Minutes of the HSC section

52\textsuperscript{nd} meeting on Monday 17/08/2015 (14:00, 6/R-012)

\textbf{HSC members}: Olav Berrig (OB), Christian Carli (CC), Elias Metral (EM), Giovanni Rumolo (GR), Frank Schmidt (FS), Elena Wildner (EW), Elena Benedetto (EB), Michael Bodendorfer (MB), Kevin Li (KL), Tatiana Pieloni (TP), Benoit Salvant (BS), Guido Sterbini (GS), Daria Astapovych (DA), Meghan McAteer (MM), Nicolo Biancacci (NB), Alexander Huschauer (AH), Giovanni Iadarola (GI), Adrian Oeftiger (AO), Serena Persichelli (SP), Tatiana Rijoff (TR), Letizia Ventura (LV), Claudia Tambasco (CT), Magdalena Kowalska (MK), Andrea Passarelli (AP), Annalisa Romano (AR), Michael Schenk (MS), Vincenzo Forte (VF), Javier Barranco (JB), Aaron Paul Axford (APA), Malte Titze (MT), Francesco Paciolla (FP), Mario Stefan Beck (MSB), Stefan Hegglin (SH), Alpo Valimaa (AV), Hannes Bartosik (HB), Lee Robert Carver (LRC).


1) Newcomers / visitors

- None.

2) Comments on the minutes of the previous 51\textsuperscript{st} meeting + Actions

- No comment.

3) General infos

- SL meeting:
  
  - ABP barbecue on 17/09/15 $\Rightarrow$ 3 people needed to help. Please contact DelphineR (with cc to me) trying to have different people compared to the past (ACTION).

  - Nothing else special to report.

- Brief review of the LHC MDs from block 1 (Impedance/instability MD: 1 point only could be done and was finally close to one already done $\Rightarrow$ Gives more statistics!; BB: BB parameter pushed to 0.05 total in the machine but the quality was not good. We did $\sim$ 0.03 in the past. Interesting data to analyse from noise studies and BTF). Block 2 under preparation.
4) Brief performance reports for the different machines

- PSB (MagdaK)

- Picture of the week:

  https://espace.cern.ch/be-dep/ABP/HSC/Meetings/PSB_report_on_HSC_17_08_2015.pptx

  - Comment from GiovanniR on the hot spot in section 4L1 in Ring 3 (100 times higher than in the other rings): the INDIV beam is always taken on Ring 3 (only) and it is the one where we do the longitudinal blow-up => Is the hot spot due to this?

  - The studies on hollow bunch started using the radial loop as the phase loop cannot be used for the moment.

- BEAMS

  The LHCINDIV_HI_INT was prepared in the PSB and successfully tested in the PS during the week. (Week 29)

  S. Hancock used the clone of the LHCINDIV to test the jitter-free injection (injection synchronised with the PSB RF) with dual-harmonic capture. He suggests that this could result in a brightness increase for the LHC25 beam by up to 50%. To be followed up. (Week 33)

  The LHC_BCMS25_A&B were tested with the PS ahead of the request for the following week and all is within specification. (Week 33)

- MDs

  The usual MD program continued, with transverse shaving, hollow bunches, Finemet cavities tests and injection BPM fluctuations.

  The LL-RF team successfully used Finemet for an ISOLDE beam as C02 replacement (with only max. ~7.2 kV available), which worked fine in terms of extracted intensity, but the bunch shape wasn’t very pretty. (Week 33)

  The results of the new shaving scheme looks very promising with reduced beam losses and improved orbits (in both planes) compared to the existing scheme. It was proved that moving the shaving from t=305ms to t=290ms will help decreasing the beam loss.

  The potential source of the injection BPM fluctuation was found by O. Berrig (see also some sldies below). It was suggested that they could be related to the asymmetries in bunch transverse profiles at the locations of the large beta
functions in the transfer line.

An MD to test the new turn-by-turn BLMs monitors was set up on the LHC_INDIV-type beam. Very useful information was gained which could help resolving the long-standing issue with the hotspot in PSB section 4L1. Huge beam loss (3 Gy/s) was registered at the moment of the longitudinal shaving. There is an ongoing discussion with the RP group to review the results.

- Slides from OlavB on BPM fluctuations in the PSB injection line:
  https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Fluctuations_on_last_two_pickups_in_BI_injectionline.pptx

  => Seems to be due to asymmetric transverse beam profiles at large beta functions (effect enhanced by Sqrt[β]).

- PS (AlexH)

  - See picture: https://espace.cern.ch/be-dep/ABP/HSC/Meetings/MTE_shadowing.pdf

  1. MTE commissioning:

  Last week a dedicated MD took place in the PS to determine the optimum positions of TPS15 and SMH16 to provide shadowing. An extraction efficiency of 98 % could be achieved by moving the TPS15 to its minimum position (80.5 mm) and slightly increasing the position of SMH16 (from 55.5 to 57 mm). However, this has an effect on the operational beams as their extractions have to be revised as well.

  Furthermore, beam was sent to the SPS and the CT optics were applied in TT2 and TT10 (including the phase exchange). The debunching was advanced by 5 ms in the PS to improve the quality of the spill and the trajectories in TT10 were corrected. The losses in TT10 are comparable to CT (about 5%), but at SPS injection 15-20% are lost, while on the CT about 1% is lost.

  2. LHC working point

  Guido and Raymond are working on a new working point for the LHC beams. This implies going to almost zero chromaticity already at injection and compensating the coupling with the skew quadrupoles. Therefore, the transverse damper is indispensable. Reduction of the transverse emittance by about 20 to 30% could already be achieved. For now, this will not be implemented in operation, but will be re-discussed once the LHC asks for reduced emittance.

  3. Measurements on the reproducibility of the multipolar components

  Work is ongoing to understand the reproducibility of the multipolar components based on the measurement coils installed in the reference magnet. In this framework an oscillation at 27 Hz was observed, which could be tracked back to the regulation of POPS. We are also looking into possible correlation between oscillations observed at
MTE extraction and this frequency.

4. Vincenzo and Guido are working on the bunch by bunch wire scanner measurement with very good preliminary results. It is clearly possible to correlate the measured emittances with the intensity delivered from the PSB.

5. Injection oscillations

Measurements on the TOF beam were performed last Friday. The effect of varying the vertical steering in BTP and using the TFB was investigated. Data analysis still has to be performed.

- SPS (HannesB)

- Pictures of the week: https://espace.cern.ch/be-dep/ABP/HSC/Meetings/ATT00001.jpg and https://espace.cern.ch/be-dep/ABP/HSC/Meetings/ATT00002.jpg

- Not a great week for the SPS. At the time of writing the North Area cannot be delivered beam due to a vacuum leak near T6 in TT20. The LHC beams however remains available and are performing well. The BCMS beam was tested with 48 bunches on Friday and studies on the MTE beam are progressing.

On Monday 10/8 morning, at 10:00, the mains tripped twice due to a compensator problem; once this was solved there was a failure of bend2 of Target T4 (NR22-001), totalling 3 hours of beam down time.

Tuesday 11/8 started with 6 hours beam down time due to an RF problem in the PS. Then, during the morning, a team from EN/MEF accessed TT41 for AWAKE installation, leaving the material door open for a long time, mobilizing the shift crew in front of the access console. It turned out this was not supposed to be a one-off but that such installations had been planned for one month. The DSO has since established a procedure, similar to the "Blind access" which exists at the PS, where one person is locally responsible for checking the accesses.

On Wednesday 12/8, during the dedicated PS MD on the dummy septum, the BA3 pump for RF cavities was fixed by EN/CV, while EN/EL repaired SMD4 and placed it back in the configuration.

On Saturday 15/8 at 21:20 the North Area beam was stopped by a vacuum leak in the T6 area. The reason could be traced by a wrong current sent to MAL2512 by an autopilot, although the angle computed was correct. Apparently the LSA correspondence between angle and current has been wrong for that particular trim.

During the leak detection, which took place on Sunday afternoon at 17:00, the target area was found flooded (see the 2 pictures). The area is still very hot (~24 mSv/h near the window). A meeting is planned on Monday at 9:00 in the CCC to organize the various interventions.
Finally, it should be noted that at many occasions, calls to GSMs did not go through, and were answered by a message from the french operator Orange, informing that "ce numéro n'est pas attribué" (sic).

- LHC and HL-LHC (EliasM)


  - Reminder on heat load predictions in the arcs (to be checked...):

    - RW in the arcs (for 1 beam): ~ 100 mW/m for nominal beam (25 ns, 2808 bunches, 1.15E11 p/b and 1 ns bunch length) => For ~ 200 bunches, it should be ~ 10 mW/m and a ½ cell is ~ 50 m => ~ 0.5 W per ½ cell. Furthermore, this should not change much during the ramp as the bunch length is ~ constant.

    - SR (for 1 beam): From the LHC Design Report, ~ 200 mW/m at 7 TeV => For ~ 200 bunches, it should be ~ 20 mW/m and for a ½ cell it should be ~ 1 W per ½ cell (at 7 TeV).

- LEIR (MichaelB)

  - See picture: [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/LEIR_17-08-15.jpg](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/LEIR_17-08-15.jpg)

  2/3 is obtained from LINAC3 compared to 2012. Last 2 months devoted to debugging of the machine. Reminder: Nominal beam consists of 7 injections. The light blue line is 50% of what comes from LINAC3 and we see that we inject much less after the 1st injection. If we skip the 1st injection then the 2nd injection works much better. Reached ~ 3-4E10 charges in the machine, whereas it was ~ 2 times more in the past.

Very intense week for LEIR. The RF capture and acceleration optimisation for NOMINAI was started and will be hopefully completed next week, after the electron cooling optimisation.

Electron cooling optimisation MDs were carried out on Wednesday 12 and Thursday 13 August, managing to increase the electron-beam current in the LEIR ecoolor from 210 mA to 420 mA.

On Thursday BI has modified the slope correction on ITH.TRA41, which should now give a more realistic reading. BI are still looking into improving the algorithm for this.

The LEIR supervisors have organised a brainstorming meeting between the LEIR supervisors/coordinators and various BE experts, aimed at collecting ideas on how to improve and make more reliable/repeatable the injection efficiency. The meeting took place on Wednesday 12 August afternoon and provided interesting ideas for measurements in both LEIR and Linac3, which have already started to be taken.

Finally, it was agreed that the Linac3 source refill would take place on Monday 17 August morning. The beam will be left to Linac3 people for MDs until Tuesday at
lunchtime and will come back to LEIR on Tuesday afternoon. TE-ABT will also profit from this LEIR stop to inspect the KFH32 element, instead of waiting for the next technical stop.

5) Wire scanner with larger aperture: CST wakefield simulations results (Tony Jin): https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Wirescannerwithlargeraperture2.pptx

- The main work of Tony was on the TDI but he made also some CST studies on the wire scanner with larger aperture, which he presents today as they are finished.

  - Motivation: inspection from the opposite flanges showed forks close to the ferrite holder in both scanners. B1 V1 fork was rubbing against ferrite holder. All available hours spent adjusting the fork positions. Some improvement but situation still not optimal. System of ferrites & holders were retro-fitted to original LEP design for LHC operation. Clearance between fork & ferrite holder too small for alignment precision that can be achieved with the mechanics.

  - Conclusion of the study:

    Small shifting of some modes toward higher frequencies.

    However those changes are not qualitatively significant.

    The impedances values stay very reasonable.

    The change is approved from the point of view of this study.

    Remark: For the update of the device, it would be appreciable to have some temperature probe near the ferrite location installed.

- Tony also discussed his TDI studies, comparing the old (current) model to a new (segmented in 3) geometry. Significant differences are observed and the work still needs to be finalized.

6) Review of activities in the different working groups / projects

- IMP: https://espace.cern.ch/be-dep/ABP/HSC/Meetings/IWG_17-08-2015.pptx. NicoloB reviewed the activities in the IMP WG, discussing the current measurements, the requests and the issues. In particular, he discussed the LHC TDI8 which revealed a transverse tune shift ~ 4 times larger than TDI2 and a stable phase shift ~ 2 times larger.

7) Highlights of LHC 25 ns scrubbing run (GiovanniR):

https://espace.cern.ch/be-dep/ABP/HSC/Meetings/ScrubbingII-overview.pptx
- 2 weeks of scrubbing

Overall good availability (~ 65%), several fills with >1500b per beam with standard 25 ns beams.

Record beam current of 2.5e14 p for Beam1 reached at the 10th scrubbing day (2400 bunches).

First tests with doublet beams with successful injection of several trains of doublets (12, 24, 36 doublets – and not bunches: typo in the slides) => Doublets extremely unstable at LHC injection at this stage of the scrubbing as they produced a lot of electrons => No way found to stabilize the doublets beam in the LHC.

Validation fills

=> Recommendation: ChromaH = 15, ChromaV = 10, Octupole knob = -1.5, damper gain 0.25.

No margin with chromaH, few units margin with chromaV => Recommended to pay attention to chroma trim along the ramp (especially the first part).

Good beam quality over 20’ after injection (no measurable emittance blow up, few % losses).

TDI vacuum always close to interlock value for the last injection of Beam2, but also MKI pressure values close to interlock values (mainly MKI8D-Q5), basically no margin.

Next questions:

- What about the absolute value of the heat load at flat-top? Will have to be dealt with by the cryo.

- What about the transient in the heat load (as during the ramp, we cannot stop the process)?

8) Actions to be taken for the next meeting

- List of all actions: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/Actions.aspx.

9) Miscellaneous

- The next (53rd) meeting will take place on 24/08/2015 => Agenda:
1) General info and follow-up (EliasM)

2) Performance reports for the different machines (PSB, PS, SPS, LHC and LEIR) => With ideally a picture of the week!

3) Review of activities in the different working groups / projects

- Important events and dates for HSC: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/EventsAndDates.aspx.

- Preliminary agendas for the next meetings: https://espace.cern.ch/be-dep/ABP/HSC/SitePages/MinutesOfMeetings.aspx.


Minutes by E. Metral, 24/08/2015.