

## Accelerator Complex Status

### End week 47 (Monday 23 November 2020)

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#### Technical Infrastructure (J. Nielsen):

- A rather busy week for TI.
- Statistics:
  - Close to 7'500 alarms
  - 952 phone calls (710 incoming, 242 outgoing)
  - 129 ODM created
- Events worth mentioning:
  - Tuesday 17.11 at 13:05, AUG in ME9 substation. The button was damaged during cabling work. It was replaced and the whole AUG chain tested before putting back in service.
  - Tuesday 17.11 at 16:44, BA5 evacuation. It looks like someone activated the evacuation. BE-ICS is investigating what is the source of the evacuation and from where it was launched.
  - Wednesday 18.11 at 09:55, Fire alarms in UPR13 in the LHC caused evacuation alarm. Nothing was found on-site, investigation is still ongoing. Could be related to electromagnetic disturbances. A dedicated meeting was held with HL-LHC, TIOC, BE-ICS, coordination, discussing the recent events and actions to take.
  - Thursday 19.11 at 16:29, SEQ4 filter in point 4 LHC was switched back on successfully by TE-EPC. No perturbations recorded.
  - Friday 20.11 at 10:45, Linac 4 tripped due to a missing water flow. Indeed, an intervention was ongoing for a filter change on the Klystron circuit and when switching from one circuit to another for changing the filter the flow dropped and caused a trip of the Linac 4.
  - Friday 20.11 at 12:30, Some calls to CERN mobile numbers from CERN landlines (traditional/SfB/IP Alcatel/CERNphone) fail. Swisscom experts are investigating and working on a solution.
  - Sunday 22.11 at 05:32, Cooling towers in building 201 tripped and caused the compressed air, heating plant and some CRYO installations to trip also. TI on-site to restart the cooling towers and compressed air rapidly avoiding the compressed air to reach a level where all installations at Meyrin would trip. Investigations about the reason of the trip is ongoing this week.
- Details: <https://wikis.cern.ch/display/TIOP/2020/11/23/TI+week+summary,+Week+47>

#### LINAC 4 (B. Mikulec):

Due to PSB (magnet cover installation) and SWY accesses Linac4 could only send beam to the Linac4 dump. Last week the focus was on a **phasing MD** with the aim to understand several details that had hampered/slowed down the last phasings.

This MD was very successful - the main points are mentioned below:

- No difference observed performing phasing with Adaptive Feedforward On or Off; it was also seen that it was sufficient to lower the amplitudes of the downstream cavities by a factor of 100 (no need for lengthy detuning of the cavities).
- As the data provided by the TOF FESA class arrives quite late and the CMW server dispatches the requests not always in order, it turned out to be essential to **compare the cycle stamps of TOF** with the one from the phase acquisition → the operational TOF application was used with a pause of 5 cycles as a temporary measure, and by the end of the week P. Skowronski has

modified it to do the proper cycle stamp comparison. (final checks will be done this week and the improved version released)

- Beam instrumentation:
  - It was found that the **distances between the TOF BPM pairs were incorrect** → J-B. Lallement provided the correct distances from the drawings (the layout DB will be updated); M. Bozzolan performed some beam-based measurements to compare the result with the new distances (still to be analysed).
  - The largest improvement was then obtained by **calibrating the BPMs**, which solved most of the disagreement observed during the last phasing campaign. Different BPM pairs now give similar results. BPMs perform steadily calibrations, but they are only applied on demand; a warning should be available when the drift is too large, but this was not the case → to be followed up by the BI team. OP will force a new calibration when starting the TOF application (with the instructions from BI).
- **Phase shifter of CCDTL5/6** (combined klystron): moving the phase shifter showed that the relative phase between the 2 cavities is not too wrong, but could maybe still slightly be improved. Unfortunately the phase shifter is at its end range, and this would mean a longer intervention (which is not essential at this point).
- A very interesting new idea has been successfully tried out, which can be used as **additional method** in case of doubts: it is based on the beam phase measured by a single BPM located downstream the cavity in question; changing the phase of the cavity results in a different arrival time of the beam at the BPM; comparing the data to simulated curves provides a new way to determine phase and amplitude of the upstream cavity. The operational applications will be extended to include this new method.

Applying all of these corrections, **the linac was rephased on Friday**; the resulting phase spread was as expected, and in particular the sharp edges of the measured profiles should be noted.

#### Additional points:

- Tuesday morning the DTL1 modulator anode divider broken Monday afternoon had to be replaced.
- On Friday morning we lost the source and complete Linac4 RF due to a mis-communication and an intervention on the cooling system.
- SIS to shorten the beam pulse to 100 us if a BI instrument is inserted in the beam: detailed studies by T. Bukovics showed that the SIS reaction time is as expected, but the data from the BPM FESA class through CMW arrives ~2 cycles too late → **insufficient protection for the instruments** → temporarily only procedure to reduce the pulse length; later on there will be specific measurement supercycles pre-programmed that should reduce the risk of wrong settings. Further discussions with the BI SW specialists are planned, but if no solution will be found, a HW protection should be implemented.

#### PS Booster (A. Akroh) :

- Last week good progress was made with the checklist as usual, but really trying to put more effort in finishing the pending issues.
- Also, last week (W47) the 1<sup>st</sup> week of the 2<sup>nd</sup> batch of the Magnet Cover Consolidation took place.

#### **Monday 16/11:**

- A. Newborough localized a water leak on BT3.QNO20 à Intervention planned W48
- W. Vigano warned us that he'll have to test again all channels on the Ring BLMs on W49 because of their lockout and cables manipulation;
- The issue while driving from the momentum on the ISOHRS\_2021 and ISOGPS\_2021 cycle did not work last week:
  - It turned out that several parameters were not initialized;

- we managed to fix it and now the hierarchy propagation from momentum down to all parameters works → A 1.4 GeV cycle has been set back (before it was a 2.0 GeV one)
- The BI.DIS has been continuously pulsing (except when an intervention took place in the neighbourhood) to check its reliability.

#### Tuesday 17/11:

- Test of the BTY.BVT101 (ISOLDE in TEST-EIS mode) has been performed after its switching back to safety chain → The test was successful;
- Tested new version of the FI application → We now have to put the reference settings in the application and test all converters once available.
- Dry Run to test a pre-magnetic cycle for the BT-BTP quads: The BTP line is fully PPM, and in the future the BT-BTP optics will change for the different PS destinations (one optics for FT physics and one optics for LHC);
  - M. Fraser (TE-ABT) tested a new optimizer to adapt the optic shot-by-shot to reduce the beta-beating;
  - TE-MSA and TE-EPC are asked to implement a pre-magnetic cycle to improve the magnetic reproducibility.
  - All in all, good and promising results.

#### Wednesday 18/11:

- The issue APS-8481 concerning BTY.QDE120 / BTY.QDE209 / BTY.QDE321 / BTY.QFO210 / BTY.QFO322 which should be PPM and stayed non-PPM is solved;
- BE.SMH15L1 in FI application was reacting correctly while BIS did not.
- Issue (APS-8498) on BTY.BVT101 external condition: Wrong configuration in CCDE, EC was reading from FGC with wrong name → **Test planned on Tuesday 24/11**

#### Thursday 19/11:

- BI.BCT10 base line extremely perturbed by BI.DIS10 and other BI equipment → BE-BI colleagues together with Fabrice had a look → “Ferrites” will be put on the cables;
- Dry-run (second try and end) on BCT watchdog, injection BCTs and Ejections BPM:
  - Successfully validated the BI.BCTWD.BR watchdog, Extraction BPMs;
  - L4T.BCTWD.BI will be validated W48 with a new BCTTRIC and BCT watchdog FESA deployment (Setting comparison when 0 turns + chopper offset taken to account);
- Issue (APS-8485) on missing OASIS signals for some magnets in BT-BTM → Solved;

#### Friday 20/11:

- Last Dry-Run on the chicane bump power converters (Blr.BSW1L1.x) took place after TE-EPC + BE-CO troubleshooting:
  - BI.BSW timings worked correctly according to the new BIXr.NT-FGC installation;
  - repeatability of the pulse is generally within specs;
  - Propagated settings to all users.
- A problem occurred in the machine while installing new covers around one of the Vacuum Ion Pump which put all the BR20 to the PA → This could have an impact which shouldn't be problematic on:
  - RF HL tests (apparently the vacuum level is not problematic with the FINEMET);
  - The new LIU-Wirescanner repair and installation has been advanced to Monday 23/11 PM.
- BIS condition for **H0/H- Current Monitor** on Slave-BIC PSB1 is fully validated and Critical properties created;
- BTM.QNO05 changed and tested → Wait for TE-VSC confirmation.
- News concerning the magnet covers consolidation in the PSB Injection/Extraction Triangle: The covers will not be ready for next week (W48) due to lack of resources. TE-MSA foresee to install it during the Technical Stop after the Christmas Break from **4th-13th/01/2021**.

- Next week is the last week for Magnet Cover Consolidation and the penultimate week before BEAM, so we'll redouble efforts make it happen!

#### PS (K. Hanke):

- MSC tests ongoing on main coils + PFWs + W8L
- Auxiliary magnets MSC tests to follow
- Very good progress on auxiliary magnets power converters commissioning
- Dry runs and checklists filling; good progress
- 10 MHz cavities water cooling circuit modification achieved
- Issue with vacuum chamber BHZ377/378
- Grid to make the TOF primary beam zone envelope closed will be installed beginning of this week.
- Vacuum broken in TT2 sector 30. TE-VSC organising repair. No show stopper for beam (enough margin in planning).

#### ISOLDE (A. Rodriguez):

- Together with colleagues from BE-BI, we completed the hardware commissioning of the new silicon detectors installed in XT02 and XT03. A day later, we used a 20Ne8+ beam to do the beam commissioning.
- We also spent a couple of days using them to complete one of the machine studies we had planned. For this, we conducted different beam energy measurements using the dipole magnets in the HEBT lines as spectrometers and the silicon detectors as particle counters.
- Even though we haven't finished yet, we also spent some time checking the scalability and the stability of REX at low A/q beams. So far, we haven't gone below 2.5 (the lowest limit at this point). But, our plan is to explore the range of A/q between 2.0 and 2.5 if we have time. We hope we can offer this range of A/q to future users if we manage to make this mode of operations reliable enough.
- In addition, F. Wenander from ABP spent one day characterizing the performance of the new cathode for two additional beams (7Li and 152Sm)
- Finally, Miguel also worked a bit on preparing operational set-ups with the current quad polarities to the LA1 and LA2 lines. In the coming weeks, we will compare these set-ups with the ones after we change the polarities of several of them before deciding what configuration we use next year.

#### ELENA (Laurette Ponce):

A reasonable week. However, some known hardware issues previously encountered returned, leading to lower beam availability:

- Trip of the HV of the source leading to the exchange of the interlock connector
- Trip of the ion switch, need again to exchange the connection box

Concerning the transfer line commissioning, setting-up of the LNE50 line, deceleration for Gbar started, but a source of coupling needs to be investigated. Also, progress was made on the LNE00 line.

#### LINAC 3 (Richard Scrivens):

- The effect on the beam of the source moveable puller was investigated more, with emittance measurements made with quad scans. The data is to be processed.
- Source gas controller was fixed – and a spare from VSC is being checked for compatibility. For the mid-term this is resolved, but needs a long term follow up.
- LLRF
  - Could measure the beam with the new LLRF controlling the buncher.
  - The correct pulse length and timing was set up.

- New phase could be found and the amplitude calibration data was taken – but could not be processed because data extraction from NXCALS was not possible (this is working now).
- The RF parameters averaged over the full pulse are very stable – the time resolved have not been looked at yet.
- Publication of data is a cycle late (and mixes over users).
- The state control of the amplifiers and breakdowns are still be to finished.

The following issues were identified and mostly solved:

- Slits – erratic publication of data – mostly fixed by EN-MMS (but still residual problems being followed up, the position is erratic every approx 6 hours – it is not blocking us).
- Vacuum – Multiple events on 19/11/2020 – closure of valves and interlocks to the source – Probable mixture of some real events and VSC triggering them while trying to investigate. No investigation over the weekend , as of Sunday evening there had been no new events.
- An issue with a sector valve in the ITL was identified (very slow closing) – the mechanism should be replaced
- LBS.BVT10 – RBAC configuration was fixed, but the power converter does not acquire current.