

Far Detector Installation (and all things Soudan)

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MINOS Meeting

Caltech

January, 2002



- Outfitting
- Magnets
- Installation
- Safety
- Run coordination
- Testing the detector with data
- Operations & installation
- Looking forward

Outfitting Status:

Almost done with those last details

- At beneficial occupancy in July there were 77 punch-list items for the outfitting contractor (Lakehead) and their subs to complete
 - > All but **3** of these items have been completed
 - All related to sprinkler head locations
 - Final Minnesota Code inspection set for January 24th
 - > After completion of their work on CDMS (first of March) the contract will be closed
- There are **10** punch-list items left from the excavation contractor (Lametti)
 - > Fix the erosion problems on the parking lot next spring
 - > Earl is negotiating removal from the contract
 - We expect it will be completed next spring

Steel & Coils Quickie

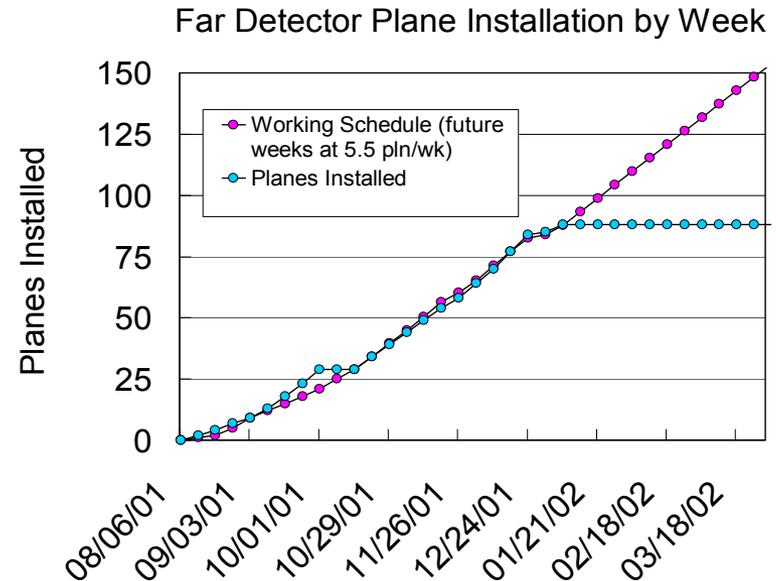
- Steel deliveries continue
 - > ND: 60% of the steel delivered... more coming each week
 - > SM1: steel deliveries continue
 - > SM2: steel option exercised
- Fixtures
 - > ND plane installation fixture: clamp redesign ongoing
- SM1 coil test
 - > Thermal and DCS integration tests completed
 - Wisconsin and Fermilab
 - Some modifications for the final coil installation
 - > Ready to be removed
- 4PPs - The **last** update!
 - > ND 4PP completely gone

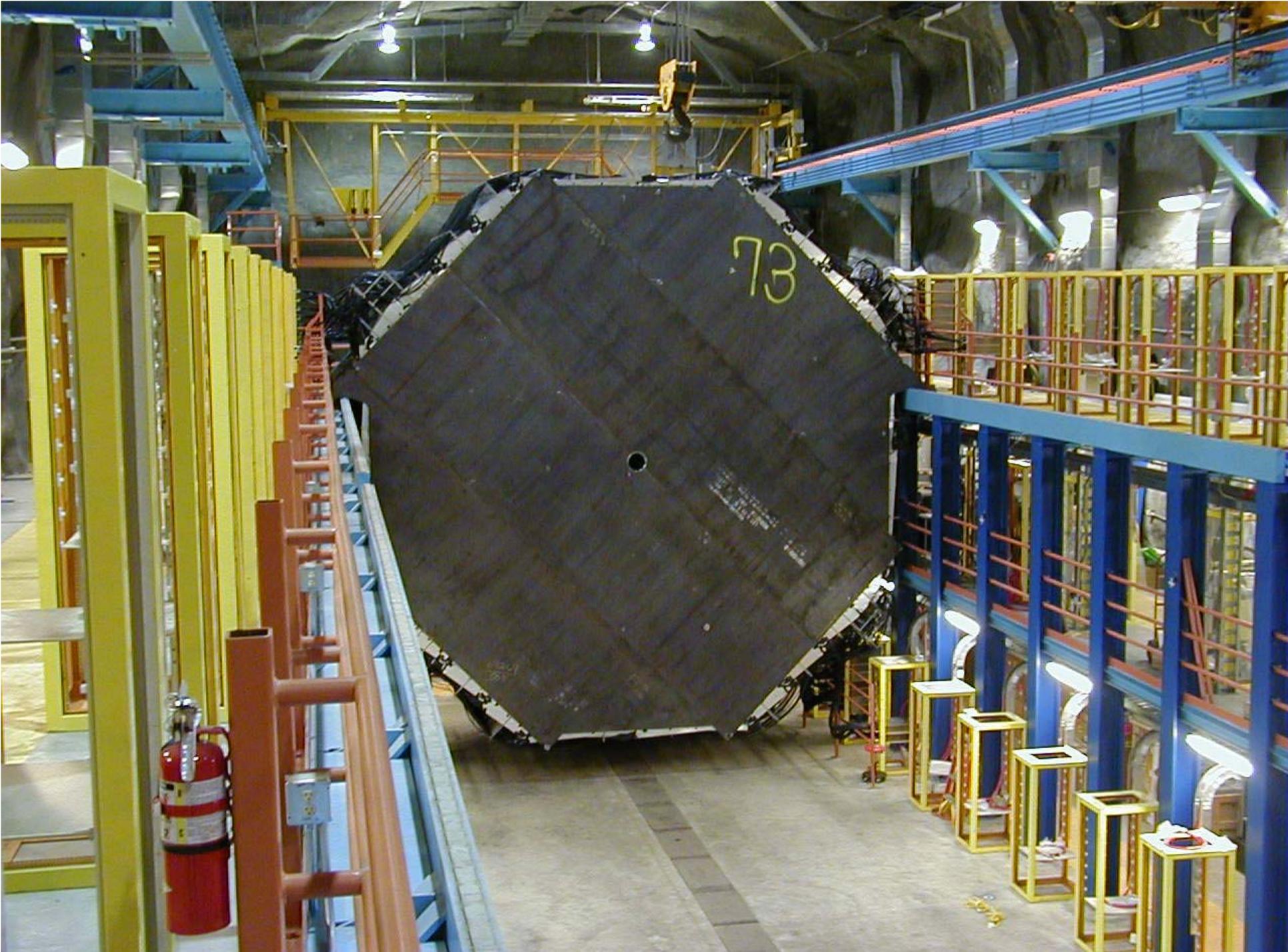
FD Plane Installation

- Plane installation status
 - > 88 scintillator planes installed
 - 36% of SM1 completed
 - 5.2 m long
 - **1.0 Kton**
 - > 76 planes reading out
 - > Material handling rates better than baseline

• This work continues slightly ahead of schedule and still accelerating

- > Installation rates have exceeded the baseline (5.5 planes per week) for the last two months
 - November 5.9 planes per week
 - December 6.1 planes per week

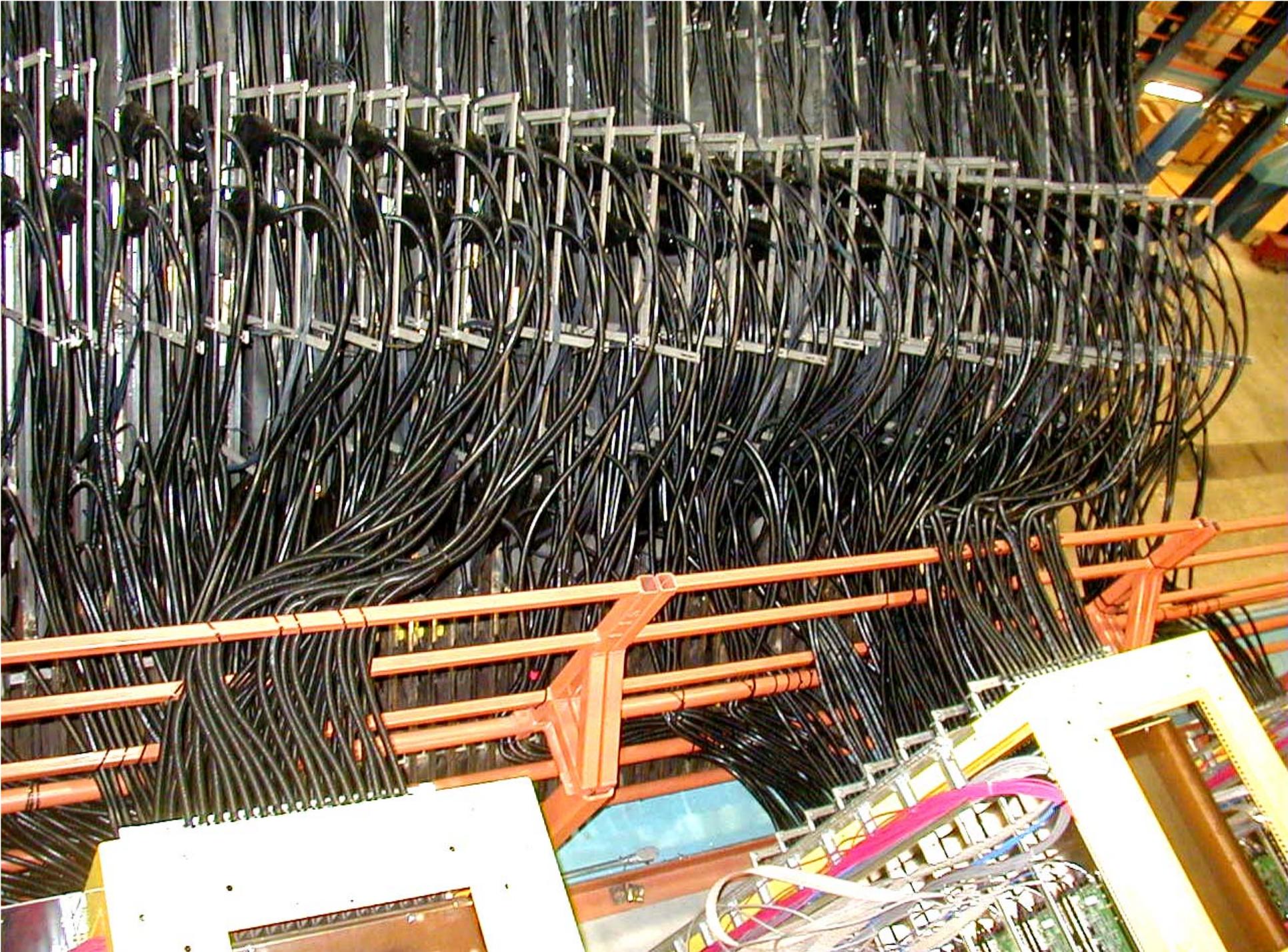




The racks are filling

This one's now
almost full too!





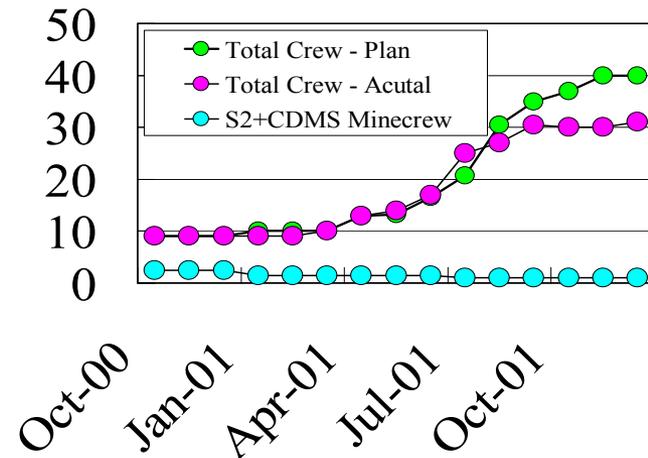
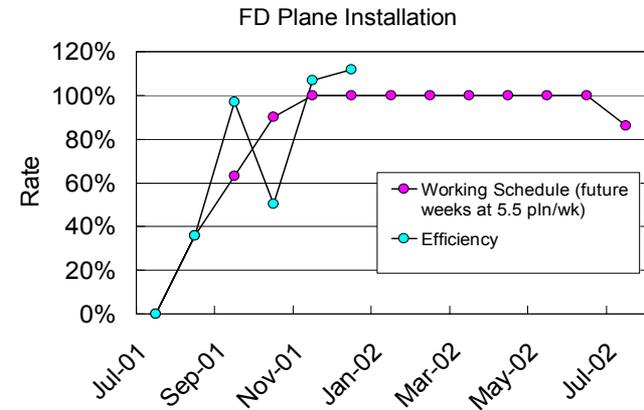


Crew Staffing

- Plane installation crews are 5 people
 - Boss, welder, 2 assembly techs, and a "floater"
 - Floater helps with workstation, testing, survey, & cabling
 - 3 workstation crews
 - Total of 15 (+1 floater for coverage of sick and vacations)
- Materials handling and receiving crews are 3 people
 - 2 operators & a lift coordinator for shaft operations
 - 3 crews (day receiving, evening surface & evening underground)
 - Scintillator sorting and handling
 - Total of 10
- Operations/Facility
 - Supervisor, coordinator, sys. admin. , admin. assist., janitor, & CDMS
 - Total of 6
- Total of 32 (currently one floater short)

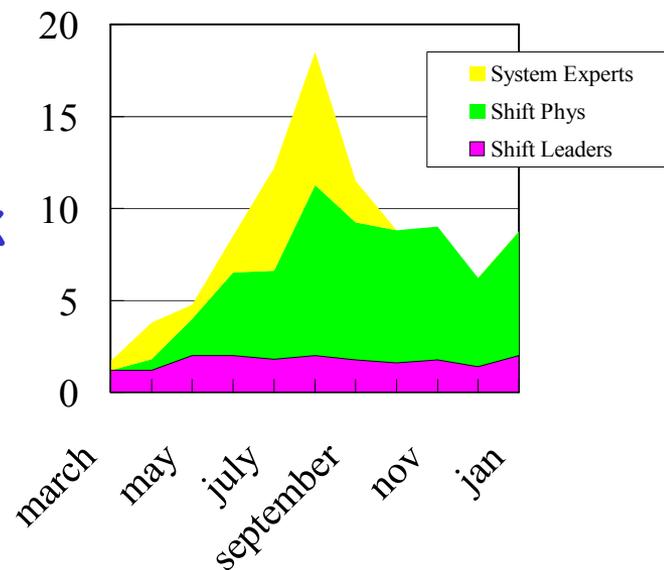
Comparison of Actual Installation to Baseline

- Plane 30 completed on 10/16
 - On schedule (even after the strike)
- Plane 64 completed on 11/30
 - Filled 2 VMEs rack in each quadrant
- Plane 80 completed on 12/13
 - Slightly ahead of working schedule
 - 6 weeks ahead of the baseline
- Mine crew effort is 9 FTE fewer than budgeted (31 vs 40)
 - We have planned on one more hire this year
 - Should provide some savings this fiscal year



Physicists at Soudan

- Made the transition from experts to long term visitors
- Currently 9 FTE of physicists covering nine 10-hour shifts/week
 - > Averaging couple visitors per week
- The first wave of long term students starting to leave
 - > Thanks Chris, & Brian (sniff!)
 - > Bernie, Ben, Igor, Jeremy, Sergey, Yan, and Tass are still on the hook
 - > Andre and Rob starting their tours this month
 - Andrew starts tour #2 this spring!
- Bob, Dave, Tim, and Louie still there



Soudan Physicist Effort: Looking Forward

- We have our shifts covered through May
- After that there are still slots needing to be filled by long term visitors
 - ~3 FTE slots open starting at that date
 - Please start planning the stays with your graduate students with us
 - These slots are open through the end of installation in the summer of '03 & into operations
 - Longer range planning is welcomed!
- People interested in learning more about the installation process, detector readout, or those wanting to look at the data first hand are welcome for shorter visits
 - Some very useful trips by experts over the last couple of months



Shifts & Access

- DNR shaft maintenance is going slow
 - › They are replacing ~30% of the rail in the shaft we use for materials handling
 - › Likely to continue until spring
- Doesn't affect
 - › The crew... they work four 10 hours shifts
 - › The installation rate is unaffected
- Does affect
 - › Access times: limited to shift changes
 - 7:15am (down), 5:30pm (down/up), 3:30am (up)
 - › Material Handling: one week in three we can not move scintillator and steel down the shaft
 - We can store enough steel underground for 8 planes - no big deal
 - › Physicist shifts: Two weeks out of three we have no physicist access on either a Monday or a Friday day shift
 - Check the installation calendar for the details in any particular week

Safety Record at Soudan

- Our first lost time accident occurred last month
 - > Sprained elbow/wrist when a drill caught rebar while drilling a core hole for a temporary CDMS clean room
 - The switch was faulty and did not turn off when released
 - > The first in the mine since '95
 - > Only lost time accident in 82,000 hours worked since beginning of the project
- No safety incidents with physicists in 450 physicist-weeks worked at Soudan in 2001

Safety Walk Through

- The FNAL PPD Safety Committee walked through the lab and provided a list of comments and recommendations
 - "Very impressed with the general appearance of the MINOS cavern."
 - Materials handling singled out: "An experienced group of workers is currently doing an excellent job."
 - Unattended operation recommended after RPS units operational
 - Safety records and training "complete and well organized."
 - Fire, egress, protective equipment & fire protection
 - "Commensurate with level of hazard to which workers and visitors will be exposed."
 - 18 recommendations - about two thirds enacted so far
- Final Minnesota code review set for later this month

Recommendations & Status (I)

1. VME rack power lugs not strain relieved (rectified)
2. Low voltage panels on HV supplies off (To be done, TBD)
3. Screws placed on the side lips of HV supply (rectified)
4. Power cables through unprotected holes in racks (in progress)
5. Old erection procedure in Standard Operating Procedure handbook (TDB)
6. Approve a procedure for lowering planes (rectified)
7. Consider a second skyjack (under debate)
8. Lift modules with 2 people to reduce risk to modules (not accepted)
9. Module spreader possible trip hazard (rectified)

Recommendations & Status (II)

10. RPS units must be operational for unattended operation (agreed)
11. Maintain electronic documentation of training records (existed but not presented to reviewers)
12. Remove door on emergency exit (rectified)
13. Place unused breaker in the off position (rectified)
14. Replace flexible power cords with fixed wiring (in progress)
15. Abandoned equipment should be removed if not going to be used (TBD)
16. Stored materials should be removed from tops of cabinets (rectified)
17. Uncover partially covered HV warning sign (rectified)
18. Maintain a clear work space around electrical equipment (rectified)

Other Activities



Unfortunately Joe had triple bypass surgery and the art is on hold for at least a couple of months

Far Detector Data Collection

- Topics
 - > Run coordination
 - > Data collection
 - > Current issues
 - > Plane check out
 - > Running planes
 - > Data check out

- » Lump of coal

Run Coordination

- Who?
 - › I am the Run Coordinator (RC)
 - › Tass Belias is the Soudan DAQ Coordinator (SDC)
- So what's that mean?
 - › We talk a lot
 - › Tass does all the real work!
- Tass and I can both field requests
 - › Email to both is best
 - › RC sets the priorities, defines procedures, & staffing
 - › SDC executes the plan & coordinates with operators/developers
- Planning usually defined at the daily level
 - › Currently putting higher priority on diagnosis and development than on exposure

Running Issues

- Unattended Operations & FEE Noise
 - › Approved for unattended operations when RPS units are functional for all powered VME racks
 - › Lab is staffed ~50% of the hours in a week
 - › First Rev2 RPS box at UMD
 - › Should be installed next week - hopeful it will solve our noise problems
 - › 3 more being fabricated (Rev 3)
 - › Need 6 after mid February to have full operations
- Runs currently focusing on
 - › Subsystem commissioning (LI is top priority)
 - › DAQ upgrades & development
 - › Plane commissioning runs
 - › Noise abatement
 - › Plane trigger data at a lower priority for the next month or two
 - About 10 hours at high thresholds in the last few weeks



PPP = Plane Check Out Procedures

- This group has been working since October to prepare standard procedures for commissioning new FD planes **using the DAQ**
- The group is made up of
 - › Tass Belias, Roy Lee, David Petyt, Brian Rebel, Chris Smith, and Jeff Nelson (Dave Ayres and Geoff Pearce too)
- The results will be
 - › Transfer of knowledge
 - A set of tested and documented procedures
 - Check sheets for future work for QC
 - Feedback to the DAQ group on the functionality of the DAQ system
 - › Reduction in pre-installation testing
 - Modules are the only thing we can't fix after installation
 - Currently, we only test modules in Soudan for light leaks
 - Other faults low enough that post-installation testing saves time

Had a 2 hour session at this meeting

- > Overview of plane check out plans (Nelson)
- > Status and plans for the DAQ to accommodate requirements (Belias)
- > MUX box check out (Rebel)
- > Pedestals, Singles, & LI check out (Roy)
 - LI in calibration session too (Smith)
- > Online monitoring update (Petyt)
- > Wrapping it up: PPP planning (Nelson/All)
- > The future: Data Certification (Nelson/All)

Plane commissioning steps (I)

- Planes are commissioned in groups of 4 for light tightness reasons
- Hardware inspection
 - > LI cables & pulser boxes (Chris)
 - > Readout cables (Brian)
 - > Light leak tests during HV ramp up (Brian)
- Database and HV tables updated (Brian)
- Pedestal Run (Tass, Roy)
 - > Spot dead chips/boards/cables
 - > First and most basic check

Plane commissioning steps (II)

- Charge Injection (Roy)
 - › Check of electronics
 - › Observe gain and nonlinearity for each electronics channel
 - › Does not test anode connectivity
- Null Trigger (Roy, Sergey)
 - › Test of anode connectivity and rates
- Dynode threshold scan? (Roy, Tass)
- Light Injection (Roy, Chris, Ryan)
 - › Verify light injection mapping is correct and working
 - › Check transmission of optical fibers (WLS and clear)
 - › Measure nonlinearity curves (combined PMT+ VA chip)
 - › Measure single p.e. peak for each channel

Plane commissioning steps (III)

- Issues

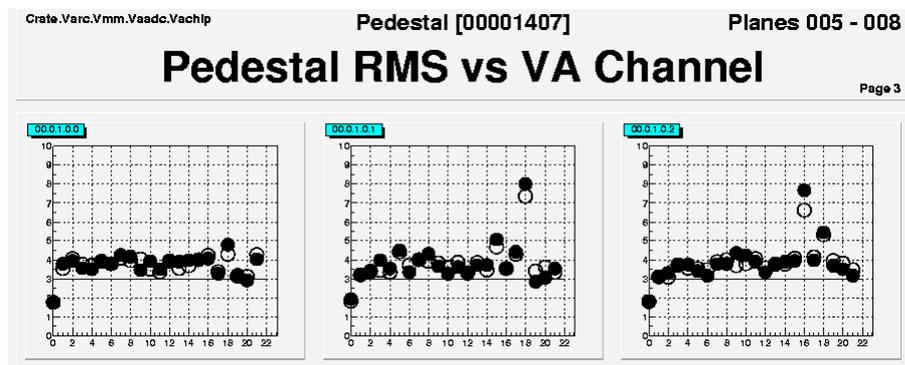
- > LI rates low (~50 Hz) due to singles rates
- > Can only take singles data with a single tube due to rates
- > Needs more work
 - Define low light level parameters
 - Look at PIN diode pulse heights
 - Incorporate known LI parameters via data stream
 - Check maximum rates with VARC trigger
 - Needs RPS for communications - only 1 running on one side
- > Dynode scan on hold until noise solved

Results and Plots (I)

- Cable/Box Light Leak Testing
 - Tests to see light leaks as we ramp up HV
 - Have seen some biggies but most small
 - Most can be rectified based on visual inspection

HV	Frequency Band On (Hz)[noise]	Frequency Band Off, Light (Hz)[noise]
-675V	0	0
-700V	10	<10
-725V	20 [20]	20 [20]
-750V	160 [20]	280 [50]
-775V	1000 [50]	1600 [100]
-800V	3700 [100]	5000 [200]

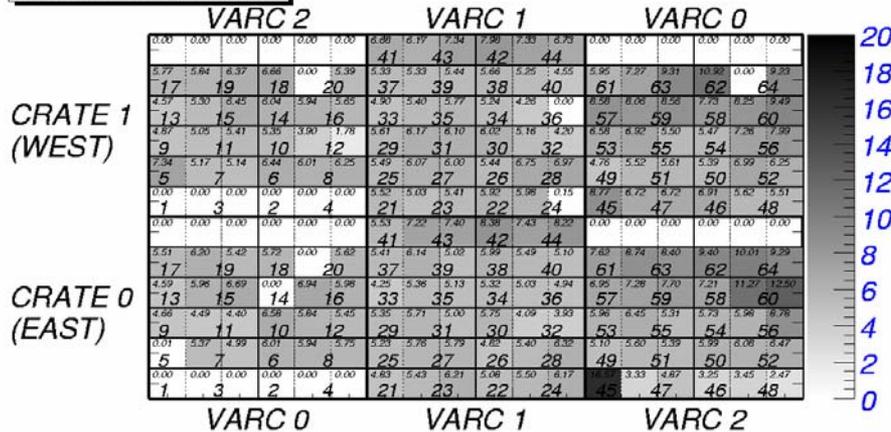
- Pedestal Runs
 - Check by channels for problems and compare RMS to a fit to look for biased runs



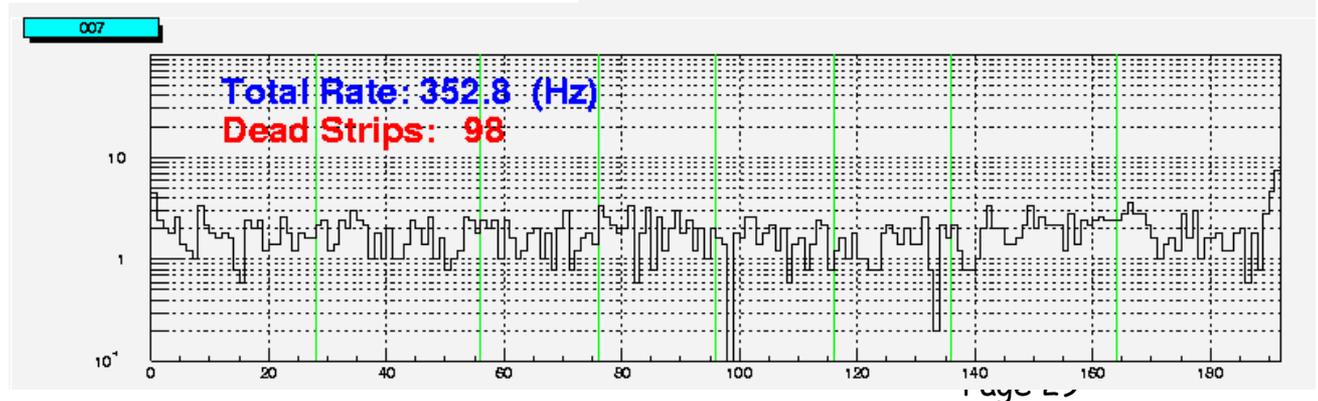
Singles

- Diagnostics for dead & hot channels

Singles rates, kHz/chip, run1787



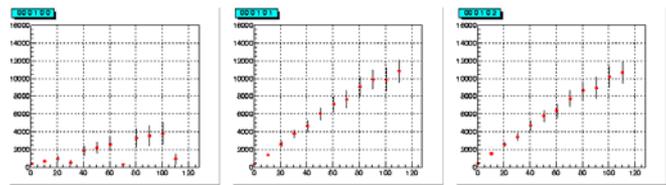
Null Trigger [00001410]
Coincident Rate vs Strip



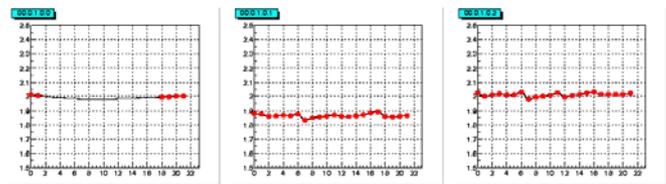
Results and Plots (II)

- **QI**

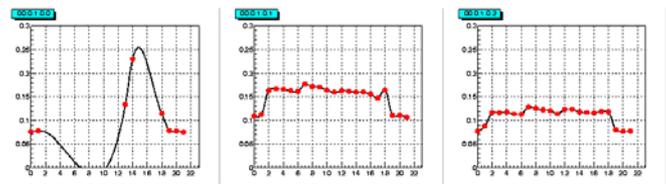
Crete.Varc.Vmm.Vaado.Vachip Charge Injection [00001520] Planes 005 - 008
Pulse Height vs Injected Charge Page 1



Crete.Varc.Vmm.Vaado.Vachip Charge Injection [00001520] Planes 005 - 008
Gain vs VA Channel (fC/ADC) Page 2

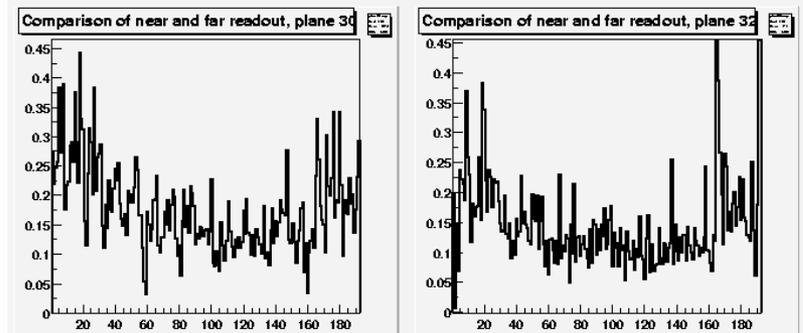


Crete.Varc.Vmm.Vaado.Vachip Charge Injection [00001520] Planes 005 - 008
Nonlinearity vs VA Channel Page 3



- **LI**

Look at Ratio Near/Far as a function of strip at a low light level:



Bottom line on this in the calibration summary!

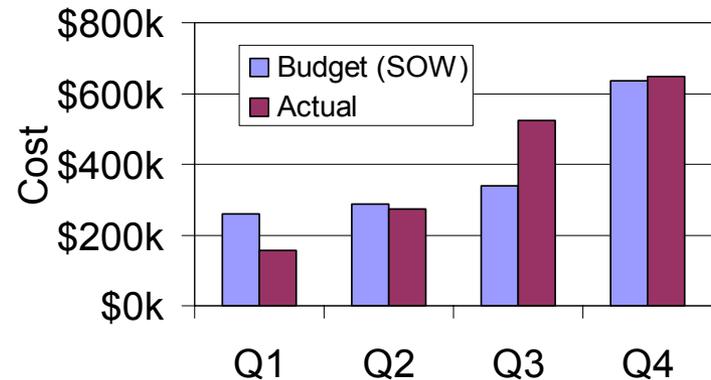
Certification of Collected Data

- What should we be checking on a run by run (or shift by shift) basis?
 - › Have the pedestals drifted?
 - › Have the hot channels changed?
 - › Have the dead channels changed?
 - › LI OK?
 - › Are the muon rates constant over the run?
 - › Are the hardware triggers constant over the run?
 - › Timing consistent with previous runs?
 - › Look at some displayed events
 - › Environmental data OK?
 - › Data being logged to FNAL?
 - › Upward muon filter (?) with an alarm?
- What's missing and what's not worth the effort to check routinely?
- Most exists but it needs to be formalized and documented

FY01 and FY02 Budget & Operations

- FY01's bottom line... Good news
 - > $\Delta_{(\text{Spent}, \text{SOW})} = \80K (~5%)
 - > Under spent on manpower
 - > Spent M&S at WBS levels (which is higher than SOW)
- Out year operations budget planning well underway
 - > Detailed planning for when funds end
 - > Project Op's \$s end in 9 months
 - > Installation \$s ends in 18 months
- FY02 PPD operations budget supports 3 people, no DNR costs, and no electricity costs
 - > This must change starting in FY03

Installation + Operations in FY01



FY02 Operating Budget for Sudan

On-Project (WBS 3.4)	\$ 368K
Off-Project (WBS 4.1)	\$ 345K
Total Non-Detector	\$ 713K

FY01 was... \$ 709k

Summary

- Going well
 - > Last outfitting details nearly completed
 - > Averaging 6 planes per week over the last 2 months
 - > Safety walk through went well
 - Down side: first lost-time accident
- The future is bright
 - > We will start routine data collection when the RPS unit is operational
 - > Some issues to deal with on data collection
 - Calibration results and first physics with muons in later talks