Accelerator Complex Status

End week 40 (Monday 10 October 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 4'300 alarms.
- 531 phone calls (378 incoming, 153 outgoing).
- 84 ODM created.

Events worth mentioning:

- Thu. 06.10:
    - Electrical perturbation, EDF-RTE confirmed -11.9% of nominal voltage for 86ms. RF tripped on PS and LHC.
    - BEQ3 SVC switched on, for a special test with EDF, to potentially help raise the voltage on the high voltage network in the area in case of problems with supply of electricity during the winter. The SVC will be left on over the weekend to see how it reacts and if the solution is viable.
- Sat. 08.10, Intermittent problems with flow meters for all water distribution circuits for EG & EM in SUX1. Values go off-scale briefly, then come back into range. Several trips during the night, until it was traced back to not only the sensors, but the power supply of the communications card connecting the sensors. The power supply was replaced by the piquet.
- Sun. 09/10, Several electrical alarms received, indicating a possible perturbation, however accelerators were already stopped for another technical problem.

Details: https://wikis.cern.ch/display/TIOP/2022/10/10/TI+Week+summary,+Week+40

LINAC 4 (Alessandra Lombardi)

An excellent week for LINAC4 no faults , around 100% availability and a short MD on Friday in the shadow of the PSB vacuum problem.

PS Booster (Simon Albright):

It was mostly a very calm week for the PSB, with one notable exception. On Thursday afternoon, there was a vacuum spike, which triggered the interlock system and cut the beam. The leak was identified in a flange with an RF bypass, which was suspected of being in fault. During the evening and into the night, the leak was repaired and a new clamp installed. Approximately 18 hours after the fault started, beam was available again. The clamp with the (suspected) faulty bypass will now be investigated by the expert to try and understand if that was the cause and how it happened.

Otherwise, there was nothing unusual. The beams required for BCMS + 8b4e mixed filling were made available in the PSB for testing through the complex, and the usual physics beams were provided without problem and within specification.

ISOLDE (Eleftherios Fadakis):

REX/HIE

-**Wednesday** we were working with Greg Kruk to try and synchronize the LINAC with the proton pulses. Work is ongoing and should finish this week as this is required by the next HIR experiment.

-**Wednesday** and part of Thursday was EBIS MD day

Short summary : Objective was to characterize the electron beam current density along the drift zone, and depending on the space charge neutralization.

Larger(*) (and short) summary kindly delivered by Niels Bidault
-**Thursday** the preparation for the next HIE run started. For this run an A/q of 4.4 was required. Unfortunately the 7gap1 could not hold the power required.
The OP team would like to thank the REX RF team (Luca Timeo, Simone Chicarella) and especially Cristiano Gagliardi (he was on vacation AND with high fever but helped us over the phone)
After the REX RF intervention all REX amplifiers were holding during the weekend. Only the HIS amplifier tripped twice, which is acceptable.
We will be running with an A/q of 4.3 and compensate the power loss of 7GAP1 with 7GAP2,3
Unfortunately this means that today we need to **re phase** the REX RF amplifiers after 7GAP1, meaning 7GAP2, 7GAP3, 9GAP AND all of the SRF

GPS
Experiment IS686(delivering to ISS) finished on Wednesday the 05/10 and new target was put in place #754 UC.
Beam was set up and users could take stable beam during the night.
On Thursday the 6th , after the proton scan, users started performing Sn collections on both GHM, GLM.
They have been running smoothly since then. Their run will finish this morning.

HRS
Target change took place on Friday, now target #751 UC VD5 is on. It was heated during the weekend since a lot of outgassing was anticipated.
Set up will start today

(*)
The objective was to characterize the electron beam current density along the drift zone, and depending on the space charge neutralization. Ultimately we want to compare the results with the measurements that were carried out with the Brillouin electron beam at TwinEBIS, showing a decrease of the electron beam current density in the drift zone, when going further from the cathode. We injected 129-Xe gas and measured the charge state distributions for various breeding times, and for three different trapping configurations: using TRAP1, TRAP2 and TRAP3. We have then progressively increased the neutral gas injection, increasing the neutralization of the e-beam and measured again the charge state distributions, as well as axial energy scans of the extracted beams. We have noticed that the electron beam current density is constant along the drift zone. The analysis of the neutralized e-beam is ongoing.

PS (Bettina Mikulec):
I guess the worst week for the PS in terms of availability this year, just above 60%, mainly due to repeated POPS issues and the PSB vacuum leak following an arc in an RF bypass.

Main PS faults of week 40:

- POPS:
  - POPS tripped several times this week (trips started already the week before), mainly due to communication issues between the FGC and the Main Controller
  - A few unrelated trips happened as well, which were sometimes traced back to the local controller
  - The specialists (F. Boattini and X. Genillon) together with the piquets were called in repeatedly and did their best to solve the problem; in most cases they exchanged some controller cards and on Monday morning even the complete rack of the Main Controller.

    - The longest downtime started on Saturday afternoon, when none of the card exchanges and other manipulations helped; the team stopped after midnight and returned on Sunday 2pm with fresh ideas; they managed to restart POPS after ~1 day of downtime. Nevertheless Fulvio mentioned in an email to V. Montabonnet that the faults are not yet understood and that there was a risk POPS would trip again. To be continued…
- A few RF cavity interventions were needed (gap relay exchange on Tuesday in parallel to the POPS-B tests).
- On Tuesday before lunchtime, problem with extraction synchro for the ion cycle --> the LLRF specialist found the 'start synchro' cable for the ion beam control disconnected
- Electrical glitch Thursday morning at 5:18.

Improvements:
- Fulvio lowered the POPS standby current from 300 A to 150 A, which will save >21 kW of losses in the magnets only. On the ZERO cycle we reduced the current from 200 A to 150 A.
- Extraction kicker KFA71 adjustment: it was found that the first and last bunches of the 8b4e beam were touched by the extraction kick; the operators performed rise-time measurements of each of the kicker modules (through OASIS). We saw that a couple of modules were outside tolerance and that the kicks of the different modules were not well aligned. The ABT team was informed, realigned the various KFA71 kicks and slightly pushed the reservoir voltage of the thyratrons from modules 9 and 12 (pushing it further could increase the erratics). By fine-tuning the delay only the last bunch of the gap is now slightly touched (we are working at the limit of the specifications with the 8b4e beam…).
- The ABT team is working on the spare MTE kicker PFN.

Beams:
- IEAST_Pb_1GeVu_22:
    - Added a 10 ms FT at 4250 G (value given by Fulvio as the minimal field with 6 DC/DC converters) after the long slow extraction plateau; this could successfully avoid POPS tripping
    - Very nice flat tune without using PFWs and XSEs; will help decoupling the effects of different magnetic elements on the tune stability
- MTE_22 provided at 2450e10 p/p
- 8b4e prepared for LHC hybrid filling test.

PS - East Area ():
No report.

AD - ELENA (Pierre Freyermuth):
AD:
The machine is running fine, however we lost an essential measurement with the loss of the BCCCA instrument. This unique device was our only way to get the circulating intensity along the all cycle. Diagnostic of beam losses and optimisation will be more complicated.

ELENA:
The machine is running fine as well. The H- ion source however needs some work. Especially the hydrogen flow controller. Until then, no H- beam is possible.

SPS (Michael Schenk):
The plan for this week was continuing ion beam commissioning on Monday, Tuesday, and Friday; dedicated and parallel MDs on Wednesday (crystal shadowing from LSS4, TT20 optics

measurements, tune-shift and instability measurements with 72b, and one-turn feed-forward commissioning); long parallel high-intensity MD on Thursday; LHC fills for physics, dedicated fills for LHCb VELO insertion, and a test fill with a hybrid 8b4e / BCMS scheme; beam to NA.

The SPS availability until now is about 53%. The downtime was caused primarily by issues with the PS main power supply (POPS) on several occasions throughout the week — most notably the ~24 h stop from Saturday to Sunday — and a vacuum leak at the PSB causing a downtime of 18 h from Thursday afternoon to Friday morning.

NA SFT: beam was provided at 4.1E13 ppp with a sharing of 90 / 70 / 130 on T2 / T4 / T6. Apart from the injectors downtime, there has been a water leak on the MBE.2103 in the TT20 line starting Sunday afternoon. The expert intervention has just finished after 6.5 h and the beam is now back.

LHC beams: besides providing beam for physics fills (5x36b BCMS, 1.35E11 ppb), two fills dedicated to LHCb VELO insertion were made with 12b and 300b on Thursday. The hybrid 8b4e / BCMS beam was tested successfully in the SPS on Tuesday and Wednesday. However, on Friday, during the actual LHC filling attempt, the beam suffered from strong losses on the SPS flat bottom and only rarely reached flat top. After more than 4 h of debugging, it was found that the longitudinal damper was mainly responsible for the losses. Unfortunately, the delay was too big by that time, and the LHC was filled instead with the default 5x36b BCMS beam for physics. The test with the hybrid pattern is hence postponed to next week. Corrective measures for the longitudinal damper were initiated, to be continued and validated next week. The 8b4e / BCMS beam was optimized in terms of energy matching PS-SPS (incl. SPS Laslett tune corrections) and TT10 trajectory steering.

Ion beam commissioning: work was mainly done to optimize recapture after slip stacking. Progress was limited by the availability of the beams, particularly on Tuesday (PS synchro loop issue & POPS trip) and Friday (debugging hybrid beam in SPS). The issues from last week generating the voltage programs from the slip-stacking GUI were resolved.

MDs: Wednesday MDs profited from decent beam availability in the morning, among others, with successful crystal channelling with the TECA, but were strongly impacted in the afternoon by the LHC filling and a POPS trip. This meant that the TT20 optics measurements could not be carried out, and the feed-forward commissioning could not be completed yet. The long parallel high-intensity MD on Thursday took nominal intensity (1.2E11 ppb) 5x48b BCMS beam first to characterize transverse tails, perform phase-loop and blow-up studies, and moved to high-intensity beam (1.8E11 ppb) in the later afternoon, once the planned Static Var Compensator (SVC) tests were finished. Unfortunately, the MD came to an early stop due to a vacuum leak at an rf bypass collar in the PSB.

Interventions: on Tuesday morning, interventions at the SPS took place to resolve the MSE cooling issue and to perform hot-spot measurements after irradiation with beam near the previously discovered aperture restrictions (329 & 401). Increased levels of radiation were confirmed; however, action is likely to be taken only during the YETS. These interventions took place in the shadow of the planned stop for POPS-B tests.

Other

- 50/100 Hz spill noise: after updating phase range for automatic correction, this seems to work better again (still using new filter electronics).
- RF modules were exchanged in the shadow of the PSB vacuum leak intervention.
- Empty bucket channelling: feedback from experiments will be provided by Monday 10.10. Aiming for operational test run in Wk 43 after IEFC (21.10.)

- MKP trip (thyratron heater) Saturday to Sunday night: restarted by Piquet, but interlock could not be reset and has been masked temporarily. To be followed up (see below).

Plan (Wk 41)

- SVC intervention (Monday 08:00 - 08:30 AM).
- Continue ion beam commissioning (Monday, Tuesday, Wednesday).
- Retry LHC fill with hybrid scheme (Tuesday or after).
- Long parallel LIU MD: planning to take high-intensity 8b4e beam (Thursday).
- LHC MD block 1 preparation (Friday).

To be scheduled

- MKP thyratron heater interlock: to be reset and mask to be lifted (N. Voumard).
- Energy matching and trajectory corrections done for LHC1 (BCMS / 8b4e): to be applied for Indiv and Pilot cycles.
- 800 MHz cavity 2 tripping on SFTPRO: temporarily resolved by adjusting load-balancing between C1 and C2. To be investigated by power specialist.
- Longitudinal damper reconfiguration / validation with LHC Indiv beam (A. Spierer, P. Baudrenghien).
- Voltage/phase jump smoothing slopes on SFTPRO, to be commissioned with beam (I. Karpov).
- 200 MHz cavity 1 consolidation, 2 h (F. Killing).
- Reinstallation of repaired BLM in LSS2 (E. Effinger).

SPS North Area ():

No report.

AWAKE (Giovanni Zevi Della Porta):

Beginning of cabling and CV work

- Cabling: start of 3 weeks of cabling in preparation for the new plasma sources of run 2b
- CV: start of 2 weeks of yearly maintenance. Ventilation off (i.e. no access) on Friday
- Vacuum: vented vapor source and surrounding sectors on Thursday
- Water leak in TCV4 (Klystron area), noticed by vacuum/plasma team on Thursday. CV reported leak stopped by the end of Thursday. Root cause and potential damage still being investigated by CV and RF team.

Plan for week 41: understand water leak, continue CV and cabling work.

LINAC 3 (Richard Scrivens):

OK week for Linac3, the beam was mostly well above >30uA. An oven refill was made on Wednesday.

Tuesday - The source was not so stable. The logbook was unavailable early in the morning.
Wednesday - Oven refill and some work on the 14GHz generator.
Thursday - Beam was ready by 8:30, and a test was made with a new foil in conjunction with LEIR. This improved LEIR injection efficiency, but we decided to keep running with the present operational one to see the evolution.
Friday - Source needed several tunings in the morning. A vacuum gauge controller used to regulate the gas injection to the source failed in the afternoon and was replaced by VSC. The beam was only back around 17:30.
Sunday - Reset of source after a solenoid trip. A little bit of source tuning.

LEIR (Nico Madysa):

Main activities

- installed new firmware and ILC correction to improve quadrupole current mismatch
- installed tune kicker amplifier
- obtained first turn-by-turn data for optics measurements

Fixed issues

- fixed issues in RF cavity phase detection and the MCB
- fixed stale firmware in ER.BHN that prevented LSA trims

Ongoing issues

- LEIR autopilot bug prevents one power converter from being restarted properly
- RF cavity: sporadic L2 faults, to be investigated when SPS stops taking beam.

CLEAR (R. Corsini and W. Farabolini):

Last week was dedicated to measurements of the E-field generated by an in-vacuum Cherenkov BPM based on an electro-optical sensor developed by the Kapteos company. In parallel the CLEAR team was developing new beam dynamic tools and quad scan codes to improve operation. The RF team managed to resume operations in less than one day after the failure of MKS15 operations by swapping its klystron with the one of MKS31 used for the RF deflector. Unfortunately, it has not been possible to prepare during this week a spare klystron for the deflector. A quick attempt to use the streak camera instead for bunch length measurement failed.
The E-field generated from the Cherenkov BPM was initially found to be too weak to be detected by the EO sensor (much lower than predicted by the CST code).
The set-up was thus displaced to the in-air test stand, first for direct beam production of E- field and then for Cherenkov generation with beam much closer to the alumina (10mm).
After the success of this in-air experiment, the correct timing was identified and it was possible to use the in vacuum Cherenkov BPM with many signals averaging (900).

LHC (Jörg Wenninger & LHC Coordination webpage):

Operation with 2461 bunches in 36 bunch trains.
A 12b fill was prepared for the VELO partial insertion test on Tuesday, but VELO could not be inserted due to a power-cut in the lHCb control room (due to a "false" fire detection). The following fill with 2461 bunches was dumped on a **UFO in 13R6**. On Wednesday evening, for the**first time bunch intensities over 1.3E11 with 2461 bunches injected**. Thursday successful partial insertion of LHCb VELO (5 mm) with a 12b and a 300b fill.
Following the problem with the PSB vacuum Thursday night, it took some time to sort out the LHC beams again in SPS, and it was decided to postpone the 8b4e mixed scheme filling to next week.
On the faults side, repeated issues (~ once / 24 hours) with the PC of RB.78 on temperature faults.
UFO dump count: 24 , UFO quench count : 1