Accelerator Complex Status

End week 31 (Monday 16 August 2021)

Technical Infrastructure (*Jesper Nielsen*):

Statistics:

- About 5300 alarms.
- 782 phone calls (551 incoming, 231 outgoing).
- 118 ODM created.

Events worth mentioning:

- Tue. 10.08: UW85 primary water tripped. A circuit breaker for a valve tripped, and caused the pompes to switch to the backup. The backup pump tripped on overload. Load wasn't too high on secondary circuits (LHCb, S78, S81, TI8) and allowed a quick restart without consequences. Only a small increase in temperatures was seen, see trends (blue is flow, green and orange is inlet and outlet temperatures)
- Wed. 11.08: Planned intervention on the SEQ4 stable filters. Intervention coordinated with TI, LHC, EPC and RF. The filters were stopped for 1 hour to preventively cut some small trees and weed that grew underneath.
- Thu. 12.08: EHT2 transformer intervention to inspect an oil leak. The inspection was agreed to be done during the 2h slot where the SPS was stopped for access electronics cards replacement. However the inspection revealed a leak that was much worse than first anticipated and the green light was therefore given to EN-EL to do the repair immediately. The access team could continue on their side to make up for the lost time.
- The repair didn't work out though and it was therefore decided to stay coupled with another transformer and give back the conditions to SPS, and do the switch back possibly next week, after the repair has been done.
- Sat. 14.08
    - Many problems due to the high temperatures and humidity. Many installations had various problems during the weekend: Cooling towers SF8 et 863, Klystrons Linac 4, eau primaire Isolde, Leir, etc. The cooling towers in LHC8 had a problem with a ventilator of the cooling tower, which imposed a limitation of the CRYO since the temperatures outside were very high at the same time. The problem was linked to the variator of the motor that overheated, an extra fan was installed in the variator to temporarily fix the problem.
    - Trip of circuit breaker EBD139/65, that cut the heaters for the CRYO. Since the LHC was not running, there was no impact.
- Sun 15.08: Trip of POPS-B cooling station. The cooling station tripped on leak warning. Manual filling on-site was forced to allow for a quick restart, piquet contacted in parallel to help find the leak, which was on a flexible hose for the SELF. The leak was isolated by EPC, pending a repair.

Details: https://wikis.cern.ch/display/TIOP/2021/08/16/TI+week+summary%2C+Week+32

LINAC 4 (*Alessandra Lombardi*):

It was a quiet week for LINAC4 with 99% availability

To mention:

- Chopper fault that needed the intervention of the RF piquet to change an amplifier module.
- Reset of SIS that got a wrong signal from EInzel lens voltage reading.

PS Booster (*Chiara Bracco*):

Quiet week at the PSB with one major fault in the night between 14th and 15th: more than 5 h stop due to a water leak on a self inductance coil of POPSb ==> switched to spare and fire brigade on site to remove the water.

Other issues:

Frequent trips of the extraction septum SMH15 ==> EPC investigating

- SMH15 magnet current is also affected by electromagnetic noise which increases with the beam intensity and leads to a perturbation of the regulation loops of the converter. The trajectories of the extracted beams are impacted by this noise. Ring 1 and 2 seem to give the greatest contribution but no correlation with losses or the position of the beam at extraction could be found. Common mode filters will be installed on the magnet at the beginning of September. ISOLDE, having the highest intensity, is the most affected user but normal operation can continue even with this situation
- TFB: some electronic coupling was observed between different rings. In particular, when injecting beam only in one ring, the pickups of the other rings show a signal with a similar pattern to those of the ring with beam. The cause is not yet understood.
- KSW: when sending consecutive requests (too close in time) of different number of injection turns, in some cases, the settings of the waveform get corrupted ==> a new version of the Cruise Control will be deployed which does not allow varying the number of injection turns until the last request is executed

For upcoming week, beside standard operation and parallel MDs:

- Monday at 9:00 new release of timing central system
- MTE: continue investigation of vertical losses in the PS when injecting >= 1.5E13 protons and effective need of shaving in the PSB
- Advance in making operational new ISOLDE beam with minimised losses.

ISOLDE (*Erwin Siesling*):

For ISOLDE it has been a fairly quiet week and from the machine point of view all has been running rather smoothly.

The duty has been shared between myself and Emiliano and I would like to thank him for being so flexible and covering for me for a few days.

As far as the machine is concerned:

GPS:

We have been running the GPS with a UC2C target #711 for the IS529 COLLAPS experiment. The machine was set up and ready as foreseen for radioactive Ca beams to the experiment by Tuesday-morning, however, on the experiment side there have been quite some issues and laser spectroscopy became practically impossible. They have only started taking radioactive beam as of Saturday afternoon. We will try to prolong the run slightly to enable them to take a bit more data today. I assume Karl will report on the run tomorrow at the FOM.

Issues ISOLDE/PSB wise:

We had a full stop of the vacuum system at the ISOLDE Low Energy part due to an issue during the emptying of one of the gas-recuperation balloons. Luckily Jose (Ferreira Somoza) was on site and could restart quick enough so we did not loose the GPS target heating.

Over the weekend there were a few interruptions dur to a LINAC interruption and PSB water leak.

A target change for a (used) Sn target #534 is being scheduled for Tuesday for which STAGISO cycles will be requested later this week (as of Wednesday-afternoon). This used target was vacuum and functionally (anode voltages) tested earlier last week on the HRS FE and is operational.

HRS:

We had a target change on Wednesday-morning for a LaC target #732 and setting up has started for the upcoming run for ISOLTRAP this week for which NORMHRS cycles will be requested.

REX/HIE ISOLDE:
In standby until mid Sept when ISS will take beam again.

PS (*Matthew Fraser*):
It was a good week for availability of the PS with a short access needed at Friday lunchtime to fix two gap relays on the 10 MHz system. An interlock issue on the hydraulic system of the injection kicker needed an expert intervention.

Work continued on the EAST cycle preparing for first extractions to the East Area next Monday 23 August. The bunch rotation was set-up along with a check of the RF settings along the cycle. Intensity variations confirmed a 400 ms spill from 8e10 to 5e11 ppp with a few low intensity "extractions" showing the beam nicely positioned on BTV57. New instrumentation devices in the EA were checked and added to the Working Sets, with BI connecting most devices; BLM's, spill monitors (scintillators) and XSECs, with many devices along the T8 beam line still waiting to be installed next week.

AD bunch rotation was adjusted to give a similar bunch length as in 2018, reducing extraction losses with no impact on capture in the AD. Unfortunately, no impact was seen on the FTA transmission. A test increasing the intensity to 1620e10 was successfully played in the PS but high losses observed in FTA. Work is on-going to improve transmission and an RP survey is planned for the week after next, although BLM's indicate an issue near FTA->9020. Dedicated time is needed with AD to steer the trajectory in this apparent bottleneck location.

Work carried on to improved losses before and at transition on TOF and dedicated studies made to understand the instability occurring on the LHC25 cycle at C2300 and with 2.3e11 ppb.

The PS took the nominal ion cycle for the first time this year and after some adjustment the beam was accelerated and extracted. Impressive data of the ion beam (with higher gas ionisation cross-section) were taken by the BI team.

Machine Development continued with RDT measurements of BGIV, tests of barrier bucket HW as well as on the East cycle preparing for empty bucket channeling.

PS - East Area (*Bastien Rae*):
- DSO test tomorrow
- Small delay on vacuum, no delay foreseen for the extraction, but the schedule will be really tight.

AD (*Bertrand Lefort*):
We are facing a total loss of the beam on the last ramp at 105 MeV.

After a 'huge' effort trying in vain to correct tune and orbit around this loss we end up adding intermediate plateau FT4A at 105.1 MeV and FT4B at 105 MeV. The beam is still lost but now the loss take place over 2 s (instead of 100 ms before) which gives us time for measurement.

The observation on the tune is that there is a sudden change of the tune at the very end of the ramp and on the flat part, the tunes are set to a value that cannot be changed changing the Quads settings. There is also a slide/drift of the Qh.

At first sight this could be explain by either a problem in one of the quad (electrical short in the magnet) or in one of the power supplies powering the quads.

After speaking with Gianluigi Arduini and Davide Gamba we should:

1. Check the AD half-quadrupoles QFC54 that has an independent trim
2. Check the stability of the Quad power supplies, we will need help of TE-EPC to have a look at this
3. Check eddy current compensation scheme with B-train specialists and Lajos Bojtar responsible of the cycle generation.
4. Look for potential source of coupling that could be generated by the e-cooler (as we already did for the kicker).

ELENA (*Bertrand Lefort*):

The cycle to receive Pbar is ready. No more tests were done this week in order to be able to focus on the AD issue.

SPS (*Hannes Bartosik*):

Week 32 was devoted to North Area physics and the first HiRadMat experimental run of the year.
HiRadMat:

- After finishing preparations and final extraction validations on Monday, the first HiRadMat experiment started on Tuesday morning with single bunches and short trains.
- Tuesday night was used for re-scrubbing the MKDV to allow acceleration of 288 bunches, which became necessary as the MKDV de-conditioned again since the mini-scrubbing run that took place the week before.
- HiRadMat extractions with 288 bunches of nominal intensity continued on Wednesday during the dedicated MD block. In the afternoon however a vacuum leak appeared at the end of the TT66 line. It was suspected that it could come from the beam window made of Beryllium. Following a special access procedure for potential Beryllium contamination established with the help of the DSO, a leak detection was performed by the vacuum specialists. The leak was confirmed at the beam window. The window was still in one piece, but swipes were taken to be analyzed in a chemical laboratory for Beryllium contamination. The assembly with the beam window was replaced by a spare on Thursday evening. A series of follow-up actions have been generated in the IEFC on Friday following a short presentation.
- On Friday the remaining pulses requested by the HiRadMat experiments could be successfully completed (the last experiment on BLM studies was cut short due to issues on the experimental setup).

SFTPRO:

- Investigations on the transmission to the T10 target continued. BI experts corrected a wrong calibration on the target instrumentation. Further investigations will most likely require dedicated MD time.
- The issue with the 100 Hz spill correction not working could be traced back to a problem in the signal generation on the FGC not being synchronised. EPC needs to update the FGCs to solve the problem.
- The dedicated MD on Wednesday aimed at studying splitting efficiencies with low intensity SFTPRO beams. Unfortunately the available time was spent only on beam preparation and the actual MD has to be rescheduled.
- On Wednesday evening there was access on T6 during which the vacuum group could fix an issue with the cable of vacuum pump for the target instrumentation. In parallel, a planned LLRF firmware upgrade was implemented. An issue with radial loop when restarting after the upgrade were traced back to a software bug in the beam control. Furthermore on Thursday an electronics module for radial loop pickup needed to be replaced.

- High losses on the last splitter in BA80 were observed during periods on Friday and on the weekend, cutting the spill due to BLM interlocks. On Saturday the situation was so bad that the intensity was decreased to 1.5e13 ppp . On Sunday evening the intensity could be increased back up to 2e13 ppp. For the moment the reason for these intermittent losses is unclear and needs to be investigated in more detail next week.
- Saturday night a flash-over occurred on the MKDV1 resulting in a pressure rise to 1e-3 mbar levels. ABT experts started the extended conditioning in the morning and beam was back at around lunch time of Sunday (pressure spikes during the restart were related to the starting of the ion pump that tripped due to the spark.

Availability and main faults:

- Availability was about 76%.
- The downtime was dominated by the long stop following the MKDV spark, several faults from the RF system (LL and power).
- On Thursday a longer stop was required for the repair of a 400 kV transformer, which took place in parallel to exchanges of electronics cards for the access system.

SPS North Area (*Bastien Rae*):

- Difficulty to have the beam back from SPS after the Wednesday MD.
- Still suffering from radiation level in H6/H8 probably due to lost on the splitter.
- There was a small water leak in the Bend9 connection in K12
- Some access problem on H6 door stay open despite the zone status.
- NA62 started data taking and waits for solution of the transmission problem.
- Compass wants to have the full intensity of 150 units.

AWAKE (*Giovanni Zevi Della Porta*):

WEEK 32 SUMMARY: access in preparation of next proton run (work on laser safety system, wakefield diagnostic, CV)

- **CV**: troubleshoot noiseon ventilation extraction
- **Laser**: functional DSO tests of LSSP1 (after its replacement). Laser permit re-activated
- **Plasma wakefield diagnostic**: progress in controlling diagnostic remotely (to avoid the manual interventions of the July run)
- **Streak cameras**: re-alignment of downstream-to-upstream streak camera optical line

Program of Week 33: Laser maintenance by external expert (M-T), SPS protons to solve time-of-arrival-jitter issue (W), RP survey and final preparation for proton run of week 34 (Th-F).

LINAC 3 (*Giulia Bellodi*):

It was a good week for Linac3 operation.
On Wednesday the source was restarted after an overnight trip.
A combined MD with LEIR took place in the morning to identify elements that could have influenced the restart from the last MD: ITF.BHZ11 was found to take about 3 minutes to reach its final current value after powering on/off.
Following that, RF and beam were stopped for 3 hours to carry out an intervention on the stripping foils (installation of two 100ug/cm2 GSI foils on arm1 in position 1 and 2). In the afternoon several measurements of beam profiles with ITM quad scans were taken.
On Thursday the stripping foil was exchanged after LEIR observed a deterioration of performance.
Foil #4 on Arm 2 is now operational (125 ug/cm2 GSI foil, old ‘witness’ foil).
On Saturday the source was restarted after a solenoid cooling trip.

LEIR (*Nicolo Biancacci*):

Main activities:

- Pushed injection efficiency on NOMINAL first injection upto 55% (as in 2018). Now working on NOMINAL beam accumulation.
- Preparation of NOMINAL 3+6 (PS 75ns beam), to be continued in W33.
- Joint Linac3-LEIR MD on Wednesday morning: no issue on correctors hysteresis identified. Linac3 MD performed in the afternoon: LEIR performance preserved once the MD was finished.

Fixed issues:

- Stripper foil exchanged on Thursday: the transmission efficiency artificially increased between Linac3 BCT15 and BCT25 due to propagation of charge states other than Pb54+. LEIR injection efficiency recovered once the foil was exchanged.
- Timing communication problem on the Linac3 LLRF server. This prevented the copy of cycle parameters from the LEIR side. Fixed by SY-CSS and SY-RF experts.
- EN-CV temporarily closed further the filling valve to have a slower filling in the cooling circuit common between LEIR and Linac3. This is done in order to reduce the slight increase in the pump output pressure when filling in the circuit, and therefore to prevent the electron cooler to trip (and/or other equipment). A survey shall be organised in LEIR in order to check for leaks, as well from the cooler owner to review the pressure interlock tolerance. From the intervention no water pressure related faults have been recorded.

Outstanding issues:

- Electron cooler power converter in fault three times since Friday. EPC and BI are investigating the issue.
- Regulation on main dipoles and quadrupole shows an initial overshoot and remanent ripples affecting the LEIR injection quality. EPC expert will have a look at the end of W33 once back from vacation.

LHC (Jörg Wenninger & LHC Powering Test webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Completed Sector @ 20K	Cooldown	Completed	Completed	Completed	Training	Cooldown	Training
77 / 11950 A	29 / 11538 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	49 / 11477 A	69 / 11585 A	40 / 11447

No training over the weekend (14-15.08).
RF pre-pulse distribution working for both beams. MKI2 and MKI8 pulsed for the first time in remote. Essential IQC data almost complete. ALICE solenoid, spectrometer and compensator ramps tested. Beam exciter (MKQ, MKA, AC-dipole) commissioning started. FMCM tests almost completed (missing RQ4/5.LR7).