

Minutes of the HL-LHC WP2 Task 2.4

**25th (VIDYO) meeting on Wednesday 08/07/2015
(11:00-12:30, 18/3-008)**

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, **Na Wang**, **LeeRC**, **ClaudiaT**.

1) General information (EliasM):

- See all the actions from the last but one meeting.
- Na Wang will not be here next week for her talk “Update on the new design of bellow shielding for the triplets”.
- We need now to conclude on the crab cavities impedance...

2) Update of beam stability studies with Crab Cavities: DELPHI (NicoloB)

⇒ https://indico.cern.ch/event/403464/contribution/2/attachments/808342/1107824/DELPHI-HOM-AllCrabs_FM_feedback.pdf.

- We reviewed the results of NicoloB (in his absence), see slides from last meeting, before looking at the HEADTAIL results. Reminder: the Crab cavities impedance (considering all the BNL HOMs as well as the fundamental mode) generally increases the HLLHC baseline growth rate. For instance, for $Q' > 0$, the increase can be up to a factor ~ 2 ($Q' = 15$).

3) Update of beam stability studies with Crab Cavities: pyHEADTAIL (KevinL)

⇒ https://indico.cern.ch/event/406037/contribution/1/attachments/812639/1113746/draft_01.pptx and https://indico.cern.ch/event/406037/contribution/1/attachments/812639/1113745/draft_00.pptx.

- 2 weeks ago (see first set of slides), KevinL showed the first pyHEADTAIL simulations considering all the HOMs of the Crab Cavities, including the spread etc. and obtained the non expected result that the addition of the crab cavity HOMs to the present HL-LHC impedance model renders the beam more stable ⇒ This still needed to be checked and if confirmed, to be understood. One way of obtaining a clearer picture is to repeat the studies for increased beam intensities ($3e11$ & $4e11$ ppb) → the relative impact of the different scenarios should not change but the rise times will become more clear. The scenarios should also be checked using other approaches, i.e. DELPHI and BimBim

- Today, KevinL showed a second set of slides, looking at higher intensities to have clearer signals. The behavior is confirmed, and for instance at 0 chromaticity the addition of the Crab Cavities leads to longer instability rise-times by a factor ~ 1.2 ⇒ Still to be understood... It should be noted that similar results seems to be obtained from BimBim.

⇒ Question: why DELPHI finds that the situation is worse with the Crab Cavities while pyHEADTAIL & BimBim find that it is better? ⇒ Are we sure we use the same input?

- DELPHI needs the impedance while pyHEADTAIL/BimBim needs the wake function ⇒ Is the latter long enough? Do they correspond to each other?

- DELPHI also considers the fundamental mode whereas pyHEADTAIL/BimBim not ⇒ To be updated.

- DELPHI does not consider the quadrupolar impedance whereas pyHEADTAIL/BimBim does ⇒ To be updated.

- Could DELPHI resolve the high Q resonances? ⇒ As NicolòN also considered the spread within 3 MHz, this might not be a problem.

⇒ The 3 codes (DELPHI, pyHEADTAIL and BimBim) should be compared with exactly the same parameters and same input impedance / wake function.

- REMINDER:

- The parameters to be used should be the ones from the operational scenarios: https://espace.cern.ch/HiLumi/WP2/task4/Shared%20Documents/FinalNote_v2.pdf. For instance, 8.1 cm should be used as rms bunch length.

- The completion of these studies is of (very) high priority now.

- Several cases should be studied:

1) Nominal scenario: Collisions at $\beta^* = 70$ cm ⇒ This means that the betas at the Crab Cavities have to be reduced by

the factor 70/15.

2) Ultimate scenario: Collisions at $\beta^* = 46$ cm => This means that the betas at the Crab Cavities have to be reduced by the factor 46/15.

3) I think the case where we collide at 15 cm should also be studied in case for one reason or another we should go down to 15 cm without collisions (to have an idea, but the operational scenarios are cases 1) and 2)).

- This should be studied for both single-bunch and multi-bunch effects and this should be studied for both the current list of HOMs and the recently received list where the situation should be improved a bit.

- Finally, we should also study the case where only half of the crab cavities are installed.

- I remind you that we should in the end try to produce "simple plots" showing in particular the amount of octupole current needed to stabilize the beam (vs. chroma and damper gain), or the maximum performance in bunch intensity vs. emittance (i.e. brightness) for the maximum available octupole current (vs. chroma and ADT gain).

- Several questions linked to the gain of the bunch-by-bunch damper, a possible wide-bandwidth damper or 800 MHz RF system remain to be answered (see past actions.)

4) Next meeting

- The next (26th) Task 2.4–2.7 VIDYO meeting will take place on Wednesday 15/07/2015 from 11:00 to 12:30 in the room 6/R-018 for the CERN people. The agenda is

1) General information (EliasM)

2) Update on the new design of bellow shielding for the triplets by Na Wang and Benoit Salvant (might be postponed as Na will not be around)

3) Update of beam stability studies with Crab Cavities: HEADTAIL by KevinL

4) Update of beam stability studies with Crab Cavities: DELPHI by NicolòB

Minutes by EliasM, 10/07/2015.