Accelerator Complex Status

End week 40 (Monday 11 October 2021)

Technical Infrastructure (*Jesper Nielsen*):

Statistics:

- 704 phone calls (524 incoming, 180 outgoing).
- 93 ODM created.

Events worth mentioning:

- Tue. 05.10, SPS tripped when both pumps of the BA2 circuit triped due to low intake pressure. The isolation valves of the distribution AQA12100 and 12101 were closed because of lack of compressed air. The valves had been closed accidentally during works.
- Wed. 06.10, Evacuation of EHN1 (CRYO software update caused an Argon release)
- Thu. 07.10, Patrol lost in BA80, due to access card problem.
- Sun. 10.10, Patrol lost in BA2, due to access card problem.

Details: https://wikis.cern.ch/display/TIOP/2021/10/11/TI+week+summary,+Week+40

LINAC 4 (*Eva Gousiou*):

The Linac4 availability this week was at **95.4%** [7h50 downtime]. The main issues were:

- **LIC Timing** controls issue caused by a hardware failure that required the replacement of an MTT board [2h, Tue]
- PIMS0304 **vacuum** interlock; the issue was caused by a faulty vacuum gauge controller board. Despite the operation **configuration** being that two faulty gauges generate an interlock, the configuration that was active was the commissioning one where one gauge error was sufficient to trigger the interlock. The vacuum team is planning the update of cavities configuration during YETS [3h40, Thur]
- Quadrupole L4L.RQF.371 **Power Converter** failure; this required an on-site intervention and the replacement of the converter that was not responding to a reset [2h, Sat]
- Finally a couple of short trips: **Chopper** trip due to the chopper amplifier [5min, Sun] and SIS trip due to Einzel lens voltage out-of-specs, still under investigation [5min, Wed]

PS Booster (*Simon Albright*):

It has been a challenging week for the PSB with several significant interruptions.

On Tuesday, we had access and several interventions, which was followed by the central timing fault. On Thursday morning we lost a couple of hours due to a problem in Linac4. Lastly, on Friday night we had a failure in a main magnet trim coil, the diagnosis and temporary repair of which took about 5 hours. The full repair of the magnet will require a significant intervention and it has not yet been determined when this will happen.

On top of this, we also have fairly frequent interruptions of the beam due to the Watchdog system, which is cutting the beam more frequently than it should, expert investigations of this are ongoing. There was also the usual selection of small resets of power converters that cut the beam for a few minutes each.

On a more positive note, we had a typically broad range of MDs with some interesting results, all operational beams are provided in specification (even with Ring 2 in degraded mode), and we have made the BCMS beam available for testing in the SPS.

ISOLDE (Eleftherios Fadakis):

HRS

The experiment (IS701) that started last week finished successfully on Thursday. New target (#738 CaO VD7) installed on Thursday. Beam set up for the WISARD experiment will take place on Monday the 10th.

On Friday we started delivering protons to MEDICIS.

GRS

Monday the 4th of October target #634 UC LIST was installed. This is a prototype target. It has been having some issues and the experts have investigated the target and found nothing wrong. This led them to believe that the actual front end might have an issue. Monday the 10th at 9a.m an intervention is foreseen on the front end.

PS (Benoit Salvant):

The PS had a rather eventful week: 82.5% availability until now with most of the downtime coming from Linac4 and PSB as well as recurring kicker related trips towards the end of the week (KFA45, KFA71 and BFA09).

The PS delivered beams to all users, in particular the NOMINAL ion beam for the first week of SPS ion commissioning, as well as TOF to higher intensity (850e10 protons per pulse).

The main issues to report were:

- One generator of injection kicker KFA45 repeatedly tripped and was put offline by the SY-ABT specialist. He worked on it together with a team on Thursday and Friday but could not put it back into operation until now. There is no spare for this generator but the maximum voltage of KFA45 is now limited to 240 kV, while several beams were using up to 280 kV (in particular AD and TOF). The injection settings were temporarily modified to account for this new constraint until the generator is put back in service, hopefully next week.
- After the PSB magnet intervention on Friday evening (BHZ15L1), beams from ring 3 (for the LHC TI8 test and EAST) were fine right away but the MTE and TOF beams were strongly affected. Surprisingly, the AD bunch from ring 2 was not too affected, even though the settings of that trimming coil looked similar to MTE. The nightshift crew corrected the position and angle at extraction on ring 2 on MTE and TOF and managed to get very decent beam back for all operational beams. The following morning, POPSB tripped on a regulation fault when the LHC25 ns cycle was put in the PSB (LHC2A/B) and we avoided adding new cycles in the PSB supercycle during the TI8 beam tests and before experts can have a look on Monday.
- Extraction kicker BFA09 tripped on Friday evening and again on Saturday morning, requiring both times the intervention of the SY-ABT specialist who performed the same resistor exchange (2h downtime). This may be due to a large number of MTE cycles in the supercycle at these moments.
- Extraction kicker KFA71 tripped at many occasions during the weekend, in particular modules 6 and 12, and this caused downtime to AD. The SY-ABT piquet intervened on module 12 and relaxed tolerances for module 6 until the specialist can intervene on Monday.
- Several trips of the pole face windings circuit PR.WDW required calling the SY-EPC specialist. He changed a circuit breaker during a 30' beam stop, but that did not solve the problem and he used another 15' stop to exchange an electronic card, which solved the problem. He also suggested switching back to the normal power supply for PR.WDNI and we stopped the beams for another 7 to do that. We are now back to the nominal situation for that equipment, with a spare ready, which is very good news.
- An exchange of a circuit breaker was needed also for the bumper in section 42.

- The PS was also affected by the central timing problem that occurred on Tuesday morning.

The short access on Tuesday allowed specialists to fix PI.BTV26 and to observe that there was no condensation on SMH57.

PS - East Area (*Bastien Rae*):

T8: in operation, instrumentation calibration ongoing with the new fast BCTs. Optics studies ongoing and an MD for validation of the used optics will be organized first week of November (Wednesday)
T9: Commissioning is ongoing. Converter and Absorber have been installed and commissioning of electron beam will start this week
T10: Commissioning ongoing.

AD - ELENA (*Bruno Dupuy*):

Week 40 was without major failure at AD/Elena, despite the often disturbed beams from the injector chain (LN4-PSB-CPS).
The MDs on Wednesday made it possible to study the following points:

- ELENA injection matching (quad scan in last part of LNI line)
- Test of the new setting for the bunch rotation of AD beams in the PS
- Emittance along electron cooling plateaus (possibly after lengthening the cooling plateaus in ELENA)
- Synchronization of the beam prior to AD extraction.

Some improvements were done :

- Improvement of AD injection line (~3%)
- Optimization on bunch rotation at AD injection
- Decreasing losses on ramp 2.5 GeV — 300 MeV

Issues:

- AD-Horn has tripped several times this week (restarted with Reset).
- AD E-Cooler energy at 100 MeV become very unstable since Sunday 19H00 due to bad vacuum around E-Cooler, the first signs of futur problem on this.device...

SPS (*Verena Kain*):

The SPS week was devoted to the first ion commissioning after LS2, LHC last TL test before the foreseen 2 weeks test period. The machine availability was again above the 2021 average but not as good as the previous week. At the moment of writing the availability is around 70%, but without considering yet the lost of petrol in BA2 (just happened).

Starting from the ions commissioning, the first beam was injected into the SPS a few hours after the start of the test. Usual complications to go through the MSI and inject on the SPS CO, but this was quickly handled. The energy of the incoming beam was very different from the expected one and a few iterations were needed to match it to the PS extracted one. After some RF controls updates needed to handle the fixed frequency acceleration for ions, the ion beam was brought to flat top in a matter of a couple of days and transmission was incredibly good: about 93% transmission was recorded at the 300 GeV flat top with 4 bunches injected. After that, the long ions cycle was also commissioned with 2 injections from the PS. The beam was accelerated to 450 GeV proton equivalent. The transmission at the end of the week was about 25% - one of the main problem observed was an instability in the radial loop. To be investigated. Slip-stacking was not attempted as additional updates are needed before being able to do it.

The LHC transfer lines test started with the left over test from last week for ALICE. After that, once the issues with the PSB were solved, the optics measurements still needed and with INDIVs were performed. On Saturday afternoon, after MKE.4 conditioning, PILOTs were delivered to the TI8 TED and the full TI8 test carried out. Optics measurements of the TL, apertures and KR were done. No

surprises found, except for the fact that a change of delay between the circulating beam and the extraction pulse was observed when the SPS radial position was changed. This could be the reason why we observed a change in synchronisation with the MKE.6 on the HiRadMat cycle. At the same time, work was also ongoing in the LHC synchronisation with the SPS. Also there significant variation of the synchronisation of the beam with the AG in the LHC was observed. Detail follow up is needed to fully understand the source of these changes.

For the SFTPRO, the main points to mention are:
- the spike at the beginning of the spill seems to be back,
- the 100 Hz harmonics on the mains changes phase and amplitude very frequently and spanning large values, so difficult to control
- symmetry on targets changes very frequently too and autopilot have to be restarted every 10 minutes.

Regarding the issues observed during the week, the majority were due to the injector complex. The main one was in the PSB which stopped operation for about 11h between Friday night and Saturday. Thanks to the efficient work of the PSB OP team, the SFTPRO physics could be restarted without too much delay after the identification of the issue and restart in degraded mode - basically the extraction had to be re-setup. In the SPS, we had again another lost of patrol due to the access system in BA80 and BA2 (just a few minutes ago) luckily patrol was not needed in BA80. Then we had a spark in MKE.4 at the first pule and then conditioning was needed. Also, the RBI.87715 gave a few problems, and the EPC had to stay long over night to fix the issue before the extraction to TI8 were possible. Finally solved but now no spare PC are available, hence time this week has to be allocated to restore this. Finally, issues on BEND.043 in NA caused the interruption of physics for almost 2h - after intervention of both first line and magnets experts the extraction could be resumed, but not clear understating of the problem. Careful monitoring needed.

SPS North Area (Bastien Rae):

H2: Wednesday : Supply failure of a power converter à piquet has to be calledà 3h downtime
H4 : No major issues
H6 : Radiation on the monitor above the roof shielding à following the measurements with RP on Thursday the PPE126 roof has been locked and the interlock level of the monitor has been raised to 50 microSv/hr from 40
H8 : Frequent interruptions due to the RP interlocks, measured RP levels are high whenever there is an extraction into the North Area, even with the H8 beam off
K12:

- Problem with vertically drifting à SIS implementation for monitoring the drift and react automatically. à Thanks to SPS-OP for fast implementation
- BEND72 in P42 had some coil temp issues à access next Wednesday plan by TE-MSC to check on site.

M2: Radiation monitor showed a high level even without beam à investigation show that in come from a very small lost on P42 beam line

- M2 RP carried out the measurement with a mobile detector on Friday and found the fixed monitor was quite well placed in the radiation cone and the levels were lower near the region where the AMBER installation was taking place
- The warning level of the monitor was therefore raised and AMBER was allowed to continue installation.

AWAKE (Edda Gschwendtner):

Week 40 (October 4-10): BTV installation cancelled. Prepare for the run.

Expansion Volume BTV (cancelled):

- Scaffolding installed
- Vacuum system pipe routed out of the way of installation
- Rubidium handling system tested (portable glove-bag) tested
- One of the external experts could not come to CERN due to a Covid contact, so we had to cancel the installation at the last minute

Rubidium refilling: Reservoirs disconnected, brought to ENH1, refilled, brought back to TAG41, reconnected

Laser:

- Replaced laser beam dumps (LBDP2 and LBDP3) with new ones
- Modified FMOUNT02 filter to become fully opaque (will use this for "plasma off" shots)

Preparation for upcoming run:

- Pump down vacuum, leak checks done.
- Re-established patrol (twice, due to Transport needing to open the MAD)
- Laser system switched ON. RF locking not there yet, will retry Monday when fully warmed up
- Tested Electron systems: RF fully powered OK, gun and beamline magnets all OK

Plan for week 41: Proton beam! Re-establish electron-seeded self-modulation as soon as possible. Then start moving the electron bunch backwards through the proton bunch, to study the competition between the electron and proton wakefields.

HiRadMat (*Bastien Rae*):

- HED installation this week. Beam based alignment procedure agreed with TE-ABT, emittance blow-up to be requested for pre-LS2 values next week. Operation plan approved by the IEFC on Friday.
- Software fully upgraded by Pascal (automatic logbook, readout, live screen of shots ....)

LINAC 3 (*Richard Scrivens*):

Linac3 operation concentrated on delivering beam for the SPS MDs.
He main downtime came from the timing problem on Tuesday and a power converter issue on Friday. All other trips could be reset quickly.
The beam was very stable, and this oven has been running for 24 days.

LEIR (*Nicolo Biancacci*):

Main activities:
- NOMINAL beam to SPS with excellent and stable performance (9.5e10 charges on average delivered).
- Investigation of hysteresis effects in the ETL line on Tuesday.
- MD activities on impedance, machine learning.

Fixed issues:
- Kicker and injection bumpers were reset after timing issue on Tuesday.
- Ecooler electron energy adjusted during the weekend.
- No other relevant issue recorded on LEIR side.

Outstanding issues:
- Machine sextupoles fixation being prepared by TE-MSC.
- BPM baseline issue on BPM ETL.UEHV30 will be looked at in W41.
- RF operation will swap the main cavity from CRF41 to CRF43 during W41.
- After the weekend, LEIR extracted intensity significantly dropped: LEIR/Linac3 teams are working together to re-establish performance.

CLEAR (*Roberto Corsini for Wilfried Farabolini*):

his week has seen the first external user coming at CERN since the Covid crisis, resuming CLIC Cavity BPMs tests that were suspended since 1.5 years.
A second experiment was performed in the frame of Cern against Covid program, i.e., the irradiation of medical masks with a 60 MeV beam for sterilization purposes.
In parallel, we have continued to assess the beam size in a water phantom under various beam conditions in order to prepare future biological tests with CHUV.
A new water phantom was prepared and installed on the test stand. This phantom is compatible with the samples handling robot.
The commissioning of this robot is continuing in the lab (faster speed, development of a user interface, camera fixed to the grabber).
During all this week, the beam was extremely stable, both in charge and in position. Beam was resumed every morning with the same characteristics as left the day before, just adjusting klystron phases.
(Wilfrid Farabolini, CLEAR weekly supervisor)

Full reports can be found as usual here: https://indico.cern.ch/category/10682/

LHC (Jörg Wenninger & LHC Coordination webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Completed	Phase 2	Completed	Completed	Completed	Completed	Phase 1	Completed
77 / 11950 A	0 / 0 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	0 / 0 A	55 / 11600

S23 moving into phase 2, S78 phase 1 well advanced, a few days ahead of schedule in terms of powering.

Second TI2 transfer line test Friday 8.10. Issue of the LHC abort gap position and the large time offset (~25 usec late) of the bunch from the SPS: LHC RF was not properly re-synchronized with master and SPS bucket 1 definition was changed, requiring a change of the time offset between SPS and LHC (LHC setting). The TI8 transfer line test could only start Sat 9.10 due to POPS-B and SPS TI8 PC issues on Friday evening. Despite a late start the program was essentially completed. Only good quality dispersion measurements are missing due to a missing link between LHC ans SPS RFs. Over the scheduled TI2/8 test time, the availability of the injectors was less than 50%, fortunately the test program could be shifted into the weekend to make up of lost time.

Both MKI2 and MKI8 injection kickers are setup in terms of kick delays and abort gap protection for the beam test.