# Accelerator Complex Status

## End week 44 (Tuesday 7 November 2022)

### Technical Infrastructure ():

Statistics:

- About  alarms.
- phone calls ( incoming, outgoing).
- ODM created.

Events worth mentioning:

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Details:

### LINAC 4 (Giulia Bellodi)

Linac4 had 100% beam availability until yesterday.
Then all the RF came down at midnight last night with what was understood as a communication problem that blocked all RF PLCs.
The LLRF piquet was called and had to restart them one by one. While the system was warming up to restart the same problem occurred a second time and the piquet was called back to restart all the klystrons again. Beam was finally back this morning at ~6h30.

In short , Linac4 beam availabiliy Mon-Mon  9h: 96.4% :

- RF PLCs communication fault: 6h
- L4L.RCH.111 steerer trip (twice): 5’

### PS Booster (Chiara Bracco):

The availability of the PSB this week was ~96% (reduction from 99% earlier in the week due to Sunday night issue with Linac 4) with mainly ISOLDE being affected by problems at two different quadrupoles of the BTY line (trip of BTY.QDE120 and acquisition not following CCV for BTY.QDE151) which required the intervention of the piquet.
The main highlights of the week are the successful preparation of all beams for the different SPS and LHC MDs and the definition of a SC fulfilling HRS and STAGISO requirements at the same time.

### ISOLDE ():

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### PS (Ana Guerrero):

The PS has had high availability during this week until last night, the main source of downtime being the SMH16 with an insulation issue (1h). POPS tripped twice but not related to the FEC power supply issue of the past weeks (~35m). Recurring issues but with hardly any impact on the beam time are kfa71 module trips and C10MHz trips. Also, a couple of interventions by HLRF were needed for cavities not following the program.
Unfortunately there was again an issue in the beam destination default EAST_DUMP when a change of sequence happened, sending around 10 ion cycles to T8 while in irradiation. The beam has now been programmed with a disabled quad in the line.
There has been a vacuum peak in the night of the 2$^{nd}$ November lasting several hours but no clear explanation has been found (one instantaneous loss found around the peak starting time)

The week was full with MDs in the PS and SPS, and with the preparation for the LHCMD2. The SPS took in several occasions some of these beams for test, in particular the high intensity BCMS and 8b4e (1.8e11p/b). Several beams were prepared for the SPS MDs too including a very low intensity MTE (50e10p). Ion beams were also sent to SPS for FT ion run preparation.

**PS - East Area ():**
No report.

**AD - ELENA (Sergio Pasinelli):**
It was a quiet week at the antimatter factory

AD:
This week began with a call from the "CCC" as they were unable to "RESET" a fault on the AD horn. After calling the specialists without success, a local "RESET" of the fault by the AD week supervisor solved the case!

Earlier this week, a water leak was detected on one of the "cryo-pumps" on the C10 cavities of AD. This leak was repaired on Friday.

The increase of the number of protons on the target continued this week.
Two more PSB turns were requested and with 6% more protons on target, we get +5% at the exit of AD.
Now we have ~1800e10 from PS, ~1600e10 on target and ~3.7e7 at the AD exit.

ELENA:
Several Alpha line correctors were in fault. First line was called and it has replaced a control board.

On Wednesday's "MD", an access was possible in ELENA in order to diagnose the Hminus source. The electronic board that controls the filament was found to be damaged.
The board was brought in for repair and was put back in place on Friday. Testing of the source is scheduled for Monday.

On Sunday morning, a glitch on a "Gbar" vacuum pump triggered the closure of the fast vacuum valve of the LNE50 line. The vacuum picket was called to open this valve.

**SPS (Kevin Li):**
This week the SPS has come back to an availability of a marvellous 94.5%, if it weren't for the intervention on the stuck collimator in the H2 line of the experimental areas. This intervention took place from Monday evening to Tuesday afternoon, requiring a 20 hours cool-down and a roughly 2 hour intervention for the replacement of a broken potentiometer. In total this brings down the actual SPS availability to 80.2%. The weekly program has been very dense with several parallel activities ongoing throughout the week, namely, ion commissioning for slip stacking, ion commissioning for the fixed target physics program, preparation of the LHC EARLY ion beams with extraction to the TT40 and TT60 TEDs, two dedicated MDs on Wednesday's dedicated MD day, injection studies for the tails characterisation int he LHC on Thursday and LHC MD beams preparation on Friday. All along LHC fillings and fixed target physics were delivered reliably and at maximum rate within the limits allowed by the super cycle.

Progress has been made for the ion commissioning. Additional firmware upgrades allow for reliable pickup switching with automatic phase compensation. Slip stacking has already been demonstrated with 2 batches and the beam ends up at good quality, intensity balance and short bunch lengths.

Moving to 14 batches has proven to be challenging and slip stacking could not be completed successfully during the dedicated ion day. The cycle requires setting up and tuning (i.e., transition crossing, 800 MHz fine tuning) which takes extremely long due to the very low duty cycle as a result of the length of the 14 injections ion cycle, which makes progress with tuning very slow. The fixed target ion cycle has experienced its own difficulties. Towards the end of the week, the cycle was readily set up crossing transition and reaching flat top with including debunking and recapture at the intermediate flat top. The voltages are still a bit too low to allow for better transmission, but further cavity conditioning is likely required to be able to push the voltages further. This is especially true for the voltages required at lower frequencies during the intermediate flat top. Moreover, the current FW only allows for a 2-fold AM, such the the exercise could only be done over one half of the SPS ring. Another FW upgrade is foreseen for next week which should allow for full 4-fold AM. As already mentioned the 3 injections of the EARLY cycle have been readily commissioned. Extraction has been set up up to the TEDs, rephasing has been done at LHC injection frequencies on the local generator.

The dedicated MDs were done on non-local crystal channeling as well has high intensity BCMS beams. The non-local crystal channeling has been more successful due to improvements on the goniometer. Loss reductions up to 48% on the ZS could be demonstrated. The 48 bunches BCMS is still limited in intensity vs. bunch length due to spiking of either the MKP4 or the MKDH. Intensities of 1.8e11 ppb at bunch lengths below 1.7 ns can not be reliably reached. For this reason, on Friday a 36 bunch variant was tested, as high bunch intensities at 1.8e11 ppb are required for the LHC MDs. During this test, 5 injection of 36 bunches at 1.8e11 ppb at flat top were reached up to a bunch length of 1.69 ns. The tests were hampered due to several trips of MKP, MKDV and MKDH, some of which were actually unrelated to vacuum activities. Furthermore on Friday the high intensity single bunches were prepared and made ready for the LHC MD. The 8b4e could not be taken anymore, unfortunately, and will have to be prepared in parallel to the LHC MDs early next week.

The T-tails studies carried out on Thursday throughout the day gave some additional insight on the differences between beam 1 and beam 2. Studying the injected batches, it appears that the MKE6 waveform is less flat compared to the MKE4. Thus, the projected batch for beam1 batch becomes larger than for beam2 in the LHC; in addition, steering with 12 bunches is less representative for beam1 than it is for beam2. This can explain the difficulties for injection of beam1 compared to beam2 and the high scraping needed. This issue has been taken up and will be further investigated.

Over the weekend, to 800 MHz cavity 2 went in fault and led to some slightly degraded spill quality. In addition, the system is critical for high intensity LHC beams. The piquet came on-site and after some investigation found an isolation transformer which had to be replaced. There are still some doubts on IOT5. For the moment the system is functional. A fallback solution was identified by means of a voltage repartitioning to limit the power requested by cavity 2 in order to be able to run with IOT5 disabled, if needed.

LHC MDs have started. Up to now, all scheduled MDs could successfully be carried out. Sunday night, the first high intensity MD with 1.8e11 ppb BCMS beams is being carried out.

For next week, an RF firmware upgrade is needed, as already mentioned above. This could be planned for Wednesday morning, before the dedicated ion run. The analog wire chamber XWCM.101.264 will need to be investigated as problems with the measurements have been reported by NA62 on Sunday morning.

**SPS North Area ():**
No report.

## AWAKE (Giovanni Zevi Della Porta):

Preparing electrons, laser and diagnostics for the run
Electrons:

- Measured quantum efficiency of electron gun cathode. Cathode is still performing well
- Measured electron bunch length on upstream streak camera for different electron gunconfigurations
- Defined reference setups for electrons at low and high charge

Laser:

- Propagated electron on main line and virtual line
- Included new BTV digital cameras in alignment tools
- Completed commissioning of new device protection interlock
- Aligned marker laser in space and time on upstream streak camera
- Work on improving signal/noise contrast (to be continued)

Plan for week 45:

- Preparation: visit from laser manufacturer to resolve signal/noise issue, align laser virtual line, warm up Rb and align Rb diagnostic.
- Run (Saturday/Sunday): proton beam characterization with all diagnostis, proton beam position scan, start physics!

## LINAC 3 ():

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## LEIR ():

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## CLEAR ():

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## LHC (Jörg Wenninger & LHC Coordination webpage):

For the entire week until the start of MD2 operation with BCMS 2462 bunches. For one fill the bunch intensity was pushed to **1.45E11 at start of stable beams, with a peak luminsoity of 2E34 cm-s-1** .
Unfortunately the intensity had to be brought down again as cryo was struggling in S81 due to the preparation of the storage for the YETS.
The SND emulsions were replaced on Friday. In the evening an attempt to perform a fill with the LHCb dipole off was dumped at the end of the ramp due to losses on the Q1s in IR8. With the dipole off the vacuum in IR8 around VELO rose to 3-4E-7, most likely driven by e-clouds with the dipole off. The dipole had to be switched back on with, but with the opposite polarity. To note that with this inverted polarity, corresponding to the largest crossing in IR8 (external and internal angles adding up), the blow up of B1 bunches in collision disappeared.
Injection studies identified the MKE6 waveform non-flatness as one ingredient of the sensitivity of B1 injection to scrapping. The waveform generates trajectory differences with a span of 1 sigma.
One H collimator was found to be at the source of the losses at the TCPs in IR7.
MD2 started Saturday evening, with very good availabiltity.