Minutes of the HSC section

90th meeting on Monday 19/09/2016 (14:00-16:00, 6/R-012)

HSC members: Javier Barranco Garcia (JBG), Mario Stefan Beck (MSB), Eleonora Belli (EleoB), Olav Berrig (OB), Nicolo Biancacci (NB), Xavier Buffat (XB), Lee Robert Carver (LRC), Giovanni Iadarola (GI), Kevin Li (KL), Elias Metral (EM), Mauro Migliorati (MM), Adrian Oeftiger (AO), Tatiana Pieloni (TP), Tatiana Rijoff (TR), Annalisa Romano (AR), Giovanni Rumolo (GR), Benoit Salvant (BS), Michael Schenk (MS), Claudia Tambasco (CT), David Amorim (DA), Alistair Arnold (AA), Sondre Vik Furuseth (SVF), Philipp Dijkstra (PD), Giacomo Mazzacano (GM).


1) Newcomers / visitors

- Philipp Dijkstra, new TECH with GianniI to work on e-cloud build-up simulations for LHC at high energy.

2) Comments on the minutes of the previous 89th meeting + Actions

- See last minutes/actions:

  - Simulations of instability at injection => Redo the same with a different emittance to see the scaling (will be shown today). Then add the quads…

3) General infos and follow-up (EliasM)

- SL meeting:

  - Offices => Some changes foreseen soon (~ October-November) for GiovanniR, ElenaW, TatianaP and NicoloB.


  - A project is discussed for decommissioning of CTF3 (minus CALIFE, waiting for the coming workshop).
- AWAKE mandate: seems it is clarified that we go for a run 2 and that CERN will essentially support for the HW.


- Travel wishes for 2017 => Deadline = End of October.

  - As concerns the issue with some students who did not get an IPAC grant last year, we keep the same approach: they can go only if they are supported by their university or if they get a grant (ideally 2nd or 3rd year).

- LMC actions

  - Talk from BenoitS on RF heating on 28/09.
  
  - Talks from EliasM on 05/10/16 on i) beam instabilities and ii) LHC test with high pile-up (EliasM and GiovanniR).

- Change of time slot for HSC meetings: was agreed to try 10:30 – 12:30 until the end of the year and then we will see.

- Farewell day for TatianaP on 02/10/16.

- ABP Xmas party: 09/12/2016. To be confirmed.

- HL-LHC WP2-WP9 heat-load meeting: https://indico.cern.ch/event/564049/

- Soft clamps around the BPHs => SPS summary week from HannesB: Technical stop on Wednesday and Thursday, during which about 200 so-called soft-clamps were installed to electrically bypass the insulating flanges around the horizontal beam position monitors. The aim of this installation is to test the feasibility of permanently short-circuiting these flanges during a future shielding campaign for impedance reduction…No major change of the machine behaviour due to the soft clamps could be observed in measurements performed at the restart, neither on LHC cycles nor on the SFTPRO cycle. However, as expected, the vertical closed orbit was modified due to the realignment of the QF506 and so TT20 had to be re-steered before the full intensity beam could be delivered to the North Area experiments at around midnight.

- TOTEM instabilities => LHC coordinators informed.

- 4) Status report of the LHC instabilities (predictions vs. measurements): injection, ramp, flat-top, end of squeeze, adjust, stable beam and special (TOTEM) fills (LeeC, KevinL, XavierB, Gianni,...): ?

- Injection (KevinL): https://espace.cern.ch/be-dep/ABP/HSC/Meetings/002_hsc_lhc_elcoud_19-09-16.pptx
Conclusions of the preliminary results:

- The effectivity of the octupole is reduced with the emittance – the exact scaling does not look entirely linear. We know that the e-cloud itself also contributes significantly to the tune footprint => The vertical instability could be explained (depending on the exact value of the e-cloud density).

- However, at the moment the H-plane should be stable with the ADT on, which does not seem to be the case in reality => To be further looked at, adding the quadrupoles, etc.

- Remark: Simulations done in H and V together which means that sometimes we might lose in V and do not see anything in H.

- Ramp (LeeC): [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Ramp_Activity_19-09-16.pdf](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Ramp_Activity_19-09-16.pdf)

- 3 fills looked at and there was no sign of coherent instability/activity.

- When do the non-colliding bunches blowup? (LeeC) => [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Non-colliding_BlowUp_19-09-16.pdf](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/Non-colliding_BlowUp_19-09-16.pdf)

- Bunches colliding in IP2 and 8.

- Same fill has before.

- Reminder on procedure: Look at max in frequency between 0.1 and 0.4.

- The timing of the blowup occurs during the collapse of IP2&8. B1 showed much stronger activity, however if it is during collapse it is possible that this is what caused the activity in B2.

- Blow-up is during the collapse => Why? Still to be looked at. The gain is lower there… At this point we are still in the high bandwidth.


- Reminder: After some BTF measurements, the better stability might come from Q” and not from nonlinear correction.

- We never did a 1 bunch stability study at EOS this year => To be done (prepare the MD)

- Conclusion

- Q” at flat top is small, as expected.

- At EOS:
B1H = Too noisy

B1V = -6367

B2H = 18,000

B2V = 2700

Taking the measurements of the octupole contribution to Q’’ from 2015, we can state that the Q’’ with \( I_{\text{oct}} = 375 \) A at EOS is:

\[
\begin{align*}
B1H &= 18,000 + \text{Noisy Signal} = (E_{\text{OmaOon}} \approx 30,000) \\
B1V &= -8700 - 6367 = -15067 \\
B2H &= 18,000 + 18,000 = 36,000 \\
B2V &= -8000 + 2700 = -5300
\end{align*}
\]

- Update on e-cloud instability simulations at 6.5 TeV (Gianni): [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/002_stability_simulations_6.5TeV_19-09-16.pptx](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/002_stability_simulations_6.5TeV_19-09-16.pptx)

- Simulations of coherent effects (instabilities) at 6.5 TeV are computationally very demanding => Need to resolve transverse beams sizes of \( \approx 100 \text{ um r.m.s.} \) in a chamber as big as 4 cm. It is \( \approx \) OK for head of the bunch but not for the tail and this is the tail which starts to be unstable.

- Worked on 2 fronts

  - Introduced multi-grid solver in PyPIC 2.0: finer resolution only around the beam => Smaller memory footprint

  - Exploit parallel computing resources: Developed an additional parallelization layer PyPARIS (Python Parallel Ring Simulator), working together with PyECLOUD and PyHEADTAIL.

- Beam dynamics studies at 6.5 TeV in the presence of: i) e-cloud in arc dipoles; ii) e-cloud in arc quadrupoles; iii) chromaticity, octupoles and damper. Parallel computing fundamental to run these simulations => Heavily relying on CNAF cluster: some simulations could be done in 3 days instead of 46!

- Only the main results for 6.5 TeV were presented today:

  - Detailed studies of the tune spreads, coherent tune shifts and instability thresholds were performed, revealing the different contributions of the main parameters. In particular, first simulations go in the same direction of the observed “pop corn” instabilities observed in 2016 => To be continued.
- More detailed presentation to be given by AnnalisaR at next e-cloud meeting on 30/9.

- Similar work being done with KevinL at 450 GeV.


  - Data analysis + first simulations seem to indicate that at least one of the instabilities observed during the TOTEM run can be explained by the very small emittance of the bunches, the much larger impedance due to collimator very close and the tails of the transverse profile which have been cut => Detailed analysis still ongoing.

5) Miscellaneous

- The next (91th) meeting will take place on Monday 26/09/2016 (in room 6/R-012 from 14:00 till 16:00) => Agenda:

  1) General info and follow-up (EliasM)

  2) Symplectic tracking in a magnetic field, focusing on magnetic fields that does not completely fulfill Maxwell’s equations e.g. measured fields with measurement errors (OlavB)

  3) Update on beam induced RF heating in LHC (BenoitS) => In preparation of coming LMC talk

  4) TOTEM instability on non-colliding bunches (DavidA)

  5) TOTEM instability on colliding bunches (XavierB)

  6) LHC second order chromaticity measurements during the squeeze (MichaelS)

  7) AOB (everybody)

- 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).
