



CONS and HL-LHC day

Analysis of needs from TE-MS

Luca Bottura and Jean-Philippe Tock

CERN 26.09.2017

CONS and HL-CONS approved requests

I.LHC COMPLEX

	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
1	SMI2 cryostat benches & tooling	790	<100 (OPER)	[2017-2022]
2 ⁽¹⁾	LHC corrector magnets (MCBC, MCBY, MQTL)	1300	100	[2018-2021]
3	Adaptation of SM18 benches for testing IR (spare) magnets	220	<100 (OPER)	[2017-2019]
4	Consolidation of a 3D Hall-probe mapper	76	100	[2018]
5	Consolidation and Spares of the LHC Warm Magnets	376	100	[2017-2019]

NOTES

(1) The present estimate for the construction of the MCBY correctors required by HL-LHC largely exceeds allocated budget (order of 5 MCHF). This is due to the larger production scope (10 MCBC + 24 MCBY magnets vs. 10 MCBC originally planned).

CONS and HL-CONS approved requests

I.LHC COMPLEX

	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
6	Repair of 2 15T-Solenoids for the Ic test stations in bldg. 163	84	100	[2017-2018]
7 ⁽¹⁾	Austenitic stainless steel	new 1410	100	[2018-2019]
8 ⁽²⁾	S/C magnets components: busbars, insulation, other components	reprofiled 660	<<100 (OPER)	[2017-2022]
9 ⁽²⁾	S/C magnets cryostats	reprofiled 540	<<100 (OPER)	[2017-2023]
10	Cold test and storage of spare diodes	150	<100	[2017-2018]

NOTES

- (1) High-strength material required for LHC spares and HL-LHC magnets. The raw-material stock is less extensive than originally thought.
- (2) Later refurbishment for LHC stock. This activity is a small part of the operation budget for magnet repair and maintenance

CONS and HL-CONS approved requests

I.LHC COMPLEX

	Description		Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
11 ⁽¹⁾	Winding machine and presses	shared HL-LHC	1430	50	[2017-2021]
12 ⁽²⁾	LHC MQ cold mass manufacture	new	4315	<100	[2017-2021]
13	S/C magnet components: strands and cables	new	830	50	[2017-2019]

NOTES

- (1) Part of the refurbishment is necessary to adapt to HL-LHC geometries
- (2) No working MQ magnet left in stock (only cold masses). Order to be placed by CERN, follow-up by CEA (contract signed)
- (3) 0.475 mm Nb-Ti wire for Q4, MCBXF and later MQM/MQY manufacturing, only a few UL in stock (order of 10)

CONS and HL-CONS approved requests

II.PS COMPLEX

Item n.	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
1	LINAC quadrupoles	228	100	[2017-2018]
2	Refurbishment of the TT2 quadrupole magnets (43 magnets)	432	100	[2017-2019]
3	Replacement of old PFW (44 magnets)	1000	100	[2018-2019]
4	Consolidation of measured and synthetic B-train systems	2283	100	[2017-2021]
5	ISOLDE: GPS separator	100	100	2018
6	ISOLDE: HRS separators	200	100	[2018-2019]
7	ISOLDE: Triplets	280	100	[2018-2020]
8	Spare bending for REX	70	100	2017
9	Replacement magnet BHZ377 & 378	18	100	[2017-2019]
10	Procurement of 80 additional PFW	1200	100	[2017-2018]

CONS and HL-CONS approved requests

II.PS COMPLEX

Item n.	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
11	LEIR spares	135	100	2017
12	PSB Spare main bending magnet coils	150	100	[2017-2018]
13	Spare Multipoles Types A, 1A, 2A & 2B, and the spare type 1 corrector magnets of the PSB	170	100	[2017-2018]

CONS and HL-CONS approved requests

III.SPS COMPLEX

Item n.	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
1	SPS, chromaticity sextupoles	67	100	2018
2	Spare coils (10) for MBB magnets	1300	100	[2018-2019]

CONS and HL-CONS approved requests

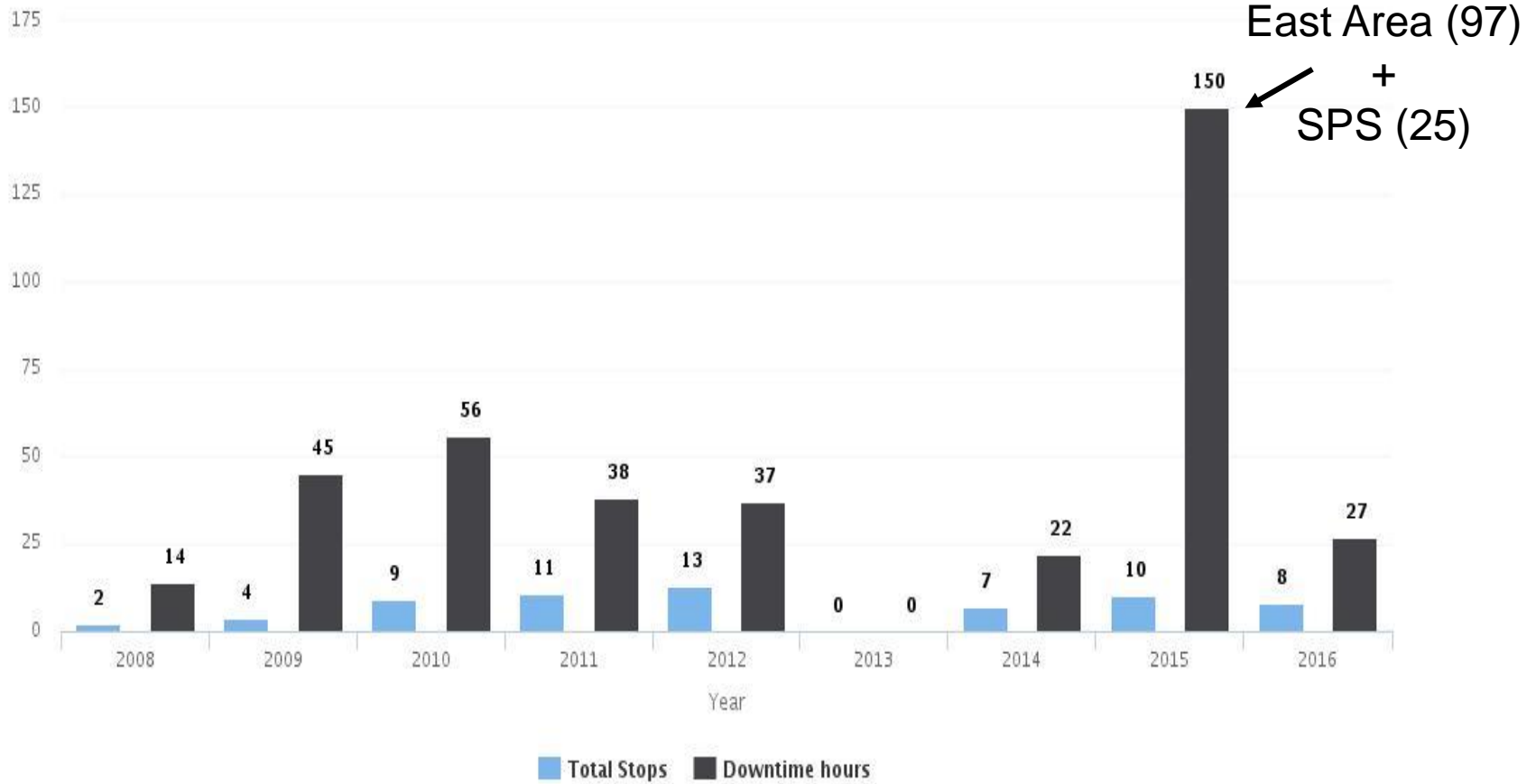
IV. AD-EA-NA

Item n.	Description	Approved Budget	Funding (CONS/HL-CONS) %	Budget to be allocated in the years
1	AD Consolidation main bending BHN	42	100	2017
2	AD Consolidation target magnets	400	100	[2017-2018]
3	North Area Consolidation	350	100	[2017-2019]

Downtime in injectors

Downtime per year

Machines stopped due to magnets



NORMA

CONS and HL-CONS requests pending approval

Item n.	Description	Budget request	Budget to be allocated in the years	Pending	Refused
1 ⁽¹⁾	LHC MQM/MQY cold mass manufacture	2500	[2021-2023]	Draft 3	
2 ⁽²⁾	S/C magnet components: strands and cables	520	[2020-2021]	Draft 3	
3 ⁽³⁾	Current leads for DFB, SSS	1404	[2020-2025]	Draft 3	
4 ⁽⁴⁾	MPLV and MPSV spares for SPS	320	2018		

NOTES

- (1) This will be needed when the new Q4 will be assembled (not enough MQY's)
- (2) Complement Nb-Ti wire, to cover MCBY and MQY manufacturing
- (3) Approved item, on-going negotiation with EN-MME as to the manufacturing schedule, presently very long (hence item postponed to after LS2)
- (4) This was part of the scraper scheme, will be replaced by spare demand

CONS and HL-CONS requests pending approval or refused

Item n.	Description	Budget request	Budget to be allocated in the years	Pending	Refused
5 ⁽¹⁾	LHC magnet test stations - Bdg. SM18 (obsolete hardware, DAQ, controls upgrades)	400	[2017-2018]		Draft 5
6 ⁽²⁾	LHC magnet test stations - Bdg. SM18 (water cooled cables)	900	[2017-2019]		Draft 5
7 ⁽³⁾	Spares from targets to experiments	300	2017		Draft 5

NOTES

- (1) Partly taken by SM18-UPG, but pending evaluation with TE-MPE
- (2) Only two clusters (A+F) are covered by the SM18-UPG, will require re-evaluation and action to allow testing of magnets
- (3) On-going discussion on AD target area, not yet resolved

CONS and HL-CONS requests pending approval or refused

Item n.	Description	Budget request	Budget to be allocated in the years	Pending	Refused
8 ⁽¹⁾	S/C magnet components: iron for spares	400	2021		Draft 5
9 ⁽²⁾	Winding machine and presses (HL-LHC part)	800	[2017-2020]		Draft 5

NOTES

- (1) Was mistaken for magnetic iron, substituted by the austenitic SS procurement
- (2) Agreement with HL-LHC that this cost will be covered by the project

MQM/MQY magnet manufacture

Rational of the request

Total Budget request	2500	Budget to be allocated in years (from-to)	[2021-2023]
Material budget request	2500	Personnel available [y/n] in addition to personnel budget request	y
Personnel budget request (M2P budget for MPAs and fellows)	To be evaluated		

Consequences of suppression of request

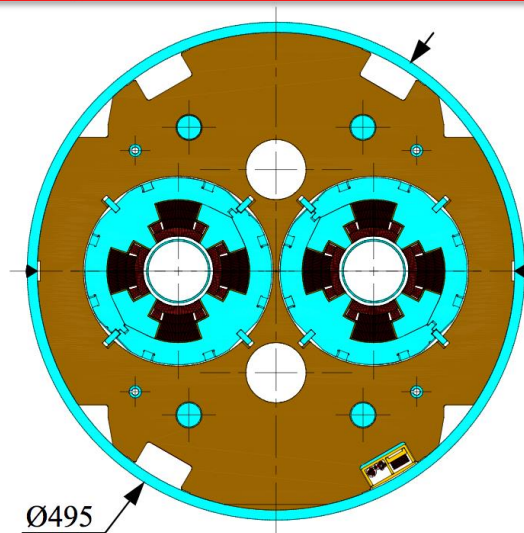
The number of MQM and MQY magnets covers only one insertion (one-side), more spares will reduce construction times, especially in view of NC resolution and HL-LHC. Note that the HL-LHC Q4 consists of an MQY. This activity to start during/after LS2 (not yet documented in EDMS), but could be re-profiled after LS2

Consequences of delay of request

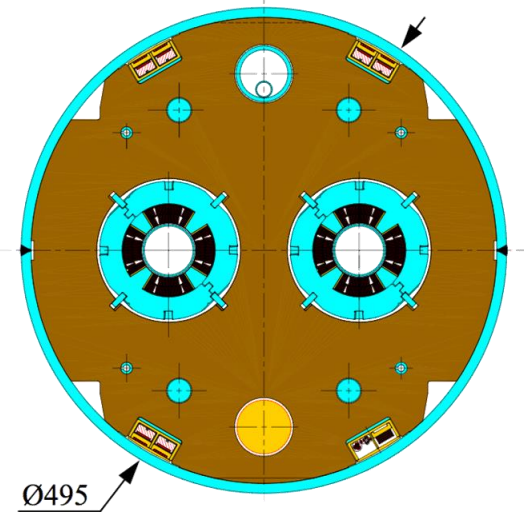
No consequence provided the magnets are built by LS3 (industry readiness)

MQM/MQY magnet manufacture

MQY
4 layers
graded design
2 cables
8.3mmx1.285mm/8.3mmx0.845mm
2 strands
0.735mm/0.475mm



MQM
2 layers
1 cable
8.8mmx0.84mm
1 strand
0.475mm



S/C magnet components: strands and cables

Rational of the request

Total Budget request	520	Budget to be allocated in years (from-to)	[2020-2021]
Material budget request	520	Personnel available [y/n] in addition to personnel budget request	y
Personnel budget request (M2P budget for MPAs and fellows)	To be evaluated		

Consequences of suppression of request

SC strands and cables required for manufacturing MQY spares

Consequences of delay of request

No consequence provided the magnets are built by LS3 (industry readiness)

S/C magnet components: strands and cables

EDMS 1737765 v.3

Project	nb	Needed Length (m)	UL type	Qty	Strand type	Cable type	Strands per cable	Strand length (m)	First UL batch need delivery date
MQYYSM Q4 Short model	1	140	UL_MQ /3	10					10-Dec-16
MQYYM Q4 prototypes	2								
<u>Batch 1:</u>		410	UL_MQ = 740 m	1	# 5	Cable type 4, trial 3 x 136 ULs	36	15941	01-Sep-17
<u>Batch 2:</u>		9020	UL_MQ = 740 m	22	# 5	Cable type 4	36	350698	10-Mar-18
D2 Dipole	1	1000	UL_MB_OL = 750 m	1	# 2	Cable type 2	36	38880	01-Mar-17
	1	2500	UL_MB_OL = 750 m	4	# 2	Cable type 2	36	97200	01-Jan-18
	6	15000	UL_MB_OL = 750 m	24	# 2	Cable type 2	36	583200	01-Jul-19
MCBY orbit correctors	16								
			UL_MCBY = 174m		type 2 0.38x0.73		15		
LHC Consolidation Project series magnet (net values)									
* Main Quadrupole MQ	5+1	7373	UL = 740 m	12	# 2	Cable type 2,	36	286662	01-Feb-19
* MQYs	5+1	17972	UL = 775 m	24	# 5	Cable type 5, OL	34	659932	01-Sep-18
		7603	UL = 710 m	12	# 6	Cable type 6, IL	22	180647	01-Sep-19

NOTES

An update of the table is in preparation to include sufficient spare for the MCBY strand (original evaluation based on 16 magnets)

Current leads for DFB, SSS

Rational of the request

Total Budget request	1404	Budget to be allocated in years (from-to)	[2020-2025]
Material budget request	1404	Personnel available [y/n] in addition to personnel budget request	y
Personnel budget request (M2P budget for MPAs and fellows)			

Consequences of suppression of request

600 A spares are not sufficient to cover a full DFB in terms of spares

Consequences of delay of request

Negotiating manufacturing schedule with EN-MME