

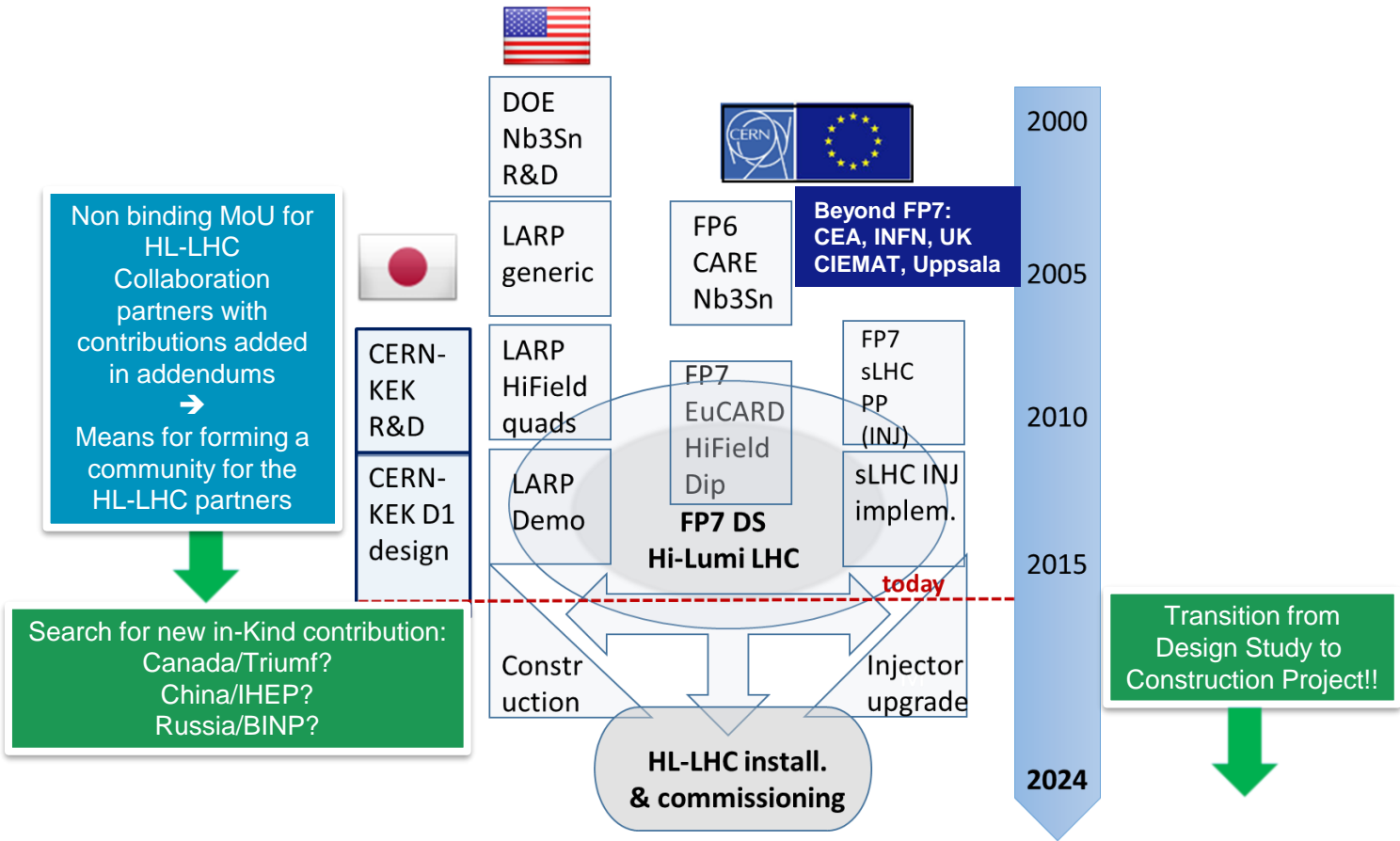


Overview of HiLumi collaborations and status of the options

O. Brüning, B. Di Girolamo, L. Rossi

HL-LHC Annual Meeting – Collaboration Board – Madrid – 13 November 2017

HL-LHC & Collaborations: the long route



HL-LHC Technical Collaborations

Launched effort for building collaborations beyond the FP7:

- Continuation of collaboration that were started under FP7
- proposals for new in-kind contributions 'k-contracts'
 - ca. 50-50 cost sharing for deliverables plus resource contributions for MS / full cost contribution for NMS

Preparation of new general framework / collaboration contract for the HL-LHC project: MoU

- Non-committing general agreement (no entry or annual fee!)
- Deliverables and commitments specified in dedicated addendums

Current Contributions Status

	Country	Institute	KE	Content
	COUNTRY ▼	Institute ▼	KE ▼	Title ▼
Member States	France	CEA	2275	Research & Development for Future LHC Superconducting Magnets
	France	CEA	2736	Thermal Design of Superconducting High Field Magnets at CERN
	France	CEA	3573 (3586)	Q4, High field Magnets, Spare LHC quad
	Italy	INFN Mi&Ge	2291	R&D for HL-LHC Superconducting Magnets (corrector magnet and D2)
	Italy	INFN Ge	3084	Design and prototyping of the superconducting D2 magnets
	Italy	INFN Mi	3085	Design, procurement and testing of the high-order corrector magnets
	Italy	INFN		Crystal collimation
	Italy	INFN LNF	3724	Synchrotron radiation tests on beam screens
	Spain	CIEMAT	2292	Design, construction & testing of a prototype of a short corrector magnet MCBX for HL-LHC
	Spain	CIEMAT	3797	Nested orbit correctors
	Finland	Lapland Univ.	3134	3D Modelization of the new HL-LHC technical infrastructures
	Sweden	Uppsala Univ.	3082	Cold testing of superconducting orbit corrector magnets and superconducting crab cavities in the framework of the HL-LHC at CERN
	UK	STFC&Dundee	3362	An Automated Machine Prototype for Vacuum Chamber Metal Inner Wall Laser Treatment for e-cloud Mitigation (LESS)
	UK	Manchester	3296	Collimation, Crab Cavities, Beam instr., SC Links
	UK	Manchester	3297	Collimation, Crab Cavities, Beam instr., SC Links
	UK	Manchester	3298	Collimation, Crab Cavities, Beam instr., SC Links
	UK	Manchester	3299	Collimation, Crab Cavities, Beam instr., SC Links
Non-Member States	USA	Several	Protocol	Triplet, Crab Cavities, Hollow lens
	Japan	KEK		D1 magnets
	Canada	TRIUMF		RFD Crab-cavities cryomodules
	Russia	BINP	P110 Add.2	aC coating characterisation
	Russia	BINP		TAXS and TAXN
	JINR	Dubna	P123 Add.1	Construction of Precision Laser Inclinometer
	Georgia	GTU		Models verification vs. as-built
	China	Bejing Univ. Tech.		Cathodes
	China	IHEP		Current leads and CCT

In **bold** the agreements already signed or being imminently signed

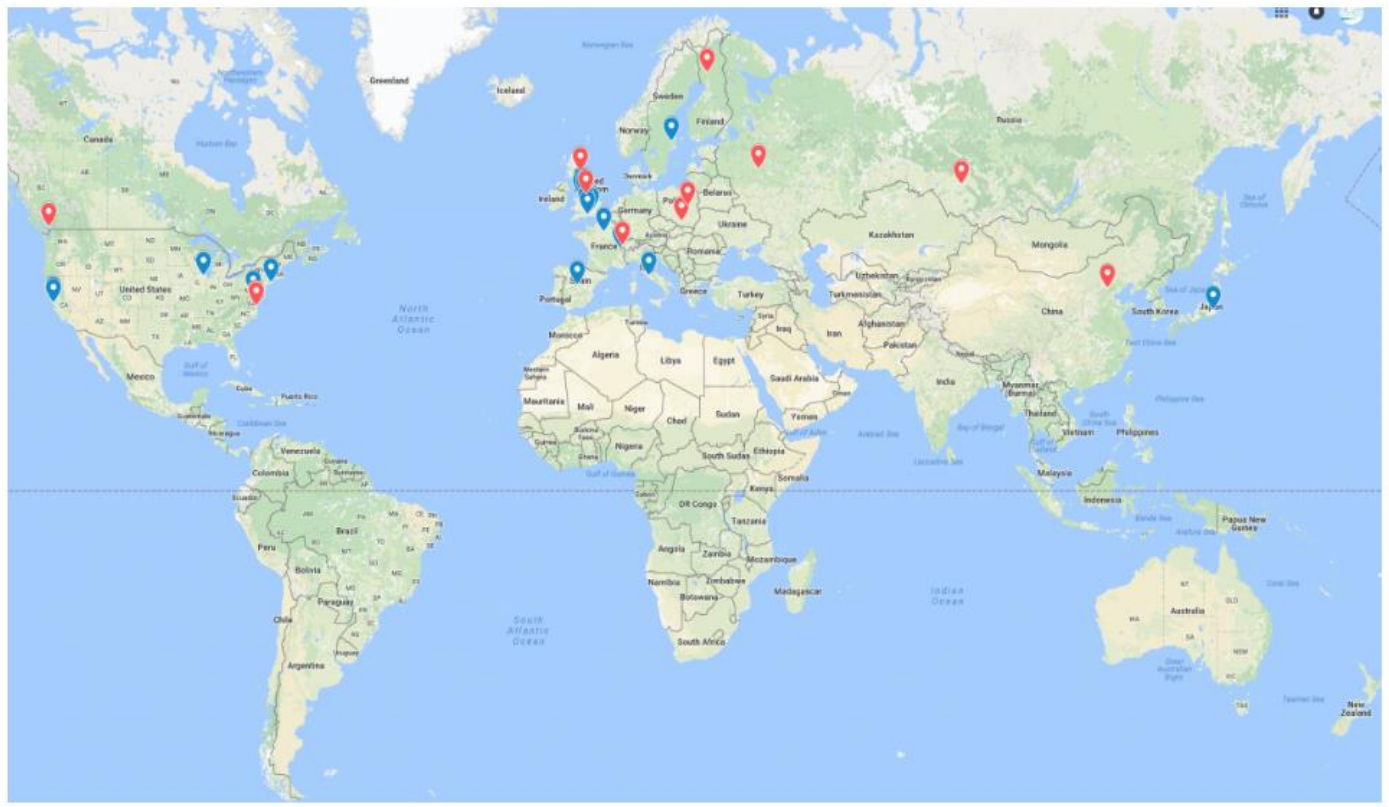
Collaborating Institutes on HL-LHC WEB



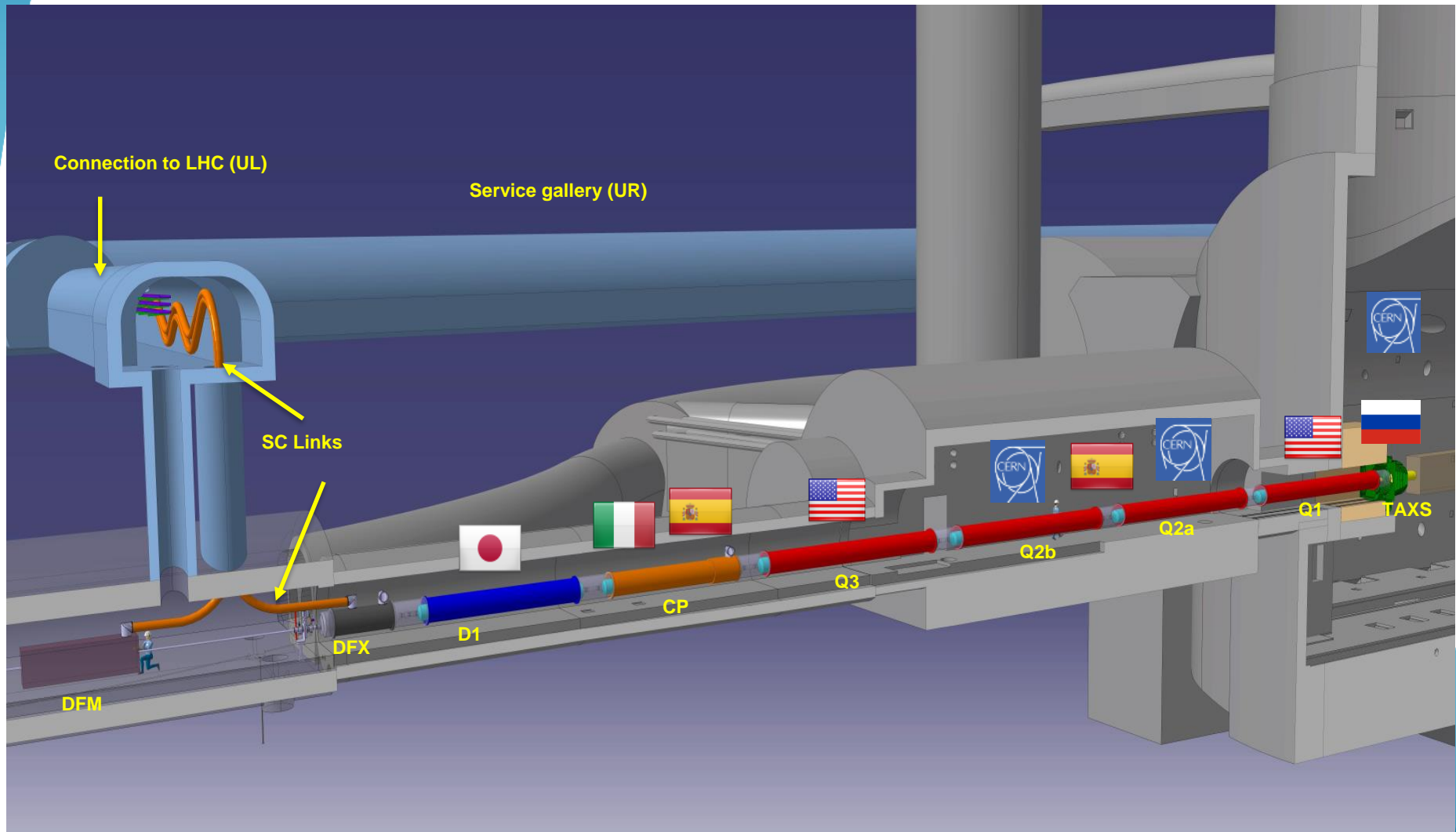
Home » Project » Collaboration Institutes

Collaboration Institutes

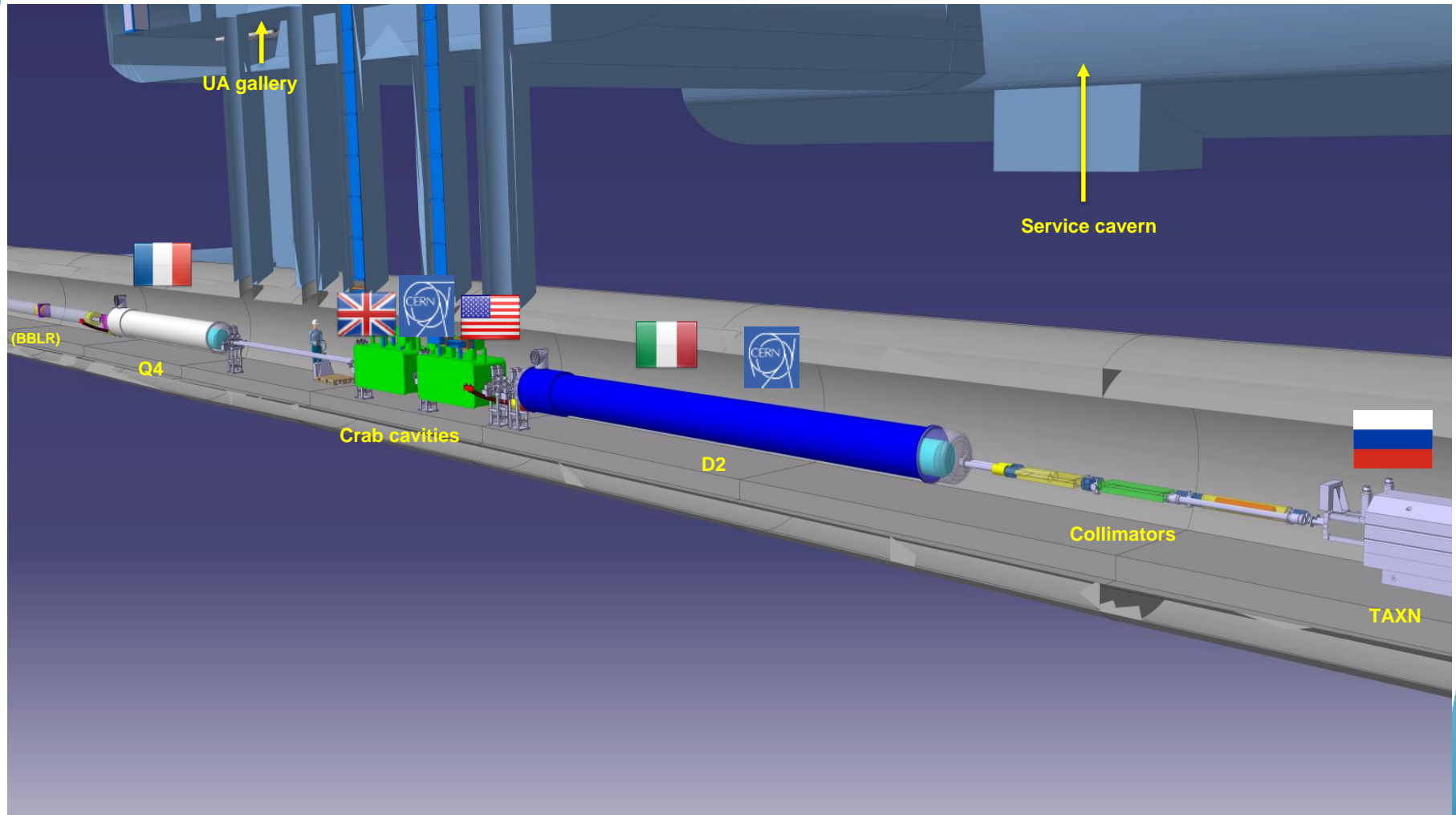
Click the map for more details on Collaboration Board members and collaboration partners



The Inner Triplet region with in-kinds



The MS region with in-kinds



HL-LHC Technical Collaborations

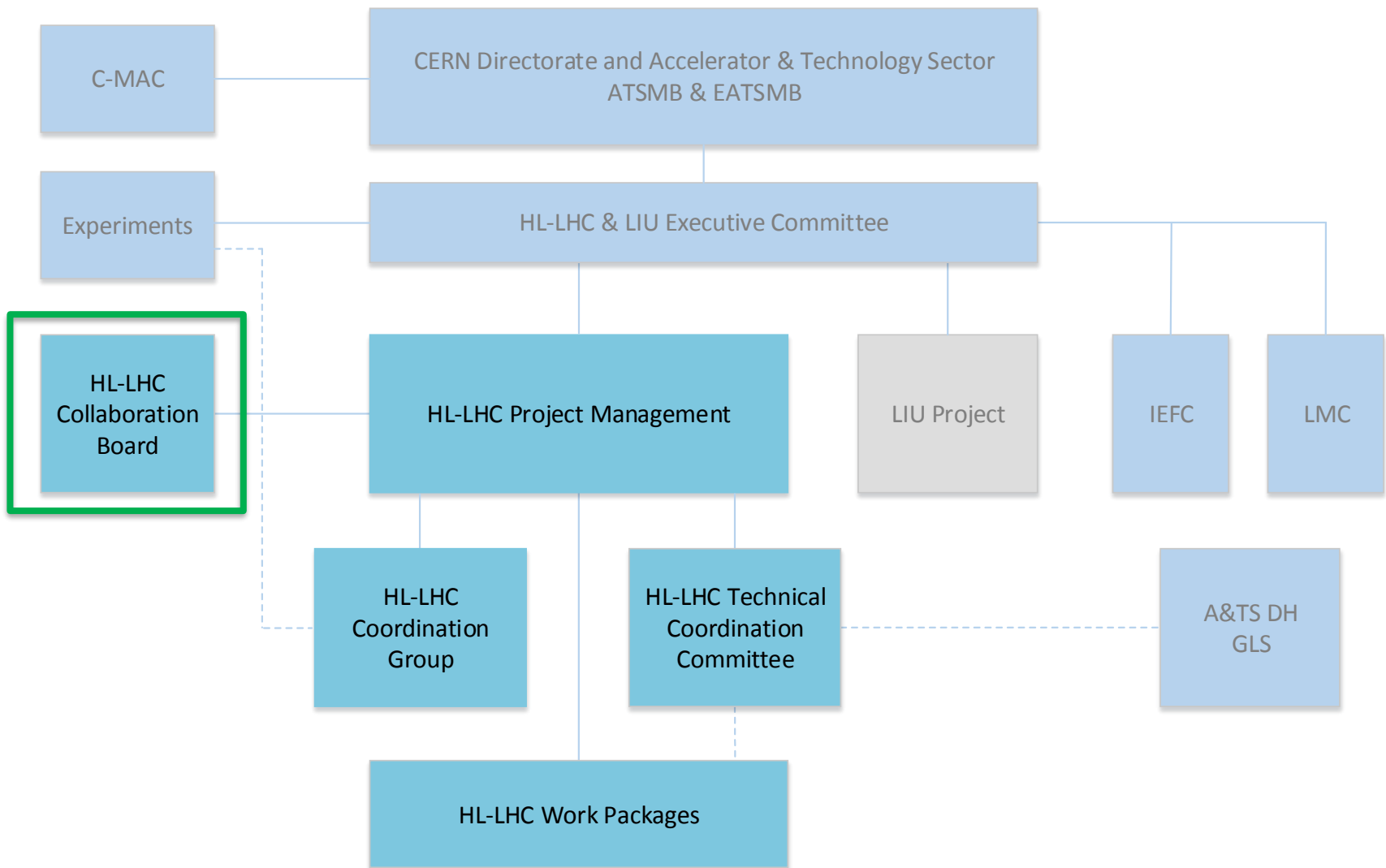
New HL-LHC Collaboration Board:

- First meeting at the annual HL-LHC meeting in Paris in 2016
- Election of the new HL-LHC CB Chairperson:
 - Rob Appleby, Manchester University, elected for 2 years
 - The HL-LHC CB will meet once per year: today at CIEMAT
 - next meeting at CERN?

Existing Collaborations with in-kind contributions:

- 9 MS [16 contributions] & 3 NMS signed [+ 6 in preparation] with
- several agreements including multiple deliverables & partners
e.g. UK (7 partner & 4+ contributions) and
USLARP (4 members + 2 partner & 5+ contributions)

HL-LHC Project Governance:



HL-LHC Collaboration Board: HLCB

Mandate:

The HL-LHC Collaboration Board [HLCB] is the official forum for information exchange and dialogue between the HL-LHC collaborators, the HL-LHC project management and the CERN management.

The HL-LHC Project Leader will inform the HLCB regularly about the situation of the project, including technical and financial aspects and the overall project schedule, and will make proposals for in-kind contributions and collaboration topics. The HL-LHC collaboration partners will report via the HLCB to the HL-LHC project management and the other collaboration partners about delivery schedule and progress of technical implementations of their contributions or changes in the expected performance scope and reach of their contributions. When needed, the HLCB will discuss measures to cope with technical or financial shortfall, as well with delay of deliverables from the collaboration partners and give advice and recommendations to the project management for the resolution of such issues

→ The HLCB reports to the HL-LHC Project Leader.

HL-LHC Collaboration Board: HLCB

Organization:

'The chair of the Collaboration Board chairs the HLCB meetings and discussions between the HLCB members. The chair will also communicate any recommendations or advice from the HLCB to the HL-LHC project management'

The chair is appointed for a 2 year mandate but can be re-elected.

Composition:

HL-LHC Collaboration Board consists of one representative per collaborating institute of the HL-LHC project and ex-officio of the HL-LHC project management, i.e., HL PL, HL DPL and the HL Project Office Manager. The Director of the Accelerator and Technology Sector at CERN, or his/her representative, will also be ex-office member.

'Collaboration partners include laboratories and institutes who have either signed directly a HL-LHC collaboration agreement or are part of an overarching general collaboration agreement and provide either significant in-kind contributions or studies and personnel for the HL-LHC project.'

Institutes that have signed the framework agreement but not a Collaboration agreement with an explicit contribution to HL-LHC can be invited as observers.

→ Each MoU signatory with explicit contribution has one representative

HL-LHC Collaboration Board

Members

Name	Institute/University
APOLLINARI, Giorgio	FNAL/LARP
APPLEBY, Rob	University of Manchester
BORDRY, Frederick	CERN
BRUNING, Oliver	CERN
BURT, Graeme	University of Lancaster
EKELOF, Tord	University of Uppsala
FABBRICATORE, Pasquale	INFN Genova
GARCIA, Luis	CIEMAT
GIBSON, Stephen	Royal Holloway University
OGITSU, Toru	KEK
PRESTEMON, Soren	LBNL
RAUBENHEIMER, Tor	SLAC
ROSSI, Lucio	CERN
SORBI, Massimo	INFN LASA
TAVIAN, Laurent	CERN
VEDRINE, Pierre	CEA
WANDERER, Peter	BNL
WELSCH, Carsten	University of Liverpool
WHEELHOUSE, Alan	STFC
YANG, Yifeng	University of Southampton

Observers

Name	Institute/University
ABDOLVAND, Amin	University of Dundee
BARLOW, Roger	University of Huddersfield
BUGADOV, Julian	JINR
DELAYEN, Jean	JLAB
DELAYEN, Jean	ODU
KARLSSON, Kenneth	LAPIN AMK
KESTER, Oliver	TRIUMF
LEVICHEV, Eugene	BINP
RIVKIN, Lenny	EPFL
SYNTFELD-KAZUCH, Agnieszka	NCBJ
WANG, Yifang	IHEP CAS

Invited

Name	Institute/University
RATOFF, Peter	Cockcroft Institute
ROLLI, Simona	DOE – US HL-LHC AUP
STRAUSS, Bruce	DOE - LARP
ZOCCOLI, Antonio	INFN

HL-LHC Intranet Page:

<https://espace.cern.ch/HiLumi/WP1/default.aspx>

Collaboration Workspaces

BROWSE PAGE



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Home WP1

High Luminosity LHC Project Intranet > HiLumi LHC Work Package 1 - Project Management and Technical Coordination

- Management Bodies
- Project Office
- Project Structure
- Organizational Chart
- Committees
- WP1 Indico

Home CB

- Collaborations
- In-kind contribution Opportunities
- In-kind contributions Presentation
- Collaboration Agreements

Former Technical Coordination meetings

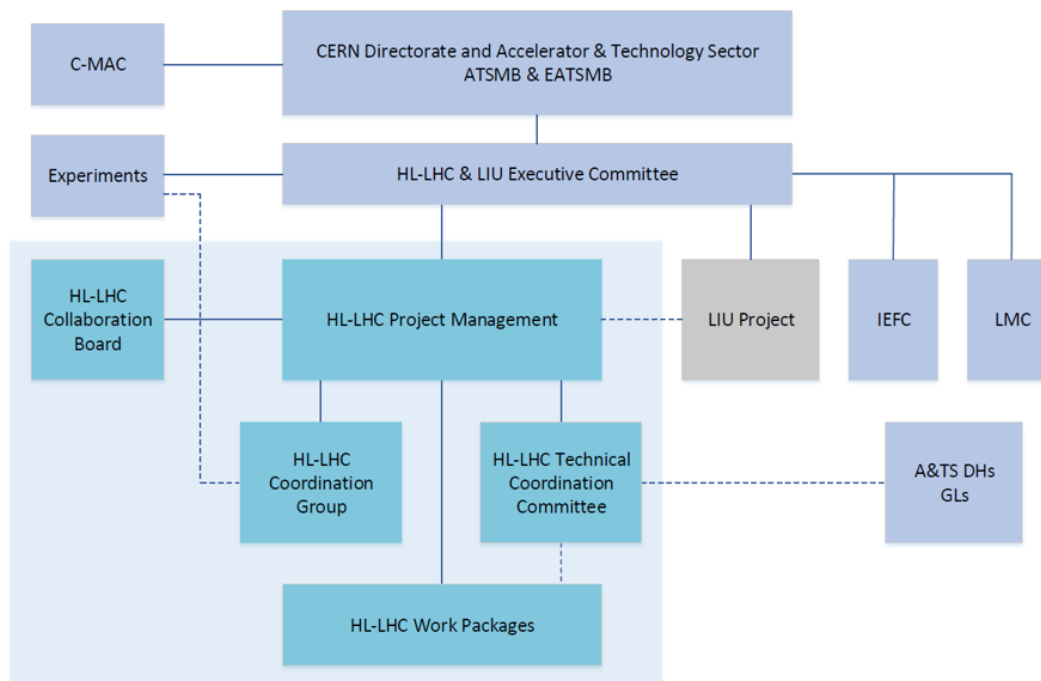
- HLTC Mandate
- HLTC Members
- HLTC Meetings

HiLumi Calendar

Recent

Site Contents

The HL-LHC structure in the A&T Sector



Excel Table for in-kind contributions:

Item	Estimated contribution value	Required delivery	Required decision time	Contribution type	HL-LHC WP	Nature	Comments
Hollow electron lens for beam halo removal		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware, SC solenoid and magnets	WP5	Option; in process of becoming baseline	Design developed in collaboration with USLARP; proposed to Russia
Undulator for synchrotron light monitor		2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware	WP13	Option	Design already exists for installed Undulator (second unit)
Long-Range Beam-Beam compensator		2023; in time for installation in LS3 (2024-2025)	During LHC Run3 (by 2021)	Hardware	WP2-WP13	Option	Implementation based on electron beam
Large aperture 2-in-1 superconducting quadrupole		2029; in time for installation in LS4	At end of LS3 (by 2026)	Hardware	WP3	Option	Design developed by CEA Saclay
200 MHz lower harmonic RF system		2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware and R&D (design) and prototyping	WP4	Option	Exists only in form of conceptual design of 1/4 wave cavity
Second half of Crab Cavities		2029; in time for installation in LS4	At end of LS3 (by 2026)	Hardware	WP4	Option	Technical solution already developed by CERN & USLARP
800 MHz higher harmonic RF system		2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware and R&D (design) and prototyping	WP4	Option	Exists only in form of conceptual design of elliptical cavity
Crystal collimation for protons		2029; in time for installation in LS4	At end of LS3 (by 2026)	Hardware	WP5	Option	Work via the UA9 collaboration; proposed to Russia
Crystal collimation for ions		2023; in time for installation in LS3	At end of LHC Run3 (by 2023)	Hardware	WP5	Option	Work via the UA9 collaboration; proposed to Russia
Additional low impedance collimators		2023; in time for installation in LS3	At end of LHC Run3 (by 2023)	Hardware	WP5	Option ←→	Technical solution already developed by CERN; proposed to Russia
Additional tertiary collimators		2023; in time for installation in LS3	At end of LHC Run3 (by 2023)	Hardware	WP5	Option ←→	Technical solution already developed by CERN; proposed to Russia
11T dipole magnets for additional Dispersion Suppressor collimators	limator pair	2023; in time for installation in LS3	After LHC Run2 (by 2019)	Hardware	WP5-WP11	Option	Design and production developed by CERN
TCLD dispersion suppression IR7		2023; in time for installation in LS3	After LHC Run2 (by 2019)	Hardware	WP5-WP11	Option	Design and production developed by CERN
TCLD dispersion suppression IR1/5		2029; in time for installation in LS4	At end of LS3 (by 2026)	Hardware	WP5-WP11	Option	Design and production developed by CERN
Inclinometer for vibration measurements		2019; in time for installation in LS2	During LHC Run2 (by 2019)	Hardware	WP8-WP13	Option	Technology developed by Dubna
Cooled ferrite rings		2023; in time for installation in LS3		Hardware	WP14	Baseline (instead of ferrites) ←→	Proposed to Russia
Collimation package				Hardware	WP5	Baseline & Option ←→	
BPM mechanics (30-50 units)		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP13	Baseline ←→	Proposed to Russia
High precision machining for MKI		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline ←→	According to CERN drawings, SS ISO standard
High curie point ferrite blocks MKI		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline ←→	In the past single source USA

Excel Table for in-kind contributions:

Damping ferrite blocks MKI	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	In the past, suppliers in PL or USA
High precision machining for MKB: SS, other metals, composites	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	According to CERN drawings, ISO standard
Modification of UHV SS vessel MKB	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	According to CERN drawings, ISO standard
Ti6V4Al tube for dump graphite containment TDE(X)	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	Known sources in CN and USA, 700 mm diam., 9000 mm long
High precision machining of Ti64 and/or 316LN, 318L TDE(X)	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	
Nitrogen sector chambers TDE(X)	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	
Dump supporting system (316L)	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP14	Baseline	Precision machining ISO standard
Doors package			Hardware	WP17	Baseline	
Ventilation doors	2019; in time for installation in LS2	During LHC Run2 (by 2018)	Hardware	WP17	Baseline	Proposed to Russia
Fire doors	2019; in time for installation in LS2	During LHC Run2 (by 2018)	Hardware	WP17	Baseline	Proposed to Russia
Sectorisation doors	2019; in time for installation in LS2	During LHC Run2 (by 2018)	Hardware	WP17	Baseline	Proposed to Russia
Blast doors	2019; in time for installation in LS2	During LHC Run2 (by 2018)	Hardware	WP17	Baseline	Proposed to Russia
Large sectional doors surface	2021; in time for installation before LS3	At end of LHC Run3 (by 2023)	Hardware	WP17	Baseline	Proposed to Russia
D2 dipole orbit corrector magnets	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP3	Baseline	Canted cosine-theta design discussed with China and Sweden
Warm 2-in-1 quadrupole magnets	2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware	WP3	Baseline	In negotiation with TRIUMF in Canada
D2 2-in-1 dipole magnet	2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP3	Baseline	Italy?
D1 dipole magnet	2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware	WP3	Baseline	In-kind contribution discussed with Japan
Nb sheets for CC production	2019; in time for CC production start in LS2	During LHC Run2 (by 2018)	Material	WP4	Baseline	Procured in China in the past; 100kg / cavity with 10 cavities
Material irradiation			Studies	WP5	Baseline	In the past with Kurchatov
Part of secondary collimators (baseline)	2023; in time for installation in LS3	At end of LHC Run3 (by 2023)	Hardware	WP5	Baseline	Proposed to Russia
TCLX Collimators (next to TAXN)	2023; in time for installation in LS3	At end of LHC Run3 (by 2023)	Hardware	WP5	Baseline	Proposed to Russia

Excel Table for in-kind contributions:

Magnets and CC jacks and controls	2021-2022; in time for equipping magnets, CC, pre-series	During LHC Run2 (by 2018)	Hardware	WP6A	Baseline	Discussion with Russia and Georgia
Superconducting link feedboxes package	2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP6A	Baseline	
DFH (10 units)	2023; in time for installation in LS3 (2024-2025)	By 2020	Hardware	WP6A	Baseline ←→	Very tight collaboration with CERN and possibly special material to be supplied by CERN
DFX (10 units)	2023; in time for installation in LS3 (2024-2025)	By 2020	Hardware	WP6A	Baseline ←→	Discussion with Sweden and China
Current leads matching section 5 units	2023; in time for installation in LS3		Hardware	WP6A	Baseline ←→	Proposed to Russia
Current leads Inner Triplets 5 units	2023; in time for installation in LS3		Hardware	WP6A	Baseline ←→	Proposed to Russia
SC Links assembly prototyping and spooling of semi-rigid cryostats			R&D	WP6A	Baseline ←→	Ongoing in Russia
TAXN	2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP8	Baseline	Anticipated decision time, ongoing discussion with BINP
TAXS	2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP8	Baseline	Anticipated decision time, ongoing discussed with BINP

New Collaboration Agreement: MoU

New multi party MoU [**finished and ready for distribution**] specifies explicitly for each partner institute the general link persons for the general, non-committing part of the agreement

- dynamic list of laboratory representatives
- dynamic list of contributions and deliverables

Collaboration partners will receive automatic updates of the membership list whenever a new partner signs the agreement

- transparent membership list

Concrete deliverables that imply commitment from the partner institutes are described in dedicated addendums

- safety link person
- technical expert

Memorandum of understanding

EDMS 17655515 V1.0

MEMORANDUM OF UNDERSTANDING FOR COLLABORATION IN THE HIGH LUMINOSITY LHC PROJECT AT CERN

BETWEEN: THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (“CERN”), an Intergovernmental Organization having its seat at Geneva, Switzerland, as the Host Organization of the High Luminosity LHC project (“HL-LHC Project”);

AND: THE INSTITUTES, LABORATORIES, UNIVERSITIES AND THEIR FUNDING AGENCIES AND OTHER SIGNATORIES OF THIS MEMORANDUM OF UNDERSTANDING,

Hereafter “Participant” and collectively “Participants”

CONSIDERING:

That CERN, an Intergovernmental Organization, is a leading global laboratory in particle physics, providing for collaboration of a pure scientific and fundamental character, with participation by scientific institutes from all over the world;

That <INSTITUTE name> wishes to contribute to the HL-LHC Project, which aims at maximizing the performance of the LHC accelerator by increasing its luminosity, and that <INSTITUTE name> has internationally recognized experience in fields that are relevant to the HL-LHC Project;

That the Participants will derive mutual benefits from their collaboration in the HL-LHC Project,

AGREE AS FOLLOWS:

Status of MoU and Agreements in one table

Country	Institution	Signed	In process of signing	Second wave
Canada	TRIUMF	MoU	CA	
China	IHEP	MoU		
	BJUT		MoU	
Finland	LAPIN	CA		MoU
France	CEA	CA		MoU
Italy	INFN	CA		MoU
Japan	KEK	CA	MoU	MoU
Russia	BINP	CA	Addendum	MoU
	MEPhI		MoU	
JINR	JINR Dubna	CA	Addendum	MoU
Poland	AGH-UST	CA		MoU
	NCBJ	CA, MoU		
Spain	CIEMAT	CA	Addendum	MoU
Sweden	University of Uppsala	CA, MoU		
Switzerland	EPFL	CA		MoU
	University of Geneva	CA		MoU
UK	University of Manchester	CA		MoU
	University of Lancaster	CA		MoU
	Royal Holloway University	CA, MoU		MoU
	Cockcroft Institute	CA		MoU
	University of Liverpool	CA		MoU
	STFC	CA		MoU
	University of Southampton	CA, MoU		
	University of Dundee	CA, MoU		
	University of Huddersfield	CA		MoU
USA	SLAC	CA		
	FNAL	CA		
	LBNL	CA		
	BNL	CA		
	JLAB	CA		
	ODU	CA	MoU	

Contributions summary table

Total Summary Table	
Country	Share of contribution
France	1.5%
Italy	8.9%
Spain	5.4%
Sweden	0.5%
UK	4.8%
USA	60.1%
Japan	10.3%
Canada	5.2%
Russia	2.6%

Conclusions

- The HL-LHC project is becoming a construction project
- Time is running and it is time to close the loop: In-kind contributions contributions have to be finalized very very soon
- More opportunities are available:
baseline [e.g. D2] and options [e.g. hollow e-lens]!
- What will not be covered by collaboration agreements will go to industry via normal procurement processes



Excel Table for in-kind contributions:

Item	Budgeted cost	Required Delivery	Required decision time	Contribution type	HL-LHC WP	Type	Comments	Collaborator
Superconducting link Feedboxes DFH and DFX		2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP6a	Baseline	Very tight collaboration with CERN and possibly special material to be supplied by CERN	
Magnets and CC jacks		2021-2022; in time for equipping magnets, CC, pre-series	During LHC Run2 (by 2018)	Hardware	WP6a	Baseline		
Nb sheets for CC production		2019; in time for CC production start in LS2	During LHC Run2 (by 2018)	Material	WP4	Baseline	Procured in China in the past; 100kg / cavity with 10 cavities	
TAXS		2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP8	Baseline	anticipated decision time	
TAXN		2023; in time for installation in LS3 (2024-2025)	by 2020	Hardware	WP8	Baseline	anticipated decision time	
D2 2-in-1 Dipole magnet		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP3	Baseline		
D2 Dipole orbit corrector magnets		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware	WP3	Baseline	Canted Cosine-Theta design	
Warm 2-in-1 quadupole magnets		2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware	WP3	Baseline	with TIUMF in Canada	
Hollow electron lens for beam halo removal		2023; in time for installation in LS3 (2024-2025)	During LHC Run2 (by 2019)	Hardware, SC soleniod and magnets	WP5	Option; in process of becoming baseline	Design developed in collaboration with USLARP	
Undulator for Synchrotron Light monitor		2023; in time for installation in LS3 (2024-2025)	During LS2 (2019-2020)	Hardware	WP13	Option	Design already exists for installed Undulator (sercond unit)	
Inclinometer for vibration measurements		2019; in time for installation in LS2	During LHC Run2 (by 2019)	Hardware	WP8 - WP13	Option	Technology developed by Dubna	

Memorandum of Understanding

- We had a pilot circulation of the MoU text to few institutes
- We are launching a second wave for everybody
- We also have the first example of:
 - An addendum for expert support, not used so far
 - An addendum for a hardware contribution: cathodes R&D with BJUT China
 - They are the basis for future addenda
- The advantage is in the higher flexibility given by the long validity of the frame document