

Accelerator Complex Status

End week 39 (Tuesday 3 October 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 4'300 alarms.
- 605 phone calls (433 incoming, 172 outgoing).
- 106 ODM created.

Events worth mentioning:

- Mon 26.09, Issue with Swisscom causing difficulties on the mobile phone network.
- Fri. 30.09, Server problem in CCR causing communication loss for SPS, LINAC4, LHC and ATLAS operation.
- Mon. 03.10, IO error in the SF5 PLC cooling tower which leads to loss of communication on some sensors. To be discussed with the specialists for repair before more consequences (such as a sudden stop of the cooling towers).

Details: <https://wikis.cern.ch/display/TIOP/2022/10/03/TI+Week+summary%2C+Week+39>

LINAC 4 (Federico Roncarolo)

It was a good week at L4, with 99.5% availability.

The main down time was 2.5h hrs (night between Wed-Thu) due to a problem with an RF buncher tuner, fixed by the RF piquet.

Other faults were:

- 1 RFQ break-down (15 min to restart)
- few LEBT bad pulses → watchdog (5 minutes, reason being investigated)
- 1 CCDTL3-4 fault (12min)
- LEBT corrector power converter trip (3min)

The LEBT gas injection was fine tuned few times to ensure pulse stability.

PS Booster (Alan Findlay):

A good week for the PSB with just a number of very short faults, so we have around a 99% availability for the past week.

Work was done to fine tune the BCMS and 8b4e beams for the LHC throughout the week, improving the beam emittances.

The HiRadMat beams were adjusted to meet the demands of the users, with 2 intensities of 12E11 and 1.6E11 being requested.

Otherwise there was the typical work done on the beams and equipment resets.

ISOLDE (Emiliano Piselli):

An excellent week at ISOLDE.

HRS has been in standby since ~10 days when we took over the central beamline for the HIE ISOLDE runs on Sn to XT03 and XT02 lines.

From Monday to Wednesday we have delivered radioactive beams $^{108}\text{Sn}^{28+}$, $^{109}\text{Sn}^{29+}$ and $^{110}\text{Sn}^{28+}$ at an energy of 4.9MeV/u to the XT03 setup.

On Wednesday we have prepared the HIE ISOLDE ISS stable beam ($^{14}\text{N}^{4+}$) and, on Thursday, we have delivered radioactive beam ($^{110}\text{Sn}^{32+}$), at 8MeV/u to their setup.

Very happy users.

In parallel, on Wednesday/Thursday we have irradiated Medicis target.

PS (Benoit Salvant):

It has been a difficult week for the PS with an availability of 69% so far and decreasing. The prospects for the next days are unclear as problems with POPS and KFA13/21 are not yet understood and have caused frequent long downtimes towards the end of the week. The PS beams have been now stopped for the night as recommended by the POPS specialist and piquet.

The week started rather well, until two PS systems tripped repeatedly with long recovery time despite the hard work of many piquets and specialists: POPS (15h downtime from Wednesday afternoon onwards and counting) and kicker generators for KFA13 and KFA21 (no beam to North Area for 27h from Friday early morning onwards). The situation with these kicker generators has stabilized since Saturday night, but there will be no spare available for a couple of weeks in case issues come back.

The generator of MTE extraction kicker KFA21 tripped on Friday early morning and could not be reset, preventing the PS to send the MTE beam to the SPS. The SY-ABT piquet came on site and was quickly joined by the team of SY-ABT specialists. It was concluded that the generator needed to be exchanged with the spare. There is one spare generator for both kickers KFA13 and KFA21 and it had already been used to exchange the faulty operational generator on KFA13 on September 7. SY-ABT had repaired that faulty generator and tested it successfully in the lab a week ago. Unfortunately, that generator did not behave well and produced a lot of erratics on Friday. The SY-ABT specialists decided to exchange the thyatron on that latter generator, and to connect it to KFA13, while the working generator on KFA13 was connected to KFA21. That intervention took 13h, during which there was no beam to North Area (all other beams can be produced as KFA13/21). Erratics on the KFA13 generator occurred later that evening and required again the intervention of the SY-ABT specialist. Together with the shift crew they tried to find a working point that allowed reaching the required voltage without erratics, and finally settled on a very low voltage on the thyatron (another 14h of intervention and downtime for North Area beam). The SY-ABT specialist agreed to join the PS MPC tomorrow morning to discuss the strategy, as a repair of a faulty generator takes 2 to 3 weeks.

In total, POPS tripped 8 times on communication issues, could not be restarted 3 times because of the water cooling pressure, and tripped 3 times while setting up a cycle with a third plateau (EAST ion or M-TOF). This has caused 9 interventions of the SY-EPC piquet (helped by the POPS specialist) and about 15h of downtime in the past 4 days. The chronology of the POPS downtimes this week is detailed thereafter. The piquet tried to contact the major event SY-EPC piquet following tonight's trips but he could not be reached. The SY-EPC piquet and specialist have recommended now (at 03:30 on Monday) to avoid risk of damage by not attempting another restart of POPS and by waiting for the input of the major event piquet and an intervention in the morning to replace the whole control crate (2 to 3 hours according to the piquet). It is therefore likely that there will be no beam from the PS until late morning.

The LHC had not been too affected until now by this very bad PS availability, but the North Area users suffered a lot from this situation. The other PS users (EAST, AD, nTOF) could benefit from an availability of about 85%.

The other points to note for this week:

- Issues were encountered when setting up the HiRadMat beam as there were losses in TT10 and removing the transverse blow up on the previously used 2 eVs HiRadMat cycle was not sufficient to reach repeatedly a low enough transverse beam size on the HiRadMat target (it was realised later that there was a problem with the observation of the spot size measured in HiRadMat). The 3 eVs variant of the standard LHC25 beam was cloned, set up and sent to the SPS.
- A 30' access was organized on Monday in the shadow of the SPS access to repair the relay gap of cavity C10-91. During this access, an inspection confirmed that we can use TDI48 now, and an exchange of an FGC on F61.BHZ02 took place but had to be reverted later that day (1h15 without beam for the East area).
- The HL-RF piquets and specialists had to work on several cavities throughout the week (C10-46, 51, 56, 66, 91, 96).
- The extraction kicker KFA71 did not pulse due to a broken connector. The issue was identified and fixed by the BE-CEM specialist (1h15 without beam for AD, SPS and nTOF).
- Extraction kicker KFA21 was in fault but could be restarted by the SY-ABT piquet and the specialist on Saturday night (2h30 without beam to the North Area).

On the beams side,

- High intensity SFTPRO tests showed that $3.2E13$ p/p can be accelerated without issues with the 10 MHz cavities.
- A TOF high-flux MD took place to observe the impact on dose and target temperature when increasing the number of TOF cycles in the supercycle to reach $200E10$ p/s and $220E10$ p/s instead of 160 p/s.
- A FTA high intensity test took place up to $2100E10$ p/cycle, and the results are satisfying so that there is a proposal to increase gradually the intensity onto the AD target until the end of the year.
- Further tests took place to try and reduce tails for the BCMS beam, but a further decrease of the transverse tunes did not help.
- Ions were successfully sent to IRRAD during a dedicated MD. EAST T8 power supplies are now ppm thanks to SY-EPC. The list of available ion beams to East area was prepared and will be circulated (IEAST_FAST_Pb_22, IEAST_LI_Pb_22, IEAST_Pb_2GeVu_22, IEAST_Pb_1GeVu_22).

For what concerns POPS:

- On Wednesday afternoon, POPS tripped twice on the low energy EAST ion MD cycle, before tripping a third time on the water cooling circuit pressure in DCP6. The piquet went on site and refilled the water circuits (2h15 downtime).
- On Thursday morning, POPS tripped on a communication error between the POPS FGC and a control crate. The specialist performed resets and reloaded libraries on the crate (1h15 downtime).
- On Friday morning, the intervention on the KFA21 generator, which is in the same building as POPS, caused a fire alarm that stopped POPS. POPS could not restart due to the same water cooling pressure fault on DCP6 as on Wednesday. The specialist restarted POPS and refilled the water circuits again (40' downtime).
- On Friday lunchtime, POPS tripped on the same communication error as on Thursday morning. The specialist changed a control card (50' downtime).

- On Saturday morning, POPS tripped again on a communication error and the piquet exchanged another control card, as agreed with the specialist (1h45 downtime).
- On Saturday evening, POPS tripped again on a communication error, but with different symptoms. The specialist suspected the card exchanged last and replaced it. While restarting, a water cooling pressure fault on DCP6 came back and the specialist refilled the circuit (1h30 downtime).
- On Sunday morning, POPS tripped again on a communication error and the piquet and specialist changed the POPS FGC controller (3h downtime). POPS tripped again in the afternoon on the MTOF cycle, hinting that POPS has not liked the third plateau since the last injector technical stop (15' downtime, as the shift crew could restart POPS). It tripped again three times on Sunday evening (3h30 as I write these lines), and no further attempt will be done until morning unless agreed by the major event piquet.

PS - East Area ():

AD - ELENA (Lajos Bojtar):

Very good week in AD/ ELENA only small faults.

- Tuesday we had investigation of vacuum spikes in the e-cooler. Apparently, increased collector voltage cures the problem.
- Wednesday corrected a few issues in the orbit system and also tested high intensity production beam from the PS.
- Thursday many ejection line quads went off in ELENA, and Sunday the QUAD-MAIN2 in the AD. In both cases reset helped.

SPS (Arthur Spierer):

A challenging week for the SPS, with a high intensity HiRadMat run, LHC fillings, ions commissioning, Crab cavities dedicated MD and NA physics. We had several issues in the SPS (RF power, kickers, ...) and with the PS extraction for the NA beam. The availability at the moment of writing is 59% for NA and 83% for the other beams.

Monday started with an issue on the 200 MHz Cavity 1 power amplifier that lasted throughout the day and night, mainly affecting high intensity beams. During the heavy intervention of the experts, low intensity LHC beams could be accelerated with 5 cavities and then SFTPRO with a 10% lower RF power on Cavity 1. The rest of the week the cavity was running at nominal power.

The HiRadMat run consisted of 200+ extractions with 288 bunches, 1.6×10^{11} p/bunch, with different extraction orbits. It required several experts and iterations to set up. The main difficulty was having a reproducible transverse emittance (2.5 μm target at flat top). Starting from Wednesday at midnight, a bending magnet transformer failure in TT66 prevented the extraction towards HiRadMat. The replacement with the last spare for this line (two more for LHC) lasted until Thursday afternoon. Despite the low beam availability, the run was successfully completed on Friday night.

The ions HW/beam commissioning continued Tuesday. It started in the afternoon only due to LHC fillings. The technical issues from the previous week were solved (Injection jitter, loss of synchronization of the phase loop). The beam was taken again on Friday to continue injection instability studies. With a slight voltage increase and phase loop gain lowered the beam is stable. The 800/200 MHz ratio function was corrected to get a better calculation of synchrotron tune at injection. The beam was brought to the end of intermediate flat top, including slip stacking to optimize the phase loop.

On Wednesday the two dedicated crab cavity MD took place with a good beam availability. The studies were done at flat bottom only.

The LHC took pilot/indiv beams as well as VdM (two batches of 4 indivs) and beams with 4 batches of 36 bunches. The time between fills started to increase only by the end of the week, making it difficult to provide beam time for the parallel MDs and other beams (almost full day on Thursday). The filling time was also increased by intermittent issues with the SPS injection kicker (solved by the expert by increasing the delay).

Friday afternoon, some network/timing glitches have affected several equipment in the complex which required resets. The weekend was quieter with SFTPRO back to nominal intensity and LHC fills.

Items to follow-up

- Aperture restrictions: Stephane C. can proceed to an irradiation and hot spot measurement on Monday or Tuesday when he is in shift access in points 3-4 that should take one hour. This is not strictly necessary since such an inspection was not always successful in the past. An alternative is to do it just before the YETS since they normally won't intervene before. SPS logbook 3626198
- SIS: TBIU added wobbling surveillance every 1.2 seconds in case of trip
- Discuss with Benoît/Greg/Philippe for Feed Forward commissioning, can use A. Lasheen cycle LHCMD2 at flat bottom
- Ivan tried the voltage/phase jump smoothing slopes on SFTPRO and observed a significant improvement in power transients, to be commissioned with beam
- Slip-stacking: Slipry generating too many function points prevents further trims of the total voltage.
- 800 MHz Cavities don't start at the same time or not pulsing -> due to a bad contact on RF on/off timing cable (solved)
- Empty Bucket Channeling (EBC) spill is reported better by NA62: When can we put it in operation? We only need to test the 800 MHz on/off timing fix.
- 50/100 Hz: The new electronic seems not to help, it should be removed during the week.

Next week

- MDs on Wednesday:
 - Cristal shadowing from LSS4, TT20 optics measurement
 - Parallel: 200 MHz RF One Turn Feed Forward
- LHC Hybrid beam with 8b4e and BCMS
- Ion beam commissioning
- 1h30 stop for POPSB planed Tuesday 8h to 9h30
- Cooling issue on MSE, check on Monday if it can wait for Tuesday morning access (Cedric Baud).

[SPS North Area \(\):](#)

.

[AWAKE \(\):](#)

.

[LINAC 3 \(Rolf Wegner\):](#)

Here is a short report on Linac3 for week 39 (26 September – 3 October):

Good and stable beam production with an intensity of typical above 30 uA until Wednesday evening. Then the source lost in stability and the source expert had quite some work to compensate the trend.

Thursday morning was used for a MD slot to perform multiple beam measurements.

Thursday around noon the source became unstable and the source expert had to adjust the settings several times for maintaining an acceptable beam intensity. Late in the evening he moved both ovens which the overall situation. After retuned the source and LEBT on Friday early morning, good and stable beam production was re-established.

Over the weekend the extraction solenoid tripped once. After the restart good and stable beam production continued.

Linac3 beam energy measurements have been performed daily.

Many thanks to Detlef, the source expert, who invested a considerable amount of time, also outside working hours, to stabilise the source performance.

LEIR (Reyes Alemany):

A stable week in terms of beam performance. Only to events to highlight:

Wednesday 28.09.2022: beam sent to east area for CHIMERA MD. Unfortunately, LSA issues affecting the RFL make rules broke the generation of the main dipole functions, together with an FGC issue in the main dipoles. Both issues were finally fixed by LSA and FGC teams by mid-day. Despite of this unfortunate event, CHIMERA MD could take place successfully.

Thursday 29.09.2022: profiting from Linac 3 dedicated MD, we had several interventions in LEIR:

- BI: Installation of a modified amplifier in one ring BPM to see if we can see the 100 MHz Linac3 RF component in the beam and use it for first turn measurements. Today the first turn is overwhelmed by the secondary particles emitted when the beam impacts the chamber.
- BI: Test of a new algorithm in the BCTs to improve the signal processing
- The planned EPC test for a new adaptive regulation algorithm to correct the inductance errors in main quadrupoles could not be done

Otherwise, we start to see the Linac3 foil degrades, since we have started to increase the RC cavity phase to accommodate for the energy changes.

CLEAR ():

.

LHC (Jörg Wenninger & LHC Coordination webpage):

A second short fill was delivered to LHCF Monday, before switching to low-beta cycle setup and loss maps.

The intensity ramp up on Thursday began with the ATLAS 140 bunch calibration transfer fill. This was followed on Friday by ramp up fills with 150, 600 and 1200 bunches following the MPP ramp up plan. The first fill with 2461 bunches came on Saturday @ 1.05E11 ppb, some transverse blow up observed during stable beams. Injection tests of trains indicated that electron cloud conditions was sufficient to switch directly to physics with 2400 bunches. On Sunday evening the bunch intensity was pushed close to 1.2E11 ppb.

As part of the loss map campaign the impact on hierarchy degradation due to octupoles and Q' was checked for betatron loss maps in the vertical plane (degradation) and negative dp/p loss maps. The issue is a hierarchy degradation / breaking by the TDI in point 2, and to a lesser extend by the TDI in point 8.

On Saturday the LHC energy was raised at injection with the horizontal orbit correctors by +0.12 per-mill to reduce the difference wrt SPS which exceeded the 0.2 per-mill threshold (in particular for B2). The bunch length at FT was raised to 1.2-1.25 ns in the last fills (long blow up in the ramp).