

Accelerator Complex Status

End week 25 (Tuesday 27 June 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- Close to 4'000 alarms.
- 702 phone calls (453 incoming, 249 outgoing).
- 125 ODM created.

Events worth mentioning:

- Wed. 22.06, Beam stoppers in TT2 not working due to loss of compressed air in TT2. Works were ongoing on another part of the compressed air network, that should not have affected TT2. Checks will be done in the next TS to understand why and how this undocumented connection exists.
- Fri. 24.06, The stable filter in LHC8 tripped for unknown reason, will be switched on when possible again (was done on Friday afternoon)
- Sat. 25.06:
 - A mechanical failure which prevented water dispersion on the honeycomb fill of ETR100 caused the tower to take the vast majority of the water flow making it impossible to provide sufficient cooling. TI put the ventilator in manual position 80% as it was found that the ETR100 regulates on ETR200 basin temperature. On site TI and piquet CV managed to manually close a bit the spraying valve in order to redirect part of the water flow towards ETR200. Cryogenic operations saw the water's temperature increase up to 29°C at their installations at SHM18 but no installation tripped. At the same time a high temperature alarm at the reject water of BA7 was received. (32 degrees at the highest. Firebrigade informed.). The mechanical failure could not be identified due to the fact that the towers were operating, further investigation will be made.
 - Perturbation at 5:35 (some alarms in PSEN), no mail from RTE, no complaints from machines. Cryogenic operator saw a WinCC OA alarm for the intensity of the compressors. Apparently all cryogenic compressors had a significant surge at their intensities, some reached quite close to tripping levels. TI called RTE, indeed a single-phase fault happened at 225kV of Genissiat-Cornier. A report will be sent to TI.

Details: <https://wikis.cern.ch/display/TIOP/2022/06/27/TI+Week+summary,+Week+25>

LINAC 4 (Alessandra Lombardi)

A generally quiet week with very good beam availability.

Short interruptions due to :

- problem (under investigation by BI) due to a SIS cutting the beam to 100microsec because FESA was publishing SEM grids position not known . Solved by rebooting one of the SEM FECs
- two trips of DTL1 , restart ok with the sequencer
- two interruption of the source due to WD and SIS (EInzel lens trip, bad pulse count needed to be reset).

PS Booster (Chiara Bracco):

An extremely good week for the PSB with >98.5% availability. In general operation was only shortly interrupted by trips which could be reset by the operators.

The only relevant episode occurred at the beginning of the week when, as a consequence of the stop of the air conditioning in the neighbourhood of the Reference magnet and a temperature rise up to 36 degrees, the B-train regulation system stopped working properly. In particular, the temperature rise caused a lowering of the V signal which is used as pre-set of the measured field. This caused a drift of the tune in all rings and for all users and, in some cases, large losses. The problem was solved by adjusting the threshold set for the detection of this signal (while still rejecting noise and spurious resonances). The air conditioning was switched on again and the new thresholds are compatible also with operation at nominal temperature.

As an additional highlight, LHC25ns beams with optimised parameters and shaving in both planes were prepared and allowed to visibly reduce the tails in the PSB. They were tested at injection in the LHC but no improvement was observed in the injection losses.

Since yesterday sporadic and unexplained losses are being observed in Ring4 for NORMHRS, this issue will be followed up.

ISOLDE (Eleftherios Fadakis):

It has been a very quiet week on the low energy part of ISOLDE.

HRS: LIST target, Experiment IS456, Polonium isotope. Experiment finished on Friday. Beam was shared between IDS and CRIS. Users were happy with the performance of the machine.

GPS: Friday, stable beam set up to LA2. New experimental station was installed. Beam was used by the users to get acquainted with setting up beam into their detector.

REX: We are trying to catch up with the beam commissioning schedule of REX. We are facing difficulties with the phasing of the normal conducting cavities of the REX LINAC.

PS (Alexander Lasheen):

The PS recovered very well from the long downtime for the nTOF destination due to the fault on the veto feedback from the FTN beam stoppers. The present availability is of about 96% (excepting unforeseen faults for the rest of the week-end).

On Monday, the objective was to recover after the issue faced during the weekend of the FTN.STP426 not providing feedback on the veto and blocking both beam and access. An important point was that long access was planned that day for nTOF, for which options were evaluated to still provide access. Following the strategy established with the safety team on the Sunday, the FTN.BHZ403 was locked out and the wrong condition on the beam stopper bypassed. An action was then proposed by the access team to replace the communication crate, that was suspected to cause the fault. The main motivation was to tentatively solve the problem during working hours with all experts present and, if successful, to easily switch back to beam mode in the evening. The decision was then taken together with the nTOF control room to delay the access and allow for the intervention. This strategy was successful as the crate replacement solved the problem (still requires offline investigation on the faulty crate) and access could be provided around lunch time. In parallel of the access, in the afternoon, partial DSO tests were performed to ensure the good functioning of the access system, the BHZ403 was unlocked and the beam permit signed. The problem didn't reappear and the beam was provided again to the nTOF destination in the evening (20:30), minimizing the downtime. I would like to thank Denis for his presence and support during this day of coordination hand-over, which allowed to ensure that no important item was lost in communication.

The rest of the week was smooth, with little downtime. The longest downtimes were two trips of POPSB and a wrong lockout of equipment in building 181 which caused a lack of compressed air in TT2. After repowering the equipment, beam could be provided to the TT2 destinations again. One aspect to follow-up are the frequent trips of 10 MHz cavities and modules of the KFA71. Despite the

very small downtime, below the AFT limit, and with very prompt reset of the equipment by OP, trips are occurring daily and sometimes many times during the day.

During the weekend, there were two occurrences of 10 MHz cavities tripping suddenly all at once (coarse tuning). Although most of the cavities could be restarted promptly, the cavities 11,51,91 had more difficulties and required call to the RF piquets on Saturday, and restarted normally after some time on Sunday. These trips could not be associated with perturbation on the electrical network after discussions with TI.

Beam-wise, the EAST beam is being optimized to minimize the tail measured on IRRAD BPM1 and is still ongoing. The T9 cycle was made ready for the change of experiment on Wednesday. The SFTPRO beam was also continuously adjusted by OP following the PSB B-train issues, which led to important ring-by-ring variations degrading the spill for PS-SPS transfer.

A notable point for the week was the comparative measurements of the 2eVs and 3eVs beam brightness up to LIU beam intensity, displaying for the first time LIU beam brightness in the PS for the 3eVs variant and that were presented at the IPP on Friday.

PS - East Area ():

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AD - ELENA (Bruno Dupuy):

It has been a good week at the Antimatter Factory, despite an orbit jump in AD ring.

This week on the AD machine:

- Monday 21: The electron cooler solenoid, repeller, collector and cathode power-supplies drop from early in the day. No major cause was found by the specialist, vacuum and power-supply interlock was normal. After a restart, the antiproton's orbit changes due to magnetization of correctors around the E-cooler. In the past, after a power cut, this was common. But without BHZ-TRIM the golden reference orbit is different. A long and painful sweep of the antiproton beam made it possible to refine the nominal beam at the end of the day.
- Tuesday 22: The intensity extracted from PSB increased after Ring4 returned to normal from $1340e10$ to $1440e10$ protons on TARGET. The BCCCA measurement transformer (Beam Cryogenic Current Comparator Version A) has been recalibrated due to excessive saturation.
- Wednesday 23: The HORN tripped several times before the beginning of MD by T.Giles and A.A.Giri (SY STI TCD) on target and horn optimization. Unfortunately, a switching thyristor on cubicle 12.2 was identified as shorted, before the end-of the MD. Specialist G.Gawer fixed this issue just before restarting physics. During the day, in parallel, orbit adjustments were made to optimize electron cooling at 300 and 100 MeV with emittance measurements.
- Friday 24: Again multiple trips from the AD Horn, The specialist was called for investigation. Nothing special was found. The horizontal beam position on target has been adjusted to recovery $4e7$ antiprotons at the first flat-top (at 3.57 GeV). After CPS RPOS adjustment (DR.GSRPOS) the AD injection instabilities disappear (visible on stochastic cooling at 3.57 GeV).
- Saturday 25: The HORN refuses to be reset by CCC around 5am. At this time we do not have "on-call service" by SY ABT PPE for the HORN. Thus the AD supervisor locally acknowledges the interlocks and restarts the device. This local action is obviously faster than trying to call people "best effort" with no guarantee of displacement. During the same morning, the QUAD's power supply fails and after reset by CCC colleagues the Quad is brought back online.
- Sunday 26: In the morning the DR.QUAD and HORN were reset by CCC (as at least once a day)

This week on the ELENA machine:

Since last week. Gbar experiment is using H- beams and Pbar. Unfortunately, the Pbar Emittance is not small enough (by factor 2) compared to the H-. The electron-cooler electron beam and orbit are not entirely identical, further investigation is needed to understand this.

- Tuesday 22: All of the Ring and LNE00 extraction line fast deflectors were found off without any error on the remote control system.
- Friday 26: The H- source was very unstable, this was confirmed by the Gbar experiment.

SPS (Kevin Li):

Week 25 had on the program for the SPS the end of the second AWAKE run of the year, the continuation of LHC scrubbing with the goal to step up towards 72 bunches, and parallel MDs in preparation for the floating LHC MDs as well as the study of the PS2SPS transfer with 72 bunches. The week has been not too bad in terms of overall availability which reached a good 83%. One big system crash had occurred right on Monday with the RF cavity 1. The ZS has been holding up so far after the sandblasting of the feed-throughs and the exchange of the cables on each of the tanks the previous week. Sparks and peculiar vacuum gauge behaviour have been observed sporadically, but clear correlations can yet not be made. Problems have emerged with the SPS to LHC transfer above 48 bunches which are dumped on TL losses after injection. Investigations are ongoing such as detailed tails analysis and TL steering studies.

Monday accumulated a 16 hours downtime due to a fault on cavity 1 originating from a burned resistor with caused a water leak. The cavity was fixed only later in the evening. At the same time, the open issue with the TX4 water cooling for cavity 2 was fixed, as well. A few more piquet interventions were required on cavity 1 before the system ran mostly stable for the rest of the week. When getting back, however, problems in the PSB led to degraded beam quality for the MTE beams and NA physics was delivered all night in degraded mode only (lower intensity, irregular spills). The problems in the PSB could be traced back to an issue with the B-train, which was fixed by Tuesday later in the evening. The fix immediately led to an improvement of the MTE beam quality, reduction of TT10 losses and improved transmission and spill quality. The SFTPRO beam was further optimized from there on and then stably delivered to the NA for most of the rest of the week. Also on Tuesday, high intensity beams were taken at flat bottom with 72 bunches at $2.3e11$ ppb with careful monitoring of the ZS. The ZS showed no irregular behaviour during these tests and the MD could be completed. At the same time, this gives the green light for the next step which will be the high intensity parallel LIU MDs for which again the ZS should be closely monitored. AWAKE finished their 2 week run with $3e11$ ppb in the end which ran mostly stable. In the evening the LHC took back the scrubbing beam. Scraping was set to lower energy (~ 125 GeV) for this scrubbing fill to check the impact of this on the LHC side. There were no remarkable differences observed to the previous scraper settings so far.

On Wednesday, the AWAKE beam was taken back for less than an hour to investigate the instability at $3e11$ ppb. Several tests were made in different supercycle configurations. The beam was stable 99% of the time. It is not clear at this moment, what could be the origin of the observed instabilities earlier during the run. The dedicated MD scheduled for this Wednesday has been postponed to November 4. Instead, it was agreed with the NA physics coordination to continue sending beam all throughout the day with the goal to catch up at least some of the lost spills due to the poor machine availability during the past few weeks. The problem with the radial loop instabilities could also be fixed by replacing the FEC for the radial pickup. A re-calibration had to be done. The orbit at extraction is now stable and the re-calibration gave some further improvement in the SFTPRO transmission. During extraction of the LHC beam, persistent losses were observed in the SPS, in particular in BA4. Investigations revealed that the orbit flattening had gotten lost. A re-flattening of the orbit was done in the SPS, which improved the beam quality there. Unfortunately, sending 12 bunches to the LHC at the flattened extraction orbit led to a magnet quench right after injection. A setting of of TI2 and TI8 was done to match the flattened extraction orbit. Further manipulations during the night, however, led to another quench at injection. It has now been agreed with the LHC,

that any optimization of the orbit involving changes of the FEI will require the strict sequence of PILOT and INDIVS before injecting bunch trains.

Thursday and Friday had both been rather quiet and focused on NA physics production and LHC beam delivery. Some problems with RF cavities and mains, which could all mostly quickly be fixed or reset. The issue with the SPS to LHC transfer is persisting, however, preventing injection of 72 bunches. Investigations until late Friday evening could not resolve the issues. The LHC has ran mostly with single bunches over the weekend delivering beam for the floating MD program. Extraction setting up and TL steering will have to be done newly on Monday morning as the current situation will prevent advancing with the LHC program. This will have implications on the HiRadMat run which was supposed to start as early as possible on Monday morning. The HiRadMat and LHC programs will have to be planned carefully next week as the two are not compatible running in parallel.

Open items:

- Extraction and beam transfer SPS to LHC to be investigated
- TT10 loss readings to be transformed into mGray
- The switch of RBI816 for AWAKE has been reverted and a test should be done at some point with the AWAKE cycle playing
- New items added to the access list - go through in case of planned or unplanned access.

SPS North Area ():

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AWAKE (Giovanni Zevi Della Porta):

End of June proton run. Beginning of 2.5 weeks of access

- Monday, June 20: Proton beam stable for 2-3 hours of proton in the evening. No results.
- Tuesday, June 21: Proton beam (1E11) stable most of the day, with long periods with 2 extractions per cycle. Scanned electron/proton/laser timing. Switched to 3E11 with large-optics around 8.30pm to measure SMI/SSM.
- Wednesday-Friday: Access
- Cool down of vapor source
- Installation of new streak camera, removal of existing one (to be sent for repairs)
- Elevator broken Wednesday morning to Thursday afternoon (including interphone to call for help) – again.. this becomes an issue

Plan for week 26: 1-day vacuum opening to replace laser beam dump foil. Electron beam orthogonal steering studies. Vapor source visit in preparation for end-of-year interventions. Align and commission new streak camera.

LINAC 3 (Rolf Wegner):

The Linac3 hardware and beam commissioning continued.

The Buncher RF system became fully operational on Tuesday (21 June) noon.

The oven re-fill has been advanced to Thursday (23 June). In parallel 4 new stripper foils have been installed on arm #2. All currently installed stripper foils (14) have been measured.

Beam has been successfully sent through the Linac. Settings are being optimised. First beam to LEIR is expected this week.

Richard is following an issue on the steerer ITH.DVT21. It seems to be an open circuit which required an access into the PS switchyard for repair.

LEIR ():

Beam permit signed.

CLEAR (W. Farabolini - CLEAR Weekly Supervisor):

This week was mainly dedicated to two experiments: the test of scattering material (tungsten and aluminium) for benchmarking codes used by CHUV, and the test of an electronic board for EO used by BI. In addition, the in-vacuum installation of a Cherenkov BPM was foreseen on Friday in order to have the whole week-end time for pumping back the sector. Various machine consolidations were also scheduled like the installation of quadrupole invertors, new power supply, removal of the PL flange, and shielding of the turbo-pump controller. All activities were carried out without major issues.

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

The week began with 4 hours of stable beams at injection.

TCDQ, TCT and TCL alignment at 6.8 TeV and aperture measurement at 30 cm were completed. The observed apertures were around 11.5 to 12.5 sigma in the horizontal plane and around 9.5 sigma in the vertical planes. On Friday the roman pots of TOTEM and ALFA were aligned at 60 cm, followed by 2.5 hours of data taking at 60 cm and at 30 cm (at close distance to the beam with collimators around 4 sigma and retractions of 0.5 sigma in V [TOTEM] and of 2 sigma in H).

Injection of 72b for scrubbing was first tested on Wednesday and the machine was filled to around 1800 bunches when an issue with the abort gap cleaning led to a beam dump. Following a change in extraction at the SPS, quench of a dipole in S81 during injection of 12 bunches with a very poor trajectory. The same issue occurred again overnight during a rocky attempt to revert settings of SPS extraction and L trajectory for beam 2. Investigations on injection losses with 25ns trains were pursued Friday. While on B1 the injection of trains of 72b is possible, the B2 losses - on the TCPs in IR7 - are too high to envisage scrubbing with trains longer than 48.

On Thursday the machine was stopped for an intervention to lower the voltage of two MKBV kickers of B2 by 20%.

Friday afternoon to Sunday evening a first sequence of floating MDs was quite successful.