

# Accelerator Complex Status

## End week 34 (Monday 27 August 2018)

---

### TI (Clement Pruneaux)

A rather eventful week with water cooling issues for BA81 early in the week, a small fire in SY5 on Saturday and a 220 kV glitch dumping LHC beam on Sunday.

Details: <https://wikis.cern.ch/display/TIOP/2018/08/21/TI+Summary%2C+Week+34>

### LINAC2 (Rolf Wegner):

Linac2 is running very well. The only issue was a sudden failure of the tube in the Debuncher DB10 amplifier last Monday. It was repaired within less than 2 hours.

### LINAC3 (Rolf Wegner):

Linac3 is running very well. On Monday the source was difficult to control but became more and more stable. The beam intensity was about 30 uA thanks to Detlef's frequent re-tuning. Excellent running over the weekend.

### LINAC4 (Giulia Bellodi):

HW commissioning is ongoing and is expected to be completed by the end of the week. RF and source restart are being followed up and coordinated by the expert groups. RF recommissioning is on schedule, and all klystrons except one have already been restarted. LLRF activities will continue next week after the return of some experts.

Concerning the source, an intervention was done On Thursday to exchange the electromagnetic valve regulating gas injection. The valve was repaired and gas regulation improved. By the evening, source experts had managed to restart RF and HT and were looking for a stable RF working point of the source. A cesiation might be scheduled some time this week.

Beam commissioning is planned to start at the end of this week or beginning of the following, once sufficient progress is made on RF and source to allow restarting operation in 3 MeV beam mode. An initial checklist and planning has been prepared and is available on the standard Machine Checkout OP webtools pages.

### LEIR ():

.

### PSB (Simon Albright):

A very quiet week with a little over 2 hours down time or 98.7% availability. The longest stop (1 hour 47 minutes) was the Linac2 intervention on Monday morning, about 30 minutes otherwise. During the Linac2 stop there were interventions on BE.BSW14L4, BTM.BPM10 and a ring BLM. Otherwise there was a few minor fixes and stops, as well as the usual large number and variety of MDs

### **ISOLDE (Simon Mataguez):**

On **GPS**, Tuesday, IS616 stopped taking data on 8B and took 12C beam in early morning. A new target was installed on Friday morning.

On **REX-EBIS**, degrading cathode EBIS has been replaced on Tuesday, immediately after pumping started.

Several technical interventions were performed in parallel.

Tapestation has been repaired on Tuesday but broke on Wednesday during the proton scan - a new intervention has to be planned.

On **HRS**, on Wednesday, a stable beam  $^{120}\text{Sn}$  was delivered through separator and RFQ(cooler/buncher) (Bunching mode) with a very good transmission set up, but optic had to be adapted several times (without reason).

When CRIS users tried to switch to  $^{104}\text{Sn}$ , Thursday evening, beam stopped at the RFQ.

Thanks to the support of Miguel and Erwin, fortunately we are able to deliver  $^{104}\text{S}$  rates of  $\sim 1500$  atom/s after the cooler only on Friday evening.

The transmission and stability across the RFQ requires to be studied further and bettered.

### **PS (Heiko Damerou):**

An average week for the PS with a beam availability above 93 %.

On Wednesday morning a dedicated MD for the injection SEM grids was scheduled on short notice, in the shadow of the vacuum problem in the SPS, then affecting only beams to AD and nTOF during 2h30. The beam synchronous trigger for the SEM grids now works correctly, but a further jitter with the (old) acquisition electronics is observed.

A first access on Friday morning to investigate a problem with the 40 MHz cavity (C40-78) revealed that an exchange of its final amplifier in the ring was required. Following a fill of the LHC with only one 40 MHz cavity, a second access was scheduled on Friday afternoon to finally repair C40-78. Both accesses stopped all beams for in total about 4h30. Later the same cavity was still troubled by a minor interlock problem, making it difficult to deliver LHC-type beam for HiRadMat for a further hour.

During the night from Saturday to Sunday, all beams produced by the H8H16 beam control were not accelerated due a sudden change of phase loop offset, supposedly due to a bad contact. The phase loop offsets had to be corrected again later and are now back to initial values.

Low intensity EAST beam has been delivered to Irrad, down to an intensity of only  $3\text{E}9$  p per spill. The 3-bunch lead ion beam with 75 ns spacing has been sent for the first time to the SPS for beam quality checks. Beam tests to produce two TOF bunches on a single cycle continued and in total about  $1.5\text{E}13$  ppp have been accelerated.

## AD (Bruno Dupuy):

The AD has chaotic week due to several problems on cavity C02.

The beginning of the week the beam intensity has unstable and much lower than a nominal value.

Furthermore, the beam dimensions, transverse and longitudinal was not stable.

Between Tuesday and Thursday many RESETs of the C02 has been executed, the specialists RF and EPC have intervened many times on site outside working hours.

- A.Findlay (BE-RF-FB), A.Jibar and M.Haase (BE-RF-IS) have worked on glitches visible on cavity voltage at capture of 3.5 GeV/c and 300 MeV/c processes.

These glitches are also present on the phase loop with beams. The consequence of these glitches is that the beam is poorly cooled by electron cooling at 300 and 100 MeV/c, but more critical the TUNE power supply dropped some time and its startup is no longer guaranteed.

- A.Jibar, C.Oliviera (BE-RF-CS) and C.Machado (TE-EPC-FPC) have worked on TUNE power supply. The restart was very critical after a sudden stop of C02.

This issue seems now fixed on Friday after hardware board replacement by C.Machado.

- A.Findlay has been adjusted Low Level process at all energy (3.5 GeV/c, 2 GeV/c, 300 MeV/c and 100 MeV/c). The bunch rotation at extraction was also adjusted, because the High level action for minimising the glitch introduce a time rise limitation during bunch rotation just before the extraction.

It remains that noise on the voltage and the phase of the C02 are always randomly present, but the low-level and high-level settings minimise the disturbance on the beam. The specialists are always on this problem.

Many electrons cooler energy adjustment and electron beam steering have been done to improve the quality of 100 MeV/c process.

Electron cooling process at 300 MeV/c needs to be improved.

Other equipment (DR.SMI5306, DR.BHZTR20.21, stochastic cooling amplifiers) have required minor interventions or reset action.

Bunch intensity is around  $3.0 \times 10^7$  antiprotons by extraction and the bunch length is lower than 180 ns.

## ELENA ():

In collaboration with the AD experiments and AD operations the AD scheduled was revised with the aim to optimise the commissioning of the ELENA machine and to maximise the available beam time with p-bars in ELENA with the equipment group experts support.

## SPS (KevinLi):

This was a bad week for the SPS with machine availability reaching only about 60%.

Monday started with FT and 2 MDs in the cycle. LHC was in the middle of a fill and HiRadMat had an access to prepare their experiment. Towards the evening, the losses on QDA.219 on the fixed target cycle had come back and the 50MHz compensation was very unstable. We started working on the problem. During optimization of the working point, an accidental trim happened to put us just on the vertical half integer resonance, causing a fast blow-up and beam induced losses in one of the known aperture restrictions around MBB.331. Almost the full fixed target beam was lost over a period of about 15ms - still below the BLM response time of 20ms. Thus, the beam was not dumped and cut a hole into the vacuum pipe of the magnet. Monday evening was spent diagnosing the error and preparing everything for the magnet exchange. Monday night the machine was left to cool down.

Tuesday, the MBB.33130 dipole magnet was exchanged. The vacuum connections were made and the alignment was done. The vented sectors were left pumping overnight. In addition, there had also been a rather large water leak in one of the magnets of BA81, which however could be repaired. Brazing of the busbar jumper was done one Wednesday early morning. Pumping continued during the day with vacuum pressures descending only very slowly. By the evening, everything had been put back into place and we injected first beam around 17:00. Due to the poor vacuum we could provide LHC only with PILOT and INDIV bunches. A dedicated scrubbing was done overnight from Wednesday to Thursday. The initial intensity ramp up went very slow with high vacuum levels at low beam intensities. By Thursday morning we had reached 72 bunches. The intensity ramp up was then accelerated and we were ready to provide beams for nominal LHC filling by noon. The beam quality was relatively good but some TL steering was needed after the MBB exchange.

On Thursday just before 17:00 both modules of the ADTH tripped on the SFT cycle just before reaching flat top. Fortunately, this time the beam was dumped by the faster LSS2 BLMs. Scrubbing continued on Thursday during the day until about midnight - to improve the vacuum and ensure beam stability for LHC filling. This was partly done on the HiRadMat cycle and thus, at the same time, served as preparation for the HiRadMat run which was supposed to take 288 bunches.

Friday there were issues with the PS cavities which in combination with the still poor vacuum in the SPS led to vertical instabilities on the nominal LHC cycle (LHC1). For this reason, we had to increase the chromaticity by 0.15 units all along the cycle. With these settings, LHC could be filled stably. The PS cavities continued to pose problems and in the afternoon an access of 3 hours was required for repairs. After LHC filling, which again went very well, and with the good evolution of the vacuum levels, we finally still were able to complete the HiRadMat program foreseen for this week during the night from Friday to Saturday.

On Saturday there was AWAKE taking beam during the day. The rest of the weekend was dedicated to fixed target. Very frequent interlocks on the SIS due to an MKD early enabled interlock signal were observed and quite heavily perturbed operation. This has appeared since a software upgrade on the FESA classes of the MKD, which was tried during the PS access on Friday and finally, however, rolled back to the previous version just before taking back the beam. A temporary mitigation was found by rebooting the cfv-ba1-mkdtrim FEC.

### **LHC (E. Bravin & D. Nisbet):**

Smooth operation was interrupted Monday evening by a vacuum leak in the SPS following a beam loss. Following the SPS magnet exchange and pump down the BCMS beam became available again on Thursday morning, when regular operation resumed with reasonable availability.

A first step of the ion cycle commissioning was performed between Wednesday evening and Thursday morning, concentrating on coupling and local phase corrections at IP1 and IP2. The weekend was quite successful, but frequent and sometimes time consuming injection beam line steering is still required.