

Accelerator Complex Status

End week 42 (Monday 25 October 2021)

Technical Infrastructure (Clement Pruneaux):

Statistics:

- About 4'900 alarms.
- 722 phone calls (570 incoming, 152 outgoing).
- 96 ODM created.

Events worth mentioning:

- Mon. 18.10, Fire alarm in building 157/R-B31. There were no signs of fire or smoke. Alarm triggered by dust when turning ON heating of the building by contractor.
- Tue. 19.10, North Area beam and experiments trips following stop CT2 cooling towers. Event caused by a manipulation on the primary water network. The contractors in charge of the installation were reminded.
- We. 20.10, Loss of TCC8 patrol resulting in loss of SPS beam. Recurring access problem already known and followed up.

Details: <https://wikis.cern.ch/display/TIOP/2021/10/25/TI+week+summary%2C+Week+42>

LINAC 4 (Jean-Baptiste Lallement)

Many events last week at the Linac4 and an average availability of 97%.

In the night from Monday to Tuesday, the CCDTL2 cavity tripped because of a cavity cooling issue (10 minutes downtime).

A LEBT steerer tripped on Wednesday morning (8 minutes downtime), followed by the RFQ (15 minutes to restart).

In the night from Wednesday to Thursday the first CCDTL tripped (11 minutes downtime).

On Thursday morning, the RF team went down the tunnel and replaced the CCDTL2 cavity flow meter that was showing signs of ageing (nothing special found on the water circuit itself). At the machine restart, a corrector in the LT line had erratic behavior and perturbed the operation for 1h30 before it was spotted and the converter rebooted. Thursday was concluded with a DTL3 modulator fault (8 minutes downtime).

Smooth weekend until Sunday night, when the CCDTL-3-4 modulator tripped. The piquet was called in and replaced the modulator driver (2h50 downtime). Finally, a LEBT corrector fault concluded this last week (5 minutes downtime).

PS Booster (Fanouria Antoniou):

we had a very good week in the PSB with an availability of around 95%. Our down time was dominated by LINAC4 faults and 3 trips of POPS-B, triggered by out of limit settings set by an MD user.

During the access on Tuesday morning, cell 7 of R4 was re-activated. A new class of FGC_62 was also deployed. After the machine re-start the watchdog was triggering without obvious reason. After a very systematic check of the OP crew it was found that the power converter of a corrector in the LT line was getting randomly very large values. This was related to the FGC_62 class update and was solved by rebooting the FGC. A difference of ~1mm was also observed in the transfer line trajectories, directly after the extraction from the rings, which was finally attributed to a small difference on BE.BSW after the class update.

Other than this, a new version of the HiRadMat beam was prepared, where the emittance can be adjusted through the length of the KSW plateau. An SIS interlock was also prepared (many thanks to Tibor for his fast reaction) and needs to be tested and configured the next days, once the SPS takes this beam.

The possibility of operating the machine without any current on the trims of the special injection and extraction bending magnets (BHZ15L1 and BHZ15L2), in case needed in the future, was also investigated. The first observations were very positive; very good extraction settings and orbit correction along the cycle could be achieved.

ISOLDE (Alberto Rodriguez):

It has been a good week at ISOLDE. No significant downtime with only minor problems in the machine. Several antimony isotopes delivered to the GLM line at the beginning of the week and multiple molecular radioactive beams (2xxRa19F^+) delivered to the CRIS experimental station since Thursday. On the REX/HIE-ISOLDE side, preparation for the next high-energy experiment started last Tuesday.

More details:

GPS:

- Monday: Target #732 installation and preparation in the morning. Initial set-up to GLM in the afternoon. Radioactive beam to users during the evening and night
- Tuesday: Set-up to central line completed. Proton scan and target yields and optimization. Radioactive beam (several Sb isotopes) to users during the evening and night
- Wednesday: Radioactive beam to users
- Thursday: End of experiment. Mass scans during the day for target and ion source development
- Friday: Target #732 removed and target #739 installed in preparation for 61Zn high-energy experiment this week

HRS:

- Monday: Target #740 installed in the afternoon
- Tuesday: Set-up of the separator. Stable beam to users in the evening and night
- Wednesday: Set-up of the central line. Proton scan. Yield measurements and optimization. Stable beam to users in the evening and night
- Thursday: Set-up to CRIS prepared. Reference set-up created using a uranium difluoride (238U19F2^+) molecular beam. Radioactive beam to users in the afternoon (multiple 2xxRa19F^+)
- Friday-Monday: Radioactive beam to users (multiple 2xxRa19F^+)

REX/HIE-ISOLDE:

- Tuesday-Wednesday: Preparation of set-up using a pilot 20Ne5^+ beam (7.5 MeV/u to ISS)
- Friday: Precise energy measurement and adjustment.

PS (Alex Huschauer):

The PS had a difficult week with an availability below 90%.

On Monday physics for the T9 and T10 branches of the EAST area started. Throughout the week work continued to set up the parasitic TOF beams on the EAST cycles, which might be required during the last weeks of the run to improve the beam sharing between the different users. Transverse and longitudinal settings were adjusted on all EAST cycles and the PS can now provide parasitic TOF bunches of up to 300E10 protons with reasonable losses. Work continues to further improve the intensity reach. In order to protect the target from beams with too small size or wrong position, a new dedicated SIS task was put in place.

A second dedicated MD to study the FTN optics took place on Tuesday, which showed that the limits from an aperture point of view are quite tight, but also that the optics model appears to be very predictive.

On Wednesday morning all EAST beams were stopped for an access in the primary area to investigate the issue with the water flow signals which cause the power converters to trip. Some fine tuning on the flow switches was performed, but no evident problem could be identified. Over the weekend, one additional trip occurred and will be followed up with the experts.

On Thursday an access to the PS became necessary to repair the 80 MHz cavity in SS08. In parallel an issue on one of the 10 MHz cavities was resolved and the SMH57 was again visually inspected, and no condensation on the connectors was found. During this access, an update to the FGC_62 class was rolled out in the Linac4, the PSB and the PS by the SY-EPC expert, which aimed at resolving an issue with the post-mortem submission after equipment trips. However, this update had some unexpected side effects, which significantly perturbed PS operations during Thursday afternoon and took until the evening to be understood and partially resolved. Once beam was back after the access significantly higher injection beam loss was observed on the high intensity users AD, SFTPRO and TOF. The BTP steering had changed by about 1 mm on all BPMs (reason still not understood), and some injection and extraction bumpers pulsed at a different current despite the same reference. In addition, we started to frequently lose communication to the PS injection bumpers and septum, which required several interventions by PIPO. The cause of these perturbations hasn't been fully understood yet, but a rollback of the FGC_62 version in the evening helped to resume stable operation. Issues still persist on the regulation of PI.BSW44, and PI.BSW42 tripped several times during the weekend.

During the weekend an air flow sensor problem emerged on the C10-51 cavity, which will require an access (probably Monday morning, still to be agreed with all machines). Because of this issue, and the fact that the C10-11 spare cavity doesn't follow the programmed voltage well at nominal intensity, the AD cycle has been operated in degraded mode at only ~1350E10 p since Sunday morning. Furthermore, a new bunch rotation scheme based on a phase jump was put in operation on Wednesday and has been running successfully since.

Further activities concerned the fine tuning of the NOMINAL ion cycle in the PS and the revival of the 3 bunch / 75 ns ion beam, which is still being set up. The PSB prepared a new HiRadMat cycle with increased transverse emittances and measurements at PS flat top also confirmed emittances larger than 2 μ m in both planes. For the CHIMERA project, a 2 GeV slow extracted proton cycle was set up and successfully sent to the EAST dump.

PS - East Area ():

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AD - ELENA (Lajos Bojtár):

The summary of the week:

- Rather good week, only small issues with the AD/ELENA.
- Elena orbit system failed due to a faulty pickup amplifier. This stopped the beam, because the LLRF system relies on the orbit system. After replacement of the amplifier the beam was back.
- Saturday afternoon the beam was lost on the first ramp. It turned out the radial loop killed the beam. When disabled the radial loop the beam was back. Its likely due to a pickup issue used by the radial loop. To be investigated further Monday.
- Stochastic cooling amplifiers resets.

Some improvements were done:

- Optimization of bunch rotation at AD injection with the new PS bunch compression.
- Work on the Ionization Profile Monitor in AD
- Trying to improve ejected beam emittance from ELENA with little success.

SPS (*Hannes Bartosik*):

It was a quite good week for the SPS. Beam was delivered to the LHC for the pilot test as well as to the North Area and AWAKE. Some work was done on the ion cycle in view of the beam commissioning next week.

- The LHC started to take beam on Tuesday. After some initial issues (wrong timing forewarning for BQM, frequency clock selection check had to be masked in the SIS, rephasing initially only working for one frequency, ...), the LHC pilot beam could be delivered to the LHC more or less as requested. On Sunday the LLRF beam control crate crashed and had to be restored by the RF specialist. After this, the injection bucket changed, which had to be compensated by adapting BQM settings. To be followed up on Monday with the experts.
- The SFTPRO beam was running smoothly. The spike at the beginning of the spill could be eliminated by optimizing the tune and slightly delaying the start of the spill. On Thursday afternoon the intensity on T4 was increased to 120 units as requested by the EA physicists. On Friday the beam had to be stopped for an access in BA81 for an intervention on a stuck collimator. Unfortunately the issue could not be resolved, and another access will be needed (most likely on Monday).
- It was the last week of the AWAKE run in 2021. The experiment requested beams with different intensities. With 3×10^{11} p/b the shot to shot reproducibility of the beam intensity was not great and could not be improved in the given time. The reason is not clear.

The overall availability was about 83%. The downtime was largely dominated by faults in the injectors. Other than that:

- a problem on the cooling circuit for the North Area caused 1h stop for the SFTPRO beam on Monday
- a spark on the MKE caused about 4h downtime Wednesday night
- the investigations on the stuck collimator in BA81 stopped the beam in the North Area for about 2.5h
- the LLRF beam control crate crash resulted in more than 1h downtime
- loss of patrol due to access system card trip in BA2 caused 1h downtime
- still quite a few RF cavity trips (although resettable).

SPS North Area ():

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AWAKE ():

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LINAC 3 (*Rolf Wegner*):

It was a rather complicated week for Linac3 with more interruptions than usual.

The beam intensity increased over the week and reached the 30 μ A level after the Tank1 amplifier intervention on Thursday evening.

- 3 source trips occurred due to cooling faults and 3 trips due to microwave HV supply faults.
- A rather complicated RF fault disrupted the beam operation on Tuesday when LEIR added a new user: the LTIM service on server cfv-351-allinac3b had stopped so that timing settings could not be written any longer to the hardware. This caused discharges in the cavity (Ramping and Debuncher) and tripped them for all users. Reyes found the issue and solved it by rebooting the server. 2.5h downtime in total.

- 2 RF interventions took place on the Tank1 amplifier: Wednesday during the source MD slot the tube in the driver stage was exchanged. On Thursday it was seen that also final stage was degrading rapidly and an urgent intervention was organised, mainly to avoid disruptions during week 43 (SPS taking ions).
- Vistar: The Linac3 BCT displays have been updated to use the offset-corrected values. Now all BCT readings are coherent.
- Regular beam energy measurements were taken throughout the week.

LEIR (Maria-Elena Angoletta):

It was a good week, with problems as well as with good achievements.

PROBLEMS:

First, on Tuesday afternoon we had problems with Linac3's debunch and ramp cavities. Experts (Daniel Valuch) intervened but it could not go far as many other experts were working in parallel. The problem was traced to a LEIR user that had been introduced in the supercycle and that - using old settings - asked a too high voltage from the two Linac3 cavities. That user for the h=3+6 in LEIR, i.e. the good old 75 ns beam that we were trying to resurrect and setup as a backup for SPS slipstacking.

To avoid the Linac3 problems, we cloned a 2+4 user and manually (we still have makerule problems and teh expert was absent) we moved it to h=3+6.

On Wed 20 Oct it was Linac3 MD (so no beam in LEIR) and a LEIR access was planned for A. Sinturel for the VHI's fans replacement. Before the access we had problem with the ER.SMH11 whose acquired current would not go down as required, hence it could be an hazard for the access. PIPO intervened and sorted it out. After the LEIR access the ER.SMH40 was not starting. PIPO sorted it out as well. Then one of the extraction kickers went down and could not be restarted. That as well was sorted out.

Finally, on Thu PM there was no beam from Linac3 for a few hours owing to an urgent intervention to replace the tube on Tank1 ampli. The exceptional crew (Gianpaolo Piccinini and co.) did it quickly and well, so normal operation was restored in the evening.

ACHIEVEMENTS

Notwithstanding all the above-mentioned hurdles, the 75 ns beam, was setup in LEIR and successfully extracted to the PS. The LEIR ejection kickers were touching slightly the third bunch so they had to be delayed by 65 ns. Some checks are still needed in the PS but then this topic can be closed, with the outcome that we're ready with the 75 ns beam in case the SPS would be needed (hope not). All is well.

CLEAR (Luke Dyks):

This week there were no user beam-time requests, so some limited beam time was used for MDs and training of the new PhD students on operation.

In parallel, preparation of the new experiments was ongoing, notably for irradiation experiments with CHUV, with the completion of the lab commissioning of the robotic system for sample handling, and the adaptation of the film roll dispenser to future alanine pellet dosimetry experiments with Manchester University.

Full reports can be found as usual here: <https://indico.cern.ch/category/10682/>.

LHC (Jörg Wenninger & LHC Coordination webpage):

After a final day of checkout, **first beam injection on Tuesday 19.10**. After initial issues with BTV image inversion and missing trajectory data due to a blocking PM data thread, both beams were threaded in around 2 hours and **first circulating beam was obtained around 18:30**. Very quick and efficient BI setup with orbit, BBQ, WS, Q' working after 2 hours of circulating beam.

On Wednesday a B1-B2 inversion was spotted with optics measurements on [RQTL7R3](#), a non-conformity that was present in 2008 and that was fixed (and closed) in 2009. During the SSS

exchange in LS2, the non-conformity was re-introduced. This inversion was "fixed" within LSA. After the fix the optics was remeasured and corrected to better than 10%. The beta-beating consistent with 2018 and expectations.

The ADT setup is well advanced with all excitation functionality in place after just over one shift of dedicated setup and the damping loops closed. The tune, orbit and radial feedbacks were commissioned. Crossing angle levelling was tested successfully.

All collimator BPMs were tested (some errors were found), collimator alignments were performed. Testing of a new loss map application was initiated.

The global aperture was found good - 12 to 13 sigma - and consistent with historic values. The local apertures in the injection and dump (only B2) regions were found as expected.