Accelerator Complex Status

End week 30 (Monday 1 August 2022)

TI (R. Ledru)

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Details:
https://wikis.cern.ch/pages/viewpage.action?pageId=200376349

LINAC4 (L. Timeo):

The availability of Linac4 during week 30 was ~99.8%. The downtime was mainly because of

- [~10 min] CCDTL7: a breakdown in the cavity carried the LLRF to push the klystron up to 1.2 MW output power. The klystron's impedance changed. The modulator current slowly dropped, while the HV increased until the modulator interlocked;
- [~13 min] EINZELLENS: three trips of the power converter (L4L.NFH.014). SIS cut the beam. Autopilot restarted the power converter. After unlatching the SIS, the beam operation restarted.

The source was unstable for some hours. The phenomenon is not fully explained but after having increased gas injection cured.

LINAC3 (R. Wegener):

After the power cut on Saturday 23 June a number of Linac3 systems had to be restarted or even repaired:
* source: oven was off a power ramp-up and re-conditioning was required
* source: Sairem2 amplifier was in HV fault, the HV power supply had to be checked/repaired and the klystron required HV forming for 1 day
* source: the Microwave generator was switched from Sairem2 (issues detailed below) to the spare Sairem1 generator. The time required to re-condition the source after the power cut and with the spare MW generator was about 2 days in total
* magnet power converters: many tripped and had to be reset/restarted/power cycled. On many FGCs the subscription had to be restarted.
* RF: tank 2 amplifier tube broken due to the power cut (filament in open circuit) and had to be replaced

A first, low intensity beam was back on Tuesday late morning. After a further oven power increase, the normal beam intensity in the order of 30 uA at the end of Linac3 could be reach on Wednesday afternoon.

As LEIR was not taking beam, Thursday and Friday was mainly used for some MDs and to work on the Sairem 2 generator:

* after the swap to a new klystron last Thursday (21 July) the nominal power level of 2 kW could not be reached, the maximum output power was about 700 W
* the new klystron was slowly HV formed again (1 day) but this resulted in same power limitation
* a new klystron configuration from the supplier (Sairem) was loaded into klystron control. This did not improve the situation
* all changes were reverted and the old klystron was re-installed into the generator. Surprisingly, also in this configuration there is the same power limitation now
* the issue seems to come from the LLRF drive or the feedback loop. Further investigations are ongoing.

LEIR ():

No LEIR operation as no resources.

PSB (F. Asvesta):

It has been a good week for the PSB with an availability of approximately 99%.

Our first stop (15min) was due to one of the power converters of the Qstrips on R4 that needed a reset as it was not pulsing resulting to different tunes in R4 that were degrading operation.

In addition, we had a couple of instances of high loss interlocks, once on an MD user (~10min) and once on ISOLDE (~3min), which occurred when they were introduced in the supercycle. In the first case, the settings for the injection turns were resent while in the second instance the situation resolved itself after a couple of resets of the BLMs. However, as the injection losses seemed to have increased over time, the injection trajectory was adjusted reducing them to approximately half.

Finally, on Sunday morning the operations were disturbed due to faults of the extraction bumper. The extraction kicker tripped three times and hence the experts were informed. Overall, this issue caused less than 30min of downtime.

All operational users were available as usual and a lot of MD studies were performed during the week.

ISOLDE (S. Mataguez):

A difficult week for ISOLDE with technical issues .

On REX-HIE , IS677 stopped with the 11Be4+ 9.78 MeV/u Tuesday morning. On Tuesday, REXEBIS quenched by itself after it was filled with LHe in the morning. In the afternoon, F. Wenander (in holydays) decided to refill the solenoid and to re-energize the magnet but the magnet quenched twice at

around 97 A.

On Wednesday F.Wenander decided to re-energize the magnet at 90A, instead of 116A, in order to allow us to deliver radioactive ions beam to ISS. We have then provided 27Na10+ since Thursday 28 July 2022 in the evening.

On Friday July 29th after an access to REXTRAP cage during the morning we have lost ~30% of the beam and, after many investigations, we could no go back to previous value. No explanations found.

PS ():

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AD/ELENA (B. Lefort):

Great news : absolutely nothing really relevant to report this week, the machines have been working like a charm.

The beam intensity was very stable and users seems very happy !

Tuesday 26th

E-Beam angle optimisation by Laurette to optimise 100MeV plateau

Wednesday 27th

Minor glitch of the kicker solved by Vasco and AD flat-top 4 reduced by 1s

Saturday 30th

ASACUSA 2 transfer line optimisation by Yann Dutheil

SPS (G. Papotti):

The SPS had been dreaming of going into a quiet, physics-producing, summer period, but was abruptly woken up by a vacuum leak at the T2 TBIu on Wednesday at 19:59, when a glitch on the T2 BEND1 preceded, and likely caused, a vacuum leak due to beam impact.
Thursday and Friday were devoted to preparing the intervention (eg. WDP, verification of the spare by BI, VSC, STI, CEM), but also waiting for a decrease of the ambient dose rate (initially 7-8mSv/h).
The removal of the installed TBIu is foreseen for next Monday August 1st, and the installation of the spare for Tuesday 2nd, in more comfortable ALARA2 conditions.
Vacuum pump down will follow and is estimated to take a day.
The power converter could be reset right after the glitch, and investigations were started by OP, EA and EPC to improve the interlocking in case of such failures (eg. reading the current more often than once per cycle).

A vacuum spike on the T2 TBId at the time of the event will only be investigated when beam is back.

At the beginning of the week, the SFTPRO beam had been improved mainly by reducing the PSB vertical emittance blow up and re-steering TT2-TT10.
This resulted in loss reduction in the transfer, at injection, and through the cycle, and allowed to increase the delivery to the targets slightly (T2-T4-T6 to 65-73-135 from 60-73-135).
The final aim of 80-73-135 will require further work and tweaks, and not only at the SPS (eg. PS RF experts).

LHC beams were provided for filling up to 144 bunches per injection.
The longitudinal blow up is not needed for stability at the SPS, but was noticed to be active due to leftover settings for higher intensity.
It was then gradually reduced in steps along the week in agreement with LHC OP.

AWAKE received 1-2-3e11ppb as requested, and could profit from increased machine availability starting on Thursday due to the missing SFTPRO cycles.

The MDs achieved nice results.
The long parallel MD with BCMS beams was dedicated to studying the behaviour of the MKDH when reducing the bunch length at flat top, and indicated that, depending on beam intensity, there is a hard limit on the available bunch length due to MKDH interlocking spikes.
Five batches of 48 bunches of 1.7e11ppb could be brought stably to the flat top.
During the studies, the MKDH and the MKP tripped twice each.

The MD on empty bucket channelling could provide and measure significant suppression of the 100~Hz with both 200MHz or 800MHz.
Further analysis including data from NA62 will follow.

The parallel MDs featured:
- chromaticity scans, eg as a function of the chromaticity knob;
- energy matching studies for pLHC and pFT (this matched to a transfer frequency of 199.948MHz);
- the transfer of the barrier bucket PS beam could be optimised to achieve similar losses as the operational beam (even though with lower intensity).

The frequent 200MHz cavity 4 trips are due to reflected power, and ceased with the absence of the SFTPRO cycle.
Work is ongoing by RF and OP to reduce the number of manual resets.

Of note also a vacuum “glitch” in TI8 at the end of Friday night, not fully understood but possibly due to some element outgassing (but not related to beam loss); operation could continue after vacuum piquet checked and opened back the valves.

The plan for the incoming week, other than the T2 TBIu exchange, includes:
- increase of the intensity per injection for LHC to 192bpi;

- available MD time on Monday and Tuesday. This is preliminary allocated for: the continuation of the past Wednesday MD on LHC BCMS beams, investigations on the AWAKE 3e11ppb instability, possibly further studies on the barrier bucket and empty bucket channelling.

LHC (J. Wenninger):

During the night of Monday to Tuesday the condition of RF line 8B2 degraded further, preventing even the ramps with 900b due to circulator arc interlocks. The circulator condition was investigated during the access for FASER/SND on Tuesday. The presence of real arcs was confirmed (not an interlock system issue). On Wednesday the circulator was inspected, ferrite debris were found in the circular which was cleaned. After cleaning the line could again be operated at full power and high intensity operation resumed.

The 900b intensity step was completed on Thursday, but it took 7 fills to integrate just 19 hours of stable beams. Two fills with 900b were dumped just as the beams started to collide on "slow" (5-10 seconds) losses from B2 in point 7, even with a monitor factor increase on some BLMs that were interlocking below the reference power loss of 200 kW. Eventually the issue was traced to a high beam 2 vertical tune using the classical tune peak search (Qv ~ 0.323 instead of 0.32). Together with high Q' (20) and high octupoles, the tune spread when arriving in collision was probably too large.

One of the 900b fills was dumped by a UFO in 31L2, another 900b fill by a UFO in 27L8 .

On Friday the number of bunches was increased to 1200. The first three fills were dumped by UFOs in 31L2 (after 6h), in 12R1 (after 4h) and 22R6 (flat top). The 5th fill ended with a quench of RB.34 (B12R3), a sector that was trained to 7 TeV. On Sunday the step to 1550b was taken. The first fill was dumped on a temperature interlock on the TCLIA in point 8, most likely a fake signal. Threshold increased to 70C, and first fill with 1550 bunches and 144 bpi. The second fill with 1500b was dumped by a large UFO in 11R1 that also quenched RB.12.

A new tune peak fit was designed - based on a gaussian fit of a broad peak - which is in the process of implementation. This fit provides a more reliable and less noisy tune estimate. It is now used to fine adjust the tunes before going into collision.

Training quench count in 2022: 3 x S23, 1x S34, 2 x S56, 1 x S81

UFO dump count: 11 , UFO quench count : 1