

## **MINOS Operations Notes Jul-Aug-Sep Quarter 3 2007**

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## **MINOS Operations, Jul 2, 2007**

### **Accelerator Operations**

Our lowest POT week since January 2007.

The previous weekend was bumpy for colliders, and they requested access Monday June 25. The rest of the accelerators were supposed to continue running through that access, but one problem after another came up, resulting in nearly 12hrs of downtime last Monday (June 25). Lingering problems with Linac/Booster caused them to reduce Turns several times during the week. And MI study periods took away NuMI beam for a few short (1-hr) periods; these were slip-stacking studies when the beam was not sent to the NuMI target - but we support these studies in the interest of future higher intensity running.

### **NuMI Operations**

The Horn engineering team has determined the cause of the horn piping water leaks which caused long down times last summer and fall. And knowing the cause, they have devised a cure. They will present a report at next week's AEM.

### **Detector Operations**

Control Room displays were put up on PCs at UMinn last Thursday as a test of concept for remote running.

Near Det - Coil at Forward, where we stay for the duration of this running period. Nothing beyond the usual CAPID.

Far Det - Big news was a Fire Alarm on Sunday. See report below.

During the down time last Monday, they changed the chip in crate 5-1-2-1-2, which seemed to fix the problem observed in the max and min singles rate plots. The next day however it showed up as a cold chip in the hot and cold chip plots. They re-seated the cable and it has looked fine since.

Network problems occurred earlier in the week, after an "upgrade" by the vendor last Sunday (may not be cause/effect, but it sure seems to be suspicious timing). Mostly up but glitchy. Tuesday was the worst, with many Spill-Server errors, which led to "TF buffer full" errors, which hung the DAQ and halted a run-in-progress, which wasn't noticed in the CR because of network connection problems. Mine crew also missed it, as it occurred exactly when they all gathered for a meeting. Lost 50min of beam-time.

On Sunday at around 5:00pm the fire alarm went off. The alarm said it was a Zone 5 flow sensor for the CDMS electronics room. The on call person contacted the rescue team and they were underground about 6:30pm. After inspecting the scene they came to the conclusion that it was a false alarm, caused by a faulty sensor. They could not clear the alarm without replacing the switch, which requires vendor technicians. After discussing the situation with the Simplex they put the shunt trip in

bypass mode, which was the only way to maintain AC power to the CDMS fire panel and also shut off the alarm. Enabling the bypass meant turning off the CDMS electronics racks (if they smoke, the shunt trip would turn them off, preventing spread of fire - but not if the shunt is bypassed). CDMS stayed cold - just no detector readout. The MINOS side of the Lab had all power restored, and the detector was turned back on, and reading out normally by 11pm.

An electrician and fire alarm technician are servicing the equipment Monday, and CDMS is expected to be taking data again by Monday evening.

## **MINOS Operations, Jul 9, 2007**

### **Accelerator Operations**

Wednesday will see a 2-shift CDF access. There will be an anti-proton Stash in the Recycler, so no Main Injector work is planned. Booster however has asked to install the 1st of a series of correctors. The series is due for installation during the Shutdown; by doing one of them early they gain experience and an opportunity to correct procedures and tooling, and also make better time/labor estimates for the Shutdown, when tech time is at a premium. They will also be able to test the new magnet.

### **NuMI Operations**

The Horn engineering team has determined the cause of the horn piping water leaks which caused long down times last summer and fall. And knowing the cause, they have devised a cure. They will present a report at next week's AEM - not today's as reported last week.

Bids for the Shutdown Target Hall work come back today (Monday Jul 9)

**\*\* Friday Update \*\***

As per request from Nu-e analysis group, we turn the horns OFF for special runs - expect to remain horns off through next Tuesday morning.

### **Detector Operations**

Near Det - A Master board appears to have gone bad - occurred just last night (Sunday). Experts decided to leave it out of the DAQ configuration and run in Test mode - **\*\*note\*\*** there is nothing on the RC which allows one to determine if the current run is Test Mode - it just says Physics, same as the normal 24-hr sequence. The Master board will be replaced when more people are around Monday morning.

Far Det - After recovery from last week's fire alarm and associated power outage, one crate, 15, came back up with more noise than it had previously. No visible extra noise on the 6V reference PS, so it's not that. Now suspect the VARC, which they plan to change out. Wednesday will offer an opportunity to futz with this.

**\*\* Thursday Update \*\***

Much futzing was done, but with no resolving of the noise problem.

Also expect Wednesday to be a good day for Lisa to get her special LI data. --> Did one more small run to confirm the configuration set-up. The long data-taking will be done during the Shutdown.

## **MINOS Operations, Jul 16, 2007**

### **Accelerator Operations**

Tuesday-Wed will see about 24hrs of running slip-stacked to the NuMI target, at as high an intensity as possible. The MI group wants to see how Operations handles this running mode when no experts are around.

\*\*\* Tuesday 9am Mtg \*\*\*

There is a leak within the Target Hall, at 3gal per day. It is under the shielding, originating out of the Horn-2 RAW system, and dripping into the Target Cave. We can top off the tank once or twice per week and run. But the Director wants a clear picture of the tritium circulation in the Target Hall system over a period of 2-3 weeks. Currently the MINOS Sump sees 8mcur per day, and the leak might disturb that to the order of 2milli-curies per day. No reason not to run the slip-stacking for a few hours - they won't go for 2+ shifts. No additional Hall access needed, unless we decide to continue running past the slip-stacking study. Mike Gerardi says this leak is enough to mess up the baseline measurements, and is large enough to declare it a radiation issue. A lot of effort goes into the tritium measurements - twice per week while we are running, and 2 measurements per day over 2-3 weeks after beam is turned off. They are setting up a program with the lab which counts the sample rates to get a good turn-around on the data.

Rob argues that given the amount of the leak, into the warm Cave, it is likely mostly evaporating, and being collected by the dehumidifier - is it enough to matter? Mike G says yesterday's measurements from collector locations indicates a rise in radioactivity, so perhaps the leak is indeed visible. And that is bad for the tritium measurements.

Decision is made at this morning's 9am meeting. After today we are turning NuMI beam off. We get ~4hrs more horn off standard running, and after that the MI group gets another slip-stacking study, during which we continue to take data. Then we are off.

### **NuMI Operations**

The Horn engineering team has determined the cause of the horn piping water leaks which caused long down times last summer and fall. And knowing the cause, they have devised a cure. They will present a report at today's AEM.

As per request from Nu-e analysis group, we turn the horns OFF for special runs - expect to remain horns off through Tuesday morning.

Unfortunately, one of the horns sprung a water leak late Monday morning. It is probably just a coincidence with the horns-off running, says Jim Hylen. No beam to NuMI for much of Monday afternoon to determine exactly where and how bad the leak is.

**\*\*Update late Monday \*\*** The leak is slow, but it is there. It's not in the RAW Room or any "above shielding" location. After various measurements, they resume beam around 4pm Monday, still in Horns Off, and run like this through Tues morning. Further inspection of water levels in various parts of the system after running overnight will tell the experts if the leak is in the horn water lines or in the horn collection tank. At any rate, the leak is slow and it is possible to continue running, Jim says.

But in the above Accelerator Ops report, you read about the discussion resulting in our early turn-off.

### **MINOS Operations**

Near Det - Had a whole minder go bad Sunday evening, located at the downstream end of the Calorimeter. Because nu-e events won't generally go that far, and because TingYun wanted to minimize detector down time, we left it until Monday morning so the fast-change experts could handle it. --> Changed early Mon am. And then another whole Minder went out Mon evening and TingYun took care of that.

Mark Dorman has updated the Data Quality Plots page. Also has been looking at the cause of the higher PH data for 2 weeks in April - appears to be un-associated with any hardware changes. After some email discussion, Peter Shanahan identifies an electronics failure mode which would have the observed signature, and would NOT trigger any error bits - therefore passing under the radar of the OM checks, other than fairly subtle changes in specific plots. He suggests a new plot with appropriate selections for this error mode be added to the OM.

**\*\*\* Wednesday \*\*\*** Jeff Nelson and others arrive to do their planned Near B-field measurements. They will be taking these measurements Wed-Thurs-Fri.

Far Det - no resolution of the noise problem on Crate 15. And now another VMM in there looks bad. Since we are doing Horn-Off today (Monday) and that is of interest in the Near Det data only, the Far Det gets today's Soudan shift to try and work on the Crate 15 problems.

#### *Report on Crate 15 work done last week - from Curt:*

We worked on crate 15 on Wednesday, July 11th. We tried to install some of our spare varcs with the original VMM's in that crate, but when we did this we could not get the ROP on crate 15 to reboot. As soon as we put the original varc back in crate 15 the reboot worked. We then took the Master Clock off of the original varc and installed it on one of our spares and then we were able to start a run. But after looking at the test run it was noted that this did nothing. So we put the original varc back in place and started swapping out the VMM's one at a time. We did this for four of the VMM's and then we ran out of time. None of this helped our singles rate for Crate 15. Doug checked all of our spare Varc's on the mini DAQ and they all had the

latest version Master Clock, which is 108 or 110 except for one that was labeled 109. I'm still very confused on why our spare varc's would cause this problem.

*More explanation, after more tinkering Monday afternoon -*

Crate 15 VARC 2 is showing up very high in the singles rate. Since last week we tried new VMM's on the old VARC, old VMM's on a new VARC and then we put in a new VARC that had all new VMM's. We couldn't start the run on the two new Varcs until we installed the original master clock on those particular VARCs. For some unknown reason we are unable to start a run with our spare varc's and the master clocks that are installed on them. After all this changing of parts, the singles rate still remained high. We also swapped the 6 volt power supply and that didn't help anything.

Any suggestions?

\*\*\* Wednesday Update & Problem Solved \*\*\*

Today we finally isolated the problem to its source and swapped out the PMT base for channel 15-2-0-0-1. All other hardware (PMT down to VARC) has been restored and is now the same as it was before this noise episode began -- only the base is new. We are working to populate the following JIRA issue with the relevant information.  
<http://minos-om.fnal.gov:8080/browse/MFD-269>

## **Message to Collaboration on early Shutdown**

It's with some sadness that we have to inform you that we expect the NuMI beam to be shut off at the end of today's day shift (Tuesday July 17) and not to resume until the end of the shutdown period (about October 10 *but turned out to be Nov 16*).

As you know, our NuMI beam has continued to produce tritium in the water pumped out of the complex, although at a much reduced rate over the unmitigated values. It is unknown how much of this tritium forms a long-term storage problem, and how much is "prompt", e.g. goes away when the beam is shut off. The only real way to test this is to have a period of 2-3 weeks when the beam is off, but the target hall remains sealed and in its "running" condition.

We had been hopeful that the work planned for the Target Hall in the first weeks of the shutdown would be performed in such a way as not to affect the measurement - this has proved a tough point to prove, and various voices at the Lab had been advocating turning NuMI off a week or so before the scheduled start of the Shutdown. In addition, and most importantly, Horn #2 developed a water leak yesterday, apparently similar to the problems we had before, which will drain tritiated water into the target chase and modify the conditions for the tritium cool-down measurement. This proved the last factor that led to the recommendation that we shut down now, so that the measurement can be done before we tear into the Target Hall ventilation system to install the next round of (you guessed it) tritium mitigation.

We argued strongly that we needed to complete our current round of horn-off running and also that the next round of slip-stacking studies be done before the beam is turned off. It was agreed that these could be done in the course of today (Tuesday July 17). We were unable to argue successfully for further running beyond this. We were hopeful up to the development of the water leak that this step would not be requested of us.

From the practical point of view, this represents about a week and a half of running at normal intensities, before they would have begun to gradually turn us off anyway. It means that we should schedule any additional desired low-intensity runs at start-up after the shutdown.

Cat has indicated to everyone scheduled for shifts up to the nominal start of shutdown that all shift credits will be awarded for canceled shifts.

We want to thank each of you for the efforts that you have put into this year's running which is beginning to bear fruit.

With warmest regards,  
Rob and Stan

## **Shutdown Status, August 31 2007**

The installation of collimators in the Main Injector is on schedule. These devices will allow slip-stacking to NuMI to become the normal mode of operation after start-up.

The upgrades to the Target Hall air handling/dehumidification units is proceeding mostly on schedule. The contractor will finish work within the Hall on Sep 28. After that date the target cave can be opened for a survey of the target location. Also any required repairs to the Horn-2 water system can proceed at that time. *[This work ran into unforeseen difficulties during September and was extended into late October]*

The Horn-2 suspected water leak is actually be an air leak in the water suction line. The leak is at the ceramic insulator as had been suspected. The good news is that this line can be repaired -- it is the same part that was replaced during the spring 2006 shutdown. Horn-2 is out of the Target Chase and sitting in the Hot Cell; however repairs will not commence until after the air handling work is completed.

A re-evaluation of the strength of the upstream decay pipe window has been performed, which adds the effects of the acidic Target Chase environment - previously unaccounted for - to the effects of beam on metal fatigue. The expected life-time of the this aluminum portion of the upstream window has been reduced from initial design expectations, and reduced enough to be a cause for concern. For continued guaranteed safe access to the Target Hall, the Decay Pipe will no longer be operated under vacuum, but will instead hold helium at or near atmospheric pressure. There is no piping yet in place to run a fill-line for helium into the Decay Pipe; work is in progress to get a filling system installed so that NuMI can come up at the end of the Shutdown in October.

On a longer time-scale, a system for recirculation will be installed.

Upgrades to the Near Detector MENUs is in progress. The upgrade installs re-settable fuses and is expected to solve 90% of CAPID errors by means of power-cycling rather than a board-swap. DAQ upgrades were installed at the Far Det during August and will be done at the Near Det in September.

## **MINOS Run Plan Summary - Pre-Shutdown, April – July 2007**

These Notes archive the dates and types of special Runs which were done close to the end of the 2006-2007 operation period.

### **Run Plan**

The target was positioned at pLE for the entire 2007 portion of the running period. A survey verification of the current target location will be performed during the Shutdown.

### **Special Runs Schedule**

Normal pLE running occurred in any of the gaps in the dates below.

- April 27-May 4 : ND reverse field running (1st week), followed by ~1wk normal field.
- May 10-11 : ND BDot studies, daytime hours.
- May 11-18 : ND reverse field running (2nd week).
- May 19-22 : problems with ND coil interlocks - coil tripping off - ran Coil OFF until experts could fix it.
- May 22-30 : Forward field running
- May 30-June 6 : ND reverse field running (3rd week).
- June 6+ : ND forward field.
- June 14 : Modified the NuMI beam tune to produce a 1.2mm spot size at the target, to allow the MI group to perform slip-stacking studies at any opportunity. This beam tune remains in place for the remainder of this period, and will also be the beam tune we come back up with after the Shutdown. No change in run conditions for the Detectors.
- early July : we have a spare target in hand as of July 2 or so. We can allow increased intensity, up to  $4.6E13$ , to NuMI target. The Main Injector group requested a few daytime shifts of slip-stack multi-mode running, delivering this increased intensity to NuMI. One study was completed on July 12. A 2nd study was completed July 17.
- July 13, 14, 15, 16, 17 : Horns-Off running, normal intensity. Per request from Nu-e analysis group.
- July 17th 6pm : Shutdown starts for NuMI. During the Horn-off running, a water leak is detected in Horn-2 water system. See the Shutdown 2007 Note for details.
- July 18, 19, 20 : ND BDot Coil data-taking, during regular working hours. Near Detector normal data-taking is turned off during this work. (Far Det cosmic data-taking continues).
- August 5 - 9am : Accelerators turn off. Shutdown starts.