Accelerator Complex Status

End week 35 (Monday 6 September 2021)

Technical Infrastructure (*Ronan Ledru*):

Statistics:

- About 3500 alarms.
- 641 phone calls (437 incoming, 204 outgoing).
- 57 ODM created.

Events worth mentioning:

- Mon. 30.08:
  - Fire alarm in building SX5. The sensor was dirty, the fire brigade asked to send the Fire detection piquet.
  - Instability of the IT network (b.354) has affected the operation of the PS complex. The faulty card has been replaced and the rooter was put back in service.
- Tue. 31.08: GSM issue in Prevessin. When the specialist arrived at Prevessin, everything was solved. This was surely due to a problem on Orange antenna
- Fri. 03.09:
  - Trip of EBD1 and EBD2 in RE32 because of a high temperature of the transformer EMT103/32. After some troubles to access, EN-EL found a wire not well screwed which has send a false alarm. Everything was ok at 13h30, the cryo didn't loose the conditions
  - During the switchover of the access mode of IRRAD/CHARM the ventilation has tripped. The ventilation has been fixed quickly to allow the purge mode the access.
- Sun. 05.09:
  - Loss of patrol at BA1 at 13:32.
  - Loss of patrol at BA2 at 18:35.
- Mon. 06.09:
  - Loss of patrol at BA80 at 00:10.
  - Trip of 18kV transformer ME49 (AD) because of High temperature alarm. The sensor seems working correctly, the transformer has been switched ON. The problem is under investigation
  - Glitch on the 400kV line between CREYS and GENISSIAT 2. Linac 4, PSB, PS and SPS tripped.

Details: https://wikis.cern.ch/display/TIOP/2021/09/03/TI+week+summary%2C+Week+35

LINAC 4 (*Federico Roncarolo*):

About 95.5% availability.

There is an ongoing communication problem with a PLC in the tunnel, managing the RFQ tuning, which was the reason of 3 downtime periods to restart the RFQ:

- on Tue afternoon, ~4h, when we agreed to stop the RFQ and restart some FESA processes for trying to restore communication
- on Thu morning, ~45min, to restart the RFQ after the timing update endorsed by the FOM.
  - On this occasion there was also a problem with a frozen process on a LLRF VME card, which may be related
- this morning after an 18kV electrical perturbation

Last week, once restarted, the RFQ operation was ok (it was only a remote monitoring problem) and we decided to wait for the technical stop for further investigation (+ a low RF low level expert back today).

This morning it was not possible to restart, for which an **access is ongoing** to locally inspect and hopefully reset the PLC.
Other points to mention:

- **2 faults (few minutes each)** due to the **source Einzenllens power converter** (it happens 1-2 times per weeks since a while, SY-EPC is aware)
- after a **SIS update** (to cope with spurious 'not connected cable' status) all **SEM grids** were re-enables on Monday morning
    - we soon realised spurious SIS interlocks (cutting the pulse length to 100us) kept on occurring due to false 'busy' status from the SEM detectors.
    - we suspect it is due to too fast write-read command sequences on the SEM control cards,
    - we disabled again the grids and we'll **test a modified FESA server today,** hopefully fixing the problem.

PS Booster (*Alan Findlay*):
Overall a quiet week for the PSB, with no major issues to report, until the electrical glitch this morning around 06H15, which we are still recovering from. We are waiting for the arrival of specialists, but we are hopeful that there is nothing serious.

The availability was greater than 95%, with the lions share of the downtime related to L4. The PSB had it's usual series of resets throughout the week, but nothing that took very long before operational beams were re-established.

There were couple of larger longitudinal and vertical emittance MTE variants prepared for SPS and tested with the PS & SPS.

ISOLDE (*Eleftherios Fadakis*):
It has been a fairly calm but busy week and from the machine point of view all has been running smoothly.
E. Piselli and S. Mataguez really contributed and shared the work load whenever needed and I thank them for this.
We have been delivering beam from GPS, continuing an experiment (Au-IS665) that started the previous week.
HRS was set up to deliver beam on Thursday to the VITO line (IS666). During the proton scan on HRS, it was discovered that the target production was fairly low and users requested another target.
Friday the 3rd was very busy since we managed to make a target change, set up the beam (using a previous set up which needed almost no fine tuning) and performed a proton scan. HRS users were not ready, so GPS users continued taking radioactive beam during the weekend.
On Thursday GLM performed collections.
Monday the 6th the target on GPS will change.

REX-HIE
S. Mataguez together with N. Bidaut conducted A/q-scans from EBIS, with and without neon injection. This was part of the preparation for the first REX-HIE run (IS689)
Also, we have been working on the characterization of the stability of the SRF cavities for different gradients.
On REX, L. Timeo with colleagues from EN-CV, improved the water stability by an order of magnitude. This will greatly assist the tuners of the REX amplifiers.

MEDICIS
MEDICIS target was being irradiated since 1st of August, until tomorrow morning.

PS (*Matthew Fraser*):

The PS itself had a good week with most of the 13% downtime coming from upstream. Today we lost an electro-valve on BSW61 tripping its WIC and decided to make a quick access at lunchtime (1.5h downtime) to be ready to continue commissioning during working hours tomorrow. A timing intervention on Thursday morning was not transparent for some of our extraction elements (FGC62) causing 2 hours downtime. KFA71 continues to trip more regularly than during Run 2 causing occasional downtime.

This week East Commissioning made significant progress with the beam extracted to all targets at 50e10 ppp with one or two cycles per supercycle. RP checks successfully confirmed the shielding effectiveness at this flux, with the number of cycles in the supercycle to be increased next week. To achieve this the pre-LS2 quadrupole settings had to be applied to the new transfer line in order to steer the beam to T8 and IRRAD/CHARM. BE-EA joined the commissioning effort and are investigating the reason why the new optics induced large losses where the beam switches from F62 (the horizontal beam size appeared large and some low beam loss remains on T08.BLM006). Transmission to the targets is to be quantified together with BI and the new XSEC system. The refurbished LSD spill monitor now called BCCGA is now operational (2.5 kHz sampling rate) and is ready for the East Vistar.

A couple of improvements were implemented on the operational SFTPRO cycle including accepting a larger longitudinal emittance from the PSB and a slightly larger vertical emittance; the later helped reduce the splitting losses in TT20 of the NA with only a small impact on transmission in the SPS.

Investigations of the TOF optics model continued with TT2 quad scan measurements and emittance measurements repeated with the dispersion measurements in the ring and transfer line. A few TT2 quads were observed to have the wrong transfer function in LSA (QDS instead of QFS) and will need updating once all quads have been checked.

Other actives included, (i) RF setup on single bunch iLHC beams continued with the beam making it to flat-top and adjustments needed on the ejection field, (ii) CBFB studies permitted 2.3e11 ppb on LHC25 72b (iii) LHC25 48b is ready for SPS MD's at 1.4e11 ppb.

PS - East Area ():

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AD/ELENA (*Sergio Pasinelli*):

Week in few lines

- AD and ELENA have suffered from IT perturbations and from missing beams due to Linac4RF, PSB and PS faults.
- Two attempts, without success, to optimize FTA lines in order to adjust the beam diameter on the target. Adjusted longitudinal position of the target and increased the voltage on the horn.
- SEM controls were problematic during the week. We have had difficulties to put in/out the SEMs and we haven't monitoring on them. Optimization of the Gbar line was canceled due to the SEMs problems. Friday, after specialist debugging, SEM were back.
- SCooling adjustments by the specialists. They have managed to decreased emittances by a factor 2 on the 3.5 Gev/c plateau. (End plateau 3.5 Gev/c = 10 pi mm mrad , begin plateau 2Gev/c = 18 pi mm mrad)
- Asacusa1 received his first Pbar beam. Now, beam is received by Gbar, Alpha and Asacusa1.
- Attempt to adjust the shape of the ADE extraction septum. Specialist has improved the form of the ejection septum pulse. It is smoother now. The coherent oscillations are still there.

- Alpha is happy with the beam (stability and intensity)

Details

Monday:

- AD & ELENA have suffered from the IT network perturbation and no beam was delivered to experiment until the end of the afternoon.
- Due to vacuum spike when opening the valves in front of the experiments, vacuum expert has increased the threshold. Now we can open the valves without the support of the vacuum piquet.

Tuesday:

- AD & ELENA have suffered from the Linac 4 RF problem.
- Asacusa vacuum valve was opened and Asacusa received his first Pbar beam. Due to his laser, Asacusa will not want to receive H- from ELENA. H- can damage his laser. Solutions must be implemented somewhere in order to avoid this.
- Experiments are happy with the Pbar beam from ELENA. They will not take the beam before the end of the week.

Wednesday:

- Target was moved out of the beam. Measurement and adjustments were done in FTA in order to reduce the proton beam diameter. Unfortunately, it was not successful. Previous values were restored.
- Target was moved back to the beam and work was done on the longitudinal position of the target (40 mm downstream) and by increasing the voltage (5470 V to 6200 V) of the horn. Pbar intensity injected into AD was increased by 6-7%.
- The water cooling expert has detected an over temperature in the main pump. The current value his slightly above the nominal. He has reduced the debit (minus 25 m3/h) now the current is about 15 [A] lower than the nominal.
- Bad beam cooling on the 3.5 Gev/c plateau due to water interlock on the Cavity C10. Specialist was called and he has adjusted the debit.
- No beam extracted from ADE. We have lost the ADE ejection septum for 1 hours. Specialist was called and he fixes it by using the spare.
- Beam jitter at the extraction due to bad beam synchronization. Called specialists for advises. Adjusted gain on the phase loop. Nominal beam back.

Thursday:

- New tentative. Target was moved out of the beam. Measurement and adjustments were done in FTA in order to reduce the proton beam diameter. Unfortunately, it was not successful. Previous values were restored. Works on TT2 must also be included in the optimization of the beam on the target.
- Horn down. Cannot restart it. Call specialists. PLC was lost communication.
- No beam from 9:00:
    - Linac 4 RF down.
    - CPS due to extraction problems.
- Beam back at 12:20
- ELENA SEM acquisitions are not operational. We cannot control IN/OUT of the grids. Called specialist.
- Water cooling expert put back the previous debit values in order to have long pauses on the 3.5Gev/c plateau.
- SCooling adjustments in H decrease of the H emittances by a factor 2 on the 3.5 Gev/c plateau.

Friday

- Reduced the water cooling debit
- After specialist debugging, SEM are back
- Attempt to adjust the shape of the ADE extraction septum. Specialist has improved the form of the ejection septum pulse. It is smoother now. The coherent oscillations are still there.

Saturday: Alpha asked to measure the bunch length => 234ns

Sunday: Alpha is happy with the beam (stability and intensity).

SPS (*Francesco Velotti*):

The SPS week 35 is the first week (at the time of writing this summary) after LS2 with availability larger than 80%! The main issues are still from the access system and especially from BA1.

Regarding SFTPRO and North Area, we recovered 2018 transmission from T4 to T10 by changing the optics in TT20 back to Q-split. This was not explicable with the available TT20 model and further investigation is needed as any of the quadrupoes might not be providing the requested performance.
The spike at the beginning of the spill was removed basically delaying the extraction, but non-negligible overshoot was observed on extraction sextupoles which could explain it.
Then we had a few tests on the automatic start of 50-100 Hz correction, which seems very promising but not yet deployed. Also, our PSB colleagues prepared a larger vertical emittance SFTPRO version. This was taken on Friday resulting is about 2% transmission losses but about 9% reduction in losses at the splitters. This seemed to have helped to reduce the frequent dumps due to vertical instability, but to be verified with data. Increase in horizontal chromaticity was needed to avoid horizontal instabilities developing along the cycle.

AWAKE had their second week of the second physics run. Data were taken with nominal and reduced intensity, with nominal and special optics in TT41. The main issue was seem on Friday evening were TAG41 patrol was lost due to lost of communication with sector 2, 5 and 6. Zone needed be re-patrolled.

The dedicated MD was devoted to the investigation of SPS transmission states and TT10 investigation. After the mains reboot, some low frequency harmonics seem to appear (17-18 Hz and around 80 Hz) - not clear is this could explain the different transmission states, data analysis ongoing. Over the weekend though, the trick of switching off the mains showed to be effective once more allowing us to re-gain the about 3% transmission that was lost with the precedent trip. Towards the evening of Sunday though, a few other trips of the mains could not be recovered in this way and instead the transmission staid lower than before the trip. The low frequency harmonics seemed to be larger in the cases of very bad transmission also on SFTPRO. It needs follow up.

The parallel MD was instead devoted to LHC test preparation. At the end of the day it was possible to test the pre-pulse generation with LHC mastership, same test done with multiple injections too, and finally re-phasing tested too. Even though with a low success rate, the re-phasing worked letting the BQM allow for extraction in a few cases. More work is needed to guarantee stable extractions.

The main issues seen this week were:
- PSB following the issue on TN router
- frequent lost of patrol in BA1 (2 times for far) due to the usual problem with the access system. The other zones that tripped too were TAG41 and BA2
- a very large amount of cavity trips, mainly cavity 5 and 2
- SPSQC not working for about half a day due to server overload - finally fixed removing the load generated from the DEV version (but only temporary fix)
- overshoot on the extraction sextupoles may explain the spike at the beginning of the spill. It needs to be followed with EPC (already informed)

For next week:
- EPC needs about 30 minutes for the sextuples spike investigation
- EPC would like 2h to work on the mains (need ring chain closed)

- Monday morning need to increase intensity on T6 to 1e13 p as COMPASS should be ready to start data taking.

SPS North Area ():

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AWAKE (*Giovanni Zevi Della Porta*):

Week 35 summary: electron seeding studies vs proton and electron bunch charges; characterize plasma light diagnostic; begin hosing studies.

Monday:
Electron-seeded-self-modulation (eSSM) established with proton intensity 1.5E11p and 2E11p. Developed faster proton trajectory alignment procedure based on average trajectory to avoid effect of jitter on BPMs.
Tuesday:
eSSM re-established at 2E11p, then 2.5E11p and 3E11p. Faster proton alignment works, but electron alignment is still challenging.
Wednesday (Machine Development):
Access during machine development. Access System patrol boxes reset, BTV magnification change, laser trigger improvement, laser power supply remote control, plasma light trigger improvement, laser autocorrelator realignment.
Thursday (Parasitic MD):
Electron/laser timing study, Electron/laser plasma light studies. Measured proton optics taking advantage of new
magnification of BTV50 and 53. Asked SPS to vary proton size at waist, and measured optics for each configuration (interesting in preparation for 2nd plasma cell)
Friday:
Proton emittance high by a factor of 2, realized through BTV optics measured, confirmed by SPS wirescan, solved by SPS-OP.
Attempted eSSM measurements at 1E11p, with electrons at 300pC and 220pC, but could not find a good electron trajectory. Access System crash around 20.20.
Saturday:
Proton optics measurement and proton alignment are now routine. Improved electron alignment to average over BPM jitter (similar to new p alignment). Found (and saved) good electron trajectories for eSSM with 220 and 300 pC.
Sunday:
SPS down 11.30-13.30, then again starting at 18.30. Plasma light study/calibration: intensity vs laser ionization front position.
Started eSSM around 18.00, so now much data, but electron trajectory from yesterday seemed ok.
Laser steering on streak camera slit to determine
slit orientation w.r.t BTVs, in preparation for hosing studies.

Next week is our 3rd and last week of this run. Since we have been focusing on improving our setup time and day-to-day reproducibility, we look forward to dedicate even more time to the actual eSSM studies.

LINAC 3 (*Rolf Wegner*):

Linac3 was running very well apart from Monday and delivered a stable beam with an intensity of typically 35 uA and above.

- On Monday beam operation was heavily interrupted due to a communication time-out issues of the digital LLRF system. This problem is very likely related to the CERN-wide network instabilities experienced at the same time.
- An upgrade to harden the digital LLRF system against communication loss was prepared on Tuesday and deployed on Wednesday.
- The LEBT tuning was improved in a Linac3 MD on Wednesday. About 15 uA were gained in the LEBT/MEBT and about 6 uA at the end of Linac3.
- Regular beam energy measurements were taken throughout the week.

LEIR (*Reyes Alemany*):

Main activities

- NOMINAL beam commissioning.
- Achieve LIU intensities
- Transverse feedback commissioning

Fixed issues

- Issue on ITH.BCT41/EI.BCT10 current to charge conversion: issues with the calibration pulses of the ITH.BCT41

Outstanding issues

- Regulation on main quadrupoles: tests done on Tuesday on QDN2040 and QFN2344 by SY-EPC: an abnormal increase of the inductance at some point during the ramp has been found. Magnet inspection to be done during TS.
- B field re-calibrated by TE-MSC to compensate drift along injection plateau. To be checked with beam.

LHC (*Jörg Wenninger & LHC Powering Test webpage*):

S12	S23	S34	S45	S56	S67	S78	S81
CompletedSector @ 20K	Cold	Completed	Completed	Completed	Trained	Cold	Trained
77 / 11950 A	29 / 11538 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	69 / 11585 A	55 / 11600

Sector 81 completed training with a single flat top quench. Little activity: successful tests of undulators at higher ramp rates (0.8 / 0.6 A/s) as well as PGCs in 81.
BLM TIM activities moving to S78.