Accelerator Complex Status

End week 32 (Monday 15 August 2022)

TI (C. Pruneaux)

Mon 08/08/22 10:50	LHC beam loss due to TAG41 and TAG42 access system fault. SPS TAG 42 access removed powering permit for sector 81 => Fixed after electronics card exchange. See event
Wed 10/08/22 13:50	Power glitch and loss of beam for SPS, RF linac4, POPS-B and RF for PSB. Confirmation by RTE of a fault fault on the 400kV line Genissiat-Vielmoulin. See event
Sun 14/08/22 11:00	Loss of SPS beam because of lightning close to CERN. No event on RTE network recorded and no alarm in TI. See event

Details:
https://wikis.cern.ch/display/TIOP/2022/08/15/TI+Week+summary%2C+Week+32

LINAC4 (P. Skowronski):

Up to now the availability is 98.3%.

On Monday the source experts intervened to investigate the previously reported frequent low intensity pulses. They found that phase of 2 MHz RF power has drifted over the year by 40 degrees and after correcting it the source came back to the original performance.

On Wednesday a power glitch stopped the machine fort about 45 minutes.

On Friday night PIMS0506 klystron tripped and only 3rd restart attempt was successful.

As every week we had a few trips of L4L.NFH.014 power supply for source's einzel lens. During this week a local oscilloscope was connected to better understand the issue. The collected traces indicate sparking in the electrode or in the connecting cables, but the analysis is still ongoing.

LINAC3 (R. Scrivens):

The source was restarted on Tuesday after an oven refill.

On Tuesday afternoon some beam reference measurements were made, including verification measurements on an oxygen beam to show how low transmission is for some accident scenarios (checked beforehand with RP).

LEIR took beam on Wednesday. Despite uncertainty as to the Linac energy compared to before the switch-off, beam could be quickly injected.

In the afternoon the power glitch knocked out quite a lot of equipment, and it took 1.5 hours to get the RF back and running.

On Thursday, the excellent source performance, coupled with a Linac tune up lead to >35uA out of the Linac.

LEIR (N. Biancacci):

- No beam until Wednesday 10/8 (no resources available)

- Wed 10/8: beam back, commissioning of EARLY beam restarted.
  - ER.ECNSC20 circuit frequently in fault. EPC informed and fixed the day after.
  - Tested a repaired power converter in the electron cooler.
  - Measurements for energy monitoring in LEIR restarted.
  - CRF41 is the operational cavity.

- Thu 11/8: EARLY beam commissioning finished
  - Stable Linac3 operation.
  - Beam at specs (50% inj. eff, 90% in-cycle transmission, 100% to EE).
  - Regulation on EARLY quad circuits improved.
  - LLRF settings updated.
  - Commissioning of NOMINAL started.

- Fri 12/8: NOMINAL beam commissioning up to extraction of 9e10c.
  - Stable Linac3 operation.
  - NOMINAL beam setup for high intensity (~14e10c accumulated / 9e10c extracted).
  - RF capture optimization with double harmonic.
  - Losses related to a regulation issue at flat top are followed up by EPC.

- Extraction of 9e10c on average until Linac3 Tank3 failure on Sat 13/8 at 18h00.

PSB (C. Bracco):

The Booster last week had an availability of ~96%.
Downtime was mainly dominated by no beam from Linac4, the electrical glitch that occurred last Wednesday and a few trips of power converters. We profited of the stop due to the glitch to perform the reboot of the H0/H- FEC, after the installation of an ADC card to allow logging the H0/H- OASIS signals.
The faults on the H0/H- monitor of last week were reviewed and it was clarified that 3 out of the 6 registered were not due to the monitor (rather to losses due to POPS and problems from the Linac) and, in the remaining cases, the interlock was correctly triggered by the monitor of Ring 1 as an effect of the steering of the beam at the foil

and some non-intercepted H- ions. The behaviour observed a few weeks ago in Ring2 hasn't reappeared since then.
ISOLDE now regularly operates with both the 1.4 and 1.7 GeV cycle and the switch between the two is in general smooth. At some occasions, the magnets in the line (especially quadrupoles) tripped when operating at higher voltage.
Fine adjustments were applied to a clone of 1.7 GeV ISOGPS, both from the longitudinal and transverse point of view, and intensities of up 780E10 protons could be reached with no major losses along the cycle. This clone was then mapped on the operational STAGISO.
On a positive note: the Isolde beam at 1.7 GeV was finalized and new optics uploaded; EPC successfully tested the BVT.BVT101 and BTY.BVT116 power converters at higher current. Everything is now ready for the 1.7 GeV tests starting this Monday.

Otherwise, we provided the usual beams for physics and MDs..

ISOLDE (E. Siesling):

GPS:

A very good week for ISOLDE with the main focus on the 1.7GeV beam from PSB sent for the first time through the BTY line to the ISOLDE GPS target.

The new optics were calculated by Matthew Fraser (ABT) and implemented by Gian Piero and the PSB OP team. At our side the TISD (Target and Ion Source Development) team took over the machine and Sebastian (Rothe), Simon (Stegemann), Mia (Au) and some of their students started an ambitious program probing the yields for a whole range of isotopes in the nuclear chart from lower to higher masses for the two energies: 1.4GeV versus 1.7GeV.

Each change required the RILIS laser ionization scheme to adapt as well for the next isotope and the ISLTRAP setup was involved for some of the measurements as well.

The collaboration with the booster was excellent and our gratitude goes to Gian Piero, Jose and the whole team who together with Matt set up the line and switched each and many times this was asked for by the TISD team.

Observations (as reported by Simon Stegemann TISD team):

'The first impression that we get from online analysis of the above-mentioned isotopes is that the yield increases with the higher energy as expected. Moreover, the 1.7/1.4 yield ratio seems to match remarkably well model predications for many of the tested isotopes (again, for an online analysis). We have also the impression that the higher proton beam energy affects the isomeric ratio in some indium isotopes that we tested, but this remains to be confirmed offline. '

A short report on the tests and findings will be mentioned during the FOM this Tuesday by Karl or Simon.

RP (Fabio Pozzi) has done measurements at several points in the hall with a 1uA proton current to evaluate the effect and difference in radiation levels when taking 1.7GeV. On Monday beam profile tests will be done taking one single pulse at resp. 1.4 and 1.7GeV on foils installed on the GPS irradiation point.

All important steps towards a possible BTY line upgrade to 2GeV.

Tests will continue until Wednesday. The 1.7GeV option will surely be asked for again during the remaining of the run for more MD's.

HRS:

On HRS a few tests were carried out earlier during the week and has been in standby since Thursday, ready for a target change on Monday.

No serious technical issues. The proton beam was lost a few times due to issues at LINAC4, PSB and power cut.

At GPS we have an issue with small separator magnet instabilities which will be addressed by TE/MSC as soon as the 1.7GeV tests are over (as of Thursday).

More serious is a problem with the GPS beamgates. With tapestation delay times for beamgate opening close to the 10ms proton beam trigger a jitter introduced by the beamgate cards starts messing up the measurements. Simular issue is observed when the beam is send to ISOLTRAP for beam analysis tests at 1.7GeV. Collection times below 10ms start to have serious issues due to jitter on the beamgate opening pulse. A workaround has been put in place similar to what we have in place for the HRS beamgate with manual control for both the GPS Main and User beamgates from the ICR.

REX/HIE:

Due to the magnet quenching two weeks ago the EBIS magnet is running at lower current (90A instead of 116A) leading to a lower production (as described in the earlier reports). The 90A seems to hold but there is surely an issue and He needs refilling often. The EBIS problems will be addressed during the coming YETS. It might be concluded that it needs replacing for its twin EBIS.

During the week the EBIS He level indicator got stuck. Fredrik Wenander found a workaround in installing a He flow meter from which the level can be retrieved.

HIE SRF instabilities being addressed by Daniel Valuch during the time we are on idle before the Miniball run will start (wk36).

All in all a very fruitful, interesting and exciting week at ISOLDE with minor issues.

PS (M. Fraser):

PS operation was smooth this week with just a few power converter trips that required PIPO or expert intervention.

During the L4 stop on Monday various basic interventions took place, most notably a reduction of the cooling water flow to PE.SMH57 to increase the temperature of the chilled water and reduce the chance of condensation forming on the device.

Although radiation alarms at injection were thought to be linked to the functioning of FGC ECO mode of the BTP line they continued during the week. The current regulation of the SMH42 was adjusted in a new release of its FGC firmware, which was carried out during the aftermath of the electrical network glitch on Wednesday. The update allows the maximum value of 32 kV to be reached. The radiation alarms at injection are far less frequent now, but still not understood: the PS operation team would benefit from the installation of independent DCCTs for critical FGC devices that can be monitored on the same scope as beam signals and other devices.

Missing pulses from KFA71 still persist and ABT have linked the problem to communication between the system's FEC and the pulse generators. A 30 minute beam stop will be needed this week to reboot the system.

Turn-by-turn measurements were attempted on the BGIV but one of the valves on the gas injection system was found to be faulty, with radiation damage expected to be cause. A spare valve exists and is planned to be installed in ITS2. Studies continue with the BI team to find ways of increasing the signal level on the vertical BGI and compare with the wirescanner.

The internal dumps give a warning now that the MTE intensity (at almost 2.3e13 ppp) exceeds the intensity used to commission the internal dumps with an LHC beam at 26 GeV. Discussions are ongoing with SY-STI to follow this up, either to ignore the warnings for lower energy beams (14 GeV) or to deal with the warning on a PPM basis based on the maximum possible energy on any given cycle.

During an intervention on the converter the F61.BHZ01, which tripped on Thursday afternoon, the converter on F61.QFN03 ended up not pulsing and in a state "ON_STANDBY". The ON_STANDBY state is not selectable from the Working Set, so it is confusing how the FGC ended up in this configuration. This was hard to spot in the Working Set (it looked ON and green) and delayed the beam being returned to T9. To fix this, the ON_STANDBY field will be added to STATE.PC_SIMPLIFIED so that we can colour it orange as a warning in the future.

The OP team continues to optimise and reduce the longitudinal emittance of TOF at transition crossing to permit the extraction of 28 ns bunches without satellites.

Finally, some interesting MDs were carried out. A slow extraction was made to the East Area driven solely by TFB excitation and with no ramp of POPS (an

application to control the extraction rate for CHIMERA). A first test of the barrier bucket implemented on MTE was successfully delivered and accelerated by the SPS. The splitting efficiency on MTE was successfully controlled overnight with software optimising continuously the TFB excitation frequency and tune, avoiding the drift seen on the operational beam.

AD/ELENA (L. Bojtar):

We had a relatively good week, with a few problems.

- Tuesday the AD ejection synchronization went unstable for unknown reason. After many attempt from our part (Pierre) the issue was fixed by the RF expert.

-During the Wednesday MD there was an optimization of the AD target position along with a higher horn current. We left the AD horn to pulse at the higher current after the MD close to the maximum.

- There was an optimization of ASACUSA optics also during the Wednesday MD.

- We had a power cut on Wednesday, many equipment went down, but we recovered without major difficulties.

-Starting from Saturday night the AD horn started to go down regularly. The CCC couldn't restart the horn and couldn't find any specialist neither. I went in to restart it locally, but the system is password protected so couldn't do much. Finally we called the ABT section leader Thomas Kramer, who found a person Sunday morning to restart the horn. It was working fine for a while, but started to go down regularly again. I put back the original tension we had before the Wednesday MD and also the previous AD target position and since it remained stable.

SPS (K. Lee):

A fine week for the SPS with an overall availability of a marvellous 87% and an excellent performance in beam delivery. The machine profited from the highly stable operational conditions. The focus was on the beam delivery for the North Area physics programme at the highest possible duty cycle for a record yield in NA physics production (> 33k shots). The machine was running at total intensities of 4e13ppm close to the limit of stability. Some re-steering at injection using 3C bumps in H and V in an attempt to optimise the MKP vacuum was done right at the beginning of the week. Sporadic optimisations in tune and chromaticity, voltage programme, injection phases and damper fine delays brought an enhanced beam stability with transmissions around close to 97%. Vertical emittance are currently in the range of 3.9/4.4 um in H/V. Splitter losses are acceptable. A test with lower emittances could be attempted in the near future but will need to be well coordinated with the pre-injectors as preparation time will be needed.

LHC has been taking 5 x 48 bunches for a total of 2173 bunches at 1.25e11 ppb up to Thursday. Since Friday the LHC is taking 2413 bunches at intensities around 1.05e11 ppb in order to be able to cope with the cryo limits of the machine. Emittances remain low around 1.5/1.3 um in H/V before acceleration in the SPS. Filling has gone stably and reliably without major problems all along the week.

The overall stability and reliability of the machine has been good despite several tests which were conducted throughout the week.

Wednesday there have been dedicated MDs taking place in the SPS. In fact, three dedicated MDs had been scheduled in parallel, which turned out not to be compatible. After some coordination efforts, two MDs could be retained in a semi-parallel mode, whereas the high intensity BCMS MD had to be canceled due to the risk of damaging the crystal used for slow extraction in one of the MDs. Hence, crystal channeling and barrier buckets could be tested in the SPS. Barrier bucket bunched MTE beams were sent to the SPS for the first time on Wednesday and were taken through the full SPS cycle just before slow extraction. Results look promising but further optimisation is now needed in the PS.

On Thursday, dedicated filling of the LHC was tested with a series of 30 injections of pilot bunches. Timing and software processing limits were identified and can now be followed up. Apart from these limitations, filling went smooth, fast and efficient.

On Friday, the commissioning of the primary beams was done after the replacement of the TBIU which was completed in the previous week. Position and angle scans showed that, a priory, no limitations on the primary beams in the EA are expected from the new position of the TBIU. The BSM has been realigned to the newly found reference position. An optimiser is now under preparation to help further improving the beam trajectory. A second commissioning run will need to be planned for the beginning of October. Wobbling changes seemed to have a slight impact on transmission; though not and issue for the moment, this still needs to be understood.

Other than that, there have been sporadic issues and faults. To be mentioned are the loss of the search boxes in TAG41 (AWAKE) which had somehow propagated to TAG42 and led to a beam dump in the LHC and a loss of sector 81. The issue was linked to a hardware problem of the access system (security cards) and could be fixed. The other major fault was a problem with the MKD IPOC which required an expert intervention on Monday night. On Sunday, oscillations on MDSV.2111 were observed; this will need an intervention by the first line on Monday. The visual inspection of the crab cavity cryogenic system was done in the shadow of the LINAC4 source intervention on Monday, hence all should be ready for the crab cavity MD in 3 weeks.

LHC (J. Wenninger):

On Monday morning the injected train length was increased to the nominal length of 240 bunches with 1935b in the machine. The same day the number of bunches was stepped up to 2173b. Among the first fills with 2173b two fills were dumped by UFOs at the TCL6s in L5 and R5 and two fills by UFOs in 13R6 and 25R8.

Tuesday night another training quench of the RBs occurred in S56 just 5 minutes after a beam dump by an RF fault, quite similar to what happened last Sunday after the electrical perturbation. This is the 3rd time this sector quenches within an interval of ~15 minutes after a beam dump. On Sunday morning RB 56 had yet another training quench!

On Thursday evening the RF group decided to replace the klystron on module M1B2 after another fault (that could be reset). All the cables and controls parts had already been exchanged during an access on Wednesday. The intervention lasted the entire day of Friday (11 hours beam to beam). The first fill after the RF intervention was with 2413 bunches at reduced bunch intensity (for cryo heat load). The first fill was dumped by a UFO in 23L2, the second by heater firing on RQX.R1.

UFO dump count: 21, UFO quench count: 1

Training quench count in 2022: 4 x S23, 1x S34, 5 x S56, 1 x S81.