

## **MINOS Operations Notes Apr-May-Jun Quarter 2 2007**

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## **MINOS Operations, Apr 23, 2007**

Apologies for a couple of weeks of no Operations Notes. Your humble logger took some vacation, and then attended the Athens mtg, with the usual associated traveling end effects on both of those; there is no designated replacement for this job if I'm not here to do it (not yet anyway). No big issues or problems during that time. See the AEM presentations for beam delivery for those weeks.

### **Accelerator Operations**

The weekend was not so good for the colliders but OK for NuMI. MI has had some instabilities in their RF acceleration system, making for some problems for NuMI - see below.

\*\*\* Tuesday Update \*\*\*

PBar has been granted it's day of reverse-proton studies, which has been on the request list for a few weeks. Taking time to do this had to fit in with the collider Store status. At any rate, this means a day-shift of NuMI-only running. In response, Main Injector was approved to do 11-batch slip-stacking studies, sending beam to the NuMI target. They have been doing these studies every week - did one yesterday - but sending beam to the Main Injector dump, because they cannot send more than  $4.0E13$  to our target. Yesterday they set a new record,  $4.61E13$  with 92% acceleration efficiency.

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

A glitch in the MI RF system trips off their radiation monitors, and keeps us off for nearly 2 hrs.

### **NuMI Operations**

There have been more-than-usual-number of trips of the NuMI Beam Permit system for the past week, which causes a spill or three to be missed but in general the Beam Permit resets with no problems. More than half of the Permit trips were due to the presence of beam in the Kicker Gap - the "hole" in the beam bucket structure within the Main Injector which allows enough time for the kicker to rise from zero to full field. Any beam in this gap would get spewed around the MI enclosure when the kicker field comes up, so in effect the Permit is preventing a radiation trip. Causes are back upstream in the way beam buckets are packed into the MI and then accelerated by the RF. The remainder of the Permit trips were due to unstable beam sent down the NuMI beamline, having it spewed about and tripping off our Loss Monitors. We have a "Beam Loss Budget" - over a year's time we must remain below some accumulated amount of beam lost in our beamline, and we get shut down if we go over that limit; this is linked to ground water activation limits. We want to understand what is causing the problem in these cases, and fix the problem. At present the instable

beam is traced back to MI RF problems, but only as a general trace-back; the experts do not understand the details.

\*\*\* Tuesday Update \*\*\*

Slip-stacking study today to the NuMI target - means a period of data with the beam at an increased spot size. Data runs were re-started to segregate this data, and the runs added to our Special Runs list.

### **Detector Operations**

Detectors humming along.

Far Det - has some Network hardware to swap in/out, and need about an hour of beam-off time to perform the work; but there is no rush.

Near Det - boards with CAPID errors have been allowed to accumulate due to lack of spares. Finally heard back from Gary today, who apologized for the dearth of boards - he has been on vacation and there is no other regular courier between Argonne and FNAL that he utilizes to transport boards.

## **MINOS Operations, Apr 30, 2007**

### **Accelerator Operations**

A Sunday evening thunderstorm caused the TeV Store to be lost but all the machines stayed up and running. The storm had no effect on NuMI, aside from scheduling - since they lost the Store the pressure is on to just stack up anti-protons and do nothing else - no studies, no short maintenance jobs. There are a few items which will need maintenance soon. A PS in the PBar area has been over-heating, and they will have to swap the PBar target within 2 weeks. The room where some of the Linac RF PS are kept lost some of it's air-conditioning; the increased temperatures in the room is causing the power supplies to be less stable, and this in turn has affected the quality of the beam coming into the Main Injector. MI has seen more frequent trips as a result, and this does affect NuMI. HVAC in Linac is expected to get repaired this week, and additional temporary AC has been installed.

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

All the HVAC problems got fixed, and there was cooler weather this week anyway. Shot Setups rotated to being done during the Day shift this week, and that meant they allowed various studies to be done between Stores, as long as sufficient p-bars were present. They allowed PBar to do requested lattice studies, twice, which took about 4hrs each and resulted in NuMI-only beam during their study. But two of these in one week has eaten into the total collider running this week, so accelerator operations will return to the usual stack/store routine.

### **NuMI Operations**

Aside from a few glitches in beam delivery, due to problems outlined above, NuMI has been running fairly well, and continued running well all week.

### **Detector Operations**

Detectors humming along.

Far Det - still looking for a 1hr or so downtime, to swap out some Network hardware and other small things - none of them urgent, but we would like to get them done.

Near Det - reversed the coil polarity Friday. Shifters became alarmed at fluctuations in the current readback. But the real mystery is why the readback was rock-solid from Mar 20 to last Friday Apr 27 - that kind of invariance in the Acnet readback usually means that the Acnet readback has frozen and is not in fact handing out the real readback. If one looks back before March 20, readback fluctuations appear identical to what they are now.

Still many CAPID errors accumulated. All the boards Gary brought last week were used up, and we need about a dozen more to catch up - the boards have not appeared yet.

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

Far Det waited all week for a possible 2hr machine downtime - which had to do with Linac - and it just didn't happen. So they are still waiting.

Near coil will be reversed back to normal today. Gary brought more boards, and the pending CAPID boards were swapped out on Thursday.

## **MINOS Operations, May 7, 2007**

### **Accelerator Operations**

Things went fairly well through the weekend until Sunday afternoon, when the Linac RF problems finally needed fixing - doesn't help the Far Det as a down time, since it was Sunday.

On Monday afternoon there was about a 1/2-hr maximum, and more like just 10-15 min, of time when TORTGT was not reading out properly.... and in fact other things were also not reading out. The problem was the Controls front-end system at MI-3; this caught the attention of the Ops fairly quickly and it was fixed within 1/2 hr and probably less.

\*\*\* Tuesday Update \*\*\*

Plans are being made to make Thursday a Down Day. The annual required Interlock Safety System tests are due by the end of this week, and these take several hours over different enclosure areas. Also the PBar target has reached the end of its lifetime, and it takes at least an 8-hr shift to change out. So the plan at present is to start the downtime by terminating the collider Store at 5am Thursday. Beam for NuMI is expected to be off until after 5pm. This schedule depends on the Stores both today and tomorrow "behaving" and running for their expected lifetimes. If today's Store is lost early for some reason, the entire Down Day could be moved to Wednesday.

### **NuMI Operations**

A Target Hall access is being planned for the Down Day. Regular maintenance of the air handling system will occur.

### **Detector Operations**

Detectors humming along.

Far Det - still looking for a 2-hr or so downtime, to swap out some Network hardware and other things - so they will finally get this on Thursday.

Near Det - normal polarity running since Friday. Gary arrived with more boards late last week and current crop of CAPIDs were swapped out. On Thursday Jeff Nelson will be here to do BDot studies on the Near field. This works well with Thursday being a Down Day - we would turn off the ND DAQ in any case.

## **MINOS Operations, May 14, 2007**

### **Accelerator Operations**

Last Thursday's Down Day went smoothly, for NuMI. However Booster problems surfaced over the weekend. At present they are coping and running fewer Turns to NuMI. There will likely be a short down-time later today or sometime tomorrow.

\*\*\* Wednesday Update \*\*\*

Booster fixed it's problems without needed tunnel accesses. Back to 11 turns for NuMI. The CDF detector has a coolant leak in it's silicon system. They had an access all day yesterday and asked for another one today. The TeV has gone into supervised access to do Worklist items, taking the opportunity. There is a big Stash in the Recycler, ready for the next Store, so that means no access to the Main Injector. PBar is taking the opportunity for more reverse proton studies. All this means many many hours of NuMI-only running, so we just sit here and take beam.

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

Down for a few hours in two instances yesterday, due to problems in Linac and problems in Booster. All fixed, and one then hopes the weekend will be smooth running as a result.

### **NuMI Operations**

Running smoothly. Got a lot of NuMI-only running this week due to CDF problems and accesses - fewer Stores meant less time spent in PBar Stacking.

### **Detector Operations**

Detectors humming along.

Far Det - last Thursday cleared out their Worklist. Got CI runs in during the beam-down times this Thursday.

Near Det - Returned to another week of REVERSE field after Jeff Nelson completed his BDot studies last Friday afternoon. Thursday daytime there was no ND data recording, while BDot studies were in progress; however during Thursday Swing and Friday Night shifts the ND continued with last week's Forward field data-taking.

-->> we will remain at REVERSE through the weekend and change on Monday - the necessary techs are not here on Friday.

## **MINOS Operations, May 21, 2007**

### **Accelerator Operations**

The weekend was good for NuMI beam running - just a couple of short downtimes due to Linac and Proton Source problems. The weekend was bad for the Colliders, due to TeV problems. That means this week they will concentrate on getting PBars stacked and Stores in the TeV. There will be few studies or discretionary downtimes approved. Early Monday the Proton Source was swapped out, and output is down 5% while it undergoes conditioning. Booster is working on Tuesday to tune 12 Turns to NuMI to compensate for the reduced Source output.

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

The PBar Lithium Lens (a device somewhat like our horns) failed around 6pm Thursday, and they had it pulled out around midnight for inspection. It will have to be replaced, which will begin around 6am Friday and last at least through Friday noon. NuMI-only running until then.

### **NuMI Operations**

Looking OK. Due to the PBar problems and subsequent NuMI-only running, Thursday has come in as the best day in terms of POT since November 2006 - 9.37 e17 protons on one day. The combination of faster cycle time and adding two slip stacked batches produces a gain of almost 50% when Pbar is down.

### **Detector Operations**

Detectors mostly humming along.

Lisa would like a morning hours no-beam time to do some calibration runs. She can take RC control to re-arrange the DAQ config with no Shifter intervention. We are looking for a real down-time of about 2hrs between 3am and noon.

Far Det - Some chiller problems on Sunday - Jerry had to kick-start the surface portion of the system, did not need an underground access. They replaced a fan as part of regular maintenance on Monday. Long period of network outage Monday morning, due to thunderstorms in the Soudan area. Detector running OK, and the Mine Crew could monitor stuff, we just couldn't see it from FNAL.

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

Further problems with the cooling loop from surface to level whatever, led to a diagnosis of a bad pump motor - one of 2 in the system. System can run OK in this cool weather on one pump while the new one is shipped.

Near Det - Coil tripped off late Saturday. Left it in Coil-Off runs, expecting the experts to take a look at it on Monday, however all the experts were taking a day off on Monday. Turned it back on around 2pm. Tripped off again around 3pm. Leave it for the experts to look at on Tuesday.

\*\*\* Tuesday Update \*\*\*

Same problem - spurious signal from the LCW skid PLC tells the coil to turn off. We once again disconnect that signal, and instead plug it into a meter which will record when some such signal occurs and we can then look at the acnet logs for the LCW system and see what was going on at that time. Don't know what to fix if the cause isn't understood. Dave Pushka notes that this bad signal seems to be more likely to occur when the system starts warming up, near when we should back-flush the HX again..... But we've been this warm in the past with no coil trips so that doesn't seem to be a consistent correlation.

## **MINOS Operations, May 28, 2007**

### **Accelerator Operations**

A shakey long weekend for the machines, again mostly affecting colliders but also spilled over to Main Injector. Main Injector problems caused anti-proton Stashes to be lost twice during transfers to the TeV. This made for smaller than desired Stores. Part of the problem is a glitch in the Timing system, and at present, to prevent further loss of p-bars, mini-Boone beam is tured off when p-bars are being transferred in or out of the Main Injector. Main Injector power supplies also had problems, which caused 6hrs of no beam for NuMI late Sunday/early Monday.

On Tuesday there are plans to get the next Shot setup completed by early afternoon, at which point there is a space of time to take a closer look at the Main Injector power supplies. Since, after the Shot, the Recycler is generally empty of p-bars there is also an opportunity to make a MI tunnel access if that is also necessary.

### **NuMI Operations**

There was a large beam loss spike on Sunday, caused by a single instance when the Main Injector RF tripped off during flattop - the 20 microsec when beam is sent down the NuMI beamline. This caused the longest NuMI specific downtime in several weeks (~1 hr), while permits and such were checked and reset. The RF people are preparing a fast signal to input to the NuMI beam permit system which would veto extraction when such a trip occurs - but it's not there yet.

### **Detector Operations**

No Monday meeting, because Monday was a US holiday. Detectors mostly humming along. Lisa did her Singles calibration runs with the Far Det last Friday, when the beam went down for 6hrs or so. No problems reported by shifters for the Far Det over the long weekend.

Near Det - A board produced massive quantities of errors starting Tuesday morning - made the rate in that crate so high that none of the other boards in the crate could get read out. Swapped out as soon as experts arrived a couple hours later.

## **MINOS Operations, Jun 4, 2007**

### **Accelerator Operations**

OK running through the weekend for the machine complex. There were a few problems which developed, primarily in the Source, Linac and Booster, but all were repaired without very much downtime - repairs more often involved changes/fixes to hardware outside of the tunnels.

The leak in the Main Injector RF cavity cooling has been getting worse, but still is not at enough of a level to induce a scheduled downtime. They will deal with it by filling the water system reservoir twice per week or as needed.

### **NuMI Operations**

A good week for us.

### **Detector Operations**

Detectors humming along.

Far Det - Looking for an hour or so of downtime to change a base. Start thinking about that MI RF leak getting worse, and maybe it will actually happen. Seems to be the only NuMI beam downtime on the horizon.

Near Det - no issues. Coil at REVERSE. We will go back to Normal Coil field on Wednesday.

## **MINOS Operations, Jun 11, 2007**

### **Accelerator Operations**

Linac developed RF problems during the weekend and has asked for a few hours of downtime sometime during the week to do more than just the quick fixes to keep things running. Booster has been running well since it's minor maintenance time taken last week. The leak in the Main Injector RF cavity cooling has been getting worse, and they expect a downtime will be scheduled this week to locate it and determine how easy or hard it is to fix (if easy they will do it right away). The Shots are currently occurring during Day shift, so the above fixes would be scheduled right after a Shot Setup, when the Recycler ring in the Main Injector tunnel is emptied of anti-protons.

### **NuMI Operations**

A good week for us. The larger spot size was not implemented last week as the Booster problems reduced Turns and intensity, and this introduced minor beam tune issues. Decided to leave things alone until the upstream machines are running better. Will go to this spot size early this week.

### **Detector Operations**

Detectors humming along.

Far Det - no pending issues.

Near Det - Coil at Forward, where we stay for the duration of this running period.

## **MINOS Operations, Jun 18, 2007**

### **Accelerator Operations**

A bumpy weekend for colliders - there were problems with both the PBar and the MI kicker magnets which affect collider operations. Very little down time for NuMI, and we got additional NuMI-only running when the PBar problems were being repaired.

### **NuMI Operations**

The larger spot size was implemented last week after the Thursday down time last week. We will remain with this beam tune for the duration of this running period, and on into the next running period.

The NuMI Kicker now gets an abort signal from the Main Injector RF, such that when any one of the RF stations trips or glitches then the NuMI Kicker will not fire. These MI RF problems cause the beam to be slightly off-orbit, and when that slightly errant beam was sent down the NuMI line it scrapes, causes losses, and frequently trips the beamline due to the losses being too large. Total cumulative losses in the NuMI line, recorded over the course of a year, are limited to be below a certain value - this is to protect the groundwater from being activated. So we always want to prevent losses from occurring if there is a means to detect when conditions might make bad beam.

### **Detector Operations**

Detectors humming along.

Far Det - ROP 6 went into alarm, via resetting the whole Branch. Shifter called Soudan On-Call for assistance. Sunday morning the DCS page went into warning with crate 13 showing the +6 volts problem. Jerry and Curt went underground about 1pm and changed the fuse. Same thing happened last month but on a different crate.

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