

Accelerator Complex Status

End week 4 (Monday 1 February 2021)

Technical Infrastructure (C. Pruneaux):

- Quite an eventful week.
- Statistics:
 - About 6500 alarms
 - 1028 phone calls 641 incoming, 387 outgoing)
 - 130 ODM created
- Events worth mentioning:
 - Tue. 26.01: Fire alarm in ATLAS. The cause was a cable that had been cut accidentally during cabling works. Ventilations were stopped by interlock, CV piquet sent to help restart the ventilations.
 - Wed. 27.01: ODH alarms in UPR13, fire brigade on-site where they measured a higher-than-normal level of CO in the air. The CO and smell of combustion engine was coming from a grinding machine, used to grind the concrete floor. In agreement with TIOC, LHC coordination, Fire Brigade, CV and HL coordinators, a VIC was organized after which access was again possible.
 - Wed. 27.01: Electrical perturbation, without consequences at CERN.
 - Sun. 31.01: Local power cut in the ME25 sub station, caused a cut of RF, vacuum, power converters for the booster. A protection relay for a bus bar had spuriously rebooted. This already happened once before in December, a date will be proposed soon to replace the relay.
- Details: <https://wikis.cern.ch/display/TIOP/2021/02/01/TI+week+summary,+Week+4>
- This week:
 - It's worth mentioning that today EN-EL is doing a maintenance in the ME10 sub station, so no backup from SIG available today in case of a power cut. The auto transfer will still work, only the SIG source is not available. TI was not made aware of this intervention before this morning when it started. This kind of information has to be communicated before doing it, it really should be cleared also by the TIOC.

LINAC 4 (Piotr Skowronski):

A rather good week with nevertheless a few issues:

- Temperature of klystron cooling water was fluctuating up +/- 5 degrees, what made beam energy to change. CV says that it is within specifications, but of course they did all the best to make it stable. It is followed up with RF and OP to find a permanent solution. More details will be given on FOM tomorrow.
- On Friday CCDTL4 vacuum pump tripped and required manual restart (40 min. downtime)
- On Sunday morning grid1 power supply for the source broke and was exchanged within 1h.

PS Booster (Bettina Mikulec):

Last week was quite eventful - despite several interventions good beam commissioning progress.

- The debuncher has been switched on in the Linac4 transfer line. As a consequence, the injection steering has been reviewed and a new energy matching with the PSB performed.
- **Injection commissioning (SY-ABT):**

- Thanks to the deployment of a new YASP version by Joerg the team could minimise injection oscillations by removing the average closed orbit of the first 100 turns
 - Kick response measurements performed
 - Ring 3 optimisation for working point $Q_x=4.4$ (LHC-like) and steering re-checked; minimisation of injection oscillations with orthogonal steering and variation of KSW amplitude —> **achieved injection oscillations of 1 mm peak-to-peak in both planes**
 - **Optics measurements (BE-ABP):**
 - Tune measurements in all rings at different settings
 - Kick response
 - Orbit measurements and corrections to improve understanding of the PSB injection effect (bump collapse)
 - Commissioning of k-modulation, k-modulation and excitation optics measurements
 - Setting-up R3 and R4 for optics measurement (k-modulation) closer to the half integer resonance (LHC working point)
 - Turn-by-turn data taken with different gains to understand the strange R1 BPM readings —> discussion organised for Monday with BI experts
 - **RF commissioning:**
 - Acceleration up to 2 GeV in all rings
 - Optimisation of 2 GeV extraction synchronisation
 - h1+h2 operation with BCMS-style voltage functions
 - Successful application of high harmonic for longitudinal shaving set up in all rings
 - **Ready to move to higher intensities**
 - **TFB commissioning:**
 - The old and new TFB has been set up in all rings for 160 MeV
 - Verification of the automatic delay compensation at 320 MeV worked for R2H; to be validated for all rings.
 - **B-train calibration** checked for inner and outer rings up to 2 GeV
 - **Extraction at 2 GeV done for all 4 rings up to the PSB dump (SY-ABT + BE-OP)**
 - Correction of the septa length and blade position by SY-ABT
 - Calibration curves for septa revised
 - Because of the model definition in MADX vs LSA the calibration curves of the BT.QNO10/20/30 had to be inverted as well as for the ring 1 and 4 bending magnets
 - Kick response measurements showed an inversion of BT.BPM30 —> corrected in an access
 - Beam extraction phases and kicker timings have been fine-adjusted with beam
 - Refined steering by the operators on Sunday
 - Difference in height of extraction bump ring-by-ring --> need to find good compromise, as the bumpers are not individually powered per ring; extraction bump not fully closed —> to be followed up, including a study to consolidate this old system in the future
 - **POPS-B:** SY-EPC performed adjustments to minimise the oscillations observed on the main quads (dedicated POPS-B operation); SY-EPC presented at the last MPC meeting potential solutions (some longer-term) - to be followed up, together with a quantification of the effect on the beam (ongoing by BE-ABP)
 - Commissioning of wire scanners ongoing
- A few interventions by specialists/piquets were required:**
- Exchange of RF carrier board in R4, replacement of a TFB signal processing card for R1, kicker SW update, RF PLC SW update, BR1.QCD3 regulation problem, BT.QNO40 controls, distributor (Saturday), BT.BHZ10.BTM (Sunday)

Access on Thursday:

- Wire scanners: it was found that the scintillators of R1 and R2 were ~30 cm away from their nominal position, which explained the low observed signal
- Successful intervention on the BT septa: reinforcement of some pieces in the current leads, leak in water battery fixed
- BTM.BCT10 signal inverted
- BT.BPM20 cable inversion corrected.

On Sunday at 20:16 the ME25 18 kV trip brought down the whole PSB.

Everything was restarted, but there are a few septa, kickers and magnets that require the piquets. Also, REMUS was lost around 03:20 Monday morning and therefore the beam stoppers were put in to wait for the RP intervention.

ISOLDE:

No report, as water cooling will be switched back on 8 February after which re-commissioning will start.

PS (Klaus Hanke):

- Last and this week POPS with “degraded” mode tests. EPC tested spare cards and found two broken. Repair has started. Otherwise feedback is positive.
- Short access to SWY to fix an issue of water cooling circuit for 10 MHz cavity C36 (done in shadow of PSB intervention)
- TT2 and n-TOF power converter commissioning done followed by magnet polarity check:
 - Two magnets have wrong polarity due to cable inversion on magnet connection.
 - One power converter found with cable inversion (with a circuit of four magnet in series)
- Vacuum chamber in magnet BHZ377/378 moves with magnetic pulse. Stopped cycling to avoid any additional stress. With VSC, EPC and OP more investigation are scheduled for Monday morning.
- Many CCC activities, like:
 - Test of Injection kicker for both instances, ok.
 - Test of “Ralentiseur” with SEMGrid
 - Test of internal dumps, issue with the “exclusion window” found
 - Checklist is well advanced and next big step will be more Dry Runs to perform.

SPS (Stéphane Cettour Cave):

Summary of last week:

- Replacement of MBB.60090 completed Tuesday morning
- Main dipoles pulsed after magnet exchange without issues
- Aux PS tests advance as foreseen
- Issues identified on MKDH2 HV cable connector
 - Already 3 days access
- TED intensity interlock completed
- Continuation of SIS interlock checks
- Continuation of BLM issue resolution and testing
 - Surface cable in BA2 to be replaced “50m”
- TI8 access Tuesday → Vacuum issues resolved
- FII/FEI debugging. Several problems resolved

Planning for this week:

- MKDH HV cable insulation
 - 1.5 days access required. Planned 9, 10 February
 - Possibly punctual access required week 5 also
- TI2 access to resolve issues on vacuum valve

- Aux PS continue as planned
- Continuation commissioning main quad
- Continuation FII/FEI debugging
- AWAKE closed Tuesday to Friday for TT41 AUX PS commissioning
- Continuation bets commissioning (Dipole dependent)

AWAKE (Giovanni Zevi Della Porta):

WEEK SUMMARY: Started up electron beam, made OTR measurements at BTV42. Completed the streak camera line, but not yet tested with electrons.

- **TAG41 interventions:** on Tuesday and Wednesday RP had unexpected interventions related to the SPS activities
- **AWAKE Laser:** UV alignment was done on Monday morning to allow for electron beam
- **AWAKE Electron Beam:** We started the electron beam successfully on Monday, and took data for part of the day every day for the rest of the week. Data-taking was hampered by two intermittent issues: a vacuum interlock shutting down the RF system, and a water temperature which was so cold that the RF system could not start.
- **AWAKE Vacuum Issue preventing electron beam:** after a couple of days of investigation, the vacuum interlock issue was tracked down to a vacuum pump power supply. A first access was made to ensure the power supply was properly calibrated. The problem was not solved, so on Friday the ion pump controller was replaced by a new one. We will see if this solves the problem.
- **AWAKE Water Temperature Issue preventing electron beam:** the water temperature in the Klystron cooling circuit needs to be at least 16 C for the klystron to start. This has never been an issue in the past, but in October 2020 we started having days when the temperature was too cold. The problem is getting worse and currently the only solution requires multiple accesses per day to regulate a valve by hand. We have asked CV to help us find a better solution to this new issue, so that we can regulate the temperature remotely without needing access.
- **AWAKE Streak Camera:** further investigation explained why the line had been modified after Run 1. A missing lens was ordered, delivered and installed. The line should now be equivalent to Run 1, and can be tested.
- **AWAKE OTR Measurements at BTV42:** an intensified camera was installed at BTV42 and aligned on Wednesday. The camera allows to measure the electron beam on the OTR screen. Data taken on Thursday and Friday will allow to compare a full emittance scan made on the OTR screen with one made on the YAG screen, both using the same camera.
- **Next week:** most of the week there will be no access because of SPS magnet tests. We will nevertheless attempt to have electron beam on the streak camera, but this is a shot in the dark since we cannot access the area for any fixes/modifications.

ELENA (Davide Gamba):

The week had the following main objective/results:

- Advance on transfer line commissioning: a first beam was successfully sent to the first part of ASACUSA for the first time. SY/ABT performed several scans to characterise the SEM monitor in the various transfer lines - data analysis/results to come in the following week(s).
- Start and keep ON the electron cooler magnetic system for all production H- beams: the impact of the magnetic system on the circulating ion beam at 100 keV is non negligible and difficult to correct, at least for the closed orbit, using conventional tools. Strong, uncorrected, orbit coupling seems to arise which will require some more ad-hoc correction tools to be implemented. The partial un-availability of the tune meter slowed down the investigation. Presently only the toroids and the dedicated orbit correctors (Kyoto) have been left on. New studies will follow in the coming week(s).

- Allow the survey team to work in the ELENA region (i.e. no beam) to allow for PUMA experimental area preparation: work is progressing as scheduled.

Additionally:

- Consolidation of ion source assembly: the source still suffers from intra-pulse intensity instability and slow orbit drift (not yet seen this year, though). Still, the present performance is deemed to be sufficient for this year objective of transfer line commissioning, so more invasive investigations will probably be done only during next winter shutdown.
- Tests on e- orbit measurement system in e-cooler: e- orbit can be easily seen in the normal BPM acquisition system. The setup in ELENA is made such that it can be deployed (in principle) also on AD and LEIR, as planned.
- First evaluation of beam losses when going through a SEM monitor: a first estimate is that ~10% of the beam is lost per each SEM (H+V) inserted in the beam.

Problems encountered:

- Several FESA classes (e.g. BPM, Tune meter, RF Cavity) are not yet fully operational/reliable and still require some debugging. The corresponding teams are working on it.

I insist on the problems with the tune meter which was working very well before the deployment of an upgrade requested by BI to have the same device on all machines. The new FESA class is not compatible with the way ELENA and AD cycles are implemented in LSA. Neither BI neither CO want to roll back because of other machine and we have to find a way to make the ELENA system which was in operation operational again.

LINAC 3 (Richard Scrivens):

The RF amplifier for cavity 1 developed anode capacitor short from the previous weekend (starting around the time of the network instabilities. This major amplifier intervention lasted until Thursday (thanks to the RF group for fixing this).

The beam was then taken through the Linac on Thursday, and the first beam into the ITH line was measured on Friday. The beam alignment needs to be corrected.

Some new issues with INCA settings and instrumentation were fixed.

In the mean time the source continued to be tested with the aluminium coated chambers, and is showing good stability at the present intensity.

LHC (Jörg Wenninger):

Summary last week:

- Second week of phase 1 powering in S45. Many issues solved. All circuits types now in test, from 60A circuits (completed) to the RB and RQ. Almost all phase1 tests completed in S45.
- First tests carried out on 60 A and 80-120 A circuits in S78. QPS-1st ongoing on the high current circuits, will be completed next week.
- [EIQA](#) at cold ongoing in S56.
- Survey confirmed the large misalignment on LHC.LEJL.5L6, the interconnection will be X-rayed in W5.

Plan for this week:

- Phase 1 powering in S78. Complete powering Phase1 in S45 outside working hours.
Complete [EIQA](#) at cold ongoing in S56.