Accelerator Complex Status

End week 31 (Monday 9 August 2021)

Technical Infrastructure (*Jesper Nielsen*):

Statistics:

- About 5'500 alarms.
- 679 phone calls (447 incoming, 232 outgoing).
- 98 ODM created.

Events worth mentioning:

- Thu 30.07: Trip of EMD604*59, powering the MEQ59 compensator in Meyrin. Repowering planned for the next day.
- Fri. 06.08, Various alarms for the UPS EAS11/A7 and the EOD2/A7 which is feed by the UPS. It seems that the cut was caused by EPO (*Emergency Power OFF). No impact for the SPS machine.
- Sat. 07.08:
    - Inundation alarm in UPR17, fire brigade intervened, unfortunately using the key which caused a loss of patrol in the area.
    - Electrical perturbations:
        - 12h27 400kV BEAUMONT-CHAFFARD 2, confirmed by RTE. Tripped PS RF 10MHz, and the mains of the SPS.
        - 13h03 another perturbation on the 400kV line FRASNE - GENISSIAT. Caused a trip of the Linac 4 and the booster.
        - 13h27 another perturbation. Trip of mains SPS.

Details: https://wikis.cern.ch/display/TIOP/2021/08/09/TI+week+summary,+Week+31

LINAC 4 (*Piotr Skowronski*):

It was quite a good week: availability 98.4%.
On Saturday after 1PM electric perturbation due to thunderstorm tripped all our RF lines and a few power converters. RFQ was sparking after the restart. Automatic recovery (reconditioning) worked all right, but it took 2h10min.
Apart of this the chopper tripped once, 4 min downtime.
Following the question raised on last FOM about safety of the SEM grids in case of a power cut or similar: in case of pressure loss in the compressed air system the grids up to L4P will move to the IN position, and eventually could be destroyed by high intensity beams. However, I believe that the compressed air system is common for all the devices in the linac. This means that in such an event all the vacuum valves and the beam stoppers will also move in. We are still waiting for the confirmation from CV.

PS Booster (*Foteini Asvesta*):

It was a relatively quiet week at the PSB with an availability >96% for all our users and one major fault.
Main Faults:

- On Wednesday afternoon one of the quadrupoles on the BTM line, BTM.QNO20, tripped as the WIC received a faulty state. The magnet experts had to access the machine and during the inspection they found out that the problem was in the flowmeter. Since the thermo-switch on the magnet is operating properly, it was decided to continue operations and organize an access to exchange the flowmeter at a later stage.

- A radiation alarm at ISOLDE perturbed operations for a few minutes. This alarm, which was unexpected, was connected to the transport of a radioactive target.
- An electrical glitch during the storm on Saturday afternoon brought down several systems (cavities, TFB, injection & extraction septa and several elements on the BTY line) but they all recovered within a couple of minutes.
- Some trips that could be reset from the CCC.

For next week the program includes beam for ISOLDE, the downstream machines & experimental areas as well as parallel MDs.

ISOLDE (*Miguel Lozano*):

It has been a quite good week at ISOLDE.
The vacuum team managed to find and fix the vacuum leak at the BTY line on Monday.
On Tuesday we reinstalled the production target on HRS and after pumping and heating it up we resumed the delivery of the 30Mg11+ to ISS.
The ISS run was extended from Friday morning to Saturday morning when GPS took over.
During the weekend COLLAPS took stable beam from GPS after having some problems starting the target.
We had several issues during the week related to RILIS , power convertors , RF amplifiers , radiation alarms and others but all of them were quickly solved not having a remarkable impact in the beam time to users.

PS (*Bettina Mikulec*):

It was a good and busy week for the PS until the weekend, when we suffered from a couple of electrical glitches and a POPS trip and an issue with the injection kicker KFA45 (~10.5h downtime in total).

Beams:

- TOF: use since last week cycle with slower magnetic field ramp-up
    - Work on injection, transition, extraction, orbit correction and longitudinal blow-up
    - H profile on target more symmetric after improvements on bunch rotation
    - Optics measurements in FTN continued
- AD:
    - Improvements led to increase of transmission to 95%; required to retouch the steering to the AD target
    - Stable phase program enabled
- LHC25: 1.3E11 ppb provided for the SPS mini-scrubbing run on Wednesday
    - From time to time losses observed at SPS injection and non-uniform bunch intensities along the batch in the transfer line finally attributed to a transverse instability at PS flat top —> stabilised through H chromaticity correction
    - Throughout the week tune and chromaticity measurements to optimise the working point; to be continued with ABP
- MTE @1500E10 ppp:
    - Nice loss reduction thanks to optimisation of low-energy working point, TFB blow-up, RF voltage increase during ramp etc.
    - Use now vertical shavers in PSB to remove vertical beam tails
- LHCINDIV and LHC25 clones: studies on bump compensation correction; to be implemented in agreement with SPS
- EARLY ion cycle: improvements yield an intensity increase before extraction
- EAST: preparations for start of beam commissioning on 23rd of August
    - Hardware commissioning ongoing
    - Continue preparation of low-intensity EAST commissioning cycle

Other points:

- Several cavity resets and a few injection and ejection kicker interventions throughout the week.
- Friday around lunch-time ~20 min beam stop to allow compensator switch-over.

PS East Area (*Bastien Rae*):
- Smoothing still on going.
- No delay foreseen for the restart.

AD (*Pierre Freyermuth*):
The week started with performance issues on the stochastic cooling at 2Gev/c. A lot of efforts were put to recover transvers cooling, from extensive measurement campaigns to the help of retired colleagues. It is finally during the Tuesday night / early Wednesday that right settings were found.
- Some faults on the power supply of the magnetic horn seems to be resettable only locally by the expert, which is following the problem.
- The DI line FGCs have now a correct and synchronized current shape.
- The beam produced by the PS was optimized, requires steering on the target and injection.
- The low level RF commissioning continues to progress despite co-activities on the other processes.
- The electron cooler was fully setup on the 300Mev/c plateau, including steering of both beams.
- A lot of orbit correction/measurement were performed. We have now 3E7 Pbar on the first plateau, ~3/4th of the usual performances.

We are facing a rather brutal total loss (in ~100 turns) of the beam on the last ramp, between 300 to 100Mev/c. Everything is nominal on the longitudinal plane and it seems not RF related. As we cannot go bellow 104Mev/c, we added an intermediate plateau to study the condition right before the loss. Measurements can be challenging at this energy, as signals are weak. This is our main focus now.

ELENA (*Pierre Freyermuth*):
The cycle to receive Pbar is ready, with electron cooling, and was prepared with H- from the local source.

SPS (*Verena Kain*):
The first AWAKE physics run in 2021 continued until Tuesday evening. The team was switching between 1e+11 and 3e+11 bunch intensity. The synchronisation issue that had been cured for the previous weekend and the beginning of the week through firmware upgrade and change of voltage program came unfortunately back Tuesday evening and needs follow-up before the next run.

The dedicated MD slot on Wednesday was sacrificed for a mini-scrubbing to tackle the de-conditioning issue of MKDV1. The kicker could be successfully conditioned for HiRadMat run 1 operational conditions. A horizontal instability on the PS side slowed down the scrubbing process somewhat and was recognised as such only at the end of the day. On Thursday, 4 batches of 72 bunches were accelerated without any issues and with operational vacuum thresholds of the MKDV1 (dynamic pressure rise to 4e-8 -> not much margin).
The energy matching for LHC beams needs to be revisited.

Next on the programme then was to extract indiv beam to HiRadMat and test the experiments' triggers and re-check the extraction - it had not been used since May. The extraction kicker had also needed a 2 h re-conditioning Thursday morning. The pre-pulses were not produced straight away unfortunately (oasis was also not working for the MKE BA6) and the final extractions could only take place on Friday where it was noticed that the kicker delay needed to be significantly changed. It was adjusted to be roughly OK for high intensity. A final cross-check will take place on Monday.

Week 31 was also the week to do the next intensity step for SFTPRO. It was scheduled for Thursday morning. The work could only start Thursday afternoon due to the morning spent without beam. The RF team found however that the phase pick-up gain switching did not work and the pick-up was always saturating. Next attempt to increase the intensity was therefore postponed to Friday with the expert back from vacation. Since then we are running with higher intensity on the targets T4 and T6 and rather good transmission (97 %) until the thunderstorm Saturday afternoon, which tripped the mains. After the thunderstorm we are back at 95 % transmission.
Due to a vacuum pump issue on the T6 TBIU that needs to be investigated with access next Wednesday, the SFTPRO intensity was only increased to 1.9e+13 instead of 3e+13 (with reduced intensity on T6, whereas T4 nominal).

The 100 Hz spill ripple issue is being investigated with EPC. So far no conclusions. NA62 is informed.

Overall availability in week 31 so far was only ~ 74 % with the access system being the main fault contribution with more than 15 hours downtime.
On the good side, the fragile electronics cards could already be replaced at three locations: BA1, BA6 and BA80.
Also to mention, Sunday evening we had another stop of the LLRF FEC cfu-ba3-allfb1, which needed rephrasing of the cavities etc afterwards - downtime of ~ 2 h 30 min.

Upcoming:
- HiRadMat run
- Increase intensity further on Monday for SFTPRO. T2 needs 80 units. Needs further check with RF for the gain switching of phase pick-up. Damper also to be adjusted for higher intensity.
- Access card replacement starting this week. In principle Thursday slot from 7-9. Need however RF firmware upgrade (3 h no beam) on Wednesday. Potential slot for RF upgrade 16:00-19:00 Wednesday. Finalise programme on Monday
- LHCION parallel MD cycle for FFA tests after RF firmware upgrade.

SPS North Area (*Bastien Rae*):
- Good week for North Area
- Main downtime from Injectors.
- Small problem with wrong information sent by a power converter to the LOKN.
    - This created some extraction cut.
    - Solve by EPC by changing an electronic card.
- Problem with FISC on K12 from instrumentation and software slow down a lot the tuning procedure.

AWAKE (*Giovanni Zevi Della Porta*):
Last 2 days of protons, then access.
- **Monday, August 2**: Short access to activate wakefield diagnostics and troubleshoot laser. Set up laser and electrons. Low-charge electrons and 1E11 protons all day. Systematic exploration of electron-seeding with different low-charge beams (separately varying total charge and charge density): able to turn on/off electron-seeding in a reasonable way. Found good settings for wakefield diagnostics: can avoid laser-Rb scattering light and see plasma light (next step: observe increased amplitude of plasma light in presence of wakefields).
- **Tuesday, August 3**: Short access for laser. Set up laser and electrons. Medium-charge electrons and 3E11 protons. Issue with electron jitter tracked to laser energy issue: access to increase laser voltage and solve problem. SPS/AWAKE extraction line magnet issue preventing extraction, solved by piquet. After magnets were fixed, we started electron-seeding studies but noticed that the 100ps jitter was back, and SPS operators were not able to fix it this time, so we stopped

extraction for electron-seeding experiments. Plasma wakefield diagnostic saw increased light with electrons/protons, possibly due to the wakefields. END OF PROTONS

- **Wednesday-Friday, August 4-6**: Access
    - **Vapor Source**: Cooldown of the vapor source
    - **Laser**:
        - Recalibrated laser attenuator
        - Replacement of LSSP1 laser shutter, which required manual operation
    - **Streak Cameras**:
        - Re-alignment of upstream streak camera optical line
        - Added remote reboot capabilities for more equipment in Streak Room (since this run requires RP to access during run)
    - **Protons**:
        - Troubleshoot RBI.81607 magnet: a jitter on this line was preventing a fraction (~5%) of extractions
    - Troubleshoot Proton BPM 412319 (horizontal): new cable to correct defective connector

Program of Week 32-33: Continue accesses for improvements in preparation of new proton run in Week 34.

LINAC 3 (*Richard Scrivens*):

Monday - Oven refill, after the intensity had dropped quickly at the weekend.
Tuesday - The lead beam could not be recovered from the source, so the oven crucible was exchanged. This also happened earlier this year, so futher testing will be made on the test stand.
Wednesday - The source was back up, and delivered to LEIR.
Friday - Source trip on cooling at 6:43. TI saw a pressure spike on the demineralized circuit at the same time, and are surveying.
A converter tripped off at midday, but the acquisition was still normal, making it difficult to localized.
Saturday - several equipment tripped at 13:03.

LEIR (*Nicolo Biancacci*):

- Source refill activities from Monday to Wednesday morning.
- NOMINAL beam commissioning well advanced: accumulating to 8e10 charges, frequency modulated capture set up by SY-RF. We currently extract about 7e10c in total. The beam is available to PS.

Fixed issues:

- Extraction BCTs gates adjusted for NOMINAL 2 bunches by SY-BI.
- NXCALS logging of injection line BPM positions reduced to operational cycle only.
- Replaced defective circuit in CRF41 by SY-RF.
- SEH10 fault fixed (low dielectric liquid) by SY-ABT
- Vistar display fixed by BE-CSS

Outstanding issues:

- Final Ia crowbar fault on CRF41 (resettable fault): monitored by RF team.
- SMH11 and SMH40 require frequent resets/standby after being switched off for an access: SY-EPC informed.
- Temporary waterflow pressure reduction affected LEIR cooler and RF cavities. The issue is common to Linac3 and is being monitored by EN-CV.

CLEAR (): Nothing.

LHC (Jörg Wenninger & LHC Powering Test webpage):

S12	S23	S34	S45	S56	S67	S78	S81
CompletedSector @ 20K	Cooldown	**Completed**	**Completed**	**Completed**	**Training**	Cooldown	**Training**
77 / 11950 A	29 / 11538 A	**71 / 11950 A**	**87 / 11950 A**	**76 / 11600 A**	39 / 11328 A	69 / 11585 A	29 / 11285

Start of S78 cooldown. As the last main quadrupole circuit, RQ.67 finally reached 7 TeV after 12 quenches, one of them at FT. On Saturday the FRS broke the patrols in point 1 in response to a flooding alarm in UPR17. This happened despite TI instructions to enter normally with tokens as they was no urgency. BE-OP had to redo the patrols to avoid loosing the weekend for training.
BPM TIM activities moved to S45, very slow progress.