Minutes of the HL-LHC WP2 Task 2.4

15th (VIDYO) meeting on Wednesday 08/10/2014 (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, **Tatiana Pieloni**, **Claudia Tambasco**

1) General information (EliasM):

- Minutes of the last meeting will come soon…

2) Beam-beam and octupoles stability diagrams for HL-LHC optics (ClaudiaT): http://indico.cern.ch/event/341818/contribution/1/material/slides/0.pdf

- Claudia already gave 2 talks on a preliminary analysis during beam-beam meetings:

  - 1st on 21/08/14: http://indico.cern.ch/event/336299/contribution/0/material/slides/0.pdf.

  - 2nd on 19/09/14: http://indico.cern.ch/event/341409/contribution/0/material/slides/0.pdf.

- ATS optics used for the studies:

  - Comparing the tune footprint between the LHC (nominal) and HL-LHC (ATS) optics for the case of the HL-LHC parameters (2.2E11 p/b within 2.5 microm) for a (maximum) octupole current of 590 A, a strong impact of the ATS is observed => 2 effects:

    1) Larger beta functions at the octupoles (~ factor 2.5) => ~ factor 2.5 more spread.

2) Asymmetric stability diagrams between LOF < 0 and LOF > 0 => The height of the stability diagram for LOF > 0 is larger and after detailed investigation it has been found that this is due to the sextupole contribution (typical for ATS). Removing this contribution, the usual symmetric stability diagrams are recovered.

- Questions:

  - The detuning from the sextupoles seems to be negative => Why is the stability diagram with LOF > 0 (positive detuning) larger than for LOF < 0?

  - Can the sign of the sextupoles be changed?

- The footprints from octupoles have been also studied for different beta* (11 m, 2 m, 40 cm, 33 cm, 15 cm and 10 cm) for both LOF < 0 and LOF > 0, as well as the corresponding stability diagrams.

- The footprints from both octupoles and BBLR have been then studied for different beta* (11 m, 2 m, 40 cm, 33 cm, 15 cm and 10 cm) for both LOF < 0 and LOF > 0, as well as the corresponding stability diagrams.

  - Question on slide 34: why, for LOF > 0, is the stability diagram for beta* = 2 m larger than for beta * = 33 cm?

- It is possible to put in place for $\beta^* = 2$ m a betatron squeeze keeping the same ATS telescopic contribution (proposal of S. Fartoukh).

- The evolution of the stability diagrams during the betatron squeeze has been studied for both LOF < 0 and LOF > 0, comparing the nominal and PACMAN bunches

  - The betatron squeeze has been simulated by increasing the crossing angle: starting point 590 μrad ($d = 12.5\ \sigma$ and $\beta^* = 0.15$ m).

  - In the collide&squeeze foreseen, we will go in collision at ~ 27 σ separation (i.e. ~ 70 cm beta*) for luminosity reason (and not for instability reason) => For instability reason only, we could go below in beta* (based only on this mechanism discussed here).

- Finally, the tune footprint and related stability diagram in the presence of full crab crossing (i.e. head-on collision) have been presented for the maximum octupole current (590 A) vs. intensity.

  - As predicted, the tune footprint (and related stability diagram) for LOF < 0 (and BBHO) is smaller than for LOF > 0 (and BBHO).

  - It is shown in particular that for a constant octupole current, there exists a bunch intensity (brightness), which reduces the stability diagram to a minimum (which is much smaller than the case with octupole only). Or inversely, for a certain intensity (brightness), there

exists an octupoles current, which reduces the stability diagram from BBHO to a minimum.

- Question: What is the minimum stability diagram (and for which intensity is it obtained) in the case presented on slide 121 on the left (LOF < 0)? To answer to this question, it would be good to make another plot with the following cases shown:

    1) I = 0 => i.e. no BBHO effect (I imagine it should be close to the 8.0E8 case).

    2) I = 8,7,6,5,4,3,2,1,0.5E10.

3) Next meeting

- The next (16th) VIDYO meeting will take place on Wednesday 15/10/2014 from 11:00 to 12:30 in the room 6/R-018 for the CERN people. The agenda is

1) General information (EliasM)

2) Review of the impedance model: Updates for crab-cavities, collimators (TCTP mode), etc. (NicoloB)

3) AOB (EliasM)

Minutes by EliasM, 11/10/2014.