Minutes of the HSC section

78th meeting on Monday 09/05/2016 (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), Edoardo Bonanno (EdoB), Xavier Buffat (XB), Lee Robert Carver (LRC), Giovanni Iadarola (GI), Kevin Li (KL), Elias Metral (EM), Mauro Migliorati (MM), Adrian Oeftiger (AO), Francesco Paciolla (FP), Tatiana Pieloni (TP), Tatiana Rijoff (TR), Annalisa Romano (AR), Giovanni Rumolo (GR), Benoit Salvant (BS), Michael Schenk (MS), Claudia Tambasco (CT), David Amorim (DA).

Present/Excused: JBG, MSB, EB, OB, NB, EdoB, XB, LRC, GI, KL, EM, MM, AO, FP, TP, TR, AR, GR, BS, MS, CT, DA, MatthewC, LottaM.

1) Newcomers / visitors

- None.

2) Comments on the minutes of the previous 77th meeting + Actions

- None.

3) General infos

- SL meeting:
  
  o Member States have asked CERN to increase the security measures.

  o Leak on the SPS beam dump. The fact that there is no real hot spare for the TIDVG should trigger a reflection about spare parts policy (e.g., in our case for the proton source).

  o The MTP has been presented to SPC and it was well received. In the previous MTP a 10% cut on the fellow budget was introduced, but it has been taken out, now.

  o Medical application steering committee: by the end of the year a preliminary CDR should be prepared, including in particular the analysis of costs and resources. In parallel, from the medical side there should be a statement about the need of such a machine.
Laurent Tavian is in charge of the French VIA programme.

- LMC talk from SimoneG on SPS TIDVG and outcome
  - The leak is not evolving for the moment.
  - Keep the one we have in the machine for the moment until TS1 and run with LHC train of 72 b max.
  - After TS1, the spare will be ready and we can take risk => Could go to 144 bunches.
  - The users will have to adapt and will be perturbed => Hiradmat…
  - And the MD in the SPS will also suffer a lot => All the studies for HL-LHC…


- Discussion on LHC instability trigger by LeeC: [https://www.evernote.com/shard/s561/sh/e02f4ff3-c3fc-4389-b5f9-0e17eb72c689/c91ac119026d0e23006e2fe1494e4694](https://www.evernote.com/shard/s561/sh/e02f4ff3-c3fc-4389-b5f9-0e17eb72c689/c91ac119026d0e23006e2fe1494e4694).

- Comment from PauloC at the last LMC about the fact that the SPS TIDVG had a pb when we stressed it a lot during the scrubbing run.

- Email from Claudio Rivetta:
  - Possible weeks to go to CERN to conduct MDs are on June weeks 24-26.
  - Reminder: July DOE review at Fermilab and September CERN review.

=> We have to be very careful designing the MDs to collect good data.

- Talks by KevinL and GianniI at the last WP2 meeting => Promising results for the 200 MHz.
- LBOC talks from XavierB => Ongoing discussion about 2 the heat load monitors in the CCC as maybe only 1 could be enough.

4) TDI - updates on tune shifts and phase measurements (Edardo Bonnano): [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/TDI_tuneshift_04092016_with_simulations-2.pptx](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/TDI_tuneshift_04092016_with_simulations-2.pptx)

- Measured tune shifts:
  - Vertical: ~ 1E-4 for both B1 and B2 (with B2 > B1, B2 slightly above 1E-4 and B1 s
lightly below).

- Horizontal: ~ 0 (as predicted).

- Assuming the nominal parameters, the measured vertical tune shift (~ 1E-4) is bigger than the predicted one (few 1E-5, exact value to be mentioned).

- EdoB presented then simulation results scanning the resistivity and the coating thickness, two important parameters very to compute the tune shifts, which are not always known with sufficient precision. Furthermore, he also scanned the gap to show the tune shift varies with it.

- BenoitS commented that, according to past discussions with the TDI responsible people, an error in the gap of ~ 500 microm would be a lot. To be followed up.

- Reminder on the procedure used by BenoitS to deduce the tune shifts (with oct = 0, chroma = 5 and ADT = off): 1) download the raw data; 2) remove the baseline; 3) correct for the drift and 4) do a moving average, otherwise we could not see anything.

- Comment from BenoitS that the new working point is close to a noise line => Worse than before.

- Therefore, possible improvements in the future:

  1) move the working point further away from noise lines;

  2) see with Rhodri Jones to have a better sensitivity (as he mentioned in the past)

  3) increase the bunch intensity.

  4) try and wait more (as FIDEL was still doing sthing in the last measurements, which was not ideal…)

- Main objectives of this week-end test:

  - Check if degradation of TDI8 after the vacuum spikes => Nothing obvious visible on tune shifts.

  - Check if difference between moving two jaws or only one => Nothing obvious visible on tune shifts. Still need to analyses in detail the tune shift from 1 jaw (which seems similar for both jaws) compared to 2 jaws.

- In summary, rather promising results. Still some work from our side to fully understand the discrepancy between the measurements and the predictions.

- As concerns the phase meas., sthing smaller than 0.01 deg will be difficult to measure and we do not see a clear signal. Next: Put also the expected phase from simulation.

=> Global summary: the only bad news until now is the vacuum spike. We still need to wait
for the high intensity to see what will happen… EliasM informed Antonio Perillo Marcone et al.

5) Discussions/updates for the HiLumi talks (GianniI and NicoloB)


- Tool develope:
  - HEADTAIL is not used anymore for these simulations => PyECLOUD-PyHEADTAIL
  - SuperLU was from our GSI colleagues and it helped a bit (factor ~ 2?).
  - Then, KLU (that GianniI found) gave another factor 2.

  => Side effect of optimization work: also PyECLOUD buildup simulations became faster: x2 gain on HL-LHC triplet simulations

- Instability simulations

  - Uniform distribution always assumed in the past, which is pessimistic.
  - At injection
    - SEY > 1.5 needed for the ecloud in the dipoles alone to drive an instability => Happens only at the beginning of the scrubbing run.
    - E-cloud in the quads is also too weak to drive an instability alone.

  => Next step: interplay with other mechanisms.

- High energy

  - Simulations are numerically more challenging due to the smaller beam size (need for finer grid) and stronger magnetic fields (need for smaller time steps to resolve electron motion).
  - Densities still well below instability threshold for reasonable values of SEY.
  - At the moment whatever is happening inside the bunch is not captured due to the mesh issue. Presently simulations at high energy are
extremely time consuming, ~1 week for 500 turns with barely acceptable numerical parameters (2 grid points per beam sigma, amplitude detuning not modeled correctly). Longer time scales practically inaccessible (needed if we want to simulate interplay with impedance).

=> Next step: parallel computing. Code presently being developed with first results expected by end 2016.

- Tune footprints

  - 450 GeV => Change of working point. Quads to be added.
  - 6.5 TeV => Work in progress due to issue of very small beam size wrt beam chamber.
    - Matching quadrupoles have a stronger effect compared to the triplets because there the beam is not going through the centre.

- Reminder about the check done (see slide 26): From the red (deduced from the simulated pinch, assumed to be fine, taking then the field etc.) to the blue there is quite some code and some mistakes could be done => It was observed to be fine.

- BenoitS gave a brief update for the impedance part (slides to come):

  - Y-chamber => No design.
  - LHCb velo => No particular worry.
  - 11 T => No particular worry with the design we have
  - Octogonal beam screen => Studied already in the past and no particular showstopper.
  - Comment: would be good now to have a summary impedance plot to show the current status with in particular the % of contribution of each equipment.


- What is the reason why in 1 chamber we can have only a maximum of few hundreds bunches from LEP experience: beam-beam? What is exactly the limit?

- TMCI from DELPHI is ~ 2E11 p/b, i.e. higher that design value but with only the RW impedance.

- CBI with few turns rise-time => Transverse feedback needed. With 4 stations, it is foreseen
to reach a damping time of 0.625 turn (feed-forward).

- Electron cloud effects => Instability threshold density agree with simulations.

- Strong strong beam-beam simulations => Coherent motion seen in H and Z (not seen in the past).

- Simulations confirm design luminosity including lattice nonlinearities Crab Waist (CW) essential.

- A new Beam-Beam effect in collisions with crossing angle (V.Telnov) => To be followed up?

- BS in the slides = Beamstrahlung.

7) Highlights from FCC-hh meeting in Rome (LottaM): [https://espace.cern.ch/be-dep/ABP/HSC/Meetings/HSC_20160509_fcc_Rome.pptx](https://espace.cern.ch/be-dep/ABP/HSC/Meetings/HSC_20160509_fcc_Rome.pptx)

- Octupole scheme => Coherent tune shift estimated/assumed to be similar to LHC one => A factor ~ 22 more octupole (total) current is needed for FCC.

- Beam-beam studies with Six-track => For new IR parameters, a 6σ DA is ensured with 0/2 ~ 76 µrad, i.e. dsep= 12.95σ (consistent with XavierB’s studies for toy model, and scaling laws from the LHC).

- Beam screen => designed to mitigate effect of synchrotron radiation at top energy (27 W/m).

  - SR directed into ante-chambers with pumping holes.

  - Reduced effect of SR induced outgassing and electrons, beneficial for impedance to shield pumping slots.

  - Prototype in production, to be installed in ANKA for testing (similar SR spectrum as FCC-ee). BenoitS mentioned that we should also try and make some bench impedance measurements.

8) Miscellaneous

- The next (79th) meeting will take place on Monday 30/05/2016 (in room 6/R-012 from 14:00 till 16:00) => Agenda:

  1) General info and follow-up (EliasM)
2) Space Charge Mitigation in PS with Hollow Bunches (AdrianO)

3) Impact of TDI8 in the 2015 LHC instabilities at injection (BenoitS)

4) Measuring TMCI intensity threshold without and with ADT in the LHC (Impedance/Instability team)

5) AOB (everybody)

- Important events and dates for HSC: 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.


Minutes by E. Metral, 09/05/2016.