

Minutes of the HL-LHC WP2 Task 2.4

**9th (VIDYO) meeting on Wednesday 09/04/2014
(11:00-12:30, 6/R-018)**

Task 2.4 members: Alexey Burov (AB), Alessandro Drago (AD), Alessandro Gallo (AG), Andrea Mostacci (AM), Alessandro Vivoli (AV), Benoit Salvant (BS), Bruno Spataro (BrunoS), David Alesini (DA), Deepa Angal-kalinin (DAK), Elias Metral (EM), Elena Shaposhnikova (ES), Fabio Marcellini (FM), Fritz Caspers (FC), Frank Zimmermann (FZ), Gianluigi Arduini (GA), Giovanni Rumolo (GR), Hugo Alistair Day (HAD), John Jowett (JJ), Kevin Li (KL), Luigi Palumbo (LP), Mauro Migliorati (MM), Michel Martini (MM), Mikhail Zobov (MZ), Nicolas Mounet (NM), Nicolo Biancacci (NB), Oliver Boine-Frankenheim (OBF), Olga Zagorodnova (OZ), Oscar Frasciello (OF), Paul Goergen (PG), Rainer Wanzenberg (RW), Uwe Niedermayer (UN), Wolfgang Hofle (WH).

Present/Excused: AB, AD, AG, AM, AV, BS, BrunoS, DA, DAK, **EM**, **ES**, FM, FC, FZ, **GA**, GR, HAD, JJ, **KL**, LP, MM, MichelM, MZ, **NM**, NB, OBF, OZ, OF, PG, RW, UN, WH, **Juan Esteban Muller**, Giovanni de Michele, **HelgaT**, **TheoA**, **PhilippeB**.

1) General information (EliasM):

- PhilippeB (Baudrenghien) and HelgaT (Timko) have been added to the mailing list.
- Actions for e-cloud team discussed and agreed plan below:
 - The question was raised whether electron cloud build-up could occur in the crab cavities and for which value of the SEY:
 - Were the other RF cavities also studied?
 - There are commercial codes to study multipacting in RF cavities => Were these used? But this is never done with beam.
 - => Will not be possible to study this effect for the moment.
 - A margin of 150 W has been provided for heat load due electron cloud in the triplets in IR1 and IR5.
 - Based on simulation results which corresponds to a SEY of ~ 1.1.
 - Simulations for the heat load due to electron cloud should be

performed in the triplets in IR2 and 8 (so far an extrapolation from measurements has been done) and for all the new elements of the IR1/5 matching section. Sensitivity to orbit (e.g. when the beams are separated should be studied).

- The latter item (IR1/5 matching) will be what will be studied first as it is a new thing.
- The electron cloud instability threshold resulting by electron cloud in the triplet/matching sections in IR1 and 5 should be estimated.
 - This is a huge effort due to the quads.
 - Could be done in the context of PyHEADTAIL but would require really a lot of time if one wants to study this properly
=> Could be a nice subject for a student.
 - => Will not be studied for the moment.
- Plan for the next weeks (until the milestone report) made. Any comment / suggestion for other topics to be discussed? Then, of course we will also continue meetings until November when we should write the final report.

2) LHC longitudinal collective effects by Juan Esteban Muller:
<https://indico.cern.ch/event/310704/contribution/1/material/slides/0.pptx>

- Reminder:
 - LHC impedance is very small => According to DR, $\text{Im } Z/n \approx 0.1 \Omega$
=> Difficult to measure with beam using existing methods.
 - No longitudinal instability in the LHC for operational beam parameters (so far).
- Plan:
 - Check LHC impedance model with => Current work
 - measurements
 - analytical calculations
 - simulations
 - Study the case of HL-LHC parameters => Future work
 - Single RF system
 - Double harmonic RF systems
- Several measurements have been with good and less good agreement with

predictions => Still ongoing comparisons with simulations => To be verified:

- Effect of distribution on bunch length measurements as simulations suggest bunches are shorter than measured.

- LHC longitudinal impedance model as simulations suggest a higher longitudinal impedance (factor 3).

- Criteria to distinguish between damped and undamped oscillations as simulations suggest different criteria needed.

- Note that 4 different codes were used => They are sure now that the induced voltage is correct but there was a bug inside ESME.

- Idea from PhilippeB is to benchmark the BQM data with experiments but normally there we have long bunches and the effect it is less important.

- Future

- Simulations to be done with HEADTAIL.

- For HL-LHC

- Really depends on the longitudinal emittance and no big problem expected.

- Potential worry: Double RF system with short bunches which have to be studied in detail.

3) Transverse beam stability studies in the presence of 2 RF systems – a status report

by

Kevin

Li:

<https://indico.cern.ch/event/310704/contribution/2/material/slides/0.pdf>

- Most of time spent in implementing and developing the code.

- TMCI used as an example.

- Tunes for HL-LHC will be different due to ATS optics:

- Tunes at injection: 62.28 (H) / 60.31 (V) instead of 64.28 / 59.31.

- Tunes in collision: 62.31 (H) / 60.32 (V) instead of 64.31 / 59.32.

- Comment from TheoA and ElenaS: TheoA has a program to match in multi-harmonics and taking into account the intensity effects => Interesting for future HEADTAIL simulations.

- Typo on slide 6 as it is $4 \sigma_{z} = 1 \text{ ns}$.

- Slide 12 => Check that in lengthening mode it converges to a limit...
- Interesting effect of chromaticity which seems more effective in the bunch lengthening mode than in bunch shortening mode while the bunch lengthening mode is more critical than the bunch shortening mode in the absence of chromaticity => To be studied in more detail.
- Summary => Next step: use the matched distribution from TheoA.
- Comment from GianluigiA:
 - Use 800 MHz in collision to reduce pile-up density => Maybe not an issue if we are in BBHO.
 - Other advantages is during injection / ramp for IBS and RF heating.
 - Question from GianluigiA about a proposition from StephaneF with 400 MHz and 440 MHz => what happens here? => To be looked at.
 - Comment from ElenaS: This study has been done without RF phase error for the moment.
 - In summary => Very interesting first results. To be continued.

4) Next meeting

- The next (10th) VIDYO meeting will take place on Wednesday 16/04/2014 from 11:00 to 12:30 in the room 6/R-018 for the CERN people. The agenda is

- 1) General information (EliasM)
- 2) Impedance of the crab cavities (RamaC and BenoitS)
- 3) Some answers to the actions (NicolasM and others)
- 4) AOB (EliasM)

Minutes by EliasM, 15/04/2014.