

# Accelerator Complex Status

## End week 34 (Tuesday 29 August 2022)

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### Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 4'300 alarms.
- 543 phone calls (362 incoming, 181 outgoing).
- 85 ODM created.

Events worth mentioning:

- Tue. 23.08:
  - UPS alarm DC residual current in TZ76 during the night. After thorough remote analysis it was clear that the new differentials installed by EN-EL had tripped and most likely cut the UPS before further damage. This was indeed confirmed during the intervention next afternoon where one of the batteries was found damaged. The battery was replaced immediately and the UPS put back in service.
  - The PLC controlling the LHC 4 cooling towers broke and caused a full stop of the cooling towers. This led to a stop of CRYO, followed by a release of helium by the overpressure valves and caused also the rupture discs for the RF cavities to rupture. The PLC was replaced by a spare by the piquet.
- Fri. 26.08:
  - Cascade of alarms in PSEN and ARGOS indicating an electrical power-cut. First diagnostic suggests that the EMD103/6E has opened (but no faults on the circuit breaker). Diesel generator starts and repowers the ESD1/6E (surface safety network), UPS at US65 powers the EOD1/65. After 37 minutes the UPS is out of autonomy. Cryo loses all its instrumentation in the first part of the arc at LHC6. A communications card for the protection relay was found to be faulty and was replaced.
  - Electrical perturbation, confirmed by EDF-RTE on the 400kV line CREYS-GENISSIAT 2.

Details: <https://wikis.cern.ch/display/TIOP/2022/08/29/TI+Week+summary,+Week+34>

### LINAC 4 (Alessandra Lombardi)

A generally good week for linac4 with the following events:

- BLM threshold was too low on ISOLDE beams and this triggered the watchdog. Threshold adjusted 24 aug (PPM copy from the other cycles)
- apparently wrong manipulation on a EIS of linac4 caused the beam mode lost and all rf cavities down – about 45 min downtime (25 aug)
- electrical glitch caused RF to go down (26aug)
- Einzel lens trip caused the SIS to cut the beam (27 aug).

### PS Booster (Alan Findlay):

Another good week for the PSB with no significant issues to report. The machine availability was around 99% with the longest downtime due to the electrical glitch Friday morning, when we were 40 minutes without beam. We had the usual resets and minor faults, but otherwise, plain sailing.

### ISOLDE (Simon Mataguez):

At ISOLDE, it has been a good week.

On **GPS**, Target#619 (Molten Pb target) Physics Collection (Beam to GLM/Biophysics chamber) started Wednesday. ONLY STAGISO protons on this target.  
the 199mHg beam intensity dropped few times, it seems to come from the target.

On **HRS**, Target#757 IDS run Cu beam, with laser ionization, until Wednesday. Very stable conditions, but low transmission for 30Al between CA0 and IDS.  
Friday, removal of #757 and installation of #753 UC.

Concerning the issue with instabilities on the non-interrupted network in the bldg. 170, the faulty equipment has not been identified.

The GPS Tesla-meter is connected to the normal power network to avoid magnet field instabilities on GPS.

#### PS (Alexander Lasheen):

The PS had a very smooth operation this week with a present availability of ~97%, before any remaining faults until tomorrow.

The main faults of the week were

- a bad contact on the W8L which was repaired after a piquet intervention
- a bad manipulation on the access system which put L4/PSB/SWY in "Repli" mode stopping beam until resolved
- an electrical glitch affecting L4/PSB/PS and causing all the PS cavities and the injection kicker to trip, which were restarted ok
- usual bad shots on extraction system leading to radiation alarms and trips on RF cavities (which are now reducing in frequency following efforts from the RF-LIS/CS sections)

This week was led by requests from experiments for low intensity variants. Notably, the TOF experiment requested for a low intensity ( $50e10p+$ ) variant which was rapidly prepared by the operations team and for which 1-2 cycles can be included in the supercycle on user request. The EAST\_T8 could also start their special run for the CERN Shielding Benchmark Facility (CSBF), for which beams were prepared previously to cover the  $5e9 - 60e10$  intensity range. Both beams were reported to be satisfactory at the PS-SPS user meeting.

The beam intensity for the SFTPRO beam was pushed to an operational beam intensity of  $2.3e13$  ppb. MDs are being continued to probe the effective limit in the PS at high beam intensities, which are now triggering faults on the 10 MHz cavities, which are interlocked on current spikes.

Finally, progress has been made in the PS for the ion beam commissioning, profiting from the advance in the schedule from LEIR. The nominal ILHC#4b\_100ns beam is now being produced in the PS with all RF manipulations, including the usage of the 80 MHz cavity tuned on the ion frequency with the new cavity controller. The beam is produced with good beam quality and can already be proposed to the SPS, should this be advantageous for their schedule.

#### PS - East Area ():

No report.

#### AD - ELENA (Lajos Bojtar):

A good week, with only minor problems.

- GBAR had trouble with the positron trajectory due to stray field from the AD ramping up. We made the AD 6 seconds longer to solve the situation. The other users had no objection.

- The capture at top energy needed some adjustment Monday due to losses. Friday we needed another one, but this time in the opposite direction. The reason for the change is unknown.
- Wednesday we had MD. Completed response matrix measurements and an attempt was made to eliminate the saturation of BPM's before ejection.
- Thursday night the quad1 went down, restarted by Firstline.
- Friday several injection line elements went down due to a power glitch. The weekend was calm, no faults.

### SPS (Carlo Zannini):

Overall a good week for the SPS with an availability of 91.8% at the moment of writing.

On **Monday** and **Tuesday**, the short parallel MDs could benefit of a very good beam availability (loss of Landau damping threshold measurements at 200 GeV, barrier bucket and impedance reference measurements). On Monday as requested we increased the bunch intensity of the LHC beam (5 trains of 36 bunches) from 1.17 ppb to 1.25ppb. On **Wednesday**, we had the dedicated MD on splitting efficiency and lossless transport in TT20 with in parallel BCMS beam for longitudinal stability studies as function of the number of batches (up to 4 batches with a bunch intensity of 1.9e11 ppb were accelerated up to 325 GeV). It is worth mentioning that during the BCMS MD MKP4 interlocking spikes occurred in the at 325 GeV with 3 and 4 batches. **Thursday** and **Friday** were quiet days with very good availability for the SPS.

The ZS issue occurred **on Saturday** around 1 PM has characterized the **weekend**. The ZS3 abruptly experienced interlocking spark events without any apparent correlation. Interlocking sparks occurred even without beam. The experts came promptly onsite to investigate the issue. To avoid interlocking sparks the ZS3 gap was increased to 27 mm (it was around 20 mm before). The reason of the abrupt manifestation of interlocking sparks remains not understood.

The operation of SFTPRO beam was strongly limited by losses after the ZS sparking issue. During the night, some of the BLM thresholds were increased to reduce beam interruptions

**SFTPRO:** Total intensity of about 4e13 protons and sharing adjusted as requested by physics along the week.

**AWAKE:** beam (1e11 or 3e11 protons) delivered to AWAKE when requested

### **Main issues/faults of the week:**

- ZS interlocking sparks (5h downtime)
- Issue to restart the quadrupole QTAF.2303 in T2 transfer line after a LSA upgrade occurred in the shadow of POPS fault in the CPS (1h 20 min. downtime)
- Recover from the electrical glitch on Friday morning (45 min. downtime)
- Communication issue with cavity 1 and 2 (45 min. downtime)

### **Some follow up for next week:**

- Test empty bucket channelling (EBC) on operational SFTPRO beam. At the user meeting, it was decided to postpone to next week the EBC test on the operational SFTPRO beam. It could probably happen on Thursday. To follow up with the EBC team and the experiments.
- Higher TT20 losses after the ZS sparking issue (some of the BLM thresholds was increased to reduce beam interruptions)
- Request from SY/EPC/HPC (Olivier Michels and Charles-Mathieu Genton) to put a new box to improve the 100 Hz regulation (one hour intervention with mains off)
- MDs
  - Short parallel
    - Test linear wire scanner 516 equipped with CNT wire (Monday morning and Tuesday)
    - PS-SPS transfer studies (Monday afternoon)
  - Dedicated MD

- Barrier bucket transfer + BCMS beam from 9:00 AM (from 8:00 to 9:00 test a new optical set-up for the BTV at HiRadMat).

#### SPS North Area ():

No report.

#### AWAKE ():

No report.

#### LINAC 3 (Giulia Bellodi):

Linac3 delivered a stable beam of >35uA all throughout the week.

An electrical glitch at 7h on Friday morning tripped the source solenoids and a few quadrupole magnets.

After reset, the source smoothly recovered its performance in less than an hour.

#### LEIR (Nicolo Biancacci):

*Main activities:*

- Tue 23/8: Correction of charge/current logging on ITH/EI BCTs.
- Wed 24/8: Check of ER.UEHV31 signal readout (coupling to kicker pulse).
- Thu 25/8: Check of debuncher "non-ppm" behavior as a function of the static phase.
- Fri 26/8: Autopilot tests, stray field measurements, preparation for Pb80+ test.
- Weekend: -
- Mon 29/08: MD cycles preparation (Pb80+).

*Highlights:*

- Beam from Linac3 very stable.
- Extracted NOMINAL beam intensity stable at spec (9e10 charges)
- EARLY-NOMINAL regularly taken by PS for optimization. Preparation for Pb80+ test.
- Autopilot tested in operation.

*Main issues/fixes:*

- Identified a possible "non-ppm" behavior of the debuncher cavity: when different settings are played among different users, there are particular phases (e.g. 20 ddeg) in which the system seems to affect the next played cycle. Details are followed up by the Linac3 team and the corresponding LLRF team.
- Fixed CRF41 HV fault issue by RF team.
- Fixed inconsistent charge/current logging on ITH/EI BCTS by BI.
- Several fix on multi-turn FESA class: to be tested.

*Next:*

- Beam delivery for PS transfer optimization and Pb80+ test preparation.
- Setup of MD cycles.

#### CLEAR ():

No report.

#### LHC (Jörg Wenninger & LHC Coordination webpage):

The week started with another training quench of S23. Following the recovery the bunch intensity was pushed to 1.25E11 ppb for 36b trains and 2460 bunches.

A **cooling tower stop in point 4** due to a PLC problem led to a failure of the cryo system. The RF cavities warmed up rapidly and the rupture disks broke on 3004 modules. Warm up of RF cavities, repair, cooling and reconditioning will take around 4 weeks. LHC beam operation stopped.

After the stop of beam operation powering of RBs to 11600A; S23 and S78 quenched after a few minutes at FT, S67 and S56 quenched around 8A below FT, while S12 and S81 stayed at FT for more than 8 hours.

**Training quench count in 2022: 5 x S23, 1x S34, 5 x S56, 1 x S81**