

Accelerator Complex Status

End week 22 (Tuesday 7 June 2022)

Technical Infrastructure (Clement Pruneaux):

Statistics:

- About 3'500 alarms.
- 632 phone calls (437 incoming, 195 outgoing).
- 82 ODM created.

Events worth mentioning:

- Thu. 02.06, Stop of building 201 cooling station and Meyrin Compressed air production station. A loss of communication caused by a faulty "sitop" on the PLC controlling the cooling station is the origin of the problem. Several users affected on Meyrin site.
- Sun. 05.06, Sudden drop in SF2 cooling tower level. No impact on LHC beams conditions. A faulty valve on "filtre doucet" was stuck in open position. Fixed by TI operator helped by piquet on call.

Details: <https://wikis.cern.ch/display/TIOP/2022/06/07/TI+Week+summary%2C+Week+22>

LINAC 4 (Jose Luis Sanchez Alvarez)

There was a good beam availability of 98.9% this week at Linac4.

The three main events were:

- On Tuesday: Modulator CCDTL3-CCDTL4 tripped (12 minutes downtime)
- On Wednesday: PIMS05-PIMS06 Klystron interlock vacuum. HLRF piquet intervened to restart an ionic pump (87 minutes downtime)
- On Saturday: Modulator DTL1 tripped (15 minutes downtime).

PS Booster (Alan Findlay):

Overall not a bad week for the PSB with almost 97% availability.

On Tuesday the compressed air failure in the CPS complex closed our beam stoppers for approx. 50 mins starting around 19H20. Then on Friday afternoon, our distributor dropped out around 14H20, requiring the piquet to adjust some internal thresholds, bringing it back on line after about 1hr 20 mins.

We took advantage of the agreed 15 minute slot on Tuesday at 14H00 to release the latest version of the LL firmware onto R4 (only). This went well and we no longer have issues with corrupted data in the cavity compensation tables, or with open gap time out errors. We will work out the best time to release these updates on the other rings.

We have noticed that we still have other issues with the R4 cavity voltage regulation, which gets worse with intensity. These would have been hidden behind our other R4 issues up until now. We are now working to understand and solve these.

The very popular LHC25A_3eVs has been used regularly over the week and we have run it to the dump as small reliability run while not being requested by the PS.

The MTE beam was gently increased in intensity over the weekend, from about 1.7E13 to almost 2.1E13 extracted from the PSB. This took a number of adjustments but seems quite stable presently.

ISOLDE (Erwin Siesling):

A busy week with successful physics but also several major issues:

GPS:

Running with the #747 LIST target for Actinium beams to experiments at IDS, LA1 and GLM. The users have been taking beam as long as they could until Tuesday afternoon and very useful data was collected. Happy users.

Target was changed to a used #754 UC2C target for which the setting up will start as of tomorrow, Tuesday.

HRS:

Last Tuesday target #755 UC with neutron converter went on. Thursday afternoon physics started with protons only on converter producing Ag (silver) beams to the CRIS experiments. The run will last until Wednesday afternoon. Despite several technical infrastructure and machine related issues and a much lower yield than expected the users are happily taking data.

Three main severe issues:

- On Thursday evening CERN wide the compressed air failed bringing down the vacuum system for ISOLDE and the Cryo plant for HIE ISOLDE. All could be restored and beam was back for the users a few hours later. For HIE ISOLDE the SRF cavities luckily stayed at 4.5K even though all He went out of the Cryo Modules. Many thanks for the fast intervention of the Cryo Piquet! Daniel Valuch continued the SRF conditioning over the weekend and we are waiting for a (hopefully positive) report. The plant went down 3 times the last 2 weeks of which one was planned, the other two due to the compressor gear box oil pump and the loss of the CERN compressed air).
- On Sunday evening physics were stopped due to the ISCOOL RF Pre-Amplifier failing. It needed replacing for its spare (luckily we have one from Matthias Haase) after which physics at CRIS continued.
- Sunday night two Turbo Pumps in resp. the HRS20 and 30 sector stopped but could be restarted, then the HRS sector 20 and 30 vacuum gauges controller failed. It blocked the HRS physics. Changed the controller and physics could continue after a few hrs of interruption.

At REX:

- Investigations on the 7GAP1 RF instabilities/vibrations issue continues tomorrow (Tuesday) with accelerometer measurements on the structure and surroundings (Michael Guinchard EN/MME, Suitbert Ramberger, Cristiano Gagliardi SY/RF, ISO OP).

PS ():

It has been a relatively quiet week so far for the PS with an availability of about 93% since last Monday at 09:00.

Equipment-related issues:

- RF:
 - An access was organized on Wednesday morning in the shadow of the LHC access to exchange an amplifier on cavity C10-11 (1h30 without beam).
 - 10 MHz cavities tripped from time to time (C10-11, C10-36, C10-46, C10-56, C10-91), causing in particular the TOF profile to be off-center horizontally.
 - 40 and 80 MHz cavities regularly tripped when playing the LHC25 12-bunch cycle on Tuesday. We had to stop playing this cycle until the issue was understood (a value cut during a ppm copy of a function from the 3 to the 2 basic-period cycle).
 - The RF specialist was called twice on Tuesday night for both 40 MHz cavities (once due to the 12-bunch cycle above and another time later due to an amplifier trip) and once more on Saturday for C40-77.

- The PR.ADT power converter was changed by the Transverse Feedback specialist on Tuesday.
- On Thursday evening, a series of issues occurred in the PS complex (in total 3h30 without beam for certain users). For the PS:
 - The cavity C200-1 could not be restarted without tripping. We switched to the spare cavity and called the RF specialist, who solved the problem the following day.
 - Following the global compressed air issue in Meyrin, the septum SMH16 would not restart. the shift crew first looked for issues with the magnet or the power converter (there was also another septum fault at the same time in the PSB), and called the SY-ABT piquet and the power piquet. It turned out it was an external condition that had been triggered by a radiation alarm, which had switched the TT2/TFP safety chain to BEAM_OFF. This was not obvious from Laser (the related alarm was unmasked after this event) and it took about 40 min to diagnose the issue and recover normal conditions.
 - The 40/80 MHz cavities were not pulsing and the LL-RF piquet was called. He oriented us to the HL-RF piquet who performed a “brutal” hard reset that solved the issue (2h30 without beam for LHC in particular).
- SY-BI profited from the access for the C10-11 on Wednesday morning to investigate the potential BLM cables swap that was diagnosed by PS OP last week. The BLM specialist indeed found 3 BLM cables swapped (between BLM 83, 84 and 85) and corrected the connections.
- A trip of DHZ18.OC caused extraction losses on Sunday early morning. It looked initially like an extraction kicker issue but it was diagnosed and solved with a reset after 1h.

Beam-related:

- LHC:
 - The 12-bunch variant was prepared and optimised on a 2-basic-period cycle with the 3 eVs longitudinal emittance from the PSB to be used this upcoming Thursday by the LHC.
 - Following a request from the LHC scrubbing team, the shift crews checked the work and time needed to produce the LHC25 standard beam with one or more PSB rings disabled, when the LHC will request 12, 24, 36, 48, 60 or 72 bunches.
 - During Wednesday and Friday’s MDs, transverse emittance measurements were performed with the BCMS beam (with the standard PSB production cycle and with an optimised cycle to reduce tails) throughout the complex with intensity from 1.4E11 p/b to 1.9E11 p/b.
- EAST:
 - It was difficult to recover beam steering on T9 on Wednesday evening after a long stop (beam was last taken on May 24). This was solved during the night.
 - The IRRAD spill was asymmetric and off-center on Wednesday evening, but the experiment preferred not to make large modifications as they were taking data.
 - Some end-line steerings were done from time to time.
- TOF:
 - Some end-line steerings were done from time to time.
- SFTPRO:
 - Investigations on stability issues with extraction trajectories and splitting continued.

PS - East Area ():

No report.

AD - ELENA ():

No report.

SPS (Carlo Zannini):

It looked like a very good week for the SPS before the ZS issue occurred on Friday evening.

All along the week we accommodate the LHC beam commissioning studies. On **Monday** and **Tuesday**, we delivered SFTPRO beam with excellent availability. **Wednesday** was dedicated to MDs: empty bucket channelling for the SFTPRO beam and qualification of BCMS beam at operational intensity. On **Thursday** we had two short parallel MDs (PS-SPS transfer studies and TFB blow-up) and on **Friday** we had a long parallel MD to qualify the BCMS beam up to 1.8×10^{11} ppb. Friday evening the issue encountered with the ZS prevented to have beam for NA. The problem was solved on Sunday at 15:00. During the ZS down time beam was delivered to LHC (pilot/INDIV)

SFTPRO:

- intensity of 3×10^{13} protons. Sharing adjusted as requested by physics along the week. Work is presently ongoing to optimize the SFTPRO beam to accommodate the latest sharing request 25/80/135 units on T2/T4/T6. Starting from June 8th for two weeks NA asked to have a sharing of 50/80/135 units on T2/T4/T6. This request implies a significant intensity step (at least 10%).
- Optimization studies of the RF spill settings for the SFTPRO beam took place on Monday (to be followed-up with NA62 to define the best strategy).
- Low intensity on Friday afternoon (about 5×10^{12}) during the investigation of the ZS alignment.

It is worth mentioning that on Wednesday it was produced the LHC operational beam. Five batches of 48 bunches (BCMS beam with reduced tails from the PSB) were accelerated at flat-top with an intensity of 1.4×10^{11} ppb and an average transverse emittance of 1.3mm. On Friday 5 batches of the same beam were accelerated at flat-top up to 1.7×10^{11} ppb.

Main SPS issues of the week:

Already from a couple of weeks the sparking rate of the ZS was creating quite some concern. From Wednesday afternoon the sparking rate of the ZS further increased. Due to the anomalous behaviour of the device the experts performed an investigation of the ZS alignment but unfortunately the situation did not improve. A ZS Ion trap bottom voltage fault occurred on Friday evening (the device was not able to keep the voltage on the ZS2 bottom). All the experts made a great effort to solve the issue as soon as possible. Due to the high radiation level of the area a first access was possible on Saturday at 16:00. Several short accesses were needed to identify the root cause of the issue (some cables could not hold the voltage anymore). Finally, to fix the issue the 4 cables of the ZS1 and ZS2 circuits were replaced and beam was restored for NA on Sunday at 15:00. However, the ZS behaviour needs to be closely followed-up next week (there are still anomalies not fully understood).

Other Issues/faults of the week:

- Issue to restart cavity 4 (1h 10 min. downtime)
- MKDV vacuum interlock but no vacuum spike (20 min. downtime)
- MST yoke temperature fault (40 min. downtime).

SPS North Area ():

No report.

AWAKE (Edda Gschwendtner):

Restarted electrons and laser in preparation for proton run

Laser:

- Aligned marker laser and IR laser lines
- Checked synchronization of IR and marker
- Continued studying and testing equipment-safety interlock. Dedicated PLC was set up in 2016, but not used. Retracing lost knowledge.

Electrons: restarted beam and took several datasets

- data to update corrector response throughout the line (inconsistency w.r.t. YASP)
- data for ML studies (quantum annealing for sample-efficient learning)
- data for emittance measurement (quad scan) at electron spectrometer
- data for ICT calibration

Plan for week 23: proton run starts on June 8.

[LINAC 3 \(\):](#)

Commissioning.

[LEIR \(\):](#)

Hardware commissioning.

[CLEAR \(R. Corsini and W. Farabolini\):](#)

Last week was dedicated to the test of an Electro-Optical pick-up, based on the polarization rotation of a laser light when passing through a crystal submitted to the beam electric field (collaboration with the BI group).

The set-up has been installed last week and first results were promising with 5 bunch train clearly visible on the EO signal.

Unfortunately, after the week-end stop and also due to many klystron trips, the beam characteristics were different from last week. In addition, it seems that the delicate alignment of the EO-PU has been lost over the WE. The attempt to align it was not fully successful and decision was taken by the user to remove their set-up for performing a full check in the optic lab. Furthermore, the MKS11 was tripping more and more frequently - indeed the klystron has reached the end of its life (after 10 years and more than 30000 working hours), and the last two days were dedicated to its replacement by a spare. The conditioning of the new klystron has been conducted over the WE.

Two visits were also given, one for a future experiment by UP-UC3 (test of detectors for a laser wire scanner) and one for the students of a Barcelona design school driven brought by idea2.

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

First test collisions at 6.8 [TeV](#) were established on Tuesday with the VDM cycle.

The TDIS and TCLIs of both beams were aligned at injection. Very large angles (up to 1.5 mrad) were observed for thr TDIS, which may delay injection of trains in the next week. The collimators were aligned at FT, but the alignment had to be repeated manually in a second fill for some collimators as the automatic alignment failed. First ramps with tight collimators exhibits again the loss spikes and low lifetimes that were also observed in Run 2.

The linear optics was remeasured twice at 30 cm and was found to be reproducible. Non-linear corrections for the triplet were tested at 30 cm.

More fills with stable beams at injection (4b per beam) were delivered at the end of the week, with non-linearity scans in ATLAS and CMS and large range VDM-type scans in LHCb.