

Accelerator Complex Status

End week 29 (Monday 25 July 2022)

Technical Infrastructure (R. Ledru):

Monday:

- 12:36: Beam lost and evacuation alarms in all machines due to synchronization of the access control system (intervention of a technician to solve an issue).
- 22:38: Trip of EHT2/BE1 transformer (400kV/18kV) on high winding temperature; the tap changer did not regulate correctly, which has increased the temperature of the winding (SPS affected).

Wednesday:

- Several trips of the LHCb magnet, which dumped LHC beam because of high temperature of the LHCb cooling circuit.

Saturday 02:01:

- Electrical glitch on RTE network which stopped all the machines (-32% during 80 ms)

Details: <https://wikis.cern.ch/display/TIOP/2022/07/24/TI+Week+summary,+Week+29>

LINAC4 (G. Bellodi):

Linac4 had a beam availability of 95.6% this week .

The main causes of downtime were :

- A scheduled intervention on Wed 20/07 for the installation of an arc detector in CCDTL3-4 oil tank (1h40 downtime), after several trip occurrences in the previous weeks.
- On Friday morning: a cascade of pre-chopper trips due to a pick-up fault stopping operation (starting from 06h in the morning) - an urgent access had to be scheduled to replace the pick-up (1h downtime)
- On Sat morning at 02h a power glitch on the electrical network tripped all Linac4 systems. Ventilation and cooling were lost for ½ hour. Source and most RF systems were restarted by 03:30, but a klystron water fault on DTL2 and PIMS3-4 needed on-site intervention of the piquet, who had to mechanically correct the water flow measurement to be able to restart. Beam was available again at 5h45 (3h45 downtime).

PS Booster (S. Albright):

Overall, it was a good week for the PSB with about 93% availability.

Along with the usual selection of minor trips and resets, there were a few noteworthy items.

- The most significant interruptions were the electrical glitch on Saturday night and the intervention on Linac4 on Wednesday afternoon.
- A problem with the H0H- monitor of Ring 2 is being worked on by equipment experts, it produces spurious interlocks that are short but disruptive.
- There was a problem of excess losses on PLS users LHC1A, LHC1B, LHC3 and LHC4 that were independent of mapped cycle, this was solved after a sextupole that was not part of the Working Set was found to be pulsing unexpectedly.

Otherwise, all required beams are available within specification and there was a typically wide variety of MD studies.

ISOLDE (J. A. Rodriguez Rodriguez):

It has been an important week for ISOLDE. Most of the work has been focused on the delivery of high energy beams to the ISOLDE Solenoid Station (ISS).

We started the week delivering $^{22}\text{Ne}^{8+}$ at 9.78 MeV/u. This stable beam is produced in the REX-EBIS when the neon that migrates from the REX-TRAP is ionized in the charge breeder. This beam is important for the users of the facility to commission their experimental stations.

On Thursday evening, we started delivering $^{11}\text{Be}^{4+}$ at 9.78 MeV/u. The beam intensity has been close to a factor 10 higher than expected. So, the users have already accumulated a lot more statistics than originally planned. We are scheduled to stop this beam on Wednesday morning. But, we are considering stopping a bit earlier (at some point on Tuesday) to have more time to prepare the delivery of $^{27}\text{Na}^{10+}$ scheduled for this Friday.

The main recurring issue during this experiment has been the stability of the SRF cavities. There are three cavities that are tripping quite often. Restarting them takes only a few minutes. But, due to their frequency, the overall downtime is quite significant.

The power glitch on Friday to Saturday night had a very significant impact as well. We lost the target heating, many power converters were down and the REX 7GP1 amplifier tripped twice. In addition, the REX-EBIS was also affected. It took a bit of time to diagnose and solve the problem. But, at the end, it was not as bad as it looked initially.

PS (B. Mikulec):

Mediocre week with ~90% availability for most destinations and 86% for EASTN.

Some longer faults and interventions:

- **POPS DC2 water leak** tripped POPS first early Monday morning
 - Monday 1h stop to remove the cell for repair → POPS in degraded mode; reverted to full operational state Wednesday during stop
 - **Sunday night DC6 cooling issue tripped again POPS** → degraded mode
- **SMH42** (Tuesday morning)
 - Vacuum spike on SMH42, tripping also other cavities and BSW42
 - Vacuum piquet and ABT interventions
 - Tripped again after first restart attempt
 - Precise restart procedure now established between ABT and OP
- **BSW57** (Tuesday morning)
 - Parallel to SMH42 arc; required access to exchange an electro-valve
- **C10-56 gap relay** (Wednesday 12h)
 - Repair required access; in parallel to Linac4 CCDTL0304 intervention
- **PSB H-/H0 monitor interlock issues on R2 and Linac4 pre-chopper swap**
- **Power glitch** (Saturday 2am)
 - Brought down most cavities and required RF piquet intervention
 - Then waiting for Linac4 to restart
- **An EPC controls issue brought down T10** for 5h on Sunday
 - A frontend service was down causing a synchronisation loss between the FGCs and the power converters

Beams:

- **SFTPRO**: intensity increase requested by the North Area physics coordinator for the 27th of July
 - Did not manage to increase the intensity significantly due to cavity trips just at transition
 - Might be able to increase by some 100-150e10 p in total before the return of the rf specialist from vacation next week, but operational stability to be verified.

PS – East Area ():

No report.

AD - ELENA (B. Dupuy):

The physics week for the Pbar Complex was quite disrupted by multiple interruptions of the proton beams from ADE injectors, but also with some unpredictable breakdowns attributed to the AD machine. ELENA had no significant problems.

The AD ring power supplies still require First Line intervention to be restarted. The absence of the BHZ-TRIM since the beginning of the physics is not without consequence of the other power supplies, which are more in demand. The 1553 bus used by these power supplies causes some issues for specialists (SY.EPC and BE.CEM). Although these interventions must be transparent for the beams, this was not the case Wednesday during the machine development period. It took all the evening to our accelerator physicist Laurette to recover nominal performance after an inexplicable lower acquisition of 0.05 Amps on the MAIN-BHZ and on some QUAD-TRIM power supplies.

Saturday's power glitch required the full restart for the AD's electron cooler.

The filament heating was carried out from 7h to 15h by the supervisor (there is no on-call service for this). Quad power was restarted by the First Line.

Sunday, the CPS crew managed the AD injection kicker issues after an AD Hall radiation alarm.

SPS (C. Zannini):

Overall, not an easy week for the SPS with the transformer trip on Monday night (6h downtime), the electrical glitch on Friday night (8h downtime) and the vacuum leak on sector 5 of Saturday evening (19h downtime).

On **Monday** after the access planned at 8h00 for the visual inspection of the MBE2103 transformer (same type of the SMD11 transformer which exploded two weeks ago) we faced an issue with the access system. Touch panels showed all sites checked out and it was not possible to access any site. The expert worked very hard to solve the issue with the shortest delay. In the afternoon we faced repeated faults of cavity 4 when playing the high intensity short parallel MD on PS-SPS transfer in parallel with SFTPRO and AWAKE. To not perturb the physics activities on **Tuesday** the MD was played with lower intensity ($1.8e11$ ppb).

On **Wednesday** we had dedicated MDs on collimation studies and the MD on the SFTPRO beam (empty bucket channeling) with the high intensity BCMS beam in parallel later during the day.

On **Thursday** it is worth mentioning that during the high intensity long parallel MDs the BCMS beam with 5 trains of 48 bunches has been stabilized on the flat bottom ($2.3e11$ ppb about 95% transmission after RF capture losses and $1.7-1.8 \mu\text{m}$ emittance).

On **Friday** night, as a consequence of the electrical perturbation occurring during the thunderstorm, we had issues with several systems. In particular, the MKP switch had to be exchanged.

The weekend has been characterized by the vacuum issue experienced on **Saturday** evening around 7pm. An access of the vacuum team was needed to identify and fix the issue. The intervention started at 9h30pm and finished around midnight. A leak was detected on a dn16 collar of a pump (placed around 514) that lost its mechanical tightening. The faulty piece was replaced and the sector pumped down and leak detected. The ion pumps were flashed on **Sunday** morning and a second access of the vacuum team took place around 12h to recover the material. At 13h the SBDS conditioning started and at 14h30 beam was back in the SPS.

All along the week we accommodated the **LHC filling** requests. Two BCMS batches of 48 bunches with the nominal batch spacing of 200 ns and average bunch intensity of about $1.2e11$ ppb were requested and delivered for the first time on Thursday afternoon. On Sunday evening high

brightness INDIV beams prepared together with the CPS during the day have been sent to LHC for beam-beam studies.

SFTPRO:

- Intensity increased to $3.7e13$ protons. Sharing adjusted as requested by physics along the week (sharing 60/73/135). Work is presently ongoing to optimize the SFTPRO beam to accommodate the latest sharing request 80/73/135 units on T2/T4/T6 needed in the coming months. This additional intensity step does not look straightforward due to PS cavity limitations.
- Work on the optimization of TT20 losses.
- Investigation of the PS-SPS transfer losses (to be continued).

AWAKE: work with $1e11$ ppb all the week. Stability of the $3e11$ ppb to be verified next week.

SPS North Area ():

No report.

AWAKE ():

No report.

Linac3 (R. Scrivens):

The Linac3 was planned to run Monday to Wednesday for LEIR, with a stop on Thursday and Friday. For the first three days the Linac ran well, the source was not as stable as previous weeks, and the oven unfortunately ran out of Pb on Wednesday morning. The beam was back from the second oven at the end of the morning.

During the Thursday/Friday stop:

- The broken foil could be recovered from the ITF line, and STI realigned mechanically the arms, which was the origin of the problem.
- RF could recondition the cavities in that line by Saturday morning.
- But the ABP exchange of the source's 14.5 GHz klystron was not as successful, as the spare does not deliver the full power. It was also attempted to run with the spare generator, but this did not result in sufficient beam by the end of the day.
- The power glitch on Saturday caused some source systems to go down and require an intervention on Monday morning.

On Monday morning the next steps have to be decided, it may be that beam is only back on Tuesday.

LEIR (R. Alemany):

This is a summary for the weeks 28, 29 and 30.

- Main quadrupole regulation problem. Expert on holidays. Hold activity until expert returns.
- Schottky acquisition not working for more than 500 ms buffer: impacts the commissioning of the NOMINAL beam. Experts on holidays. But they were back after a week and the problem was patched (not solved).
- Cross-check of the quadrupole strengths in the transfer line before starting the Kick Response measurements: all quads in ITH and three in ITE had not the nominal values from the design optics. We do not know why (it is the case at least since 2018), but now we are operating with the design optics values.
- Lots of power converter issues:
 - **ER.DEH20** in ERROR, local reset needed
 - **ER.ECSCN20**: Physical Status ERROR, recurrent issue since last two weeks - there was an Irms fault, as if we were requesting too much current. However, the limit is 700

A, but we request only 656 A. PC expert installed an oscilloscope at the PC that will trigger in case of RMS limit. Problem under investigation.

- **RF cavity 43 is in Fatal Error:** Connection problem with PLC: the problem is difficult to diagnose and RF team switched to cavity 41 as OP cavity until the issue is fixed. Finally problem fixed during week 29.
- **Bus communication issues** for the following converters solved already:
 - **ER.QFT20, ER.QDT20, ER.QFT23, ER.QFT24:** User Status ERROR since many days.
 - **EI.BHN10** : Physical Status ERROR
 - **EE.QFN10** : Physical Status ERROR
 - **EE.QDN20** : Physical Status ERROR
 - **EE.QFN30** : Physical Status ERROR
 - **EE.BHN1020** : Physical Status ERROR
- **LEIR horizontal tune** shows a big excitation, we are investigating.
- No beam in LEIR since 20th July in the evening because several interventions were programmed for source and Linac3.
- Today (25.07.2022) the beam should be back, but lots of issues in the Linac3 Source Microwave generators. Let's hope for beam back tomorrow.

Reyes will be on holidays as from Thursday 28.07.2022. Nico and Nicolo are on holidays. Nicolo is back on 03.08.2022, so there is no LEIR supervisor until Nicolo is back.

CLEAR ():

No report.

LHC (<https://twiki.cern.ch/twiki/bin/viewauth/LhcMachine/LhcSummaryWeeks2022>):

The 300b intensity step was completed on Monday. The first 600b fill on Tuesday was dumped in the ramp by RF line 5B1. The second attempt made it to stable beams, but was dumped by another **UFO in cell 17L2**. The fills with 600b were all quite short due to dumps - sometimes already before reaching stable beams - on LHCb spectrometer (2x), PIC, RF (4x) and another **UFO in cell 13R6** on Thursday. This complicated the execution of the low pile-up program for AFP and CTPPS.

On Friday the intensity was increased to 900b, but the first fill was short due to an issue on RQ10.R4. An electrical perturbation during the night to Saturday brought down many LHC and injection system until Saturday end of the morning. A second 900b fill was completed with test of acollinearity knob, BBLR (to 100%) and BI gas injection, before an intervention on a DFB heater PS by cryp and MPE. A vacuum problem in the SPS delayed beam until Sunday afternoon. LHC restart was further delayed by an issue with one RF PC ([M2B2](#)) and a QPS board requiring access in S45.

The impedances of the new coated [MoGr](#) collimators were measured as part of the remaining commissioning activities.

The phase advance knob for the beam-beam MD (to enhance BB effects) was tested successfully on Tuesday. The BB MD was executed successfully over the night of Sunday to Monday.

To note issues with the ALICE solenoid PC between Monday and Wednesday.

Training quench count in 2022: 3 x S23, 2 x S56, 1 x S81
UFO dump count: 5