

Accelerator complex status

End week 27 (Sunday 6th July 2015)

TI (Jesper Nielsen)

A very warm and busy weekend for TI keeping everything running despite the high temperatures!

<https://wikis.cern.ch/display/TIOP/2015/07/03/TI+summary+week+27%2C+2015>

Linac2 (Jean-Baptiste Lallement)

On Tuesday, at 12:45 PM, the source cathode broke unexpectedly. After diagnosing the problem, the cathode was replaced in the afternoon and the source pumped over the following night. The cathode forming started on Wednesday at 4:00 AM, once reached an acceptable vacuum level. The beam production restarted at 16:30 on Wednesday afternoon (29 hours down time). Waiting for a more detailed analysis on the reason(s) of the cathodes failures, we decided to run the source with conservative settings (low cathode current, low arc current and higher gas injection than for the previous cathode). The current delivered to the PSB is around 145 mA (it was 155 mA before the cathode failure).

On Friday evening, a tank3 RF tube started to show signs of ageing. The RF tripped many times (approx. 35 times) from Friday evening to Sunday morning when we finally manage to reach the RF expert on the phone. Every RF trip induced a beam stop of about 10 to 15 minutes (time needed to recover the RF in the 3 tanks after resetting tank3) for a total integrated time of 6 hours. With the help of the PSB-PS operators following the instructions of the RF expert, the filament current of the tank3 tube was decreased on Sunday at noon. Since then, the RF has been stable. The 3 RF tubes of the tank3 will be replaced tomorrow from 8:30 AM. Beam expected around 15:30 in the afternoon.

ISOLDE (Lefteris Fadakis)

GPS:

Tuesday yield checks on target #535 Nb-neg, with the interruption of the linac2 broken cathode. Wednesday we changed the polarity of the power supplies for LA0, LA1. Stable beam tuning was performed with almost 70% transmission. Target people continued with their yield checks until midnight of Thursday when radioactive beam was delivered to LA1. They continued taking beam (74 -71Br and 42 – 39Cl) until Monday. PSB lost ring 4 on Friday so they had to lower the intensity, also several small proton stops during the weekend, other than that it went very well.

HRS:

Following our meeting with TE-EPC and BE-OP, BE-CO on Tuesday, M.Dudek from TE-EPC agreed to roll back the changes he made during the last technical stop in his software. I have been cycling both HRS magnets since then and they have not failed a single time. Will discuss in the next days if and in what way he should upgrade to rda3.

This was one of the quietest weeks ever (or the new sim card does not work in the house)

LEIR (Michael Bodendorfer)

LEIR had a hot week. We had to solve multiple communication issues with our power converters, especially often during the hot afternoons of last week. The issue has been attended by the BE-CO and EPC-CO groups. The experts on site have efficiently identified out the causes for the problems (bad connectors and a device address 15 replaced with 17) during several afternoons. Since the last change (Thursday July 2nd, replacement of the controls crate back plane of ETL.BHN20 converter) no more issues have occurred.

LEIR is circulating Pb54+ ion beam, at rather low intensity (between $0.3E10$ charges and max. $0.8E10$ charges). Compared to the last values of Early beam in February 2013, we are short at least 55% in intensity.

However, this is the first full week of beam operation and it was a success in the sense, that we actually had beam in the machine.

The LEIR ion beam is currently intense enough for the LEIR beam instrumentation to acquire some first data of tune (H: 1.82, V:2.7), longitudinal momentum distribution via Schottky and RF pickup-signals for the low level RF loops. We have not yet RF-captured beam. But we all work hard and try, especially Maria-Elena as our RF expert, to get the ion beam captured before the end of week 27.

As a challenge, we see that the Pb54+ ion beam from Linac3 in the transfer line to LEIR is not stable in position. The beam moves sideways from shot to shot but it also drifts from the center to the edge of the vacuum chamber over the course of 24h. We don't know yet why that is, but it represents a large challenge for us, since the LEIR injection is very sensitive to positional and directional errors of the incoming ion beam.

Booster (Bettina Mikulec)

- The week started continuing the investigations on the **ring 4 losses** present since around beginning of June with the usual C02+C04 cavity configuration, but degrading in the sense that the losses now affected apart from ISOLDE beams also medium-intensity users like SFTPRO.
- We were interrupted by the **Linac 2 cathode breakage** on Tuesday around 12:40. 26.5 hours downtime, slowly restarting the machine on Wednesday around 1pm. Then the MPS couldn't be restarted and required PIPO intervention (40 min downtime). After this we realised that we couldn't get any beam because the beam stopper BI.STPFA10 was in 'unknown position'. The beam stopper specialist had to access to solve the problem with a switch (switchyard in 'Test EIS' mode). The EIS was retested following the instructions from the DSO M. Tavlet. 1.5 h downtime. Beam was finally back at 5pm and linac current slowly increasing (was reduced again on Friday after some source parameters had to be modified by the linac team).
- Losses on ring 2 only for the AD beam. They seemed to be related to the working point and multipole settings, but the situation drifted during a couple of days until it became again stable.

- Losses on ring 4 now even for LHC50 and LHC25! Only LHCINDIV seems to be below the threshold for these losses to occur.
- After the restart on Wednesday we were also suffering from important losses - on ring 3 to change - for the LHC50 user. We found out that these losses were related to shaving, and we had either to decrease the amplitude of the vertical shaving or reverse the polarity to get these losses under control. To be followed up at a later point...
- On Thursday just before 10am, the **ring 2 C04 cavity resets** started. This was due to the too **elevated temperature of the demineralized cooling water** (28 deg. Instead of 24 deg.). As immediate solution the supercycle had to be alleviated. EN-CV continued their investigations, but confirmed that the circuit was already running at 100% cooling power. They then proposed to run the primary circuit in open loop, as was already done during the last 'canicule' period. This allowed us to charge the supercycle again according to the user demands. On Friday the situation degraded again, but stabilised after another intervention and adjustments of EN-CV. Thanks to EN-CV for all their efforts!
- Also on Thursday synchronisation problems appeared on AD and LHC25, leading to losses at PS injection. After some investigation the beating frequency of rings 1 and 4 had to be increased, which cured the issue, but the RF specialist will need some time in the near future to solve this problem at the source.
- Friday afternoon important losses were observed on NORMGPS ring 4, although we are using the Finemet to control for this users. The loss pattern is different though compared to the C02+C04 situation. Awaiting the work of the RF specialist, we had to reduce the intensity on this ring.
- Still on Friday, since around 7:30pm, **Linac2 tank 3 started dropping out**. Throughout the weekend the operators had to do many resets, which in average meant no beam for about 10 min per reset. As the frequency of the tank 3 RF trips increased, the operator tried to reach the RF specialist throughout Saturday morning; F. Gerigk replied around 1pm and came in. He diagnosed that the **RF tube of tank 3 is at the end of its lifetime** (already Friday the power had to be increased) and that it needs replacing, but for this intervention 2 RF specialists are required. Therefore (as the other RF specialist couldn't be reached) Frank suggested doing the replacement Monday morning and continuing with resets throughout the weekend. MANY resets were indeed required! On Sunday end of the morning, as the Linac 2 tank 3 resets were so frequent, the PSB operator called once more the Linac 2 supervisor, who finally managed to get into contact with J. Marques Balula. The next trip was not reset, the source beam stopper inserted and he analysed the situation. J. Marques asked that the PSB operator should go on site, and he then **reduced the filament current** following the instructions of J. Marques on the phone. **Since then no more trips**. Tube exchange planned for Tuesday morning.
- Continuation of the ring 4 loss saga:
 - With the tune pickup (without kick or chirp) it was observed that the losses on ring 4 follow important horizontal and vertical position jumps, but these position

variations are too slow to be explained by a transverse instability, as they last of the order of 100 turns. This is also the reason why the transverse feedback cannot damp the oscillations. All pickups around the ring also confirm these orbit jumps ($\sim\pm 7$ mm amplitude both in horizontal and vertical with the 1 ms averaging; no turn-by-turn PU data yet available). We tried to correct virtually these orbit deformations with YASP selecting all available dipolar elements, but no correction with 1-2 elements could be found. A check of the analog signals of each equipment in the ring that could lead to a dipolar kick was also unsuccessful.

- On Thursday morning A. Findlay set up ring 4 of LHC50 and LHC25 to work with the Finemet cavity; we are now running with the Finemet for ISOLDE and LHC50/25 beams.
- Investigations continued on Thursday afternoon in close collaboration with the RF team to try to pin down the problem of the ring 4 losses, but without much success. It could only be confirmed that the losses appear 3-4 ms AFTER the change in radial position.
- Friday afternoon **very good progress was made in the understanding of the origin of the ring 4 losses with C02+C04**. Both S. Hancock and S. Albright managed to observe independently that the origin of the losses seems to be a phase jump (see plots in the PSB elogook at 12:15 and 16:16). M-E. Angoletta uploaded a new firmware code in the evening with increased diagnostics. She then confirmed that **'The occasional frequency jump in the phase loop is caused by a jump in the Beam phase signals.'** Still it was not clear from where these phase jumps came from.
- Sunday afternoon investigations continued. We finally managed (thanks to the support from CO!) to switch from ring 4 to the spare ring 0 beam control (used for Finemet), and **the losses disappeared!** This **points to a faulty daughter card (DDC) in DSPB of the ring 4 beam control**. M-E. Angoletta is organising the exchange with her RF colleagues for Monday, and the aim is to also add diagnostics to be able to identify this problem next time it will occur.
- 1.5 h later losses occurred for the cycles that have been switched to ring 0 beam control (with or without the use of the Finemet cavity). The loss pattern is completely different though, slow losses over >100 ms. The PSB supervisor and RF piquet were called in, but after midnight they had to give up. No beam for the moment from ring 4 except if the LHC requests the LHC50 (but ring 4 will be unstable). The RF specialists were asked to have a look once the intervention with the daughter board exchange will be finished (and will hopefully provide stable beam in ring 4 for all users).
- In-between these major issues there were many other small problems that could be solved within a reasonable time by the operations team, specialists or piquets (affecting EPC, BI, RF and vacuum equipment).

PS (Rende Steerenberg)

Despite quite a few small breakdowns of several PS equipment the PS machine had a good up time. However the beam availability was hampered by serious problems on the LINAC2 side and issues with ring 4 of the PSB.

The IRRAD/CHARM beam optics was successfully switch from an 8 cm x 8 cm FWHM beam sine to the usual parallel optic which has a 12 mm x 12 mm FWHM beam size.

During the LINAC2 source repair quite a few interventions requiring access that were on the waiting list could be made.

Throughout the week the PS had a few problems with the 200 MHz blow up cavities and some 10 MHz accelerating cavities, but they could be solved by the specialists in a reasonable short time. Towards the end of the week the LHC beams suffered from problems in the synchronisation at extracting, causing the beam to be sometime in the wrong bucket in the SPS. This was overcome thanks to the intervention of the low level RF piquet.

Beside the routine delivery of the EAS, TOF, SFTPRO, AD and LHC beams the MTE beam was also delivered to the SPS for setting up the injection there on a special short cycle were the beam is only accelerated up to 200 GeV.

SPS (Benoit Salvant)

It was a good week for the SPS, with delivery of 25 ns and 50 ns beams to the LHC for scrubbing and physics, the completion of a series of HiRadmat tests and delivery of proton beams to the North Area, despite many problems in the PS complex.

From the beams point of view:

- Up to 72 bunches per extraction with 25 ns spacing were sent to LHC (up to 108 bunches per extraction with 50 ns spacing).
- The MD cycle without acceleration to test injection of the MTE beam was generated and used in parallel to operational cycles.
- A series of shots were sent to HiRadMat with intensities ranging from $4.0E10$ to more than $1.0E12$ with vertical scans and as constant beam size at the target as possible.

On the technical issues front:

- The MKDV fan issue that has brought down two power supplies was understood and fixed.
- The SPS took the opportunity of the long source stop to perform some accesses that were on the intervention list. In particular an inspection on the MDLV211512 in TT20 confirmed that the water leak had been stopped by the patch applied at the last technical stop. The dipole 10130 change could however not be organized in the shadow of the stop.
- There were a couple of trips of the injection kickers due to vacuum interlock (one with a spark of the PFN7).

- A ripple of about 1A on QF was observed on Saturday and Sunday and has affected the slow extraction to the North Area for several cycles. This will have to be discussed with TE-EPC after the weekend
- A spurious injection bucket change was intermittently affecting the LHC beams injected from the PS throughout the weekend. It was investigated by both PS and SPS RF specialists who found a fix on Sunday afternoon. This issue was linked to the heat wave.
- The BBLR MD could not take place because of a hardware issue.