

# Accelerator Complex Status

## End week 38 (Monday 24 September 2018)

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### TI (Ronan Ledru)

A reasonable quiet week from breakdown point of view. However, the technical stop week, caused a substantial increase of the number of phone calls from around 750 per week to close to 1300 calls last week.

The main events were:

- Sat 22/09/18, 01:30: Fault on the 18kV circuit breaker EMD112/A2 at BA2. The EN-EL piquet went on site and changed the circuit breaker,
- Sat 22/09/18, 06:38: Trip of the SEQ2 TCR due to a low pressure on the cooling circuit. The TCR has been switch on in the evening as the LHC wasn't running.

Details: <https://wikis.cern.ch/display/TIOP/2018/09/24/TI+Summary%2C+Week+38>

### LINAC2 (Giulia Bellodi):

Linac2 had a smooth week until Friday.

All interventions foreseen during the Injectors Technical Stop were successfully carried out on time and beam was readily available mid-morning on Wednesday.

At machine restart, however, an RF gravity switch was found to be broken and needed to be replaced, and Tank2 showed some unstable behaviour, which required longer tuning. Tank2 eventually went on fault on Friday morning at 4h30. Experts were called on site, and after lengthy investigations managed to restart it after replacing the whole resonator. Normal operation was recovered by midday and was stable over the weekend.

Overall beam availability was around 95.5% this week.

### LINAC3 (Giulia Bellodi):

Linac3 had a very good week. Beam was available in the linac during the technical stop and was used to take some reference RF measurements. On Friday a new GSI-type 100ug/cm2 foil was put in operation, and performance has been very good do far . The RFQ amplifier tripped over the weekend and experts had to replace the rectifier box in the final stage filament current measurement and interlock circuit.

### LINAC4 (Alessandra Lombardi):

The previous week started with routine measurements on Monday. Tuesday there was the tech stops with tests on the RF amplifier of the source, and upgrades from EPC. Following the tech stops an accident to the CCDTL3-4 modulator, some problems with the FG63 in the LEBT and MEBT. The linac was available for measurements and tests only on Friday morning. Now retuning is ongoing. The source was cesiated with good results.

Autopilot was resumed in the minimal functionalities.

### **LEIR (Maria-Elena Angoletta):**

LEIR started to get beam after the technical stop on Wed 19 September late afternoon. On Thursday, work was done to recover the performance LEIR had before the technical stop.

On Friday morning the Linac3 foil was changed, so that our Linac3 colleagues could gain as much as possible operational experience with the new GSI stripper foils, which are very good. The LEIR efficiency depends a lot on many Linac3 items, one of them being the foil, so Linac3 people were ready to move back to the previous foil in case of bad efficiency. That was not needed as the new foil did not cause any loss of performance on LEIR side.

MDs were done in parallel to recovering the performance. In particular, work preparing bunched beam cooling was carried out, as well as tests on accelerating the beam using the ecooler.

### **PSB (Simon Albright):**

The first half of the week up to the end of the ITS went well, and the recovery was very smooth with only a few minor hiccups before beam was back. Afterwards beam was provided to the SPS for the COLDEX run on time and in spec. One important outcome was the discovery that a couple of ring vacuum valves have developed a leak, which prevented the planned replacement of a wirescanner in ring 2.

Towards the end of the ITS the problems with BTY.BHZ301 started, as it was necessary to switch to a spare power converter. The spare converter started to trip with too many cycles destined for ISOHRS in the super cycle on Friday. On Saturday, with the help of the piquet and equipment specialists, it was possible to enter a steady state by limiting the number of ISOHRS cycles and grouping them in the supercycle to avoid changing the current in the magnet. A further problem appeared on Saturday when BTM.BTV10 was found to be stuck half into the transfer line. To repair BTM.BTV10 an access was required to manually move the screen out of the line as the crate was not responding.

### **ISOLDE (Erwin Siesling):**

It has been a busy week at ISOLDE with a number of issues.

Overall the machine itself has been performing very well but there were issues with cryo and with the protons from PSB that made setting-up the machine difficult and in case of the protons, reduced the physics time significantly.

At GPS we have had many collections (228/223Ra, 148Gd, 133Ba) for different experiments taking beam whenever possible in parallel to the HRS physics. Things there worked very well (whenever protons were available).

At HRS we set up with stable  $^{22}\text{Ne}^{7+}$  and are sending  $^{28}\text{Mg}^{9+}$  radioactive beam at the highest energy we can deliver, 9.4MeV/u to the Miniball experiment in the first HIE beamline. For the ionisation of the Mg we have the RILIS lasers running. We also set-up and send this beam to the ISOLDE Solenoidal Spectrometer in the second HIE

beamline in preparation of the first ISS physics run later this week.

We suffered from a few major issues:

- On Wednesday-morning around 10h15 the cryo plant compressor stopped due to an over-current. This took down the whole plant and we lost all SRF. Thanks to the fast reaction of the SM18 cryo operators and Daniel Valuch from RF to get back up the SRF as soon as the plant came back up we had the HIE beam back at 16h30 and managed to keep the schedule for setting up to Miniball.

- On Wednesday-afternoon at ~14h a resistor inside BTY.DHZ301 burned. This is the bender that sends the beam to HRS instead of GPS. EPC moved to the spare but the spare has an issue going to 0A when pulsing. This problem lasted throughout the weekend and caused together with extraction problems at PSB (due to a half inserted screen in their beamline on Saturday) about 30hrs of downtime for HRS physics.

Jose Sanchez managed to find good settings for the super cycle with many consecutive cycles HRS so that there were little 0A switches and the power supply held. The users received 1.5uA out of max 2uA proton current throughout the weekend and are very grateful for the effort that PSB and EPC put in to keep going!

- Wednesday-evening a vacuum leak occurred at Miniball bringing down the XT01 line. Luckily the fast valve was fast enough to protect the SRF Linac.

On the positive side:

The SRF as well as the REX RF systems have been very stable during the whole run, even at this highest energy (9.4MeV/u). Very few trips even after the cryo plant went down which normally would cause some instabilities over quite some time (we experienced that during the power cut some time ago).

During this week we also had some MEDICIS target irradiations in parallel to the HRS physics.

We also continued tests on the new Fast Tapestation in the LA2 line in parallel to the OLD Tapestation.

### **PS (Ana Guerrero):**

All beams except those for UA9 were switched off at 16h on Monday and all beams were off by 7h30 on Tuesday for the TS2 access.

The PU90 was replaced by vacuum pipe and the vacuum was well recuperated by the restart on Wednesday. The switchyard was on beam mode by 12:30 and the PS by 13h. First line had to intervene to lock out some equipment in the east line and after for F61N.QFO02. After FL intervention came the turn of PIPO for the septa SHM57-61. The issue was coming from the water circuit. Since no users could take beam, turn by turn injection profile measurements were envisaged. However they had to be stopped because BSF54 got stuck in the beam pipe and an access was needed to bring the device out. The problem comes from a PLC block and there are no spares left. This device will be completely replaced during LS2 thus will remain unavailable until the next run. BSF48 is still available for the 2turn tests.

Beam came back at 18h but not without issues. EAST beam suffered from spill and extraction line trajectory instabilities until Thursday morning when a OFF/ON action on F61.QFO03 solved a regulation issue in the quad. Also, PR.WFNP tripped

frequently, PIPO and the specialist worked on the device in several occasions but found no particular reason for the problem. The beam was down in total for around 4 hours and no LHC type beams could be played until the descending slopes of the cycle functions were reduced on Friday afternoon, on time for the LHC restart. Also on Friday the east beams were stopped for 1h20 mins to remove an interlock in ZT11.BHZ01.

The week end was difficult too due to amplifier problems in C81 and C11. The PIHLRF was called on Friday night and finally an access had to be organized on Saturday (1h 10m beam down). The amplifier could be exchanged for C11 and the other one is pending. The most affected beam has been TOF that was played with reduced intensity until after the access on Saturday. PIPO was called twice, Friday night and Saturday afternoon to restart POPS which slightly delayed the LHC restart on Friday. In both cases the issue was coming from the cooling pressure in DC4 that had to be increased in both occasions. The total beam downtime was almost 3h. Finally, there was also a PLC issue affecting the transverse feedback (beam down during 1h) Beams for Coldex were delivered as requested and the same for SFTPRO that started with low intensity ( $\sim 500e10$ ). AD requested beam again ( $I=1350e10p$ ).

### **AD (Bruno Dupuy):**

Monday, Tuesday continuation of the plan (1) on the e-cooler, and replacement of the repeller power supply and setting up a shunt on the cathode HT switch. Sparks were observed on the previous Friday (the fire alarm was triggered). Despite all these repairs. It was impossible to raise the voltage cathode and to produce electrons, there was too much spark ...

Tuesday, at the end of the afternoon, the decision is made to follow the plan (2) During ITS (Injector Technical Stop), clogging resin was poured. On the following Thursday and Friday, after verifying the clogging of the leak, the water circulation was restored. It was necessary to change several times the filter and rinse the circuit many times in order to obtain a conductivity lower than 0.1 uS.

Other interventions were performed and disrupted or were disrupted by the failure of the E-cooler.

The power tube of the cavity "C10-26" has breakdowns. The specialists can't work during ADE ring access. The tube was cleaned and reinstalled, to be continued.

Cooling of the target is converted from a water circuit to an air circuit during ITS. The first beam pulses are only possible under the control of specialists. It took place on Friday.

Friday, September 21 at 15:30, the antiproton beam was correctly injected into the AD ring and cooled slightly to 300 MeV/c. It was then lost in the ramp (300-100) at 2.4 seconds of the 100 MeV/c plateau.

This Saturday, Lars and I worked on all the processes to try to capture the beam at 100 MeV/c without success.

Note that the cavity "C02" fell several times due to an electrical problem in the 193-RA-J008 (low level electronics) racks.

This Monday we will continue our investigations with the help of the specialists.

Plan:

1. Differential pumping on the cooling circuit of the E-cooler, with the pump at 27 kV potential. This pumping replaces the circulation of water at the level of the cylinder head.
2. The resin will be passed into the cooling circuit of the cylinder head. An air circuit will be established, to avoid obstruction. Those conditions must be maintained 24 H.
3. Change of the breech (top part of the collector) by the previous-breech. Unfortunately this is a version already changed in July. The leak is not ironed yet. The welds are made in parallel with the action (1) and (2).

### **ELENA (Sergio Pasinelli):**

Due to vacuum leak on the AD no Pbar was sent to ELENA during this week. H- beam was used by the commissioning and by Gbar.

Commissioning:

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Life-time measurements were done for different RF voltages. No strong variations of the life-time have been seen.

A quad scan on the injection line was done.

Debugging of the Schottky was done by the BI team.

Gbar

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In collaboration with Gbar, several optic adjustment and steering were done in the LNE50 line.

We managed to obtain a pretty good alignment in GBAR tubes.

We saw that AD cycle has an impact on horizontal position of the 100 keV beam in GBAR MCP (of the order of 5 mm delta from AD injection and extraction energy).

Friday afternoon we have had a bad and half good news.

The ELENA insulation transformer died. No more H- from the source.

The AD E Cooler is back but the beam is lost during the ramp from 300 MeV/c to 100 MeV/c.

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

The first part of the week was devoted to a 24 hours UA9 run, the 36 hours technical stop and a 24 hours slot for the COLDEX experiment. The main highlights from the technical stop were the installation of a crystal in LSS2 for testing loss reduction during slow extraction, the installation of a prototype vacuum chamber for eliminating the momentum aperture bottleneck, and the reconfiguration of the Landau octupole circuits for minimising the induced second order chromaticity in the

Q20 optics. The start of the COLDEX run after the technical stop was slightly delayed because of the retuning of the power converters for the octupoles after the modification of the circuits and because of an issue with the QF function generator following a firmware update deployed in the morning.

The restart for North Area physics was scheduled for Thursday 2 pm was. At this point, the Constant Optics Slow Extraction (“COSE”) was put in operation which allows for constant extraction conditions from the SPS. The beam could be sent to the North Area at around 5 pm once the Firstline piquet solved an issue with the MBB2404M power converter for T4. The beam intensity was increased to around  $3.5 \times 10^{13}$  ppp to satisfy the higher intensity on the targets requested by the experiments. After a few iterations on optimising the spill structure (in particular to avoid intensity spikes at the beginning) a very good spill quality has been achieved. A ZS girder scan was performed on Saturday but the original position was already giving minimum losses. So far the experience with COSE in operation is very good. The potential loss reduction during slow extraction needs to be studied on the long term.

The beam availability for the North Area was unfortunately relatively low these days (around 80%). Several issues in the injectors lead to long downtimes. In addition, Friday night the power converter for the MBE2103 could not be restarted after a trip of Chains 13 and 15 (4.5 hours no beam) and Sunday night Chain 1 was lost because of a bad contact on a shielding door in BA2 which required a patrol plus the RP picquet intervention to reset the RP veto (2 hours no beam).

The LHC started to take the pilot beam on Friday evening after their technical stop activities were finished. The BCMS beam was injected into the LHC on Sunday for the intensity ramp-up with no particular issues.

Finally it should be mentioned that measurements of the nonlinear chromaticity performed on Friday confirmed that the new octupole powering scheme deployed during the technical stop reduces the second order chromaticity induced by the octupoles in the Q20 optics as expected.

### **LHC (Jorg Wenninger & Markus Zerlauth):**

Monday 06:00 start of TS2.

TS2 ended as usual with access for MPE (EE in S78). During the pre-cycle RD1.LR5 did not react to timing events as it was left in a test mode. Overnight to Saturday the AGK was revalidated and a first cycle to 25cm was used to check out the machine. On Saturday the CTPPS RP alignment was checked (no change) and the CTPPS calibration runs at 27 cm and 25cm were completed. The loss map campaign was done in the night of Saturday to Sunday morning, it was followed by a 50b fill (~4 hours) and a 600b fill. Monday morning the fill was dumped allowing cryo to intervene on a DFB heater.

Thursday there will be a test for the Low energy high beta cycle and a final setting up of the ion cycle is foreseen for October 2<sup>nd</sup>.