Minutes of the HSC section

123rd meeting on Monday 16/10/2017 (10:30, 6/R-012)

Present: See [https://docs.google.com/spreadsheets/d/1fZiu3vtf546odhd2ONxtW0mx9p8cV-fURT9Kxi7QCys/edit#gid=0](https://docs.google.com/spreadsheets/d/1fZiu3vtf546odhd2ONxtW0mx9p8cV-fURT9Kxi7QCys/edit#gid=0)

1) Newcomers / visitors

- None.

2) Comments on the minutes of the previous 122nd meeting + Actions

- **Action ArekG**: Is the issue with dBLMs vs ADT due to some intrinsic limitations from the dBLMs or do we need just more time for the detailed analysis? => Some limitations solved and analysis still ongoing. Might need to postpone the LMC talk.

  - It is followed-up by MassimoG.

  - Reminder: It is important to know which bunches are losing and we hope we will be able to correlate the ADT and dBLM data.

  - Info from BenoitS on FR 08/09/17: FBCT post-mortem data (100 turns total with ~3 turns after dump) now available to see which bunches are losing (in complement) => Let’s see what it will give at the next 16L2 dumps.

- **Actions XavierB**:

  - What happens to the injection oscillations in the presence of beam-beam, impedance, e-cloud, etc.? => It might be wise to try and minimize the beam-beam coupling, which is mainly due to the BBLR, i.e. we should increase the Xing angle (but the effect goes linearly with the BBLR distance).

    - Check the different roles of IP1 and/or 5, or 2 and/or 8? Similar for all of the them due to the linear dependence.

    - Effect of polarity? Probably it has an impact…

    - Effect of the parallel separation? It is small compared to the one of the crossing angle.

    - The orbit effect at injection (~ 0.4 sigma oscillation) is predicted to have a negligible
effect of the transverse emittance growth, even for intermediate (~ 50 turns) ADT gains

=> What about HL-LHC?

- HL-LHC at ultimate energy of 7.5 TeV => Some actions from us by the end of September

  - StefanoR should send us the settings for collimators asap.

  - Then we should assess the impact on beam stability (Action: SergeyAnt, AdrianO, AnnalisaR)

    - Impact of higher energy on beam stability for proposed collimator settings.

    - Assuming sextupoles and octupoles being able to operate to 600 A, assuming constant kick voltage from the damper.

    - Electron cloud driven instabilities => Impact of higher energy => Info already sent to EliasM by GianniI.

    - Any intensity (number of bunches or bunch population) limitation?

    - E-cloud and synchrotron radiation effects => Action GianluigiA, GiovanniR and GianniI => Info already sent to GianluigiA by GianniI and GiovanniR.

- Actions from last WP2 meeting => Action NicoloB and SergeyAnt

  - “… This needs to be done in any case for the high frequency HOMs which are present also with longitudinal RF fingers installed”.

  - “Gianluigi proposes to identify one or two critical HOMs close to delicate components to be provided for a thermo-mechanical analysis to assess heating and outgassing”.

  - “Chiara asks if issues could appear also in the transitions next to the TDI. This is confirmed by Elias and Nicolo. Evaluate the impact of the transitions”.

  - “Elias adds that at some point stability studies need to be performed in addition of heating studies”.

- Long-term upgrade/replacement of TRAIN => To be finalized with YannisP and XavierB by end September (Action EliasM, YannisP and XavierB).

- aC coating of HL-LHC: What would be the effect on beam stability and TMCI? Action NicoloB and SergeyAnt.

  - Reminder from Giovannis: If the sectors would be as the good one, then we would not need to coat.
- If fact LHC could be coated ~ ½ or ~ 1/3.

- Might be good to review the effect for the SPS.

- HE-LHC impedance model: after discussion with FrankZ, the goal would be to have a first model by mid October (Action BenoitS).

- Invitation to write an ICFA BD NL article.

- Low-impedance HL-LHC collimators (Action SergeyAnt): only show the delta in Ioc (for a certain chromaticity and ADT gain) for the different cases (and the different contributions to the impedance model) compared. It might be good to have this info both on plots and in tables. We should also put ourselves in the most critical case, i.e. assume the transverse emittance that we have at injection (as the blow-up might not occur at injection) => Update the plots etc. using the emittance at injection, i.e. 2.0 for the nominal HL-LHC and 1.7 for the BCMS beam.

- Also update the plots with the measured Mo resistivity and then the results could be presented at a WP2 meeting => Planned for 31/10/17 (already partly discussed at the last ABP info group meeting).

- Action from last WP2 meeting (Themis, Riccardo and Elias)

  - The CC feedback system appears to be effective in fighting the emittance growth due to CC noise; however there are additional points to be addressed:
    - Pick up location and achievable beta function.
    - Interplay with the ADT, especially in the presence of impedance.

  - Others? => Update of the HL-LHC OP scenarios still under preparation (EliasM)…

3) General infos and follow-up (EliasM)

- SLM:

  - The Christmas party could be either the 8th or the 15th December. Alessia will check on the availability of 6-2-4 on those dates => Seems it will be HSC to organize (tbc).

  - Ipac18 participation will be discussed tomorrow. As in IPAC17 there will be the possibility to submit papers for peer review on a first come first served basis. For peer-review the submission is 2 weeks before the deadline (regular deadline is on 18th April 2018). Rules are the same as for IPAC17 and the author should indicate the choice when submitting on the BE website.

  - BE central secretariat will move to building 774, an email will be sent around.
- Beam lifetime presentation by YannisP at the LMC. Worth noticing is the behaviour of the BCS beam: there is a marked blow up which follows the intensity (blow up of 1 micron of beam 1 during the ramp). Emittances are not the same for the two beams. Beam 2 below 2 μm, beam 1 above 2.5 μm. Maybe an issue with instrumentation? To be investigated. The discussion will continue at the LBOC next week. In Evian there will be a session on emittance preservation.

- J. Wenninger said that the LHC is back on track for 45 fb-1 target. Maybe we can get some days back for MD. LHC is 6 days “ahead of schedule”. Levelling is visible.

- Under the FOM report OP said that they would like more information on what goes on during tech stops. The information should be selective of what has an impact on OP activities. OP would like clearer information about short TS work that might have implications for the restart.

- EN-ACE propose that co-ordination of all activities in the PS tunnel will be done by the PS co-ordinator (i.e. beamlines crossing the PS would also be co-ordinated by them).

- C Carli gave a detailed presentation on the milestones of Elena. The electron cooling (1.5 years delay) will be commissioned during the YETS.

- Discussion with SergeyArs about the TMCI for FCC-hh at injection, both single-bunch and coupled-bunch => 1 slide today.

- Action for me: I will (try to) read/finish the papers I need to read by tomorrow.


- For one day only LHC collides xenon beams: [http://home.cern/about/updates/2017/10/one-day-only-lhc-collides-xenon-beams](http://home.cern/about/updates/2017/10/one-day-only-lhc-collides-xenon-beams).

**4) Follow-up of actions (Everybody) => Please have a look to the minutes and we will discuss in more detail next Monday**

**5) Multi-bunch and single-bunch TMCI (SergeyArs):**
[https://indico.cern.ch/event/672729/contributions/2752406/attachments/1540691/2416398/Multi-bunch_vs_single-bunch_TMCI.pdf](https://indico.cern.ch/event/672729/contributions/2752406/attachments/1540691/2416398/Multi-bunch_vs_single-bunch_TMCI.pdf)

- SergeyArs explained clearly the potential issue for FCC-hh, which could be operating close to the single-bunch TMCI intensity threshold but well above the multi-bunch one!

- This requires further study (with DELPH for instance).
- If we compare to the LHC case, it is true that the multi-bunch TMCI intensity threshold is predicted to be lower than the single-bunch one (~20% lower at high energy and ~a factor 2 lower at injection => Based on a very old impedance model and btw it should be updated), but we are operating the LHC well below both intensity limits (both at injection and flat-top).

6) First highlights (wrt beam stability) from SPS high-intensity run (KevinL): https://indico.cern.ch/event/672729/contributions/2752416/attachments/1540979/2416519/go

- Pending questions
  - Can the vertical single bunch instability still be cured with reasonable chromaticities?
  - Is the 20 MHz coupled bunch horizontal instability still present? Does the damper successfully combat these?
  - Do we still need the octupoles to stabilize?
  - Can Q” also stabilize?

- First results
  - Q20 and small Q’ ~ 0.1-0.2 was OK for vertical chroma.
  - 20 MHz instability => Disappeared this time after good adjustment from the ADT.
  - However, the Head-Tail instability is now observed in H-plane and depending on chromas we can see mode 1 or 2.

7) LHC MD proposals for MD4 and before EoY (XavierB): https://indico.cern.ch/event/672729/contributions/2752407/attachments/1540910/2416475/2017-10-16_MDProp.pdf

- B1 blow up during the ramp (for BI): check the calibration of the BSRT => Calibration test performed last week, waiting for outcome

- MD proposals
  - B1H
    - Is linear coupling changing dynamically along FT after the end of the ramp => Measurement seems to say no.
    - Is the tune spread changing dynamically along FT after the end of the ramp: Is it feasible to use BTF to see if there is a difference between beams and planes along FT?
- See if the real part of the impedance is larger for beam 1: growth rate (or grow damp experiment) versus negative chromaticity at injection, flat top and end of squeeze for both beams both planes => Under study with old data.
- Determine the role of the IRs in the instability mechanisms, removing the crossing angles => New MD proposed.

- 16L2: what if the cure of 16L2 does not work for next year? check the impact of the solenoid with current schemes (by turning it off with 1.2e11 p/b) and if we could run with standard BCMS 25 ns beam with the solenoid ON.

- For FCC (after discussion with Sergey Arsenyev): could we operate close to 0 chromaticity if linear coupling is under control?

8) Changes in LHC between 2015, 2016 and 2017 (BenoitS):

- Table started by BenoitS: https://indico.cern.ch/event/672729/contributions/2752407/attachments/1540910/2416528/instability2015-16.pdf => To be continued.

9) Movies for HL-LHC project (for general public): impedance, space charge, beam-beam, e-cloud (Everybody):

- Suppression of a beam instability by bringing the beams into collision more quickly: https://indico.cern.ch/event/672729/contributions/2752406/attachments/1540691/2415925/go.


- Transverse Mode-Coupling Instability if the impedance is too large: https://indico.cern.ch/event/672729/contributions/2752406/attachments/1540691/2415923/tmc_i_N15e11_hllhc.avi.

10) Progress/status in the different activities/projects and reports from meetings and in particular the issues/succeses in the different machines (Everybody)

- ATS-IWG (BenoitS)
  - Not discussed.

- HSC-IWG (NicoloB)
  - Not discussed.
- Ecloud (GianniI)
  - Not discussed.

- Beam-beam (XavierB)
  - Not discussed.

- Space charge (AdrianO)
  - Not discussed.

- ABP-CWG (GiovanniR)
  - Not discussed.

- PyHEADTAIL (KevinL)
  - Not discussed.

- DELPHI (DavidA)
  - Not discussed.

- NHTVS (SergeyAntipov)
  - Not discussed.

- LIU (GiovanniR)
  - Not discussed.

- HL-LHC
  - TCC:
    - Not discussed.
  - WP2:
    - Not discussed.

- FCC
  - Not discussed.

- PBC (GiovanniR)
  - Not discussed.
- Machines

- SPS:

- Standard 25 ns and BCMS beams were taken with up to $2,1\times10^{11}$ ppb and the required longitudinal characteristics from the PS. The emittances were about 2 um for BCMS and about 4 um for the standard beam. Losses in the SPS as well as emittance blow-up are still beyond the allocated LIU budget with these intensities. The origins of both are being investigated.

- LHC is continuing with four batches of $8b+4e$ BCS and bunch intensities of $\sim 1.25 \times 10^{11}$ in 1.3 um emittances.

- MDs (past and future)

- Not discussed.

7) Miscellaneous

- The next (124th) meeting will take place on Monday 23/10/2017 (in room 6/R-012 at 10:30) => Current agenda:

1) General info and follow-up (EliasM)

2) Follow-up of actions - see past minutes (Everybody)

3) IPAC18: participation and updated abstracts list (EliasM)

4) HSC travels list for 2018 (EliasM)

5) LHC follow-up and future studies (BenoitS and XavierB)

6) Progress/status in the different activities/projects, reports from meetings and in particular the issues/successes in the different machines (Everybody)

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


Minutes by E. Metral, 19/10/2017.