End Week 28 (July 18th 2010) – Status of the Accelerators

PS Booster

After another series of re-settable faults on Monday night, the MPS finally went into fault and refused to be reset around 07H30 on Tuesday morning. A meeting with the magnet and supply specialists (A.Newborough & M.Veenstra) concluded that a machine access would be required to check all magnets, with and without the machine pulsing. Although a very small amount of resin was noted leaking out of a power connector on BHZ62, nothing obvious was found. By 12H25 the machine was restarted, as no link could be found to the trips.

By 15H30 the MPS was tripping again with a ground fault, and the magnet specialist was keen to perform a high voltage test of BHZ62, just to be sure this was not the problem. An access starting at 17H30 proved that this was not the problem, and the machine was started up again to give beam by 19H30. The MPS was still not stable though, so only LHC was running in the hope of limiting the load on the supply while the fill took place. Once LHC had had their fill, other users were slowly introduced, and although the PiPO had to be called a couple of times during the night for a reset, some beam was supplied to the users. However, by 6am the MPS would not even stay up for a few minutes, so it was left in fault and the MPS and magnet specialists were called in to investigate further.

The BHZ, QF, QD, TRIM1+4, BDL & Q Strip magnets were separated from their respective supplies and a D.C. H.V. test was performed, proving that there was no obvious fault on any of the magnets. The MPS filter was also H.V. tested at the same time and found to be OK. The BHZ & QD were re-connected with the original supplies, while the TRIM1+4 and QF connected with the spare supplies (as opposed to the original they were running with before), but the BDL & Q Strips were left disconnected. This set up ran for 1.5 hours without any fault.

Armed with the above information, the original supplies for TRIM1+4 and QF were connected and the MPS started to trip immediately. Unfortunately at this point, a series of other faults raised their ugly heads, and number of other things had to be fixed before we could return to the " stable" situation we had so tantalizingly had a glimpse of earlier. While these faults were being repaired, the machine magnets were reconnected to the normal set up, so that we would be ready for when the MPS was fixed.

By 20H45 the MPS team declared victory over the recalcitrant hardware, and advised us to fill the LHC as soon as we could! The temporary fix they had put in place did not allow any remote reset, so the PiPO would have to be called for any problems, but they were well instructed as to the new procedure for switching on and off the MPS.

We quickly got the machine ready for beam, but it was soon obvious that the beam would only make half a turn round the machine, so we suspected an inversion of one of the quad supplies during all the work in the afternoon. By the time we had the PiPO team back and ready to perform the polarity change, we knew it was the QD supply that was set with positive polarity in place of negative. Once changed, the beam was accelerated and ready for the PS by 22H45. The LHC was filled, then other users slowly introduced, and the MPS has remained stable since.

During the technical stop, the team will repair the faulty quad supply, repair the faulty short circuit switch, verify there is no earth fault and repair the vibrating relay/interlock in one of their PLCs. This is estimated to take from 8-13H00 for hardware repairs, then pulsed power tests will take place during the afternoon once the machine accesses have finished.

Although paling into insignificance compared to the above problems, we also have a kicker (BT.KFA20) that starts to drop out towards the weekend! We were dogged by it last weekend, and Friday afternoon it started to play up again, but could be reset. However, Saturday night we were obliged to call in the specialist (B.Bleus), as it was requiring regular resets. After his intervention, it did not drop out again, but it will be followed up during the tech stop.

AD

The main event of this week was the problem of the BOOSTER main power supply.
(more than 32 hours without beam). n the shadow of this problem, all power of the ring AD, were tested. We found two power supplies failing. These power supplies are controlled by the GFA (function generator).
- Trim DR.DVT1608 provided a current of zero Amps, despite a few milliamperes for this function.
- Trim DR.DVT2904 the negative segments of the function was always equal to zero Amps.
Both power supplies have been changed by First-Line.

Six failures have affected the beam:
- Ring Power supplies.
DR.QUAD was OFF (12/07 4:47): It was solved by the First-Line (downtime of 2 hours).
- Power supplies in the injection line, after target AD.
DI.BHZ6035 (13/07 13:00) and DI.BHZ6044 (17/07 22:47) acquired current at zero Amps, the status was ON without error.
These power supplies are pulsed every 1.2 seconds. Several big capacitors have been changed by Fist-Line.
(downtime 3+3 hours).
- Power supply in the injection line, before the target AD.
FTA.DHZ9028 (15/07 08:00) intermittent fault. This fault had been detected the day before.
An bad electronic card in the power supply was sending an "red button is pushed on magnet" (downtime 1 hour).

- The security status "Experimental Secure Area" of the chain TARGET-AD
This condition has disappeared from the safety chain in the TARGET-AD (17.07 at 19.00).
Therefore, no beam could enter the ring AD. This problem was solved by specialists secure by a reboot of PLC (2 hours of downtime).
-Target Station Cooling Fault (same breakdown as last week.)
The station stopped because of a temperature fault. (18/7 19H00)
In Building 195 Rack RA009 resets interlock target temperature, and restarted the pump for cooling the target (downtime 1 hour).
- One failure of instrumentation did not affect the beam users.
All transformers of measurement, before the target, in the ring, and in extraction line, have been out of order.
A power-supply of a 'NIM' rack equipment was changed by specialist F.Lenardon (15/7)
The beam ejected has always been higher than 3.2E7 anti-protons.

Isolde

The week was very quiet at Isolde.
We could not deliver any beam to the user (MINIBALL esperiment using REX) because as in the previous week, they required the production of the Krypton72 and there was an high contamination of Germanium72. According to target experts this isotope contamination could not been predictable.

From GPS side we have changed target on Thursday and we started setting up with stable beam on Friday.

PS

The PS had a week pretty good, without any particular problem, except:

a) an access at the beginning of the week was needed to change a gap relay of a 10 MHz cavity.
b) The MTE-MD4 user was found corrupted again, on Friday. This time, the Bfield was set to zero.

The INCA deployment is progressing. The source of the first corruption of the MTE MD4 user of last week has not been understood yet. By further investigations, it was found that also a second user, the MD3, was corrupted, or saved in the INCA database with corrupted settings.
The MTE setting-up continues. However, after the user problem of last week, it was not possible yet to restore the situation prior to the user corruption. The spill is still more instable than before the corruption.

Users:
SFTPRO, CNGS, TOF, LHCINDIV/PROBE, MD4 (MTE), AD, EASTA/EASTB, MDPS (LHCINDIV with 30e10 p, eps_l=0.324 eVs, Eh=1.274 mm.mrad (norm,1s), Ev=1.275 mm.mrad (norm,1s)), LHC150 (setting up).

The setting up of the ultimate LHCINDIV continued.

Monday
Access is the evening to change a gap-relay of one of the 10 MHz cavities.

Tuesday afternoon-Wednesday night
Reduced operation due to the PSB-MPS problem.

INCA tests to solve few problems related to: a) ppm copy. It was found that during a ppm copy some of the settings was not correctly copied; b) coherency between knob color, settings and reference value; c) consistency between GFA settings saved in the database and knobs.

Wednesday night
Restart after the PSB-MPS problem without any difficulty.

Thursday
Problem with the wire scanners: depending on the speed of the wire used one can get a very different emittances at extraction for the LHC beams. In fact, the emittance measured decreases on the extraction flat bottom up to 15%. BI expert is working on the problem, but the BI expert suggests that the instruments lost their mechanical calibration.
At the same time, the BI expert solved the problem on the BWS64. The huge peak appearing on top of the Gaussian beam profile shape disappeared. The solution was to increase the speed of the cooling fan of the electronics rack.

The orbit on TOF at injection was found again with a peak-to-peak of about 20 mm, as at the beginning of the year. Investigations are ongoing to understand how it is possible that the orbit degrades without any apparent reason.

The MD4 user, the MTE operation one, was found corrupted again. This time, the B field was programmed at zero. Investigations done by the CO expert and the MPS CO responsible showed something clearly unexplainable. The user was found corrupted the 15 July, and the MPS was reprogrammed at the same moment to recover the user. The MPS CO system logged a reprogramming of the MPS on this user the 8 July, when according to the logging, the MPS was programmed to zero.
Then the same logging recorded the recovery of the user the 15 July, when effectively the B field was reprogrammed because the user was found corrupted. The MD4 was used, however, many times between the 8 and the 15 July, whereas according to the MPS CO logging system the B field should have been at zero. This means that: a) the user was corrupted, but it is not clear how this could happen without a clear trace in the logging system and when it happened; b) the MPS logging system and the use of the MD4 are not coherent, since the MD4 was used when according to the logging this would not have been possible due to the zero B field. CO is investigating the problem.

Friday
INCA development -> first correction of the INCA ppm copy.

Tests with the LHC-BLMs for the MTE and injection losses related studies. The BLMs are giving signals which are not clear at all, as if there was too much noise on the cables or as if the detector was not correctly insulated. There is probably a problem for few of them in the tunnel that will be investigated by BI during technical stop. The use of the LHC-BLMs is a bit difficult since one has to connect the signals to a local oscilloscope and then connect to it via a remote desktop. This is because once connected to OASIS, the signals are not consistent with the local ones. CO and BI are investigating the problem.

Saturday
Normal operation

Sunday
Normal operation

SPS

Two main perturbations this week: problems with the booster MPS caused a 36 hours interruption on Tuesday - Wednesday and the CNGS had to be stopped all weekend, including Friday because of a vacuum leak on a SPS dipole magnet.

On Monday the extraction of the LHC2 cycle with four individual bunches was set up and the beam was transferred to the last TED in the LHC transfer lines.

On Tuesday we managed to inject and capture an intense single bunch at 26 GeV. With the 2 micrometer transverse emittances as delivered by the PS we managed to get 2.4 10E11 in one bunch and by blowing up the beam with TT10 screens we got 3.1 10E11 per bunch with emittances of 5 micrometer. The studies with these bunches were interrupted by the booster problem.

During the booster stop, the power converter experts managed to get rid of a 100mA ripple on the QF by changing the active filter.

On Thursday the transverse blow up, scraping and beam quality monitor was set up on the LHC2 cycle which is now considered ready for LHC use. In the evening we noticed a bad vacuum bump around 406. The phenomenon started at 15:30 and the leak bursts could be correlated with the up and down ramps of the magnetic cycle, indicating a leak in a magnet. The vacuum leak became more severe during the night and on Friday morning we decided to stop the frequent CNGS pulses in order to reduce the stress on the leaking magnet. CNGS needed an access anyway because of a problem with an UPS (48V). The LHC cycle was only pulsed when needed and we managed to sail through the weekend without having to stop the fixed target physics. On Friday a leak detection was performed in order to identify the broken magnet (MBB40688) which will be replaced today (Monday).

LHC

LHC operation is now based on using bunches with ~nominal values of emittance and intensity, providing physics with an increasing number of bunches. The bunch pattern remains 'democratic' in that all experiments see the same number of colliding bunch pairs, at the expense of the overall performance in any given point. This strategy has now reached injecting 12 or 13 nominal bunches, of which 8 collide in each IP. This has produced instantaneous luminosities well in excess of 10^{30} cm^{-2} s^{-1}. A recurrent problem with this mode of operation has been sudden losses of intensity of particular bunches, which looks to be clearly a beam-beam effect. Various things have been tried to prevent these losses (chromaticity, octupoles, transverse feedback, tunes of each beam) with the result that the last few fills have been much more stable. A typical delivered luminosity per fill is now of order 50 nb^{-1}, pushing the total delivered well over 300 nb^{-1}. Following the technical stop in week 29, the number of bunches will be pushed higher (first to 24 bunches per beam, with 16 colliding pairs). This is now getting to the point where the filling scheme needs to use multiple bunches from the SPS. This has been commissioned for 4 bunches per SPS cycle, and will be pushed into operation soon.

LHC – full details under coordination at:

http://lhc-commissioning.web.cern.ch/lhc-commissioning/