Minutes of the HSC section

120th meeting on Monday 25/09/2017 (10:30, 6/R-012)

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

1) Newcomers / visitors

- Yuri Alexahin (from FNAL) for 1 month.

2) Comments on the minutes of the previous 119th 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.

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

  - E-cloud and synchrotron radiation effects => Action GianluigiA, GiovanniR and GianniI

- 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 Ioct (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.

- 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.

- Movies for HL-LHC project (everybody) => To be discussed on HSC section meeting on 02/10/17.

3) General infos and follow-up (EliasM)

- MDs from MD block 3: TMCI seemed nice but during this MD and the Train MD we still had the unexplained instabilities observed before (which we did not have last year!).

- 1) 1st MD:
  - The plan was to take 1 train of 144b in B1 and 1 high brightness bunch (2e11 and 1um) in B2 for instability studies. With a priority on attempting to recreate the B1H instability that was observed in the previous MD on the first batch with Ioct even higher than in physics (but the filling scheme is slightly changed to see if there is a slot dependence and this MD took place at FT whereas the previous one was at EOS).
  - We observed that B1 horizontal becomes unstable ~7minutes after arriving at flat top (with Q'=15/15 and Joct=376A) in exactly the same pattern as observed in the previous MD, with rise times of ~4-5 seconds and 2 nodes in the headtail trace.

- We then performed a quick octupole reduction on both B1 and B2 and the high intensity bunch in B2 went unstable at Joct=180A (which seems to be ~ as predicted, tbc). The other batches of B1 were able to be reduced to Joct=0A, showing that the stabilising non-linearities must come from IP2 or IP8 because IP1 and IP5 were were at beta*=1m.
- For the second ramp, a slightly different filling scheme was defined which placed the 144b much closer to the bunches in the gate, as well as placing a single nominal and a single train of 48b closer to each other but about half of the ring away. The single nominal bunch and the train of 12 bunches could potentially play the role of a "clearing" bunch.
- We ramped to flat top with these settings, and saw that the instability occurred again in B1H, but only on the trains, with no blowup on either the first 12 or on the nominal. This provides additional valuable information regarding what effects are present during the instability, while a clear hypothesis for the origin of this instability has not been found.

• 2) 2nd MD:
- The goal was to measure the tune-shift as a function of intensity to deduce the TMCI intensity threshold.
- First ramp with three bunches of 0.6e11, 1.0e11 and 1.3e11 in both beams. Reached flat-top with Q'=15/15 and octupoles at max current (560A).
- Trimmed down chromaticity in two steps of 5/5. When decreasing the damper gain in B1 to improve the kick signal, an instability occured in B1H (with 560 A!!! Why?). The gain was reverted.
- Then we kicked several times both beams and both planes to retrieve the bunch-by-bunch tunes for several positions of the secondaries and primaries of IP7.
- At the end of the fill, the damper was switched off to drive a clear instability.
- Second ramp with two bunches of: 0.9e11 and 1.9e11 (high brightness bunch) in both beams. Reached flat-top with Q'=15/15 and octupoles at max current (560A).
- Trimmed down chromaticity in two steps of 5/5.
- Then we kicked several times both beams and both planes to retrieve the bunch-by-bunch tunes for several positions of the secondaries and primaries of IP7.

- Benevento workshop last week (with many people from HSC):

  - Very well organised and appreciated => Many thanks GiovanniR!
  - Many talks from the team (and the group), which were of high quality.
  - One highlight worth mentioning in the context of the LHC 16L2 issue => Hosing instability in PWFA (beam break-up instability) from G. Stupakov.
  - Some subjects coming back each time such as effect of SC on instabilities (to be discussed more at the SC workshop next week) => AdrianO presented the stabilizing effect of space charge on the LHC transverse single-bunch instability at low energy (proposing a possible explanation for the first instability observed in 2010 during the 1st ramp with neither ADT nor Landau octupoles).

- Proceedings needed before the end of the year.

- HE-LHC meeting last week where SergeyAntipov went => 3 options for 3 different energies. This will be discussed during our next HSC section meeting on 02/10/17.

- Low-impedance collimators => The 2nd measurement confirms the 1st one.

  - We still have an issue with the Mo.

  - GiacomoM did also some analysis => See pictures of coating: https://indico.cern.ch/event/666414/#preview:2392417, https://indico.cern.ch/event/666414/#preview:2392416 and https://indico.cern.ch/event/666414/#preview:2392415.

  - SergeyAntipov reminded us (after some discussions with SergioC) that the resistivity depends on the thickness of the layer

  => To be followed up.

- News from LHC, 16L2 issue (with the new solenoid installed) and 08:30 meeting

  - Re-start was smooth and we are now at ~ 1.4E34 peak lumi.

  - Effect of solenoid already seen on the steady-state losses.

  - Next: see what will happen when the intensity per bunch is increased.

- SLM:

  - IPAC18 abstracts and participation was discussed

    - Current "preliminary" list from HSC: BenoitS, NicoloB and EliasM.

    - As discussed, there will be also the BB, e-cloud and HB workshops in 2018.

    => Action (everybody, as sent by email): Could you please send me your "wishes" for the 2018 workshops/conferences/course etc. by this Friday 29/09/17 with the possible subjects/results you could present.

  - F. Schmidt is nominated representative to the Scientific Information Panel.

  - Students: Lore Taillieu proposed that phone calls to student during the selection period are again allowed. Students will also have the choice to have a Sonru interview, which will be like a "video-CV" and will be one of the several supporting doc that can be uploaded. No obligation on either side (to post it for student/ to watch it for future supervisors). LoreT will send around a presentation with the details of this new procedure, which applies to TECH and not DOCT.

- New bike-shelter around building 6: cost of 45k might be shared between BE and TE.

- The LHC performance is still limited due to the issue in 16L2. MD were done with about 80% availability of the machine and part of the program had to be cancelled. GianluigiA proposal of installing a solenoid around the inter-connect in 16L2 has been evaluated by the experts. The solenoid will be powered by two corrector circuits already present in the tunnel and the field on the beam screen will be about 70 Gauss. Decision Monday 18th after the SLM. The technical stop has been shortened and beam will restart on Thursday with beta*=30 cm.

- The commissioning of ELENA is slower than expected.

- P. Cruikshank presented at the IEFC the planned amorphous carbon coating that will be applied in one cell of the SPS during the YETS.

- Discussion at the HL-LHC TCC about the coating => Follow-up by BenoitS as it seems that now (as already discussed during a dedicated WP2 meeting), the thicknesses for both Ti and Carbon layer have been exchanged.

- CollUSM meeting => TCSPM Results for HL-LHC Intensity presented by SergeyAntipov.

4) Possible movies for HL-LHC communication: impedance, space charge, beam-beam, e-cloud (Everybody): pdf

- Movie (from SergeyAntipov) of a horizontal instability driven by electron cloud. In a dipole the cloud forms a vertical stripe (the color shows its density), which 'follows' the motion of the beam (the beam center is represented by a white square), and drives an instability: https://indico.cern.ch/event/666414/#preview:2392550.

- See action above, which will be discussed during next HSC section meeting.

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

- ATS-IWG (BenoitS):

- Exchange of MKI during YETS to alleviate the pb of vacuum.

- LMC BGI talk postponed. Reminder: 4 BGI in the LHC but would like to replace by a BGC: another beam gas device without the gas but with a camera (it is a small T instead of a pipe).

- HSC-IWG (NicoloB):

- Not discussed.

- Ecloud (GianniI):

  - Not discussed.

- Beam-beam (XavierB)

  - New development by MichiH for the TRAIN code => To be followed up by AriadnaRB. In the H-plane one needs to take into account the BBLR after the D1 to be able to represent the data, even if there the separation should be very large… To be looked at in detail.

  - LaurentB obtained very good results with COMBI and the BB compensation with an e-lens (in which case the results from BimBim are recovered) => It is now possible to turn on/off the Landau damping in COMBI.

- Space charge (AdrianO)

  - Not discussed.

- ABP-CWG (GiovanniR):

  - Not discussed.

- PyHEADTAIL (KevinL)

  - Not discussed.

- DELPHI (DavidA)

  - Currently implementing the air-bag model.

- NHTVS (SergeyAntipov)

  - Not discussed.

- LIU (GiovanniR)

  - Not discussed.

- HL-LHC

  - TCC:

    - Not discussed.

  - WP2:

    - Not discussed.

- FCC

    - Not discussed.

- PBC (GiovanniR)

    - Not discussed.

- Machines

    - LEIR (NicoloB): Schottky peaks => Some nice observations and explanations by NicoloB et al. (which should enable to deduce the longitudinal impedance).

- MDs (past and future)

    - Not discussed.

6) Miscellaneous

- The next (121th) meeting will take place on Monday 02/10/2017 (in room 6/R-012 at 10:30) => Current agenda:

    1) General info and follow-up (EliasM)

    2) LHC single-bunch stability predictions vs. measurements in 2017 and comparison with 2015-2016 (LeeC and XavierB)

    3) HE-LHC injection stability estimates (DavidA and SergeyAntipov)

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

    5) Impedance reduction techniques (MarioSB)

    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.

- Web site: https://espace.cern.ch/be-dep/ABP/HSC/default.aspx.

Minutes by E. Metral, 27/09/2017.