Accelerator Complex Status

End week 36 (Monday 13 September 2021)

Technical Infrastructure (*Clement Pruneaux*):

Statistics:

- About 3'700 alarms.
- 509 phone calls (354 incoming, 155 outgoing).
- 88 ODM created.

Events worth mentioning:

- Mon. 06.09:
  - Loss of patrol in BA80
  - ME49 transformer tripped by high temperature. The source of the problem has not been found by EN-EL piquet who restart transformer at 03:33. No impact on Meyrin's beams (AD & Elena).
  - Electrical disturbance which tripped LINAC4, Booster, PS, and SPS beams. RTE has confirmed a major disruption on the whole network (-15.34% voltage deep during 96ms on the CERN network).
- Thu. 09.09: Loss of patrol at BA3
- Fri. 10.09: 19:40 Thyristor controlled rectifier tripped at LHC point 8 on low water flow, TE-EPC/LHC verified not needed over weekend and CV investigating. No event yet, more news during the week.
- Sat. 11.09: Loss of patrol at TCC8.

Details: https://wikis.cern.ch/display/TIOP/2021/09/13/TI+week+summary%2C+Week+36

LINAC 4 (Eva Gousiou):

The Linac4 availability this week was at **95.3%** [7h downtime], which is lower that usual; a number of issues appeared and the downtime was longer due to the constraints of the holidays. The main issues were:

- Failure of the 18kV **Power Converter of the Source RF** Amplifier. The Converter could not be restarted and it was replaced with a spare; after three years of uninterrupted operation, it had three restarts in the last two weeks [3h, Wed]
- Three trips of the **DTL1** Cavity, all within ~1h, probably due to the **High Voltage measurement of the Modulator**. On the third trip, after the previous two remotely-recoverable ones, the piquet service was called for a deeper analysis. There was an unavoidable downtime to contact all the experts on a holiday and to diagnose the failure as the issue affects two groups, RF and EPC. It was decided to attempt another remote restart while all the experts would be getting prepared for a potential intervention if necessary; after the restart, the issue did not reappear. EPC and RF are now all informed and would be ready to intervene if needed or take measurements on the High Voltage divider system in the upcoming TS [3h, Thur]
- Three short trips of the **Power Converter** of the **Einzel Lens**. The last two weeks we have been having several of those trips; now the experts are back from holidays and are putting in place extra diagnostics [0.2h, Tue-Fri-Sun]
- Two short **Chopper** trips from the Chopper Driver Unit; the experts are aware of these frequent trips and will work on that after the SPS priorities [0.3h, Sat-Sun]
- Finally a **DTL3** trip (seems to be due to the Modulator) and a short **CCDTL04** trip (breakdown in the main coupler) [0.5h, Thur-Sun].

PS Booster (*Fanouria Antoniou*):

We had a relatively quite week in the PSB with a good availability of around 93%.

Our downtime was dominated by the Linac4 faults and a stop of 1h19min on Thursday due to an intervention for the replacement of the FGC and the power converter of the BR2.DVT8L1 corrector. The corrector was in fault and could not be reset. PIPO was called on site and initially changed the FGC. This did not solve the problem and finally, the power converter was exchanged as well. During this time, the machine was in degraded mode, not providing beam from R2, for 90 min in total and stopped for all users for 1h19min.

Other than this:

- The B-train issue reappeared at the beginning of the week. Even though the B-train was lost for some users, the experimental FESA class was proven to be stable. The B-train experts therefore decided to deploy this version in operation during the technical stop this week. This is expected to solve the long standing issue we have with the simulated B-train getting lost when a new clone is inserted in the supercycle, causing losses in other users.
- A new version of the MTE beam was prepared as requested by SPS, to be tested this week.
- The small mask was inserted in R3 and several measurements were performed. The MD was successful and had no impact on any of the other users.
- Optics measurements started in the 160 MeV flat cycle.

ISOLDE (Emiliano Piselli):

Low energy beamlines:

HRS:

Radioactive beam to users on Tuesday, Wednesday and on Thursday. By Friday beam shared with GPS until Saturday evening. No issue to share.

GPS:

On Tuesday and Wednesday morning the problem for the clamps not opening/closing properly has been investigated with accesses in the separator zone and HT room to check compressed air connections and values. OP has helped EN-STI to perform all these tests.

In the Isolde target workshop, our colleagues from EN-STI have found that the M12 thread on rear piston side failed due to the force and a bad machining. Then they have installed a Helicoil to fix it and it has worked properly.

On Wednesday afternoon we have installed a new target on GPS and started pumping the sector and heating the target.

On Thursday I went to Isolde and I have prepared stable beam for the users. In the night, sharing beam with HRS users could take beam in LA1.

On Friday proton beam scan and yield measurements (EN-STI) and then beam to users (LA1+GHM). Rilis ON.

On Saturday and Sunday radioactive beam (shared with HRS until Saturday evening) without any particular problem. Called in for a vacuum valve interlock on Sunday evening. It was a vacuum spike which switched off all the devices in the same sector. Everything back after few minutes.

HieIsolde-Rex

Beam set-up to the end of XT02 with 22Ne8+ and beam to users by Friday late afternoon.

Problem on Friday night with the cavity XLL2 CAV4 (Cryomodule 1, cavity 4) which was tripping very frequently. On Saturday morning we have contacted D.Valuch who has increased the feedback gain to the maximum he could and no issue afterward.

Problem on Saturday morning with 7GAP3 which failed and could not be restarted. C.Gagliardi (SY-RF) was called and, as best effort, he was very available and kind to come in and check the system.

After a quick diagnose he has exchanged the module GRID1 for this amplifier and everything went back to normality.

PS (*Benoit Salvant*):

The PS had a rather quiet Jeûne Genevois week: 89% availability until now with most of the downtime coming from Linac4 and PSB.

There were indeed only a couple of relevant issues in the PS to report:

- a fault on the hydraulic part of a solenoid valve on SMH57 required an access (3h on Monday when restarting the complex after a Linac4 fault).
- moving the PEX.MC-CTML forward on an MD cycle tripped many FGCs in TT2 (1h40 downtime on Tuesday).

East commissioning continued throughout the week with improved steering of the T8 line with the slow and fast extraction cycles. DSO tests in the East area were completed on Wednesday.

On Friday, BE-BI worked on the calibration of the XSECs and BCTs in F61 and T8: the XSECs were tested and calibrated from the ring BCT (F61.XSEC023) or the theoretical throughput (T08.XSEC070 and 094) and the BCT calibration needs more work from BE-BI.

Investigations on the transverse emittance of the LHC beam with 48 bunches (2 basic period) led us to harmonize the injection settings with the 72-bunch variant (3 basic periods) over the weekend.

The dedicated MD on parallel measurements to compare BGI and SEM grid turn-by-turn took place and allowed confirming that the first turn was seen on all SEM grids and both planes and that all wires looked intact. Several actions were identified with BE-BI in order to be ready for the second MD in October.

The issue that had been causing the PS cavities to trip when the SPS was playing the coastable cycle could finally be identified and fixed by the PS and SPS RF teams towards the end of the coast MD on Wednesday: the gain of the SPS phase loop was too large, leading the loop to be unstable, which caused large RF frequency drifts to be sent to the PS after PS ejection while the RF cavities were still pulsing.

PS - East Area (Bastien Rae):

- DSO tests for the secondary beamlines have taken place on 8th of September and were successful.
- The secondary beam commissioning it is scheduled to start after the technical stop on 16th of September.

AD - ELENA (*Lajos Bojtar*):

- There were many faults in the injectors at the beginning of the week, often there was no production beam.
- Monday the magnetic horn failed, no beam for 3 hours.
- Wednesday morning we noticed spikes in the AD vacuum at the e-cooler section. Did OP 7 to the ring to check the cooling water conductivity of the e-cooler, it was found O.K. Then noticed arcing in the Faraday cage time to time. The specialist stopped the e-cooler to not damage it. While pulsing the high voltage (27kV) to find the exact place of the arcing an insulator tube produced smoke, which triggered a fire alarm. The AD hall and CR was evacuated. The fireman came in a few minutes and checked the Faraday cage. After that, while restarting the e-cooler, the cathode had to be re-heated, this took many hours. Beam was back at 22h35.

- Friday night the magnetic horn failed. As there were no users taking the beam during the weekend there was no urgency to fix it. Next morning I went to check it and found a faulty PLC. The PLC specialist was not available. Later CCC contacted the ABT kicker piquet and managed to put the horn ON, but it is still not pulsing. According to G.Grawer who is the eqp. specialist it can not have major problem if it is ON, he will have a look Monday morning.

Improvements during the week:

- Optimization of the dogleg
- Improved e-cooling on 300 MeV/c (without the de-functional scrapers, only by looking the intensity)
- Some tune corrections
- AD deceleration efficiency is nearly the usual pre-LS2, about 80%.
- Improved ejected AD beam stability by installing a filter on the ejection septum power supply.
- FTA and 9000 injection line studies Sunday by Yan Dutheil.

Instrumentation issues:

- AD target BTV9064 not working beginning of the week, fixed now.
- AD scraper does not work in both planes.

SPS (*Hannes Bartosik*):

It was a relatively good week for the SPS, apart from a period of 22 hours without beam caused by a failure of the MKP PFN, as well as the long stop due to the Linac4 and subsequently the PS in the beginning of the week, as well as the usual issues with the access system cards.

- SFTPRO
  - relatively good transmission during this week. Since Wednesday evening the SPS was running with slightly lower intensity as requested by the users (25 units to T2). Only for a short test 150 units were provided to COMPASS as requested.
  - Tests of an automatic correction of 50 and 100 Hz components of the spill are ongoing and look promising so far.
  - EPC improved the regulation of the extraction sextupoles (for 2 out of 4 power converters) to minimize the overshoot at the beginning of the extraction pulse. This should improve the start of the spill - to be tested in the coming days.
- AWAKE
  - smooth running with different intensities as requested by the experiment.
  - From time to time re-steering of the extraction trajectories is requested.
- Long parallel MD on Tuesday for LHC beams
  - Devoted to high intensity studies of 72 bunches with acceleration.
  - The transmission on flat bottom could be slightly improved by adjusting the tunes (it was found that the tunes were too close to the coupling resonance). This also reduced the transverse emittance blow-up. For an intensity of about 1.5e11 p/b, emittances of around 2.1 um in H and 1.9 um in V are measured at flat top after the optimization.
- dedicated MD on Wednesday: setup of coast cycle
  - a new LLRF firmware was deployed to enable the coast recovery functionality
  - the issue of RF cavity trips in the PS caused by the coast cycle could be traced back to a wrong gain of the phase loop pickup, rendering the loop unstable and resulting in large excursion of the frequency sent to the PS.
  - The LQR filter settings had to be corrected on this cycle to accelerate the beam to flat top, as for the moment they don't follow the trims of the RF voltage.
  - For the moment the RF is still switching off when going to coast. Also the beam dump kickers seem to fire before switching to coast. These issues need to be further investigated next week.

Main faults and other issues to be followed up

- On Friday evening the beams could not be injected correctly any more. The issue was traced back to the MKP, and experts found an issue with the PFN, which required the change of the front-cell capacitor on Gen 2, PFN3. During the intervention, also the oil was changed and the PFN cleaned too, The beam was back only after about 22 h.
- Very frequent trips of cavity 5, and cavity 2 on the SFTPRO cycle. This issue already occurred last week, but could not yet be resolved. Further investigations by the experts needed.
- Also quite some trips of the transverse damper on the SFTPRO cycle.
- Loss of patrol due to the issues with access system cards in TCC8, BA3, BA80. Fortunately the specialist could restore BA80 without need of access. For BA3, the access card could be restarted and the search history reset, however a problem with the biometry could not be resolved and so biometry had to be temporarily deactivated.

SPS North Area (Bastien Rae):

H2 :

- NA61 have finished their run and are ready to take physics on the next one. Atlas Zdc started, unfortunately the 380 GeV proton could not be delivered due to current limitations of the LOKN.

H4:

- NA64 has been uninstalled and are happy with the run. GIF started their run on Wednesday. Lot of experiment inside the bunker profit of the muons beam.

T4 Wobbling:

- Friday the 3rd the wobbling was changed back from -300 GeV @ H8, -120 GeV @ H6 to the standard setting of +180 GeV @ H8, +120 GeV @ H6.

H6:

- Friday wobbling was changed back to receive +120 GeV in H6.
- CMS Pixels continues to take data this week.

H8:

- SND was able to finish their data taking with three energy points.
- On Sunday ATLAS TileCal has become main user in H8. The dump upstream of the zone has been closed and the zone has been used for installation with FASER as parasitic user in H8A.
- On Monday the vacuum has been installed up to TileCal to permit electron beams and all parasitic users have been moved out.

M2:

- COMPASS started taking physics data on Tuesday.
- Nominal T6 intensity of 150 units on T6 reached on Wednesday. Intensity lowered back then to 110 units on request of COMPASS due to problems of some detectors.

For P42/K12:

- Lau performed a collimator 3 scan to check the dispersion in the P42 line. This looks the same as in 2018 and thus confirms again that the 2018 optics in TT20 give back the same performance as we had before.

NA62 is in general happy with the beam, but would like that the colleagues improve further on the 50/100Hz spill structure.

AWAKE (*Giovanni Zevi Della Porta*):

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LINAC 3 (*Richard Scrivens*):

The spark rate of the source (causing ~30s loss of beam) has increased to ~80 per day. A alternative source tuning was tried from Wednesday.

With the calibration of the BCT41 fixed on the LEIR side, and showing some losses, the trajectory was swept to see that there is a higher transmission possible, but has a very large excursion trajectory. Survey of the lines is foreseen for the YETS will might help explain why.
A Semgrid pre-amplifers failed, and were repaired in the week.
On Thursday to Friday, the source intensity dropped and became less stable. Tuning could not fully recover by the end of the day, with the source being left to stabilize with a different set of tuning parameters.
However, on Friday-Saturday the lead ran out, so the ovens will be refilled on Monday.

LEIR ():

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LHC (Jörg Wenninger & LHC Powering Test webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Completed	Cold	Completed	Completed	Completed	Trained	Cold	Completed
77 / 11950 A	29 / 11538 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	69 / 11585 A	55 / 11600

Testing of the new R2E PCs following their modification. Sectors 23 and 78 moving into ELQA phases.