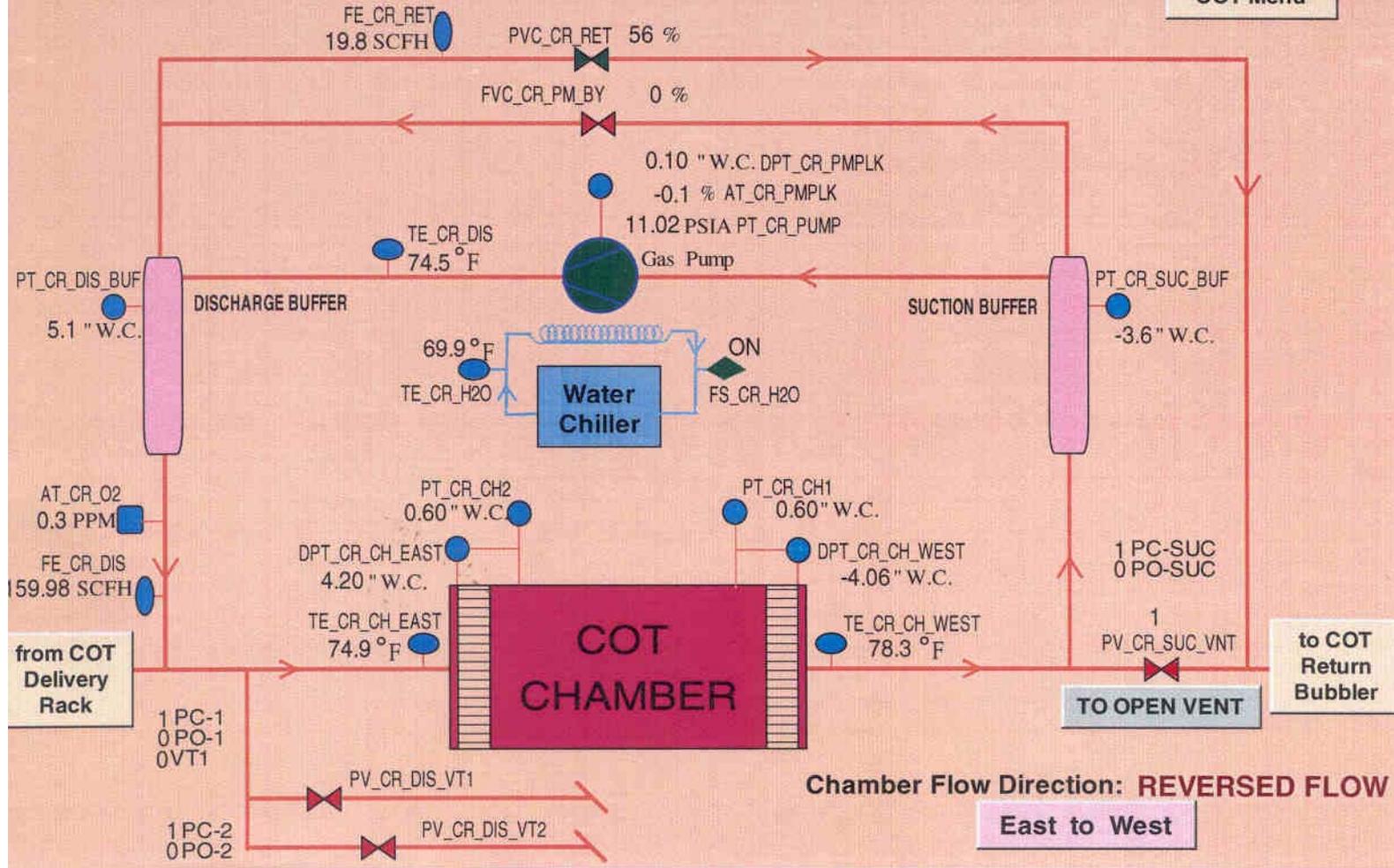
# COT Plumbing...

3:09:35 PM  
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S5



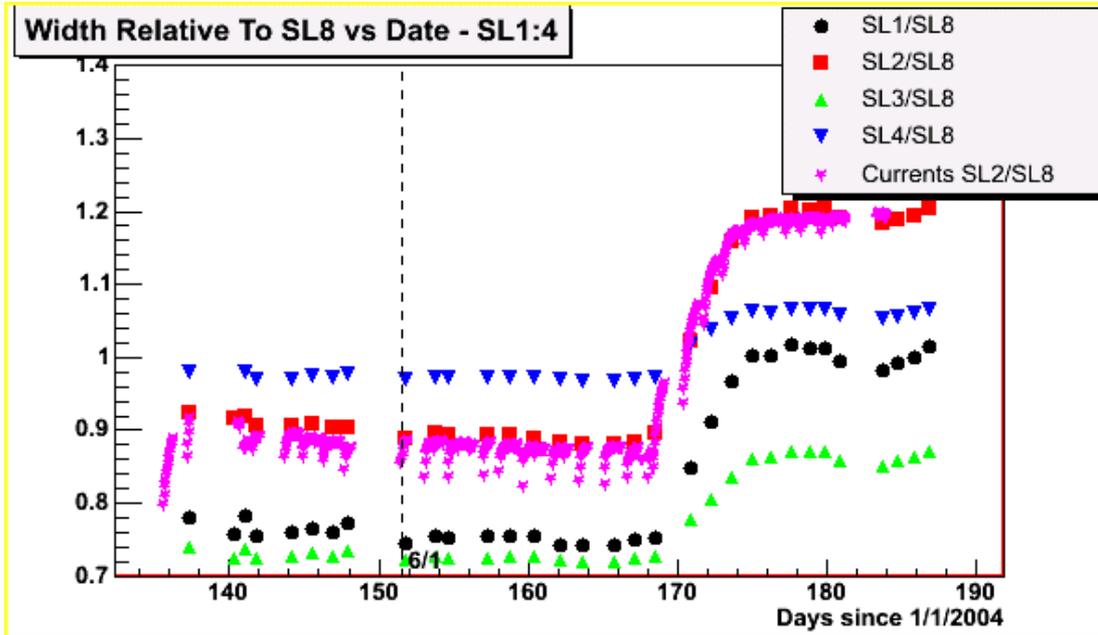
## COT CHAMBER

GAS Menu  
COT Menu



# The Results...

➤ The COT is now back to its original operating condition



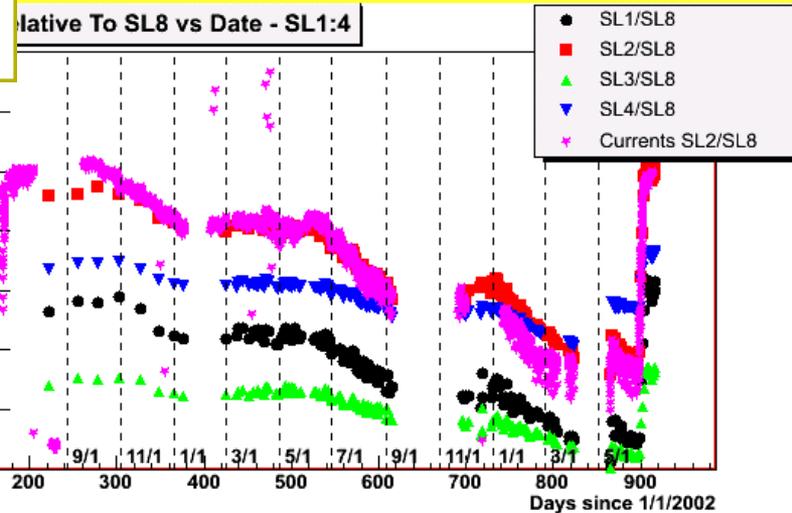
Last 2 months...

Flat section the result of recirculation.

Sharp increase the result of adding oxygen to the gas

Last two years

Note we are back to pre-aging conditions!!!



## COT Jobs for this shutdown

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- Test how chamber responds with Ar-CO<sub>2</sub>
- Isolate COT and Silicon gas volumes at COT endplate so that we can work on COT without warming up the silicon
- Redo grounding on some problematic channels
- Replace Faraday cages on SL8 to reduce noise
- Rework some of the plumbing to allow us to recirculate at higher rates if desired in the future
- Install "hooks" in the gas mixing and storage sheds to allow us to build an Ar-CO<sub>2</sub> mixing system in the future

# Solenoid Work

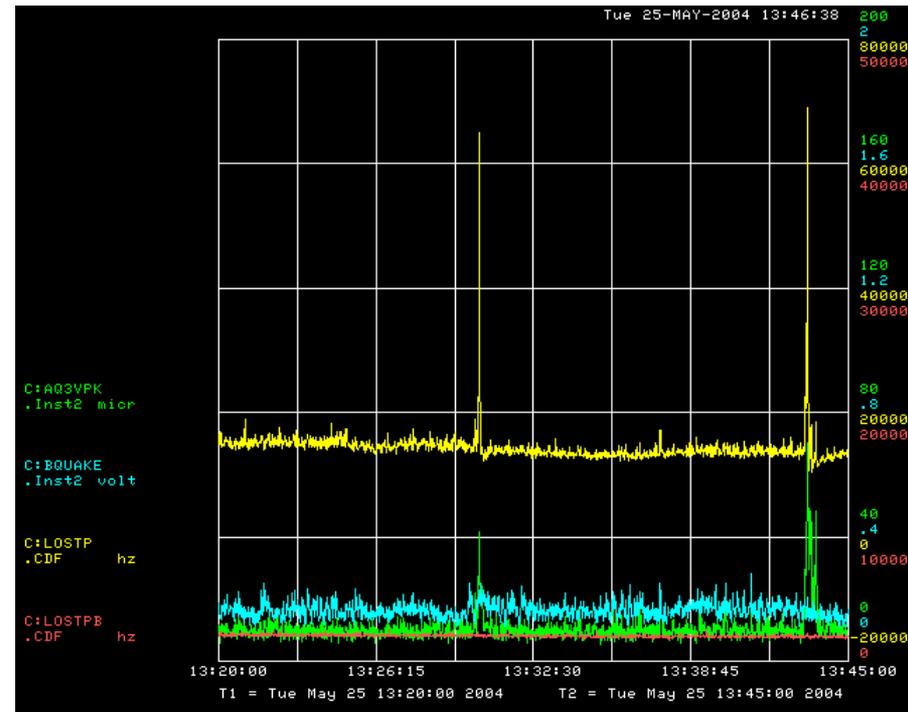
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- The point in which the copper bus attaches to the superconducting leads of the solenoid is called the Watt can.
  - This can has a leak and requires periodic pumping
  - We worry about pumping directly on the Watt can while the solenoid is powered
    - We built a system which allows us to indirectly pump
    - If this is not working, we have to power down and then perform the pump out procedure
  - CDF experienced some downtime in the past few months due to automatic valves breaking
  - These valves will be replaced during the shutdown with a more robust type of valve to prevent future problems
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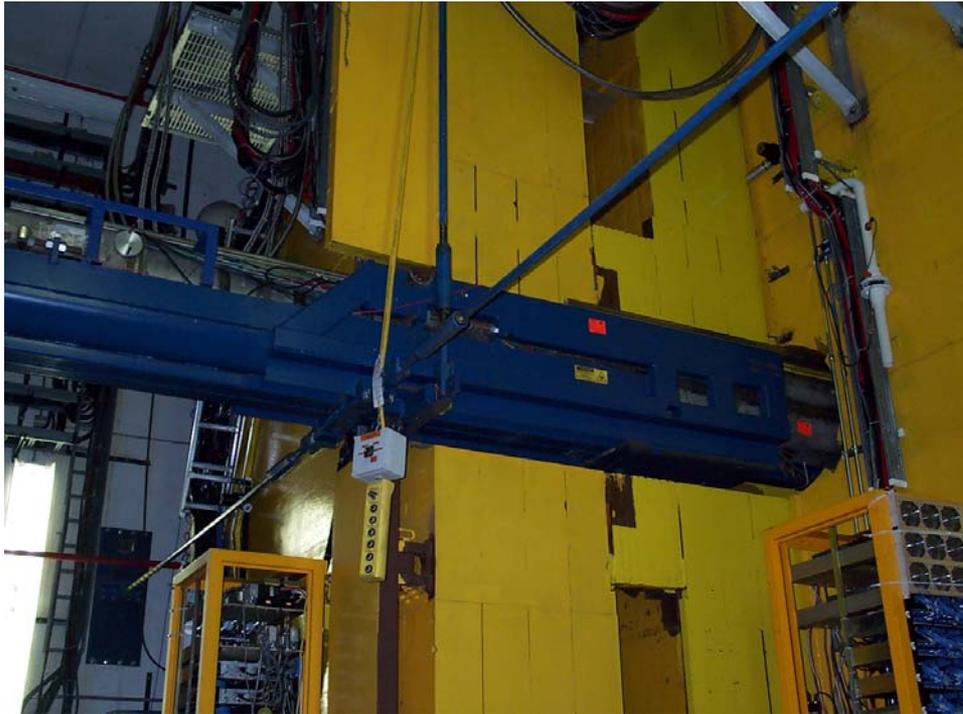
# Rework Low Beta Quad Supports

- The low beta's exhibit a steady 12hz oscillation
- Heavy trucks on both the inner ring road and main road can create losses at CDF as they drive by
- Small changes on the Collision Hall temperature/pressure have significant impact on the beam losses
- The plan is to support the low beta quad "cradle" from the floor and remove the long INVAR rods and the mounting fixtures on the ceiling

Losses as measured at CDF and local "quake" meter



# Low Beta Quad Magnets (A Side)



← Low beta quads,  
cradle and invar  
bar supports

Concept of  
Support Structure →



# EM Timing

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- We are now on phase 2 of the installation
  - Last summer, EM Timing was installed on BOTH plug calorimeters as well as on four central wedges (out of 48) as a test
  - A careful analysis was done comparing the newly instrumented central wedges with the others to make sure the timing installation did not adversely impact the calorimeter performance.
- The job
  - Install splitter harnesses on each of the remaining 44 wedges. (all limo terminations)
  - Dress the cables along the wedge to the appropriate readout crate.
  - Install electronics cards
  - Connect the cables to the readout as per a pre-described map

# EM Timing (page 2)

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## ▪ Status of Parts

- Splitter harnesses have all been made, tested and labeled courtesy of Lab 6.
- Readout cables from detector electronics crates to the counting rooms are already installed
- Electronics Cards
  - Transition cards
    - provides a path between the splitter cables and the ASD Readout board have to be remade.
    - Current crop of boards do not satisfy our mechanical tolerances.
    - Boards will be made here under FNAL supervision
    - Expected completion date for these boards is mid August.
  - ASD Boards
    - 27 currently in hand and tested.
    - Readout plan has changed - now require this system to respect the same crate/wedge boundaries as the other sub systems.
    - Will require the fabrication of 8 additional boards (including spares)

## EM Timing (page 3)

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- Project just underwent a readiness review
- Outcome
  - Compile a procedure/checklist that can be used to verify the status of each wedge from installation through commissioning
  - Hold off on installation of any splitter harnesses until new transition boards arrive
  - Install top and bottom wedges first and move toward the middle (3 and 9 o'clock positions)
  - Stop installation if parts are not available
  
  - The committee requested weekly status reports of parts procurement and will reconvene in late September to evaluate the progress of the project.

## Run 2B TDC's

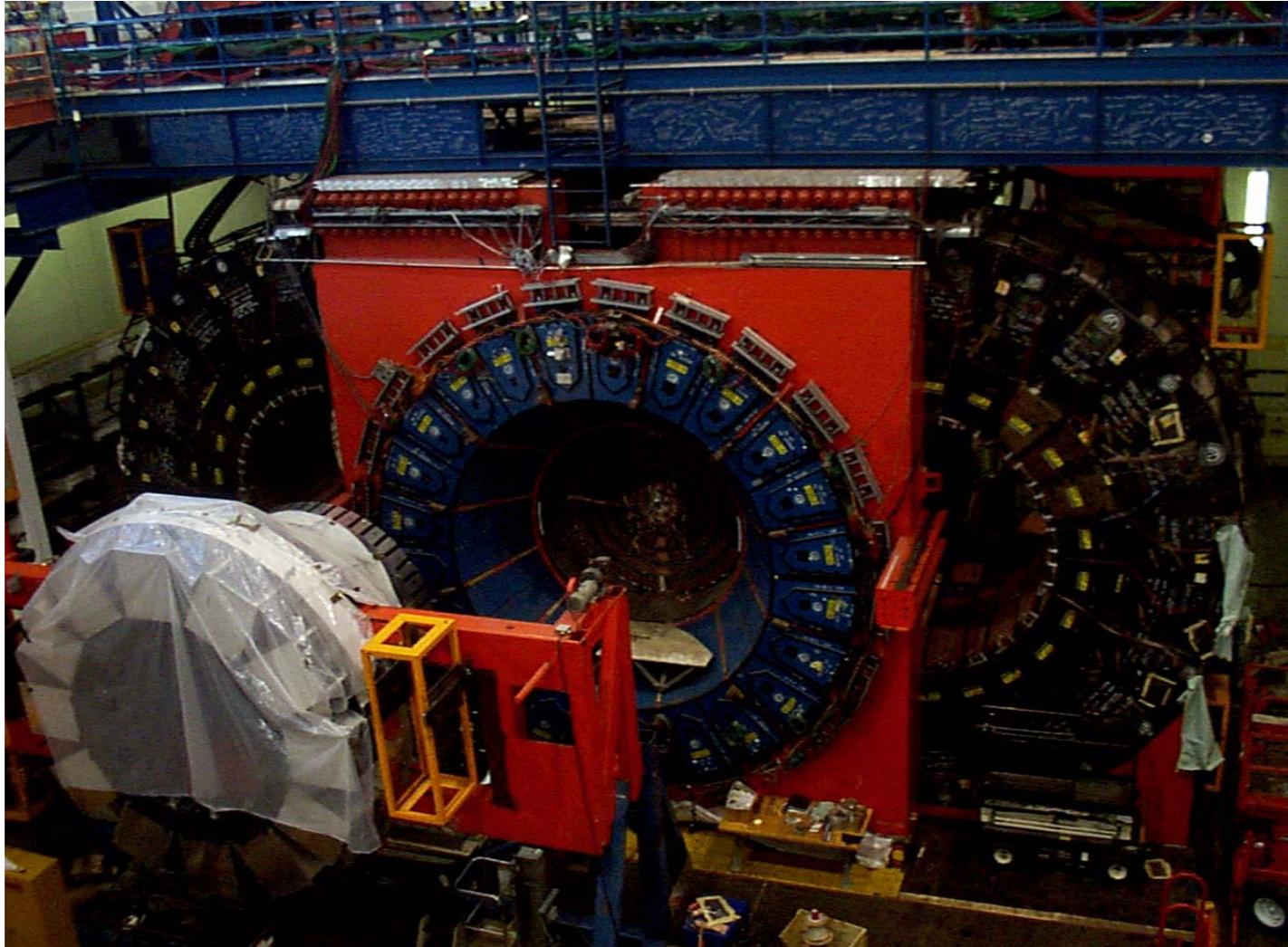
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- 4 TDC's are currently being tested.
- 1 crates worth of TDC's are in the process of being fabricated
- Once the TDCs pass the suite of tests deemed necessary in the test crate, they will be installed in an actual COT detector crate.
- We hope to have at least 1 month of experience with these boards during the shutdown
- Prior to the end of the shutdown, the new TDCs will be replaced with the current set.

# Calorimeter Preshower and Crack Detector Installation

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- The installation will be done in the Collision hall
- Limits access and degree of parallelism
- Requires new work platforms that can be installed in this constricted environment



# The Big Picture

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- Install one Central Arch worth of detectors at a time. (12 wedges)
- Don't move to the second arch until the first arch is done and tested
- After the completion of any given arch, we can evaluate whether sufficient time remains in the shutdown to start the next arch
- This system will undergo an internal readiness review in the upcoming week

# The Plan

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- There are two components to this installation - a front side and a back side. They can proceed in parallel.
    - Front Side - home of the detectors
      - Old detectors need to be uncabled and removed
      - New detectors are installed
      - New cables are strung from inside to out
    - Back Side - home of the readout electronics
      - Phototube boxes must be installed
      - Cables have to be installed and dressed
      - Readout electronics needs to be removed, modified, and reinstalled
    - We will open an arch (Southwest) on the second day of the shutdown, assemble the work platforms and start.
      - Since we have had limited access in this region, planning has been difficult. Anxious to make sure there are no surprises
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## The Plan (2)

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- Dervin's team will take care of all the work on the back of the arches
- A combination of physicists, project engineer, and technicians will work on the inside installing the detectors.
- The schedule is currently written as a single shift. We can use an evening shift as contingency
- Currently, there are 10 days of float in the schedule.
- Unlike the other parts of this schedule - the time estimates are not well "grounded". We have never done anything like this before in these conditions.

## Summary of 2004 Shutdown

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- Lots of work to do in 12 weeks
- We have an experienced crew that has been through this several times before
- Most of the jobs are similar in nature to other work that we have done that we have a high comfort level
- Preradiator installation is new and will present a significant challenge

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## 2005 Shutdown

# The 05 Shutdown

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- Collision Hall Work
    - Installation of new COT TDCs
    - Completion of Preradiator?
    - Installation of transition boards for XFT stereo readout
    - Routine maintenance of the various detector sub systems
  - Other work
    - Installation of new L2 trigger (Pulsar)
    - Installation of new event builder
    - Installation of XFT trigger electronics
  - We do not, at the moment, have a long list of jobs which require a lengthy shutdown in 05.
  - Based on current tasks, 8 weeks should be sufficient time to complete the remaining projects
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