Accelerator Complex Status

End week 45 (Monday 15 November 2021)

Technical Infrastructure (*Jesper Nielsen*):

Statistics:

- About 9'000 alarms.
- 987 phone calls (707 incoming, 280 outgoing).
- 105 ODM created.

Events worth mentioning:

- Mon. 08.11, Patrol lost in BA2, caused by faulty access system electronics card
- Tue. 09.11, RE42 water leak in a pressure release valve, repaired rapidly by CV
- Thu. 11.11:
    - Alarms received on cooling circuit of TCR and trip of EMD205/8E, indicating the trip of TCR at P8.
    - Patrol lost in BA2, caused by faulty access system electronics card
    - Patrol lost in TCC8, caused by faulty access system electronics card
- Fri. 12.11, Patrol lost in TCC8, caused by faulty access system electronics card
- Sat. 13.11, Communication lost with PLC for cooling system nTOF. Quite complex problem, caused by a faulty IT switch. Some crates for the PS were not communicating also, caused by the same problem.
- Sun. 14.11, External fault in a power converter in AD. A water leak had been know about for a few days, and is thought to have increased and caused the trip. This was confirmed first by the trends for filling the cooling circuit and later during an access on-site. Details: https://wikis.cern.ch/display/TIOP/2021/11/15/TI+week+summary,+Week+45

LINAC 4 (*Luca Timeo*)

In general

It was a smooth week, and the availability was 99.3%.

On Monday

Short beam interruption due to an arc detected in the DTL2 waveguides.

On Wednesday

Joint MD for optimising the RFQ tuning; beam parameters changed as follow:

- source current reduced from 35.0 mA to 34.5mA;
- transmission through the RFQ increased to 82.5%;
- current out from the RFQ increased to 28.5 mA (gained ~1mA).

On Thursday

Beam interruption due to a problem in the TGM front-end: the timing team replaced the CPU card (suspected memory problem).

As follow up to the MD:

- BE-OP corrected the vertical trajectory;
- SY-RF readjusted the RFQ feedback parameters.

During the weekend

Short beam interruption due to a chopper trip.

On Monday - Nov 15th
End of the 160MeV run. Klystron heater curves' measurement (SY-RF) and 3MeV run (BE-ABP) period started.

PS Booster (*Jean-Francois Comblin*):
This was a good week for the PSB with an availability of more than 98%.

Tuesday, we run during 2h30 with reduced intensity from ring 4 due to the transverse feedback system. Specialist tracked the problem down to a bad contact in a cable coming from the beam control.
Thursday, a timing distribution problem affected all machines during 45 minutes. Specialist had to change the CPU card of the FEC, with one with more memory.
Friday, POPS-B tripped due to a fault of the main quadrupoles (BR.QFO). It took 14 minutes to restart it.

Otherwise, we had a busy week, with a full schedule of MD beams for all machines, in addition to the standard operation.
Finally, we just stopped the protons at 6AM Today.

ISOLDE (*Erwin Siesling*):
It was probably the most dense ISOLDE week-schedule this year to squeeze as much as possible out of this last week of protons:

GPS:
Collections:
During the week collections of 149 Terbium isotopes overnight (IS688) that were shipped to the Paul Scherrer Institute each morning.
During the weekend collections of 46 Scandium isotopes (IS627). The Terbium collections went very well, for the Scandium we are awaiting the results.
Both Tb and Sc have been running with RILIS laser ionization schemes.

HRS:
'Nuclear clock':
The first half of the week was used to send 229 Actinium to the LA1 line (IS658) to confirm observed transitions related to an earlier run in September. The IS658 experiment could be groundbreaking with the Actinium being the doorway to the road from the atomic clock to a nuclear clock. I hope Karl will say a few words on this at the FOM on Tuesday.
HIE ISOLDE:
In parallel the full HRS, TRAP, EBIS, REX- and HIE Linac chain was set up for the 209 Francium run for the ACTAR (IS581) experiment at the HIE ISOLDE XT03 line.
The machine was ready for the radioactive 209Fr run at 7.6MeV/u starting on Thursday but due to various issues at their setup the experiment could only start taking beam as of Friday-evening.
Some specific safety aspects: The experiment uses highly flammable Deuterium gas in their setup for which a dedicated venting line was installed, various safety meetings were held and 'ok to run' inspection was carried out (coord. Letizia Di Giulio EP/DI).
Since Friday-evening the experiment is running well and foreseen to take data until the very last minute of available protons from PSB.

Irradiations in parallel:

The first irradiation target was placed at the new GPS irradiation point and HT tests were carried out successfully.
On the HRS side a MEDICIS target was placed on the irradiation point. It took protons during Thursday-night and a large part of the day after which it was replaced by another target that is being irradiated over the weekend for the upcoming winter physics as of this Monday using long lived species after the protons are gone.

Technical issues:
The machine has been remarkably stable. Apart from some usual hick-ups like some electrostatic power supplies tripping and the target and line heating on resp. HRS and GPS once going off we had two issues with the HT for GPS which required the intervention of the specialist Thierry Gharsa (SY/ABT):
On Wednesday-night the HT timing stopped working blocking the Tb collections and needed intervention of Thierry to restart and on Saturday-morning a power pre-amplifier on the GPS HT stopped working which needed to be replaced by Thierry for a spare.
Many thanks to Thierry Gharsa (SY/ABT) for all his commitment and efforts (his support is on a 'best-effort' basis). Without his swift intervention and repair we would have lost a Tb collection for PSI and the complete Sc collections over the weekend!

Remark:
'Winter-Physics'
As was mentioned by Karl during the FOM a few weeks ago: The Low Energy part of ISOLDE will keep running for 'winter physics' without protons until the 6th December. For this the various services will need to stay available. We have asked Marzia (Bernardini EN/ACE) to keep the ISOLDE schedule up-to-date in the Master Schedule so that the various groups are aware of this.
Stop and Warm-Up of HIE ISOLDE:
Together with the proton stop, as of Monday morning (15th Nov) the HIE ISOLDE cryo modules will start their controlled warm-up to have the machine out of critical temperatures before the scheduled AUG tests on 27/28 Nov.

PS (*Benoit Salvant*):
It was a relatively good week for the PS with 88% availability.

Beams were sent to all users and prepared for the last tests and runs of the year: ions to T8, HiRadMat tests with increasing intensity to SPS for SPS kicker tests, scans of n-TOF beam position on the target.

We had organized with the Linac3 and LEIR supervision team to provide a best effort in case something happens during the weekend, and they kindly agreed. This turned out to be very important as Linac3 HV modulators for tanks 2 and 3 went down on Friday night, and a heavy intervention from SY-EPC had to take place after the Linac3 specialist came on site. Many thanks to all of them for recovering the situation and for allowing to provide ion beams for the weekend. Users were extremely happy.

Also on Friday night, communication was lost with two RP monitors in nTOF and this took a long time to repair, as a network switch needed to be replaced (major OP-TI event). The BE/CEM specialist made a temporary connection to hold until the end for the run, and it will be switched back to the normal situation during the YETS.

We had several trips of 10 MHz RF cavities requiring several interventions of the Piquet during the weekend, in particular in view of the SPS kicker beam tests.

An issue with the B-train was causing issues with the revolution frequency and was finally identified in a bad setting and fixed.

Many MDs took place all week and allowed for instance reaching 2.9e11 p/b on LHC25 beams.

Beam permit for T11 was signed on Saturday and the zone was put in beam mode during the weekend so that tuning of the line could be done.

PS - East Area ():

.

AD - ELENA (Davide Gamba):

AD: a pretty unlucky week:

- On Wednesday afternoon and night issues with DR.BHZTR20.21 trim power supply required several times the intervention of first line, with several hours of beamtime lost.
- Access in the AD Target area revealed a water leak on DI.QFO6020 inner coils. See report by Laurette below for details.
- On Thursday Cryogenic Pickup temperature re-started to rise, anticipating possible issues with vacuum and therefore AD e-cooler instability as seen in the previous months.
- As expected, perturbation on 100 MeV/c e-cooling were observed (and mitigated by continues manual adjustment of e- energy) in the following days

On water leak (by L. Ponce):

- Wednesday 10/11: access request from STI for inspection in AD target area following an alert from CV on the increasing level of water in the recuparation tank in TT70. During access, leak source identified at the water cooling circuit of the quadrupole DI.QFO.6020 (second just after the target). After checking the leak rate and the that all water coolected in the tank, decision to go on operation.
- Friday: pumping of the water in the tt70 tank to the surface tank in Bat 196 and analyse by RP. The surface tank is now full, water cannot be evacuated. Analysis from RP not available yet. Saturday night: second alert from CV as level was increasing much faster, threshold set to 1200 for stopping AD target water cooling (level at 600 at that time).
- Sunday morning 7h30: debit interlock on the quadrupole, not possible to go on operation of the magnet. After discussion with Antony Newborough and Nicolas Roget, decision to stop cooling circuit of that element with a short access in AD target access tunnel (lower radiation area). Leak stopped, magnet OFF, resuming operation without the magnet.

Since Wednesday afternoon, Yann Dutheil made simulation to find an optics of DI without the magnet. We tried shortly different options but no magics in the result. Optimization made by Davide and Bertrand for a couple of hours. Discussion with the users and agreement to stay with 1.1 e7 pbars extracted from AD stable as further optimization would mean instability.

ELENA: also not the most lucky week of the year:

- On Tuesday night issues with several transfer line quadrupole power supplies: required first line to come on site over night.
- On Friday afternoon the power supply of the e-cooler filament tripped with regulation error.
    - beam was degraded/not available for most of the afternoon and evening.

- source of the issue still not clear despite investigation on experts called on site till late in the night.
- decided to run with power supply in local mode, bypassing power supply regulation control and therefore allowing to restore nominal beam operation.

On the positive side:

- AD Vistar is now publishing intensity data along AD cycle (feature that was missing for the whole run)
- Agreed with users to have one hour every day (from 11am to 12am) for this last week for taking reference measurements before shutdown instead of MD for whole Wednesday (morning only anyway, as no protons in the afternoon)
- Profited of Wednesday's proton stop to replace a few amplifier on AD stochastic cooling (actually, some of those were found not stable/working after short time)
- H- beam extensively used and appreciated by users
- At least some pbars till the end of the run (or at least till now), despite the many issues encountered during the week, thanks to the commitment and persistence of several teams.

SPS (*Verena Kain*):

In the last week of the year the SPS was back at the pre-LS2 availability numbers - at the moment of writing of the summary the availability over the last 7 days is 85.4 %. Main fault contributor were the SPS injectors with 10 h, followed by the access system with 4 h.

Week 45 was also the final LHC ion commissioning week with much progress on slip-stacking tuning and transmission during the second acceleration. Some work still remains to be done for next year: further voltage conditioning and/or AM modulation of RF voltage after slip-stacking, bug fix on the phase loop mask for group 2,…
In preparation of the LHC ion cycle of next year with 14 injections, 6+6 injections were successfully slip stacked and re-captured during the Wednesday dedicated MD. The batch spacing was still only 250 ns - to be fully set up for 150 ns next year.

During the Wednesday MD, EPC profited from tests of TI 2 and TI 8 power converters in preparation for the YETS and next year. AWAKE took beam on Saturday for beam instrumentation tests. The tests could be completed in only one day despite issues of some quadrupole circuits in TT41 with current acquisition and subsequent power converter extraction interlocks. As the piquet could not solve the issue, it was therefore finally decided to mask the interlock as it was no physics run. To be followed up over the YETS.

The intensity was increased on SFTPRO by 10 % upon request of NA62 for all targets to not change the sharing and hence beam size. Availability suffered to some extent with this higher intensity (~ 3.5 e+13). It would have needed fine tuning again. AWAKE with the Q20 optics disturbed the FT beam on Saturday morning when putting the cycle in and again when removing it later on. The vertical tunes needed adjusting each time otherwise the BLMs would abort the beam before extraction or even before acceleration.

Sunday midnight the MKDV1 stress test started with a super cycle consisting of 2 FT cycles followed by 1 HiRadMat cycle and higher interlock threshold on the vacuum system at the MKDV1. The MKDV1 stress test went fine with the increased vacuum thresholds and injected bunch intensities of > 1.7e+11.

SPS North Area ():

.

AWAKE (*Giovanni Zevi Della Porta*):

Recovery from water leak in electron gun area. Last day of proton beam.

- Flippers/PLC intervention: Laser flipper motor controls now properly configured with PLCs (we were using a temporary arrangement before). Troubleshooting automatic movement of laser beam dump every 250 shots (we have been doing this manually so far, but it used to work in Run 1)
- Proton beam on Saturday: issues in TT41 magnets power converters (SPS extraction line) in the morning, showing large instabilities. After piquet intervention, which did not find a clear culprit, SPS proposed to extract anyway. Beam trajectory was reasonably stable at AWAKE (we did not check timing), and we achieved our goals:

Proton beam goals:

- BPM tests: confirmed that BPM51, now connected to both electron and proton electronics, can measure both protons and electrons (electrons only in shots without protons).
- BTV tests: several digital cameras, usually connected to PXI system, were tested with the new BI DAQ system, with a server in the CCR. They were able to see protons as expected
- Measured an additional reference proton trajectory and optics, required for physics analysis.

Plan for week 46: RP survey of TAG41 area. Venting of AWAKE system for vacuum work. CV intervention. SPS magnet tests. Access system tests.

LINAC 3 (*Giulia Bellodi*):

It was an excellent week of operation until Saturday, with > 30uA ion beams steadily delivered to SPS.

The only two minor issues were :

- a source HT spark on Monday, which created a vacuum fault and triggered the valve to move in
- a timing issue on Thursday morning, with a frozen TGM (but no impact on beam operation)

Then on Saturday early morning beam was stopped by a Linac3 Tank1 and Tank2 HV modulator fault. The supervisor was called in during the night by the PS operator but an EPC piquet intervention was in the end necessary to fix the problem after an IGBT exchange. Beam was back at 13h on Saturday after a 10 hours stop.

LEIR (*Nicolo Biancacci*):

Monday:

- ITE.BHN40 investigation: 3A current decay measured on the magnet power converter. To be fixed during shutdown.
- NOMINAL/EARLY optimization activities
- Energy measurements in LEIR
- Test on t-b-t system capabilities.

Tuesday:

- NOMINAL capture in h=1
- Beam delivered to SPS for 14 injections + slip stacking cycle
- New peak detection algorithm deployed for t-b-t system.
- Current measurements on ITE.BHN40 with high precision: found significant overshoot.

Wednesday:

- Beam to SPS
- MDs on capture of NOMINAL in H=1+2
- MDs on impedance and Schottky machine learning

Thursday:

- Beam to SPS
- MDs on impedance and Schottky machine learning
- Turn by turn FESA class setup
- General timing issue: beam recovered in short time.

Friday:

- Beam to SPS
- MDs on impedance and Schottky machine learning
- Turn by turn acquisitions
- Reference measurements for 2022

Saturday/Sunday:

- Smooth operation.
- Beam delivered to PS for IRRAD/CHARM
- Reference measurements acquisition in transfer lines
- Schottky machine learning studies

CLEAR (Roberto Corsini, Pierre Korysko):

This week was fully dedicated to irradiation for CHUV. On Monday, the samples handling robot was used in order to perform the chemistry experiment with CHUV colleagues.
Both FLASH and Conventional irradiation conditions were used, for doses of 10, 15 and 20 Grays. Twelve water samples in Eppendorf tubes were used in total, with 2 gaschromic films to monitor doses on each of them. The concentration of H2O2 in each sample was then analyzed by CHUV colleagues.
Several scans and checks were done during the rest of the week, to complement and better understand what was measured on Monday. These included scans of longitudinal positions in the water tank using both the films and the YAG screen. Charge/dose dependence and the impact of film position were also checked.
(Pierre Korysko, CLEAR Weekly Supervisor)

Full reports can be found as usual here: https://indico.cern.ch/category/10682/

LHC (Jörg Wenninger & LHC Coordination webpage):

S12	S23	S34	S45	S56	S67	S78	S81
Completed	Warm up	Completed	Completed	Completed	Completed	Training # 2	Completed
77 / 11950 A	0 / 0 A	71 / 11950 A	87 / 11950 A	76 / 11600 A	62 / 11600 A	19 / 11594 A	55 / 11600

Diode tests in S23 before warm up: QH firing at 10'500 A to test the 9 suspicious dipole diodes and 2 quadrupole diodes (Q32L3) in S23. All tests were successful, all diodes functioned correctly. The fast retraining of S78 continued on the same track, at the end of the week the RBs are just 6A below the target.