Accelerator Complex Status

End week 41 (Monday 17 October 2022)

Technical Infrastructure (J. Nielsen):

Tuesday:

- UPS in fault in BA5. A leaking battery was found and replaced on-site.

Wednesday:

- Impossible to give access in LHC. An intervention was on-going by the access technicien at the same time, which made the PLC unavailable during the intervention.
- Ventilation UUW1-130 in building 179 in alarm; the technician on-site asked to check if beam was lost. Indeed Isolde beam was off, probably due to this intervention.
- IMPACT tool was down for a little while, during access. Not possible to create IMPACTS for interventions. Quickly solved by the support.

Thursday 11:48:

- Major water leak on the CERN water supply. SIG cut the supply to CERN. CERN crisis team was quickly contacted and took the lead on the event. All automatic flushing of cooling towers were blocked and levels were closely monitored from the CCC, no cooling towers stopped. Within the hour a by-pass supply was established by EN-CV and less than two hours after the incident nominal values were restored almost CERN wide.

Friday:

- Problem with temperature sensor on cooling tower in LHC5. Regulation didn't work correctly due to the faulty sensor, and temperatures for CMS and CRYO started increasing. TI regulated manually the fans of the cooling towers until the piquet could come in and block the faulty sensor.

Details: https://wikis.cern.ch/display/TIOP/2022/10/17/TI+Week+summary,+Week+41

LINAC4 (J-L. Sanchez):

The availability of Linac4 has been **90.3%** this week.

The main faults were due to:

1. On Thursday evening (HL-RF-Piquet) has changed the Drive Unit of the Chopper (1h52 downtime).
2. On Friday early morning at 3:46, the **CCDTL0102 tripped**. Piquet EPC and HLRF were called. Around 8:30 a.m., specialists of EPC and HLRF started to check the resistance and capacitor in the HT tank. At 10 a.m., EPC specialists decided to change the transformer of the modulator L4C.AC.01. The only spare was in the RF test stand bat 112. Disassembly of the two transformers, transportation and reconnection was completed at 4:30 p.m. (**Total downtime 13h11min)**

Other than that, there were some other minor trips of :

1. RFQ (6min)
2. Source Einzel lens tripped twice (14 min)
3. Pre-Chopper (14 min)
4. CCDTL2 (4 min)

PS Booster (F. Asvesta):

The availability for the PSB this past week was approximately 89.5%.

However, only two faults accounting for approximately 30min of downtime were connected to PSB equipment.
One fault of the extraction kicker in ring 4 and one of the BTY.QDE120 that blocked operations to ISOLDE for ~25min.
Several interventions took place during the stop on Friday:

- Replacement of broken Finemet amplifiers
- Visual inspection of the BR.QDE5 water leak status
- Replacement of BSW faulty card
- Removal of an ADC card on the H0/H-

Otherwise, setting inconsistencies on the EAST users were identified and resolved.
All beams were available for our users, while ISOLDE used both 1.4 and 1.7 GeV variants.

ISOLDE (E. Piselli):

GPS
Target change done on Tuesday morning. On Wednesday and Thursday morning we have been working on stable beam tuning. Beam to users (SY-STI) for 1.7 GeV tests since the same day in the morning.
They have been running smoothly since then. Their run will finish this morning.
Many thanks to all PSB crew for their work: users have been asking to swap between 1.4 GeV and 1.7 GeV beam very often and everything has worked perfectly.

HRS
Stable beam setting up on Tuesday and proton beam scan in the late afternoon.
From the evening radioactive beam to users.
Problem in the night, when a sector valve interlocks tripped and closed the 2 valves. Users have called the vacuum specialist and he has raised the vacuum valve interlock threshold to higher values in order to let them continuing.
Users finished on Thursday morning.
On Friday we have identified a faraday cup as the cause of the vacuum issue. SY-BI has exchanged the entire beam diagnostic box (Faraday cup + scanner) in the afternoon and the problem has been solved.

REX/HIE
We have been working the entire week trying to re phase all the REX RF amplifiers after 7GAP1 (running at lower power) with A/q=4.3. Unfortunately we were not able to complete the setup yet. We will need to continue working on it this week.
On Wednesday we have been working with Greg Kruk and J.L. Sanchez to synchronize the LINAC with the proton pulses (required by the next HIE experiment). We have tested the new configuration of the timing and it works. Modification of the high level application needed and implemented. Final deploy today.

PS (A. Huschauer):

The PS had another difficult week, with ongoing POPS problems and a long stop due to the Linac4 intervention. The availability is currently at ~82%. The main points of the week are listed below.

- As in previous weeks, the **main issues came from POPS**.
    - several trips throughout the week causing in total ~9h downtime
    - most trips were caused by **communication errors**, even though over the weekend trips due to the **cooling system** occurred
        - micro water leak on the cooling circuit of DC6, which will need to be repaired during the YETS

    - EPC experts continue to investigate, but **reason for the trips remains unclear**
        - during the week the experts managed to roll back the software version to pre-TS2 state, which also didn't improve the situation
        - meeting with EPC organised for Monday 11:30 to discuss the strategy
- In view of ramping up the AD beam intensity, the **operational AD beam was replaced by an optimised version** on Wednesday. This beam will allow to slowly increase the intensity over the coming weeks up to 2000E10 ppp. Currently, we are still delivering nominal intensity as before Wednesday.
- After a period of high-intensity run, the **SFTPRO beam intensity** has been significantly **reduced** to ~1.7E13 p per PS extraction. The experiments confirmed that we'll continue to run until the end of the year with this intensity.
    - Following the **very good feedback from the NA experiments** on the spill quality of the beam using the **barrier bucket** and the reduced intensity, we plan for an **operational test run** during the last weeks of the year (ideally starting in ~10 days).
    - The barrier bucket cycle will still need operational tuning and the period of reduced intensity is hence a perfect opportunity.
- News related to LHC-beams
    - the PS is ready to deliver also 8b4e beams up to LIU intensities
    - in the beginning of the week we had issues with the synchronisation of the ion beams, which was resolved by adjusting the radial position before extracting
- During the week it was also realised that the **rise time of KFA71 was longer than usual**
    - this was visible when extracting the 8b4e beams 1-2 bunches were touched by the kicker
    - at the same time the gap between the SFTPRO islands and core was realised to be longer than usual, another indication of increased KFA71 rise time
    - investigations together with the ABT experts revealed that the **modules of KFA71 and KFA79 were not well synchronised** and the improvement was immediately visible on the SFTPRO beam
        - 8b4e beams also appeared less impacted, details still to be checked
- over the weekend the standard **super cycle was increased from 24 to 36 BPs in order to improve the proton sharing in the EAST area**
    - this allows T9 and T10/11 users wo receive ~50% more spills, with negligible impact on other PSB and PS users and no impact at all for the SPS users
- MDs:
    - throughout the week **slow extracted ion beams at different energies** have been prepared for CHIMERA
        - on Tuesday a 750 MeV/n version was sent to T8 for the first time and the following days were devoted to improving the spill quality
        - over the weekend a 460 MeV/n version was prepared, but only very little beam was seen on the EAST dump
        - next step will be to set up a 500 MeV/n cycle
    - successful proof-of-principle of the **double-batch TOF cycle** (previously M-TOF)
        - B-field was modified to stay at 20 GeV, which improves the B-field stability (no RMS limitations for MPS and PFW)
        - extraction elements around SS16 and TT2 elements successfully tested to pulse at first and second extraction (following the EPC modifications during TS2)
        - 2 bunches of 600E10 p were accelerated, bunch (and anti-bunch) rotations were implemented and **both bunches were successfully extracted** (with a time difference of 1.2s) to D3

        - cycle to be further optimised longitudinally and triggering of the experiment on the second extraction to be discussed
    - additional MDs were ongoing throughout the week to study the automatic correction of the MTE efficiency, to control the PFW using a neural network and to characterise instabilities
- a lot of **preparatory work ongoing using the sequencer**
    - preparing the PS energy saving modes and for stops by switching equipment off or putting it in standby
    - exploring the functionalities in view of hardware commissioning

PS – East Area ():
No report.

AD - ELENA (L. Ponce):
Period with no beam delivered to the users due to:
- no beam from injectors (LINAC4 issue and many POPS issues).
- water leak on a the cooling circuit of the e-cooler collector, repaired with an access of ~2 hours.

We also had a couple of hours with degraded performances due to:
- water flow problem on a C10 cavity fixed by intervention on site by the expert to re-adjust the flux. Beam was still available, but almost 30% intensity lost.
- problem with PS cavity sending bad quality beam in FTA and causing losses of 5% of the beam already at the entrance of FTA.

Since Wednesday morning, we are using the ADO_2000_22 user in PS to produce the AD beam, but we do not increase the intensity yet.

On the ELENA side:
AEGIS magnet ramped up for the first time this year on Tuesday morning.
Resteering of the ALPHA and ASACUSA2 lines needed to bring back the beam to the initial position. We also had to recorrect injection oscillation in vertical plane between AD and ELENA, GBAR has also reported a noticeable effect in their line. AEGIS magnet switched off twice this week, causing downtime to ALPHA.
- Hminus operation resumed on Friday thanks to the reprogramming of the source PLC by Bruno and Sergio.

SPS (V. Kain):
Another week with a rather low availability in the SPS due to various long issues in the injectors (POPS, LINAC4 modulator) - only about 75 % overall availability. The SPS itself had few faults throughout the week with the main fault only concerning the LHC, when the BQM was failing on pattern check after a frontend reboot.

One of the highlights during this week was the operational test of Empty Bucket Channeling (EBC). It was left on over night from Thursday ~ 10:00 am to Friday early in the morning when LINAC4 tripped. All ripple is significantly reduced. Even with the drifts at 50 and 100 Hz, no further corrections are necessary. However, NA62 had issues with the 200 MHz component in the spill in the evening. With a slightly modified setup of EBC to account for the 200 MHz component the ripple suppression is not good enough. Dealing with the 200 MHz, the drifts and hysteresis are subject to further investigation. This can however only take place after COMPASS' current polarisation setup - after next Wednesday. Also, NA64 have finished their run. The intensity on T2 is therefore 25 - 30 units leading to an intensity of only about 3.3e+13 in the SPS and a transmission of often more than

97.5 %. To investigate the 100 Hz component of the QD circuit, the QD power converter has been replaced by the spare for the time being.

There is nothing special to report concerning the LHC operational beams. 8b+4e was prepared several times, but never taken in the LHC. The situation with injection losses is unchanged. During the long parallel MD on Thursday, 8b+4e with high bunch intensity (~2e+11) was studied. This beam has very good transmission, but causes significant vacuum activity in the 800 MHz cavity 1. The experts came to the conclusion that it needs further conditioning with this beam type.

Also, further conditioning is required to have the correct parameters at extraction with the ion beam. The RF team has fully commissioned the entire cycle discovering a few things on the way (with phase loop, voltage clipping etc). The transmission through transition, slip stacking, re-capture and second acceleration are remarkable now. The final voltage increase for rotation at flattop is however not possible yet due to lack of power (final bunch length > 2 ns).

For next week:
- arrange for fast spill monitor (PMT-OTR) parasitic tests
- HiRadMat will need access from Wednesday
- EBC tests to be continued after Wednesday
- verify settings of BQM for all LHC beams

SPS North Area ():
No report.

AWAKE ():
No report.

Linac3 (D. Kuechler):
Linac3 had an excellent week with a beam most of the time above 30eμA.

- Monday the stripper foil was exchanged on request of LEIR (the foil to be used was already tested the week before).
- Thursday morning two MD's took place:
  - Measurements in the ITF line as input for the discussion about the linac realignment.
  - Measurements to study the beam tails in the LBS line.
- Friday the linac continue to run without coffee.
- Sunday the microwave generator tripped, but could be easily resetted.
- The energy measurements were taken every day.

LEIR (M. Bozzolan):
Main activities

- Slip stacking studies in SPS on Tuesday, Wednesday and Friday
- Installation of a BPM test amplifier for first turn trajectory measurement in LEIR on Thursday
- High energy trails characterization in LBS and LEIR (with Linac3 team) on Thursday

Fixed issues

- Solved the frequent RF cavity faults
- Replaced an OASIS crate in LEIR CR with fire principle on Thursday
- Vacuum issue on Friday fixed with an orbit steering on the l3_monit around the IPM

CLEAR ():
No report.

LHC (https://twiki.cern.ch/twiki/bin/viewauth/LhcMachine/LhcSummaryWeeks2022):
Operation with 2461 bunches with the bunch intensity at start of stable beams now up to 1.35E11 ppb. Three fills dumped on UFOs in Q6R1, Q10R1, Q6R5 and 13R6.

UFO dump count: 28, UFO quench count : 1