

HL-LHC WP2 on Accelerator Physics

TASK 2.4: COLLECTIVE EFFECTS STUDIES

Beam-beam is
treated separately in Task 2.5
(W. Herr)

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- ◆ **Objectives & description of the work**
- ◆ **Sub tasks**
- ◆ **Deliverables and milestones**
- ◆ **Collaboration**
- ◆ **Proposed modus operandi**
- ◆ **Next steps**

OBJECTIVES AND DESCRIPTION OF THE WORK

- ◆ **OBJECTIVES:** To evaluate intensity limitations due to collective effects except beam-beam, which is treated separately, (i.e. from space charge, machine impedance, electron cloud and intra-beam scattering) and to specify in particular limits for the maximum acceptable impedance of new components in the LHC upgrade
- ◆ **DESCRIPTION OF THE WORK:**
 - The goal of this task is to define key parameters such as maximum acceptable impedance values and to identify optimum beam configurations (e.g. required chromaticity control and Landau damping octupole settings) for the different scenarios of Task 2.2 (Optics and Layout Studies)
 - This task will provide critical inputs to estimate the potential performance reach of the upgraded LHC and therefore feed directly into WP1 and other tasks of WP2

SUB TASKS

- ◆ **2.4.1: Impedance and wake field calculations for new components of the upgrade options**
- ◆ **2.4.2: Estimates for the required corrector circuit settings (chromaticity and Landau damping octupoles) and additional heat loads**
- ◆ **2.4.3: Provide estimates for the Intra Beam Scattering (IBS) growth rates for different beam parameters**
- ◆ **2.4.4: Proposals for beam/lattice manipulations to increase the LHC performance, such as flattening of the longitudinal distribution, use of circular optics etc.**

DELIVERABLES AND MILESTONES

- ◆ **D2.6) TZB: Total Impedance Budget estimate: Estimate of the total Impedance of the modified LHC machine. (Task 2.4.1) [M36, i.e. month 36 after the start of the project].** Publication in form of project report
- ◆ **D2.7) BIL: Beam Intensity Limitations: Estimate of intensity thresholds for beam instabilities. (Task 2.4.2) [M36].** Publication in form of project report
- ◆ **D2.8) BPT: Beam Parameter Variations: Estimate of beam parameter variations such as tunes and emittances. (Tasks 2.4.2 and 2.4.3) [M36].** Publication in form of project report

COLLABORATION (1/2)

- ◆ **Already discussed in the past with Oliver Bruning**
 - **BINP: V. Smaluk**
 - **CERN: F. Zimmermann et al.**
 - **DESY: R. Wanzenberg, O. Zagorodnova**
 - **INFN-Frascati: M. Zobov, A. Gallo, A. Drago, D. Alesini, F. Marcellini**
 - **KEK: K. Ohmi**
 - **SLAC: U. Wienands, T. Markiewicz**
 - **STFC: B. Muratori, D. Angal-Kalinin**
 - **UNILIV: M. Korostelev**

To be contacted after
the 1st General HL-LHC project
meeting of next week

COLLABORATION (2/2)

To be contacted after
the 1st General HL-LHC project
meeting of next week

- ◆ **Other possible collaborators, already in collaboration for several years (for impedance/ecloud and/or related instabilities and/or benchmarking simulation tools)**
 - **FNAL: A. Burov => Already agreed**
 - **GSI/TU Darmstadt: O. Boine-Frankenheim, G. Franchetti, V. Kornilov and U. Niedermayer**
 - **JAEA: Y. Shobuda**
 - **JPARC/KEK: Y. H. Chin**
 - **TU Darmstadt: T. Weiland, W. Mueller and L. Haenichen**
 - **Univ. of Naples, INFN: V. Vaccaro**
 - **Univ. of Roma: A. Mostacci and M. Miglioratti**
 - **Others?**

MODUS OPERANDI

- ◆ **Proposition (still to be discussed with collaborators)**
 - Classical web pages and/or Wiki
 - WebEx meetings every 2 months
 - 1 meeting altogether / year => Each time at a different place (one of the collaboration)

NEXT STEPS

- ◆ **1) EM will give a 20 (+ 10) min talk on “Impedance and beam stability lessons learned from the 2010-2011 operation of the LHC and their implications for the HL-LHC project” at the 1st general HL-LHC meeting at CERN next week (16-18/11/2011) => Starting point for discussions with the collaborators**
- ◆ **2) After the talk, EM will contact all the (possible/interested) collaborators to**
 - Finalize together the modus operandi
 - Define together small “work packages” for the different labs (to work on more or less independently)
 - Start together this great adventure!