Accelerator Complex Status

End week 47 (Tuesday 28 November 2022)

Technical Infrastructure ():

Statistics:

- 3'200 About alarms.
- 700 phone calls (454 incoming, 246 outgoing).
- 116 ODM created.

Events worth mentioning:

- Mon. 21.11, Waterleak in building 904, a leak on the roof sprays water on racks for CMS in the building.
- We. 23.11, Fire alarm on the central SFDIN00513 sextant3+ nothing to see on site, no real alarms. Only the central is in alarm, no detectors. After a little while the alarm could be reset.
- Fri. 25.11, Several ventilations in East Area, CHARM, IRRAD + and others, stopped for no obvious reason. Only reason found was a signal from the "Fire fighter" that was active for 45 seconds only. Several ventilations in East Area, CHARM, IRRAD + and others, stopped for no obvious reason. Only reason found was a signal from the "Fire fighter" that was active for 45 seconds only.
- Sun. 27.11, Water leak in BA6, caused the cooling station to stop. The magnet was isolated and the cooling station could be started again.

Details: https://wikis.cern.ch/display/TIOP/2022/11/28/TI+Week+summary%2C+Week+47

LINAC 4 (Piotr Skowronski)

Excellent week for LN4 with total 14 minutes of downtime taken by 2 faults.

PS Booster (Gian Piero):

We had a very positive last week in the PSB with an availability of ~99.6%, so no major issue to report apart from standard resets or re-adjustments due to MD beams which needed a better setup.

Most of the effort in the PSB was in fact dedicated to support the operation of the remaining running proton facilities and the various MDs all across the complex, including the floating MDs in the LHC for the validation of the 2023 optics and the special beam for the BSRT calibration.

One highlight is that we profited during the last few days of run to stress test the LIU WS in R1H.
In agreement with the SY-BI experts, we performed ~14k scans in about 3 days.
We did not experience any mechanical fault, proving the excellent performance of this new equipment.
The BI experts will replace the tested wirescanner and perform a more in depth mechanical analysis during the upcoming YETS.

Other than that, a big thank to all the experts and the operation team for yet another excellent year in the PSB in terms of machine availability and performance.

ISOLDE (Miguel Lozano):

It has been , and still is , a very intense week at Isolde.

On the HIE-ISOLDE side we delivered beam , 182Hg45+ , to Miniball at 4 MeV/u.

It was a quite demanding run with a liquid molten Pb target that needed a lot attention to keep the Pb in the liquid phase during the run while staying cold enough to avoid any Pb vaporization.
The run was scheduled to start on Thursday afternoon and it did but 2 minutes after starting delivering beam to users we lost the 7GAP3 accelerating cavity.
The problem turned out to be related to the low level RF system. After many investigations Cristiano Gagliardi managed to get the system back on Friday at around 15:00. Many thanks to him and his hard work the last HIE-ISOLDE run could run from Friday afternoon until Monday morning when protons were stopped around 6:00 AM.

Users are quite happy with the data taken and they only had very little downtime due to the trip of the IHS accelerating cavity that they managed to restart by themselves.

On the HRS side we have been irradiating a target for the winter physics campaign and simultaneously we have been irradiating a MEDICS target.

Today , once protons are gone, we are taking some beam emittance measurements and we will have a target change on GPS for some RILIS schemes development.

PS (Alexander Lasheen):
The PS ended the 2022 run with a good and dense week of operation. The present availability is around 93% before remaining faults overnight, these being shared between the PS and the ion pre-injectors.

The main considerations in terms of beam operation were:

- The ion run in the PS was successful with delivery of beam to the CHIMERA experiment, at 0.65, 0.75 and 1 GeV/u.
- The TOF with 28 ns bunch length at extraction was tested together with the TOF experiment in preparation for 2023. The bunch rotation was optimized to have a sharp front rising edge in the longitudinal plane, the horizontal and vertical beam size are acceptable on the SEM grids but requires verification in the future on the PS SIS (None/large beam size values returned while beam appears to be OK).
- Beam was otherwise delivered in good condition to AWAKE (1-3e10), EAST (T8/T9), AD (1800e10), MDs (for PS and SPS, various studies at LIU intensity, ions transmission and slow extraction with TFB, SFTPRO barrier bucket at high intensity and spill optimization…)

The main considerations in terms of hardware were:
- The C10-51 second stage of the amplifier is not working since early this week. This impacted mostly high intensity beams like AD where the cavity was not following its program. The choice was made to leave the cavity as (degraded) spare until the end of the run. On Sunday evening, a trip of all the C10 cavities was followed by the impossibility to restart C10-46, requiring C10-51 to be used (an update will be sent tomorrow morning if any issue occur overnight).
- The ion stripper in the TT2 transfer line caused issues overnight from Saturday to Sunday and prevented delivery of SFTION beam on Sunday morning. The issue of the ion stripper was difficult to identify as the main observation was a sudden change in trajectory in TT2-TT10-SPS, manifesting as an orbit difference on the first SPS turn. This was compensated by an important change in the PS B field at extraction and re-steering in the transfer line, allowing to recover a reasonable transmission. The situation degraded further in the morning where beam was intermittently then completely lost in TT2. The complete loss facilitated the understanding that the stripper foil was the root cause of the issue. Changing from the original (#1) to the spare foil

(#2) solved the problem and allowed to resume operation. A remark is that no alarm was raised from the stripper foil controls, as the measured foil position (switch IN/OUT) behaved as expected. Further investigations would be required on the foil itself to understand the issue and possibilities for diagnostics.

PS - East Area ():
No report.

AD - ELENA (Bertrand Lefort):
In terms of Fault, It was a very quiet week at the antimatter factory and, luckily, there is nothing really interesting to report.

For the rest, it was the "Last week of the run". For those unfamiliar with the concept, imagine a very very large bed (the antimatter factory) and you put in it : Users, Specialists and an amazing OP-team. In the room, it is very cold. It is due to the stress floating in the air : 'I hope there will be something to publish', 'my hardware will never make it through this run', 'I want beam time because I need fricking references for the restart'…. Now the duvet (aka. The beam time), it is very small, it can bearly cover one person but everyone is pulling from it, and independently of what you do, you end up with a frozen toe…

So yes it was intense but also really interesting... AND we sent beam successfully to STEP !

General :
- We have a bug in our Bunch delivery system (aka pizza'30) that make us loose one ejection sometimes. We know how to reproduce the bug so no issue.

AD:
- Few issues with the C10 cavity, we need to reset it several times, The specialist is aware and knows the reason.
- Radiation on AEGIS are still fluctuating and the alarm is triggered from time to time. Lot of time dedicated to find the source of these variations. So far in vain. Probably something upstream.

ELENA:
- Electron Beam studies by Maestro Davide Gamba (I could try to explain all what he did but I'm not sure that I can)
- Magic Yann did also a new optic for the brand new BASE-STEP line and it works 'as-is' ! The first shot went straight to STEP sensor (bull eye) !
- Some beam instability during the weekend detected (only) by ALPHA, maybe a failing ion switch (can't be sure but quickly solved)

Maybe "Nothing relevant to report from the AD-ELENA machines" would have been enough :-)

SPS (Giulia Papotti):
One last week of 2022 operation that did get boring at anytime, while achieving 85.8% availability (at the time of writing).

The fixed target ion beams carried on producing physics at the same flat top energy as the previous week.
Some tweaks at Linac 3 and LEIR were necessary to keep the performance up.

Awake received beams of 1-2-3e11 ppb and with different optics as requested, profiting from 3 cycles per supercycle in addition to 1 SFTION1.

The LHC received many different flavours of beams: apart from the standard physics filling, BCMS 1.8e11ppb for the floating MD, and single bunches with different emittances for the BCMS calibration.
One test of dedicated LHC filling was planned for early in the week but slipped until Saturday. Despite some delays due to independent problems, the test was successful, and the LHC could be filled with a supercycle composed of LHC1 + ZERO + 2x MD1 in about 35' (a few shots were dumped by BQMSPS due to bad beam quality from CPS).

The (Wednesday) long parallel MD aimed at tackling the limitations for the high intensity pLHC beams, and most of the day was devoted to studying the pressure spikes at the MKDH.
Spikes could be provoked at lower energy with short bunch lengths, but the conditions were not stable enough - or the timescale too short - to conclude on the yearned conditioning.

Some time with 8b4e was also planned to get measurements with 2 newly installed microphones on LSS3 equipment (AETA and APWL) in the vacuum sector with the pressure spikes, neat the 800MHz C1.
Due to some doubts on the installation, the tests were postponed to Friday morning, when the beam was taken for an hour in parallel to the SFTION1.
The results of the measurements will be known only tomorrow morning after the access.

Parallel MDs took place on Monday: PS2SPS transfer studies comparing slow flat bottom losses with and without feedforward, and loss of Landau damping at 200GeV.
Studies on energy matching procedures could not take place on Monday, and a couple of hours were negotiated for Tuesday: references for proton fixed target beams at the frequency of 199.948MHz for next year could be recorded.

The main stops of the week, other than the injector chain, were due to:

- Wednesday morning in BA3: (false) fire alarm + visit of the fire brigade + patrol + access for the installation of the microphones in LSS3.
- Sunday afternoon/evening: water leak at RQIF.6104 in TT60 (a small leak was already present from before, and degraded), the shift managed to fill the LHC without cooling, and then carry on with the SFTION1 for the last few hours of 2022 operation.
- a few PC and RF trips, which also required piquet calls.

Other follow-up:

- the scrapers lose steps and have to be retracted at every LHC fill; experts are informed and will investigate during the YETS.
- on Wednesday, it was attempted to break wire scanner 41678.V by measuring high intensity beams, as it is supposed to be removed, but it survived.

SPS North Area ():
No report.

AWAKE ():
No report.

LINAC 3 (Richard Scrivens):

The availability of the Linac3 was quite good, with one source trip and one RF trip during the week (each about 1 hour downtime).
The source stability was not so good, and it required a lot of tuning – with it behaving like the good conditioning had been lost. On Friday and Saturday, it was not possible to keep the Linac's intensity target, and on Sunday the situation became better.
We will now switch to 2.5 days of MD on to characterize the RF settings before the new amplifiers are installed in the YETS, as well as MDs on the source.

LEIR (Nico Madysa):

Main activities

- beam delivered to PS for lifetime studies and to SPS for north area
- reference measurements on NOMINAL and EARLY for 2023 run
- Tue: stripper foil change in LINAC 3
- Fri: IPM measurements to check emittance preservation along chain
- MD: turn-by-turn optics measurements
- MD: data taking for Schottky computer vision project

Fixed issues

- Wed: accidentally left synchronization with PS disabled after a short dedicated MD during PS downtime
- Thu: ZERO cycles accidentally put in by PS degraded performance
- Thu: ER.QFN1030 went into fault, reset by piquet
- Sat: unstable LN3 source during night shift

Ongoing issues

- adding a validation rule to the Timing app to prevent ZERO cycles in LEIR.

CLEAR ():

No report.

LHC (Jörg Wenninger & LHC Coordination webpage):

The issues related to RF and ADT were finally solved Monday morning by a hard reset of the ADT crates.
The fill that followed was used to probe the cryogenic limit of the triplets. Through a step-wise increase of the luminosity by beta* leveling, **the peak luminosity was pushed to 2.55E34 cm-2s-1** before reaching the cryogenic limit (immediate beam separation required). The test was concluded with around 1 hour of operation leveled at 2.4E34 cm-2s-1.
The second and third fills of the 2023 configuration MD were completed Tuesday with bunch intensities of around 1.75E11 ppb in collision. This was followed by an unsuccessful quench test at maximum power loss of 700 kW. A fourth fill of the 2023 configuration with 1.8E11 ppb at injection and collisions in all points was completed Wednesday evening, following one attempt dumped on a **UFO in ATLAS**.
Production was rocky over the entire week, with one fill for CMS at pile-up 60 and for LHCb high pile-up. A BSRT calibration fill was inserted on Thursday evening. Three ramps were lost at the start of acceleration due to losses in IR3: the problem was most likely an uncorrected injection phase error of B2 (40 deg) coupled to poor injector beam quality (large intensity, bunch length spreads). After the period of MD and quench test, B2 lifetime in the ramp degraded for unknown reasons, leading to a dump close to 6.8 TeV Sunday evening.
Despite those issue the **integrated luminosity delivered to both ATLAS and CMS passed the 40 fb-1 mark** on Sunday.
On Saturday evening a successful test of **dedicated LHC filling** in the SPS (LHC1 + ZERO + 2x MD1) with a fast filling time of 35 minutes.

The **RD1.LR1 power converter failed** Friday late afternoon, it had to be replaced by its spare converter. To validate the change, a dry test of the FMCM and a probe cycle to FT with FMCM validation.