

HiLumi LHC

FP7 High Luminosity Large Hadron Collider Design Study

Milestone Report

DISTRIBUTION OF PRELIMINARY OPTICS AND LATTICE FILES TO ALL WORK PACKAGES

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27 November 2012



The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

This work is part of HiLumi LHC Work Package 2: **Accelerator Physics & Performance**.

The electronic version of this HiLumi LHC Publication is available via the HiLumi LHC web site <<http://hilumilhc.web.cern.ch>> or on the CERN Document Server at the following URL:
<<http://cds.cern.ch/search?p=CERN-ACC-2013-021>>

Grant Agreement No: 284404

HILUMI LHC

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Seventh Framework Programme, Capacities Specific Programme, Research Infrastructures,
Collaborative Project, Design Study

MILESTONE REPORT

DISTRIBUTION OF PRELIMINARY OPTICS AND LATTICE FILES TO ALL WORK PACKAGES

MILESTONE: M26

Document identifier:	HILUMILHC-Mil-M26
Due date of deliverable:	End of Month 12 (October 2012)
Report release date:	27/11/2012
Work package:	WP2: Accelerator Physics and Performance
Lead beneficiary:	CERN
Document status:	Final

Abstract:

The preliminary lattice and optics files are available in the HL-LHC data base for further use by the members of all the WP involved in the HL-LHC Project (e.g. for beam-dynamics considerations and simulations, collimation studies, energy deposition estimates, etc.).

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The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404. HiLumi LHC began in November 2011 and will run for 4 years.

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Delivery Slip

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Edited by	G. Arduini, S. Fartoukh, B. Holzer, M. Giovannozzi, A. Wolski	CERN	16/11/12
Reviewed by	L. Rossi [Project coordinator]	CERN	18/11/12
Approved by	L. Rossi [Project coordinator]		20/11/12

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Executive summary

The preliminary lattice and optics files are available in the HL-LHC data base for further use by the members of all the WP involved in the HL-LHC Project (e.g. for beam-dynamics considerations and simulations, collimation studies, energy deposition estimates, etc.).

1. INTRODUCTION

The preliminary HL-LHC lattice and optics files [1] are available in the CERN optics HL-LHC data base for further use by the members of all the WP involved in the HL-LHC Project (e.g. for beam-dynamics considerations and simulations, collimation studies, energy deposition estimates, etc.).

2. OPTICS, LATTICE FILES, AND ANALYSIS TOOLS

The milestone MS26 (“Distribution of Preliminary Optics and Lattice files to all work packages”) was reached ahead of schedule in month M5 via the publication on the official CERN optics database of a complete optics and layout version of the HL-LHC, the so-called SLHCV3.1b version, with crab-cavities and 140 mm-150 T/m Nb₃Sn inner triplets equipping the new high-luminosity insertions ATLAS and CMS [1][2] (see also second Task leader meeting held on March 16th 2012 <https://indico.cern.ch/conferenceDisplay.py?confId=182291>). Anticipating already a further increase of the triplet aperture up to 150 mm, the aperture and basic performance requirements (e.g. nominal gradient for quadrupole magnets) of all other equipment (TAS and TAN absorbers, separation dipoles D1/D2 and matching quadrupoles Q4/Q5) were then derived and communicated in May to all WP3 participants (including US labs) in the framework of the LARP/HiLumi LHC collaboration meeting [3]. A preliminary design of the triplet corrector package, including additional (a5,b5,a6) correctors (not present in the nominal machine) is also implemented in SLHCV3.1b. Finally this version includes already a battery of new dedicated analysis tools, to study the incoherent beam-beam effects, or the impact of the field imperfections of the new HL-LHC magnets on the HL-LHC dynamic aperture, and to simulate their correction with the dedicated corrector magnets made available.

3. FUTURE PLANS / CONCLUSION / RELATION TO HL-LHC WORK

Updates of the optics files will be made available whenever modification of the layout will be required and approved by the Parameter and Layout Committee taking into account of the progress in the design of the magnets and of the other components.

As an example, after re-optimization of the HL-LHC lattice, a full set of beam optics has been established and optimized for all relevant operation modes and the baseline for the new 150 mm triplet version, called HLLHCV1.0 has been made available.

Injection, flat top, pre-squeezed and ATS squeezed optics are available, including the collision optics for the low luminosity IPs 2, 8 and for possible ion or ion-proton operation mode at the era of the HL-LHC [4,5].

4. REFERENCES

- [1] A repository for the optics and layout of the HL-LHC with a 140 mm-150 T/m inner triplet is available at </afs/cern.ch/eng/lhc/optics/SLHCV3.1b> and <http://hllhcoptics.web.cern.ch/hllhcoptics/SLHCV3.1b/> .
- [2] S. Fartoukh and R. De Maria, Optics and Layout Solutions for HL-LHC with Large Aperture Nb₃Sn and Nb-Ti Inner Triplets, CERN-ATS-2012-136, in Proceedings of the *3rd International Particle Accelerator Conference*, New Orleans, USA, 20-25 May 2012, C. Petit-Jean-Genaz, J. Corbett, eds., p. 145-147: <http://cdsweb.cern.ch/record/1459916/files/CERN-ATS-2012-136.pdf>
- [3] S. Fartoukh, *HiLumi-LHC Optics*, Presentation given at the LARP CM18/HiLumi LHC Meeting, Fermilab, 7-9 May, 2012: <https://indico.fnal.gov/conferenceOtherViews.py?view=standard&confId=5072>
- [4] A repository for the optics and layout of the HL-LHC with a 150 mm-140 T/m inner triplet is available at: </afs/cern.ch/eng/lhc/optics/HLLHCV1.0> and <http://hllhcoptics.web.cern.ch/hllhcoptics/HLLHCV1.0/> .
- [5] R. De Maria, S. D. Fartoukh, A.V. Bogomyagkov, M. Korostelev, *HLLHCV1.0: HL-LHC layout and optics version for 150 mm Nb₃Sn triplets and local crab-cavities*, Presentation given at the 2d Joint HiLumiLHC-LARP annual meeting, 14-16 November, 2012, INFN, Frascati, Italy: <https://indico.cern.ch/getFile.py/access?contribId=11&sessionId=1&resId=1&materialId=slides&confId=183635>