Accelerator Complex Status

End week 19 (Monday 16 May 2022)

Technical Infrastructure (Jesper Nielsen):

Statistics:

- About 5'800 alarms.
- 776 phone calls (559 incoming, 217 outgoing).
- 132 ODM created.

Events worth mentioning:

- Thu. 12.05, Trip of electrical breaker EMD203*25 caused a trip of the Booster. The breaker was quickly switched on by the EN-EL piquet. After investigation it was traced back to being linked to a spurious reboot of protection relais. These are known to be troublesome, and are of a certain age (1996).
- Sun. 15.05, 2 consecutive electrical perturbations:
    - 18:24: Trip of POPS-B, and therefore a stop of the booster. PS cavities tripped. Confirmed by RTE as a perturbation on the 225kV line CORNIER-ST TRIPHON et CORNIER-RIDDES
    - 18:42 Another perturbation on the same 225kV line. Trip of RF cavities for Booster and PS, this time also some chilled water distribution pumps in BA3 tripped.

Details: https://wikis.cern.ch/display/TIOP/2022/05/16/TI+week+summary,+Week+19

LINAC 4 (Eva Gousiou)

The availability of Linac4 has been **99.1%** this week. The **1h35** downtime was due to:

- [1h10 hrs] **Vacuum interlock** on the **klystron** of the PIMS0506; the interlock was triggered by a power supply instability on the klystron vacuum pump and there was no issue with the klystron vacuum. It required an after-hours on-site intervention for the restart of the pump; the possibility of having a remote reset when an interlock is triggered without a vacuum degradation is being discussed in the klystron team.
- [2 x 10 min] Reset of a transfer-line quadrupole **power converter**.
- [5 min] **Chopper** trip.

PS Booster (Simon Albright):

Most of the week has gone very well, with a few noteworthy exceptions, which brought the availability down to about 85%:

- On the early hours of Thursday morning, an electrical perturbation brought down several power converters for 3h20m.
- On Friday, a problem with the HLRF cut the beam on a couple of occasions for about an hour each. The problem was related to an issue in the PLCs, which should now have been solved by a software upgrade.
- On Sunday evening, two more power glitches happened close together. The first brought down the main quads, which required PiPo intervention, and the second disrupted the HLRF, which required specialist support to fix.
- During the HLRF intervention on Sunday evening, a water leak was identified from the roof at the join between b.361 and b.37, where water was dripping onto a rack. This was found to be due to condensation from the chilled water distribution above, some of which was not dripping into the recovery tray. A solution has been put in place.

- There was a fault in the Ring 1 extraction kicker, which required piquet intervention and the ring was down for nearly 4 hours. The other rings were unaffected.

I want to extend a particular thank you to Davide Landre, who came on site late Sunday evening to solve the HLRF fault, and also to Cristiano Gagliara, who brought the water leak to my attention, which allowed it to be solved before it caused any problems.

Otherwise, it was a very calm week with a fairly standard schedule of physics and MDs.

ISOLDE (Emiliano Piselli):

HRS:

On Tuesday radioactive beam to ISOLTRAP and LA1, on Wednesday ion source studies from EN-STI.
On Friday target change.
On Saturday, following the failure of the GPS target we (thanks Alberto) have setup the beam to IDS. It took some time, but users could profit of it by late evening for all the night.
On Sunday I was called in at 11h30 from the users: they could not cycle the first separator magnet (mag90) to a low mass (8Li). Once at Isolde, I have set the magnet in current mode and not field regulation mode (thanks Lefteris). Anyway we were not able to pass the RFQ with such low mass and users decided to go to a higher mass (20Na) and they could get back beam. I was then called again in at 22h00 because the magnets got stuck. I did a reset on the power supply controller and it worked.

GPS:

On Tuesday we have setup the machine and we have delivered beam to GHM.
On Wednesday we have setup beam to IDS and they have started sharing beam with GHM.
On Saturday target broke and, together with Isolde physics coordinator, we have decided to setup HRS for the users in IDS.

REX-Hie:

Investigations on the instabilities f 7GAP1 ongoing, C.Gagliardi (SY-RF).
Cryo ok signal lost on Friday night for cryomodule 2 due to LHe level fluctuations caused by RF conditioning after working hours (D.Valuch). No 24 hours cryo coverage for Hie-Isolde.
We have send beam to XT01 with RFQ energy in order to test some beam instrumentation. We have found some small issues which are addressed to the responsible.

PS (Benoit Salvant):

It was a rather good week for the PS with an availability of about 91%.

Few faults affected the PS itself during the week:

- On Wednesday, POPS could not restart after a trip due to a thermal switch protection wrongly set to 40 C instead of 50 C. The specialist corrected this setting (50 min without beam to PS users).
- On Thursday evening, KFA45 required the intervention of the kicker piquet as two modules were down (1h15 without beam to PS users). One module was systematically bringing down the other when trying to restart, and that feature will be followed up by the kicker team during the technical stop.
- The electrical glitch this evening brought down several PS systems and the RF cavities required the intervention of the HL-RF piquet after he had finished working on the PSB (30' without beam after the PSB was back).
- The RF specialists and piquet were called several times on various C10 and C40 PS cavities throughout the week.

Otherwise, the PS provided beam to all its users (AD, EAST, SPS, TOF) throughout the week.

Following SPS requests, we worked together with the PSB to increase the transverse emittances of AWAKE (already used), as well as HiRadMat (ready for next week's run) and MTE.

The propagation of the corrections following the energy matching between PSB and PS was attempted this week, but led to large losses in TT10. It was decided to rework the PS to SPS extraction after the technical stop.

PS - East Area ():
No report.

AD - ELENA (Sergio Pasinelli):
Tuesday:
AD: Beam lost on 300MeV/c and 100MeV/c plateaux due to ECooler malfunction. The fault was located on the power supply which controls the cathode voltage of the Ecooler. The VCathode did not follow the requested reference. It was necessary to decrease by 300V on both plateaux in order to have some cooling. Nominal values are 26KV and 3KV. We turned the power supply ON/OFF and we have had several good shots and then instabilities . Put back the initial values and turned the power supply off again for 10 minutes. Turned it back ON and we were able to adjust the cooling.
ELENA: Elena: Gbar asks to shorten the length of the bunch

Wednesday:
AD: intervention on the SCooling in order to replace a relay.
EPC,BI and CO have done measurements and have tried to understand the malfunctioning of the VCathode power supply. Everything seems to be OK!
ELENA: In accordance with the other experiments we have activated the bunch rotation

Thursday:
AD: No more beam injected => reset of the FTA.QDE9010 CPU
ELENA: due to high losses in ALPHA. It ask to remove the bunch rotation

Sunday:
AD: Beam was lost on the 2GeV/c plateau due to a fault on the power supply DR.DHZ2908. Cannot managed to switch it ON. First Lines was called. In the same time CPS&PSB have had several glitches on the electrical network.
AD&ELENA: Beam back in Pbar complex around 21h40.

SPS (Verena Kain):
The week was entirely dedicated to physics to catch up after the TCSC leak. No MD took place. At the moment of writing the availability for FT beams to the NA is 86.7 % with the main fault contribution coming for the SPS injectors with in total about 14 h of downtime. No major downtime from any SPS system. The increased number of cavity 4 trips during the weekend was due to an optimised voltage program. The cavity conditioning is not sufficient however for that program.

On Monday LHC was still taking beam and it was noticed that the Indiv cycle with single injection deteriorated the macro-spill structure of the subsequent SFTPRO cycle. This could finally be traced back to a settings issue of the long blow-up on this particular cycle, which caused the blow-up on the subsequent SFTPRO cycle to not work and hence modify the long. distribution.

The AWAKE bunch length at extraction was not stable enough for 3e+11 bunch intensity from the middle of the week. The RF experts together with OP adjusted the voltage ratio (200 to 800 MHz) function. This improved the situation, but did not solve it. To be investigated further for the next AWAKE run beginning of June. Also, the emittances are too small for AWAKE. The PBS worked on providing larger emittance (2.5 um for 3e+11) and the AWAKE team is working on an optics with a larger beam size. (A new optics was uploaded - with 700 in the name. It does not work due to a required polarity change in one of the quads. The issues is understood and the experts are working on it.)

Whereas NA62 appreciates the better debunching at start of flattop, they are worried about the 200 MHz component in the spill. The SPS RF experts worked on the settings for the voltage jump to ensure counter-phasing and improved the 200 MHz component as measured by the ABWLM. Feedback from NA62 is now required. Also, online monitoring with the dBLM system at the ZS will have to be set up on our side. The FESA class is ready. NA62 is also complaining about increased 10 Hz and 25 Hz, but it is less of a problem than the 200 MHz.

The SPS crew took the loss optimised MTE beam that was prepared by the PS team to check transmission in the SPS. Unfortunately it causes rather high losses in TT10 and is not used operationally yet. Further optimisation on the PS side is required.

Upcoming:

- Monday 8:00 stop of SFTPRO and start of MD block: crab cavity COAST
- Tuesday: TS1: all beams stop at 4:00. Access after RP veto removal (< 8:30)
- Tuesday: access closing time: 16:00; physics start 18:00
- Tuesday evening: LHC back online
- Wednesday: HiRadMat run 1.

SPS North Area ():

No report.

AWAKE (Edda Gschwendtner):

Second week of 2022 proton run. Obtained reliable/reproducible electron-seeded self-modulation. Studied adiabatic focusing of the proton beam in low density plasma. Studied self-modulation of a low density proton beam. Studied laser-ionization-front seeded self modulation at different proton intensities. Collected data for ChDR BPMs.

- Protons: received proton beam from SPS for the entire week, alternating 1E11 and 3E11. Mainly nominal optics, but also some large-beam optics. At 3E11, occasional proton shots with 20% longer bunch. SPS RF experts reduced this effect to around 1 every 20.

- Long access (with RPE survey) on Monday (instead of Wednesday, since MD was cancelled) to align plasma light diagnostics and modify BTV filters. Short accesses needed to electron bunker (to refill chiller) and laser room (to move damaged filter)

- Cherenkov Diffraction Radiation BPMs: collected data in different conditions (protons only, electrons only, protons+electrons, each with different charges) to commission the new BPMs

Day-by-day:

- Monday: access until 3pm. Proton optics measurements (small/large size) at 1E11. Laser/proton timing scans at 1E11 and 3E11.

- Tuesday: work on establishing a reproducible procedure to reliably obtain eSSM based on electron/proton alignment on 3 BTV.

- Wednesday: proton optics measurements at 3E11. Measurements of seeded and unseeded self-modulation with large proton optics

- Thursday: studies of adiabatic focusing of the proton bunch in low density plasma. eSSM setup studies. Decided to cool down vapor
source in the night, to attempt eSSM in different conditions

- Friday: adiabatic focusing studies during vapor source warmup, to study focusing as a function of the plasma density. eSSM setup
studies with different temperature of the system. eSSM setup studies with minimal jitter electron beam

- Saturday: laser filter damage required access in the morning. In the afternoon, obtained eSSM reproducibly several times, focusing
on plasma density gradient stability and electron beam jitter minimization

Plan for week 20: access for several interventions (BTV screen replacement, Cherenkov BPM buttons installation, proton BPM maintenance).

LINAC 3 ():
YETS.

LEIR ():
YETS.

CLEAR (R. Corsini and W. Farabolini):
Last week was dedicated to an experiment of beam transverse shaping by scatterers of different geometries, devised by Cameron Robertson (Oxford PhD student), aimed at medical or other electron beam irradiation applications.
In particular, 2 scatterers were installed: one cylindrical on a linear stage, for enlarging the beam while keeping a Gaussian profile; the second one conical installed on a holder handled by the robot, to flatten the beam profile. The beam profile was finally measured on the last YAG screen just prior to the dump, which has required several improvements of the set-up to obtain high images quality. Measured beam profile showed a flattened distribution, compatible with expectations. Data collected are then to be fully analyzed later. To be noticed: some problems for the klystron modulator, gun chiller and laser due to high temperature in the gallery during the sunny days afternoons. The two last days of the week, the experiment being achieved, were spent to install the next BI test: generation of ps short RF pulses with the wall current monitor for testing an electronic PCB and installation of waveguides for the test of a Chrerenkov BPM on the vacuum line.
A visit of the facility was also given to an artist in residence at CERN in the frame of Art@CERN program.

LHC (Jörg Wenninger & LHC Coordination webpage):
Due to the intervention for the installation of the second half of the LHCb VELO detector, beam operation was limited to Monday. The final flat reference orbit was defined for a nominal bunch at injection with well centered beam in the ADT. A ramp was performed on that new orbit to verify the

quality along the cycle. Crystal tests were performed at injection and a first test of a global correction and of waist shift knobs were made at 30 cm.
The VELO intervention started Tuesday morning and is on track to end Tuesday 17th May.