

Accelerator Complex Status

End week 50 (Monday 14 December 2020)

Last weekly report for 2020.....

Technical Infrastructure (J. Nielsen):

- A fairly quiet week for TI.
- Statistics:
 - About 7500 alarms
 - 1090 phone calls (769 incoming, 321 outgoing)
 - 194 ODM created
- Events worth mentioning:
 - On Monday, Tuesday and Wednesday the compensators of BEF4, LHC8 and LHC 6 were switched on successfully by TE-EPC.
- Details: <https://wikis.cern.ch/display/TIOP/2020/12/14/TI+week+summary,+Week+50>

LINAC 4 (B. Mikulec):

Main points from this week:

- **Monday providing for the first time beam from Linac4 to the PSB!**
- Monday night profile measurements for ABP for emittance reconstruction at LBE for the situation with debuncher detuned.
- Tuesday morning during the PSB access the LLRF team worked on PIMS0708 to check it with a lower modulator voltage, which will reduce the probability of restart problems for a cold klystron.
- Tuesday evening the RFQ went into breakdown protection mode level 4; normally it would take about an hour to restart automatically, but R. Wegner managed to restart it quicker. It tripped again, but after adjustment of the RFQ filling transient offset beam, the RFQ was again in operational state.
- Wednesday morning reload of the LEBT beam stopper FESA class and restart of the INCA server.
- Thursday evening A. Topaloudis deployed a new FESA class for the BCTs that solves the problem that the low-energy watchdog inhibits the beam and thus stops the Linac4 source pulsing when there a 0 turns set (or an interlock that sets 0 turns).
- On Friday B. Bielawski updated the configuration of PhaseMonitoring → indicator that has been added to the Vistar and RF display will show when the phase of a cavity drifts by more than 3 degrees.
- The Cruise Control is now using Custom Chopping patterns, using as input the required bunch length at PSB injection.
- Some chopper trips during the week.
- R. Ruffieux adjusted the BCT start/stop windows of all BCTs for the short commissioning beam and the change to the custom chopping patterns. On Saturday J-L. Sanchez adjusted in addition the BCT delays to account for the beam time-of-flight. P. Skowronski works on a solution to update the Vistar with more correct current measurements.
- **Friday evening the PSB beam commissioning had to be interrupted, as the low-energy watchdog always tripped for beam with destination PSB.** Finally, on Saturday morning it was found that the reason was that the BI.SMV10 acquisition was outside the interlock window, which then blocked the beam through the BIS. Also, some low-energy watchdog BCT settings had to be adjusted.

- **Sunday around 1:45am DTL1 tripped and couldn't be reset.** The EPC piquet was called in in the morning to investigate on the modulator. He replaced a module, but DTL1 could then at 12:30 only be restarted at a lower voltage by R. Wegner. **An intervention with all specialists is planned for Monday 8:30.**

Concerning the beam head observed at the screen between distributor and vertical septum in the PSB BI line, a rough estimate showed that with a full supercycle the load on the head dump of BI.SMV10 would exceed the specifications for the continuous operational scenario. A. Lombardi said she would have a look at this in more detail (she already took measurements with the MEBT wire scanners). One option would be to reduce a bit the length of the beam head (but this could lead to non-flat pulses). My preferred solution would be to investigate increasing the chopping efficiency, as we also see unchopped beam on the H0/H- monitor that would fall outside the PSB bucket in-between micro-pulses and would lead to activation at PSB injection.

PS Booster (G.P. Di Giovanni):

Last week marked the beginning of the PSB beam commissioning after LS2.

It was an eventful week with several milestones reached:

- The PSB beam commissioning team managed to steer the beam through the BI line and up to the BTV at the location of the foil already on the very first day.
- The following day we managed to repeat the same achievement for all the remaining 3 rings.
 - The usage of YASP and the steering of the BI line on a reference could be tested successfully. More optics checks will follow in the next weeks.
 - With this initial setting-up done, we could start collecting data for the calibration of the H0/H- monitor in front of the H0/H- dump in ring3. The calibration of this equipment is crucial to allow safe operation when injecting with the foil.
- On Thursday we inserted the foil for the first time and could circulate low intensity proton beam in the ring for only a few turns, on both ring1 and ring3.
- On Friday we set a flat cycle at 160 MeV, cleaned-up the settings and managed to have low intensity commissioning proton beam circulating in ring3 for the duration of almost the entire cycle, as confirmed by measurements on the ring BPMs, BCTs and even the tune measurement on the BBQ system.
 - This marked the beginning of the RF commissioning, as the RF team started working on the capture of the beam from mid-day.
- Later on Friday evening the beam commissioning was stopped because of an interlock with the low-energy watchdog for beam with destination PSB. On Saturday morning, the shift crew identified the issue to come from the BI.SMV10 acquisition being outside of the interlock window. Resolving the issue allowed ABT and BI experts to continue the collection of the data for the H0/H- calibration on the various rings during the week-end.
- Finally, the nights were mainly used to work on performing the left over tests of the PSB HW commissioning.

A few issues were also discovered along the way, in particular the presence of a beam head, as observed at the screen between distributor and vertical septum in the PSB BI line. The initial estimate indicates that, with a full supercycle, the load on the head dump of BI.SMV10 would exceed the specifications for the continuous operational scenario. More details in Bettina's report about the ongoing follow-up with the Linac4 team.

The experts are now working on their system with ABP, ABT, BI and RF heavily involved. Clearly, the commissioning is more a marathon than a sprint, and this is just the beginning. On the other hand, it was extremely relieving to attain these goals, as they are a critical proof-of-principle of the new PSB injection schema.

Next week will focus on the energy matching at PSB injection with Linac4, the RF setting-up for capture, the testing and implementation of H0/H- interlock, and the usual debugging of the various equipment (for instance now we can display the ring BPMs information only for 1 ring at the time). If time allows it, we will work to bring the other rings to the same injection performance of ring3.

PS (K. Hanke):

- TT2 EIS tested for SPS DSO tests
- TT2 vacuum repair ongoing. Chamber welded will be installed today. Start pumping Tuesday.
- Commissioning of n-TOF magnets well advanced.
- SMH57/61 operational
- KFA71 module 10 and 11 with short pulse. Will be corrected in Jan'21
- Timing and pulse of transition quads tested and adjusted
- This week PSR in Access General to allow transport of MU covers (installation scheduled for Jan'21).

SPS:

Monday the SPS ring was patrolled followed by the DSO test, which could be concluded successfully on Thursday. The access system and its interfaces with the EIS are working very well. A big thanks congratulations to the access project team.

On Friday the hardware commissioning activities started with high voltage and powering tests.

An 1850m long cable for the control and status of quadrupole busbar "couteau" switches was found to have an open circuit and will be replaced during the nights of week 2. At this stage of the hardware commissioning this does not pose a problem.

ISOLDE (A. Rodriguez):

The highlights of the week at ISOLDE:

- The warm-up of the cryomodules continued during the week. The cavities are now at ~275 K.
- We repeated some of the Ir and Ce contamination measurements last Tuesday. The initial data was not very good and we wanted to double-check with a different preamplifier for the silicon detector
- In the low energy side, we installed a new target to see if the old one was the reason why we couldn't hold 60 kV. The situation has improved since then. But, we still see occasional sparks
- We reverted the polarities of some of the quads in several of the low-energy lines and we are preparing new set-ups with the new configuration. We will continue doing this today and tomorrow.
- We also did quite a few quad scans using the triplet in the new front-end. We hope we will be able to use the data to determine the beam emittance and Twiss parameters out of the target. But, we haven't done the data analysis yet.

ELENA (Laurette Ponce):

- We could restore the extraction to LNE00 on Wednesday, using the old Iseg power supply for the ion switch, no sparking up to now.
- On Wednesday beam was sent to ALPHA for a couple of hours, we could move the beam on their screen as requested and rematch the line to get rounder beam.
- Test on electron cooler performed successfully: e-beam produced on Hminus cycle, orbit of the e-beam observed on the BPMs, still some work on settings to completely compensate the effect of the magnetic system on orbit and optics
- Beam successfully accelerated to 100 MeV, tune and orbit corrected along the ramp

- We had another trip of the source HV, after working for 1 day with higher gaz flow to compensate source instability. Needed to exchange the dongle (connector interlock), but no effect on the ion switch power supply.

LINAC 3 (G. Bellodi):

The week was mostly devoted to further investigations on the effect of the moveable puller position on beam extraction and RF commissioning.

On Wednesday and Friday morning charge state distribution scans were taken at different puller positions, together with solenoid scans (on Thursday morning) and general re-tuning studies of the low energy transport line to maximise transmission after the RFQ.

No clear intensity gain was observed for either puller configuration, just a higher frequency of plasma breakdowns for certain settings.

RF commissioning of Tank2 and Tank3 continued on Thursday and Friday afternoon to re-validate phase and amplitude settings, after a phase drift problem was fixed last week.

There were no critical operational issues to be reported.

