HL-LHC project presentation and Forthcoming procurement overview and schedule

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On behalf of the HL-LHC Project team

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The HL-LHC Project

Goals, schedule and technologies

Goal of High Luminosity LHC (HL-LHC) as fixed in November 2010

From FP7 HiLumi LHC Design Study application

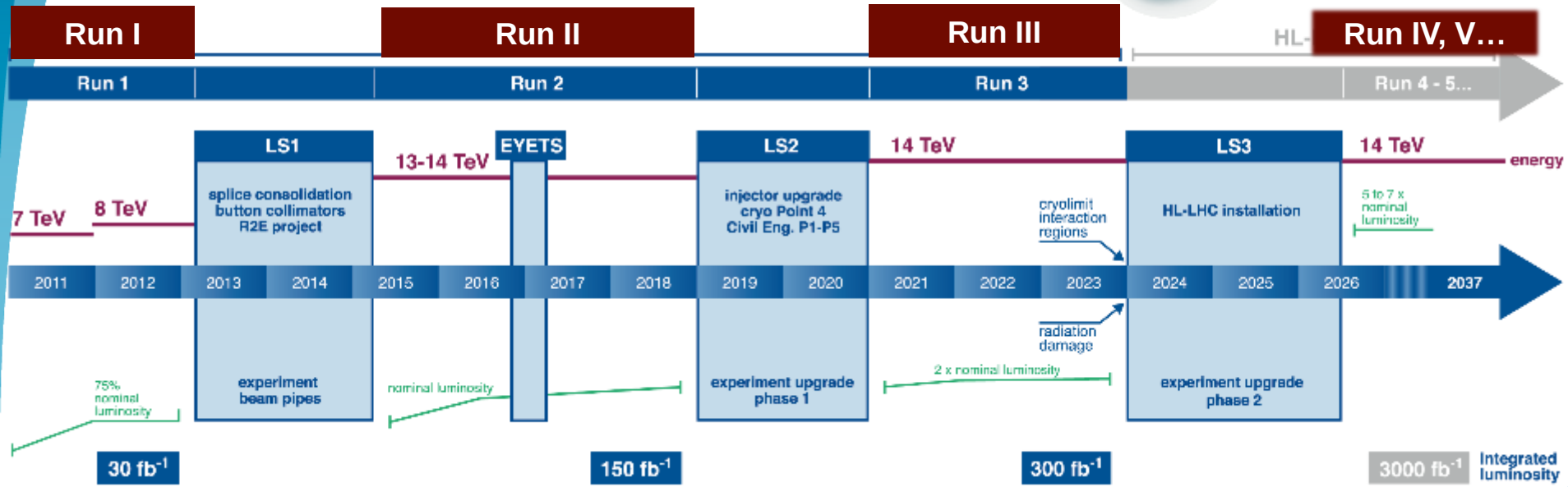
The main objective of HiLumi LHC Design Study is to determine a hardware configuration and a set of beam parameters that will allow the LHC to reach the following targets:

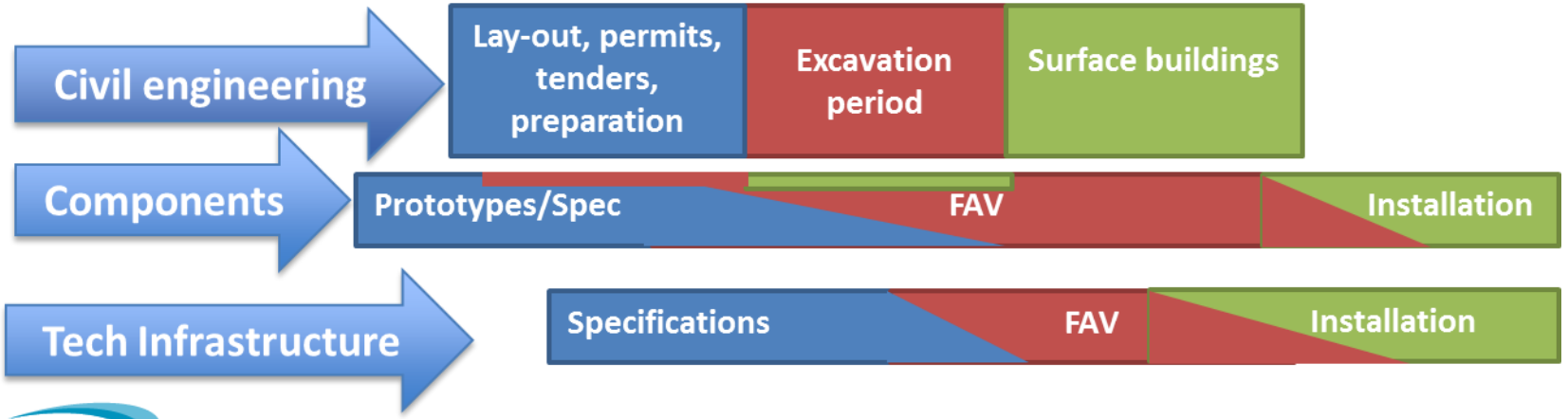
A peak luminosity of L_{peak} = **5×10^{34} $cm^{-2}s^{-1}$ with levelling**, allowing:

An integrated luminosity of **250 fb^{-1} per year**, enabling the goal of **L_{int} = 3000 fb^{-1}** twelve years after the upgrade.
This luminosity is more than ten times the luminosity reach of the first 10 years of the LHC lifetime.

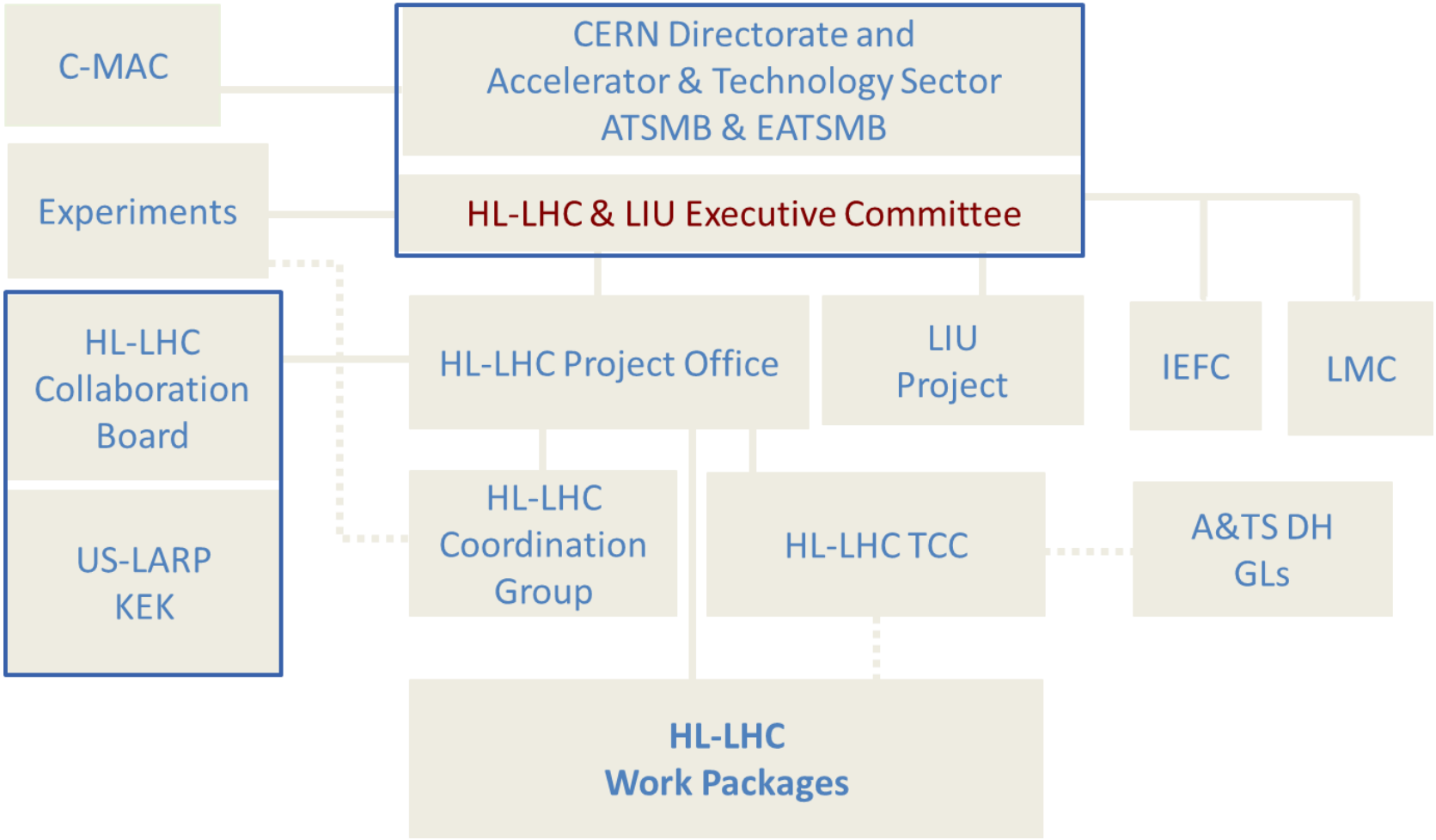
Concept of ultimate performance recently defined:
$L_{ult} \cong 7.5\ 10^{34}$ $cm^{-2}s^{-1}$ and **Ultimate Integrated $L_{int\ ult} \sim 4000$ fb^{-1}**
LHC should not be the limit, would Physics require more…

LHC / HL-LHC Plan

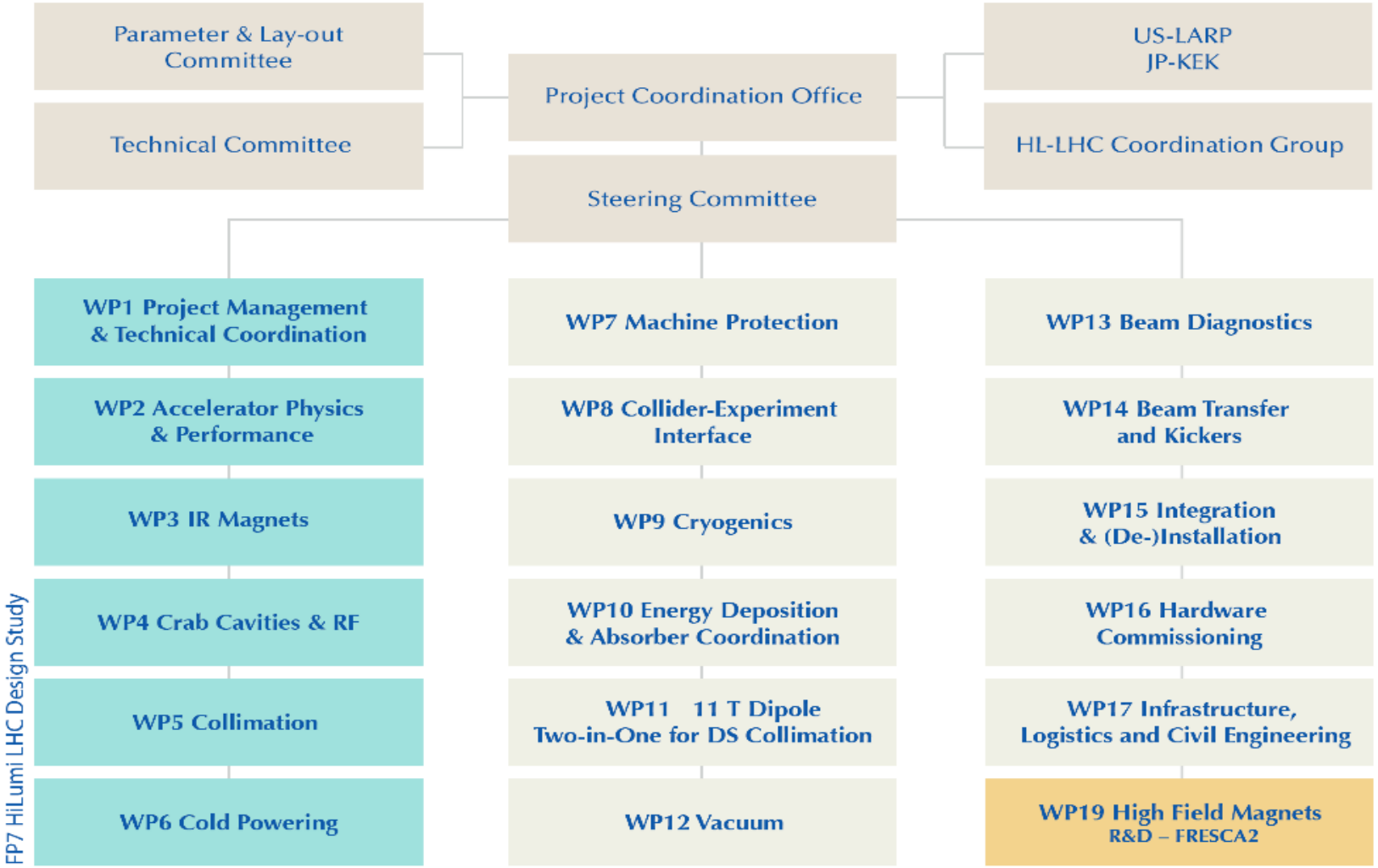




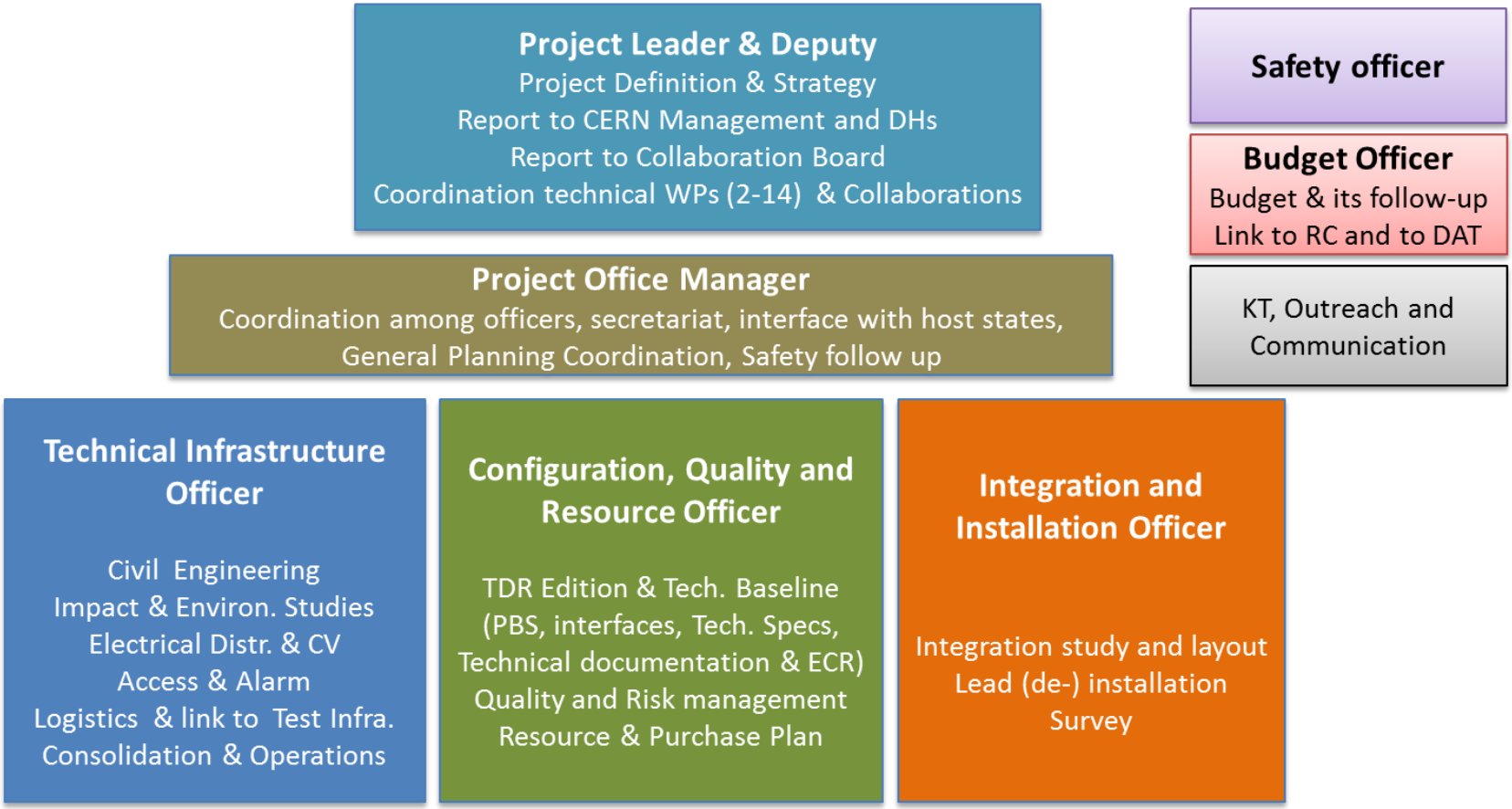
HL-LHC Project Governance

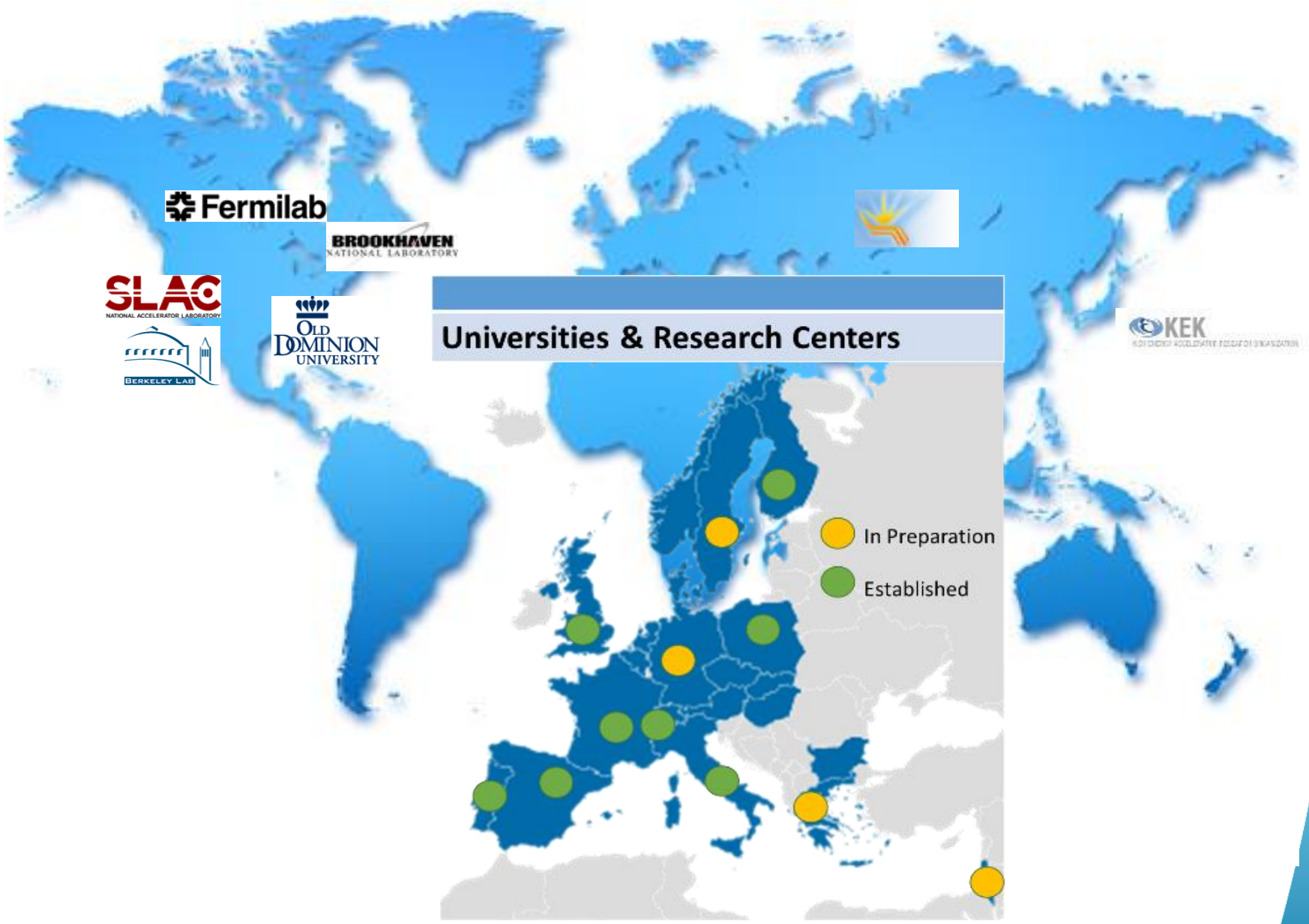


HL-LHC Workpackages



HL-LHC Project Office Organization

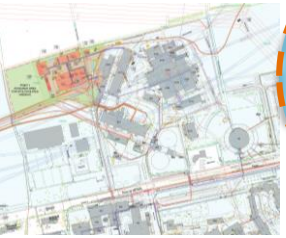


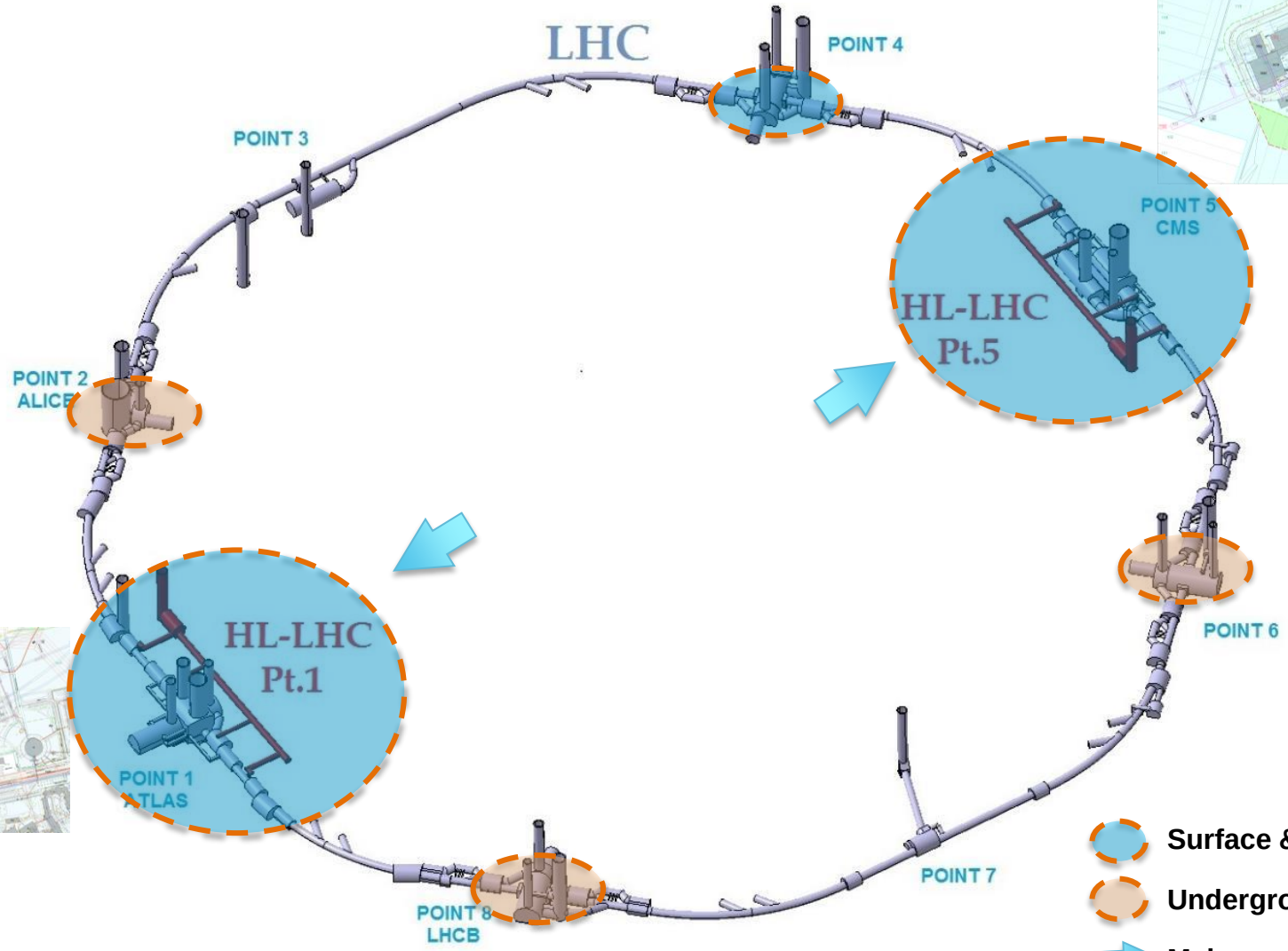

Fermilab
BROOKHAVEN NATIONAL LABORATORY
SLAC NATIONAL ACCELERATOR LABORATORY
BERKELEY LAB
OLD DOMINION UNIVERSITY
KEK
Universities & Research Centers
In Preparation
Established

The HL-LHC Project

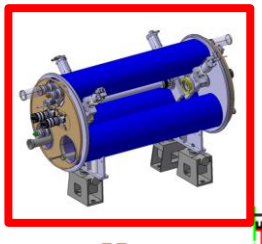
Main components, technical services and infrastructure

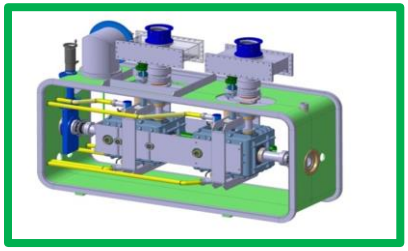
Many points around the ring

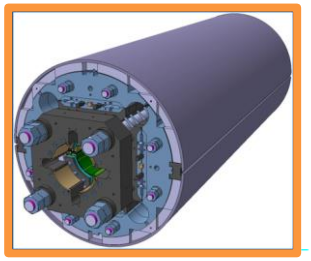


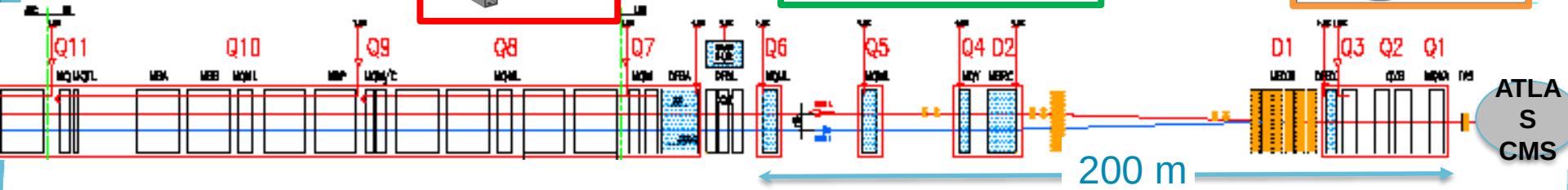


The largest HEP accelerator in construction









Dispersion Suppressor (DS)

Modifications
1. In IP2: new DS collimation
2. In IP7 new DS collimation with 11 T

Cryogenics, Protection, Interface, Vacuum, Diagnostics, Inj/Extr… extension of infrastr.

Matching Section (MS)

Complete change and new lay-out
1. TAN
2. D2
3. CC
4. Q4
5. All correctors
6. Q5 (Q6 @1.9 K?)
7. New MQ in P6
8. New collimators

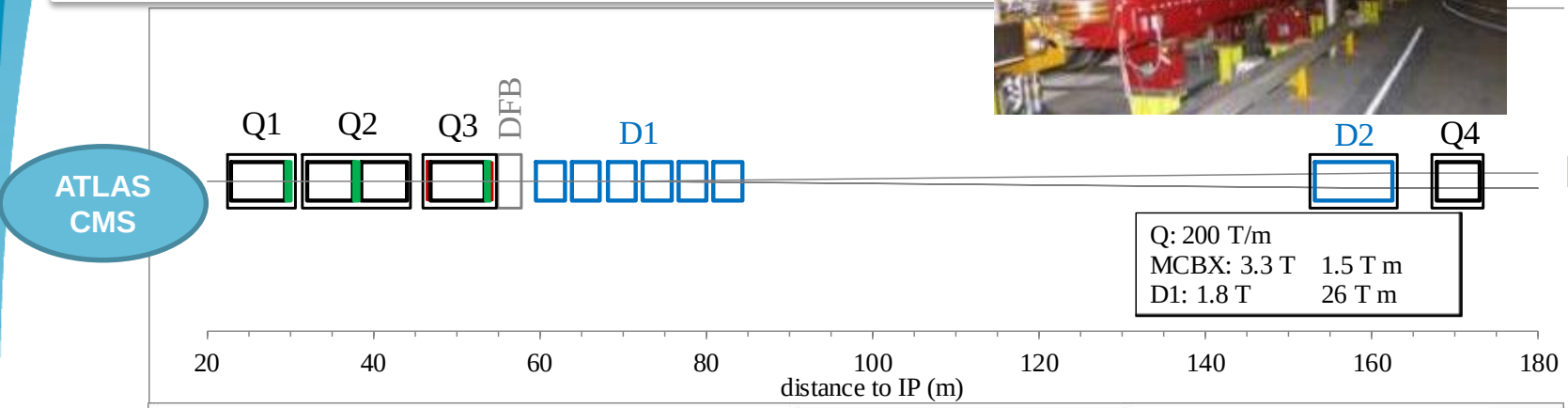
Interaction Region (ITR)

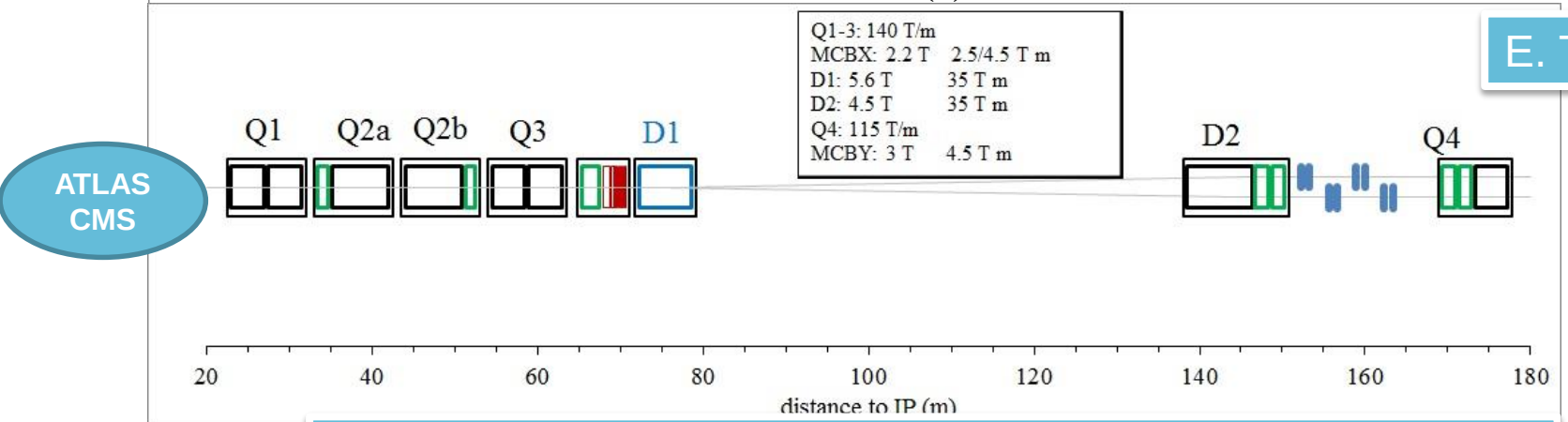
Complete change and new lay-out
1. TAS
2. Q1-Q2-Q3
3. D1
4. All correctors
5. Heavy shielding (W)

> 1.2 km of LHC

New Insertion Region lay out (TAS, TAN, Q5 and collimators omitted)

Longer Quads; Shorter D1 (thanks to SC)
Interaction region length is unchanged



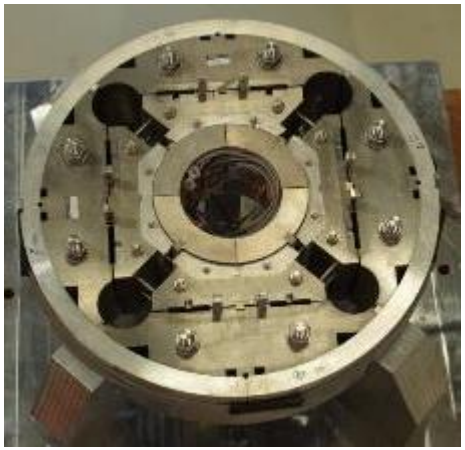


E. Todesco

Thick boxes are magnetic lengths -- Thin boxes are cryostats

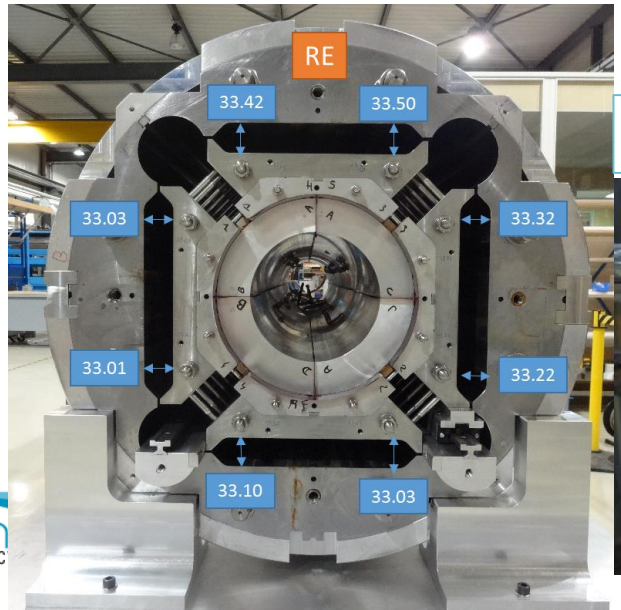
Working on the Inner triplet magnets

CERN

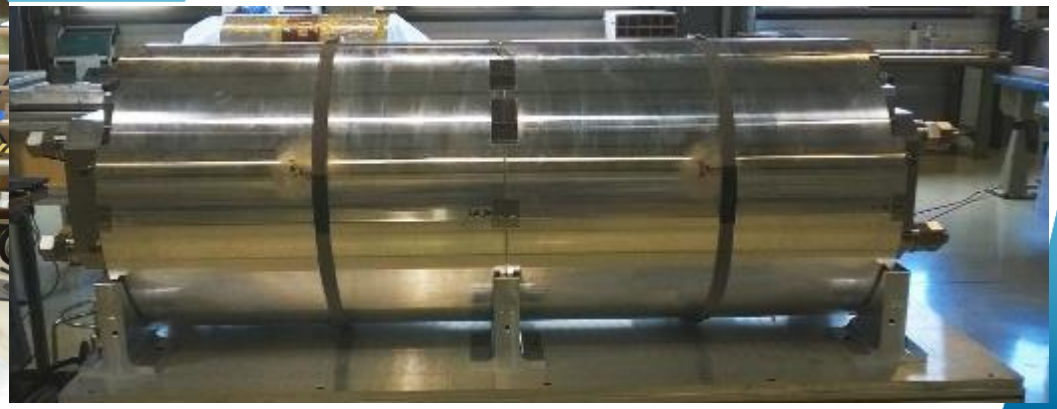


LARP

- 1 mechanical model (15 cm long)
- 2 short model structures with dummy coils

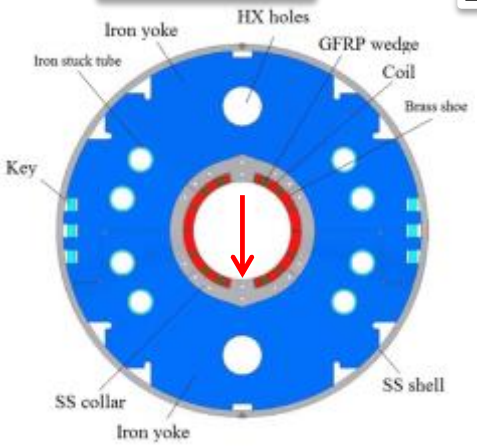


CERN

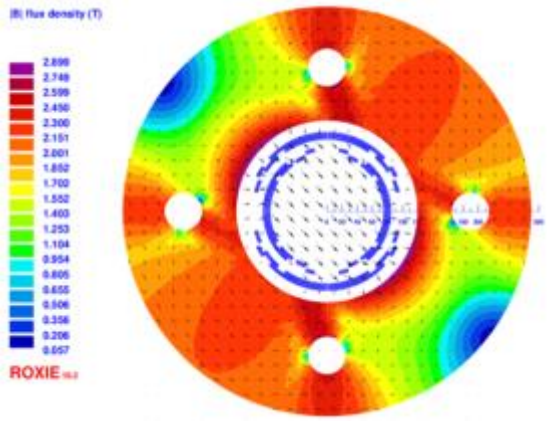


The HL-LHC Nb-T magnet zoo…

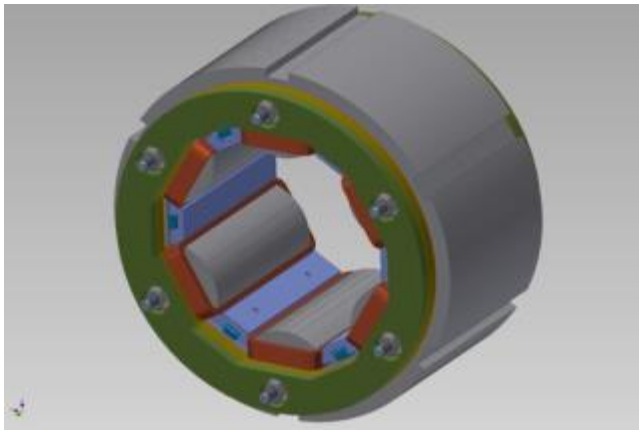
D1 (KEK)

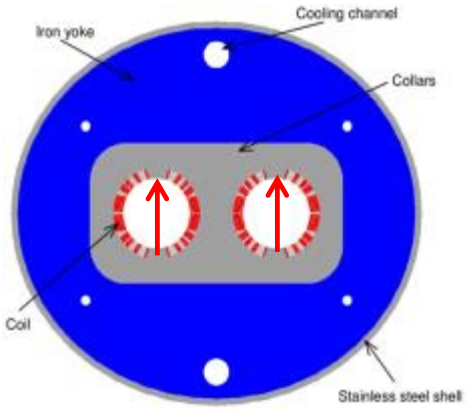


Nested orbit corrector (CIEMAT)

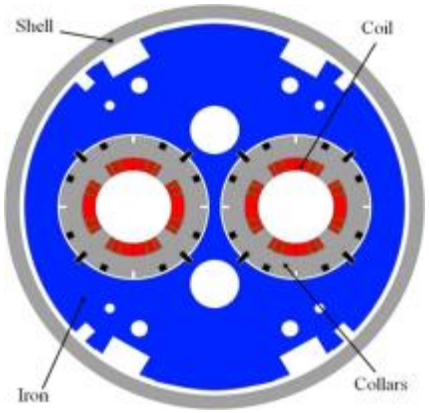


HO correctors: superferric (IN

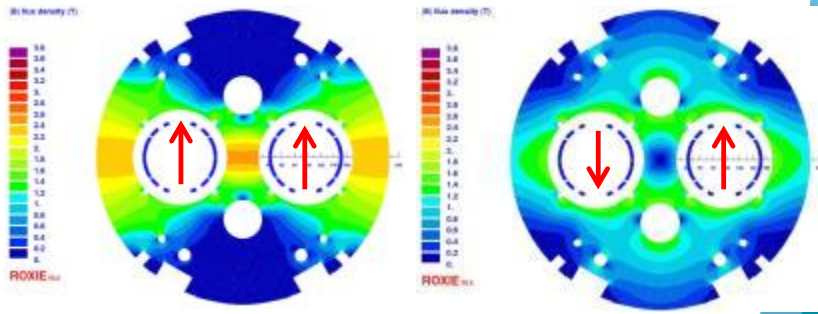




D2 (INFN)

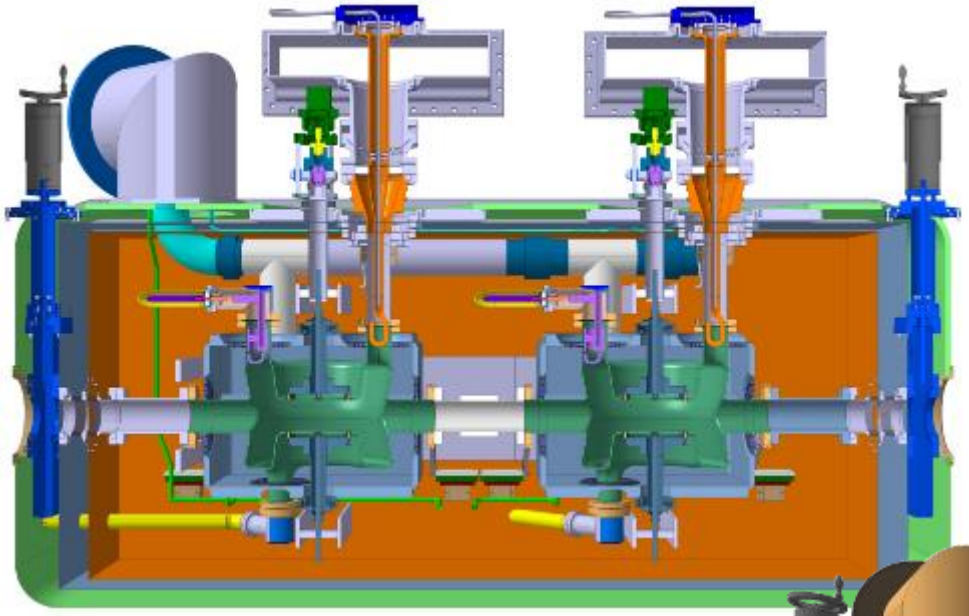


Q4 (CEA)



D2 corr

Crab cavities

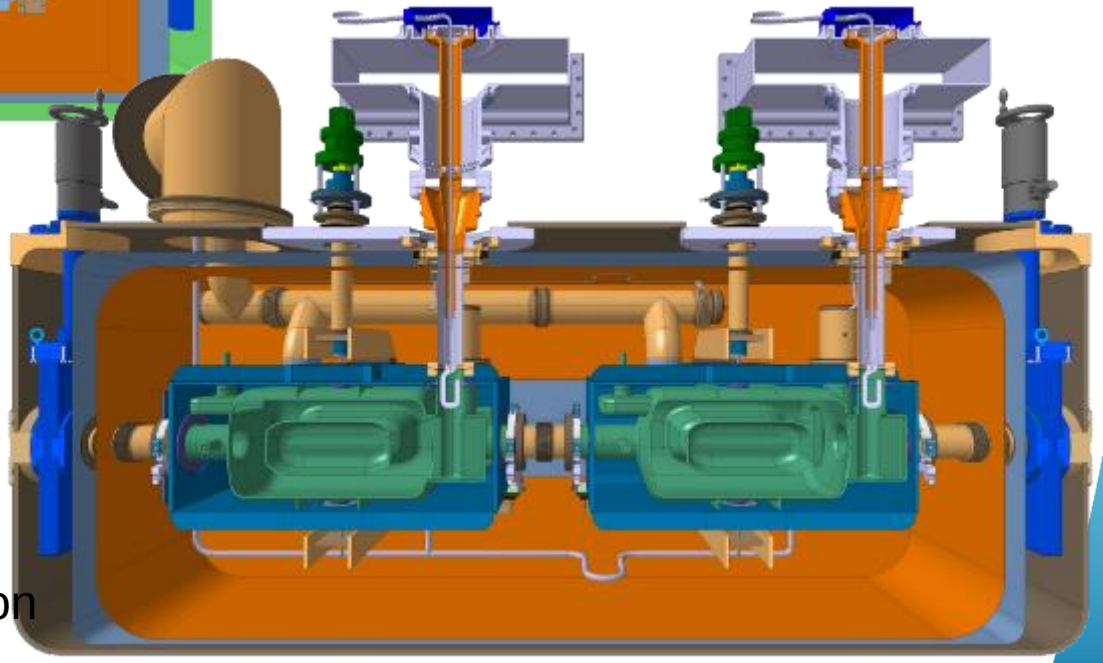


Mostly standardized interfaces and common platform

Main differences

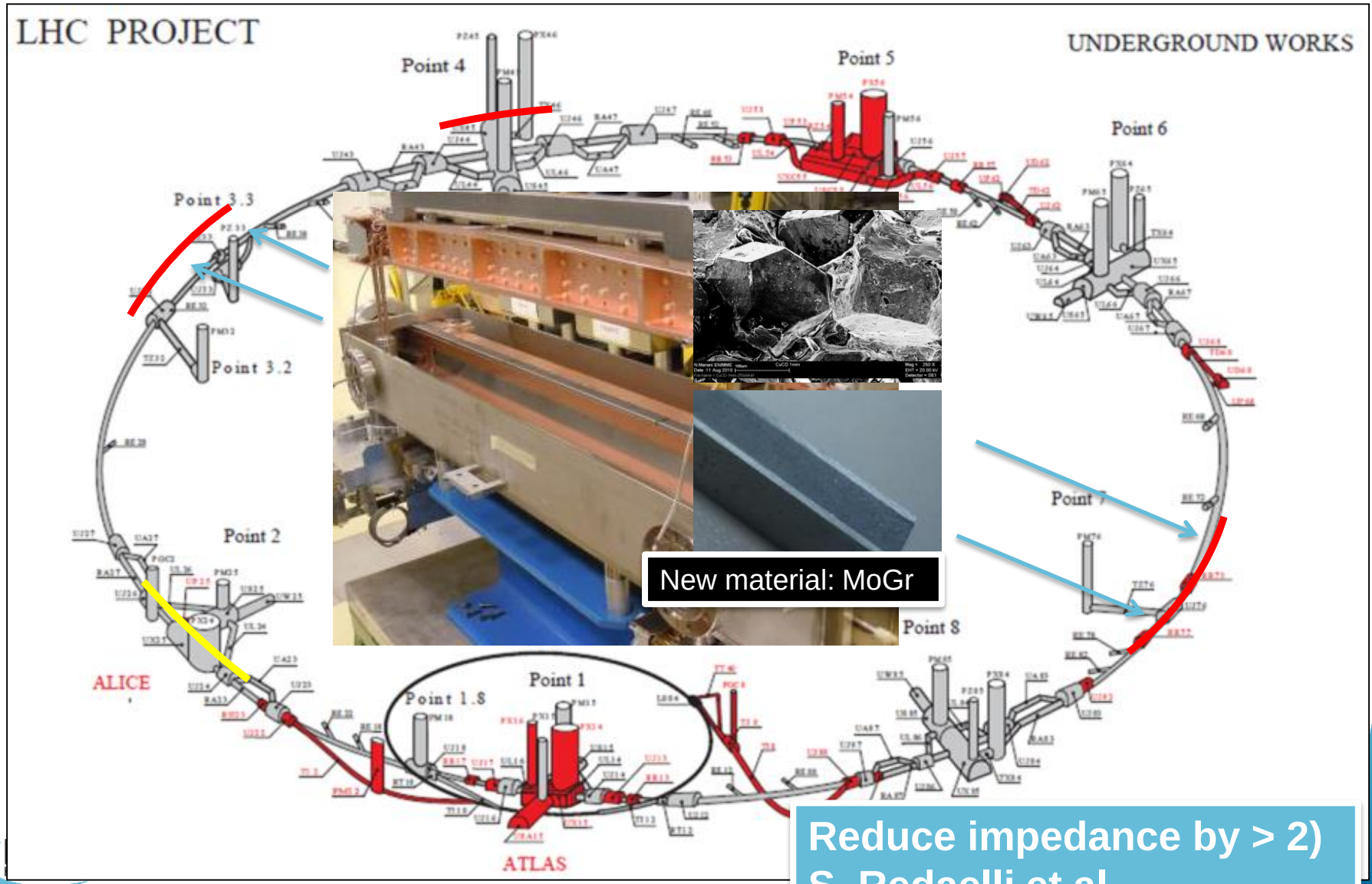
- Cavity symmetry & length
- HOM couplers

Double Quarter Wave,
Vertical Deflection



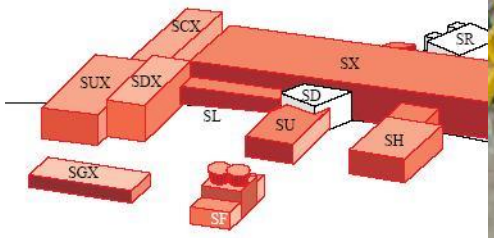
RF Dipole
Horizontal Deflection

Low impedence collimators (LS2 & LS3)

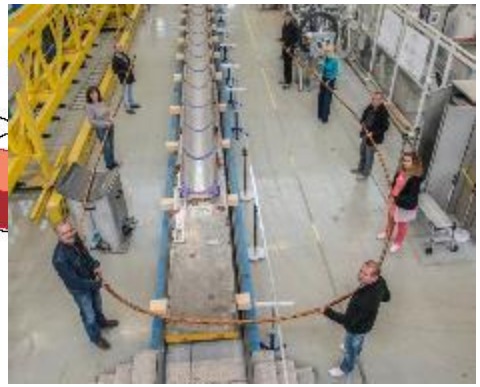


Reduce impedance by > 2)
S. Redaelli et al.

Increasing availability



POINT 5

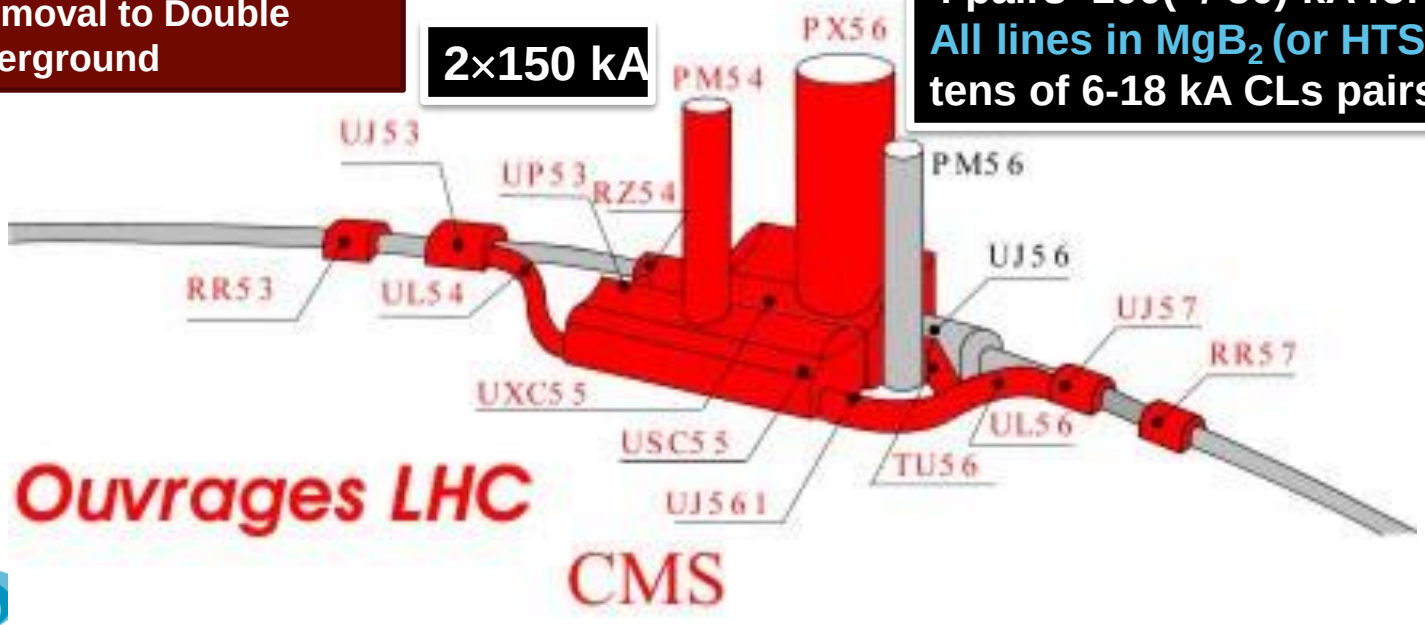


Baseline: removal to Double Decker Underground

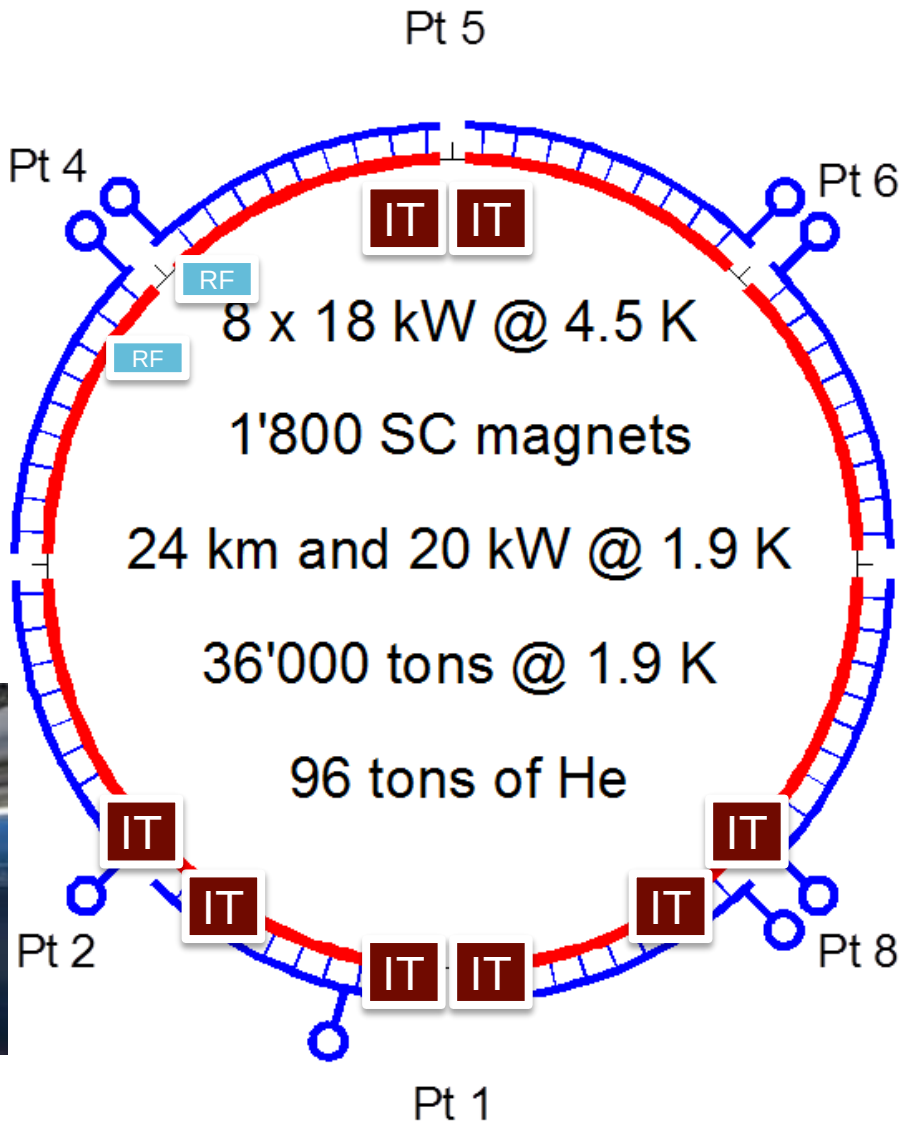
2×150 kA

Point

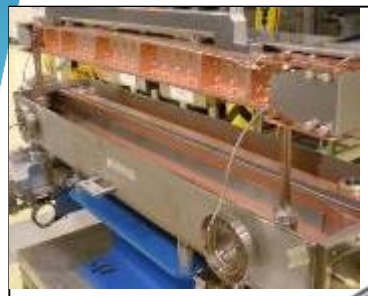
4 pairs 150(+/- 75) kA for MS– LS3
4 pairs 100(+/-50) kA for ITR – LS3
All lines in MgB_2 (or HTS)
tens of 6-18 kA CLs pairs in HTS

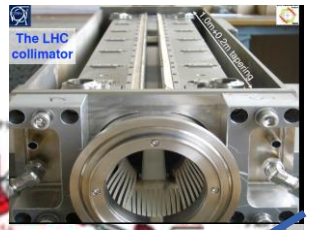


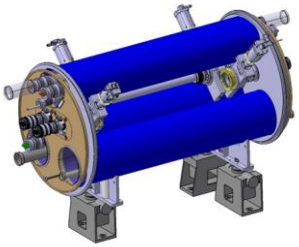
Eliminating Technical bottlenecks



11 T Magnets



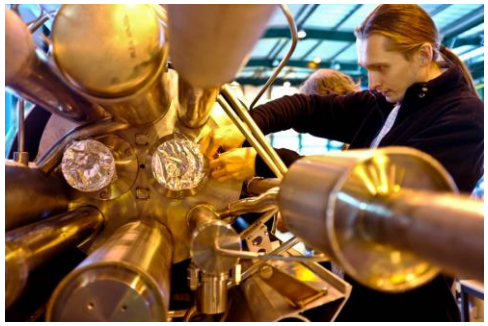


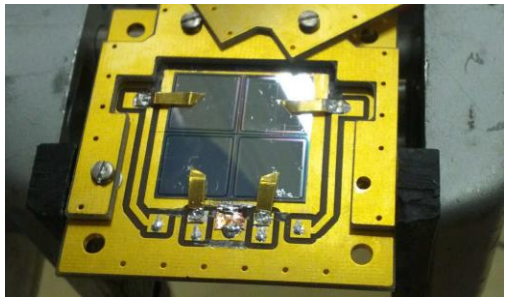


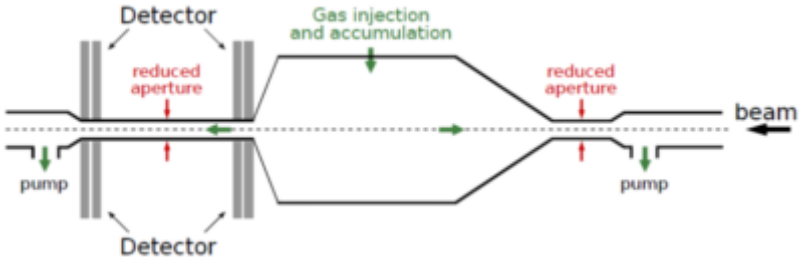
11 T Nb_3Sn

Beam diagnostic improvement

- Cryogenic BLMs & Radiation Hard Electronics
  - Cryogenic BLMs
  - Radiation hard electronics
- Fast WireScanners
- Insertion Region BPMs
  - Cold directional couplers
  - Tungsten shielded cold directional couplers
  - Warm directional couplers
  - High precision electronics for insertion region BPMs
- Luminosity Monitors
- Diagnostics for Crab Cavities
- Upgrade to Synchrotron Light Monitors
  - Upgrade to existing monitor
  - New light source
  - Halo diagnostics
- Beam Gas Vertex Detector
  - Final Implementation
- Long-Range Beam-Beam Compensator
  - Prototype
  - Final Implementation

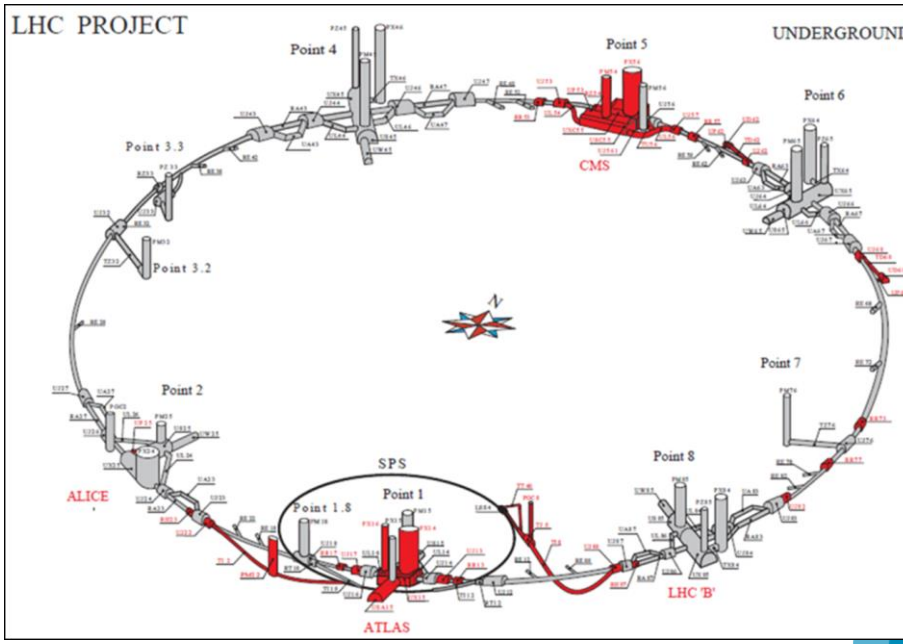




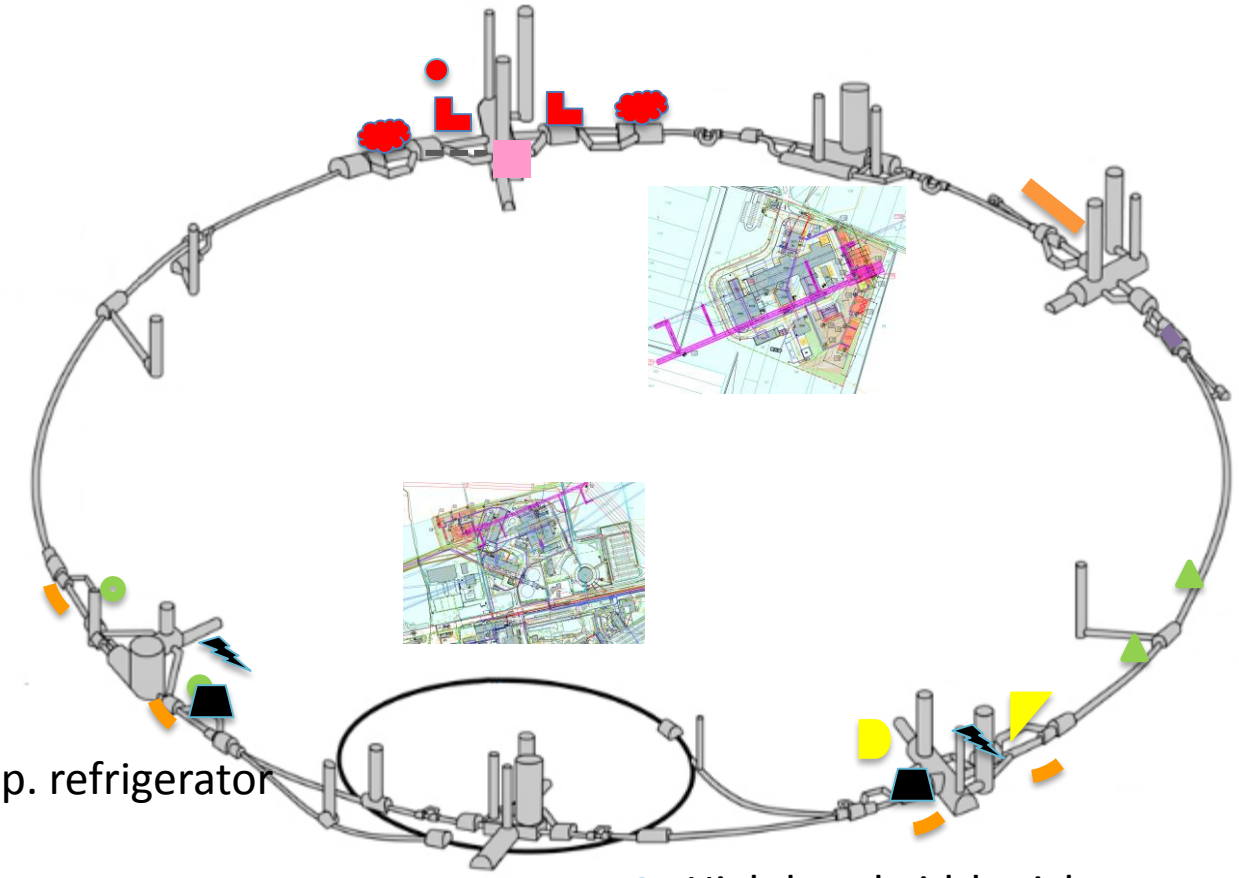


And many other improvements

- **Machine protection:** improved robustness to mis-injected beams, to kickers sparks will be required. The kicker system, collimation and TDI, is the main shield against severe beam induced damage.
- **Quench Protection System** of SC magnets to remake a 20 years old design.
- **Remote manipulation:** the level of activation around 2020 requires development of special equipment to allow replacing/servicing collimators, magnets, vacuum components etc., according to ALARA principle. Remote manipulation, enhanced reality and supervision is the key to minimizing the radiation doses sustained during interventions.
- **Vacuum** …



Installation Overview for LS2 (2019-2020)



New transp. refrigerator

New Q5

TCSPM

Cryo-bypass+TCLD

In-situ a-C coating

Mask for D2

TAXN

High bandwidth pick-ups

Fast wire scanners

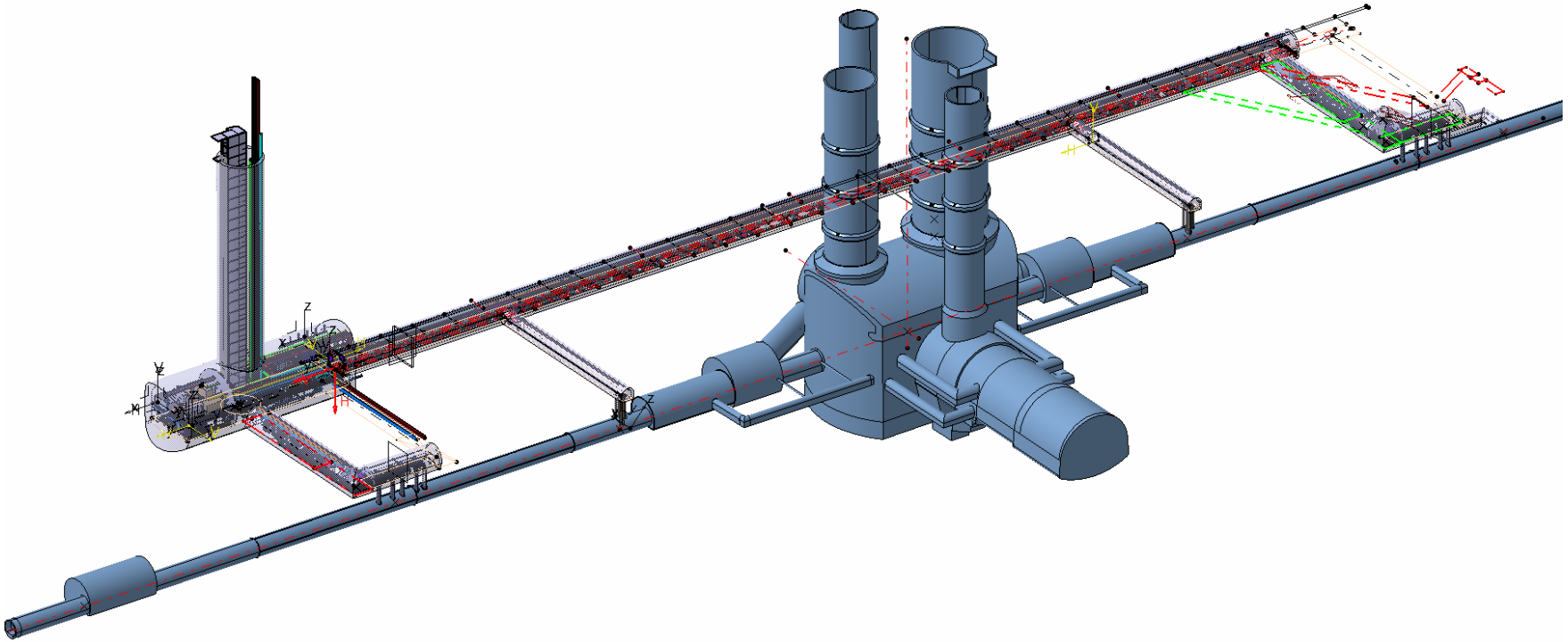
BGV

Prep. works halo diagnostic systems

TDIS

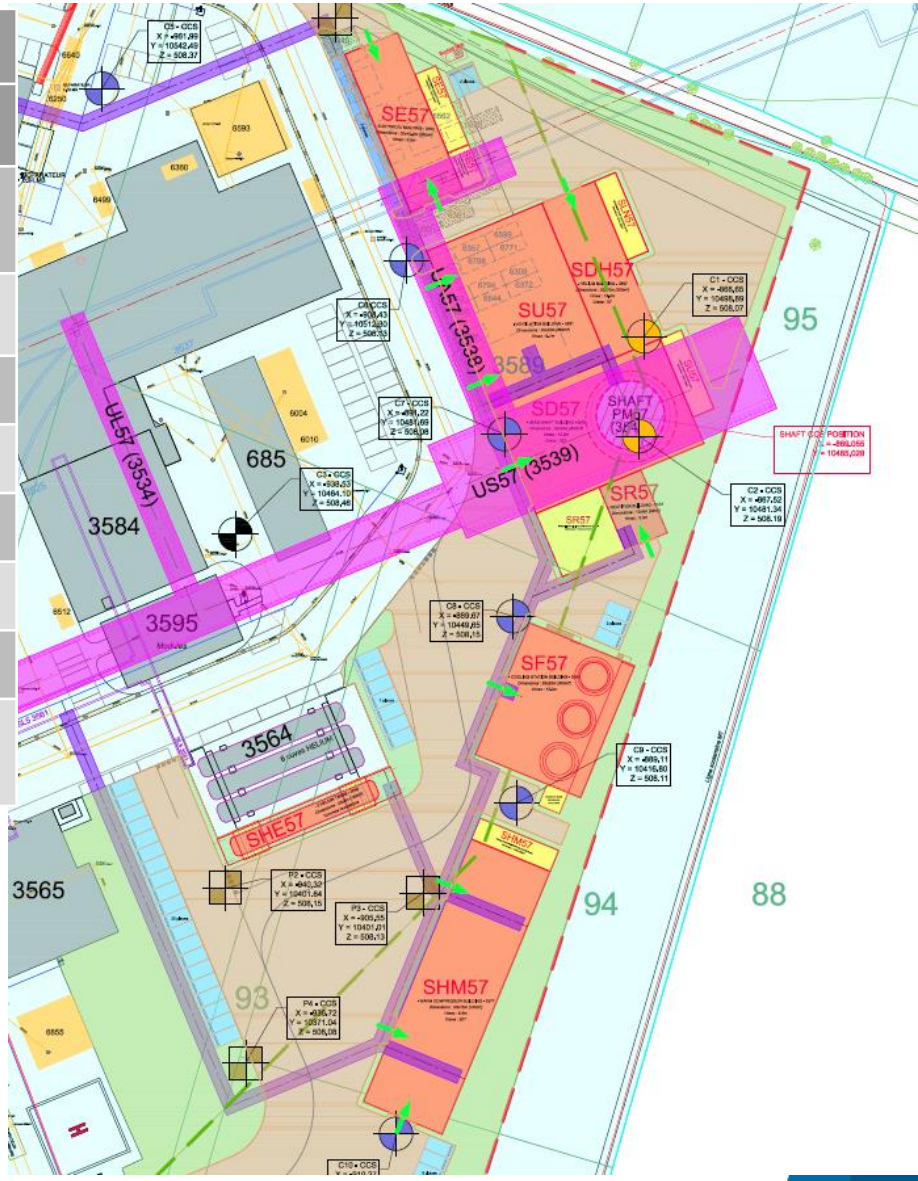
TCDD Mask for D1

Point 1 Civil Engineering underground



Surface buildings

Description	Sigle	DIMENSIONS (m) H	L	W
Plateforme réservoirs hélium	SHE	5	33	5
Bâtiment ventilation	SU	9	30	22
Bâtiment électrique	SE	3	30	10
Bâtiment tête de puits	SD	15	32	20
Bâtiment compresseurs	SHM	9.5	50	15
Rectifier Building 3175	SR	7	12	8
Tour de refroidissement	SF	12	25	20
Bâtiment déchargement hélium	SDH	14.4	30	10

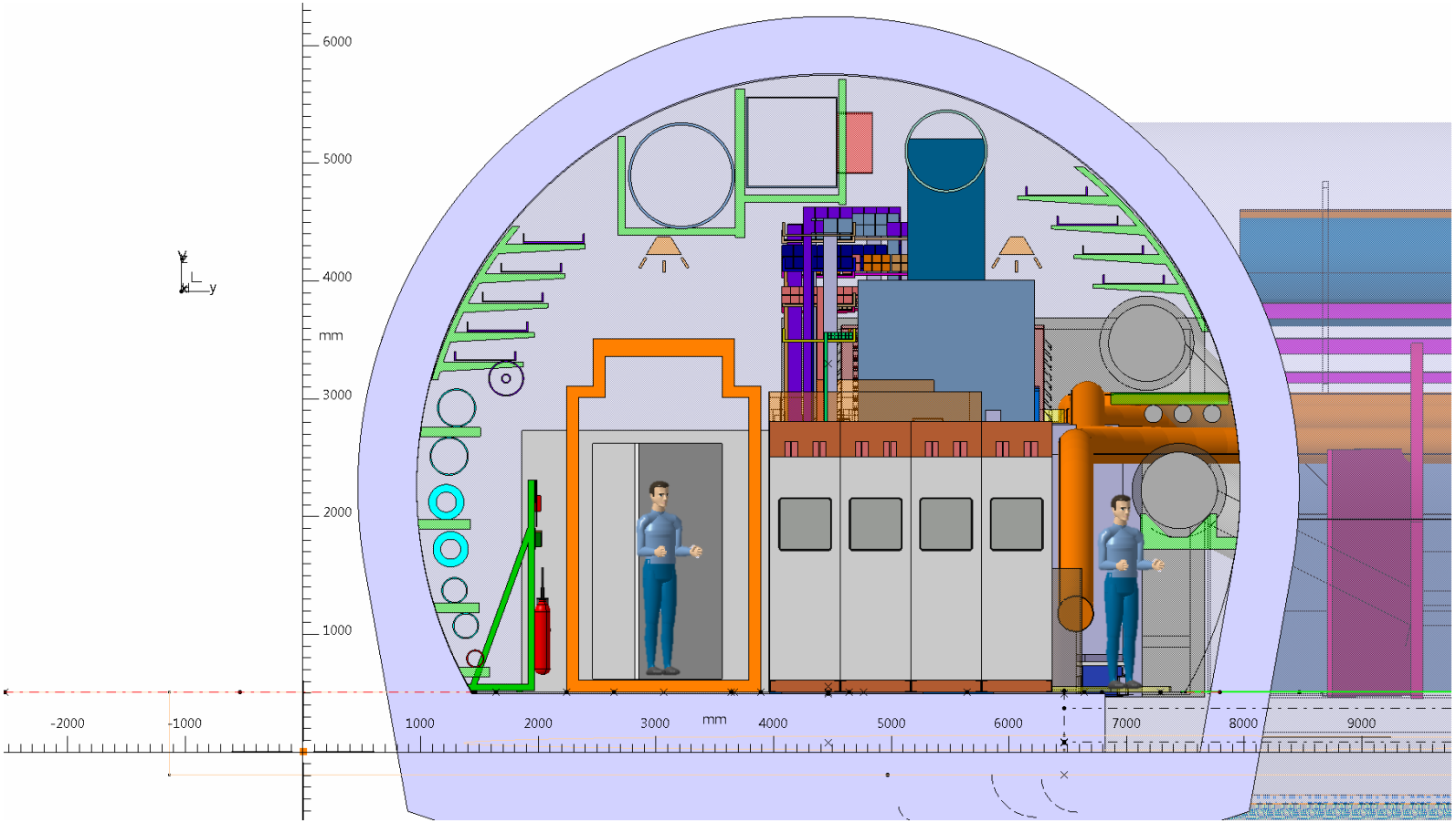


≈ 3’400 m^2 new buildings

P1
- Present surface≈ 75’200 m^2
- New surface≈ 91’200 m^2

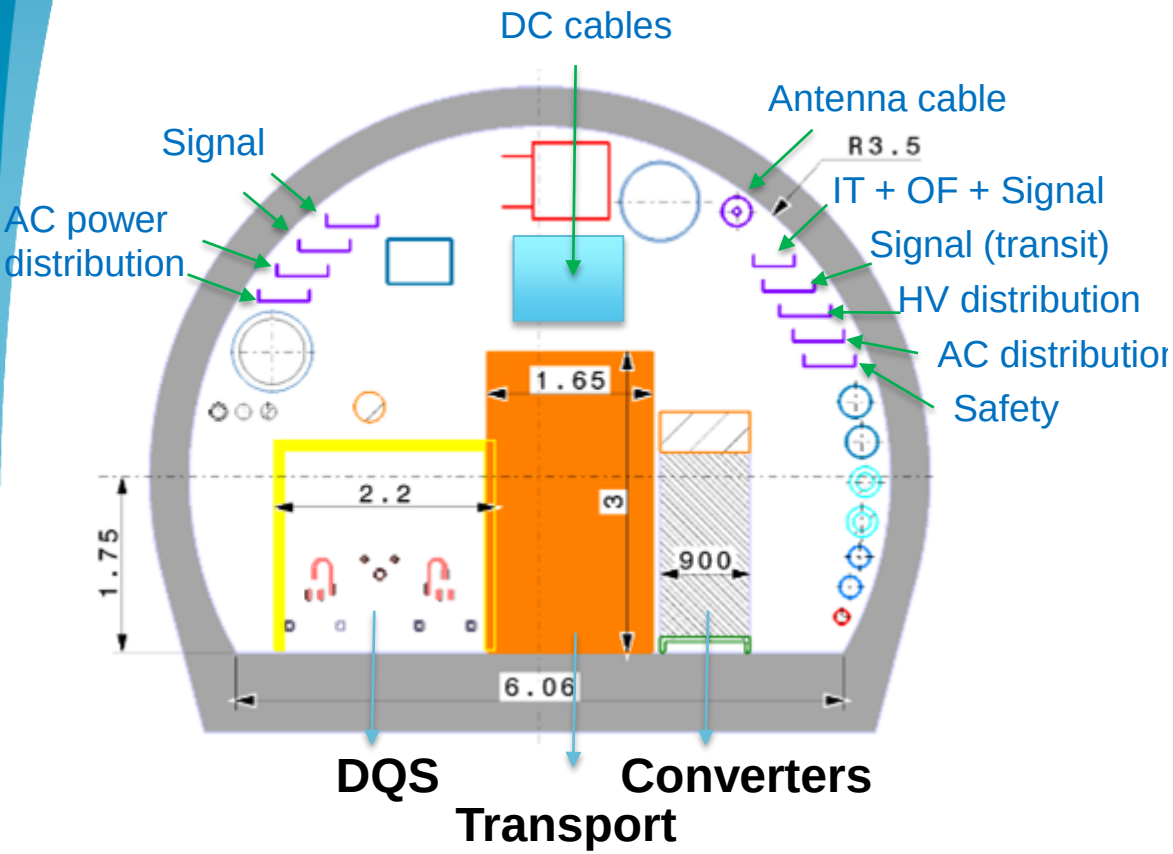
P5
- Present surface≈ 42’300 m^2
- New surface≈ 55’300 m^2

Typical view of the infrastructure needs

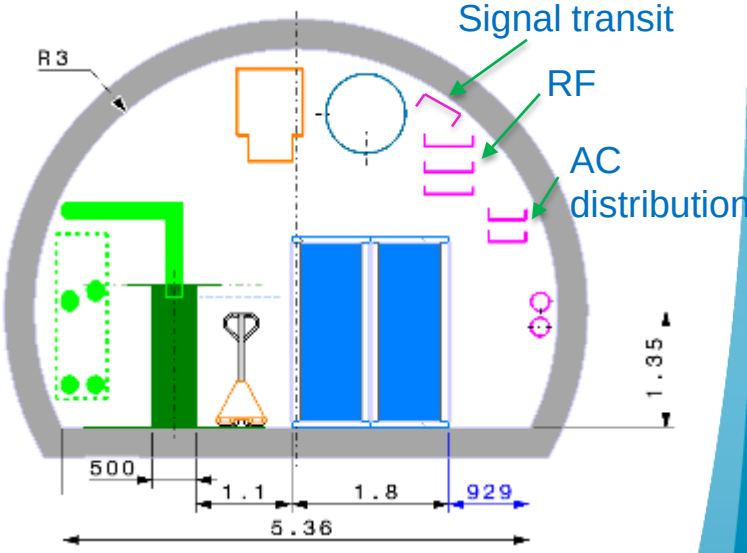


Space needed for cable trays

UR:



UA:



Size of cable trays (AC and signal):
600/60 mm. Distance between: 250mm

Constraints: Cable trays must be accessible for additionnal cables.

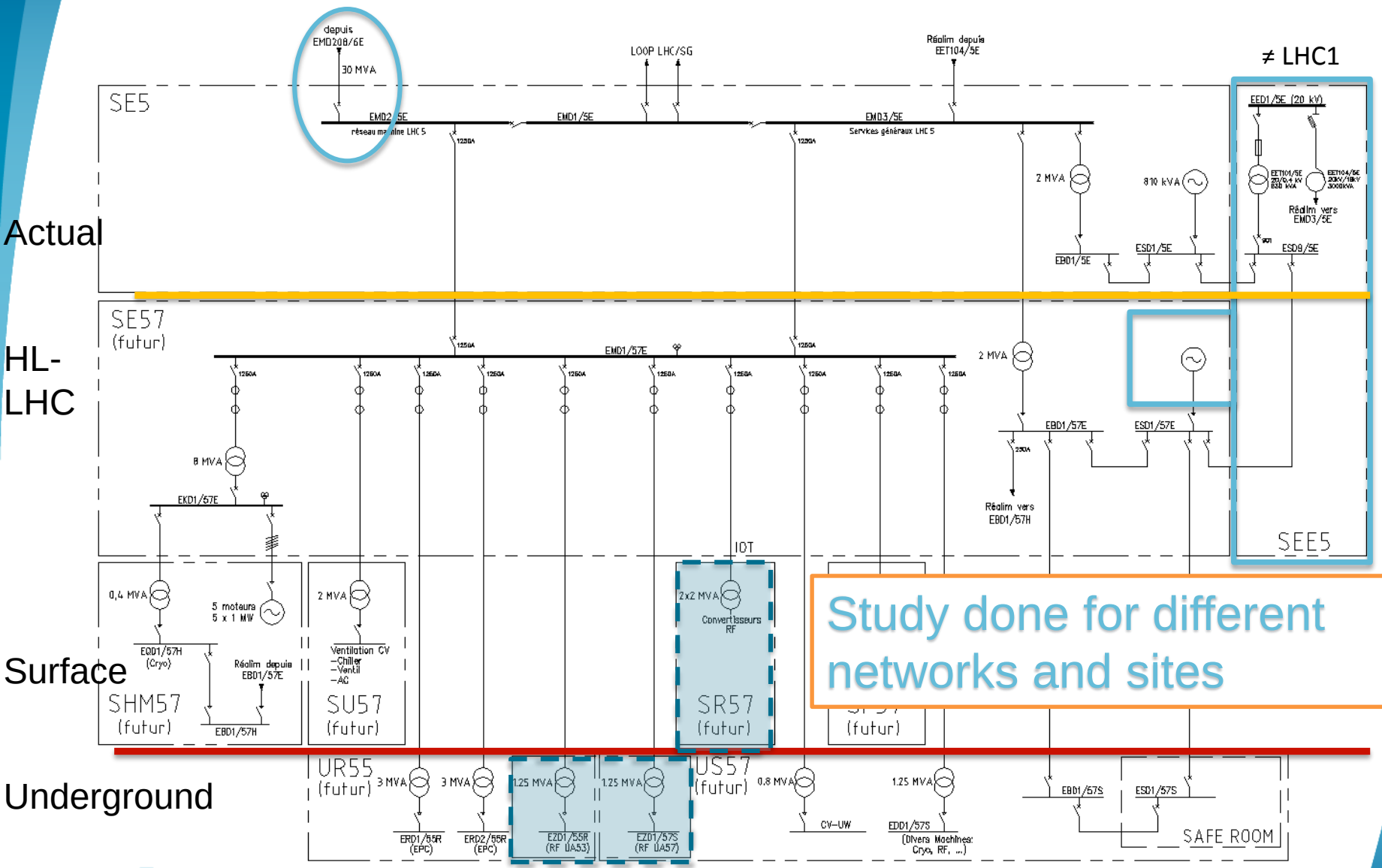
18 kV single-line diagram for LHC5 HL-LHC

Actual

HL-LHC

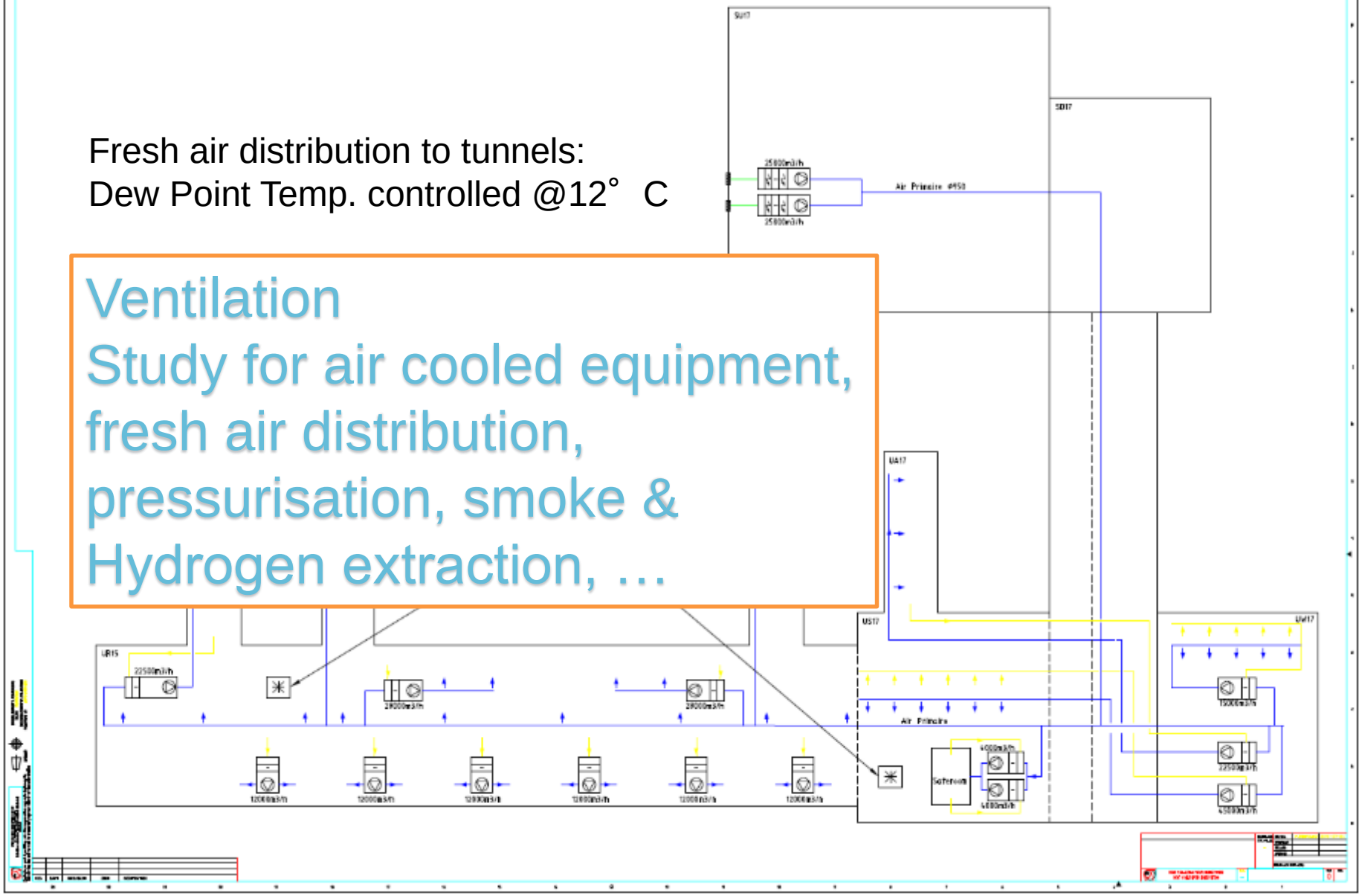
Surface

Underground



Study done for different networks and sites

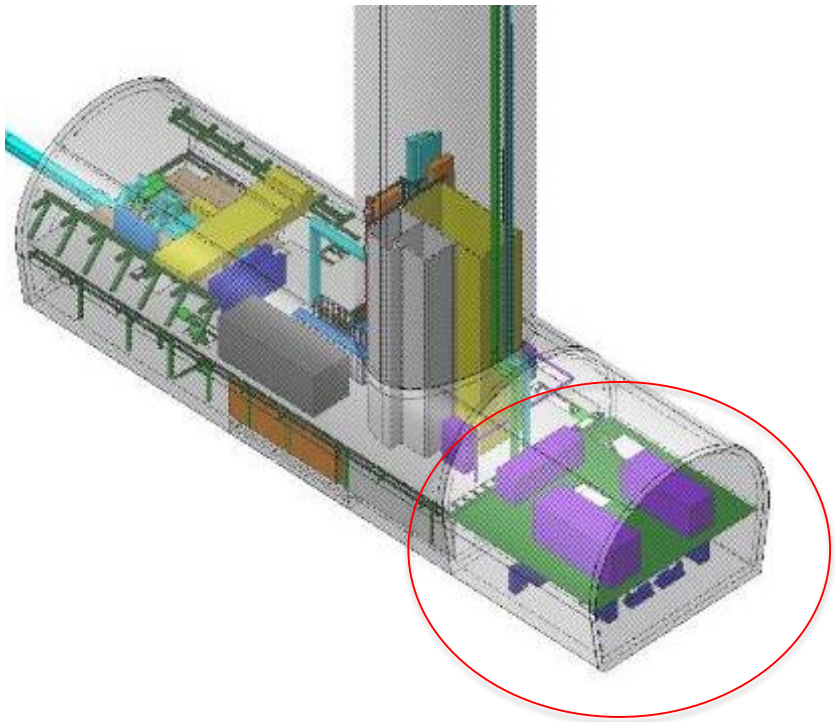
Fresh air distribution to tunnels:
Dew Point Temp. controlled @12° C



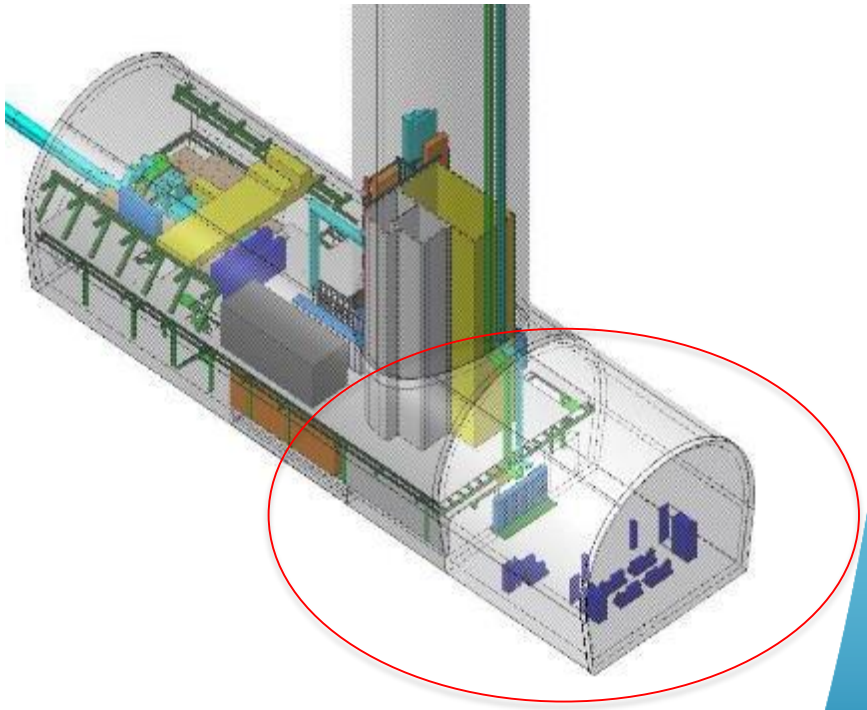
Ventilation
Study for air cooled equipment, fresh air distribution, pressurisation, smoke & Hydrogen extraction, …

EN-CV equipments integrated in 3D models

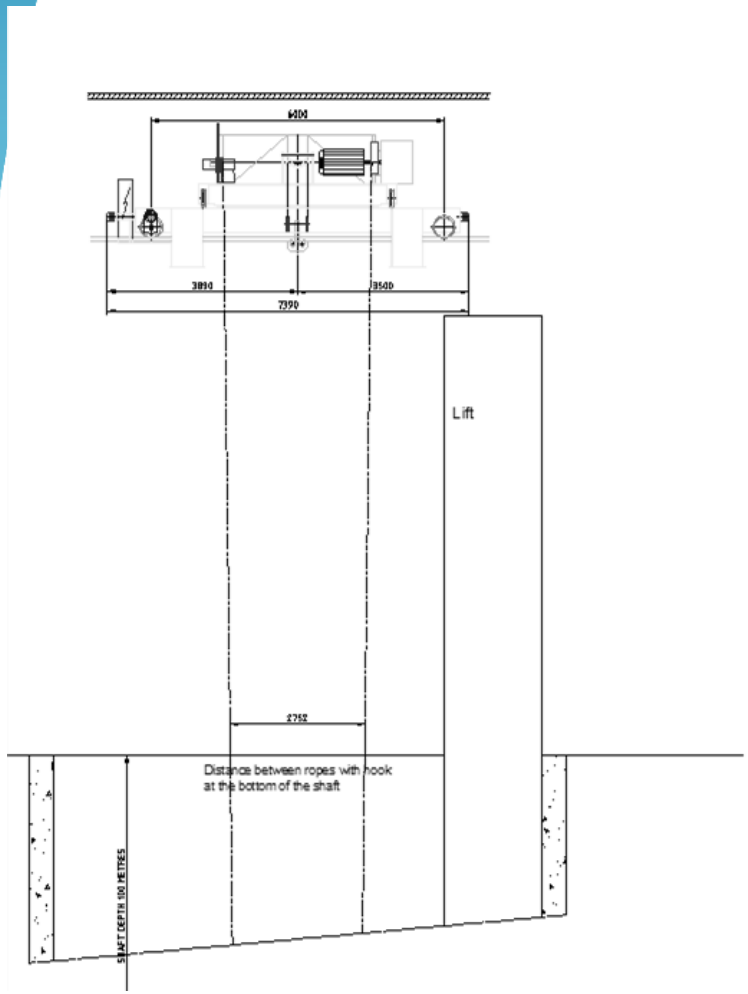
UW ventilation units & distribution

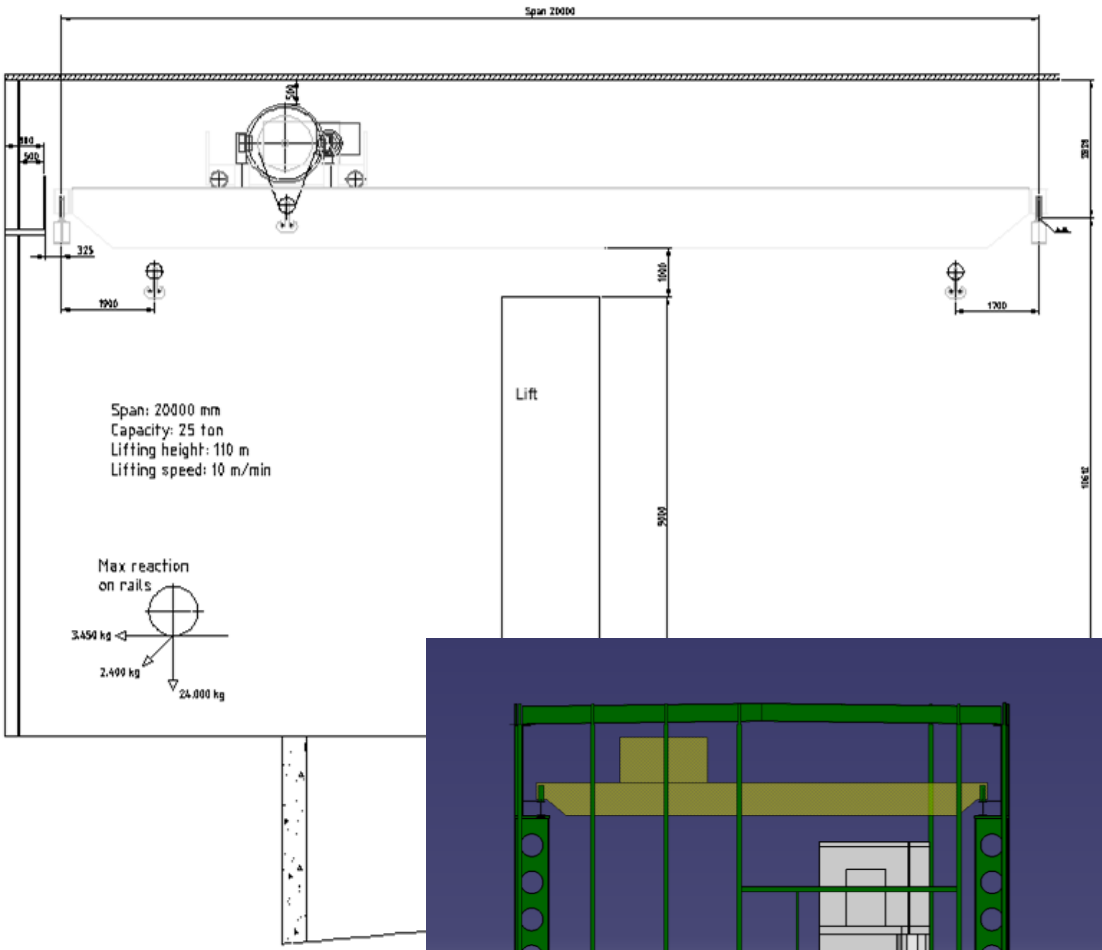


UW cooling station

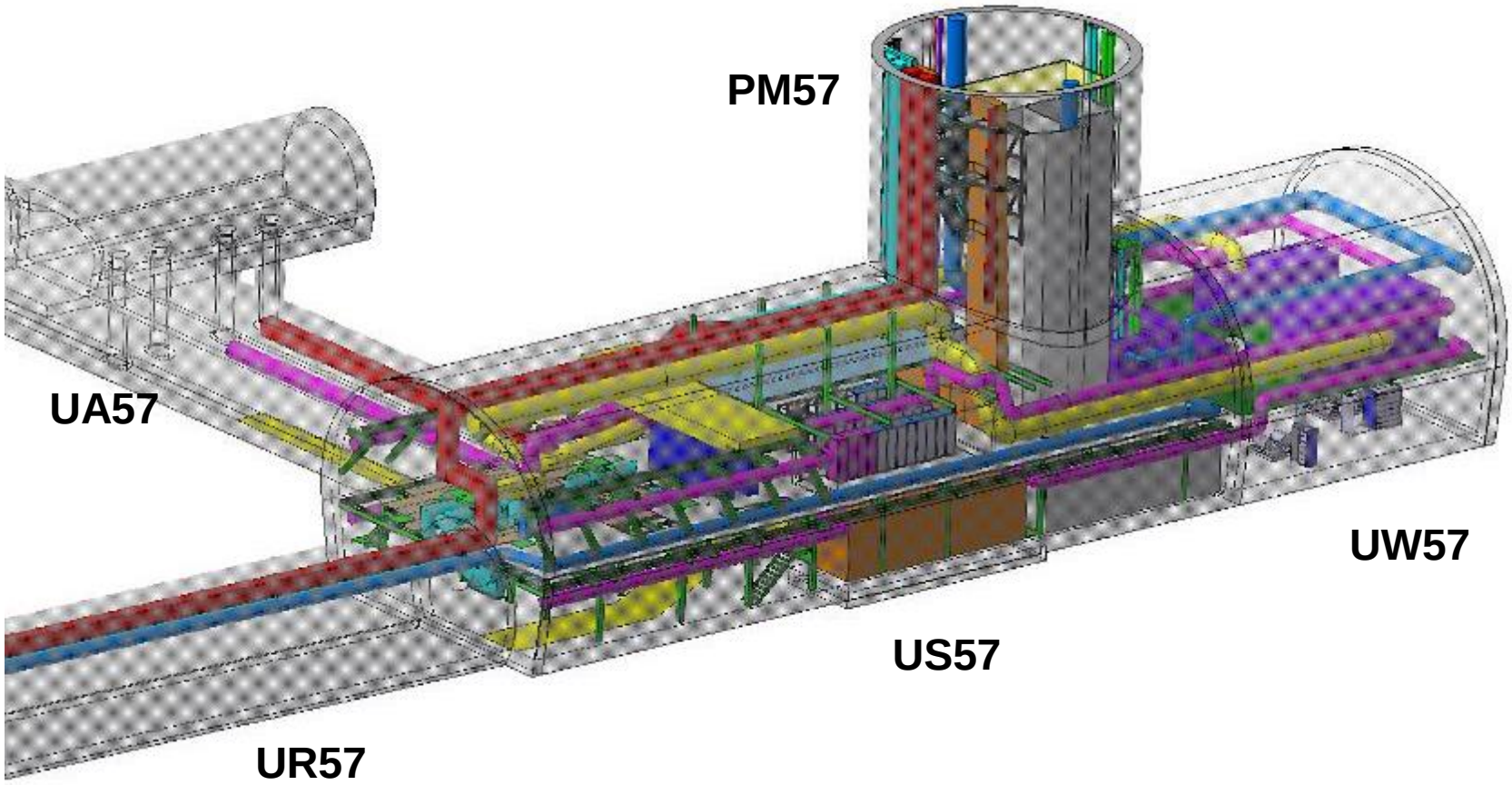


Example of SD17 & SD 57 cranes





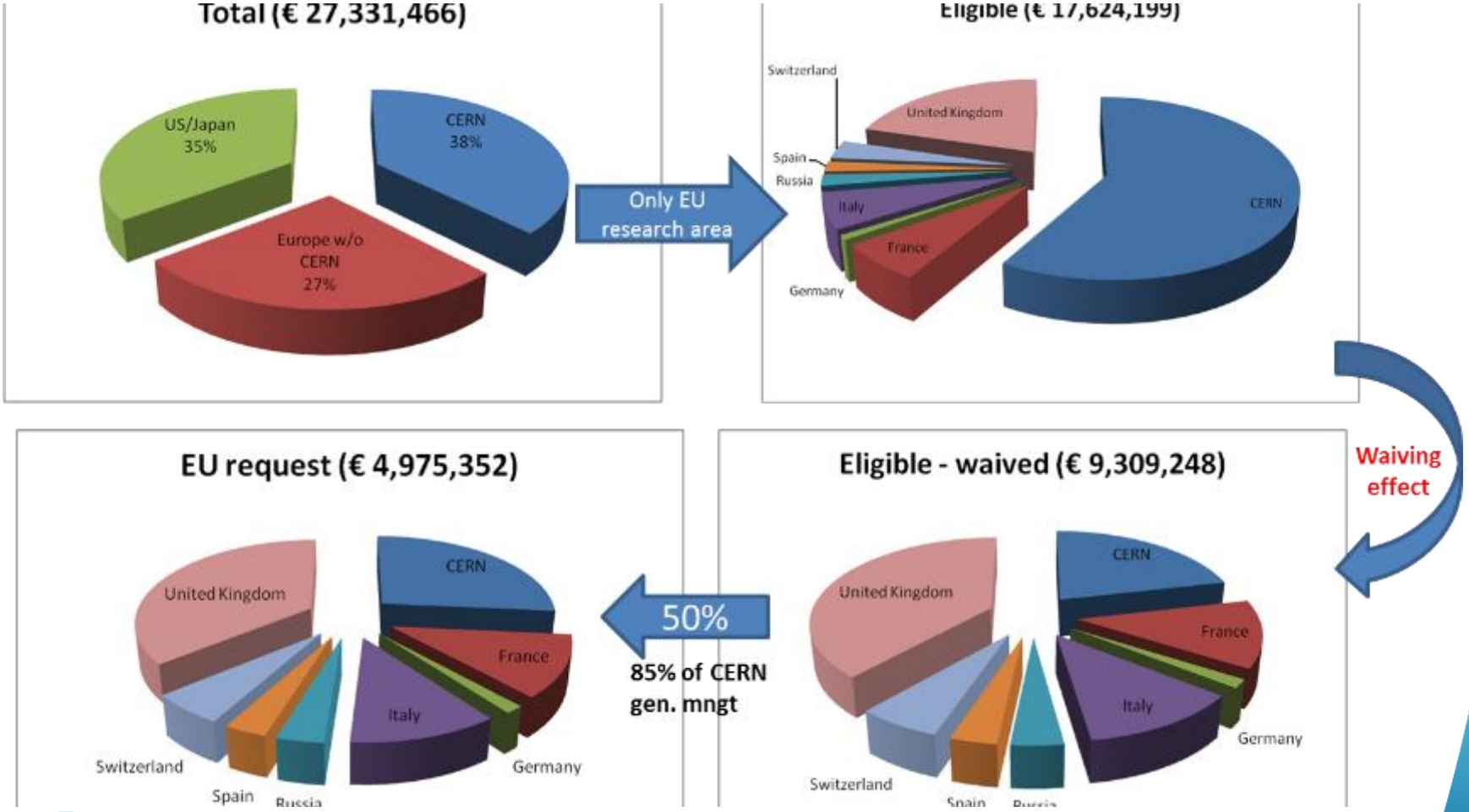
General view



Industry

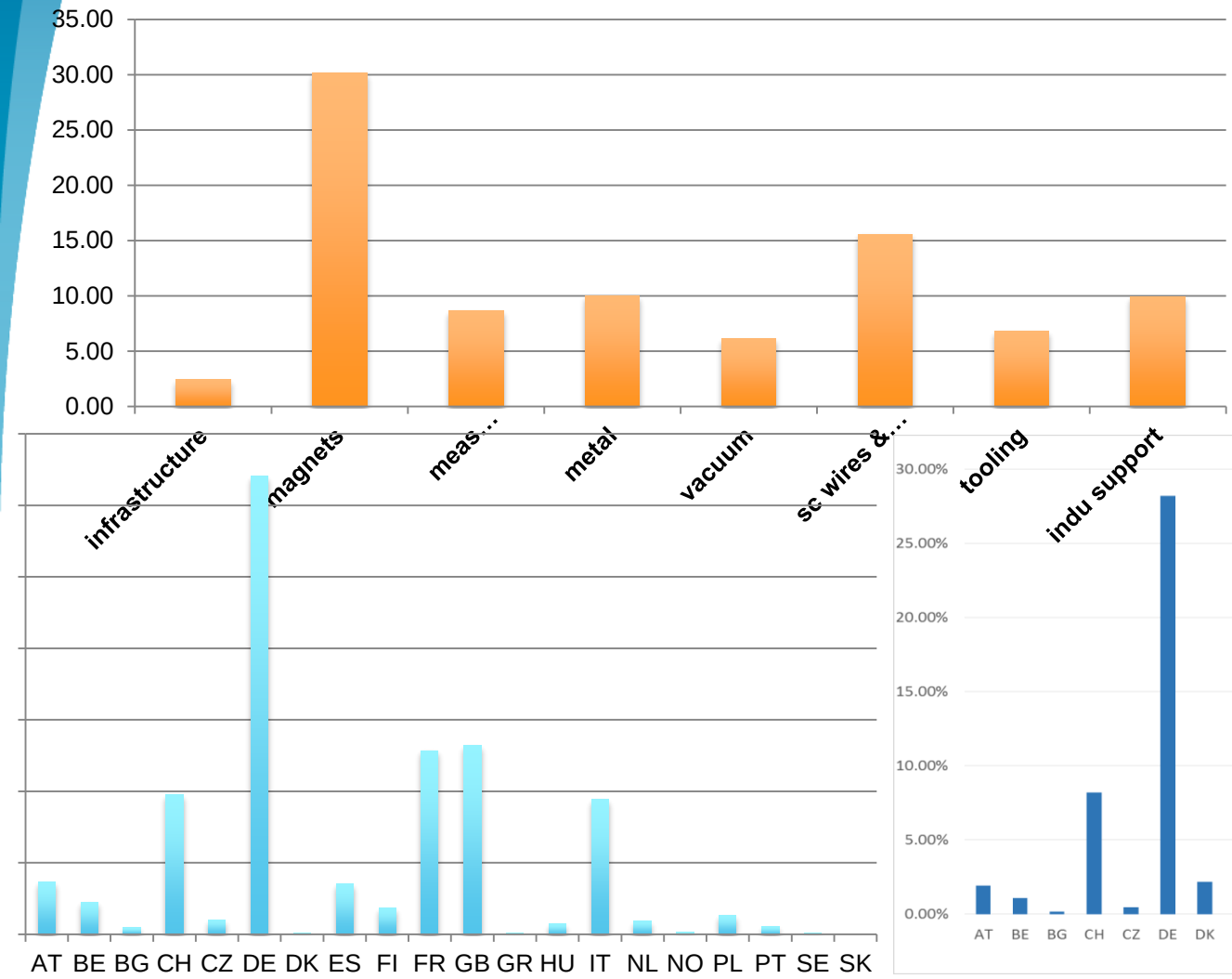
Procurement from HILUMI to HL-LHC

HILUMI FP7

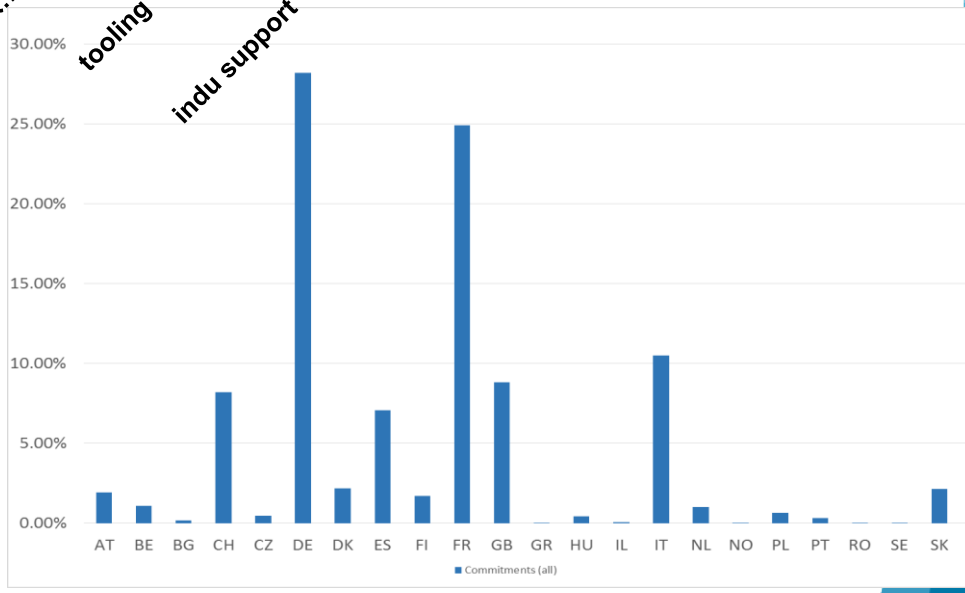

Total (€ 27,331,466)
US/Japan 35%
CERN 38%
Europe w/o CERN 27%
Only EU research area
Eligible (€ 17,624,199)
Switzerland
United Kingdom
Spain
Russia
Italy
France
Germany
CERN
Waiving effect
Eligible - waived (€ 9,309,248)
CERN
United Kingdom
France
Italy
Germany
Switzerland
Spain
Russia
50%
85% of CERN gen. mngt
EU request (€ 4,975,352)
CERN
United Kingdom
France
Italy
Switzerland
Spain
Germany

HILUMI Procurement

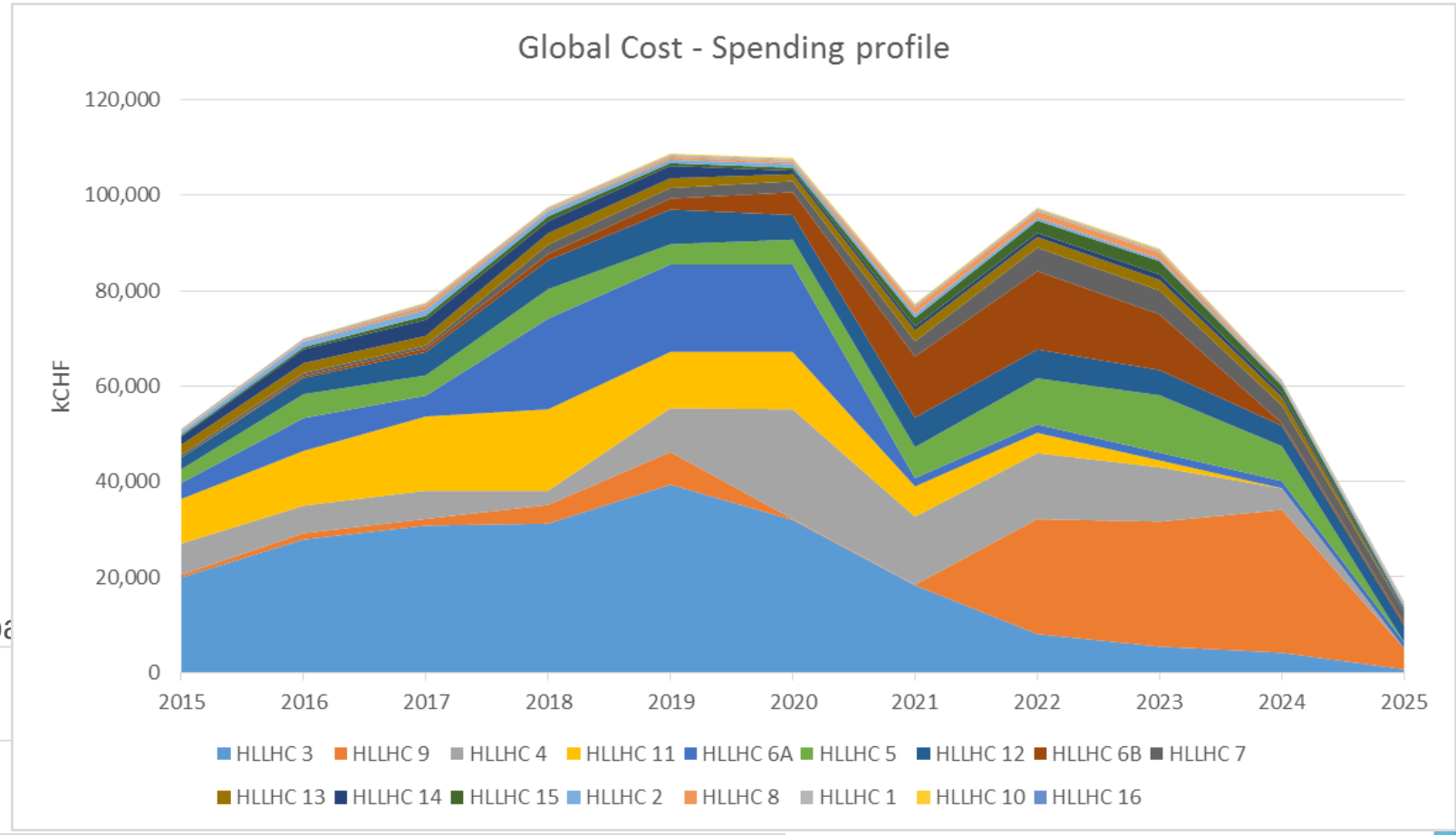
Hi-Lumi procurement sector allocation, %

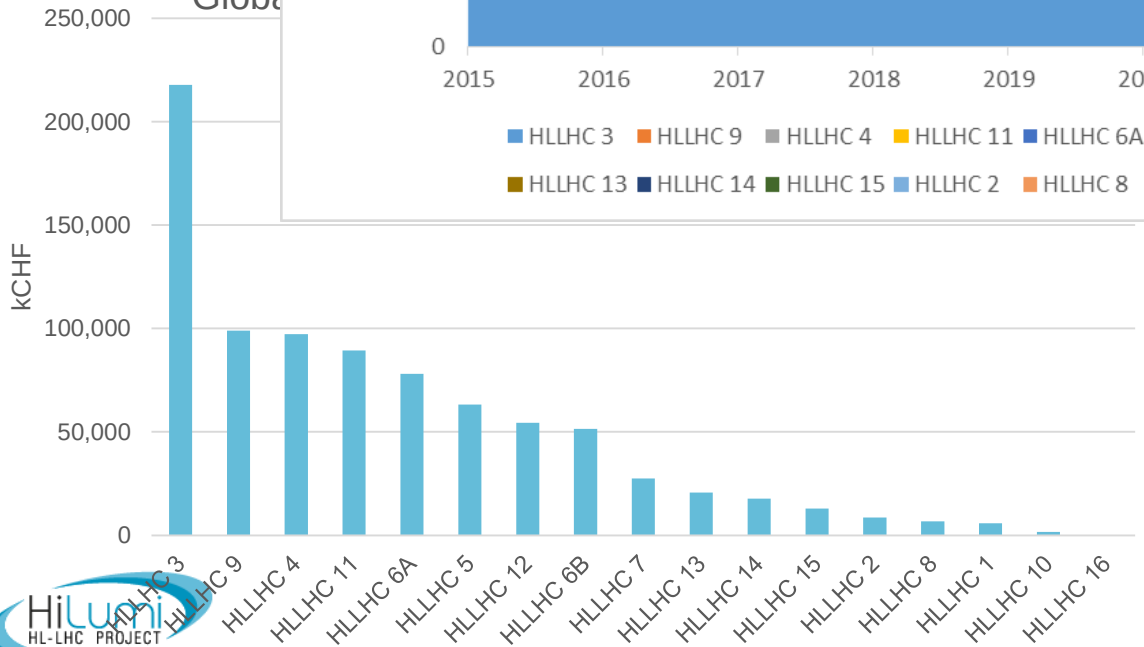


2012 - 2014



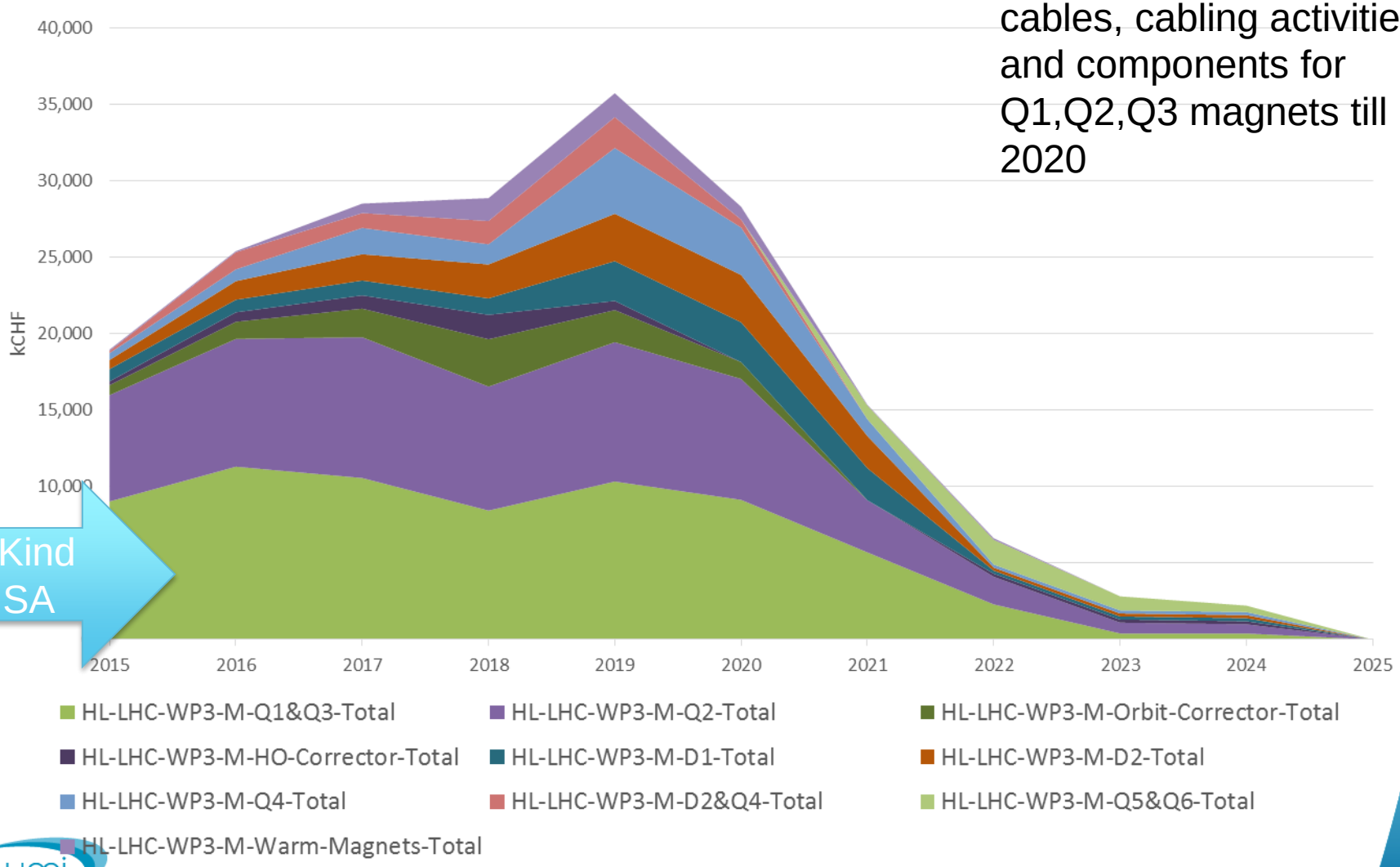
2012 - 2015


Global Cost - Spending profile
120,000
100,000
80,000
60,000
40,000
20,000
0
kCHF
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
HLLHC 3
HLLHC 9
HLLHC 4
HLLHC 11
HLLHC 6A
HLLHC 5
HLLHC 12
HLLHC 6B
HLLHC 7
HLLHC 13
HLLHC 14
HLLHC 15
HLLHC 2
HLLHC 8
HLLHC 1
HLLHC 10
HLLHC 16


250,000
200,000
150,000
100,000
50,000
0
kCHF
HLLHC 3
HLLHC 9
HLLHC 4
HLLHC 11
HLLHC 6A
HLLHC 5
HLLHC 12
HLLHC 6B
HLLHC 7
HLLHC 13
HLLHC 14
HLLHC 15
HLLHC 2
HLLHC 8
HLLHC 1
HLLHC 10
HLLHC 16

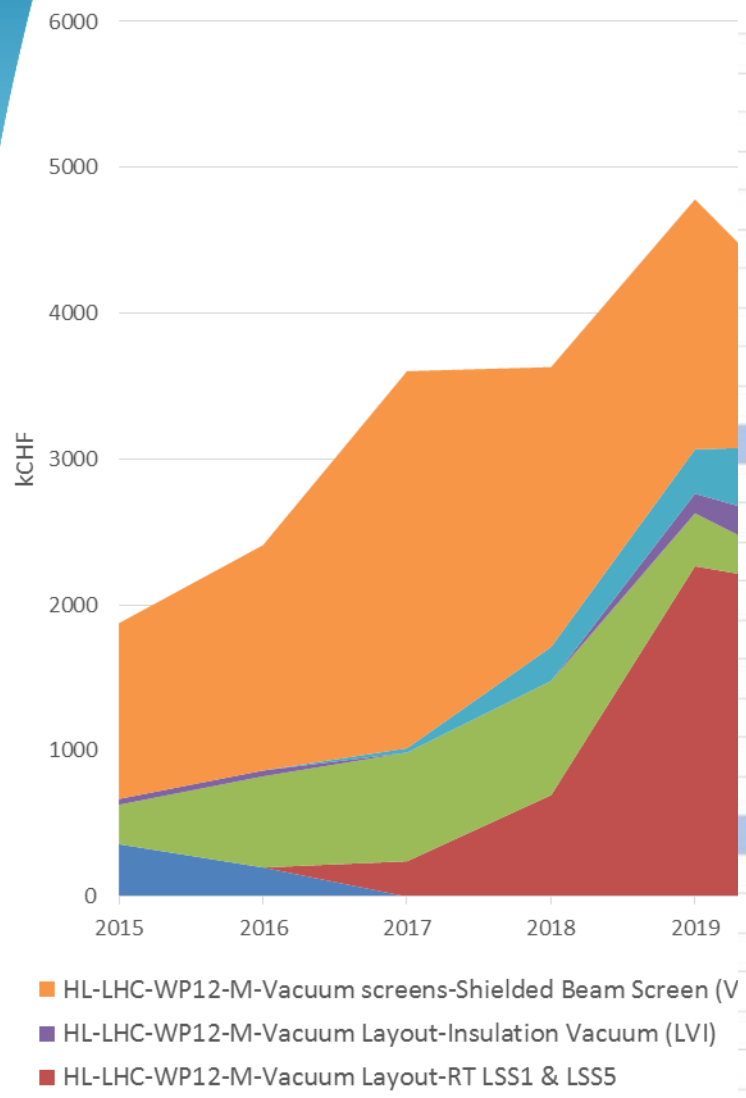
HL-LHC – IR Magnets

WP03 : most spending in GOODS, purchase of cables, cabling activities and components for Q1,Q2,Q3 magnets till 2020



In Kind USA

HL-L



WP12: Beam Vacuum	**Wed 01/01/14**
HL-LHC Shielded Beam Screen @P1 and P5	**Wed 01/01/14**
Acquisition process	**Tue 30/06/15**
tungsten (c>750)	Tue 15/12/15
Titane and supporting system (c<200)	Tue 14/06/16
Thermal link (c<200)	Tue 14/06/16
BS strip (cat 200<c<750)	Tue 30/06/15
BS colamination (cat 200<c<750)	Tue 15/12/15
BS punching, forming & welding (c>750)	Tue 15/12/15
cooling pipe (C<200)	Tue 14/06/16
CB (200<c<750)	Tue 15/12/15
PIM (cat c<200)	Tue 30/06/15
interconnect (beam vacuum+cooling) (200<c<750)	Tue 10/01/17
CWT (c<200)	Tue 14/11/17
Tooling BS horizontal coating -----> 500 (C<200)	Tue 14/06/16
HL-LHC (non shielded) Beam Screen	**Wed 01/01/14**
Acquisition process	**Tue 30/06/15**
BS strip (200<c<750)	Tue 30/06/15
BS colamination (200<c<750)	Tue 14/06/16
BS punching, forming & welding (200<c<750)	Tue 30/05/17
cooling pipe (C<200)	Tue 14/06/16
BS tube (c<200)	Tue 14/06/16
CB (c<200)	Tue 14/06/16
CWT (200<c<750)	Tue 23/01/18
Tooling BS coating (shared at 50 %) (c<200)	Tue 14/06/16
HL-LHC Beam Vacuum Layout in LSS1 & LSS5	**Wed 01/01/14**
Acquisition process	**Wed 11/01/17**
supports (200<c<750)	Tue 04/04/17
chambers (50% LSS) (c>750)	Wed 11/01/17
VM (c>750)	Wed 11/01/17
gauges (VGR, VGP,VGI) (200<c<750)	Tue 04/04/17
gauges (VGI) (c<200)	Tue 27/06/17
sector valves (c>750)	Wed 11/01/17
roughing valves (c<200)	Tue 27/06/17
VPI pumps (1 VPI tous les 14 m across all the ring) (c>750)	Wed 11/01/17
NEG cartridges (excluding ALARA 3 and 7 i.e. CONS 50 %) (c<200)	Tue 27/06/17
bakeout jackets, cable, thermocouple) (200<c<750)	Tue 04/04/17

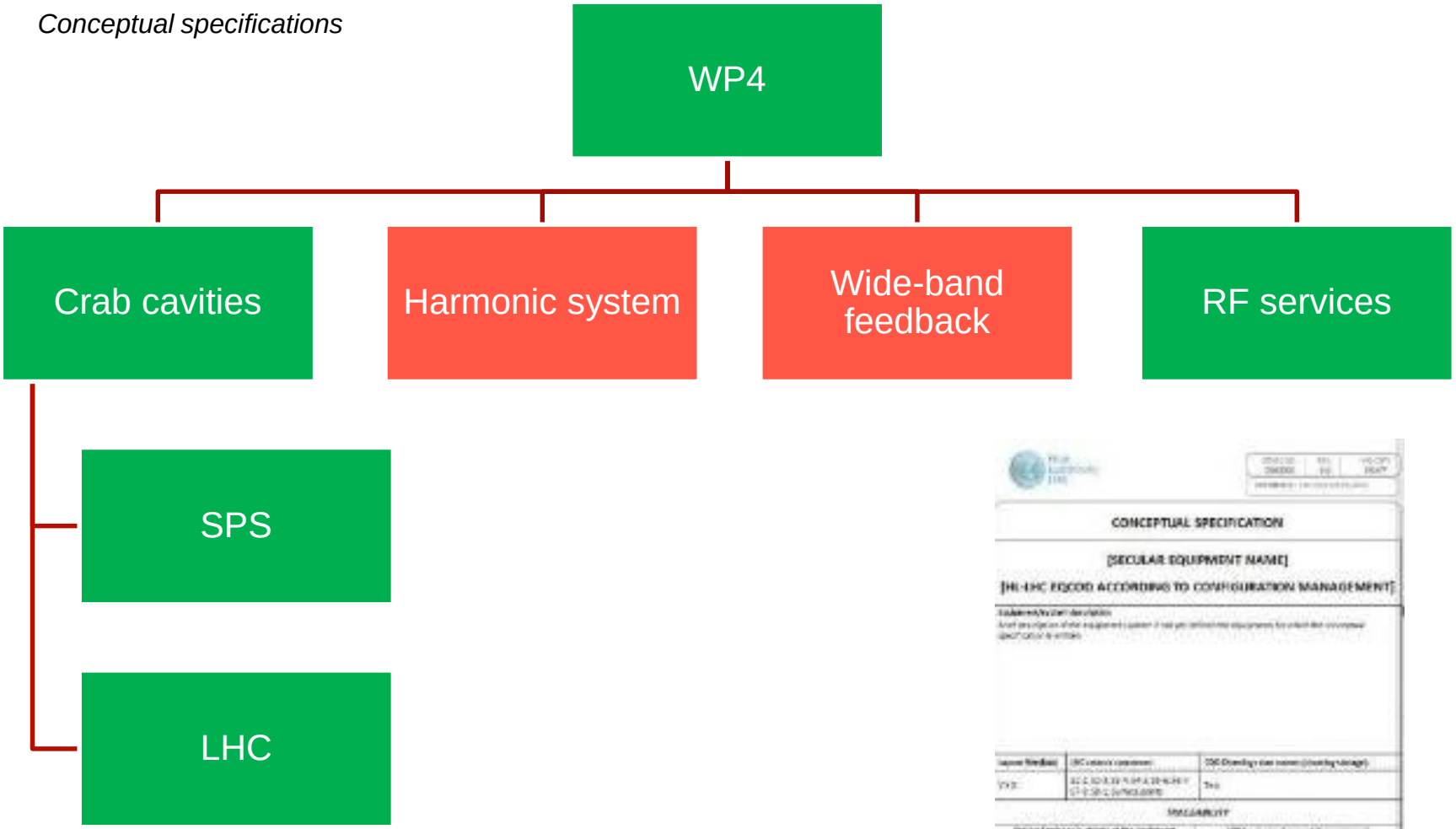
HiLumi HL-LHC PROJECT

Industry

Make or buy

Ex. WP4 Crab Cavities and RF systems

Conceptual specifications

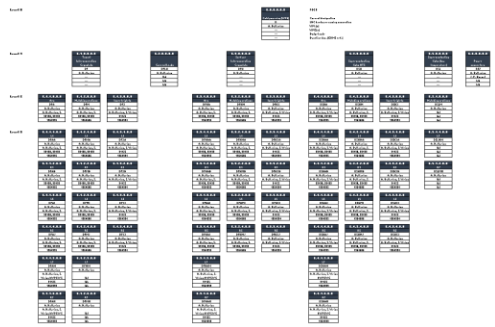


CONCEPTUAL SPECIFICATION

[SECULAR EQUIPMENT NAME]

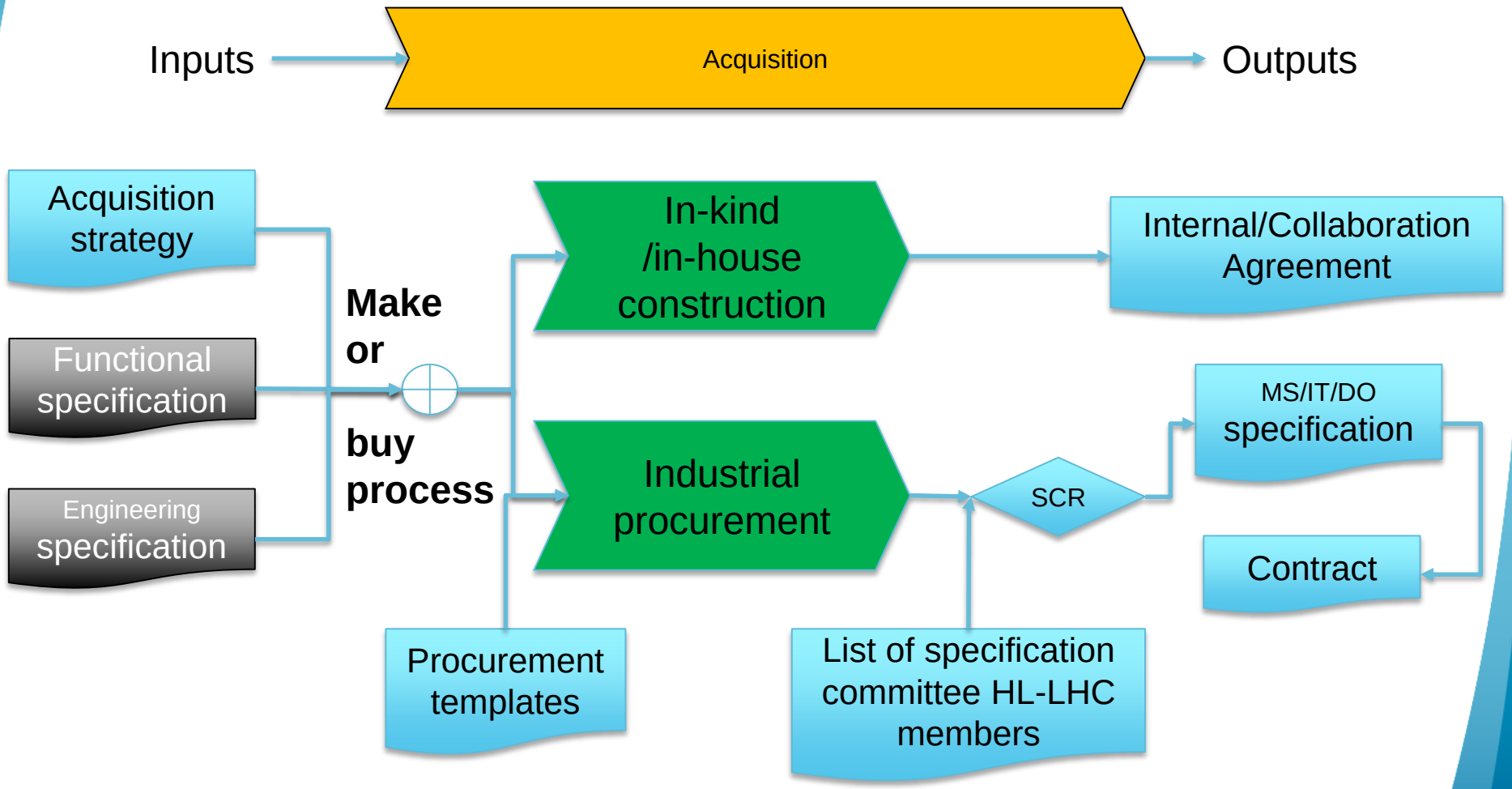
[HL-LHC EQCOD ACCORDING TO CONFIGURATION MANAGEMENT]

Analysis of the subcomponents



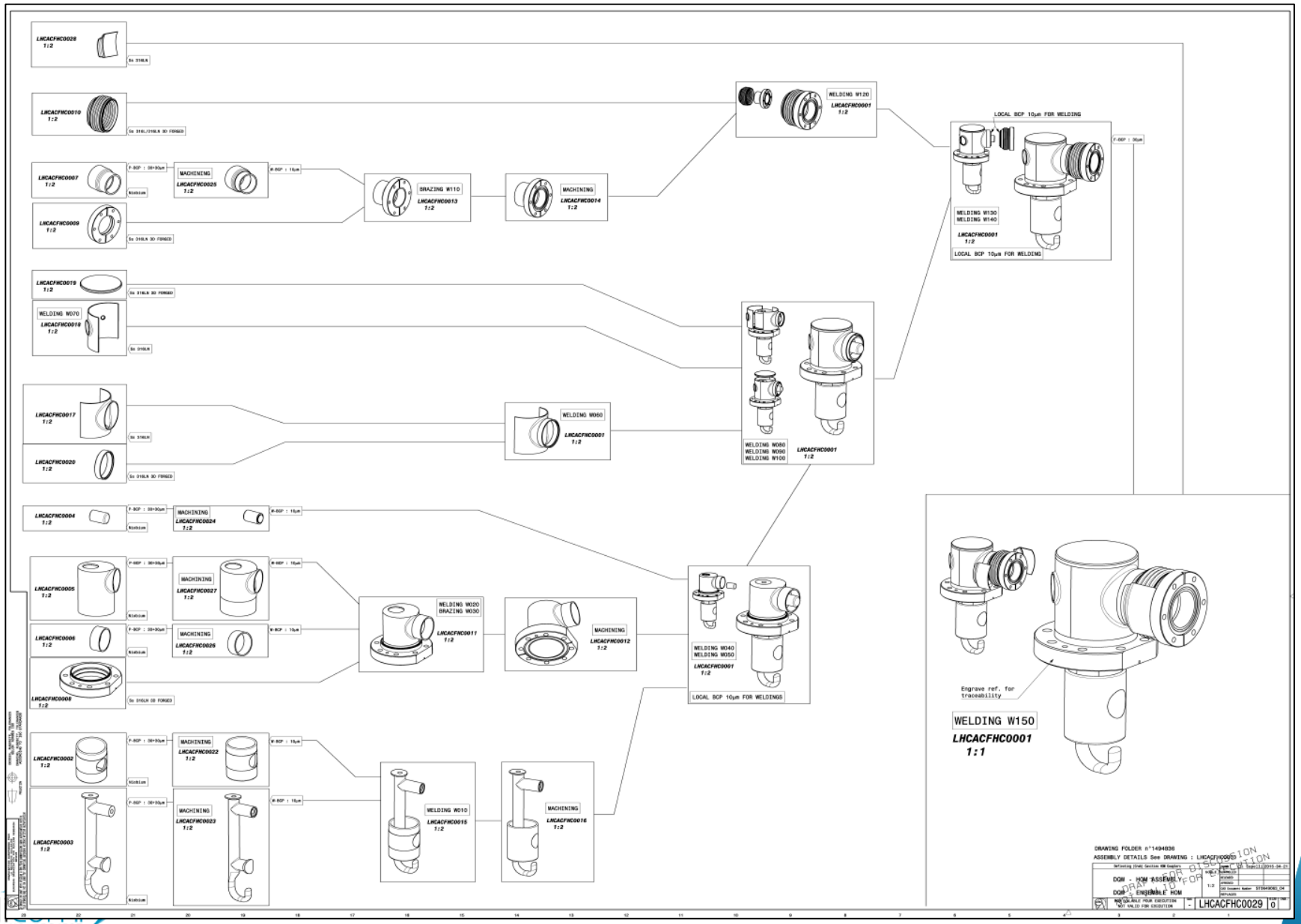
- WP4
  - Crab cavities **(ACF)**
    - LHC (ACF)
      - Cryomodule **(ACFGA)**
        - Vacuum vessel **(ACFVT)**
        - External supports (HACF)
        - Cryostat components (ACFAC)
          - *Cryogenic circuits*
          - *Supports*
          - *Thermal shield*
          - *Magnetic shield*
        - Dressed cavities **(ACFDC)**
          - Bare cavities with interfaces **(ACFCA)**
          - Tuning system **(ACFTU)**
          - Helium vessel **(ACFHT)**
          - HOM couplers **(ACFHC)**
        - Instrumentation (ACFIS)
        - Main coupler (ACFMC)
        - Vacuum valves (VVG)
      - RF services (ACFSV)
        - LLRF & Fast Controls (ALL)
        - RF racks (AY)
        - Slow controls (AS)
        - Transmission lines (ACFWG)
        - Pick-ups (APW)
    - SPS prototype (idem to LHC)

Acquisition process



SCR: Specification Committee Review

Example - HOM Couplers



Make or Buy Plan

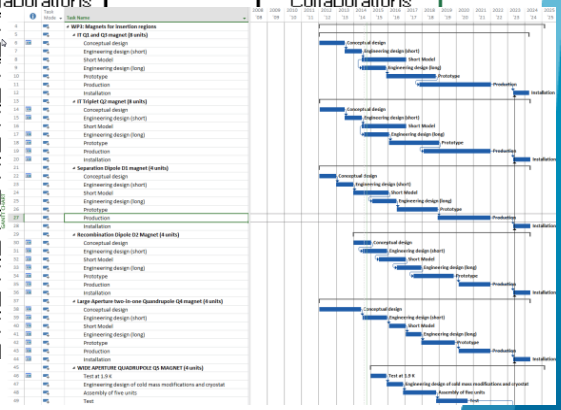
PBS Element Life-Cycle

High Luminosity LHC

EDMS NO.	REV.	VALIDITY
1517895	1.1	VALID
ACQUISITION		RESTRICTED

MAKE OR BUY PLAN

PBS Iter	LHC Equipment code	Name	Engineering specificatio	Fabricatior	Assembl	Verificatic	Installatio	Commissionir
4.1.1.1.0.0	ACFGA	SPS Cryomodule	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.1.0	ACFVT	SPS Vacuum vessel	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.2.0	HACF	SPS External supports	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.3.0	ACFAC	SPS Cryostat components	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.4.0	ACFDC	SPS Dressed cavities	CERN	CERN + New Collaborations	Collaboration US-LARP	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.4.1	ACFCA	SPS Bare cavities with interfaces	CERN	Collaboration US-LARP	Collaboration US-LARP	CERN + New Collaborations	CERN	CERN + New Collaborations
4.1.1.1.4.2	ACFTU	SPS Tunning system	CERN	CERN + New Contract	CERN	CE Coll		
4.1.1.1.4.3	ACFHT	SPS Helium vessel	CERN	Collaboration US-LARP	Collaboration US-LARP	CE Coll		
4.1.1.1.4.4	ACFHC	SPS HOM couplers	CERN	CERN	CERN	CE Coll		
4.1.1.1.4.5	Not defined yet	SPS Cold magnetic shield	CERN	Collaboration UK	Collaboration UK	CE Coll		
4.1.1.1.5.0	ACFIS	SPS Instrumentation	CERN	CERN + New Contract	CERN	CE Coll		
4.1.1.1.6.0	ACFMC	SPS Main coupler	CERN	CERN + New Contract	CERN	CE Coll		
4.1.1.1.7.0	VVG	SPS Vacuum valves	CERN	CERN + New Contract	CERN + New Contract	CE Coll		



HiLumi HL-LHC PROJECT

What and When

Name	Number of units	Engineering specification	Fabrication	Assembly	Verification
Power Converter [Current 16.5 kA, Voltage 20V, 1 Quadrant]	16	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 13 kA, Voltage 18V, 1 Quadrant]	8	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 6 kA, Voltage 8V, 1 Quadrant]	16	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±2 kA, Voltage ±10V, 4 Quadrant]	60	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.6 kA, Voltage ±10V, 4 Quadrant]	4	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.2 kA, Voltage ±10V, 4 Quadrant]	28	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.12 kA, Voltage ±10V, 4 Quadrant]	40	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 17 kA, Voltage ±18V, 2 Quadrant]	R&D	New collaboration			
Power Converter [Current 13 kA, Voltage ±18V, 2 Quadrant]	R&D	New collaboration			
Power Converter [Current 6 kA, Voltage ±10V, 2 Quadrant]	R&D	New collaboration			

2018

2020 for launching of Fabrication orders

Looking for (short term)

- Collaborations with universities interesting in R&D on 2-quadrant topologies for converters up to 17kA to improve current ramp down (17kA/±18V)
and squeeze time (6kA/±10V) – end 2015
- Potential suppliers from MS - before 2020

Contacts & more info

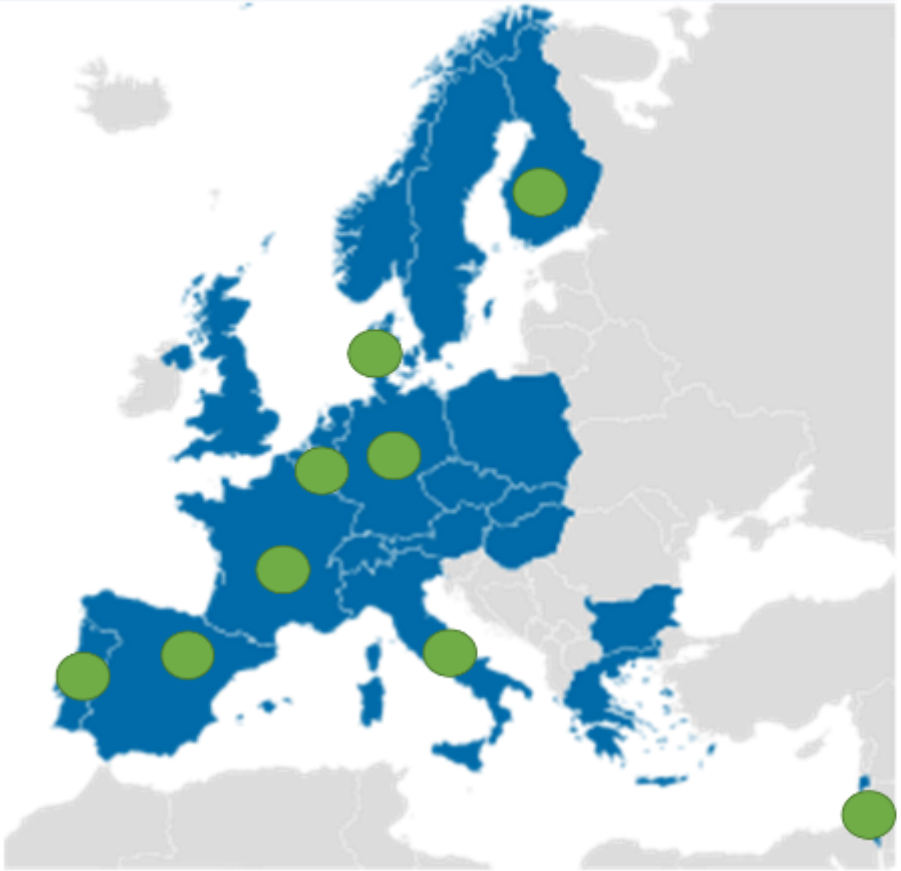
HL-LHC_Knowledge_and_Industry@cern.ch
WWW: HL-LHC Knowledge & Industry

HiLumi HL-LHC PROJECT

Example of procurement lists/suppliers

Domains of Activity

Power Converters



Presently identified as potential suppliers

MS	Firm	MS	Firm
AT		HU	
BE	JEMA	IL	TDK-LAMBDA
BG		IT	EEI, OCEM
CH		NL	
CZ		NO	
DE	TRANSTECHNIK, HEINZINGER	PL	
DK	DANFYSIK	PT	EFACEC
ES	JEMA	SK	
FI	KEMPOWER	SE	
FR	SIGMAPHI	UK	

PBS Item #	Name	WP	Required on	Foreseen cost	DR Description	Comments
3.1.0.0.0.0	Q2 Magnets	WP03	2015-05	c>750k	Strand for prototypes OST	
3.1.0.0.0.0	Q2 Magnets	WP03	2015-05	c>750k	Strand for prototypes PIT	
3.2.0.0.0.0	Q1 & Q3 Magnets	WP03	2015-05	c>750k	Strand for prototypes OST	
3.2.0.0.0.0	Q2 Magnets	WP03	2015-05	200k<c<750k	Winding-curing tooling	
3.2.0.0.0.0	Q2 Magnets	WP03	2015-06	200k<c<750k	Tooling: reaction fixture	
3.2.0.0.0.0	Q2 Magnets	WP03	2015-06	200k<c<750k	Tooling: impregnation fixture	
3.2.0.0.0.0	Q2 Magnets	WP03	2015-06	50<c<200k	Short model coil: End-parts (spacers, end-shoe)	
3.2.0.0.0.0	Q2 Magnets	WP03	2015-06	50<c<200k	Prototype coil: Poles and end-shoe extensions	
3.6.0.0.0.0	D2 Magnets	WP03	2015-08	50<c<200k	Manufacturing short model	
11.1.2.0.0.0	Cryo-Magnet assembly for High Field 11 T Dipole - Prototype	WP11	2015-08		Ceramic Binder	EDMS #1513360 - Specification for procurement Material will be also used for series
11.1.2.0.0.0	Cryo-Magnet assembly for High Field 11 T Dipole - Prototype	WP11	2015-08		Cable Insulation	EDMS #1431875 - Specification for procurement Material will be also used for series
3.2.0.0.0.0	Q2 Magnets	WP03	2015-09	50<c<200k	Laminated structure short model	
3.2.0.0.0.0	Q1 & Q3 Magnets	WP03	2015-09	50<c<200k	Laminated structure short model	
3.7.0.0.0.0	Orbit Correctors	WP03	2015-09	c>750k	Strand for correctors	

HiLumi HL-LHC PROJECT

Our objective

- The High Luminosity project seeks industrial suppliers and collaborations to start the construction phase and make the High Luminosity upgrade.
- CERN aims at fostering R&D collaborations and knowledge exchange also with SMEs, a perfect opportunity to match their capacity with the requirements of HiLumi.
- Next 4 years there will be intensive prototyping and the production of some of the first series of components.
- Understanding our needs is the first step to tender successfully.
- Understanding your capabilities and the know how that could come from industry is the best way to specify equipment that can be built by industry

Ready for the challenge?

Become a CERN supplier to built future accelerators

From the 22nd March visit us on

https://project-hl-lhc-industry.web.cern.ch

Procurement needs now->2018

Some examples

What and When

MAKE OR BUY PLAN

Name	Engineering specification	Fabrication	Assembly	Verification	Installation	Commissioning
SPS Cryomodule	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Vacuum vessel	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS External supports	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Cryostat components	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Dressed cavities	CERN	CERN + New Collaborations	Collaboration US-LARP	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Bare cavities with interfaces	CERN	Collaboration US-LARP	Collaboration US-LARP	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Tunning system	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Helium vessel	CERN	Collaboration US-LARP	Collaboration US-LARP	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS HOM couplers	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Cold magnetic shield	CERN	Collaboration UK	Collaboration UK	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Instrumentation	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Main coupler	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
SPS Vacuum valves	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Cryomodule	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Vacuum vessel	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC External supports	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Cryostat components	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations

2018

MAKE OR BUY PLAN

LHC Dressed cavities	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Bare cavities with interfaces	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Tunning system	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Helium vessel	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC HOM couplers	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Cold magnetic shield	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Instrumentation	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Main coupler	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
LHC Vacuum valves	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations
LLRF & Fast Controls	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
RF racks	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
Faraday Cages and Ancilliary Equipment	CERN	CERN + New Contract	CERN + New Contract	CERN + New Collaborations	CERN	CERN + New Collaborations
Slow controls	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
Transmission lines	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
Pick-ups	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
Power Amplifiers	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
Power Amplifiers	CERN	CERN + New Contract	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
4 - RF & Crab Cavities - Harmonic system	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
800 MHz	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations
200 MHz	CERN	CERN	CERN	CERN + New Collaborations	CERN	CERN + New Collaborations

2018

Looking for (short term)

- Collaborations interesting in R&D on Digital I/Q Demodulators & DSPs, low noise demodulators, Tetrode, IOT & SSPA, flexural guides , machining, forming techniques, E-beam welding and for Nb and NtTi sheets – by 2016
- Potential suppliers from MS on raw materials (Nb and NbTi), machining and forming of raw materials, vacuum valves and RF equipment – before 2016

Contacts & more info

HL-LHC_Knowledge_and_Industry@cern.ch
WWW: HL-LHC Knowledge & Industry

HiLumi HL-LHC PROJECT

High Luminosity LHC

What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Target Collimator Tertiary Pick-up Metallic	CERN	New procurement contract	New procurement contract	New procurement contract	CERN	CERN
Long Collimator IR1&IR5	CERN	New procurement contract	New procurement contract	New procurement contract	CERN	CERN
Target collimator long mask IR1&IR5	CERN	New procurement contract	New procurement contract	New procurement contract	CERN	CERN
Target Collimator Long Dispersion suppressor	CERN	New procurement contract	New procurement contract	New procurement contract	CERN	CERN
Target Seconday Collimator Pick-up Metallic	CERN	New procurement contract	New procurement contract	New procurement contract	CERN	CERN

2018

Looking for (short term)

- Potential suppliers from MS on Raw Materials for Advanced Collimators for Accelerators & manufacturers of Collimators – before 2016

Contacts & more info

HL-LHC_Knowledge_and_Industry@cern.ch
WWW: HL-LHC Knowledge & Industry

What and When – WP6a: Cold Powering

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Tunnel Interconnection cryostats prototype	CERN	CERN or Industry	CERN	CERN	CERN	CERN
Current Leads prototype	CERN	CERN or Industry	CERN or Industry	CERN	CERN	CERN
Surface cryostats prototype	CERN	CERN or Industry	CERN	CERN	CERN	CERN
Superconducting links prototype	CERN	Industry	CERN	CERN	CERN	CERN
Tunnel Interconnection Cryostats series	CERN	Industry	CERN	CERN	CERN	CERN
Current Leads series	CERN	Industry	Industry	CERN	CERN	CERN
Surface cryostats series	CERN	Industry	CERN	CERN	CERN	CERN
Superconducting links series	CERN	Industry	CERN	CERN	CERN	CERN

2018

Looking for (short term)

- Potential suppliers from MS on cabling of superconducting and semi flexible long cryostats – by 2016

Contacts & more info

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What and When

Name	Number of units	Engineering specification	Fabrication	Assembly	Verification
Power Converter [Current 16.5 kA, Voltage 20V, 1 Quadrant]	16	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 13 kA, Voltage 18V, 1 Quadrant]	8	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 6 kA, Voltage 8V, 1 Quadrant]	16	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±2 kA, Voltage ±10V, 4 Quadrant]	60	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.6 kA, Voltage ±10V, 4 Quadrant]	4	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.2 kA, Voltage ±10V, 4 Quadrant]	28	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current ±0.12 kA, Voltage ±10V, 4 Quadrant]	40	CERN	New procurement contract	New procurement contract	New procurement contract
Power Converter [Current 17 kA, Voltage ±18V, 2 Quadrant]	R&D	New collaboration			
Power Converter [Current 13 kA, Voltage ±18V, 2 Quadrant]	R&D	New collaboration			
Power Converter [Current 6 kA, Voltage ±10V, 2 Quadrant]	R&D	New collaboration			

2018

2020 for launching of Fabrication orders

Looking for (short term)

- Collaborations with universities interesting in R&D on 2-quadrant topologies for converters up to 17kA to improve current ramp down (17kA/±18V) and squeeze time (6kA/±10V) – end 2015
- Potential suppliers from MS – before 2020

Contacts & more info

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High Luminosity LHC

What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Energy extraction system - High DC Switches, By pass Diodes, High power diodes, High Power Resistors, Electronics Controls	CERN + New Collaboration	New procurement contract	New procurement contract	CERN + New Contract	CERN + New Collaboration	CERN + New Collaboration
Beam Interlock System - Electronic Cards and Cabling, Optical Components, and communications	CERN	New procurement contract	New procurement contract	CERN + New Contract	CERN + New Collaboration	CERN
Quench Detection System - Electronic Boards, Cabling, Communications	CERN	New procurement contract	New procurement contract	CERN + New Contract	CERN + New Collaboration	CERN
Power Interlock - PLC (Safety PLCs) and Cabling	CERN	New procurement contract	New procurement contract	CERN + New Contract	CERN + New Collaboration	CERN

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Looking for (short term)

- Collaborations with universities interesting in R&D on design and manufacturing of Mechanical High DC Current Switches, Cold By-pass Diodes and Assembly of these Diodes – before 2016
- Potential suppliers from MS – before middle 2017

Contacts & more info

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What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Neutral Beam Absorber TAXN (ATLAS, CMS)	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations
Neutral Beam Absorber TAXN (LHCb)	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations
Target Absorber for Insertion region TAXS (ATLAS, CMS)	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations
Radiation shielding (ATLAS & CMS)	CERN	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations	CERN + New Collaborations

2018

Looking for (short term)

- Collaborations with universities interesting in R&D on design and manufacturing of Neutron absorbers for accelerators – end 2015
- Potential suppliers from MS on machining in situ of radioactive materials – before 2016

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What and When

MAKE OR BUY PLAN

Name	Fabrication	Assembly	Verification	Installation	Commissioning
Q1 & Q3 Magnets					
Model	Collaboration US-LARP	Collaboration US-LARP	Collaboration US-LARP		
Prototype	Collaboration US-LARP	Collaboration US-LARP	Collaboration US-LARP	CERN	Collaboration US-LARP
Series	Collaboration US-LARP	Collaboration US-LARP	Collaboration US-LARP	CERN	CERN
Q2 Magnet					
Model	CERN	CERN	CERN		
Prototype	CERN	CERN	CERN	CERN	CERN
Series	CERN	CERN	CERN	CERN	CERN
Short Orbit Corrector					
Model					
Prototype	Collaboration CIEMAT	Collaboration CIEMAT	CERN		
Series	New procurement contract	New procurement contract	CERN		
Long Orbit Corrector					
Model					
Prototype	Collaboration CIEMAT	Collaboration CIEMAT	CERN		
Series	New procurement contract	New procurement contract	CERN		
High Order Correctors					
Model					
Prototype	Collaboration INFN	Collaboration INFN	Collaboration INFN	CERN	CERN
Series	New procurement contract	New procurement contract	Collaboration INFN	CERN	CERN

2018

MAKE OR BUY PLAN

Name	Fabrication	Assembly	Verification	Installation	Commissioning
D1 Magnet					
Model	Collaboration KEK	Collaboration KEK	Collaboration KEK		
Prototype	New procurement contract	New procurement contract	Collaboration KEK	Collaboration KEK	CERN
Series	New procurement contract	New procurement contract	Collaboration KEK	CERN	CERN
D2 Magnet					
Model	New procurement contract	New procurement contract	Collaboration INFN		
Prototype	New procurement contract	New procurement contract	CERN	CERN	CERN
Series	New procurement contract	New procurement contract	CERN	CERN	CERN
Q4 Magnet					
Model	Collaboration CEA	CERN	Collaboration CEA		
Prototype	New procurement contract	New procurement contract	Collaboration CEA	CERN	CERN
Series	New procurement contract	New procurement contract	Collaboration CEA	CERN	CERN
D2 & Q4 Correctors					
Model					
Prototype	CERN	CERN	CERN		
Series	New procurement contract	New procurement contract	CERN		
Q5 Magnet					
Model					
Prototype					
Series					

2018

Looking for (short term)

- Potential suppliers from MS on Raw Materials Metallic and non-Metallic (Stainless Steel, Cooper, Low Carbon Steel, Fiberglass, Mica, Ceramic Binder), Machining of metallic components, Machining of composite component and Cryostats – before March 2016

Contacts & more info

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What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Magnet Model Single aperture	CERN	CERN + New suppliers	CERN	CERN		
Magnet Model Double aperture	CERN	CERN + New suppliers	CERN	CERN		
Cryo-Magnet assembly for High Field 11 T Dipole - Prototype	CERN	CERN + New suppliers	CERN	CERN + New suppliers		
Cryo-Magnet assembly for High Field 11 T Dipole - Series	CERN	CERN + New suppliers	CERN	CERN + New suppliers	CERN + New Collaborations	CERN + New Collaborations

2018

Looking for (short term)

- Potential suppliers from MS on Raw Materials Metallic and non-Metallic (Stainless Steel, Cooper, Low Carbon Steel, Fiberglass, Mica, Ceramic Binder), Machining of metallic components, Machining of composite component and Cryostats – before March 2016

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What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Shielded Beam Screen (VSM)	CERN	New procurement contract	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry
Beam Screen non-shielded (VSC)	CERN	New procurement contract	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry
In-situ coating of Inner tripplets IT2 & IT8	CERN	CERN	CERN	CERN	CERN + Industry	CERN + Industry
Room temperature vacuum system in LSS1 & LSS5	CERN	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry
Room temperature vacuum system in LSS4	CERN	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry
Insulation Vacuum system	CERN	New procurement contract	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry
Vacuum system in experimental areas	CERN	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry	CERN + Industry

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Looking for (short term)

- Collaborations with universities interesting in R&D on Laser Engineered Surface – before 2017
- Potential suppliers from MS on Bake out System, Machining and Assembly of UHV Components, Raw Materials (W alloy, Al alloy, SS…), Beam screens, bellows for UHV, Supports and Vacuum system controllers – before 2018

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What and When

MAKE OR BUY PLAN						
LHC Equipment code	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Beam diagnostics & instrumentation - BLM - Beam loss monitors	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BWSF - Fast wire scanners	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BPM - Beam position monitors	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BRANQ - Luminosity monitors	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BPW - Wide-band pick-ups	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BSR - Synchroton light monitors	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - BGV - Beam Gas Vertex Detector	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam diagnostics & instrumentation - Long range beam-beam compensator	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN

2018

Looking for (short term)

Qualification of potential suppliers:

- cryogenic cables – before 2017
- UHV RF feedthroughs – before 2017
- Packaged diamond detectors – before 2017

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What and When

MAKE OR BUY PLAN						
Name	**Engineering specification**	**Fabrication**	**Assembly**	**Verification**	**Installation**	**Commissioning**
Beam transfer & kickers - Injection System - Absorber for Injection Segmented	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - Injection System - Collimator for D1 Protection	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - Injection System - Injection kickers	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - Injection System - Beam Instrumentation	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - LHC Beam Dumping System - Collimator for MSD Protection	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - LHC Beam Dumping System - Diluter Dump Kicker	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN
Beam transfer & kickers - LHC Beam Dumping System - Controls	CERN	CERN + New Contract	CERN + New Contract	CERN + New Contract	CERN	CERN

2018

Looking for (short term)

- Potential suppliers from MS on Raw Materials (Glidcop, Graphite, 3D C-C composites), machining of components, Welding (Electro Beam Welding), Brazing, Interferometers, Bake out coating, Vacuum equipment and Water System equipment – before 2017

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The most busy section