

# Accelerator Complex Status

## End Week 28 (Monday 17 July 2018)

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### TI (J. Nielsen):

Please find the TI summary of the week

here: <https://wikis.cern.ch/display/TIOP/2018/07/16/TI+Summary+Week%2C+28>

### Linac2 (D. Kuchler):

Linac2 had an availability of 98.5% this week. Main issues were two times tripped power converters (Friday evening: LA1.QFN46S, Monday morning: LA1.QFN06), two times tripped RF equipment (Saturday afternoon: all linac RF [after a glitch], Monday morning: Tank1) and on Friday evening a trip of a vacuum rack, which stopped the source by vacuum interlock (rack was overheated, source needed local reset).

### Linac3 (D. Kuchler):

Linac3 source had to be restarted with the second oven last Monday, as the first one had a broken filament. Otherwise smooth operation (some resets outside working hours), quite stable beam with good intensity.

### Linac4 (G. Bellodi):

The arc detector cables have been pulled and the connectors are being made. This work is scheduled to finish by the end of the week, including tests of the new installation. Dismantling of the arc detectors will start soon after that in the tunnel, followed by reinstallation at surface level near the klystrons. Work is in schedule.

### LEIR ():

### PSB (G. P. Di Giovanni):

It was a week better than the previous one for the PSB with an average availability of about 94% and a quite some activity in both operation and machine studies.

Most of the downtime the week is associated with issues with the recombination kickers and the aftermath of couple of electrical glitches, in particular the one of Sunday evening.

We requested a stop on Monday to fix the issue with the BSW14L4 3-phase contact which caused major downtime two weeks ago. The stop took about 1h 30 minutes. During the stop several experts profited to access the machine to successfully fix the BLM in section 5 (superior), which was out of order since few days, and investigate a problem with BTM.BPM10, which unfortunately is still not working. Concerning BSW14L4 there is still a mismatch CCV/AQN which will require another expert intervention without beam, so either during ITS2 or at the next available occasion.

Several issues were observed with the production of high intensity beam in ring2 whenever the intensity was above  $800E10$  ppb. In particular, we confirmed an issue with the H1 phase loop observed in previous weeks, and a new one manifested itself due to the CO2 cavity dropping out either for a short period or completely, unbunching the beam at extraction and causing all extraction BLMs to trigger. The High Level RF piquet was called to investigate this last issue, but he could not find anything obvious. Today the expert is back from holiday and will have a look. Meanwhile, we moved the production of TOF beam from ring2 to ring3 and compensated for the losses of intensity with the other rings for ISOLDE.

Otherwise, several other power converters tripped but were always reset successfully and few vacuum pumps required the piquet intervention to be restarted, without impacting the vacuum level.

On the positive news, a good preparation for the special dedicated MD thanks to the combined effort of BE-OP, BE-CO, BE-RF and TE-ABT allowed to perform the MD and go back in operation with minimal turnaround.

PS completed the commissioning of the MTE with H1 synchronization from the PSB which now became the new official operational MTE. Progress were made in reducing the noise of the BPMs in the rings which are split for the radial steering, even though additional work is still needed to completely remove the noise to the same level of the other BPMs. Finally, the TFB fix delay in each ring was measured and corrected to improve performance.

As usual, a lot of MDs were carried over the week and, in particular, the OP crew started working on the preparation of the beams needed for the LHC MDs in week 30.

## **PS (H. Damerou):**

The PS had a difficult week with an average beam availability of only 87%, caused by a number of faults lasting about 1-3 hours each. The beams to the EAST area were cut for 1h30 on Tuesday, due to the Software Interlock System (SIS). The MTE beam was perturbed the same day, as the cycle in preparation for the dedicated Wednesday MD caused timing issues for the kickers. A problem with the recombination kickers of the PSB stopped all beams other than EAST during 2h30. On Thursday a fan needed to be replaced in the power

converter of F61S.QF001, resulting in 1h45 downtime for the beam to EAST Irrad. An access was organized on Friday to exchange the broken Mylar window (175 micrometer) in the F61 line by an aluminium window (200 micrometer). In total this took about 2h45 and the vacuum in the line seems fine since. On Saturday, all beams were stopped due to an issue with the airflow interlock of one of the 10 MHz tuning power converters. Finally, multiple trips of POPS lead to about 2h downtime for all beams on Sunday.

For the dedicated MD with the injection SEM grids on Wednesday the super-cycle was blocked to prevent unintended injection of other beams.

The 25 ns beam with various bunch intensities and batch length for the crab cavity MD has been prepared, as well as high-intensity ( $2E11$  ppb) variant of the BCMS beam with minimum longitudinal emittance for the Thursday MD in the SPS. In view of the upcoming MD in the LHC, the 8b4e BC beam (32 bunches at PS extraction) has been revived. The setting-up of the low-intensity MTE beam and the ion beam to the EAST area have started by the operations team.

### **ISOLDE (J. A. Rodriguez Rodriguez):**

It has been a good and very busy week at ISOLDE. Most of the work has been focused on the preparation and delivery of the first HIE-ISOLDE radioactive beam of the year ( $^{96}\text{Kr}23+$  with an energy of 4.8 MeV/u to Miniball). The users have been taking beam since Wednesday evening (one day ahead of schedule) without any mayor issues.

In addition, we delivered several Bi isotopes to IDS (Monday and Tuesday morning), several Xe isotopes for collections in GLM (Tuesday night) and  $^{22}\text{Ne}7+$  and  $^{129}\text{Xe}31+$  to Miniball (Monday and Tuesday night).

### **AD (L. Ponce):**

AD did not encounter major problems this week. The total yield of the machine is not at maximum despite a good deceleration efficiency mainly due to limited intensity on the target and big fluctuation of the injected intensity (between day and night and shot to shot).

The target leak problem is under control (no sign of leak since intensity is limited on target)

The main sources of downtime for this week are:

- no beam from injectors
- several trips of the MAIN.QUAD mainly following electrical perturbation
- several trips of Bend in line 6000 (DI.BZ6024), a preventive intervention has been done on Thursday.
- 2 electrical perturbation over the week-end, recovered without problems in the shadow of recovery of the injectors

### **ELENA (C. Carli):**

The main activity with antiprotons was optimisations of the working point and coupling along the second ramp down to 100 keV with the magnetic system of the cooler switched on (and some cooling on the intermediate plateau). Finally, it was possible to have again (as before without the magnetic system of the cooler) some beam (up to around 30%) on the 100 keV plateau. The main issue is now still the significant beam loss along the second ramp and a low beam life-time. Next steps will be the (i) implementation of debunching and rebunching at 100 keV to observe life-time without RF (on the intermediate plateau, the life-time is longer without RF and RF noise has been discussed as possible limitation) and as preparation for electron cooling tests and (ii) further optimisation of the cycle and cooling.

The Tomoscope issues have finally been solved. The instrument has been useful to improve rebunching at the end of the intermediate plateau.

On Tuesday and Friday (after the antiproton shift), again some beam has been provided to GBAR. Investigations to understand the fluctuations of the H- beam position observed on the BTV at the ELENA injection have been made. The reason could be the source, but as well the transfer line.

## SPS (K. Li):

The SPS itself had a rather good week. The availability was around 87% with faults almost exclusively coming from the injectors. The only bigger problem in the SPS was a faulty input mixer of TWC 200MHz line 4 which stopped the beam on Monday evening causing a downtime of 2:40h.

The SPS served the LHC on Monday morning with inject and dump INDIVS for modification and validation of the AGK. This was followed by injection loss studies. The beam was stopped in the afternoon for an access in the PSB for the BE.BSW14L4 extraction bumpers. On Thursday evening, after the high intensity MD, the LHC took a set of special INDIVs prepared in the booster for the BSRT calibration. The rest of the week was dedicated to physics with 2556 bunches BCMS which went mostly without problems.

The fixed target beam was running at a slightly lower duty cycle over the previous weekend to relax the tension on the ZS. It was set back to high duty cycle on Monday night. ZS sparking was not a problem for the fixed target beam all over the week. Whenever possible, we therefore concentrated on delivering fixed target beams at high duty cycle. The splitter BLMs are currently still running with the robust power supply (70V/3A) with missing interlock channels. A new power supply has been ordered but has yet to arrive to be prepared for installation. During middle of the week intensity fluctuations were noticed in T2. This is now being monitored more carefully. The source of these fluctuations are not yet understood.

Awake has taken beam during the full week. On Thursday, the experiments had been perturbed by frequent interlocks. It was found that the AWAKE transfer line had one BPM, which apparently has a bad reading and another BPM, which is perturbed by the electron injection. Moreover, the thresholds for the interlocks were very tight already for the golden

trajectory. On Friday afternoon, the AWAKE team decided to disable the BPM interlocks in front of the plasma cell in the AWAKE transfer line to help getting more stable conditions.

HiRadMat beams were prepared on Wednesday over night. The beam is in good shape. Three injections up to 216 bunches can be taken with the FT in parallel, the ZS spark rate remained calm. For four injections and 288 bunches, the FT beam was stopped with the ZS at -30 kV. Again, the ZS did not show an enhanced spark rate. It was agreed in the User Meeting that HiRadMat could take dedicated beams of 288 bunches over a period of 4 hours on Wednesday next week after the dedicated MD.

The dedicated MD on Wednesday was split in two different MDs. The first MD on slow extraction was completed successfully with all measurements taken as planned. The second part of the MD was dedicated to tests on the coast cycle in the SPS. During this MD, the CBCM in the injectors was blocked for reasons of security due to a dedicated MD in the PS. Hence, all supercycles had to be prepared and set up before. Unfortunately, however, the coast sequence itself could finally not be launched as it needs to access the CBCM config folder. Hence, the coast tests could not be made. Nevertheless, the time was then used for an access where among others, the QF51610 support could be installed.

The high intensity run took up to four batches at intensities up to  $2e11$  ppb. In the morning, mainly longitudinal measurements were made. It turned out, that sensible results could only be achieved with a maximum of three batches at bunch intensities at  $1.3e11$  ppb. In the afternoon, high intensity beams were taken with the headtail monitor acquiring in multi-acquisition mode to investigate the transverse beam stability in these conditions. A large amount of data was taken that needs to be analyzed offline. During these tests it was also found that the TT40 and TT60 extraction elements were pulsing on the LHC50NS user. They could not be turned off as the cycle does not have a particle transfer (and AWAKE was taking beam in parallel). The pulses impact the vertical beam orbit leading to high losses for the high intensity beams. The MD was stopped early since the LHC had to refill.

The SLAC team is here for this week and the next to progress on the wideband feedback system studies. The slotline kicker has been taken into operation. First tests indicated a clear increase in bandwidth. A polarity error was found which was fixed on Friday during an access.

During the nights, MDs were ongoing to investigate further horizontal instabilities and the stabilizing mechanism of  $Q''$ .

During the weekend there have been several problems mainly in the injectors with finally an electrical glitch just at the moment of global discharge of tension as France won the world cup.

**LHC (E. Bravin):**

The past week was devoted mainly to physics production with the ATLAS experiment, and partially CMS, taking data in low mu mode (very low luminosity levelled by separating the beams). Fills of 20-30 hours were targeted for this mode of operation.

On Monday the collimation hierarchy with the positive ALICE spectrometer polarity was investigated following the high losses observed on the TCLIA in Pt. 2. The conclusion is that before operating with the ALICE dipole in condition other than negative polarity the orbit at Pt.2 has to be corrected and the collimation alignment verified (loss maps).

On Thursday we made a fill with 12 bunches of different emittances for BSRT calibration.

Through all the week we had problems with high losses at injection. These have been found to be of two families; on one side the need to steer frequently the transfer lines (B1 in particular) on the other a problem with the RF system that causes debunching of the beams at injection.

The weekend was perturbed by a spark in the MKBs, several electrical perturbations, the return of the RF de-phasing with full detuning, communication glitches and the return of 16L2.

On Sunday a large electrical perturbation caused the fast abort of several magnets and the firing of quench heaters.

On Monday morning a 900b recovery fill has been performed and we will now attempt to restore physics with the full machine (2556b).