

# HL-LHC WP2 TASK 2.4

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- ◆ **HL(High Lumi)-LHC project (L. Rossi) => Status:** <http://indico.cern.ch/getFile.py/access?contribId=1&sessionId=0&resId=1&materialId=slides&confId=150474>
- ◆ **WP2 = Beam Dynamics and Optics (A. Wolski & O. Brüning)**  
**=> 1<sup>st</sup> general meeting:** <http://indico.cern.ch/getFile.py/access?contribId=60&sessionId=20&resId=1&materialId=slides&confId=150474>
- ◆ **Task 2.4 = LHC collective effects studies (E. Metral):**
  - **SharePoint site:** <https://espace.cern.ch/HiLumi/WP2/task4/SitePages/Home.aspx>
  - **Deliverable => D2.4: Collective effects beam intensity limitations [report, month 36 => End 2014]**

# 1<sup>st</sup> General HL-LHC Meeting: WP2

## WP2 Tasks within the EU funded HiLumi Design Study:

- ➔ Task 2.1: Coordination and Comm ➔ A. Wolski & O. Brüning
- ➔ Task 2.2: Optics and Layout ➔ Bernhard Holzer
- ➔ Task 2.3: Particle Simulations ➔ Massimo Giovannozzi
- ➔ Task 2.4: Collective Effects ➔ Elias Metral
- ➔ Task 2.5: Beam-Beam Effects ➔ Werner Herr
- ➔ Task 2.6: Beam Parameter ➔ A. Wolski & O. Brüning

## Additional WP2 Tasks outside the EU funded HiLumi Study:

- ➔ Task 2.7: Intensity limitation from existing LHC hardware  
➔ Ralph Assmann

# 1<sup>st</sup> General HL-LHC Meeting: WP2

## WP2 General Tasks:

- Design IR layouts.
- Provide specifications for hardware teams:
  - triplet, D1 & insertion magnets; vacuum; CRAB cavities etc.
- Develop optics for full machine with modified IR layout; collimators in Dispersion Suppressor; CRAB cavities.
- Study potential performance limitations for the HL-LHC.
- Identify beam parameter sets for reaching HL-LHC goals:
  - $L_{\text{peak-operation}} = 5 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
  - $L_{\text{peak-virtual}} > 10 \cdot 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
  - $L_{\text{int}} = 200 \text{ fb}^{-1} \text{ to } 300 \text{ fb}^{-1} \text{ per year}$

# 1<sup>st</sup> General HL-LHC Meeting: WP2

## Summary of WP2 Deliverables:

	Deliverables
D2.1	Optics and lattice Files [month 18]
D2.2	Magnet Field Specifications [month 36]
D2.3	Corrector magnet specifications [month 36]
D2.4	Collective effects Beam intensity limitations [month 36]
D2.5	Beam-Beam effect related intensity limitations [month 36]
D2.6	Specification of the machine and beam parameters [month 48]

- ➔ Most deliverables are only due towards end of design study
- ➔ But most deliverables are required early as input for other WP!
- ➔ Detailed sub-tasks not 'cast in stone' but will evolve over time  
(with lessons learned from studies and LHC operation)

## TASK 2.4: 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.**

## COLLABORATION (1/2)

- ◆ **Already discussed in the past with Oliver Bruning**
  - **BINP: V. Smaluk**
  - **CERN: F. Zimmermann** + W. Hofle (for transverse damper), E. Shaposhnikova (for longitudinal dynamics), M. Martini (for IBS) => Already discussed together
  - **DESY: R. Wanzenberg, O. Zagorodnova** => For impedance, already discussed together
  - **INFN-Frascati: M. Zobov, A. Gallo, A. Drago, D. Alesini, F. Marcellini** + B. Spataro (already discussed together)
  - **KEK: K. Ohmi**
  - **SLAC: U. Wienands, T. Markiewicz**
  - **STFC: B. Muratori, D. Angal-Kalinin** (for IBS => already discussed together)
  - **UNILIV: M. Korostelev**

## COLLABORATION (2/2)

- ◆ **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 discussed together**
  - **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?**



## NEXT STEP(S)

- ◆ **Finish to discuss with / contact all the collaborators**
- ◆ **Finalize together the modus operandi**
  - Infos put on the SharePoint site: <https://espace.cern.ch/HiLumi/WP2/task4/SitePages/Home.aspx>
  - WebEx meetings every ~ 2 months
  - 1 meeting altogether / year => Each time at a different place (one of the collaboration)
- ◆ **Define together small “work packages” for the different labs (to work on more or less independently)**
- ◆ **Start this great adventure!**