

# Accelerator Complex Status

## End week 33 (Monday 20 August 2018)

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### TI (Ronan Ledru)

A very eventful week with water leaks, electrical glitches on the 400 kV, but also on the UPS and the activation of the AUG in POPS.

Details: <https://wikis.cern.ch/display/TIOP/2018/08/20/TI+Summary,+Week+33>

### LINAC2 (Detlef Kuchler):

Linac2 had a good week (97.9% uptime). The stops were all related to external problems. There were the two power glitches on Wednesday and Thursday evening. And on Friday a FEC had preventive to be replaced (the fan of cfc-363-csis was broken during the last power glitch, this FEC runs the linac watchdog).

### LINAC3 (Detlef Kuchler):

Linac3 it was foreseen to repair the source extraction system during the whole week. But the beam was already back on Thursday lunchtime (1.5 days in advance!). Up to now it looks like that the repair was successful (less high voltage breakdowns). The source suffered from the two power glitches as every time it lost the vacuum pumps.

### LEIR ():

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### PSB (Fanouria Antoniou):

Not a very nice week for the PSB with an availability of 84.8%, corresponding to a total downtime of 25.4h.

On Wednesday afternoon at 17:40 a power glitch due to an intervention of EN-EL in 4 UPS tripped most of the PSB systems. At 20:52 the beam was back in R1/2/3 while R4 was still suffering by an RF problem until 21:25. Due to a timing fault, the ISOLDE request could not be seen by the external condition until 00:44.

On Thursday morning the beam was cut at 07:40 for a PS intervention. During this time some shadow interventions also took place in the PSB. The beam was back at 09:42.

On Thursday afternoon we had another electrical network issue. ME4 and ME6 tripped during the restart of POPS and all the Meyrin site was down. Once more most of the PSB systems tripped. The beam was back at 01:23.

During the week we had several trips of the recombination kicker BT1.KFA10. The TE-ABT experts asked for an intervention on ring 1 of at least 4h on the BT1.KFA10 tube as it was very unstable. The intervention was finally scheduled on Friday morning starting at 11:30. Due to a problem with the hydraulic system after

changing the tube, the intervention lasted finally for 8h.

On the MDs, a full agenda also for this week with studies on: Tune scans, Wire scanner setting optimization, PS WS vs PSB SEM grid checks, Setting up of 1GeV cycle, Finemet cavity setting up, K-scan in BTM line, injection efficiency for ISOLDE.

### PS (Ana Guerrero):

Extremely eventful week. The PS was down for 32 hours from Wednesday afternoon till Friday at 4am, then with issues due to frequent trips of the PFWs until 11am and finally running with beams affected by the missing booster R1 until 19h30 on Friday.. Round 17h30 on Wednesday all FECs started rebooting. This was the start of a 12h beam stop due to an electrical distribution problem apparently originated from an intervention in a UPS battery.

The first beam recuperated was EAST at 1h30. All beams were back at 5h30 after solving many issues:

- Most of the FECs lost the communication with the equipment including POPS FGCs. TI could not reset the 18KV cells anymore and the piquet EN-EL had to intervene once a start point had been fixed by IT specialist.
- It was not until all RF FECs were rebooted after the fix of the SP that all beam controls started working and all beams could be played. The 256h clock is distributed to the beam control hw and it is connected to the UPS network. The FECs which started without seeing the clock distribution could not work.
- Once POPS restarted, the B-train was not received anymore. Both new B-train systems were in fault, Marco tried to put the system back in place but finally the cycling was restored by switching to the old B-train until the next morning when the systems were fixed.
- The FEC of the injection kicker kfa45 did not come back either and ABT had to intervene too. Finally CO solved the issue. The configuration of the fan had been lost.
- PIPO and EPC CO were also busy to recover other equipment that did not reset. IT specialist was called again for a communication problem in building 269 affecting the injection septum and all TT2 line equipment. FECs in 269 had to be rebooted again after the intervention to recover.
- First line was called for ZT10.QFO02. A big intervention needed: exchange of MCB.
- CO timing expert was called for SMH16 timing missing. Two problems: Ethernet network speed and the forewarning timing missing in cycles with a preceding 1BP cycle.

Two hours later, at 7h30, a programmed stop to search for a water leak in the PS ring and agreed at the FOM took place. The visit started in the switchyard to minimize the stop time for PSB. The leak was found in MU57 a very hot place situated next to the EAST extraction septum. The magnet expert informed that a restart of the machine without fixing the leak would risk the magnet integrity. The magnet team could only start the first inspection at 13h. Then they managed to repair the leak by 17h30 and the recover of the machine started. The total downtime was of 10and ½ hours.

While switching back POPS on, PIPO was forced to press the AUG in building 355 producing again a cut of a large part of PS and PSB equipment. When they were starting one of the 18kV cells again they could see that the command on/off was being sent in continuation.

The recovery was finished by midnight taking 6hours:

- Intervention of PIHLRF for the autotuning of C40 and C80 and for the 200MHz cavities
- Intervention of IT in SPS of buildings 132 199 and 400
- Intervention of PI Kicker for kfa45 FEC again and to restart the MTE kickers.
- SMH57 in external fault, specialist called
- PIVAC started the vacuum in booster and PS
- PILLRF came due to a water issue in the transverse feedback. The problem was solved by the operators by switching on/off each control.
- Firstline intervened on ZT11.QFO04 to change a24V power supply
- Once POPS was back PIPO restarted PR.QFNO5, PR.QFNO95 and F16.QFO225S. Also checked on a communication problem with F16.QDE163, F16.QDE210 and F16.QFO215. Finally they restarted PR.XNO55.
- EN-STI piquet worked on TDI48, not in, nor out. It did not come out of the busy status.
- Restart of the central timing gateway. All back to red for a few minutes!
- CO specialist called for two OASIS FECs, one had to be restarted locally.
- Other instrumentation FECs had to be restarted locally.

Once PS was ready, we had to wait for Linac2 to be back. All beams except LHC beams were back at 2am. One C40 and one C80 were not pulsing: PIHLRF called again and at 4am LHC beams were also back.

However the problems did not end here the SMH16 did not pulse for the LHC4 user. After some investigation it turned out that the forewarning was firing 1s in advance. On top of this from around 4am the PFW started tripping very often (each 15 to 20 min) producing large losses and alarms. The MTE intensity was reduced by 1/3. The issue was tracked to the PFW FGC gateway "cfc-355-rps3" which prevented the PFWs to pulse during 1 minute, and was solved at 11am by CO. The ethernet card of the gateway was restarting with a connection of 10MHz instead of 100MHz so the queue was piling up the notifications until it crashed.

During Friday other non-critical issues risen from the electrical distribution cuts were solved.

Also this week there was a dedicated MD on Wednesday that started searching for the sextupolar interaction with the beam that needs compensation and ended with injection semgrid tests.

### **AD (Lajos Bojtar):**

The AD has a difficult week like the other machines due to various problems.

At Tuesday during the PS access we made tests on the thermal stability of ring power supplies. Also a new notch filter for the stochastic cooling made nearly operational

by the RF people, sometimes we use it sometimes we go back to the old, its still under testing.

Lots of trouble to restart the AD after the power glitch.

- Many front-end went down and I had to restart.
- There was no timing events in the AD, first the central timing was suspected, but turn out to be a problem with the beam request server. After restarting that we had timing in most of the machine.
- The FTA.9000 line still didn't have timings. After a CPU card has been replaced in a timing front-end the timings were back. This seems to be a configuration problem rather than a HW one, this issue will be followed up by the control group.
- The electron cooler had an interlock due to a bad water level sensor, it has been bypassed by the specialists as a temporary solution
- The DR.QUAD-MAIN1 power supply didn't start up. It took 6 hours for the FL to fix it.

After fixing all this we have beam in the AD, but the intensity was low partially due to a missing booster ring, but mainly adjustments needed in the AD ( 33% efficiency). It has been improved a lot, now we have about 70 % efficiency, but this is still lower than the usual performance which is about 80 %. Particularly the cooling performance at 300 MeV/c needs improvement and the recapture after.

### **ELENA (Christian Carli):**

Most of the time last week was used to provide beam (mainly antiprotons, but as well some H- ions) to GBAR and to chase and solve a tricky timing problem on Monday and Tuesday (jitter between the trigger sent to GBAR and the bunch sent to them). If the machine is working properly (important to run an application correcting coherent injection oscillations), we can send bunches with  $2E6$  to  $3E6$  antiprotons with good reproducibility (but larger than nominal bunch lengths and probably emittances).

During the night from Thursday to Friday, we had foreseen to take for the first time a night shift for ELENA setting-up and commissioning. Finally, this did not happen as no antiprotons were available after the power glitch on the Meyrin site. Next week, no antiproton shifts are scheduled for GBAR and/or ELENA, but we will try to work with H- ions. The week after, morning shifts are scheduled. Afterwards, we will have again antiproton shifts to be shared between GBAR and ELENA commissioning mainly outside working hours, unless the AD schedule is indeed modified.

Still some cabling work is required for the electron cooler to connect the small coils to compensate field errors and to improve the magnetic field quality in the region, where the beams interact. I have as well still not seen a compensation setting (currents exciting these circuits) and an explanation how it has been devised. This compensation scheme has to come from the electron cooler team, as the company had troubles with the magnetic field measurements and did not manage to provide a

reasonable compensation setting and to prove that the field quality specification can be met.

### **SPS (Hannes Bartosik)**

It was again a week with relatively low beam availability for the North Area (slightly less than 80%). The largest part of the downtime was caused by the injectors, most importantly due to the power cut following an UPS intervention in the Meyrin site on Wednesday evening causing 12 hours downtime and the repair of the water leak in the PS on Thursday and issues at the restart resulting in almost 18 hours of downtime. On the SPS side, a fault on the TX2 driver filament on Monday night required the intervention of the Piquet. For this the water circuit had to be drained, but unfortunately after the intervention the valve was left open and the the water for the cooling circuit had to be refilled. About two hours were lost in total. The fault on TX2 itself was finally resolved by exchanging measurement and interlock cards. Furthermore, TX3 could not be restarted by the OP crew after a trip on Sunday night but only by the Piquet resulting in 40 minutes without beam to the North Area.

On Tuesday the 24 h test run of the TPSWA diffuser in front of the ZS extraction septum on the operational SFTPRO beam was completed successfully. A loss reduction of about 10% on the ZS could be achieved stably. On Saturday, the BLM threshold interlock level was reached systematically on QDA.219 at the end of the spill causing a reduced spill length. The losses could be reduced by slightly lowering the vertical tune at the flat top. The losses in this region are now well below the interlock level.

The LHC fillings went rather smooth throughout the week with no particular issues encountered. This gives promise for a possible future operational implementation. The dedicated MD on Wednesday was devoted to crystal collimation studies in coast.

Otherwise, the RF experts worked on the AWAKE cycle to reduce satellites and to optimize the extraction timing with respect to bunch rotation. In preparation of the HiRadMat run next week, the transverse damper has been set up on the HiRadMat1 cycle on Friday. Finally it is worth mentioning that the interlock levels on the power converter for the main QD circuit have been adjusted so that the LHC ion cycle with ramp to 450 GeV/c proton equivalent with the Q26 optics can be played without tripping the mains.

### **LHC (Elias Metral & Markus Zerlauth)**

RF voltage reduction to 5.5, 5 MV and then 4.5 MV at injection, no problems observed with current conditions for injected beams.

The octupoles are now pushed to -4.7 (knob) at injection, yet instabilities leading to bunch blowup were observed near the start of the ramp following the reduction of RF voltage (leading to lower synchrotron tunes). The octupoles at FT were lowered to -1.9 (knob).

Operation was very smooth until the CPS AUG on Thursday that generated a 20 hour period without beam.

