Accelerator Complex Status

End week 25 (Monday 28 June 2021)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 10'500 alarms.
- 773 phone calls (504 incoming, 269 outgoing).
- 104 ODM created.

Events worth mentioning:

- Tue. 22.06:
    - Leak on the roof of the CCC, caused infiltrations in the CCR, above the racks.
    - SEQ4 compensator tripped due to a high temperature. An intervention was ongoing at the same time, and unfortunately the switch over of the pumps took too long and was sufficient to reach the limit of the trip. The procedure was reminded to the contractor who did the intervention.
- Wed. 23.06: The lift of the booster was unavailable for a good part of the morning, hard to diagnose, but solved by the contractor at the end of the morning.
- Fri. 25.06: Many safety alarms in the SPS, piquet contacted and after investigation it was found that the order came from a safety button that had been activated by the SPS control room. Will be looked into during the week how to avoid this in the future.

Details: https://wikis.cern.ch/display/TIOP/2021/06/28/TI+week+summary,+Week+25

LINAC 4 (Federico Roncarolo):

it was a very smooth week at LIINAC4

- On Wed morning (in the shadow of PSB-PS access):
    - SY-EPC intervened on the controls of L4L.RLF.121,
        - changed an FGC Ethernet connection to understand why the replacement of a cable during the previous access (cable that was later validated in the lab as fully functional) mitigated a problem with SIS faults due FGC communication.
        - Transparent to operation before an after the intervention. No SIS faults of this type occurred last week
    - SY-RF intervened on the PIMS 11-12 klystron to change an HV cable (for klystron internal vacuum pump) suspected to be the source of (various) spurious vacuum interlocks in the last few weeks
        - on Thu there was another of these interlocks
            - SY-RF re-opened the klystron to tighten the HV cable.
                - No further interlocks since then
- Fri 3a.m.: SIS interlock generated by Einzel Lens Voltage out of tolerance. 5 min down time
- Sat 1.30 a.m. : SIS LEBT triggered for all LIFETIME counters. 10 min downtime, cause under investigation by SIS expert, likely only a glitch in the data (UCAP?).

PS Booster (Fanouria Antoniou):

Interventions

- On Wednesday morning we had the **QFO161 intervention**. When the experts went in, they saw that the magnet was already leaking. The magnet was fixed in situ with a soft brazing, as decided during the FOM. This fix should now hold at least until the YETS. The magnet group will check the status of the fix whenever possible, in the shadow of other interventions.

- In parallel to this, **several other interventions** took place as well:
    - RF experts tightened the end caps of the purging valves of the Finemt cavities.
    - BI experts rechecked the cables of the BT.BPM40. The ringing observed on these BPMs is now solved and was related to some bad connections.
    - BI experts changed the head amplifier in BCT8L1 in R3, which **solved the injection watchdog issues** we had when low intensity cycles were following high intensity cycles. The same solution will be applied in the other three rings, whenever there is an opportunity for an access in the machine (~2h needed).
    - Investigations on the H0/Hm monitor signals proved that indeed there is noise in all four rings, clearly correlated with the kickers and the distributor. This will be followed up by BI.
    - BI experts did an access on the **LIU WS in 4L1** and found a **mitigation** on the BE.DHZ and BE.DVT 4L1 **interference towards the BWS PMTs**. The profiles now look very nice!

Main fault of the week

- On **Saturday morning, the beam operation was interrupted for 5h40min** due to a trip of POPSB followed by a WIC interlock. The EPC expert was called and after a first investigation he suggested that this was a magnet issue. The magnet expert was then informed and initially thought that this could be related to QFO161, so he decided to go in the machine and check. Fortunately, no problem was found related to QFO161. Trying to restart POPSB, still the WIC interlock was there. The WIC responsible and the EPC expert worked together and finally, found out that for some unknown reason Bdl and Qstrips were OFF. After switching them back ON the POPSB could finally be restarted. It is not clear if the root cause of this problem is the WIC or POPSB. A discussion will be organized with the experts to follow this up.

Investigations and studies

- Investigations continued on the understanding of the sudden loss of the simulated B-train which continue causing sporadic issues with beam losses. The experts are following this up and currently working on the debugging of the FESA class.
- Studies related to the beta-beating measurement and correction during the fall of the injection chicane and the impact on the beam brightness continued.
- Injection painting optimization studies for minimizing losses on the ISOLDE beam continued.

ISOLDE (Eleftherios Fadakis):

It has been a very productive and exciting week at ISOLDE.
The facility has been performing very well and delivers a plethora of isotopes to the users, for physics (Ag: 99, 100, 101, 102, 106, 108, 109, 112, 113, 114, 117, 120, 122, 123, 125)
Unfortunately, the initial goal of reaching 129Ag wasn't reached due to some serious contamination issues around 122Ag and they then went neutron deficient, but the target was not ideal for that.
Main highlights of the week:

- Tuesday, OP did a proton scan, using 26Na, with the new tapestation.
- Wednesday, OP provided stable beam to the CRIS experimental station.
- SY-STI performed yield measurements on the new tapestation
- Thursday Users started physics

For HIE-ISOLDE things have been somewhat worrying.
Regarding the SRF. We performed some analysis of the trips of the SRF and they are far from ideal. D. Valuch has tried his best to stabilise the cavities and it was achieved in great extent on Thursday. Over the weekend all cavities were quite stable but 1 cavity in cryomodule 2 and 3 cavities in cryomodule 4 are not stable enough for beam delivery.

PS (Frank Tecker):

The PS had an eventful week with around 82% availability but with good progress for the various beams.

The week started with a power converter problem of the PFW PR.WDNI which went down on Monday at 22h. The EPC piquet didn't manage to fix it immediately, tried to exchange it for a spare, which also didn't work. The problem was fixed in the morning by the expert who had to replace a broken measurement card. (12h25 downtime)

- The AD started taking beam: the beam permit was signed Monday but a problem on the AD side with the cycle synchronisation prevented beam first. Tuesday a specially prepared low intensity beam at 1% of the AD nominal intensity was sent to the AD without the target installed. The orbit was corrected and BCTs set up. On Friday the intensity was increased to 20% and later to the nominal AD intensity of 1400e10.
- LHC and SFTPRO beam were sent to the SPS as requested.
- A high-intensity LHC beam is being prepared, and the triple splitting works fine up to a bunch intensity of 2e11 p.
- Also a higher intensity SFTPRO version with 1e13 p was set up and optimisation has started.
- Furthermore, the intensity of the TOF beam could be increased to 600e10 without excessive losses with careful adjustment on the longitudinal side.
- Work on the setting up of the EAST cycle continued. The PFW functions were prepared, tune and chromaticity measured.
- During the weekend, a large series of tune and chromaticity measurements was performed on a low energy cycle to study the effects of all different PFWs.

An access on Wednesday morning in the shade of the quad water leak repair in the PSB was done for survey measurements (TT2 around BPM106), investigations of BLM noise and cable routing checks, WS motor noise investigations and other works. Another shorter access was needed for repair of the 10MHz cavity C86 on Friday morning.

Very interesting results could be obtained in BGI studies: A vertical bump (negative 2 - 5 mm) at BGI82 avoids losses and BGI glitches/saturation. A single-turn measurement every 2 turns at injection on LHC25 with a low intensity bunch (PSB R3) at about 50e10 could be done using online mode and gas injection. The measurement requires low intensity to avoid events piling up in the online mode and it was not possible to measure every turn.
You see a clear oscillation of the beam size over the turns when you mismatch the injection by changing a quadrupole in the injection line, filamentation takes ~250 turns.
For the nominal injection, there are no significant beam size oscillations and there is also no obvious blow-up of the beam size from non-closure and power converter ripple of the injection bump.

AD (Laurette Ponce):

AD target:

- First beam in FTA on Monday afternoon, steering measurments, some optics checks performed with proton beam. RP checks with nominal proton beam intensity on Friday.
- Horn pulse tests performed in parallel of proton beam checks, first version of the controls application deployed by OP (Inspector).
- Plan to insert the target on Monday.

AD Ring

- Lots of progress on LLRF tests: Finemet cavity control, samplers and OASIS signals. Tests of RF segments postponed to this week

- Pulsing injection kicker with injection timing, some timing problems on the extraction kicker to be investigated this week
- e-cooler filament switched ON and DC electron beam produced, pulse tests postpone as AD was cycling with short cycle for the FTA line commissioning.

ELENA (Laurette Ponce):

- No Hminus operation
- Bake-out of injection line completed, lock-out electrostatic elements removed on Friday
- Preparation for the Hminus restart
- Plan to condition ion switch on Monday and resume Hminus operation Tuesday

SPS (Francesco Velotti):

The SPS W25 was a very productive week, despite the main issues countered. The main plan for this week was: setting up of 800 MHz, multi-bunch acceleration and steering on the TT20 targets. In short, 3 batches were accelerated to flat top, 4 batches to about 300 GeV, 800 MHz roughly commissioned and beam sent to the targets but still without symmetry. Still more work is needed to consolidate and terminate them all.

The week started with some intermittent issues on phase pickup. The root cause of this is clear yet but RF experts are working on this to try get to bottom of the issue. RF interlocks were finally deployed in operation, even though some still do not work (FFW, etc.). Most of them are ready and started a reliability run before physics starts. Longitudinal blow up was integrated in LSA. Before the night-long stop of the PS due to PFW, we achieved one of the first milestones: 11 PSB rings were accelerated to flat top (440 GeV). Here we observed severe longitudinal instability with lead to some spurious dumps over the ramp due to losses.

The EPC team kept working until Tuesday on the final resolution of the issues with noise and regulation. This terminated on Tuesday morning leaving the system in a very similar state as pre-LS2 and now the harmonic correction of the spill with the QF circuit is in place and tested with operational applications. In fact, even the automatic correction of 50 Hz was tested and showed to work as expected. Large noise observed on the BSI - follow up needed. Still on the mains side, an investigation to understand the issue with SMD12 took place and a few tests to attempt to fix the issue were attempted but without success: the ramp down from 450 GeV still makes the regulation go unstable leading to main trip. The EPC expert seem to have found a solution to this and aiming to deploy it on Monday morning. Work to prepare to allow beam in TT20 kept going for the whole beginning of the week. Magnets tests were finished on Wednesday and leak investigating showed an additional leak in TCC2 (a previous one was found next to the TAX after T6 already). This basically blocked the beam permit and the consequent extraction until Thursday morning. Additional work on the optimisation of the damper settings for the SFTPRO cycle took place.
On Thursday, TT20 was closed and petrols done. The first issue encountered were the ion splitter left in beam erroneously. Then one and one corrector needed the first line intervention before beam could be sent to TT20. At first, we could not get any meaningful signal from the grids after the TED, nor none of the BTV were working (missing FESA device and streaming not working). On Friday morning, thanks to the help of the BI experts, the BTVs were back in operation and, thanks to that, we were able to quickly get to the targets but still without symmetry. We were also able to find that the data we were using were the raw ones - switching to normalised data made the readings much cleaner but still missing info on data quality. To be followed up as symmetry is needed to had over beam to secondary beamline experts.

On the LHC multi-bunch side, the commissioning of the 800 MHz took place, first all the loops were closed without beam and then phasing was done using a single bunch (PILOT beam actually, which is

also the beam that will be used for LHC tests). Once ready, the 800 MHz showed to be the main player to stabilise the beam during the ramp and at flat top - thanks to that we were able to cleanly accelerate 72 bunches to flat top. This also showed to be beneficial for the vacuum activity on the MKDV. Looking at the acceleration of 72 bunches with 1x10^11 ppb, it was fund that the an instability seen was actually driven by the phase loop as the PU was saturating. Friday night was spent at flat top with 72 bunches. Between Friday and the weekend we managed to accelerate 3 batches at 440 GeV and 4 batches at around 300 GeV, before the issues with GSS and cavities kicked in. We managed to have about 4 hours of consecutive dumps at high energy of 2 batches and a full night with 3 batches dumped at high energy, in the context of the TIDVG commissioning. 4 batches were taken and accelerated to 300 GeV.
On Sunday it was decided to stop all high energy dumps following the request of ABT MKDV expert as access needed before they could be sure the switches are healthy enough to continue high intensity operation. Scrubbing at flat bottom is the plan for the evening.

Issues seen/solved:

- twice seen issues with WR and RF distribution: still not very clear to isolate the actual source of the problem between LLRF and WR
- BLM in TT10 spurious trigger investigated extensively and almost all of them solved except for the ones just at the end of TT10 were the kicker interference dominates the signal readings
- Added to the SIS: batch spacing for LHC and SFTPRO and clock selection for AWAKE
- Recurrent issues from Friday evening on GSS on MKDV1, 2 and 3. This may be something more serious and high energy dumps were stopped as of Sunday afternoon. Monday access to ECA5 needed to check switches.
- Cavities tripped on Sunday morning when attempting 4 batches acceleration and then longitudinal losses were blocking acceleration beyond 300 GeV. RF piquet called but decide to postpone intervention to Monday morning as moved to low energy scrubbing.

AWAKE (Giovanni Zevi Della Porta):

WEEK 25 SUMMARY: Laser out of order on Monday, came back on Wednesday, but another issue on Friday.
Electron beam studies and short accesses.
Accesses:

- Access System cabling intervention on TAG41 and TAG42
- CV short intervention interrupting TAG41 ventilation
- Maintenace puisard

Laser:

- One of the pump laser (ProPulse) amplifier flashlamps found not working on Monday. Replaced on Wednesday, and system working.
- Another ProPulse issue on Friday, this time with the oscillator. Solved with a few reboots, but it failed again after a few hours. Contacted supplier and asked for a spare system and new flashlamps.
- Replacement planned for Week 27. Until then we have no IR
- UV laser (for electron gun) is still working, since it does not need the Propulse

Electron beam: continued commissioning Method 3 optics optimization.

- Part 1: optimize quadrupole strengths to achieve desired size at the last BTV of the beamline
- Part 2: transfer optics from last BTV to entrance of plasma (~1m downstream) (requires improved measurement of initial beam parameters)

PLAN FOR WEEK 26: Access on Monday for CV and motors interventions in Laser Room. For the week we will be out of IR laser,
but we can continue with electron beam (commissioning new optics), and perhaps some alignment using the HeNe laser.

LINAC 3 (Richard Scrivens):

The report for Linac3:

- Beam measurements were made on the stripper foils and emittance measurements in the MEBT.
- On the source, tests were made of spare electronics, the charge-state distribution scanning software was tested. The source is running stably 24 days after the last oven refill.
- RF – Measurements on OCEM Modulator were made.
- RFQ – Multiple trips on Friday, the interlock levels for Final-Grid1 were opened up.

LEIR (Reyes Alemany):

Monday morning DSO tests, RF final checks, and the signature of the beam permit.
First beam expected early afternoon.

CLEAR (Roberto Corsini):

Last week was dedicated to:

1. LHC Cherenkov diffraction radiation button BPM measurements,
2. LHCb Photonic crystal tests,
3. measurements on a diamond Beam Loss Monitor.

All experiments were able to take good data. Towards the end of the week it was also possible to do some measurements on a micro-beam position monitor for IRRAD.
No major issues, a few minor ones being rapidly solved. On Thursday a problem with the control room air conditioning was signalled.

LHC (Jörg Wenninger & LHC Powering Test webpage):

S12	S23	S34	S45	S56	S67	S78	S81
CompletedSector @ 20K	Warm up for repair	**Completed**	**Completed**	**Training**	**Phase 1**	Room T	**Phase 2** Sector @ 20K
77 / 11950 A	29 / 11538 A	**71 / 11950 A**	**87 / 11950 A**	61 / 11488 A		69 / 11585 A	

Phase 1 powering in S56 almost completed. Powering paused over most of the weekend as too little tests available and training of S56 blocked by a quench heater PS. Two consecutive de-training quenches in S56.