

## Accelerator Complex Status

### End week 15 (Tuesday 19 April 2021)

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#### Technical Infrastructure (Clement Pruneaux):

Statistics:

- Close 5000 alarms.
- 620 phone calls (464 incoming, 156 outgoing).
- 92 ODM created.

Events worth mentioning:

- Tue. 13.04: Multiples faults by two times on new fire safety system for SPS. No consequence on SPS operation. The causes are not yet fully identified but may be a faulty microphone, still under investigation.
- Wed. 14.04: EBD139/25 triggered following start-up of LHC circuits. Impacted UW25 DQRS cooling station and cryogenics heaters. No other impact users thanks to to UPS safety supply. EN-EL established power supply. (Already happened on 06/04).
- Thu. 15.04: EBD139/25 triggered again following start-up of LHC circuits. Some more investigation were done with EN-EL specialist on site, EPC expert on call and LHC EIC on phone. Thanks to this the cause has been probably identified (energy extraction switch).

Details: <https://wikis.cern.ch/display/TIOP/2021/04/19/TI+Week+summary%2C+Week+15>

#### LINAC 4 (Bettina Mikulec):

Excellent week for Linac4 with only 3 equipment resets.

Some profile measurements in LBE were performed and are being analysed by ABP, plus a slightly revised energy matching with the PSB.

#### PS Booster (Foteini Asvesta):

Progress on operational users:

##### **ISOLDE:**

- The cycle for ISOLDE was setup for the first time this week and a lot of progress has been made already.
- Initial longitudinal and transverse setup as well as painting functions and extraction steering have made it possible to safely extract approximately  $800 \times 10^{10}$  protons on rings 1 & 3.
- In the following week further improvements are expected on all rings to improve transmission and beam characteristics.

##### **MTE:**

- All the improvements made by the experts have been propagated to the operational user, which has currently improved characteristics: Intensities up to  $600 \times 10^{10}$  with 1.3 eVs longitudinal emittance, 105 ns bunch length with transverse emittances of approximately  $12 \mu\text{m}$  in the horizontal and  $3.5 \mu\text{m}$  in the vertical plane.
- A new clone of this cycle has been prepared for extra fine-tuning from the experts.

##### **TOF:**

- The cycle has been revived and all the experts have worked on optimizing the parameters.
- Longitudinal blow-up has been applied on all rings reaching 1.7 eVs.
- The orbit has been improved using the special bending magnets and the orbit correctors.
- The steering has also been reviewed.

### **LHC25:**

- Work on synchro reduced perturbations on the flat top which were observed for high intensities.
- Investigations of different working point evolution in order to further reduce the transverse emittances.
- All studies are currently done on a clone and once completed they can be propagated to the operational user.

### **Other studies:**

- Loss maps & resonance compensation studies on the 160 MeV flat cycle to understand the interplay of the various corrector magnets needed for the compensation of the observed resonances. Final aim of the studies is to improve the current resonance compensation scheme to further reduce losses on ISOLDE and minimize vertical tails on the LHC25 cycles.
- Chromaticity was measured & corrected for the first after LS2. The chromaticity & the correcting values are similar to the pre-LS2 ones and in agreement with the model.
- Stripping foil characterization studies, emittance measurements for all the available foils in all rings. Smaller blow-up was observed for the GSI-200 foils.
- LIU WS measurements for different users and various intensities. Data acquired using both new and old devices for benchmarking and definition of the best settings.
- Optics studies using the AC dipole.

### **Outstanding issues:**

- It was discovered that the PSB Extraction BIC was not acting by not pulsing the PSB extraction kicker in case of a FALSE beam permit, as the bypass put in place on the kicker side during LS2, had not been removed. The bypass is now removed and the issue is being followed up by the experts.
- Several trips of the BE1.KFA14L1 required a crate exchange by the ABT piquet.
- Several trips of the POPSB on Saturday, coming from a fault on the BHZ151 in ring 3. Access in the machine by the experts, who identified the problem and replaced a faulty flow-meter on Sunday morning.
- Different MRP values on the various applications observed for TOF, triggered discussions with the BPM experts which are still ongoing. Improvements already made on the Samplers.
- Horizontal LIU WS on R2 is broken. Experts are working on the replacement in order to install it during the technical stop of next week.
- Energy matching needed to be readjusted for all users, to be followed up with systematic studies next week.
- Oscillations of the extraction trajectory for users going to the PS were observed. The effect was coming from the fact that the BE.BSW14L4 was pulsing at lower voltage when the cycles were following a ZERO or an ISOLDE user. The experts are following up this issue. For the time being it can be resolved on the ZERO user by pulsing the extraction bumpers, while for the ISOLDE it is unavoidable due to the different extraction energy.
- Vertical position jitter observed at extraction BPMs, especially for short bunches, is being followed up by the experts..

### **ISOLDE (Miguel Lozano):**

It has been a very good week at ISOLDE.

We finished the recommissioning of the RFQ getting good settings for both transmission and bunching mode. Very good transmission values for both modes.

On the GPS side RILIS took some time for finishing their tests and our developers worked on our mass scan applications.

We only had a small issue with the HT power supplies overheating due to the scheduled maintenance stop of the ventilation. After increasing the threshold of the oil temperature interlock everything worked fine again.

We also had some interventions related to beam gates that should now be operational. We will be testing them this week.

#### **PS (Denis Cotte & Frank Tecker):**

The start of the week was marked by the first LHCINDIV beam sent to TT10 and SPS Ring. A change in the value of F16.BHZ377/378 from 1012A to 1530A was necessary to steer the beam to TT10. (because of a wrong value in NORMA)  
A bug on the FGC economic mode was found, understood and solved later in the week for TT2 devices. (setting issue)

Tuesday, horizontal instabilities were detected on the LHC25ns\_72b and cured during the following night by doing a PFW function generation.

Both injections have been optimized and low energy orbit have been corrected to minimize losses around SS88

On Thursday, the losses that we had when we started the splitting of the LHC25 at flat top were finally due to electron cloud effect.

From this day we started a scrubbing run with high intensity LHC25 beam and no bunch rotation at the end.

Friday, internal dump TDI48 has been validated up to the intensity of  $1250e10$  while TDI47 suffered from a flowmeter issue. (to be checked during ITS1)

During the week-end, the scrubbing run continued with some PSB beam interruptions. Vacuum level was still going down slowly this Sunday.

Wire scanner bunch by bunch emittance measurements were carried out successfully at injection and extraction on LHC25 with predefined settings given by Ana.

All along the week, several tests have been performed on DFAs (242 and 254) in order to check acquisitions, PPM behavior and different limits of the system. Finally, POPS had been running in degraded mode all the week.

#### **AD (Laurette Ponce):**

- Stochastic cooling kicker has been pressurized with water successfully, confirming the leak repair.
- electron cooling is under test to check performance and decide if change of the cathode need to be performed
- we validated the Hw permit for AD ring magnet on Friday, but HW tests will not be performed before 27 April because of holidays of experts! (We've been informed on Friday 17h30!)

#### **ELENA (Christian Carli):**

The main event of the week was beam seen for the first time at the end of the LNE05 line (longer one of the two ASACUSA lines). Again, it took little time to bring the beam through the line despite one profile monitor not installed (we had decided to keep one position without monitor to be able to test the line earlier) and one monitor with accidentally two vertical grids mounted (impossible to measure horizontal profile). Amongst the lines needed for the first physics run starting in August, only the short LNE02 towards AEgIS has not yet been tested with beam. This will probably be done during this week or next week.

Tests on measured B-train and magnetic history effects: After spending a day with B-train specialists, we have now a better understanding on the setting-up of the measured B-train. The field corresponding to the trigger of the low field NMR marker has been reduced and allowed to set a large (negative) frequency offset programmed via the LLRF back to about 0Hz. A gain has been adjusted as well to improve. The magnetic field at 100 keV was found to depend on the cycle executed before. Some indications that this field depends (mainly) on the slope of the ramp down of the last cycle executed before. We saw as well indications that the variations of the magnetic field along the 100 keV plateau measured by the B-train are larger than the ones seen by the beam in the ring.

Continuation of setting up of machine cycles accelerating the beam followed by deceleration to mimic an antiproton cycle. Use of synthetic B-train to avoid fluctuations from the measured B-train (real fluctuations or just noise generated by the system?).

### SPS (Verena Kain):

First beam 2021 on Monday April 12. Only managed to inject in the afternoon after access to investigate BHZ current issue.

Injected into in the SPS with new injection geometry (no dogleg after removing beam dump). Had applied theoretical 13 mm bump in preparation. First injections were achieved without PFN8 of the MKP due to broken main switch. Established a couple of turns after adjusting the mains. The new ALPS trajectory (FIFO) and orbit system had worked first shot.

The main switch was then repaired and beam was back at about 19:15. Injection steering had to be redone and soon afterwards circulating beam could be established with beam all the way to start of ramp. The orbit could be corrected at 0 ms and injection oscillations in difference to the 0 ms orbit. Many other diagnostics systems were straight away available (BBQ, headtail monitor, BLMs, continuous bunch length measurement, mountain range,...). Also the SPSQC was tracking. The last hour with beam was spent checking out function optimisation tools.

The remaining week was dedicated to RF HWC, main unfinished parts/systems are cavity controller and WR2RF. WR2RF seems to be working well now. The synchronisation test on WR2RF with the PS Friday evening did however not work yet. To be repeated next week.

### **Other activities:**

- Test of 50 Hz x n injection on QS successful. Still on QS, need to switch back to QF before beam.
- Crab cavity conditioning ongoing.
- BETS reduction of tolerances was not successful. To be repeated during TS.
- Softstart for SBDS implemented and working well.

### **Next week:**

- Test for compensator again. Tuesday afternoon: 4 h of pulse with all main power supplies.
- Switch QS --> QF
- Test COAST for SBDS reliability run
- Beam expected Thursday evening. Capture start Friday morning.
- Prepare cycle for 14 GeV injection, MTE core (aperture measurement cycle). Adjust still MKP settings for no dogleg on 14 GeV cycle.

### AWAKE (G. Zevi Della Porta and J. Moody):

**WEEK SUMMARY:** Beginning of laser experiments studying behavior of ionizing laser pulse propagation through the Rb vapor source when laser frequency is on/off-resonance with Rb

- **Vapor source:** 3 failed control thermal probes on the vapor source (cause of the failure not known). These probes need to be replaced before going to higher temperature for reaching higher Rb vapor density. The contractor has been notified, and will provide remote support to the AWAKE team to replace these probes during Week 16.

- **Laser/DAQ:** Final setup of all diagnostics for laser propagation experiments completed (triggered USB spectrometer, schlieren imaging diagnostic, single shot autocorrelator, PXI cameras triggered at 0.1 Hz, and energy meters for input and output energy). Data acquisition script fully implemented, with Wigner Research Center for Physics (RCP) team working remotely on data verification and debugging.
  - **Laser:** experiments in Rb vapor started, at low Rb density ( $2e14/cm^3$ ).
- Next week:** Replace temperature probes on vapor source to be able to continue data taking with higher Rb density in Week 17.

**LINAC 3 (Giulia Bellodi):**

The Linac3 source was restarted last Tuesday after a plasma chamber replacement. Both ovens have been refilled with new lead in a crucible with beak. An interlock on the source cooling flow was triggered during the installation, and investigations revealed a too high return pressure. Increasing slightly the input pressure to have enough flow helped as temporary solution. CV later confirmed the problem and an intervention on the LEIR water station has been programmed during this week's TS to reduce the return pressure in the circuit.

First beam was extracted on Wed afternoon after the source was left conditioning for a couple of days.

HT sparking problems during restart were solved by a slow ramp-up procedure.

The stripping foil was exchanged on Friday morning.

SY-BI noticed a noise problem on ITF.BSG05 SEMgrid and investigations are ongoing to check possible equipment interferences.

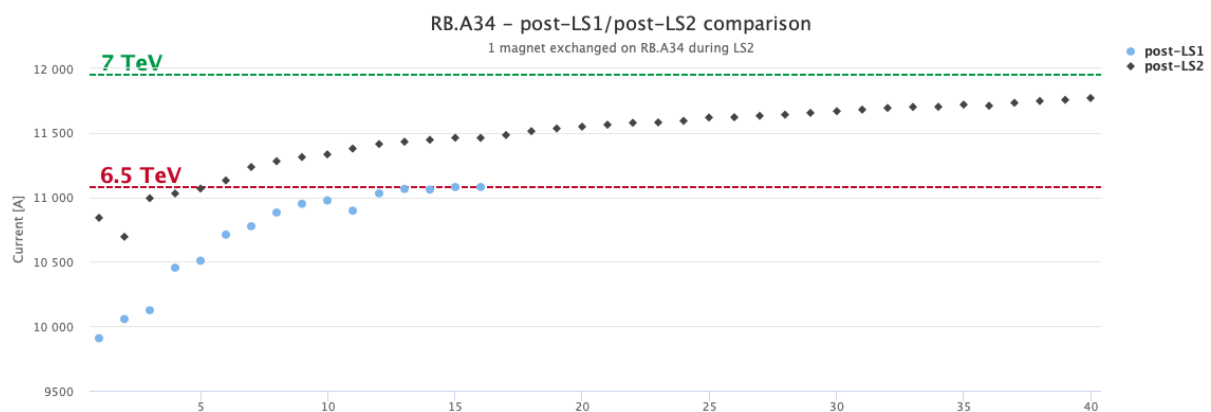
First tests on a Linac3 energy measurement application were done on Friday.

**LHC (Jörg Wenninger & LHC Powering Test webpage):**

S12	S23	S34	S45	S56	S67	S78	S81
Phase 2	Phase 1	Training	Phase 2	Phase 1	Cooldown	Training	Cold
		40 / 11770 A				59 / 11534 A	

Phase 2 near completion in S45, well advanced in S12. Ohase 1 well advanced in S56.

Green light for cooldown of last sector 81.



### RB.A78 – post-LS1/post-LS2 comparison

NO magnet exchanged on RB.A78 during LS2

