Accelerator Complex Status

End week 33 (Monday 23 August 2021)

Technical Infrastructure (*Jesper Nielsen*):

Statistics:

- About 5800 alarms.
- 517 phone calls (367 incoming, 150 outgoing).
- 107 ODM created.

Events worth mentioning:

- Tue. 17.08:
    - Pump for TT2 water cooling tripped on flow alarm. On-site a valve was found manually closed, after reopening the valve the circuit restarted without problems.
    - EHT2 transformer was repaired and put back in service with no load for the moment.
- Thu. 19.08, EHT2 transformer and BEQ2 SVC were switched back on again in the shadow of the access cards exchange campaign. The electrical network is reconfigured in nominal configuration.
- Fri. 20.08:
    - SPS BA2 patrol lost, although all access cards were exchanged it seems the problem persists.
    - Ongoing work on local emergency stop button in building 107. Power to EBD3*15K cut which supplies EBD8*15K and CV control cabinet for waste water. Caused loss of power to the extraction of Acid, Alkaline, Cyanure since no power to puisard R34 & R36. When power was back the puisard was manually emptied and all alarms cleared.

Details: https://wikis.cern.ch/display/TIOP/2021/08/17/TI+week+summary,+Week+33

LINAC 4 (*Giulia Bellodi*):

It was a very good week for Linac4, with 98.3% beam availability up to now. Beam was unavailable for a total of 2.5 hours.
On Wednesday a TGM crash during a LIC central timing update caused a chopper and DTL1 trip, and operation was recovered after one hour. The issue is being followed up by BE/CCS.
During the rest of the week there were only a few chopper trips, an RFQ breakdown and a SIS einzel lens trip.

PS Booster (*Simon Albright*):

It has been a very quiet week for the PSB. There were no major faults, but a small number of faults around 1 hour in length plus a standard selection of minor short faults a few minutes in length. Following from previously reported problems, we can now say:

- The POPS-B water leak has been confirmed by EPC to be an isolated incident.
- An intervention was performed on the power converter of the magnetic septum (BE.SMH15L1), which has significantly reduced the noise and the stability is now much improved.

Finally, with the increased intensity being requested on the MTE cycle, the longitudinal stability is starting to suffer. A new variant of the cycle, with a modified splitting process has been prepared. After some fine tuning in collaboration with the PS, this cycle will be ready to go into operation.

ISOLDE (*Simon Mataguez*):
Both separators have delivered beam to 2 users

On **GPS**, Target#534 -Sn-VD5 for 111Cd beams to GLM. HT = 30kV
The machine was set up and ready as foreseen for radioactive Cd beams to the experiment by Wednesday evening, however, GLM (YGLM.ZBG.0300) beam gate didn't work. For the night run user used the YGLM.BFC900 to stop the beam. Issue (Faulty connector) solved the day after.

On **HRS**, HRS: #732 LaC Ta n-deficient beams for ISOLTRAP. RFQ in transmission; HV = 30kV.
The machine was set up and ready Tuesday, but user got trouble with the beam gate YHRS.BG.4600, that didn't work properly. Until now a few glitches had been noticed, but the requirements of this week were not the same (no beam below 450 us beam gate).
It has been decided to bypass the new beam gate system, and thanks to Erwin Siesling and Frank Wienholtz a temporary solution was put in place to start the run on Thursday 19th. Expert will come on Monday 23rd (today) to replace all faulty connectors which could be the cause of the issue.
Since the machine has been running rather smoothly.

On **REX-HIE side**
As it is in standby until mid Sept when ISS will take beam again. Machine development takes place.

PS (*Frank Tecker*):
The PS had an excellent week with an availability of over 94%. The only relevant items for downtime caused on the PS side was a problem with cooling water on SMH57 and SMH16, and the access required for unlocking the beam stoppers for the East Area.

The DSO tests for the East Area were completed on Tuesday, the patrols were done on Friday and the beam permits signed in on Friday afternoon.
After all preparation work of setting up the East cycle during the week (power converter preparation, BI, setting up the East beam up to the screen on SMH57), the beam could be slow extracted on the East dump on Saturday. An issue with the temperature interlock on SMH57 preventing the nominal spill length needs to be followed up on Monday.

An emittance measurement campaign on the LHC25#72b was done in the PSB, PS and SPS. Lowering the RF voltage along the injection plateau (1/4 of the original value) reduces the blow-up of the first 4 bunches. This clearly improved the emittances and yields at flat top (before double splittings):
H: 1.2 um compared to 1.35 um
V: 1.1 um compared to 1.3 um.
Nevertheless, the consistency of horizontal wire scans still needs verification.

Also on the LHC25#72b, studies were done on the intra-bunch and coupled-bunch signals of horizontal instability during the ramp.

Otherwise, beams were routinely provided to NTOF, AD, and the SPS as requested, with the SFTPRO intensity reaching up to 2000e10/pulse.

PS - East Area ():
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AD (Lars Joergensen):
The problem befuddling us for the last couple of weeks where we saw total loss of the beam at the end of the last ramp in the AD cycle was solved last Monday. It turns out it was and I(min) setting on

the quadmain1. Once this was corrected the antiproton beam was able to survive all the way to the end of the AD cycle. The emittances were still quite high both after stochastic cooling and after electron cooling, but this was left to optimize later as long they were sufficient to get most of the beam transferred to ELENA,
These values were slightly improved to the point where transfer to ELENA was possible thus following the priority plan for the week of trying to get antiproton all the way through to the end it of the AD cycle, transfer them over to ELENA, do some deceleration and cooling and then try to eject beam to the experiments.
Beam too large longitudinal. Transfers to ELENA only take the central bit of the bunch longitudinally.
Beam transformer BCT7049 between AD and ELENA not working.
Ejection left on overnight most night to verify the stability of the trajectories out to the experiments.
No signal from BCCCA from Friday midday onwards -experts only back from holidays Monday.
BTV5303 has several errors where it stays in beam when it should be out.
FTA line before ADT was re-tuned.

ELENA (Lars Joergensen):

The pre-prepared cycles for pbars in ELENA worked very well when pbar beam finally arrived at ELENA
SEM grids in injection line fixed by Mark.
Workingsets for the experiments with knobs for offset and angle both horizontally and vertically have been prepared.
Extraction lines re-tested, especially to ALPHA.

SPS (*Verena Kain*):

The intensity on SFTPRO was increased to > 3.3e+13 to run at T6/T4/T2 = 100/60/60 units beginning of the week. As a consequence of the higher intensity the fixed target was plagued throughout the week with many trips of RF, BLM triggers and high losses at the splitters. The situation much improved, when on the weekend the intensity could be reduced to about 30 units for T6 as COMPASS could not run. On Friday the intensity for T2 was also increased to 80 units for NA64. The normalised losses at the ZS are also higher (but still much lower than in 2018) despite of crystal re-alignment. A slight movement of one of the ZS anode motors is suspected. A ZS alignment with lower intensity should be scheduled. The 100 Hz spill modulation can now be corrected after an FGC upgrade by EPC. The momentum of TT20 is now scaled following the COSE extrema to help reducing beam sizes at various locations.
Week 33 was the first LHC parallel MD week (marked as LIU MD week). The progamme was to finish off the long. blow-up studies, reach 1.2e+11 ppb in 4 batches at 440 GeV for HiRadMat and start to work on understanding the transmission issues for LHC beams. It became however clear rather quickly that with the MKDV1 and MKDH vacuum behaviour, reaching the first two goals would be impossible. Instead it was then decided to focus on only one batch and push the bunch intensity as far as possible. The maximum was > 1.3e+11 almost at flattop (the beam was programatically dumped earlier to not trigger the MKDH vacuum limit that reacts with too small bunch length). The long. blow-up was used to ease the dynamic pressure rise with short bunch lengths. The automatic laslett tune shift correction on the main quadrupoles has finally been successfully debugged by EPC. So overall for 25 ns beam studies not much progress unfortunately and this will have an impact on the next HiRadMat run and reduce the prospects for the Thursday MDs.
An automatic energy-matching routine is being developed for LHC beams. Debugging is however still ongoing. The momentum aperture with Q20 was measured on Friday as well (still asymmetric, but slightly better than in 2018 as seen already with the horizontal aperture measurements).

The Wednesday dedicated MD took place, with a number of important tests in parallel. The dedicated MD was to study the splitter losses and splitting efficiency in the SPS TT20 line. ABT has

come up with a very good measurement technique to study these in detail with the analysis to be presented in the next SPS coordination meeting. It seems that the splitter ensemble with collimator is misaligned and the minimum achievable losses are higher than expectation from theory and simulation. The operational steering through the splitter was already very close to optimum.
The LHC pilot was taken to test LHC mastership, injection requests and re-phasing. It was a very useful exercise, as none of the test goals could be achieved due to missing FC, pre-pulse in the SPS and telegram issues in the LHC. It will have to be repeated as one of the Thursday parallel MD slots - and is already foreseen for Thursday 2nd of September. The last parallel test on Wednesday was the study of the synchronisation jitter in AWAKE. The rare issue could be traced back to the last stage of the re-phasing, which is sometimes not converging. Possible mitigation has been discussed (interlock, fix by designer on the LLRF side). Until this can be in place, the AWAKE team will have to offline filter the data with the logging data of the re-phasing parameters.

The availability of the SPS was particularly bad this week - only ~ 68 % at the moment of writing this report - due to a mixed bag of several planned interventions and long break-downs.
Planned interventions:
repair power converter/WIC control issue on extraction sextuples and extraction bumpers in LSS4.
Timing upgrade for the LHC injection requests, cavity 6 voltage calibration (Monday) and phasing (Thursday), energy tracking table update to lower voltage of MKDV1 after big flash-over previous weekend.
Break downs:
All access system cards have now been exchanged, but BA80, BA1, BA2 access card issues reoccurred due to SEU this week. In total about 14 h downtime were caused in this way. The next Thursday 7-9am slot will be used to install shielding in BA80 and increase shielding in BA2 and BA1.
The BLM on ZS tank 2 stopped working Friday afternoon and needed replacement with the preceding long cool down time of 4 h.

Upcoming:
- AWAKA run 2 starting on Monday
- plan ZS alignment
- Increase intensity for SFTPRO to T6/T4/T2=100/60/80.

SPS North Area ():

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AWAKE (*Edda Gschwendtner*):

WEEK 33 SUMMARY: Laser system maintenance. SPS RF troubleshooting. Optical alignment.

- **Laser maintenance with supplier's visit to CERN:**
- **CFR head was exchanged with a loaned spare and sent for repair. Energy and stability seemed reestablished during maintenance tests. Full report will soon be sent us by supplier (Energy, contrast, pointing jitter were measured).**
- **Remaining issue: propulse powersupply still has to be turned on/off from the laser room, but a module to solve this issue will be send us next week.**
- **Proton time-of-arrival 100ps jitter:**
- **Investigated with proton beam on streak camera. Caused by the third stage of the phase locking before extraction.**
- **RF SPS experts working on the solution, it might be needed to interlock the extraction when the delta phase is larger than 1deg**
- **Streak cameras: completed re-alignment of downstream-to-upstream streak camera optical line**

Program of Week 34: Protons starting on Monday, for 3 weeks. Re-establish electron seeding and explore its parameters systematically.

LINAC 3 (*Detlef Kuchler*):

- The linac was running smoothly. Intensity out of the linac over 30eμA.
- Wednesday:
  - CSD scan application was further tested and a serious bug could be removed.
  - Some more measurements with the old, last used stripper foil were done to verify the foil properties.
  - Some more scans in the ITL and the ITM were done.
  - Over midday the BCTTRIC frontend crashed and needed a reboot.
- Thursday: LEIR could not inject the beam in the afternoon. cfv-351-alllinac3a and cfv-351-alllinac3b had to be rebooted.
- Friday: Oven1 tested, if it still can deliver lead vapor. Without success. Oven1 was switched off after the test. Oven2 is delivering the lead vapor for the operation (crucible with beak and new lead).
- The energy measurements were done daily.

LEIR (*Nicolo Biancacci*):

Main activities

- Accumulation improvements continue on NOMINAL (now at 8e10c).
- NOMINAL 3+6 (PS 75ns beam) prepared: RF capture at reference as in 2018.
- Linac3 MD on Wednesday: additional measurements on used foil taken.

Fixed issues

- General timing issue on Wednesday: reboot of several servers brought back the machine functionality.
- BHN regulation: SY-EPC improved the precision at injection and extraction.
- Intermittent problem with the control of the CRF41 RF voltage for h=3+6: HL-RF informed, will investigate in W34.
- ER.DWH32 main circuit breaker in fault: EPC piquet fixed it.
- CRF41 cavity in L2 fault: reset could fix it.

Outstanding issues

- Regulation on main quadrupoles seems to introduce noise: will be looked at/improved in W34.

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	60 / 11600 A	69 / 11585 A	49 / 11547

S67 reached the 6.8 TeV / 11600A flat top after 60 quenches, flat top training starting.

SPS-LHC injection dry run for injection requests (mastership etc), injection timing distribution and TI2/8, LHC beam instrumentation. Partial success as beam requests could be made, interrupted due to remaining issues with event and telegram updates that led to a crash of the LIC MTG. BPM acquisitions of the TI lines and of the LHC (FIFO, injection capture, IQC, orbit) tested successfully in calibration mode. MKIs pulses triggered on LHC injection requests, last MKI IQC issues fixed: MKI system ready for beam test !

BLM TIM activities in S34 (LSS4). Rocky movement of TIM from from 34 to 45 (cable ripped off on sector door, TIM blocked at ventilation door, safety).