

Accelerator Complex Status

End week 38 (Monday 27 September 2021)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 3400 alarms.
- 580 phone calls (454 incoming, 126 outgoing).
- 78 ODM created.

Events worth mentioning:

- Tue. 21.09, C2MON servers stopped receiving updates from data tags, TIM Viewer and ARGOS (TI alarm screen) out of service. BE-CSS restarted the servers.
- Thu. 23.09, Electrical perturbation, confirmed by EDF-RTE. Measured at 10% for 50ms at CERN, caused a trip of the RF cavities for the PS.
- Sat. 25.09:
 - Patrol lost in SPS BA2. Follow up in TIOC done
 - Power converter in BA80 tripped on high temperature. Heat exchanger seems to be blocked and will need cleaning, cooling towers are put in manual to compensate for the blocked heat exchangers.
- Sun 26.09, Trip of North Area Cooling Towers. Two pumps smell burnt, they are isolated and the cooling towers have been restarted without them. Filters were also blocked, and only when bypassed the North Area could be restarted. Cooling towers run in manual all evening and part of the night, Rounds on-site to check on the pumps. Compass filling circuit switched to Demineralized water temporarily, since not enough pressure on the Raw water circuit. CRYO north area perturbed by the multiple stops

Details: <https://wikis.cern.ch/display/TIOP/2021/09/27/TI+week+summary,+Week+38>

LINAC 4 (Jean-Baptiste Lallement):

An excellent week for Linac4 with 99.9% availability and only 3 minor 5 minute beam interruptions. In details: a SIS trigger on Wednesday, a quadrupole power converter reset to get rid of a warning before the weekend and a source-Einzel lens spark on Monday morning.

PS Booster (Jean-Francois Comblin):

This was a good week for the Booster with an availability of 98%.

Tuesday evening we had a problem with one of the recombination kickers. It required an intervention of the piquet to adjust the voltage of the thyatron. So we missed the ring 1 for about 1 hour.

We also had some issues following the TS2:

- The SIS of the main bendings in the extraction lines had to be masked after an update of the FGC gateway. (They are also interlocked by BIC). Tuesday, FGC, UCAP and SIS specialists agreed on a temporary fix on the FGC gateway, and will implement a longer term solution during the YETS.
- After a change of the timing structure for the injection WD and tail clipper, the beam was erratically cut by SIS. Monday, timing specialists found that SIS required additional evaluation time due to the increased latency.

- We also noticed an increase of injection watchdog interlocks since the end of TS2. Friday morning, the specialists have recalibrated the ring BCT. This reduced the number of interlocks. They are still following the problem.

ISOLDE (Erwin Siesling):

Another busy week behind us at ISOLDE.

GPS: Target #734 UC VD7: The schedule was mainly dictated by the repair of the electrode mechanism at the GPS Target Front End. Excellent intervention and analysis by the STI team (Stefano, Joachim & colleagues). The issue was a slipping clutch which was caused by mechanical friction due to a small misalignment between the 90 degree conical transmission and the axis going into the vacuum of the Front End. This prevented the electrode from moving in or out.

By Tuesday afternoon all was ready to go and the setting up of the GPS target started. With a well prepared pre-setting up of the EBIS, REX Linac and HIE Linac to ISS we managed to deliver the foreseen 212Rn beam to the ISS experiment on Friday afternoon, only a day late with regard to the original planning. (212Rn50+ beam @ 7.61MeV/u).

Good production and very good feedback from ISS.

A few issues over the weekend:

- The REX 7GAP GRID1 RF amplifier unit blew a fuse on Saturday morning. Many thanks to Cristiano Gagliardi from SY/RF for coming in (best effort) and replacing the faulty component inside the GRID1 unit after which the amplifier has been running smoothly.
- We had an issue on Sunday morning with a faulty vacuum gauge in the XT02 line to ISS for which a work around was found by Abel Gutierrez from TE/VSC (piquet).
- Later on Sunday morning the Target Line tripped and heating had to be restarted. The target recovered and production remained the same.

HRS: Target change to a new #735 UC n target this morning.

REX-HIE ISOLDE: running smoothly for ISS delivering 212Rn50+ at an energy of 7.61MeV/u with the usual/normal trips of some of the SRF cavities every now and then.

PS (Bettina Mikulec):

Quite good week for the PS, with >90% availability for most destinations, except for EAST, due to the earth fault of PE.SMH57.

Main faults:

- PE.SMH57 developed an earth fault last week Monday. 2 accesses were required to check magnet and the 24 cables and to revert to the operational condition. In the end it turned out that the problem was condensation water dripping on the HV contacts. Everything has been dried, and as the septum is now regularly pulsing it should not be a problem until the YETS. The ABT team will keep an eye on it and discuss with CV potential mitigation issues for the future.
- 2h45m fault of POPS Saturday morning; the internal fault could be cleared by the piquet with the help of the specialist.
- AD suffered beginning of the week from bad beam quality, which was traced back to ~100 Hz difference of the external synchronisation frequency (a left-over from an MD 10 days before). The RF specialist solved this issue Wednesday morning and managed to dampen a coupled bunch instability occurring after batch compression.

Beam-related progress:

EAST:

- Last Monday OP handed over commissioning of IRRAD/CHARM to EA team; instrumentation debugging is still ongoing with BI.

- Over the weekend the operators refined the T8 optics and steering to approach the desired profiles at the 4 BPM locations

AD:

- Solved above-mentioned operational issues and managed to increase transmission to AD by 2%.

Ions (NOMINAL):

- RF and transverse basic setup done. 8E10 ppp at FT.

LHC beams:

- Thorough optimisation of LHC25 beam at high intensities (2.6E11 ppb)
- Emittance measurements confirm excellent brightness, reaching almost already the 2022 LIU goals (see presentations at IPP)
- A 2 BP variant with 48 bunches has been prepared for the upcoming LIU MD

TOF:

- Beam to n_TOF will be stopped Monday morning at 2am to allow for a 30h radiation cool-down to prepare another RP survey of the FTN line Tuesday morning, after running for almost 2 weeks again with the pre-LS2 optics. This should confirm that the hot spot detected during ITS2 has diminished and that radiation levels will return to pre-LS2 values.

PS - East Area (*Bastien Rae*):

- SMH57 earthing problem due to condensation à solved and follow up by PS-OP
- T10 beam permit was signed on Friday beam coming soon.
- T9 commissioning on going with a lot of problem to see beam from CESAR due to timing issue à reconfiguration is needed à discussion between by BI, EA, OP, and CSS next week.

AD - ELENA (*Bertrand Lefort*):

Globally: AD/ELENA are working nicely and provide nice and stable beams 24/7 to our users

In detail :

AD:

- Samplers are now connected to the BCCCA (Thx to JM Nonglaton)
- Phase loop and Radial Loop are now active on the first deceleration and are nicely controlling the beam (Thanks to Simon Albrigh and a.l.)
- Bunched beam cooling at 100MeV/c has been optimised and replaced by one flat top of Normal cooling plus a short flat top of Bunched beam cooling (it makes measurements possible at this energy)
- Yann Dutheil ran an LNI optic characterisation, deployment foreseen of the new optic parameters week 39.
- PS operation team has improved the batch compression. Better efficiency at 3.5 GeV/c. (Many Thx !!).

ELENA:

- Re-steering of the transfer lines
- Correction of the coherent oscillations of the beam at injection
- E-cooler parameter tuning

Issues:

- Monday to Wednesday : The Synchro frequency (PS \longleftrightarrow AD) was changed by 100Hz. Following this change, the synchro was not always locking leading to some bad shots / unstable beams in AD/ELENA (synchronism between C10 and LLRF no longer working) \rightarrow Solved
- LTIM configuration issue, no beam for ALPHA on Saturday \rightarrow Solved.

SPS (*Giullia Papotti*):

Week 38 was defined by operation for HiRadMat, for which the requirement was extraction of up to 288 bunches at 1.1e11 ppb.

The AFT availability at the time of writing is 75.7%.

On Monday the cycle was recovered (PC fixed, extraction checks), followed by single bunch extractions for BBA, and by Tuesday the requests for up to 72 bunches were satisfied. Scrubbing was required next, for the 144 and 288 trains - and it was a struggle. The MKDV interlock was set to 5×10^{-8} mbar, but was triggering at lower levels ($3\text{--}4 \times 10^{-8}$ mbar); by Wednesday evening it was negotiated with the BT experts to increase it to 6×10^{-8} mbar. This allowed to scrub overnight, and deliver trains of 144 to the experiment on Thursday morning - in addition to a smart procedure: injecting the last batch in the other half of the ring, accelerating it to flat top, and only then reducing the batch spacing, in steps, until nominal. The acceleration of 4 batches took another day, by using the same technique, and was especially tricky when approaching the last batch in the last 1-2 step. During the night of Thursday 288 bunches could finally be extracted to HRM. The run was abruptly stopped when about to finish, due to the loss of vacuum at about 5:30 am on Friday morning, due to the likely breakage of the Be window. An access to investigate this is foreseen for Monday... But at least the HRM experiment was 98% finished.

Note also that:

- SY-BT and TE-VSC are investigating on the disagreement on the number of interlock triggers (for VSC, the interlock should have triggered only twice in the past month).
- the PS was asked to “de-optimize” the vertical emittance, as otherwise it’d have been too small, we measured ~ 1.4 μm (target 1.5 μm).
- when HRM operation was stopped by the Be window, the MKP temperature was about to interlock (57 deg reached).
- MDs in parallel to HRM had low efficiency: the Wednesday dedicated MD had little results, and 2 PS parallel MDs had to be stopped on Thursday as they were causing too many cavity trips (which’d require stepping back in scrubbing).

Concerning the SFTPRO, the SPS was dedicated to it since the end of HRM.

Main issues are the reduced availability due to HRM operation and scrubbing and related faults, and the BA80 water cooling problem that manifested itself on Saturday and took down the full Afternoon shift on Sunday (hopefully solved at the time of writing, after the exchange of 2 clogged filters).

Minor other subjects during the week:

- the LHCPILOT was taken for an hour during the dedicated MD to verify the LLRF beam control bug fix, and finish the setup of the SPS BQM: all ok, rephasing did not fail a single shot of the ~ 30 that were measured;
- the LLRF team worked on the LHCION1.
- parallel MDs took place on PS-SPS transmission and TMCI instabilities.

Other main faults:

- patrol losses (3x BA80, BA2)
- no beam from injectors (SMH57, POPS)
- 4 h downtime, RF HW cavity 5 tube 16
- still many trips of cavity 5

Upcoming are the LIU MD week, and the TI2 beam transfer tests.

SPS North Area (Bastien Rae):

Suffered from cooling problems over the weekend, causing some magnets trip.

- H2: Primary beam for NA65 à no major issues

- H4 : LHCb continuing data taking with High energy electron and high energy pions. à no major issues
- H6 :
 - User change today taking electron beams.
 - BI is working to get the signal from XCET for the users.
 - So far with the long super cycle tertiary electron beam can have the nominal rate without radiation issues
- H8 : Totem started to take data with Muons. UA9 profit of parasitic pions upstream. à no major issues
- K12: Magnet problem in second achromat, heavily monitored during the week and intervention on Wednesday, however not understood and no good reason found. Now stable situation, but needs continuous monitoring.

AWAKE (Edda Gschwendtner):

Last week: Access in preparation for rubidium exchange and BTV installation.

- **Preparation for recycling/refilling rubidium in vapor source**
 - Tested glove-box pressure controller, which had prevented summer intervention. Supplier fixed it and sent it back, and it works now.
 - Transported all equipment to TAG41
- **Preparation for installation of new BTV**
 - Cabling done
 - Vacuum parts received and cleaned
 - Actuator received, still to be connected and tested
- **Instrumentation**
 - DMD system alignment (with HeNe and IR laser)
 - HeNe laser (used for easier alignment) optics improvements (change focus to increase spot size)

Plan for next weeks: open vacuum to refill/recycle rubidium and install a new BTV screen.

LINAC 3 (Rolf Wegner):

Linac3 was running very well and delivered a stable beam with an intensity of typically 35 uA and above.

- One trip of the RFQ amplifier, one of the tank2 amplifier and one trip of the source occurred during the week. All systems could be restarted without difficulties.
- On Thursday afternoon LEIR had problems with the 2nd injection of some NOMINAL cycles (only the 2nd out of the 7 injections was concerned). The issue started around 15h and disappeared around 17h. In the follow-up it was seen that at least 2 FGC based power converters pulsed about 1 ms late on the 2nd injection (pulse length about 200 us). The origin of the problem was found by the timing service to be an overload of events to be sent over the GMT cable (present capacity 5 events + 3 fixed slots) so that one event had to be delayed to the next millisecond. There were events sent over the LEI GMT network which belong to the PS rather than to LEIR. The timing team will discuss solutions, proposals are available.
- Regular beam energy measurements were taken throughout the week.

LEIR ():

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CLEAR (Roberto Corsini):

This week was dedicated to the Cherenkov Diffraction Radiation measurements using a 10 cm diameter teflon cylinder, in collaboration with our BI colleagues.

After installation on Monday, data taking took place from Tuesday to Thursday with a 10 Hz optimized beam. On Friday, a machine development session took place, testing the use of the laser double pulse system to produce a 3 GHz spaced beam (instead of the standard 1.5 GHz corresponding to laser pulsing). In such a configuration, a record train charge of 45 nC (110 bunches) was reached. No major faults this week. (Pierre Korysko, CLEAR weekly supervisor).

CLEAR has now reestablished "standard" beam operation for users after the mid-year shutdown, during which the access system has been modified, some consolidation work was completed and full operation was not possible due to manpower limitations.

Please find below short reports on the last 3 weeks - full reports can be found as usual here:

<https://indico.cern.ch/category/10682/>

Week 30/08/2021 to 03/09/2021

This week was dedicated to resuming irradiations on ESA and ISSI monitors before the Radec conference, in collaboration with the CERN R2E group. Results previously obtained in collaboration with the Oldenburg University have to be confirmed and complemented for different doses and dose rates. The scope was to evaluate the dose rate where the damages are no longer linear with the doses due to simultaneous arrivals of electrons on the same electronic gate. On Friday, installation and beam preparation for dosimetry tests for the CERN-CHUV collaboration.

Week 06/09/2021 to 10/09/2021

This week was dedicated to scans of beam sizes and transverse profiles vs. longitudinal position in-water, in preparation for CERN-CHUV experiments. For this purpose, a YAG movable screen has been installed in the water phantom allowing measures with beam going through 30 to 230mm of water. Some beam time was also used by CERN-BI on EOS OTR screen for BI training. Shielding on CLIC BPMs electronic was also installed by BI. Thursday off (Jeune Genevois).

Week 13/09/2021 to 17/09/2021

This week was entirely dedicated to CHUV beam preparation for the next FLASH irradiations with high doses (scope up to 40 Gy) delivered on a large area (10mm diameter @ 90% of the peak). After accurate beam and laser settings a beam charge of 32nC (110 bunches) was routinely obtained with a transport higher than 80 %

Many tests have been achieved with data records including images from the screen still to be fully post-processed. It seems that the YAG screen is degrading after a long immersion in water (to be investigated).

[LHC \(Jörg Wenninger & LHC Powering Test webpage\):](#)

S12	S23	S34	S45	S56	S67	S78	S81
Completed	Phase 1	Completed	Completed	Completed	Trained	Cold	Completed
77 / 11950 A	0 / 0 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	0 / 0 A	55 / 11600