Minutes of the HSC section

20th meeting on Wednesday 20/08/2014 (09:00, 6/R-012)

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), Adriano Garonna (AG), Meghan McAteer (MM), Nicolas Mounet (NM), Carlo Zannini (CZ), Nicolò Biancacci (NB), Xavier Buffat (XB), 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), Danilo Banfi (DB), Javier Barranco (JB), Joseph Kuczerowski (JK).


1) Newcomers / visitors

- None.

2) Comments on the minutes of the previous 19th meeting + Actions

- None.


3) General infos

- No particular comment from anyone.

- SL meeting:

  - OliverB will become the new deputy BE department leader and will stop as group leader on 01/10/14 (an email has been sent to everybody). He will be replaced by GianluigiA.

  - ABP BBQ on 09/09 => Any other volunteers to help preparing the BBQ area and start cooking the meet before all the people arrive? For the moment, there is only one
person from the section and we would need ~ 2-3. Many thanks in advance for your help!

- HL-LHC: The list of parameters has been updated.

- LIU-ION review last Wednesday and nice talk from MichaelB => Many interesting beam dynamics studies to be done => We should really try and help MichaelB as much as possible for all the measurements to be done (related to the different working groups): Chromaticity measurements, instabilities (without and with transverse feedback), space charge effects, etc.

- Ecloud meeting the week before: scrubbing studies with MTE-type beams in the SPS, 1st version of PyECLoudforPyHEADTAIL.

- Approved space charge 2015 workshop in March next year at Oxford.

- BB meeting last week where ClaudiaT discussed the stability diagrams with both octupoles and BB for ATS => Still some issues to be understood (asymmetry of stability diagrams, etc.).

- MadgaK will start as PHD soon with EPFL (15/09) => Congratulations!

- ELENA tracking with e-cooler => Status report (OlavB):
  - Track with MAD-X without e-cooler.
  - Track with Mathematica
  - Study should be finished soon and will be presented at a future HSC meeting.

- Report for the machines:

  - PS (GS):
    - It has been a hectic, dense and fruitful period for the PS.
    - East Area and nToF user are satisfied receiving regularly their beams. The situation is good also because at the moment they are not so many users and we can ‘easily’ reach the production target. Typically we have 5 ToF + 3 East cycles in the super-cycle.
    - To summarise the latest news and headlines:
      - Yesterday night and during today morning Ar beam was injected, accelerated, and extracted in the PS. Thanks to our LEIR colleagues.
      - We add a new operational cycle to the present set (EAST2->nToF-East). With the parasitic nToF we hope to meet the nToF request of 160e10 p/s, leaving space in the super-cycle for the other users (PSB will serve more and more ISOLDE and on our side there will be SPS...
requesting beam soon). Thanks a lot to Cedric who helped a lot during the setting of the nToF extraction. This extraction scheme is very elegant using 4 kickers to extract nToF bunch without perturbing East bunch.

- Great progress on the MTE was achieved by Simone et al. during the week (islands capture). The next challenge is to increase the reproducibility of the beam-lets intensity distribution (20% on each beam-lets). Investigations are on going. All beams are extracted with the dummy septum 16 on its final position. This was true…

…until yesterday morning when a major fault occurs on the KFA21. The analysis/repair is on going and as already foreseen for long fault of the MTE kickers (13 and 21), the 16 was put in garage position, and we went back to the standard extractions scheme.

- Raymond is continuing is studies on the skew resonance compensation with the recently re-installed skew sextupoles. The preliminary results are very promising.

- Main short-term goals:

1. Prepare SPS beam (SFTPRO). This means having MTE extraction operational.

2. LHC beam for scrubbing run of the SPS. A lot of work is on going on the longitudinal plane.

- SPS (BS):

- Statement of David: SPS Impacts will change after Sept 1st, and will be signed by BE-OP.

- We are in cold checkout since yesterday but still many interventions were performed these past days (vacuum leaks, vacuum pump, wire scanner, Headtail monitor, kickers, RF: 2 modules of the high bandwidth feedback kickers installed), still a few interventions to come but it is narrowing down.

- Still many power converters with faults. The fact that now only Firstline (and not TE/EPC) is in charge of all SPS power converters is not making things easier, together with absences of experts during holiday period.

- However, very strong effort from all groups to be ready for the DSO tests tomorrow and Thursday. Many thanks to all involved!

- Shifts had to start at 6am for TDC2 cabling activities this week (as far as we are concerned this was not announced), operators spontaneously agreed to start all shifts at 6am.
- RP warned that there is still a lot of equipment lying around in the tunnel, and that everything should be removed.

- MKP water manifold now finally fixed on Thursday after many attempts, and conditioning has now started and according to TE-ABT, it should take 3 weeks (Karel: we will not be ready for the scrubbing run, 1 week of delay expected).

- LEIR (MB):

  - We are delivering beam to ETP.MTV10 (last MTV screen before the PS).

  - We don't see the beam in the respective beam transformer in the ETP line. Lars Jensen is trying to find a solution.

  - The power converters of the main quadrupoles and the main bending magnets showed ripples in OASIS. EPC is trying to find a solution. Matthieu Cattin has received the first badge of 10 difference signal extenders, which mitigate the current usage of the "shielded" cables as a problem source. To be installed Wednesday or Thursday this week.

  - The transverse feedback system shows erroneous behavior at the BOSS (Beam Offset Suppression System) level. Alfred Blas and Alan Findlay are trying to find a solution.

  - The most recent LEIR performance:

    - Injected intensity (before cooling): 2.4E10 charges

    - Intensity right before RF capture: 1.8E10 charges

    - Extracted intensity on the way to the PS: 1.3E10 charges

    - Intensity seen on ETP beam current transformer right before the PS injection septum: 5E9 charges.

  - Note I: The transmission from LEIR to the PS is not yet optimized.

  - Note II: The maximum expected extracted LEIR intensity would be 3.3E10 charges at extraction with a Linac3 current of 52 micro-amperes (now 50 - 54 micro-Amperes).

- Alpo Valimaa comes from Finland and was summer student from 16/06 to 29/08, under the supervision of GS.

- Goal: Develop a user interface for a PS digitizer (which was already there and which has a lot of memory) to gain w.r.t. some specs if compared to the oscilloscope in use and to have an environment where to start data post-processing.

- Alpo developed a Matlab class and a Matlab GUI (see code in Appendix) for a fast and easy post-processing of the data acquired with the ADQ214 (digitizer) and showed some interesting physics cases => nTOF cycle spectrum, where we can see:

  - Change of frequency over the cycle and recognize transition crossing and related oscillations.
  - Longitudinal signal as well as horizontal one.
  - Final bunch rotation can also be observed.
  - An algorithm was also used to find the nearest significant peak (nearest in f-domain) and it was developed further to follow a curve.
  - With external clock we lose the information of time but we can record the beam position w.r.t. RF clock and gating is possible.

  => Many thanks Alpo and good luck for your future activities!

5) Tune spread and stability diagram in the presence of both octupoles and Beam Beam Long Range (EliasM): [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/HSC_EM_27-08-14_Final.pdf](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/HSC_EM_27-08-14_Final.pdf)

- In the framework of the recommendations to be given for the LHC in 2015 (and LMC talk next week), EM discussed the tune spread and stability diagram in the presence of both octupoles and BBLR.

- The interplay between octupoles and BBLR is an important mechanism, which needs to be taken into account properly during the betatron squeeze and adjust for beam stability considerations as this modifies the tune footprint (and related stability diagram).

- Detailed discussion by StephaneF at the LMC-141 (11/07/2012) on the LHC BBLR tune footprint, which is similar to the one of an octupole, and on the compensation of the tune footprint on the anti-diagonal when LOF < 0.

- A simple formula was then proposed by StephaneF in 2013 giving the equivalent octupole current from BBLR (as the BBLR is acting like and octupole) based on MADX simulations and the scalings with the different beam and machine parameters.
The goal of this simple study was to try and re-derive it (with a simple analytical model), checking the scalings and the absolute value, compare it to past and recent simulations from the BB team and make predictions for 2015 (comparing to 2012).

In conclusion, the simple model describes well the compensation on the anti-diagonal for LOF < 0 (and the increase of the tune footprint length for LOF > 0) and gives the same scalings for the equivalent octupole current from BBLR, and an absolute value very close to the one from StephaneF’s simulations for the case without // separation (which is the case “~ properly” treated in these slides => See slide 50).

For the case with full // separation, an equivalent \( d \) separation was used (giving a value within ~ 20-30\% compared to the one from StephaneF) but it is clear that a better / proper analysis should be done (Action: BB team).

Comparing the results from the simple formula to past simulations made for 2015, reveals a good agreement as concerns both the reduction of the tune spread and of the stability diagram. However, the simple formula seems more pessimistic at (very) low beta* (BB separation) => This needs to be investigated in detail (Action: BB team).

Using the simple formula for 2015, several predictions have been made which will be used to give recommendations for next year.

Note that using the matrix formalism (relating deltaQx and deltaQy as functions of Jx and Jy), a simple formula is given (see Appendix B) to deduce the value of the octupole current giving the compensation on the anti-diagonal.

In Appendix C, a comparison is done with the case of space charge in the presence of octupoles. There are similarities and differences. Similarly, it can be seen that the tune footprint area reduces and reaches a minimum for a certain value of LOF < 0 (which can be estimated also with a simple formula) and that in the opposite, it increases with LOF > 0 (note that the study was done for the case of a LHC bunch at injection with a transverse beam profile extending up to 3.2 \( \sigma \)). Differently, space charge is not an octupole (as the LHC BBLR revealed to be as concerns the tune footprint) and no full compensation is expected. The evolution of the space charge tune footprint of the LHC at injection vs. octupole current should be studied carefully, as already discussed in the past for both beam stability and DA considerations (ongoing Action for the SC team). Might be also interested to see what can be done from simulations and real measurements in the PS and if something can be gained (ongoing work by RaymondW).

6) Actions to be taken for the next meeting

- New actions:

  - **Action 1 (BB team):** Try and derive a (simple) BBLR model for the case with full // separation.
  
  - **Action 2 (BB team):** Check the limit of validity of the simple formula giving the equivalent octupole current from BBLR.
7) Miscellaneous

- The next (21\textsuperscript{th}) meeting will take place on **03/09/2014** => Agenda:

  1) General info and follow-up (EliasM)
  2) Discussion about the LMC talk in the afternoon (EliasM)
  3) Report from the different machines (PSB, PS, SPS, LEIR and LHC)
  4) AOB (EliasM)

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

- List of actions: [https://espace.cern.ch/be-dep/ABP/HSC/SitePages/Actions.aspx](https://espace.cern.ch/be-dep/ABP/HSC/SitePages/Actions.aspx).


Minutes by E. Metral, 29/08/2014.