

## Minutes of the HL-LHC WP2 Task 2.4

### 16<sup>th</sup> (VIDYO) meeting on Wednesday 15/10/2014 (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, **Juan Esteban Muller**.

#### 1) General information (EliasM):

- This is our last meeting before the write-up of the final Task 2.4 report (first draft will be sent this Friday).
- KevinL sent me his final analysis on the effect of a double RF system on transverse coherent instabilities => 2 very interesting things, which are new (and could be discussed / presented during a coming meeting):
  - Initialization procedure for a beam distribution in an RF system in pyHEADTAIL => Well-matched distribution.
  - Studies in the presence of a perfect transverse damper.

#### 2) Update on the HL-LHC impedance budget (NicoloB): <https://indico.cern.ch/event/341819/contribution/0/material/slides/0.pdf>

- CC not discussed today => Will be mainly on collimators and work done in the last months.
- Reminder on the status of the LHC impedance model vs. measurements:
  - Factor ~ 3 discrepancy between measured and simulated tune shifts

vs. intensity at 450 GeV.

- Factor  $\sim 2$  discrepancy between measured and simulated tune shifts vs. intensity at 4 TeV.

- 3 possible explanations for the disagreement:

1) Finite length  $\Rightarrow$  Should not be more than few %.

2) Geometric contribution  $\Rightarrow$  Up to  $\sim 20-30\%$  on impedance at 1 GHz. NicolasM computed the tune shift including the geometric part and found that  $\sim 15\%$  can be explained by this  $\Rightarrow$  See slide 6 of <https://indico.cern.ch/event/310353/session/3/contribution/9/material/slides/1.pdf>.

3) Resistivity (due to ageing from radiation)

- The tune shift goes  $\sim$  with the square root of the resistivity  $\Rightarrow$  A factor 4 increase (compared to the 5 microOhmm used) is needed to explain a factor 2 in tune shift.

- We asked to measure the resistivity on a TCTP collimator, which was removed due to some beam-induced RF heating reason (it is the only one and therefore it seems to be a nonconformity).

$\Rightarrow$  If this is not due to resistivity, what is then another possible reason?...

- Molybdenum jaws

- HL-LHC impedance reduction strategy  $\Rightarrow$  New Molybdenum jaws in IP3 and IP7.

- Possible different material scenarios:

1) MoC: Molybdenum-Carbon (also called Mo-Gr) only.

2) Mo: Molybdenum only.

3) Mo-coating on CFC.

4) Mo-coating on MoC (error in the slides).

- Studies have been done with the HL-LHC impedance model with 15 cm round optics and **considering all the collimators after check with collimation team (1 collimator was missing  $\Rightarrow$  The first in the plot with all the collimators)**.

- Comment from BS: the TCTP mode might shift in the future.

- Should be good to add the picture with Mo-coating on MoC

compared to baseline (CFC) => Should be the preferred scenario.

- Next / final step (for hilumi meeting) will be to compute and compare (on the same picture) the stability limit (intensity vs. emittance) for all these collimator scenarios.

- Present TCT-TCSG in IP6 design => Potentially harmful low frequency modes

- Collaboration with INFN.

- Comparison with measurements => Ongoing. Comment from Mikhail: depending on the wire position there is a change of the characteristic impedance which should be taken into account (and was not yet) => **NicoloB will update this in the future.**

- DELPHI simulations.

- TDI

- Present TDI design

- Heating issues + presence of many harmful trapped modes.

- Impedance bench measurements confirmed the presence of the low frequency modes.

- Short term: post-LS1 mitigation

- Change of the beam screen from copper to stainless steel → more robustness.

- 1µm Ti + 2µm Cu coating → power loss reduction.

- Long term: Device re-design from scratch => Iterations with the collimation and INFN-LNF group to take into account mechanical feasibility (number of modules, transition geometry, gaps, etc..) and impedance compatibility (transition + jaw material).

- Many thanks to our INFN colleagues for all the work already done for the TDI! To be continued and discussed during the next meeting (see below).

- Next steps:

- Replacement of the BPM broadband model with accurate impedance estimations.

- Update of the other broadband impedances (valves, Y chamber, ...) from design report.

- Update of the Crab Cavities design → impedance HOM updated list.

- Etc.

### **3) Next meeting**

- The next (17<sup>th</sup>) VIDYO meeting will take place on Wednesday 29/10/2014 from 11:00 to 12:30 in the room 6/R-018 for the CERN people. The agenda is

1) General information (EliasM)

2) Wake fields and impedances simulations of LHC collimators with GdfidL code (Oscar Frasciello)

3) AOB (EliasM)

*Minutes by EliasM, 15/10/2014.*