Closing remarks

Lucio Rossi
CERN
HL-LHC Project Leader

INTERNATIONAL YEAR OF LIGHT 2015

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.

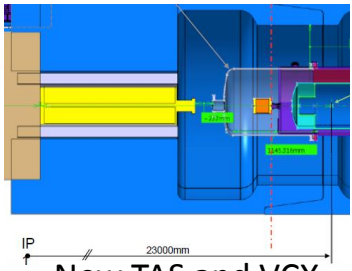
Works all around the ring… new C.E. and technical infrastructure

CIVIL ENGINEERING
2 new 300-metre service tunnels and 2 shafts near to ATLAS and CMS.

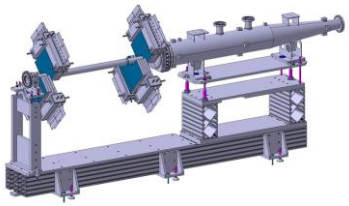
"CRAB" CAVITIES
16 superconducting „crab" cavities for each of the ATLAS and CMS experiments to tilt the beams before collisions.

Cryo@P1-P5

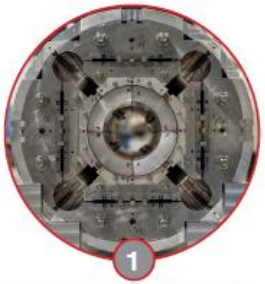
Cryo@P4



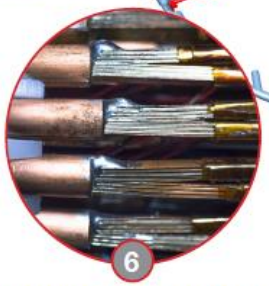
New TAS and VCX



Beam diagnostics
BGV



FOCUSING MAGNETS
12 more powerful quadrupole magnets for each of the ATLAS and CMS experiments, designed to increase the concentration of the beams before collisions.



SUPERCONDUCTING LINKS
Electrical transmission lines based on a high-temperature superconductor to carry current to the magnets from the new service tunnels near ATLAS and CMS.

COLLIMATORS
15 to 20 new collimators and 60 replacement collimators to reinforce machine protection.

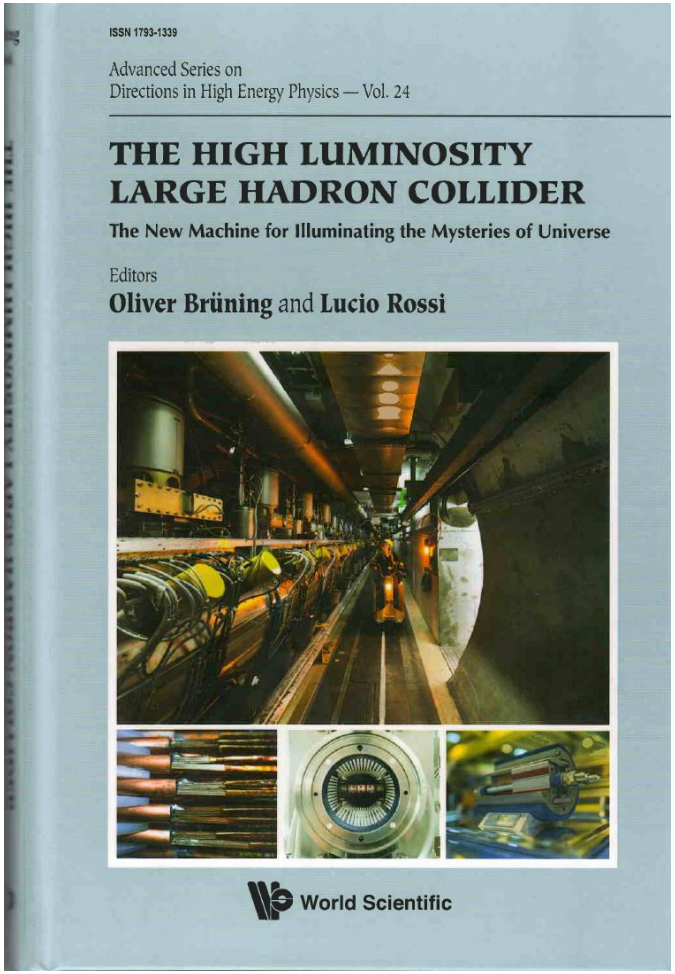
BENDING MAGNETS
4 pairs of shorter and more powerful dipole bending magnets to free up space for the new collimators.

LHC TUNNEL
CMS
ALICE
ATLAS
LHCb

CERN November 2015

L. Rossi-5th Annual Meeting -CERN 29Oct15

HiLumi book: a copy for each members (if more just ask) – Open Access



Chapter 6

Superconducting Magnet Technology for the Upgrade

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In this section we present the magnet technology for the High Luminosity LHC. After a short review of the project targets and constraints, we discuss the main guidelines used to determine the technology, the field/gradients, the operational margins, and the choice of the current density for each type of magnet. Then we discuss the peculiar aspects of each class of magnet, with special emphasis on the triplet.

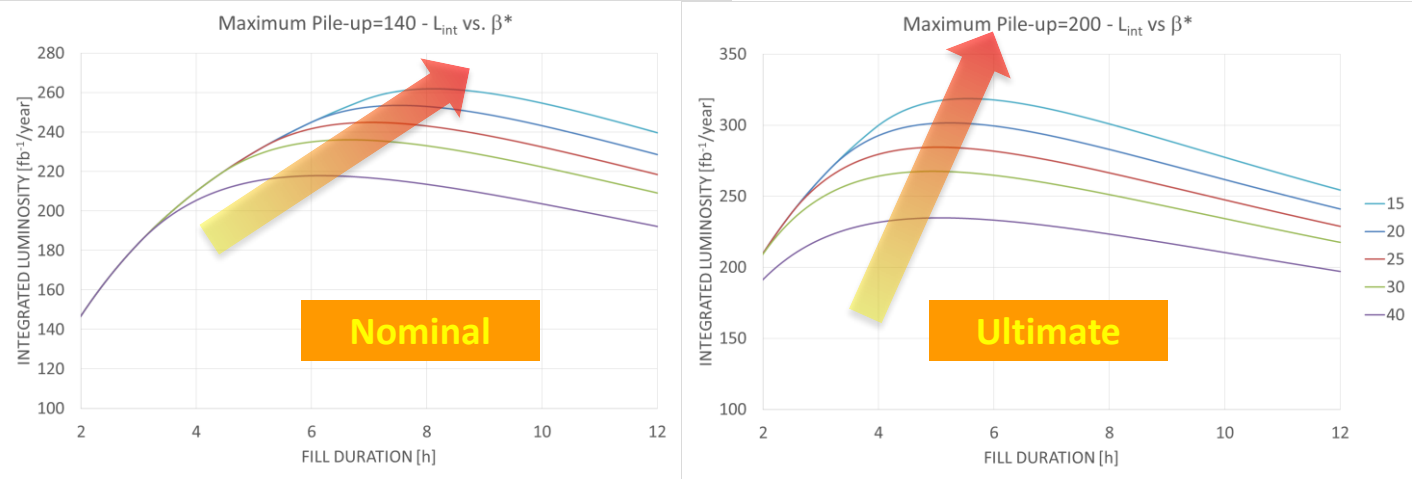
1. Targets

The HL-LHC aims at gathering 3,000 fb^{-1} over ten years. As discussed in the previous section, this ambitious target can be obtained by operating with a peak luminosity leveled at 5×10^{34} $cm^{-2}s^{-1}$. The plan is to obtain it through higher intensity/lower emittance and a larger focusing in the Interaction Point (IP). This second part is given by the magnetic lattice; the target is to be able to reduce the beam size in the IP by a factor two, and therefore one has to double the size of the quadrupoles aperture in front of the IP (triplet).

Some of the previous proposals, done during the LHC luminosity upgrade studies [1, 2, 3], aimed at a reduction of the beam size of 30%, increasing the triplet aperture 30% (see Fig. 1 for an historical view, indicating short models which have been built). The present target of reducing the beam size in the IP by a factor of two was based on theoretical studies (see for instance [4]), and was enabled by advances in magnet technology, i.e., test results from model quadrupoles of progressively larger aperture (Fig. 1).

A critical design parameter for a superconducting quadrupole is the peak field in the coil, which is a function of the aperture times the gradient. For Nb-Ti coils

Robustness of the upgrade: relatively small sensitivity to any parameter

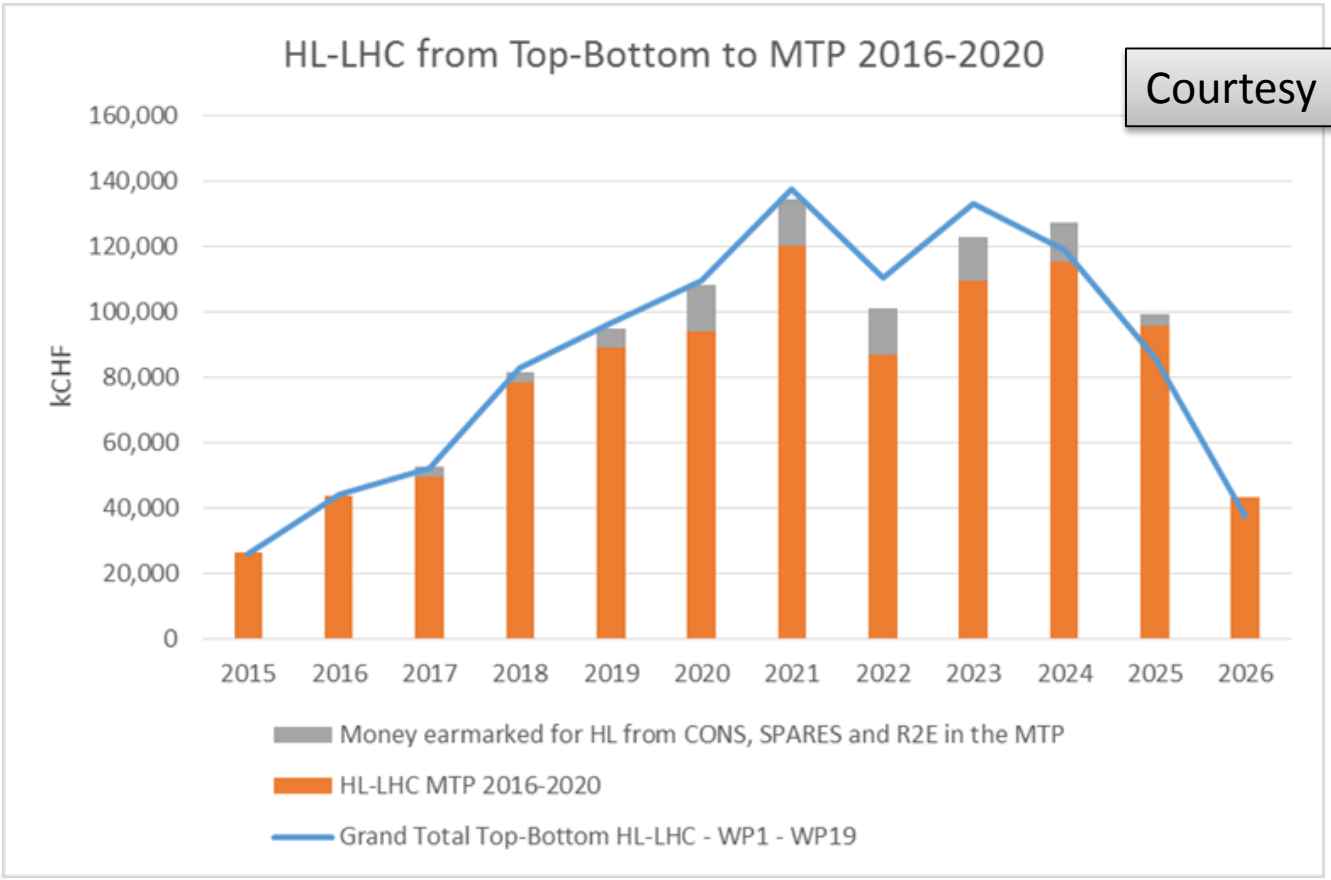


- Ultimate performance requires the capability of operating down to 15 cm with average fill lengths already achieved in 2012
- Large values of β* imply optimum fills of 4 to 6 hours in particular for the ultimate luminosity, which might be suboptimal for reliability

Courtesy WP2

Most significant steps to accomplish transition from DS to Construction - 5

Following success of C&SR: CERN management inserted HL-LHC CtC in the MTP2016-2020 with profile till 2026 (LTP): MTP and strategy approved by Sept. 2015 Council.



Courtesy B. Delille

∫ =82.8 MCHF

∫ =953.8 MCHF

∫ =1036.6 MCHF

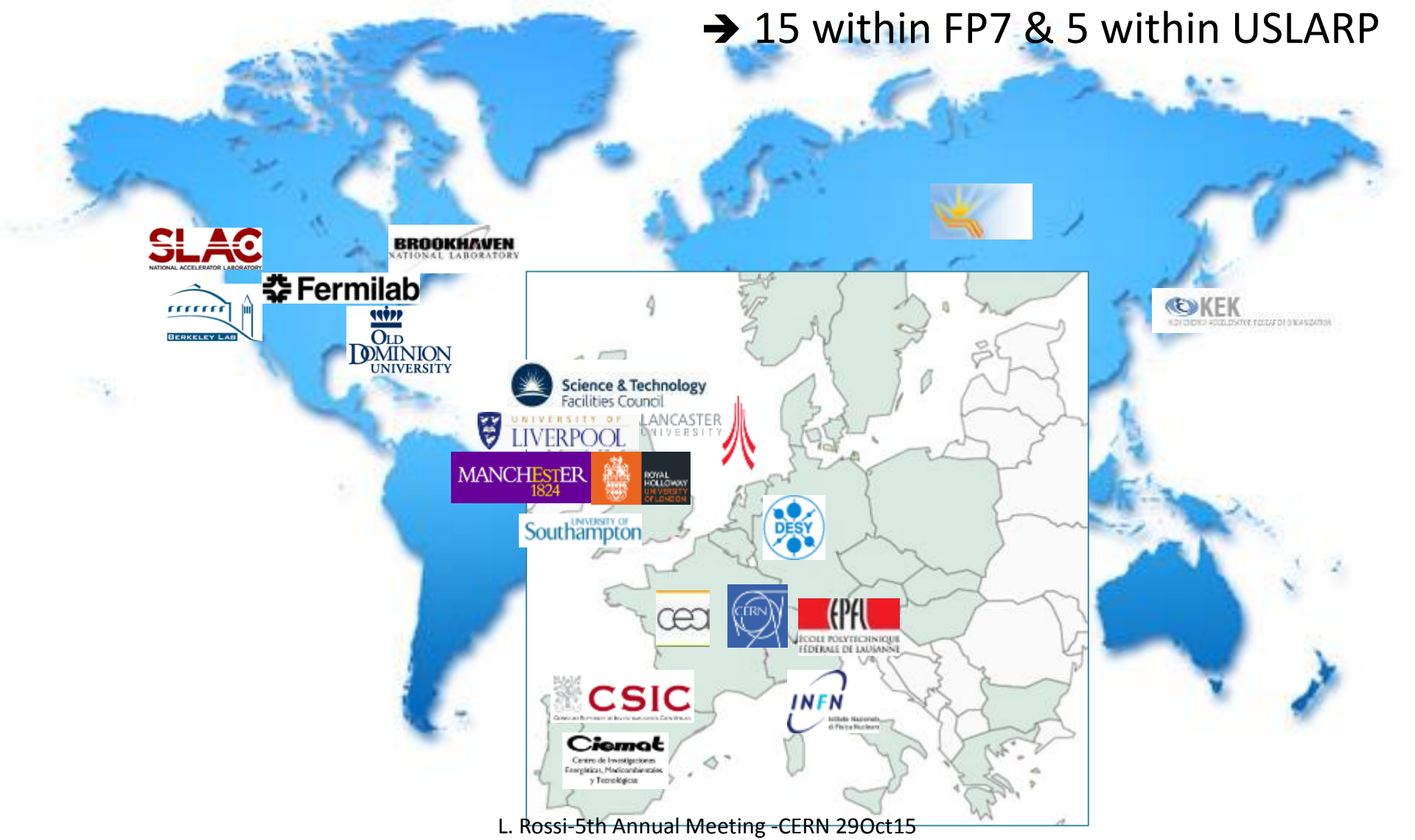
CERN personnel: 1600 FTE-y

No overheads, no contingency

High Luminosity LHC Participant

➔ 20 partners worldwide

➔ 15 within FP7 & 5 within USLARP



Most significant steps to accomplish transition from DS to Construction – 7 : **Collaborations**

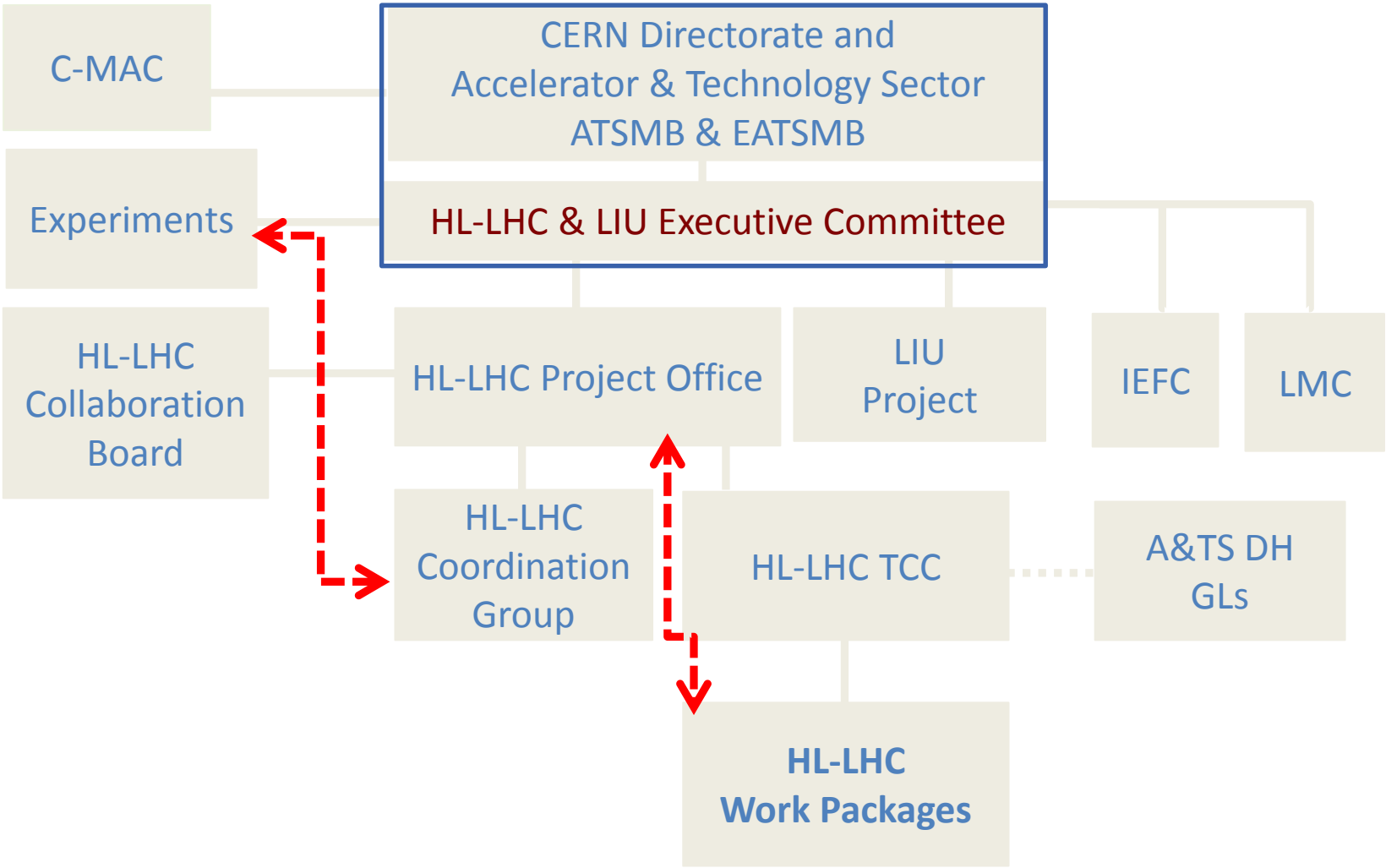
Courtes

Countries (CERN Member States in blue) with a present, or under preparation, partnership with a university or research centre

In-Kinds (for the tunnel):
USA-LARP (half of IT triplets, CC + …)
KEK : D1 (+collab. SCRF and BI), +
Finmet cavity for LIU
THANK!!!!

Further collaborations with contribution being discussed:
Georgia
Russia (Dubna and BINP)
…

Post FP7 HL-LHC Project Governance:



1st High Luminosity Collaboration Board CERN, 1st Joint Annual Meeting, Nov 2011

2nd Joint Annual Meeting

3rd Joint Annual Meeting

- 11-15 November 2013, Daresbury Lab, UK
- 175 participants, incl. 92 CERN registrants

4th Joint Annual Meeting in Tsukuba (KEK)

5th Joint Annual Meeting @ CERN

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