Minutes of the HSC section

130th meeting on Monday 11/12/2017 (10:30, 6/R-012)

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

1) Newcomers / visitors

- None.

2) Comments on the minutes of the previous 129th meeting + Actions

- 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?

- Actions from a past 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".

=> Was said that it will be for end November.

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

=> News from XavierB:

- We have the order of magnitude and someone to work on it.

- RamaC has some info as concerns the CCs. And we could work on the phase advances to mitigate possible issues if needed (by November we would be able to state if it works).

- 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.

=> News from BenoitS (from a recent talk from TE-TM): The temperature of the new a-C coated shielded beam screens in Points 1 and 5 will be higher than the usual 5-20 K: 60-80 K is currently contemplated.

- HE-LHC impedance model: after discussion with FrankZ, the goal would be to have a first model by mid October (Action BenoitS) => ICFA BD NL article written.

- 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 => 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.

3) General infos and follow-up (EliasM)

- Finalization of the Xmas party preparation.

- Impedance board will certainly take place on 27/02/2017.

- Some people will change status in the near future:

    - FrancescoG will become PHD with BenoitS in April 2018 (2-month extension as TECH before).

    - LaurentB will become PHD with AdrianaRossi from BI in May 2018.

    - AntonioG will become PHD with RobertoCorsini in February 2018.

    => Good luck to all!

- Congratulations to GuidoS who got an IC!

- Reminder also about diversity: important already when we select TECH and DOCT to try and select (the best) people from all the countries.

- SLM:

    - LHC scrubbing run for 2018: 1 day first and then 3 days => OK with GianniI and GiovanniR.

    - Decision taken to remove the CT and keep only MTE in PS => Impedance team to qualify this. BenoitS and GiovanniR informed.

    - FrankS will step down as SC working group leader (but will continue to work on space charge) and HannesB will take over the SC working group.

    - FCC week: registration should not take place before the list of participants is approved by the ATS management.

    - Protons stop (and Linac2 dismantling starts) on 12 November 2018.

- We had a 2nd Evian preparation meeting => https://indico.cern.ch/event/686966/.

- All the MERIT interviews already planned for beginning of 2018 => Please prepare well the info before.

- HL-LHC OP scenario finally sent to LucioR and OliverB => Waiting for comments and then try and publish it asap at the beginning of 2018.

- ABP software asset => GiovanniR is the contact person now that he is chairing the ABP-CWG.

- Email from RichardS for the AFS phaseout => Answer from XavierB.

- Impedance meeting

- This week:

    - Evian workshop.

    - HE-LHC review.

- SPS MKE kicker impedance

    - MarioB and CarloZ => ChristineV has a very old model of the SPS MKE in the longitudinal impedance model. This is being followed up.

4) Follow-up of actions (Everybody) => Nothing special to report.

5) LEIR impedance and beam instability studies with Xe39+ (NicoloB): https://indico.cern.ch/event/686642/contributions/2816883/attachments/1572944/2482682/HSC_LEIR_11122017_NB.pdf

- NicoloB reported about the status of the LEIR impedance and instability studies during the year with Xe39+.

- The impedance model was continued to be develop, taking into account ~ 85% of the LEIR circumference.

- Very nice measurement of the longitudinal impedance by Shottky peaks separation => In good agreement with expectations.

- Measurements of the transverse impedance:

- Done in 2016 with *Pb*54+ => Agreement within 80 % for both coasting and bunched beam cases.

- In 2017 with Xe39+ => Agreement within 50 % for coasting case but large noise. Bunched case more reliable: still to be done.

- Some complication: 500 Hz ripple => Originates in the main quads: being followed up.

- Longitudinal instability => When the cooling is too strong the *rms* beam size shrinks and we can go out of the longitudinal stability limits.

- Transverse instability

  - The instability observed in 2016 is still present.

  - At Q' = 0 we often observe the 100 kHz mode (1st unstable betatron mode) rising being overcome by the 1.9 MHz one.

  - Scan in Q' => Stable above 6 units.

  - Dragging at the end of the cooling has a strong effect on momentum spread... and stability / transmission.

- BTF measurements

  - Performed several tests with different intensities, Q', damper and cooler settings => Main goal: identify what is the spread and impedance at 1.9 MHz.

  - We can see the rewall impedance at low frequency.

  - Larger impedance at 1.9MHz and 2.2MHz => No clear HOM: to be followed up.

- Conclusions

  - LEIR impedance model:

    – Investigations being performed on septa, kickers and all those elements with ferromagnetic properties: only feature that would allow a 1.9MHz mode to exist.

    – Already analyzed elements like ecooler, finemet cavities to be included in the baseline model.

  - Longitudinal impedance measurements:

    – Done through Schottky peak separation at n=50: good agreement with

impedance model.

– It should be performed at other harmonics as well.

- Transverse impedance measurements:

– Coasting beam tune shift measurement very noisy: cannot conclude as well as last year until bunched beam measurements are redone.

- Longitudinal instability observation:

– Loss of Landau damping with strong cooling observed.

– Little bunches appear. Instability is readily cured by the cooler itself.

- Transverse instability observations:

– 1.9 MHz mode instability still observed

– Would limit operational performance if damper is lost. Seems to be possible to cure it also with chromaticity.

– BTF measurements:

– Set up and operational.

– Spread of low frequency lines vs Q' seems consistent with the model (momentum spread only).
– Discrepancy with expectation for the 1.9 MHz mode: can we really have the predicted large spread?
– Transverse impedance deduced from intensity scan: growth of real part above 1MHz: not only 1 HOM?

=> In summary a lot of very nice new observations => To be continued!

6) Proposal for a new formula to calculate beam impedance for 2D structures in the classical thick wall regime (AntonioG): https://indico.cern.ch/event/686642/contributions/2816882/attachments/1572958/2482628/Calculate_beam_impedance.pdf

- AntonioG gave a short summary of what he showed at the impedance meeting:

- The idea is to obtain the density of current over the surface. Then calculate the power loss, and equalize that to the power loss of a lumped impedance.

- OlavB gave then a short talk on the quadrupolar impedance: https://indico.cern.ch/event/686642/contributions/2816882/attachments/1572958/2482623/Presentation4.pdf

=> Still several questions which need to be answered: to be followed-up and finalized. Next: gather in a single presentation all the past work done on the possible new collimators (checking with the collimation team that these collimators could be used/moved in practice) and compare to cylindrical / flat collimators (both the dipolar and quadrupolar impedances).

7) General discussion about the 16L2 instabilities (Everybody): Nothing special to report.

8) 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)

  - Not discussed.

- HSC-IWG (NicoloB)

  - Not discussed.

- Ecloud (GianniI)

  - Not discussed.

- Beam-beam (XavierB)

  - Not discussed.

- Space charge (AdrianO)

  - Not discussed.

- ABP-CWG (GiovanniR): https://indico.cern.ch/event/686642/contributions/2816881/attachments/1572942/2482616/GR-HSC-meeting-111217.pdf

  - New HPCs cluster at CERN presented by N. Høymir at last meeting.

  - Should be running in test mode, IT are eager to have us test and work on our typical applications.

  - CNAF machines still down after the incident (flooding) back in November

  - Continue with the completion of the cluster and purchase of GPU server.

- PyHEADTAIL (KevinL)

    - Not discussed.

- DELPHI (DavidA)

    - Not discussed.

- NHTVS (SergeyAntipov)

    - Not discussed.

- LIU (GiovanniR): https://indico.cern.ch/event/686642/contributions/2816881/attachments/1572942/2482616/GR-HSC-meeting-111217.pdf

    - SPS: Important progress on understanding of the mechanisms leading to injection beam losses => There are 4 main problems linked by longitudinal emittance at transfer

        − CB instabilities in the PS

        − Uncontrolled longitudinal emittance blow up along batch in PS

        − Fast capture losses in the SPS

        − Slow losses on injection plateau in the SPS

    - PS: Important role played by bunch shape in longitudinal phase space from bunch splitting and bunch rotation in SPS (tails)

    - SPS, problems identified in

        − Present LLRF (beam and cavity control)

        − Leak/loss of particles close to separatrix (due to bucket area shrink e.g. for intensity effects or beginning of the ramp)

        − Reduced momentum aperture at the QD flanges, especially with Q20 (below 4σ for negative momentum deviations).

    - Important studies to be done in 2018 identified and recommendations made

- HL-LHC

    - TCC:

        - Not discussed.

    - WP2:

        - Not discussed.

- FCC

    - Not discussed.

- PBC (GiovanniR): https://indico.cern.ch/event/686642/contributions/2816881/attachments/1572942/2482616/GR-HSC-meeting-111217.pdf

    - PBC Annual Workshop 21-22 November => Presentation by E. Koukovini Platia on future non-LHC users that will/might make use of the LIU upgrades and ongoing studies

        - ISOLDE beams in PSB

        - nTOF beam in PS

        - FT (MTE) beams for BDF in SPS

- Machines

    - Not discussed.

- MDs (past and future)

    - Not discussed.

9) Miscellaneous

- The next (131th) meeting will take place on Monday 15/01/2018 (in room 6/R-012 at 10:30) => Current agenda:

    1) HSC Xmas party => Reminder to buy and bring a present (maximum: 15 CHF)!

    2) General info and follow-up (EliasM)

    3) General discussion about the 16L2 instabilities (Everybody)

    4) Present understanding of the LHC transverse single-bunch instability: both head-tail and TMCI regimes (DavidA, XavierB et al.)

    5) Status of multi-bunch pyHEADTAIL: development and simulations (KevinL)

    6) Progress/status in the different activities/projects, reports from meetings and in particular 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, 10/01/2018.