Accelerator Complex Status

End week 8 (Monday 28 February 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 5'900 alarms.
- 600 phone calls (444 incoming, 156 outgoing).
- 76 ODM created.

Events worth mentioning:

- Wed. 23.02, the Phonebook data got corrupted, as a result of wrong data injected into the FAP database. The problem is not yet solved and may compromise the reactivity of BE-OP when experts need to be contacted.
- Thu. 24.02, OP-Webtool service went down for about 10 min. but came back by itself.
- Sun. 27.02, SF8 cooling towers tripped on "forced filling" alarm. It was not yet understood why, a small electrical perturbation on the controls circuit is one possible cause that is being looked into.

Details: https://wikis.cern.ch/display/TIOP/2022/02/28/TI+week+summary,+Week+8

LINAC 4 (Alessandra Lombardi)

A very quiet week for linac4 so far. Only minor events

- Sunday : RFQ recovery activated
- Friday : DTL1 tripped
- Thursday night : PIMS7-8 tripped
- Tuesday : HSL tuned the source (gas).

PS Booster (Gian Piero Di Giovanni):

The PSB standalone beam commissioning week could progress with the preparation of several beams, uncover and understand a few issues, hence the longer-than-usual report.

We reported at the last FOM about an issue with **extraction synchronization**. The RF team narrowed down the problem to be the **side effect of the LTIM migration** which was causing the DSP B, that handles the synchro, to receive two triggers and confusing the whole extraction process. We are **still experiencing issues with cross-talk between rings** for the extraction synchronization. Initially it seems only to happen for 1.4 GeV where the problem was more apparent, but on Friday the RF team saw similar effect for the 2.0 GeV beam.
A LLRF **bug was found affecting the TFB in R4**. The RF team **patched** the issue and new version of the LLRF with the **fix has been prepared** and it will be deployed next week.

Beam progress:

- **LHCINDIV** ready. We still need to fine tune the transverse emittance, but it was already taken by the PS.
- **TOF** ready at nominal intensity (850e10 p) in both R2 and R3, the latter in case of failures in R2. The PS is taking a low intensity version in R2 for the first days of their beam commissioning.
- **MTE** ready at nominal, i.e. 2000E10 ppp. The PS is taking only the core for the first days of beam commissioning.
- **ISOGPS** first version ready at 3200E10 ppp. RF team is investigating the aforementioned issue on the extraction synchronization cross-talk.

- **STAGISOGPS** first version ready at 900e10 ppp.
- **LHC** standard 25ns beam first version ready at 160e10 ppr. We mainly optimized the injection and the RF setting-up has started. Work is still needed in the transverse and longitudinal planes to bring it to specifications.
- **EAST** first version ready. The PS team requested for future studies to have variable transverse emittances. The experts are looking into the possible production schemas.
- **AD** first version prepared in the week-end and ready for the experts to have a look.

We found **two important issues with the PSB alignment**:

- Following the BSW.1L1.1 re-alignment campaign during the YETS, we measured the **BSW leakage with beam**. At nominal current, the **roll angle mis-alignment was estimated to be ~12.5 mrad with beam**. In 2021 it was measured to be 6 mrad. Later BE-GM experts confirmed that indeed there was a**mistake during the alignment done in the YETS**. In this conditions we have no margin to correct for the mis-alignment and it affects our performance at injection.
- The **bare orbit of the PSB worsened in the V plane**, while in **H we observed a systematic difference between the internal and external rings**. The difference in H was tracked back to the replaced **BHZ15L1** which has **different calibration curves** for the internal and external gaps. It was not the case for the previous magnet. After updating the calibration curves in LSA, the ABP experts calculated**a new alignment proposal**. As a side note, we hoped that the new calibration curves could help understanding the degraded (wrt to 2021) POPS-B performance in the external rings, but it was not the case until now.
- **For these reasons we organized, in agreement with the PS team and all the experts, a day long access in the PSB on Monday morning to realign the BSW and 3 quads in the rings:**
    - The length of the access is driven by the need to **vent the vacuum sector of the BSW and pump it down**.
    - The DSO test for ISOLDE has been pushed to Tuesday morning.
    - **The PS started the beam commissioning on Thursday afternoon, to mitigate for the loss of activities on Monday.**
    - **The PSB team would like to thank all the experts and the PS team for their professional response and willingness to rapidly intervene under these circumstances.**

With the start of the PS commissioning, POPS started pulsing, so the new stray field compensation of the PS in the PSB injection line was calculated over the week-end.
We also has multiple progress on the BI side to fix teething issues and improve the operability of the equipment (BTVs, BPMs, BCT, BBQ, H0/H- Monitor). For instance this year, BI reduced the EMI noise on the H0/H- equipment adding ferrite to their connection patch box and the LIU WS seem more resilient to errors, as a result of the FW update done during the YETS.

Finally, we managed to unlock the remaining BTY magnet converters to complete the HWC testing which were still missing last week. This was urgent because the commissioning to ISOLDE will start the 7th March.

As a last remark, the major stops to the PSB beam commissioning happened on Monday afternoon because of a Linac4 fault on the DTL1, which generated a downtime of about 7 hours.

ISOLDE (Alberto Rodriguez):

It has been a busy week for the ISOLDE facility. We have made quite a bit of progress on the commissioning of the facility. The main goals of the week were to:
- Recommission the HRS FE11 front-end
- Recommission the HRS separator
- Recommission the cooler/buncher

- Investigate and possibly solve the problem with the extraction from the cooler/buncher
- Prepare reference set-ups from the HRS front-end to the RC4, LA1 and LA2 lines
- Recommission the GPS front-end using a plasma target
- Commission the GPS gas injection system using the OP high-level new application

We managed to complete most of the program. However, we have not been able to solve the problem with the extraction from the cooler/buncher. We believe that there is big misaligment of the extraction electrode. This produces a big transverse kick in the beam that is very difficult to correct afterwards. Because of this kick, the beam bounces back and forward around the beam axis while being transported further down the beam lines. We think it gets too close to the edges of the electrostatic devices and non-linearities are introduced resulting on an effective emittance growth and beam losses. The conclussion is that the cooler/buncher doesn't really cool the beam because of this problem.

This is not a new issue. We have been suffering it for many years. We were hoping to solve the problem during the early commissioning in 2020. But, because of the delay in the installation of the FE11 front-end. We didn't have time to investigate the issue until this year. We will discuss with SY-STI what can be done during the 2022-23 YETS to improve the situation. In the meantime, we will need to continue using it as it is.

PS (Alex Huschauer):

Moved from HWC into the BC, Following the excellent work done during the HWC by all involved groups, very good progress was made during the first days of the BC.

 The HW commissioning for the PS RING and TT2 has made sufficient progress to allow an anticipated start of the beam commissioning on Thursday evening. All systems were commissioned and tested remotely, which is also illustrated by our checklists.

 HWC details:

- Work on the PFW was completed on Thursday afternoon, with the PR.WFNP circuit still needing some fine tuning by EPC, in particular regarding POPS compensation.
- There was a SF6 leak on KFA79 module 7 and a timing controls issue with module 12 (it was impossible to reduce the pulse duration), both successfully fixed by ABT
- We have had some explanations by BE-CEM on the controls for the new TT2 stripper
- We have successfully tested the PSB BIS which cuts the beam if any of the two PS internal dumps (TDI47/48) is in an unknown position.
- The 200 MHz cavities were switched back ON and to remote on Thursday. They had been kept OFF to save filaments lifetime. Now they need phasing with beam.
- RP made a final inspection tour of TT2 on Monday, and a final inspection of the PS ring on Wednesday. OP made a final tour on Thursday morning to remove mechanical pieces which had been left at a few places in the machine.
- In TT2/TFP : a new vacuum window was installed in FTN, there has been an (unsuccessful) attempt to install kapton on TT10 quadrupoles (situated in the TT2 access area) and BI asked for a last access to check the FTN semgrid. All those accesses were completed on Friday morning.

 BC details:

- PS RING beam permit obtained on Thursday evening, which allowed first injections, while dumping the beams with the internal dumps.
- TT2 beam permit obtained on Friday morning, which enabled the tests of the EIS interlocked by this safety chain, and of first beam extractions to TT2 D3.

- Setup of LHCINDIV, low intensity SFTPRO and TOF beams has started and all of them were successfully extracted to D3.
- The AD beam was also successfully tested with beam and accelerated to flat top.
- First optimisations on the injection trajectories and the injection bump closure were performed.
- RF experts started to look at the longitudinal plane, verifying the different bunch splittings and recording references with the tomoscope.
- Commissioning of BI equipment with beam was started on the wire scanners, the BGIs, the SEM grids/SEM fils and the TMS.
- Following the redesign of the BGI84 magnet, the induced orbit distortion was reviewed and corrected. Using the available low-intensity beams, it indeed seems that the skew sextupole component of the magnet has been significantly reduced as no beam loss could be observed close to the Qv=6.33 resonance. Further measurements needed for verification.
- At least two 10 MHz require an access tomorrow to replace their amplifiers. Fortunately this could be spotted last week so that we can profit from the beam stop in the PSB tomorrow.
- The ring BCT showed erratic behaviour making an intensity read-out almost impossible at some occasions during the weekend. To be followed up with the expert tomorrow.
- C40 and C80 cavities haven't been available for operation yet, but should become so tomorrow.

PS - East Area ():

YETS.

AD - ELENA (Laurette Ponce):

AD:

- Some delays on the bake-out in AD ring, with impact on the restart of the mains power converter which will not be available for test for the DSO tests on 11/03. Will do partial test for closing the ring on the 11/03 and repeat for special permit after the closing of the machine.
- Closing of the machine planned for 16/03 to allow HW test of C10 cavities and power converters.

ELENA:

- Leak on the ELENA injection kicker repaired, bake-out completed on Friday. Re-installation of septum on-going, kicker conditioning to be started tomorrow.
- ELENA DSO test postponed to Tuesday 1/3 to give priority to LHC RF DSO test.
- Hminus beam commissioning to re-start on Monday 7/3 with the new HV transfo on the source.
- Delays on the installation of the profiles monitors for STEP and ASACUSA, venting of the of the sector to be started this week for STEP (impact on ALPHA line).

SPS (Stephane Cettour Cavé, Johan Dalla-Costa and James Ridewood):

Ring BIC loop closed and SBDS rearmed with MKDV1 pulsing at nominal voltage

- Issue identified on injection kicker MKP not kicking on first injection traced to software modification which has been subsequently corrected and retested but awaiting operational deployment, foreseen next week
- Main power supply spurious trips traced to faulty connection on control PLC module. Faulty module replaced and no further spurious trips observed
- SMD9 backplane contact problems also resolved
- Majority of FEI and FMCM tests complete
- Some issues with beam instrumentation remain, particularly in north extraction and transfer. BI are aware and working to resolve
- ALPS and TTPOS tested with calibration signals - all appears OK
- BLM INJ for transfer lines tested OK

- MPE BIS and SMP tests performed OK
- Main power supply trip beam dump reaction delay checks complete
- Polarity issue identified on MDLV2505 resolved and retested
- RF power control FESA class not yet available -Normally foreseen next week

Conditioning RF cavity (from RF power colleagues) Cavity 200MHz
- Cavity 1, 2, 3, 5,6: Conditioned at 650 KW cw (nominal= 650 KW cw)
- Cavity 4: Conditioned at 550-600 KW cw (nominal= 650 KW cw) Cavity 800MHz
- Cavity 7, 8: Conditioned at 180 KW cw (nominal= 180 KW cw) RF low level

Some uncertainty regarding power conditioning levels between RF power and LL. RF colleagues To convene early next week. Otherwise on track.

No major issues to announce as yet. HW commissioning proceeding as foreseen.

SPS North Area ():
YETS.

AWAKE ():
A quiet week, waiting for laser fix on Week 9
- Replaced digital cameras at Station 1 and Station 2
- Continuing to commission BI DAQ system for digital cameras

Plan for week 9: Laser expert arriving Tuesday. Access tests in TAG41/42 expected to break (and re-establish) patrol on Wednesday. As soon as laser is fixed, test laser and electron beam on new BTV.

LINAC 3 ():
YETS.

LEIR ():
YETS.

CLEAR ():
No report received.

LHC (Jörg Wenninger & LHC Coordination webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Phase 2	Cold	Phase 2	Phase 2	Phase 2	Phase 2	Phase 2	Phase 2
77 / 11950 A	0 / 0 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	21 / 11600 A	55 / 11600

ELQA finished in S23 (in advance). Sector 45 completed with the exception of one 60A circuit. RB56 had a quench after 40 minutes at FT. RF cavities filled with Helium for DSO test next week.