Accelerator Complex Status

End week 28 (Tuesday 18 July 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 4'500 alarms.
- 665 phone calls (448 incoming, 217 outgoing).
- 113 ODM created.

Events worth mentioning:

- Wed. 13.07, SPS beam dumped due to a problem with a radiation monitor. TI intervention on-site: Breaker on the RP rack had tripped. Switched on by TI, RP was informed that the rack made a suspicious noise and that an inspection was required rapidly. To be noted that visually it was not easy to see the breaker had tripped, since it is blocked physically by the protection case (if one doesn't open the case, the breaker stays in "on" position although it has in reality tripped)
- Fri. 15.07, Evacuation set of during Beam Imminent Warning in LHC. Alarm seen for "Evacuation button" in the sector. Fire Brigade on-site, nothing abnormal found, and nobody present in the zone. Alarm was reset by the Fire Brigade.

Details: https://wikis.cern.ch/display/TIOP/2022/07/18/TI+Week+summary,+Week+28

LINAC 4 (Jean-Baptiste Lallement)

It was a very good week for the Linac4 with 99.8% availability and only two short beam interruptions. RFQ breakdown recovery on Monday (11 mins) and CCDTL 3-4 trip on Sunday (8 mins).

PS Booster (Alan Findlay):

Overall a good week for the PSB with over 99% availability, probably greatly helped by holiday season! There were no major issues that need to be raised.

There were minor issues without LHC beams, above all for R4. Small losses were noticed for R4 and the fix seems to be to move the tune change to be around 50ms later. This is a small loss, but the discussion continues as to why we need to move the tune change. It was also noted that R4 for LHC25A_3eVs (and the also the B user) was too large in H &V at 1.5 mm.mrad in both planes, when we expected closer to 1 mm.mrad for this ring. The ops teams worked to reduce the emittances by working on the injection, resulting in beams that were acceptable for LHC fills. This will be followed up in detail today.

ISOLDE (Simon Mataguez):

For ISOLDE it has been a good week.

On **GPS**, Target#754 Physics Collection ongoing until Target change to #761 (Friday morning)

On **HRS**, Target#654 VITO took stable beam to optimize position on their detectors. Since Wednesday evening, users took protons and have been running on 47K.

On **REX-HIE side,** Tuesday and Wednesday morning, SRF cavities have not been phased as an issue with the overheating of the REX RFQ RF amplifier with the dirt in the 20 degree mixed water system caused by a malfunctioning of the chiller station which took dirt accumulated over time in the buffer tank. The RFQ heat exchanger took off to open it up to clean out the radiators.

All SRF cavities have been phased and ready Thursday evening .
Friday 15 July 2022 evening first stable beam 22Ne8+ at 9.78 MeV/u has been sent to XTO2 (ISS – IS677) **for all weekend**.

Issue to be follow-up: QP array does load or very slow.

PS (Alexander Lasheen):
The PS had a good week despite the beam stop for access and the warm temperatures. The present availability is about 96% before any remaining faults until tomorrow.

The main event for the week was the beam stop and access in shadow of the SPS/LHC. The main items:
- The stop was planned initially on Wed 13/07 from 08:30 to 11:00. The stop took until 13:00 due to further investigations on the 20 MHz cavity C20-92.
- The C20-92 cannot presently be used following issues with the amplifier. The choice was taken to prolongate the investigations in the ring as a short circuit was found and required deep checks. The amplifier couldn't unfortunately be repaired in situ and will require a specific long access and material do exchange the full amplifier (possibly during TS). The situation will be followed up with the RF team, and the other C20-80 cavity will be used for LHC beams meanwhile.
- The POPS cooling tower was cleaned, following the cooling system fix earlier during the week (Monday, following issues last weekend).
- The broken power supply of the BHZ378 between the TT2/TT10 transfer lines was replaced (the spare was in use). This intervention was done later in coordination with the SPS as the replacement required specific access conditions, as being part of the EIS chain.
- The patrol was lost in the East Area (EA1 Sector 1). The procedure formally required 3 people (i.e. all the operators of CPS island), which caused concerns as beams were already delivered back to TOF and AD destinations. Eventually, 2 people were sufficient to patrol EA1 Sector 1, causing temporarily a high load on the remaining operator in the CPS island.
- No strong post-access hangover was noticed, and beam performance was good after the stop.

Along the week, multiple short faults occurred due to the RF cavities (mostly 10MHz) and KFA71, which were too short to be included in AFT (<2min with fast restart). The issue are being followed up together with the equipment groups. Notably, actions are already being taken for the RF cavities to investigate in details the root cause of the faults (mostly signal processing in new PLCs). The faulty module 6 of KFA71 was replaced during the week.

Regarding beams, the main follow-up point concerns EAST_T8, where intermittent drops in intensity were observed in specific moments during the week. The intermittent shots couldn't be correlated with any clear observable so far (super cycle composition…) and will be investigated further.

Finally, a highlight of the week was successful tests of barrier buckets on the SFTPRO beam, including synchronization to SPS and a frequency bump to steer the beam in an ideal region for the MTE splitting. The test was associated with observations of loss reduction on the diamond BLMs at extraction. Tests will be continued in the coming weeks.

PS - East Area ():
No report.

AD - ELENA (Lajos Bojtar):

We had a calm week in AD/ELENA. The issue with the QUAD-Main1 is still present, time to time it needs the be reset. Apart from a few resets of DR.BHZ and DI.DHZ6025 there was no major fault this week. We shortened the AD cycle by 8 seconds on 100 MeV/c making the e-cooling shorter. During the Wednesday intervention the amplifier of the RF cavity has been repaired and back now to the nominal voltage. After the interventions we noticed a trajectory change in the AD ejection line which we easily corrected and also shot to shot variations. The shot to shot variation has been traced back to a known issue, the ejection septum introducing coherent oscillations. This problem was known for many years and has been mitigated, but not fully solved. Never the less the stability of the ejected beam from the AD is good enough, so the users are not effected.

SPS (Francesco Velotti):

Good week at the SPS with 2018 average availability of about 82% at the moment of writing. The main downtime was due to the injectors and, on our side, the replacement of the transformer on SMD11 following the explosion of last week.
For this, it was agreed to postpone the dedicated MD to exploit the LHC access on Wednesday.

Performance:

- Intensity spike at the beginning of spill and uneven momentum distribution on SX beam fixed by changing the couples of cavities that are in counter-phase to each other. Additional configurations were tested but none of them gave better results
- Instability on the AWAKE beam which caused shots with larger bunch length studied along the week. Observed correlation with SC composition and it seems to be driven by the phase-loop. Instability is now gone, switching phase-loop off after injection and keeping only longitudinal feed-forward. Not clear why though at RF experts still looking at this. AWAKE observed still some issue on the 3e11 p bunch but not clear what the source is and if it is related to their instrumentation or really something coming from the SPS.
- Issue on the settings of the voltage jump found on AWAKE which caused the trips of cavities.
- Accelerated to about 115 GeV 2.3e11 p/b of 5 BCMS batches.
- 48 BCMS bunches of 1.2e11 p/b injected into LHC - basically loss free in TL and TCPs
- Short bunch length version of standard beam prepared for the LHC and delivered. Fill done and very low losses as well. To be followed up as this may help understand the issue in transfer.

Issues and modifications:

- Access on Wednesday to replace transformer on SMD11
- BLM on scraper moved away from beam pipe - to be checked if any visible effect on losses during high energy scraping
- Access system upgrade of PPS non-safety SW (various upgrades also of UI and touch panel)
- ZS generator fault seen over the weekend. Piquet changed it. This is already the second time in a week.
- RF4 continues to trip. More than 5 trips a day. Time dedicated to investigate potential issues given but still not solved.

Follow up for next week:

- Monday morning at 8:00 stop for NA (~1h) as EPC team has to inspect transformer on MBE as they suspect it may be the same family as the one it exploded
- Issue seen by IT on switch in BA80 - to be replaced. Access only possible via BA80, hence cool down needed before giving access. Can the MD be used as cool down? To be organised next week
- Losses in TT20 a bit larger than before. To be optimised.
- Start intensity increase on SFTPRO to reach 80:85:135 by the 27th of July.

- Cavity 1 repetitive trips over the weekend - piquet checked it but nothing obvious found. To be followed up.

SPS North Area ():
No report.

AWAKE (Edda Gschwendtner):
First week of the July proton run. Start-up, 3E11 instability investigation. Start of hosing studies.

Monday: Proton beam (2 extractions) from 1 to 8pm(minus 1.5 hours of LHC fill). Proton beam dedicated to studying 3E11 instability with RF experts: new working point found, but no conclusion. On AWAKE, issues (solved) with laser shutter and laser beam dump. Commissioning BI DAQ system.

Tuesday: Proton beam (2 extractions) stable most of the day. SPS RF experts continued 3E11 instability study until ~2pm, found a configuration without observable instability on on bunch length monitor. In the afternoon/evening, first attempt of adiabatic focusing experiments, but Rb density was too high, possibly due to cold spots

Wednesday: access (BTV filter, plasma diagnostic filter, laser beam dump position sensors, etc). Planned to attempt adiabatic focusing studies, but beam was mainly dedicated to LHC.

Thursday: Proton beam: 1 extraction from 10am to 7pm, then 2 extractions from 7pm to 11.30pm. Adiabatic focusing studies as a function of temperature in the first part of the day. Then attempted to set up eSSM at 3E11 to test the new RF working point, but could not find a stable configuration. This might mean that the 3E11 beam is not yet "stable" at the level of 2021: further investigations needed.

Friday: Access until 6pm to align Rb, recover laser lock, troubleshoot streak camera trigger. Stable 1E11 protons with 2 extractions from 6 to 10.30pm, until LHC fill started. Began hosing studies with 250pC electron beam.

Saturday: LHC scrubbing plan was initially to inject every 3 hours, but then changed to inject every 40 minutes, so we canceled the day program

Sunday: Proton beam (2 extractions) from 9am to 4.30pm, with a 1.5 hour interruption, then LHC started scrubbing again.
Continued hosing studies with 1E11 proton beam

Plan for next week: short access on Monday morning, long access on Wednesday. Continue hosing studies at different proton/electron charges, and potentially continue 3E11 instability investigation.

LINAC 3 (Detlef Kuchler):
Source and linac were running with excellent performance and stability. We had most of the time around 33eμA out of the linac.

There were two issues, Wednesday morning (40 minutes) and Friday morning (1h20). The chilled water that cools the demineralized water for the source solenoids was interrupted for some minutes which caused an increase of the source cooling water temperature which caused a trip of the source (we are operating at the limit of the cooling capacity).
After reestablishing the good cooling conditions the source was restarted but needed than up to an hour to get back to normal performance.

We got from the CV the info that they switched between the two available chilled water circuits to analyze and correct the faulty one.

LEIR ():

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CLEAR (R. Corsini and P. Korysko):

Last week was like the previous one mainly dedicated to the VHEE focusing experiment with Manchester University, plus one day for CHUV irradiation. In addition, some measurements on ChDR BPM studies were done together with BI colleagues On Monday the faulty charger on MKS11 was changed by RF, and we could restart wiht beam as planned. A circuit breaker on MKS11 was still giving problems from time to time, but was also changed by RF on Tuesday, and operation was stable since. Several beam size scans, both in air and in water, were performed for Manchester and several batches of gaschromic films irradiated. On Wednesday the irradiation of zebra fish eggs with CHUV collaborators was performed successfully, after which the Manchester focusing studies were resumed. During the week some beam time was also allocated to ChRD BPM studies and data were taken.

LHC (Jörg Wenninger & LHC Coordination webpage):

On Monday the 75b ramp up step was completed. It was followed by a 72b very low mu (0.005 pile-up compared with 30-40 pileup for normal fills), a fill that was unfortunately interupted by a **trainign quench of S23**. Following the recovery in the late evening, the first 300b fill made it to stable beams before being **dumped by a UFO in 21R2** on Wednesday morning.
After the access day on Wednesday, a change at the level of the TCDQ hardware led to a spurious beam dump of the following 300b fill. Access on Thursday to repair. This was followed by the second fill with 300b that lasted around 12 hours.
The BBLR / TCTW was successfully tested at 30 cm. A sign issue on the B2 compensation was corrected on the fly. The impact on tune and optics is small, as expected.
The direct dump BLM was tested Friday morning by shooting fat probes onto the TCDQ.
A 24 hour period on Saturday was dedicated to the validation of the scrubbing with reference fills, affected by a number of issues. A change of a control card on TI2 PC RBI.22134 led to a change of current of 6A in the circuit as the former card seemed to have had an offset. Important re-steering of the line was required. A fault developed on RF converter of module M2B2 on Saturday afternoon. Unfortunately the spare converter which was put in service late at night on Saturday, with different name and address, was not recognized by the RF control system delaying restart with beam. It took until Sunday afternoon to restore compatibility and switch on the module. Some remaining scrubbing could then be performed.

- **Training quench count in 2022: 3 x S23, 2 x S56, 1 x S81**
- **UFO dump count: 3**