

## End Week 22 (June 1st) – Status of Accelerators

### CTF (Django)

The week was dedicated to Delay Loop optimisation and response matrix measurements in TL2.

On Wednesday a specially low Dp/p beam was designed to improve the measurements as it is thought that the low energy tail pollutes them.

The scraper in the first chicane is used to get rid of the low energy tail. By Wednesday evening full transmission through delay loop was obtained.

Unfortunately on Friday MKS03 tripped again with apparently the same fault as week 16, needing transport of the transformer's oil tank to the end of the gallery in order to open it and change the (expectedly) damaged diodes in the rectifier bridge. The intervention is planned for Monday June 2nd, 9:00 At 14:00 on Friday D.Gros inspected the cooling water towers, as the blades of the fans had been found damaged on similar towers. Fortunately in CTF they are OK.

At 17:00 CLEX was closed again to allow CALIFES conditioning.

### Isolde (Pascal Fernier)

#### GPS : 2 problemes cette semaine :

1) GPS.FC490 et GLM.DP10 se sont collisionnees ( non fonctionnement du système de securite du aux precedents problemes avec les cartes electroniques des stepping motors) ☒ mise a l'atmosphere de la section separator et changement du piston de mouvement de GPS.FC490 .

2) La cible donne une tres faible production de Rb et le run de mesure est annule et remis au prochain run dans 10 jours.

HRS : excellent fonctionnement.

Setting-up , proton scan et yield measurement montrent une tres bonne production de krypton qui doivent etres utilises par Rex puis par les utilisateurs.

Machine OK mais pas d'utilisateur car Rex est en panne ; peut-etre 1 equipe d'utilisateurs est interessee par le temps faisceau disponible.

#### REX : 2 problemes cette semaine.

1) Changement d'une pompe a vide de Rextrap jeudi par Fredrick Wenander☒ ok apres 4H00 d'intervention

2) Fuite de vide sur la cavite sur la cavite 7 gap de Rex : malgre un tres gros travail des equipes vides et de Didier Voulot, cette fuite n'a pas pu etre reparee et abandon apres la 4eme tentative de reparation : une nouvelle solution est en cours d'etude mais elle demandera 1 a 2 semaines pour faire cette reparation. ☒ le run de physique avec Rex est donc annule (run qui devait durer jusqu'au jeudi 04 Juin)

## Booster (Jocelyn Tan)

### Tuesday

afternoon.

- BPT.MBL10 has triggered for EastB : The low threshold for EastB being very low, it was easily reached by the remanence activity of the preceding users (SFTPRO here). After moving EastB the problem disappeared.

### Wednesday

afternoon

- The PIPO was called for BE.SMH15L1 whose aqn was 10A lower than the CCV. The PIPO asked to cut the beam for 10mn. It worked fine after his intervention.

night

- There was a jitter of 1/2 Trev on BAX.TRFPSBSYNC which affected [Isolde](#) and all [dumped beams](#). The PICO was called but could not find anything as the problem has disappeared.

### Thursday

morning

- The RF team and PICO have followed-up last night's RF issue and have checked all RF signals on a scope. "Unfortunately" the jitter has disappeared and the team could not diagnose the problem.

### Friday

night

- at 2:15AM the bending magnet BT.BHZ10 tripped and could not be restarted neither remotely nor locally. The PIPO was called and found a broken repetitor (which prevented the interlock of BT.BHZ10 and BTY.BHZ301 to work). After replacing it by the spare part, beam was back. Down time 1h33min.

### Saturday

afternoon

- There was a controls issue at 4PM : everything was frozen, no timing nor MTG event. 27 DSCs turned to red, but the Laser application just displayed 3 errors which were not linked to the problem.  
PICO was called. In the meantime, Ernesto could switch to the spare right spare module. Down time 35min.

### Sunday

- The same frozen MTG problem as yesterday occurred twice, once in the morning and in the afternoon. [As a temporary fix solution](#), the operators have switched from MTGA to MTGB once and then from MTGB to MTGA. [This will be followed-up by CO.](#)

### Monday

afternoon at about 3 o'clock

- The MPS was not pulsing due to a missing B-train. A remote reset did not work, and the B-train specialist could not be reached. In the mean time the operator went locally

and switched off and on the dpsbmps chassis. His action solved the B-train problem. Down time ~55min.

Night

- Whereas BTY.BHZ301 was pulsing at the right CCV value, the power supply sends a wrong error message which triggers the HRS beam interlock : RF is cut by the timing BAX.RFRESET. This timing could not be disabled by a knob. The operator has plugged this timing cable to a non-operational pulse repeater so that this interlock timing does not come out anymore. But there the bendings BT.BHZ10 and BTY.BHZ301 have not anymore a “magnet fault” interlock : a real concern especially for BT.BHZ10 which is powered either positively or negatively.

**Tuesday**

- The power converter expert has been contacted this morning for BT.BHZ10.

**Beams :**

Following the injection septum replacement, the beams LHCINDIV and LHCPROBE have been checked and archives updated.

VELO experiment has been carried out on Thursday and Friday on the user MDPSB.

## **PS (Rende Steerenberg)**

The restart on Monday after the long technical stop was not without problems. The beam for the SPS were available in the afternoon, but the East Area beams only early Tuesday morning.

The realignment of the T7 irradiations equipment on Monday showed that several equipments were from 1 cm up to several centimetres out of line. This was corrected on during the same stop.

Tuesday the first beam was sent to the nTOF target with success. However, there are some problems with the beam current transformer in the FTN line. Our BI colleagues have been working on this, but the problems are not yet fully understood and solved. Since not all the shielding is in place we are not allowed to go beyond 1 pulse per 28 basic periods and  $5E12$  per pulse for nTOF. The parasitic nTOF beam at  $4e12$  is also ready on the EASTA beam and the EASTC beam will follow soon.

Last weekend the whole accelerator complex suffered from problems with the MTG that froze three times. The exact reason is not yet known, but investigations are ongoing.

## **SPS (Elias Metral)**

During the week, most of the efforts were devoted to the setting-up of CNGS (to be ready to start physics => Many scans of beam vs. target, horizontally and vertically, target table re-alignment, and extraction tests), and LHCFAST (to be ready for the TI8 tests), as well as many adjustments on the transverse dampers. On Wednesday and Thursday, the LHCPROBE bunch (on LHCFAST) was extracted in TT60 and TT40, with a vertical emittance of  $\sim 1.5$  micrometers (measured in the line). The value in the horizontal plane is larger and both transverse values could not be confirmed yet by measurements with wire scanners in the ring. This work is still ongoing.

On Monday morning, during the SFTPRO slow extraction, beam losses were observed in LSS5 (in 518), where usually no losses are observed. The newly (during the week before) installed quartz for the crystal experiment was rapidly identified as the culprit. As it was not possible to remove the

losses by retracting remotely the quartz to its (maximum) parking position, it was decided to make an intervention to try and move it locally. It was indeed possible to retract the quartz even further by 5 mm (in total), which made the losses disappear. The motor was also disconnected at the same occasion to be sure that nothing would move during beam operation. During that day, there were also problems with the RF synchro loop (where the offset in the phase disc had to be modified), with a thyristors' bridge broken on the SMQD (which had to be replaced by its spare), and with a tube and a power supply (which had to be changed) on the TRX1.

On Tuesday, the symmetry of T4 didn't indicate the small 'a'. This was solved by increasing the amplifier gain of BSMH.241105 and BSMV.241105 from 1 to 4 (the code which is used for the PAGE1 display uses an intensity threshold for the beam detection which is set to 100. The raw data with gain 1 was below that threshold). On another subject, RF experts switched to synchro loop pick up 2 (for both SFTPRO and CNGS; before it was 1). This changed the orbit, which had to be corrected.

On Wednesday, LHCFAST8400 (8.4 s) was replaced by a LHCFAST7200 (i.e. shorter by 1.2 s) to have Eddy currents on the following SFTPRO cycle similar to the ones of CNGS, which was used when SFTPRO was optimized. Once this was done, losses previously observed on the flat-bottom of SFTPRO disappeared. On LHCFAST, beam losses were observed after  $\sim 150$  ms and this was traced back to be due to the PlayBack mode. Indeed, in the FC, on the SPS Frequency Module there is either ReferenceMagnet or PlayBack. For all beams, what is normally done, is that the frequency is computed from the Bdot each  $x$  ms for each cycle, in the ReferenceMagnet mode. The PlayBack mode has been implemented for LHC filling to have an easier rephasing on the flat-top. The idea is to average during the last 20 cycles in the ReferenceMagnet mode and then fill a table of frequencies. In the PlayBack mode, only this table of frequencies is read (and not updated). The losses observed were due to the fact that this PlayBack mode was on this morning (with a table produced in bad conditions). Once we came back to ReferenceMagnet mode, the losses disappeared. Later, we also checked from the FC that it also works in the PlayBack mode when the table is created in good conditions.

On Thursday, an intervention on the MKQV took place as well as on SMQD (the QD was put secure to be able to work on it for few days and avoid the bad contacts between the thyristors. Once the specialists have finished, they will ask to come back on the QD).

On Friday, several attempts were made to try and measure the transverse beam emittances of the LHCPROBE bunch with the new application but they were not yet successful.

During the (long) week-end, many trips with the damper H1 were observed, and it was often not possible to restart it. The intensity on CNGS was increased and on Monday,  $\sim 2E13$  p/p were reached at 400 GeV/c.

## AD (Tommy Eriksson)

Major activities during last week:

- Target area access for fixing interlock problem.
- Optimisation of target z-position - best Pbar yield found at nominal position. More optics studies of inj.line to follow
- electron cooling verified and adjusted for good final emittances at 100 MeV/c

- some HW-problems w. e-cooler - cathode power supply replaced with spare
- ejection lines verified up to entrance of the experimental areas
- tests of switching between experiments w/o hysteresis cycling of dipoles (for faster switching)
- ASACUSA RFQD multi-pulsing tested in view of one of the experiments to take place this summer (a first for this operation)
- various ctrls and BI problems, some outstanding issues : TFA7049 (ej. line), orbit measurement system.
- 3.6 E7 injected and cooled with 1350 E10 on target, stable beam from PS
- Good deceleration efficiency.

So, it looks good for physics start next Monday !

### Technical Infrastructure (Peter Sollander)

- 26/5: A fault on an electrical equipment (48V) trips UPS power for ATLAS
- 28/5: EMD204/BE supplying BA5 trips. It looks like another cable problem, but the problem is not yet located. EPC put in service a reserve cable (EMD203/BE?)

### LHC – Successful tests for validation of the LHC Access System at P8 of LHC (Ghislain Roy)

The validation tests of the LHC Access System at P8 of the LHC have been completed successfully this afternoon.

We have tested for intrusion a subset of the doors and access point equipment.

In all cases we have checked that the interlock was properly transmitted from the LHC to Chain 3 of the SPS, both the PLC and Wired chains.

In many cases we have been able to switch ON the EIS of Chain 3 of SPS and have checked that the interlock was working end to end.

The results have been compiled into an Excel file and published on EDMS :

<https://edms.cern.ch/document/1002056/1>

I conclude that the Access System at P8 of LHC is qualified in view of beam transfer through T18.

### Tests of LHC Access Systems (Saturday) – Ghislain Roy

Today GS/ASE and BE/OP have tested some of the functionalities of the LHC access systems.

After a complete closure of all LHC sectors, including the experiments, we were able to identify the following points:

- all doors and access elements behaved as expected; the preventive maintenance is paying off.

- the interlocked power converters in Point 8 were found to be still "out of chain". This has been fixed.
- the sirens did not sound in Point 5. This could not be fixed and is outstanding. We worked around it for today.
- the EIS that were tested and could be switched to UNSAFE status (ON or OUT\_OF\_BEAM) are:
  1. all interlocked power converters at Point 2 (MSI and MBI in Chain 2) and the TED at the bottom of TI2
  2. all interlocked power converters at Point 8 (MSI and MBI in Chain 8) and the TED at the bottom of TI8
  3. interlocked power converters at Point 3 and Point 7 (RD34.LR3 and RD34.LR7 in Chain 1)
  4. interlocked electron stoppers at Point 4 in Chain4
  5. interlocked Access Safety Block at Point 3 in Chain 1 (Only the one on Blue Beam)
- the EIS that were UNSAFE in beam mode have been correctly tripped to SAFE when the chains 1, 2 and 8 were tripped on the LHC access console.
- the same EIS were also tripped to SAFE when an intrusion was actually and voluntarily performed at Point 5 (end-zone door at the top of Sector 3, the technical staircase in the PM56 pit)
- the EIS that could not be tested and are left out-of-chain after the test are :
  1. the RF system (all three interlock points are not available; the RF waveguides are not connected to the cavities)
  2. the Access Safety Block of the Red beam at Point 3 ; it is blocked
- all other EIS are now in-chain and will now be strictly managed by the DSO.
- upon moving back to ACCESS, the actual mode of the access points is correctly the CLOSED mode, while we were in RESTRICTED mode on all access points before switching to BEAM. This is validated.
- we were careful not to stay in beam mode for longer than 30 minutes in order to make sure that no radiation veto would be activated.