

# Accelerator Complex Status

## End week 18 (Monday 7 May 2018)

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### TI (Jesper Nielsen)

A rather good week for TI.

On Tuesday 01.05 at 12:16 there was an evacuation in extension of building EHN1 due to a fire alarm. The fire alarm was caused by soldering works in the building, and the IS37 didn't include the correct sensors.

Wednesday 02.05 at 01:20 a water leak appeared due to a broken purger on the raw water circuit in LHC8. When switched to spare pump, it also tripped, possibly on low flow interlock (to be confirmed). The spare pump was started manually after isolating the leak on-site with the fire brigade.

Saturday afternoon the demineralised water circuit in BA2 tripped. Both CV and SEPTA piquet was contacted, SPS operators saw also a vacuum spike at the moment of the trip. Temperature readings were showing 3000 degrés which, surely is a false reading. The circuit was restarted without problems, more investigations will take place between the groups.

Details: <https://wikis.cern.ch/display/TIOP/2018/05/02/TI+Summary+Week+18>

### LINAC2 (Jean-Baptiste Lallement):

It was another perfect week for Linac2 with 100% availability.

### LINAC3 (Jean-Baptiste Lallement):

The Linac3 source, that was refilled 10 days ago, was rather unstable and required very frequent tuning and adjustment in order to keep providing lead ions to LEIR.

### LINAC4 (Silvia Schuh):

The beam-permit loss in week 17 was understood to be due to external conditions raised due to a faulty digital pressostat - exchanged in a fully transparent way.

An arc detector interlock on PIMS9-10 in the evening of 30/4/2018 caused the L4 to be off until 02/05/2018 - it needed a HW reset. In parallel, the bias resistors of the Source RF failed several times again - they have now been replaced with higher-rated components, procurement of better quality components is looked into.

Further work on PPM-copy to a clean USER done, revealed that some more migration to FESA3 needs to be done during ETS.

Continue different user patterns - MD1 MD5 MD1 MD5 to LNDMP destination.

A number of trips of the chopper - a problem with a blown fuse, and an issue with some electronic parts on an electronic board, being investigated in the lab.

Investigations on beam instrumentation (SEMgrid and BWS): some wires found broken, some glued. ToF tests with cavity detuning performed. Measurement of chopper rise/fall times. Investigations on intensity dip for 600us beam.

Source cesiation successfully performed by OP under the watchful eyes of Jacques.

Frequent WD-trips from Friday evening onwards - BS was in for most of the weekend, being investigated - possibly the source beam pulse shape after the cessation not being optimal. Beam is back this morning.

### **PSB (Alan Findlay):**

It was a good week for the PSB with just shy of 95% availability and no serious issues to report.

Monday morning we were planning to supply beam to ISOLDE during the PS access, but BT.QNO20 tripped requiring a 1.5 hour PiPO intervention to fix it.

Thursday night BTY.QF0119 tripped and would not reset, depriving ISOLDE of beam, so Firstline were called. Seemed to require a local reset, so beam was back after 1.25 hours.

The planned dedicated PSB MD on Wednesday took place between 11H00 and 17H15, at which point beam was returned to ISOLDE. The rest of the complex resumed their requests at 18H15.

Sunday the BI4.SMV tripped requiring a PiPO intervention, so no R4 during 2 hours. Otherwise there was the usual minor resets, tuning of beams and setting up of MD beams. A high intensity TOF type beam was requested, so the injection was optimized, many things RF were tweaked and  $1.05E13$  was consistently extracted from R2. This is now available for the users. There was also a request for a high intensity LHC25ns with at least  $260E10$  per ring, so 4 rings of  $2.75E10$  were prepared and are ready for PS MD next week.

Seems like the old girls is settling back into her stride.

### **PS (Ilias Efthymiopoulos):**

Smooth and quiet running for the PS with excellent overall 97.7% availability (up to Monday 07/5@08:20AM)!

PS delivered beams to all destinations during the week with typical intensities: East Area (including IRRAD,  $\sim 3.5$  Tp/pulse), nTOF ( $\sim 7.9$  Tp/pulse), AD ( $1.45$  Tp/pulse), and SPS (intensity increased to  $12.6$  Tp/p), and BCMS beams for LHC filling with 48b (with  $\sim 1.2E11$  ppb, and  $1.1/1.0$  mm.mrad  $e_h/e_v$  @ extraction). The beam to nTOF reached  $3.50e18$ , 16.1% of yearly statistics.

The total down-time of the week was 11.1 h, attributed to issues with RF (8.41h) and power converters (2.62h) systems. Studies were made to optimise the MTE beam tuning with the intensity ramp up, and the emittance of the LHC beams when operating with one of the two 40MHz. cavities. The scheduled MDs (5) of the week were successfully completed, including a dedicated MD on Wednesday for PSB-PB transmission.

### **ISOLDE (Alberto Rodriguez):**

It has been a fairly good week at ISOLDE.

On GPS, we continued to deliver cadmium isotopes to Solid State Physics users on the GLM line until Wednesday morning. We installed a new target that same day and had a new set-up to the GHM line ready by Friday afternoon. No major problems to report on this separator.

On HRS, a new target was installed on Monday morning and we were able to deliver several germanium isotopes to the COLLAPS users on Tuesday after we solved some problems we had with the cooler/buncher. They have been taking beam since then.

However, the beam transmission through the cooler/buncher degraded over time and we had to make several adjustments during the week. We also have had some problems with the front end ion source earlier today (a high impedance short of the anode).

### AD & ELENA (Bruno Dupuy):

This week was the first week of beam for physics for all experiments (or at least those that were on the schedule to take beam this week).

After the Magnetic Horn problem (from 09/04 to 16/04), following by FGC\_63 software not ready (from 09/04 to 18/04) and finally two water leaks on the AD target (23/04 and 25/04), the 2 weeks of beam setup was reduced to 4 days!

But the beam was delivered on Monday 20 around 15H00 to ASACUSA.

	The schedule of the week						
	Mon 30	Tue 1	Wed 2	Thu 3	Fri 4	Sat 5	Sun 6
07:00	ELENA	ALPHA	ELENA*	ALPHA	ELENA	ALPHA	ALPHA
15:00	ASACUSA	ASACUSA	ASACUSA*	ASACUSA	ASACUSA	ASACUSA	ASACUSA
23:00	AEGIS	AEGIS	AEGIS	AEGIS	AEGIS	AEGIS	AEGIS

\* No beam from 11:00 to 18:00 due to dedicated CPS & PSB machines studies.

Very few stops caused by AD breakdowns.

When	Start	Duration	System	Action / Comment
Tue 1	7:05	10'	Cavity C10-25 + DR.QUAD	Reset by CCC crew
Tue 1	11:53	5'	DR.SMI5303	Reset
Sun 6	14:30	-	C10-25 down since 6:55	Reset from Home. (Beam extracted was limited to 2E7 per shot).
Sun 6	16:47	2'	DR.SMI5303	Reset by CCC crew

The ELENA antiproton period of Friday 04 (7:00-15:00) has been used for several actions for understanding AD limitations. Despite the efforts of many specialists, there are still many processes to adjust.

Potential problems are:

- Polarity on magnet DR.DVT4408 is inverted. The function is temporarily adapted to this situation.
- Application for Emittance measurement is not working since the scrapers renovation (an initial analysis indicated that the old algorithm must be

adapted). So it's impossible to quantify the cooling processes (Stochastic & Electronic) efficiency.

- Application E-Cooler Orbit bump is not correct (DR.DHZ2904 correction must be inverted), this needs to be clarified.

Currently, the bunch length of extraction is at 200ns (130ns nominal) and the intensity mean is equal  $2.9e7$  ( $>3e7$  nominal) antiproton per shot.

One thing is certain: Much more needs to be done to back to nominal efficiency.

### SPS (Francesco Velotti)

Busy week at the SPS. It started on Monday, when profiting for LHC access, we let the access for cooling filter replacement (again) at the septa in LSS6. For the whole week, the intensity on T6 has been increased stepwise reaching 100 units Friday afternoon. Also, there was found a problem with the FGC firmware - every time a server is restarted, the functions are taken from the wrong cycle, it needs deployment of latest firmware to fix the bug.

On Tuesday, the drifting scraper position, already seen during last weeks, gave quite some troubles, also slowing down LHC fills. It was decided to move to the spare, but, after a day of normal operation, the same problem showed up also on the spare. It seems to be a software issue and the experts are working on it.

Wednesday was dedicated to the access for crab cavities. Here, all different interlocks were tested and no issues were identified. Such an exercise was very useful and done by the first hours of the afternoon. The rest of the dedicated MD slot was devoted to the setting up of the crab cavities cycle. Chromaticity measurements using radial position sinusoidal modulation was performed showing already nice results.

Profiting about the stop, the cooling problem in T10 was also addressed. Also an intervention in BB3 on a cooling circuit for a cavity was done, where the spare pump was put in operation.

On Thursday, the set up of the crab cavity cycle continued and was started for the high intensity cycle. There was a problem with the H wire scanner filter, which it was then fixed by the end of the day.

Instabilities on the BCMS operational cycle were observed on Friday. It was finally understood that this was due to the poor beam quality coming from the PS as consequence of a problem on a 40 MHz cavity. Issue solved shortly after. At the same time, strong 50 Hz oscillation was observed on one chromatic sextuple family - first line found and fixed the problem. The same day, following the request of the NA experiments, we rolled back to the last year QF regulation (the suppression of 50 Hz brought with it low frequency broadband noise). NA62 appreciated very much the spill quality delivered in this configuration.

In the afternoon, the weekend Odyssey of the slow extraction elements started. At first, ZS4 started sparking at an incredibly high rate. This interlocked the beam 3 times. After, it was still sparking, also without beam, hence the decision to increase its gap by 5 mm and increase the voltage accordingly (now -230 kV). This solved the issue and NA physics restarted. The ZS4 should be kept under observation.

On Saturday afternoon the MST tripped during flat of of fixed target slow extraction cycle as a consequence of wrong temperature reading on the MST2. It was recorded in the logging a temperature spike unreasonably high (and also with a very strange signature as no decay was seen after) in the MST2 temperature sensor (PT100). Having the MST off, caused the beam to hit the MSE - here we recorded a vacuum spike, water temperature rise and consequent trip of the power supply. Losses recorded at the MSE1 and 2 were also way beyond thresholds (a factor 10). A beam dump was not triggered during the cycle. Only in the following cycle the beam was stopped. This should not have been the case as there we have LSS BLMs (first 16 in LSS2) which should have triggered in max  $\sim 800$  us (or 20 ms in the worst case, i.e. SW interlock) after exceeding the threshold.

After investigation of what happened, we realised that the BLMs in LSS2 (all) were not dumping the beam when losses above threshold - we decided to stop the slow extraction and investigate with the expert. BI experts worked during the night (Saturday) to try to fix the problem. This was done at about 2AM, when the software (20 ms) interlock was back in place and we restarted the NA physics. During the investigation, it was also found that the HW interlock (800us) was not working on the LSS BLMs and left to be fixed in the morning. After a few iteration, the problem was isolated to be purely software. Lars managed to fix it at about 13:00 Sunday morning.

Before restarting with NA physics, we perform a qualification check of the LSS2 interlocks. With an INDIV, we caused losses in LSS2 (vertical) and we lowered the thresholds on the LSS2 BLMs just above noise level. Looking at the time between injection and dump event (we used the signal from the mountain range), we concluded that the dump took 500 us. BLMs are considered qualified and we started with NA physics again (<https://ab-dep-op-elogbook.web.cern.ch/ab-dep-op-elogbook/elogbook/secure/eLogbook.php?shiftId=1097357>). The other LSS BLM which showed the same problem will be fixed Monday morning. It was also discovered that this was not the first time that such an event happened. In fact, the 15th April we had again a sudden temperature spike in the MST which made it trip. In that case, we extracted the whole beam ( $\sim 1.4e13$  p) on the MSE. This unfortunately went unreported. Like Saturday, the BLMs didn't trigger as they are suppose to.

### LHC (Jorg Wenninger):

The week started with an intensity step to 1550b, followed by 3 fills at 1880b before a series of steps led to **2556b on Saturday 5th May in the morning, marking the end of the intensity ramp up** . This is 10 days ahead of the schedule presented in Chamonix. The weekend was somewhat rocky with many short fills dumped on BLM SUEs, UFOs and QPS issues on RCBX. The peak luminosity may have reached a new record aoce  $2.1 \times 10^{34}$  cm<sup>-1</sup>s<sup>-1</sup>, pending confirmation of the luminosity scales. Losses in 16L2 were kept further under control with negative orbit bumps of -1.5 mm (B1) and -1 m (B2). There was little to no impact on the steady state losses, but the spikes seemed to be significantly suppressed.