

Task 2.3 organisation

M. Giovannozzi

- Introduction and a bit of history
- Tools
- Approach
- Work packages

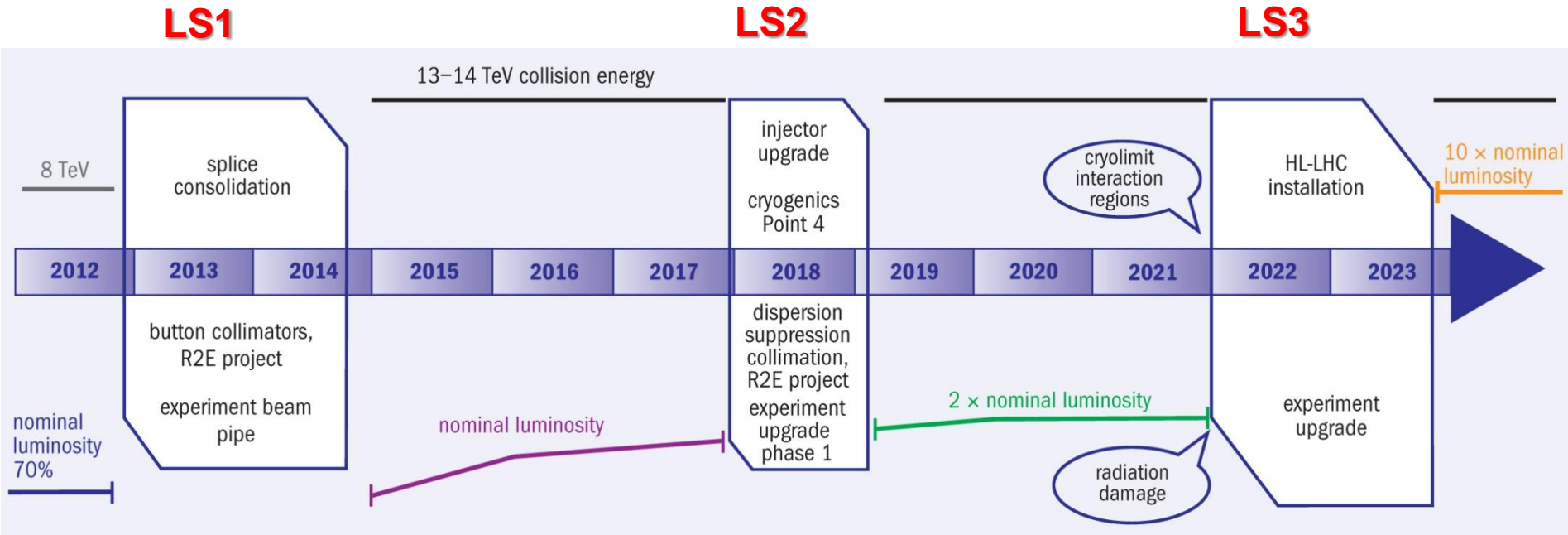
Feedback is more than welcome!

Partners: BINP, CEA, CERN, CSIC-IFIC, EPFL, INFN-Frascati, SLAC, Uni-Liv, Uni-Man

Introduction

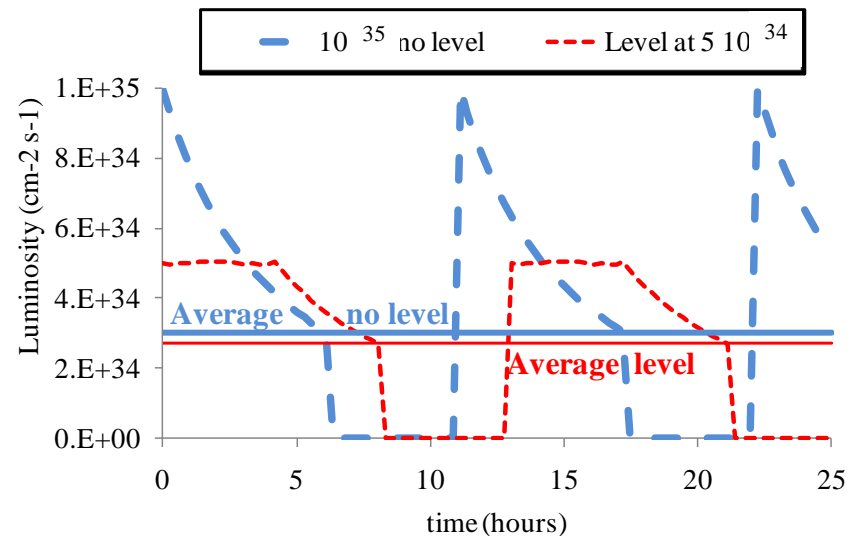
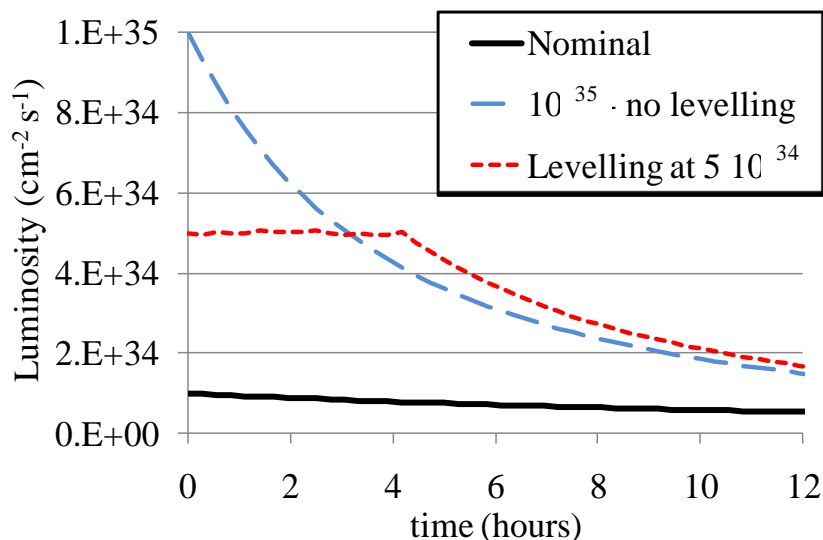
- The need of an upgrade for LHC has been studied through the years:
 - Special task force: 2001.
 - HHH (FP6 Programme), USLARP: between 2003-7.
 - LHC Phase I upgrade: between 2007-10.
 - HL-LHC: after June 2010.
 - HiLumi (FP7 Programme): after November 2011.

LHC programme for the next 10 years



Scope of High-Luminosity upgrade of LHC

- Targets:
 - A peak luminosity of $5 \times 10^{34} \text{ cm}^{-2}\text{s}^{-1}$ **with leveling**
 - An integrated luminosity of 250 fb^{-1} per year, enabling the goal of 3000 fb^{-1} in twelve years.



Courtesy E. Todesco

HiLumi structure

- PL: Lucio Rossi; DPL: Oliver Brüning;
- WP2 - Accelerator Physics and Performance: Stephane Fartoukh
Deputy: Andy Wolski
 - Task 2.2 Optics and Layout
 - B. Holzer
 - Task 2.3 Particle Simulations
 - MG
 - Task 2.4 Collective Effects
 - E. Métral
 - Task 2.5 Beam-Beam Effects
 - A. Valishev (T. Pieloni CERN link)
 - Task 2.6 Beam Parameter
 - O. Brüning
 - Task 2.7 Intensity limitation
 - from existing LHC hardware
 - TBA



CERN European Organization for Nuclear Research



HL-LHC: High Luminosity Large Hadron Collider



HOME ABOUT HL-LHC ACTIVITIES NEWS EVENTS RESULTS

Physics	Institute	Accelerators & Services	Communications
Experiments & Research Library & Archives Conferences & HEP Community ALICE ATLAS CMS LHCb LHCf MoEDAL TOTEM Database of experiments (Grey Book) LPCC	Organization Administration Jobs Newcomer's guide Users' office Users' Committee (ACCU) Training & Development Coming to CERN, Integration Staff association Social Life, Activities	Accelerators & technology sector Accelerators, Machines & Technical Facilities CLIC Study LHC status, "page 1" High Luminosity LHC LHC Injectors Upgrade Engineering Computing On Site Services	Media & Public Corner Press Office Public Welcome Page Relations with: States, labs and organizations Industry EU Projects EIROforum

The next step for the Large Hadron Collider

The Large Hadron Collider (LHC) is the largest scientific instrument ever built. It has been exploring the new energy frontier since 2009, gathering a global user community of 7,000 scientists. It will remain the most powerful accelerator in the world for at least two decades, and its full exploitation is the highest priority in the European Strategy for Particle Physics, adopted by the CERN Council and integrated into the ESFRI Roadmap.



To extend its discovery potential, the LHC will need a major upgrade around 2020 to increase its luminosity (rate of collisions) by a factor of 10 beyond its design value. As a highly complex and optimized machine, such an upgrade of the LHC must be carefully studied and requires about 10 years to implement.

The novel machine configuration, called High Luminosity LHC (HL-LHC), will rely on a number of key innovative technologies, representing exceptional technological challenges, such as cutting-edge 13 Tesla superconducting magnets, very compact and ultra-precise superconducting cavities for beam rotation, and 300-metre-long high-power superconducting links with zero energy dissipation.

European support for a worldwide project



The HiLumi LHC Design Study is a sub-system of the overall HL-LHC project and receives cofunding from the European Commission. It involves European participants as well as participants from outside the European Research Area (ERA), in particular leading US and Japanese laboratories.

This project will facilitate the implementation of the construction phase as a global project. The proposed governance model is tailored accordingly and may pave the way for the organization of other global research infrastructures.

The HiLumi LHC Design Study (a sub-system of HL-LHC) is cofunded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404

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INTRANET

Member registration

LATEST NEWS

24 Apr: Issue 1 of Accelerating News now out: [www.acceleratingnews.eu](#) [Read more >>](#)

23 Feb: CERN Courier features the project in *Designs on Higher Luminosity* article. [Read more >>](#)

UPCOMING EVENTS

16 Jul: HL-LHC Coordination Group Meeting, CERN

14-16 Nov: 1st Joint HiLumi/LARP Annual Meeting, Frascati, Italy

LHC@HOME

CERN's core websites will be changing. Learn more about these changes and get involved via the project blog: <http://cern.ch/change>

News

Latest on CERN: twitter.com/cern

RT @presschep Media Invitation: The biggest questions in #physics to be answered in #Melbourne in July - #CHEP2012 - <http://t.co/1t0k1Ygz> Tue 19 Jun

19 June: Last places available to visit B904 (CERN card holders only) - book your place now!

11 June: Featured in the latest issue of the Bulletin: Straw detector: 1 - Vacuum: 0 - June's festival of physics - LHC Report: Full data production mode - Detector recycling leads NA62 to new standards - LEAR: a machine ahead of its time - LEAR's physics legacy - From 174 to 107 - Freeing up access to CERN technology - Particle physics in your pocket! - Highlights from e-SPS: Neutrino Oscillation / DPG President / Outreach Database - Sustainable development and CERN's role: Panel discussion at the Globe - Quantum Diaries Blog: Is the moon full? Just ask the LHC operators - "Clas-si-fied (/ /kæs'fi:fd)" - What's that? - Ombud's corner: Sincere feedback favours efficiency - News from the Library: Gordon Fraser presents his book, "Quantum Exodus"

Special Announcements

Leisure - Physical activity for health and weight loss? 21.06.2012 at 6.30 pm, main auditorium

Conférence : Bouger pour la santé, bouger pour perdre du poids ? 21.06.2012 à 18 :30, amphithéâtre principal

Movel & Eat better: Medical service launches new health campaign

Bouger + manger mieux : Le service médical lance une nouvelle campagne de santé publique

Bike2work@CERN: Le CERN participe en juin 2012 et à cette occasion Bike2work@CERN : CERN is participating in June 2012 and will be ouvrira la porte C entré 12 et 14h. Inscrivez-vous, par équipe de 4, avantpnting the C entrance between 12am and 2 pm. Register by groups of le 31 mai 2012 : Recherchez des coéquipiers. Inscrivez votre équipe 4, before 31 May 2012: Find team members Register your team

Car sharing à la carte Discover a new way of commuting to work with Green Monkeys. For more information, read the *Bulletin* article.

Covoiturez comme vous voulez ! Découvrez une nouvelle façon de vous rendre au travail avec Green Monkeys. Pour plus d'informations, lisez l'article paru dans le *Bulletin*.

LHC access

Please consult access conditions before entering the tunnel. You can check your own access rights here (<http://cern.ch/adams>). Further information on access services are available here (<http://cern.ch/service-access>)

Login as CERN account needed

High Luminosity LHC Project Intranet (incl. HiLumi LHC FP7 Design Study)

WP1 Project Management and Technical Coordination

WP2 Accelerator Physics

WP3 Machine Protection

WP4 Collide Experiment Interface

WP5 Diagnostics

WP6 Energy Deposition & Absorber

WP7 Beam Diagnostics

WP8 Beam Diagnostics

WP9 Integration & Commissioning

WP10 Hardware Commissioning

Task 2.3 Meeting - MG

Goto WP2 web space

Task 2.3 objectives

- To study the field quality tolerances for new magnetic elements for the LHC upgrade.
- To specify the circuits for the non-linear correction of the triplets field quality.

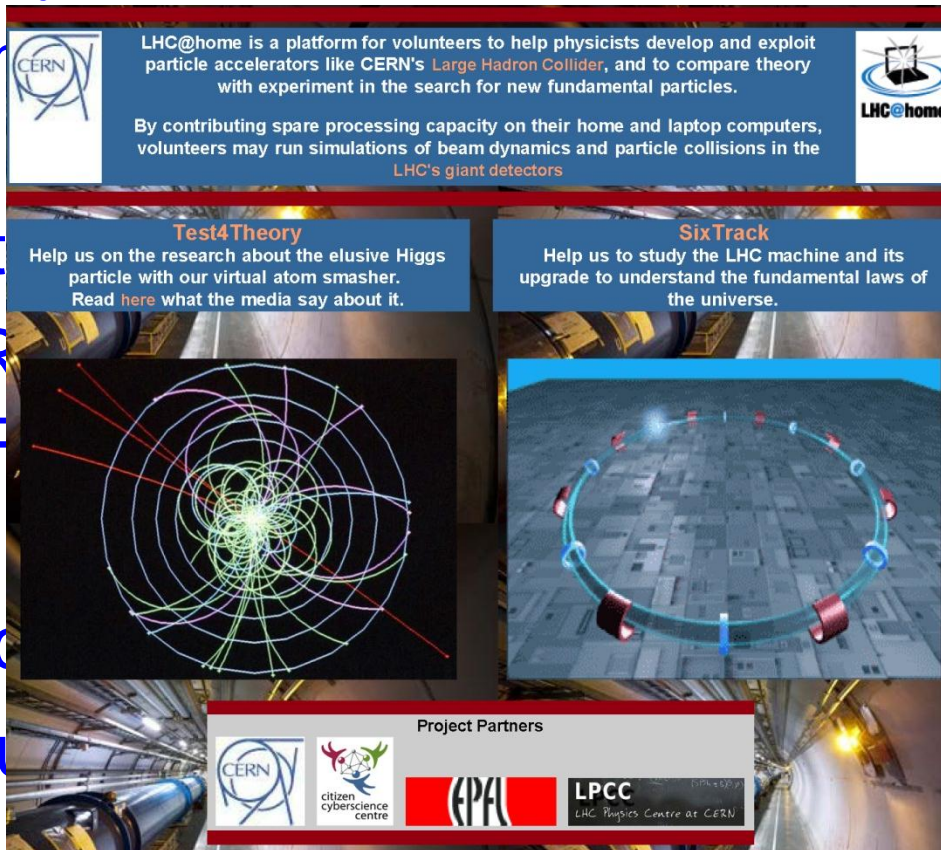
Tools - I

- Tools

- MAD-X: used to generate the lattice, optics, and files for subsequent simulations (SixTrack).
 - Large set of tools for dealing with (HL-)LHC studies.
 - All optical configurations stored under afs:
 - **[/afs/cern.ch/eng/lhc/optics/SLHCV3.01](#)**
 - **[/afs/cern.ch/eng/lhc/optics/SLHCV3.1b](#)**
- SixTrack: workhorse of LHC simulation studies (single particle, weak-strong beam-beam, collimation)
- Tracking environment: adapted environment to run massive numerical simulations.

Tools - II

- Tracking resources:
 - CERN batch system (LSF)
 - Volunteers' based tracking system
- LHC@home (based on Boiron)
- Well-tested chain of tools: tools (apart for few exceptions)
- This implies having a CERN-like environment as CERN
- Please, communicate your requirements to set-up details (e.g., batch)
- Instructions to install the required software are prepared.







LHC@home is a platform for volunteers to help physicists develop and exploit particle accelerators like CERN's Large Hadron Collider, and to compare theory with experiment in the search for new fundamental particles.

By contributing spare processing capacity on their home and laptop computers, volunteers may run simulations of beam dynamics and particle collisions in the LHC's giant detectors

Test4Theory
Help us on the research about the elusive Higgs particle with our virtual atom smasher.
Read [here](#) what the media say about it.

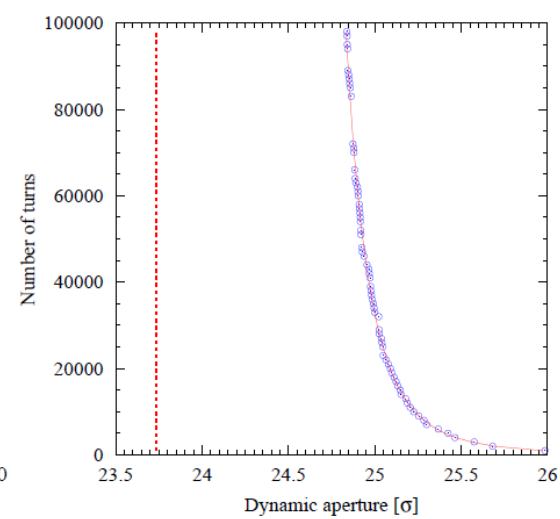
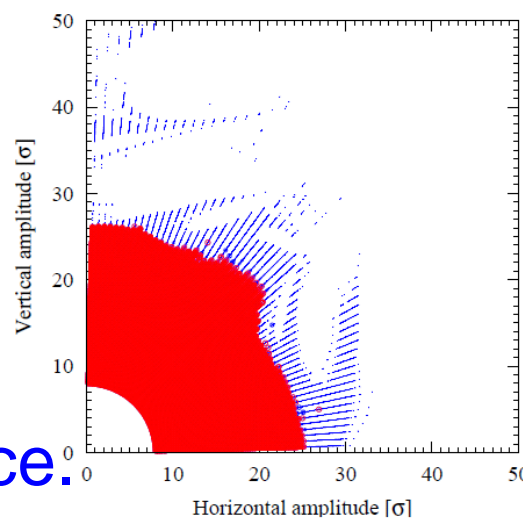
SixTrack
Help us to study the LHC machine and its upgrade to understand the fundamental laws of the universe.

Project Partners



Approach

- Dynamic aperture (DA) is the figure-of-merit for single-particle performance.
- It has been used to derive field quality specification for the magnets of the nominal LHC.
- It will be used also for HL-LHC studies and field quality specification.
- However:
 - DA is a global quantity -> the details of the dynamics should be looked at. Therefore:
 - Tune footprint
 - Tune scans
 - Phase space topology



**Should all be considered
with care to spot possible
pathological behaviours**

General organisation guidelines

- Weak-strong beam-beam activities moved to Task 2.5.
- Attempt to re-arrange activities “by magnet” classes, instead than “by layout”.
 - This is also triggered by the fact that there is a convergence towards two configurations:
 - IT at 123 T/m (ex-Phase I) -> **SLHCV3.01**
 - IT at 150 T/m -> **SLHCV3.1b**
- The approach “by layout” has been kept for **SLHCV3.01** studies.
- Information about workflow in Task 2.2 (optics and layout) has been taken into account in the organisation of Task 2.3.

Work packages break down - I

- MAD-X tools: S. Fartoukh, R. de Maria
- General infrastructure: M. Giovannozzi
- IT, D1, D2, Q4, Q5, field quality for layout with IT (123 T/m), round and flat: Y. Cai, Y. Jao, Y. Nosochkov, M. Wang
- IT correctors specifications for layout with IT (123 T/m): S. Fartoukh, R. de Maria
- Tune scans and phase space analysis with layout with IT (123 T/m): Y. Cai, Y. Jao, Y. Nosochkov, M. Wang
- IT and D1 field quality specification for layout with IT (150 T/m), round and flat: J. Payet, A. Chancé
- D2, Q4, Q5 field quality specification for layout with IT (150 T/m): M. Korostelev, K. Hock
- IT correctors specifications for layout with IT (150 T/m): S. Fartoukh, R. de Maria
- Tune scans and phase space analysis for layout with IT (150 T/m): E. Levichev, P. Piminov

Work packages break down - I

- Analytical estimates of fringe fields: A. Bogomyagkov
- Implementation of fringe fields and assessment with layout with IT (150 T/m): B. Dalena
- Tools for crab cavity studies: R. Tomas
- Preliminary specification of crab cavity field quality: R. Appleby, M. Giovannozzi, R. Tomas
- Final specification of crab cavity field quality: PDRA, M. Giovannozzi, R. Tomas
- Tune scans and phase space analysis for layout with IT (150 T/m) with crab cavity: E. Levichev, P. Pimonov
- **The deliverable is field quality specifications for IT, separation dipoles and insertion quadrupoles on 1/11/2014**

Gantt chart

- Disclaimer: next to impossible to represent actual resources (in FTE or ppm) to a Gantt chart. Time line is indicative and not to be used to evaluate allocated resources.

