

Accelerator Complex Status

End week 23 (Monday 14 June 2021)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 5'500 alarms.
- 870 phone calls (604 incoming, 266 outgoing).
- 140 ODM created.

Events worth mentioning:

- Wed 09.06: Electrical alarms similar to an electrical perturbation, but no impact on operation.
- Fri. 11.06: Trip of 18kV transformer in AD. It is not clear yet why the transformer tripped, it is still being looked into.

For this week no major changes:

- The load transfers of the 48V loads in North area are continuing
- The administrative 18kV loop is in open loop since this morning (no redundancy) due to works on science gateway.

Details: <https://wikis.cern.ch/display/TIOP/2021/05/03/TI+Week+summary%2C+Week+17>

LINAC 4 (Evangelia Gousiou):

The Linac4 availability has been 99.1% this week.

The 1.5h total fault duration has been mainly due to:

- A chopper trip during the weekend that required on-site surface intervention. The issue was due to an unexpected impedance change of a monitoring scope; the scope has now been removed. [Fault duration: 43 min]
- Several short trips of the SIS due to the required updates not arriving from LEBT devices; this is a recurrent issue and we are looking into it with EPC colleagues. [15 trips; total duration: ~45 min].

PS Booster (Simon Albright):

It has been a calm week for the PSB. The longest interruptions were for scheduled accesses to the PS, which we profited from to allow access and interventions in the PSB. Otherwise, there was only a scattering of typical short interruptions.

In terms of progress with operational and commissioning beams for the rest of the complex:

- ISOHRS and ISOGPS are now regularly sent to the ISOLDE facility
- The LHCPILLOT has been modified to better suite the emittance requirements of the higher energy machines
- Injection has been optimised on several operational cycles, leading to lower transverse emittances and reduced losses
- A special ultra-low longitudinal emittance LHCPILLOT type beam has been prepared for the SPS
- The East Area beam with parasitic TOF has been set up and is ready to be tested in the PS
- Further studies of energy matching with Linac4 have not shown any significant slow drifts, additional monitoring is now planned to check over longer time scales
- An energy matching with the PS showed that the PSB 2 GeV extraction field should be increased by 2 Gauss, this change will be gradually propagated to other cycles.

ISOLDE (Erwin Siesling):

Protons and Low Energy:

Last week we took for the first-time protons onto both GPS and HRS production targets for tests of the extraction High Tension voltage pulsing and the new beam-gates as well as to test the functionality of the new fast tapestation and its detectors with radioactive beam (^{23}Na) extracted from the target on GPS. Also at GPS, there is TISD (Target and Ion-Source Development) going on using the RILIS lasers for beam onto the detector in the GLM line as well as into the MR-ToF at ISOLTRAP. Apart from that the COLLAPS experiment would tune stable beam into their setup, whenever the beam is available, which continued over the weekend.

Few issues: For the HT pulsing at proton impact an issue was found for the trigger which has been resolved by Thierry Gharsa (SY/ABT) during the week. For the beam-gates we found an issue with the system detecting from time to time an internal communication problem causing the beam-gates to briefly close unwantedly which we hope to tackle in the coming days.

The new tapestation is working well and a first proton scan, release curves and yield measurements were successfully carried out by our colleagues from SY/STI using radioactive beam from GPS. We hope to do the same the coming week with radioactive beam from HRS through the ISCOOL.

REX:

For the REX Linac all cavities were phased early last week using $^{20}\text{Ne}^{6+}$ and $^{40}\text{Ar}^{12+}$ ($A/q=3.33$) beams reaching a total energy of 2.85MeV/u.

The REX pulse lengths have been increased to ~ 1.2 ms on Friday which caused multipacting effect in the 9GAP REX cavity during the weekend bringing down the 9GAP amplifier. This was noticed by C. Gagliardi SY/RF who swiftly restarted the RF – many thanks for being so alert.

HIE ISOLDE:

Cryo intervention(s):

Last Thursday: The phasing of the HIE SRF part was interrupted on Thursday by an intervention on the HIE ISOLDE Cryo plant which was dominated by a preventive action on replacing a partial clogged up water flow meter at the compressor station. The intervention of ~ 1 hr demanded 6 hrs to recover the LHe levels in the cryo modules and before the system was stable again, however, an uncontrolled stop would have been much more severe than that.

This Monday: During this intervention the water circuit of the compressor station gear box was inspected and (limestone) clogging there has also been observed. In cooperation with cryo (N. Guillotin) we have agreed on an intervention as soon as possible, this Monday, again with in mind the benefits of a controlled stop with a cryo dedicated task force in order to minimize the risks of a much longer stop later on. The intervention this Monday will take ~ 1 h30 with an estimated recovery of ~ 10 hrs.

The phasing of the HIE ISOLDE SRF Linac continued on Friday up to SRF cavity 07 bringing the total energy of REX/HIE to 5.3MeV/u, so far. We hope to finish the phasing of the remaining 13 SRF cavities this week after the cryo has recovered from the planned intervention this Monday.

PS (Matthew Fraser):

Beam commissioning continued on many fronts this week. The AD cycle injection optics was optimised, the extraction synchro adjusted and bunch rotation implemented. The beam loss could be reduced to values comparable to pre-LS2, confirmed with reference BLM data provided by the MCWG, which is being incorporated as operational BLM thresholds. The variations in the MRP at injection that were causing beam loss on AD (before injection optimisation) led to a discussion with the B-Train team who are looking into re-implementing PR.TRAIN/CCV to allow us to offset the measured B-field for the next cycle. For some reason this functionality was removed during LS2. Work continued on TOF and a first set-up of EAST cycle carried out.

Work continues on SFTPRO preparing for the upcoming intensity increase and discussions started with EPC to improve the tracking of the multipole functions by the power converters. Systematic wire-scanner measurements were carried out to optimise the bunch length received from the PSB and to confirm good stability and reproducibility of the islands position before extraction. The DFA's were synchronised with the beam and a first iteration carried out to minimise the spread in the turn-by-turn trajectory differences along the spill.

Throughout the week investigations on the wire-scanner continued and the source of the 16.1 kHz noise on the PM signal was identified as the wire-scanners' own motor drives. The BGI team released an update of its online data mode allowing measurements on Friday of the beam size every few ms throughout an LHC25 cycle using the OP BGI application. The results are very exciting and show unprecedented detail of the behaviour of the beam size long the entire cycle.

A second iteration of energy matching was started with the PSB match on Ring 3 to the PS and needs completing on the other rings next week.

On Monday afternoon an intervention was needed for a couple of hours on QKE16 to repair a thermoswitch causing an interlock on its WIC. At the same time an intervention was carried out on C36 to fix a fault ventilation fan.

On Tuesday two modules of the KFA71 suffered similar faults appearing to be in short-circuit. An intervention throughout Wednesday morning found faults on the short transmission lines in the tunnel (module 4) between the SF6 PFL and magnet, and on the surface (module 6) between the SF6 PFL and main switch. Spares were installed, the system returned to operation and investigations being made if we need to replace the transmission lines as the age of the components that failed was probably a contributing factor.

On Friday afternoon the PS had trouble synchronising with the PSB, most noticeably on LHC25 (h=7) type beams but also on others. The RF experts worked late into Friday evening to fix what was diagnosed as a communication issue with the distribution of the RF harmonic number. Further investigations will be needed next week to understand the problem.

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AD (Laurette Ponce):

Continuation of HW tests: injection kicker, injection and ejection septum
Cleaning in the ring and launched Beam Permit signatures
Closure of the AD ring for lock-out on Monday

Problems:

- 1 hour power cut in Bat 193 on Friday due to (false) temperature interlock on transformer (electrical work on-going in the "faux plancher" may be at the origin, touching the interlock cable?)
- Major disturbance in AD target (survey work on the target) on activities already on the critical path for the planning.

ELENA (Laurette Ponce):

No Hminus operation in ELENA for profile monitor exchange in the injection line

- Vacuum sector of the ion switch vented to exchange the 4 monitors (3 bad quality + consolidation of the mechanics for the last one)
- Cabling installation for LNE51 on-going in the shadow of the stop:

Lock down of all electrostatic elements in ELENA transfer lines + ring (incl. Electron cooler power supplies)

- No test possible with electron beam before completion of the cabling campaign

Completion of access system installation in the experimental areas

- Suspension of Hminus beam permit till revalidation Pbar DSO tests planned or 16th of June in parallel with beam permit validation for experimental areas.

SPS (Francesco Velotti):

Very busy week for the SPS as moving out from dedicated scrubbing and coming back to normal commissioning. In a few words: the AWAKE cycle is ready (with reduced intensity), SFTPRO with 5 PS turns almost and we have 4 batches of 72 bunches stored in the machine for the whole flat bottom. Still a few issues to solve, though.

The main locations that gave more headaches for the scrubbing team were still the new beam pipe in LSS6 (not coated), the MKDV1 and the TIDVG. In order to optimise the machine scrubbing, the vacuum thresholds in LSS6 and TIDVG area were increased to $1e-5$ mbar, as no sensitive equipment were in danger. This allowed a much faster progression. The MKDV1 showed also signs of conditioning and getting better specially by the end of the week. Acceleration of 72 bunches seems within reach for next week even keeping the same thresholds as we have now for high energy dumps.

On the physics cycles commissioning side, great progress were done both on AWAKE and SFTPRO. For the latter, the important issue of the radial position stability at flat top was addressed and solved by the RF team. Also, RF gymnastics was tested and the relative firmware updated needed deployed. There was not time though to test this extensively. Another great news was the signal seen on the BSI in TT20. The AWAKE cycles was fully setup together with the RF manipulation needed at flat top to reduce the bunch length of the extracted bunch - we now have 1 ns bunch length at extraction as requested by the experiment.

Regarding the issues, on Tuesday there was the access to remove COLDEX from the machine. During this time, the vacuum team accessed in BA5 to solve the issue with a valve in 513. This turned out to be a very long intervention but finally completely solved the issue on that valve allowing the continuation of scrubbing in the best conditions.

Another very particular problem was seen the night of Wednesday when the WR in BA3 lost synchronisation with the Gran Master Clock. This resulted in a long stop as very difficult to realise that this was actually the issue and not the RF. Proper monitoring of this will be put in place. During the cooldown time, a successful upgrade of some firmware in the access system took place without major impacts on the machine. Though, in the course of the week, many recurrent lost of petrol in different zones of the SPS needed the operators to re-petrol these areas with consequent down time.

On Thursday and Friday the DSO test of the NA took place. All areas were done but some issues were found and will be followed up the coming week. In order to tackle the stating important issue on the QD and QF main power supplies, the slot for the MKDV reconditioning that takes place every morning has also been proposed to the EPC team for their investigations. This resulted to be very effective, in fact the team proposed already some modifications, to address the 150 Hz noise issue, that will be put in place Monday morning. Such a slot will be kept also next week, of course depending on the success of the problem resolution.

The weekend was rather quite, except for a few sparks on the MKP during scrubbing. The piquet intervened twice reconditioning the kicker. The root cause seems to have been identified and test will be done Monday to fix this. For the whole weekend, 4 batches of 72 bunches were kept for the whole long flat bottom. This made us reach close to the MKP temperature limit - the behaviour of the MKP is as expected.

SPS North Area:

Following the fire, the repair and modifications went well last week and were completed end of the week. Monday, following testing and a thermography the circuit will be back in operation for the users at 10:00 at the latest.

AWAKE (Giovanni Zevi Della Porta):

WEEK 23 SUMMARY: Second of 3 weeks of access. New screen on BTV412442 and new mirror on LBDP3.

Work on Spectrometer and DMD installations.

- **Vacuum:** vented on Monday, plan to pump down on June 18. Faulty penning gauge replaced
- **Laser (in vacuum):** installed new mirror for damage testing (for Run 2c study) in LBDP3
- **Instrumentation (in vacuum):** installed an OTR screen in BTV 412442
- **Post-proton Lights issue (from last week):** TT41 and TCC4 have lights mostly off. Called TI, and expect intervention soon.
- **Instrumentation:** installed DMD mirror setup (test setup for Halo/Core cameras, potentially used in Run 2c). Connected data and trigger for new spectrometer cameras (test setup for Run 2c).
- **Access System:** deployed bug fix for RadVeto (required full reboot of Global Interlock controller). Next time we have protons, the RadVeto should lift automatically 30' after the end of Beam

PLAN FOR WEEK 24: setting up scaffolding for Expansion Volume BTV installation in July, and continued work on instrumentation (DMD, spectrometer cameras).

LINAC 3 ():

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CLEAR (Roberto Corsini):

Last week main activity was a Photonic Crystal experiment from the LHCb group. Several angular scans were performed, using different narrow-band filters, to detect the expected beam induced radiation. Unfortunately no clear signal was visible, possibly due to the high background. A setup improvement was prepared and tested on Friday, and will possibly be used for further checks later on. Parasitically, data about beam stability with high charge per train were recorded in preparation for dosimetry experiments for CHUV. A vacuum issue with the turbo pump of the Plasma Lens set-up interrupted operation but was solved rapidly.

The full report is available here: <https://indico.cern.ch/event/1026613/>

LHC (Jörg Wenninger & LHC Powering Test webpage):

W23: 07.06.2021 to 13.06.2021

S12	S23	S34	S45	S56	S67	S78	S81
Completed @ 20 K	Warm up for repair	Completed @ 20 K	Trained	Training	Cold	Warm up for repair	Phase 2 @ 20K
77 / 11950 A	29 / 11538 A	71 / 11950 A	87 / 11950 A	27 / 11261 A		69 / 11585 A	

S12 completed all tested, including PGCs (with RBs already at 6.8 TeV). S12 and S81 emptied and warming up to 20K for the magnet replacement. S34 at 34 for alignment of connection cryostat.

Circuit	Circuit quenches	Last quench current	Equivalent E	Target reached
RB.A78	69	11585	6.79	-
RB.A34	70	11950	7.00	7 TeV
RB.A45	87	11799	6.91	7 TeV
RB.A12	77	11950	7.00	7 TeV
RB.A23	29	11538	6.76	-
RB.A56	37	11330	6.64	-

