EN-MME Activities

Francesco Bertinelli / EN-MME

(25’ + 5’ discussion)

LS2 DAYS

29-30 SEPTEMBER 2015

http://indico.cern.ch/event/436424/

MME for LS2 (with earlier YETS and EYETS)

- Preparation (… very different nature of LS1 and LS2)
  - Engineering and Design
  - Fabrication: internal and sub-contracting
  - Non-destructive testing (NDT)
  - Mechanical measurement laboratory
- Installation
  - RP workshop Bldg. 109
- Commissioning

does MME have enough resources for LS2?

MME for LS2 (with earlier YETS and EYETS)

Activités de:		*Réels* Facturé 2010	*Réels* Facturé 2011	*Réels* Facturé 2012	*Réels* Facturé 2013	*Facturé* Facturé 2014	*Facturé* CrFact 2015 06/07/2015 2T 2015	WIP 06/07/15
Bureau d'Etudes	(MCHF)	2.4	2.7	2.8	2.8	3.4	1.5	1.5
Fabrication Interne	(MCHF)	2.6	3.5	4.3	5.7	5.5	2.6	2.4
Fabrication Sous-Traitance	(MCHF)	3.8	5.9	7.0	7.9	9.3	3.8	6.1
Contrôles Non-Destructifs	(MCHF)						0.1	0.0
Laboratoire Mesures Mécaniques	(MCHF)						0.2	0.0
Total	**(MCHF)**	**8.8**	**12.1**	**14.1**	**16.4**	**18.2**	**8.2**	**10.0**

- ~3000 jobs / year to follow
- Design and Fabrication have ~6 months workload ahead
- MME subcontracting does not have unlimited capacity

Source JMT

MME Design Office current workload

Number of jobs	Date fin	Estimated workload (h)	Work in Progress (h)
44	≤ 2014	15 500	4 200
31	S1 2015	9 900	3 100
74	S2 2015	27 500	15 700
17	S1 2016	8 500	6 900
2	S2 2016	700	500
1	≥ 2017	400	0
∑ 169		∑ 88 200	∑ 30 400

Source JMT, situation 22/09/2015

MME Design Office issues

- Workload capacity
  - In recent months increased from 41 to 44 MME Designers (14 staff, 30 Industrial Support, 1 IS for workshop)
  - This is maximum capacity (IS contractual limit and staff/non-staff ratio) unless additional staff designers are recruited
  - ~60 000 job hours / year, ~5 000 job hours / month
  - Hence an existing Work in Progress (WIP) workload of ~6 months
  - Options for new requests:
    - Join the queue
    - Justify higher priority over other ongoing work
    - A small job is nevertheless done early (not all WIP – and Users – are ready for the work to be done)
    - … outside MME (e.g. FSUs)

Are enough designers working for LIU / LS2?

Design Office Work-In-Progress (h)

Date fin	HL-LHC	LHC	SM18	R&D Magnets	HiRadMat	LIU	Non-LHC Accelerators	LINAC4	HIE-ISOLDE	ELENA	AWAKE	CLIC/CTF3	SPL	LHC Experiments	Non-LHC experiments	Other	Total
≤ 2014	1 700	350	100			250	550	550		350		250			50		4 150
S1 2015	900	450	400	100	300	400	50	250				150		100		50	3 150
S2 2015	6 000	250	550	100	200	3 050	900	650	150	800	100	500	350	50	100	2 050	15 800
S1 2016	4 100		150			700				150	900	550	300				6 850
S2 2016			250													200	450
≥ 2017	0																0
Total	12 700	1 050	1 450	200	500	4 400	1 500	1 450	150	1 300	1 000	1 450	650	150	150	2 300	30 400

Source JMT, situation 22/09/2015

Design Office Work done Jan. - Aug. 2015

Source PPT, analysis 23/09/2015

	HL-LHC	LHC	SM18	R&D Magnets	HiRadMat	LIU	Non-LHC Accelerators	LINAC4	HIE-ISOLDE	ELENA	AWAKE	CLIC/CTF3	SPL	LHC Experiments	Non-LHC experiments	Other	Total
Work done (h)	13 834	1 160	2 719	522	1 975	3 735	1 141	2 082	455	4 890	2 683	1 841	657	73	63	3 270	41 100
Equivalent FTE	13.8	1.2	2.7	.5	2.0	3.7	1.1	2.1	.5	4.9	2.7	1.8	.6	.1	.1	3.3	41.1
FTE	20.2					6.9				8.1		5.9					41.1
FTE %	49%					17%				20%		14%					100%
WIP	*15 900*					*9 800*						*4 700*					*30 400*
Months FTE WIP	**6.3**					**5.2**						**6.4**					

Recommended tips (for LS2)

- Design & fabrication requests
  - Think ahead in time:
    - consider one Semester (or more) for new MME design requests (starting S1 2016)
    - Consider a 2nd Semester (or more) for MME fabrication requests
  - Include in PLAN
  - In launching a design job do not assume that MME fabrication automatically follows
  - In following-up an MME design&fabrication job, balance the necessary time for both activities
    - When design is 80% ready start fabrication contacts (too early = ignored, too late = wasted time …)
    - Special supplies can take several months (3 to 6), e.g. special raw materials, forgings, bellows, ceramics

Design Office MME for User Groups

"LIU" in this table includes jobs: AD, PS, ISOLDE, SPS, LINAC2, LINAC3, LIU but not ELENA, AWAKE, HIE-ISOLDE and LINAC4

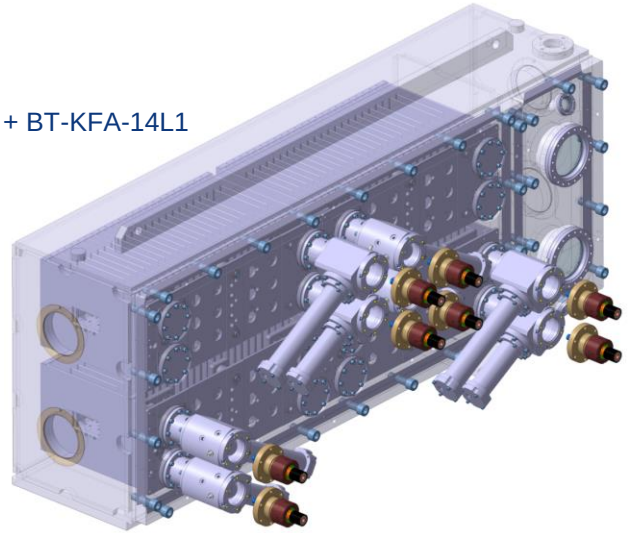
LIU	BE-ABP	BE-BI	BE-OP	BE-RF	EN-MME	EN-STI	TE-ABT	TE-MSC	TE-VSC	total
No. of jobs	3	8	1	4		6	6	4	5	37
Estimated workload (h)	640	3 140	620	640		2 950	3 835	920	900	13 645
WIP	422	340	16	463		2 119	1 512	499	524	5 895

JMT Design Office, situation 2/09/2015

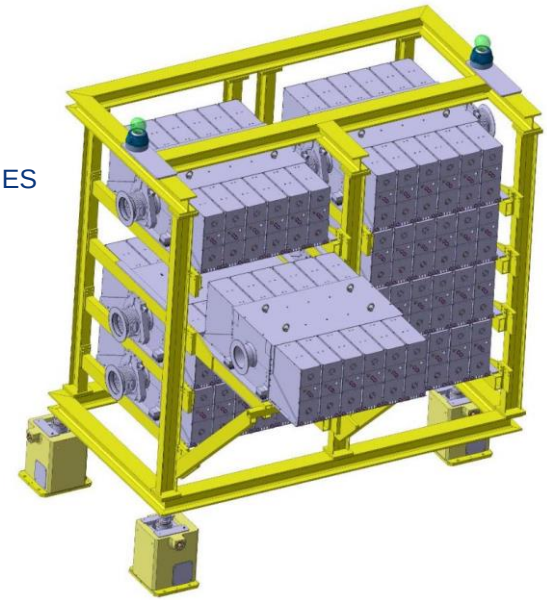
HL-LHC	BE-ABP	BE-BI	BE-OP	BE-RF	EN-MME	EN-STI	TE-ABT	TE-MSC	TE-VSC	total
No. of jobs	7	3		3	1	1		21		36
Estimated workload (h)	3 010	1 340		6 000	660	1 500		13 610		26 120
WIP	1 880	791		3 121	196	1 231		5 487		12 706

Design WIP LIU examples

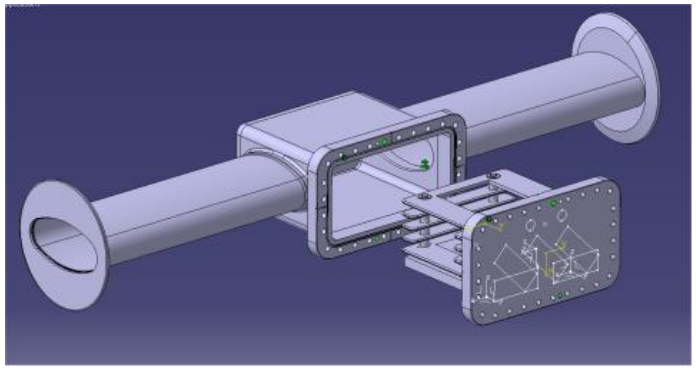
J3016223
TE/ABT
KICKERS BT-KFA10 + BT-KFA-14L1
LIU-PSB
Installation LS2



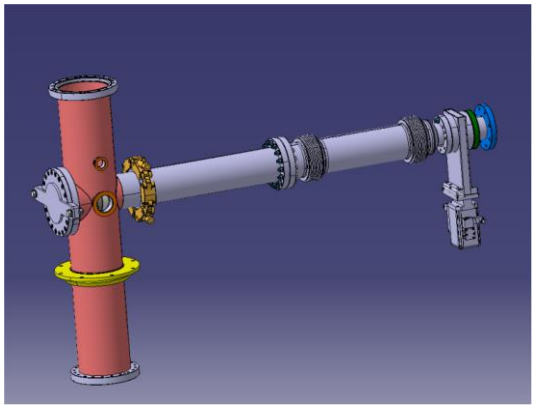
J3025838
BE/RF
FINEMET CAVITIES
LIU-PSB
Installation LS2



J3019356
BE/BI
BGI (Beam Gas Ionization monitor)
LIU-PS
Installation YETS 2017-2018



J3025439
BE/ABP
NEW LEBT OPTICS LINAC3-GTS
LIU-ions
Installation EYETS 2016-2017



… more known coming for LIU

Project	Description	WP Holder	MME Pilot	Designer	Design Kick-off (est)	Deadline Installation	Design Status
LIU-PSB	BI.SMV POWER SUPPLY (TRANSFORMERS)	J-M. Cravero	B.Riffaud	Y.Coutron	15/11/2015	EYETS 2016-2017	Scheduled
LIU-PSB	BSW1 POWER SUPPLY (TRANSFORMERS)	J-M. Cravero	B.Riffaud	L.Zuccalli	01/11/2015	EYETS 2016-2017	Scheduled
LIU-PSB	BHZ11 & BHZ162 ASSEMBLY DRAWINGS	W.Weterings	B.Riffaud	L.Zuccalli	01/10/2015	EYETS 2016-2017	Scheduled
LIU-PS	BEAM PIPE MODIFICATION (WIDE BAND PICK-UP INSERTION)	TBD	B.Riffaud	R.Ricol	01/11/2015	EYETS 2016-2017	Scheduled
LIU-PSB	PICK-UP TUNE (RE-DESIGN)	TBD	D.Steyaert	Y.Coutron	TBD	EYETS 2016-2017	Identified
LIU-PSB	SUPPORT FOR WIRE SCANNER (PROTO)	B.Dehning	N.Chritin	A.Demougeot	TBD	EYETS 2016-2017	Identified
LIU-PSB	SEM GRID + SUPPORT	F.Roncarolo	D.Steyaert	TBD	TBD	YETS 2017-2018	Identified
LIU-PSB	BEAM PIPE MODIFICATION (SEM GRID INSERTION)	TBD	D.Steyaert	TBD	TBD	YETS 2017-2018	Identified
LIU-PS	PS INTERNAL DUMP	F-X.Nuiry	D.Steyaert	TBD	TBD	YETS 2017-2018	Identified
LIU-PSB	SUPPORT FOR WIRE SCANNER (SERIES)	B.Dehning	N.Chritin	TBD	TBD	LS2	Identified
LIU-PS	BMP42 (BUMPER) & SMH42 (SEPTUM)	M.Hourican	B.Riffaud	L.Zuccalli	25/09/2015	LS2	Scheduled
LIU-PS	BMP42 & SMH42 POWER SUPPLY (TRANSFO.)	J-M. Cravero	B.Riffaud	L.Zuccalli	TBD	LS2	Identified
LIU-PS	BTV MU41	S.Burger	D.Steyaert	TBD	TBD	LS2	Identified
LIU-PS	SEM GRID MU42	C.Vuitton	D.Steyaert	TBD	TBD	LS2	Identified
LIU-PSB	BTM-BHZ10	A.Newborough	D.Steyaert	TBD	TBD	LS2	Identified
LIU-PSB	VAC. CHAMBERS FOR BTM-BHZ10	J.Hansen	B.Riffaud	TBD	TBD	LS2	Identified
LIU-PSB	PSB ABSORBER	F-X.Nuiry	D.Steyaert	TBD	TBD	LS2	Identified
LIU-SPS	TPSG4 & TPSG6	B.Balhan	B.Riffaud	TBD	TBD	LS2	Identified
LIU-IONS	LEIR EXTERNAL BEAM DUMP & Y CHAMBER	A.Perillo / J.Hansen	D.Steyaert	TBD	TBD	LS2	Identified
LIU-SPS	SPS ION DUMP	F-X.Nuiry	D.Steyaert	TBD	TBD	TBD	Identified
LIU	DIFFERENT MAGNETS FOR LIU	A.Newborough	D.Steyaert	TBD	TBD	TBD	Identified

- Forum for priority discussions is LIU-PLI follow-up meetings with EN/MEF

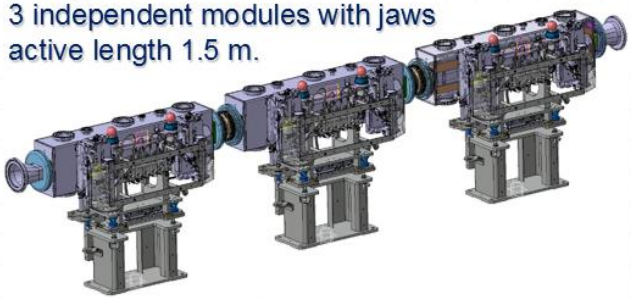
Design WIP collimators

Engineering Department

EN

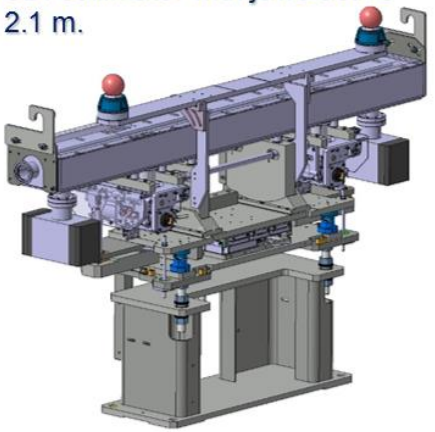
TDIS absorber

New generation of TDI absorber.
3 independent modules with jaws active length 1.5 m.



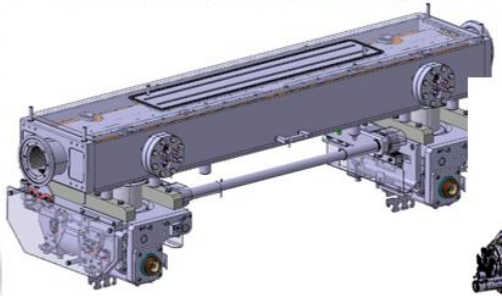
TCDIL Collimator

New TCDI collimator with jaws active length 2.1 m.



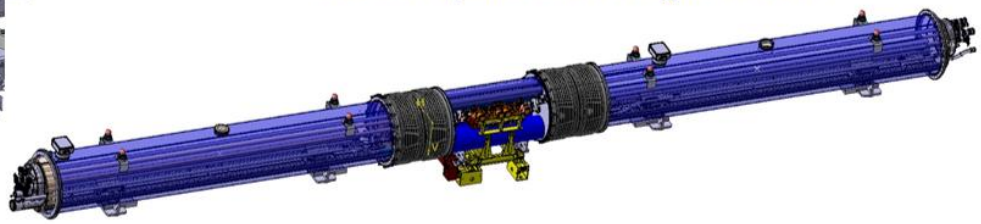
TCSPM Collimator

New generation of collimator for HL-LHC.
Completely new jaw design.

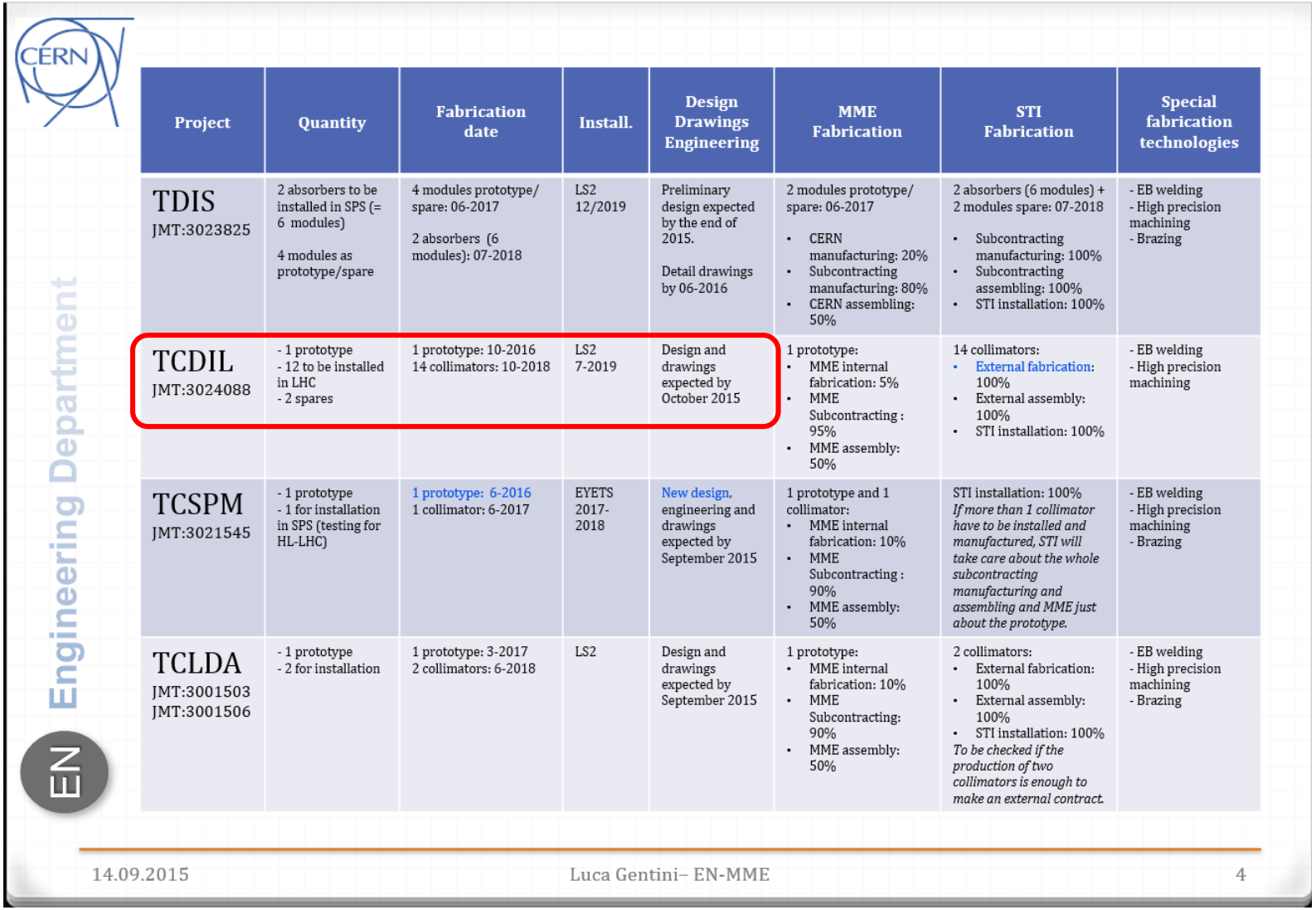


TCLD Collimator

New TCLD collimator to be installed between two 11T dipoles. Active length 600 mm.



Fabrication strategy collimators



Engineering Department

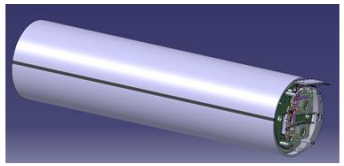
EN

Project	Quantity	Fabrication date	Install.	Design Drawings Engineering	MME Fabrication	STI Fabrication	Special fabrication technologies
TDIS JMT:3023825	2 absorbers to be installed in SPS (= 6 modules) 4 modules as prototype/spare	4 modules prototype/ spare: 06-2017 2 absorbers (6 modules): 07-2018	LS2 12/2019	Preliminary design expected by the end of 2015. Detail drawings by 06-2016	2 modules prototype/ spare: 06-2017 • CERN manufacturing: 20% • Subcontracting manufacturing: 80% • CERN assembling: 50%	2 absorbers (6 modules) + 2 modules spare: 07-2018 • Subcontracting manufacturing: 100% • Subcontracting assembling: 100% • STI installation: 100%	- EB welding - High precision machining - Brazing
TCDIL JMT:3024088	- 1 prototype - 12 to be installed in LHC - 2 spares	1 prototype: 10-2016 14 collimators: 10-2018	LS2 7-2019	Design and drawings expected by October 2015	1 prototype: • MME internal fabrication: 5% • MME Subcontracting : 95% • MME assembly: 50%	14 collimators: • External fabrication: 100% • External assembly: 100% • STI installation: 100%	- EB welding - High precision machining
TCSPM JMT:3021545	- 1 prototype - 1 for installation in SPS (testing for HL-LHC)	1 prototype: 6-2016 1 collimator: 6-2017	EYETS 2017-2018	New design, engineering and drawings expected by September 2015	1 prototype and 1 collimator: • MME internal fabrication: 10% • MME Subcontracting : 90% • MME assembly: 50%	STI installation: 100% *If more than 1 collimator have to be installed and manufactured, STI will take care about the whole subcontracting manufacturing and assembling and MME just about the prototype.*	- EB welding - High precision machining - Brazing
TCLDA JMT:3001503 JMT:3001506	- 1 prototype - 2 for installation	1 prototype: 3-2017 2 collimators: 6-2018	LS2	Design and drawings expected by September 2015	1 prototype: • MME internal fabrication: 10% • MME Subcontracting: 90% • MME assembly: 50%	2 collimators: • External fabrication: 100% • External assembly: 100% • STI installation: 100% *To be checked if the production of two collimators is enough to make an external contract.*	- EB welding - High precision machining - Brazing

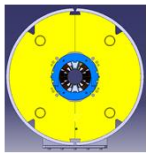
14.09.2015 Luca Gentini– EN-MME 4

Design WIP HL-LHC SC magnets

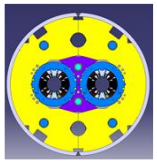
11T Dipole & Collimator



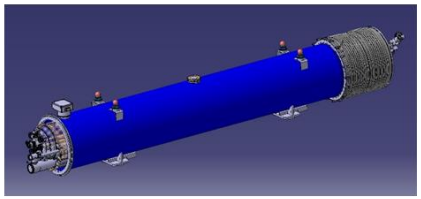
Dipole 2m Short Model



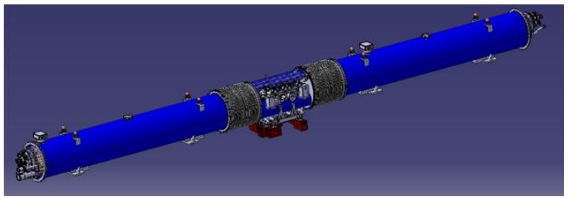
1in1



2in1

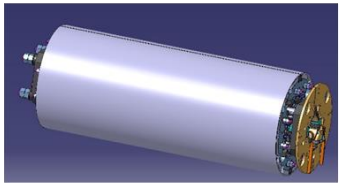


Dipole Assembly

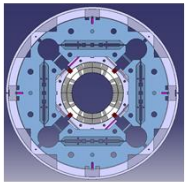


Dipole & Collimator assembly

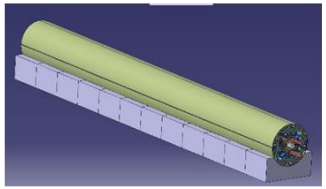
MQXFS/MQXFB Quadrupole



MQXFS 1,5m Short Model

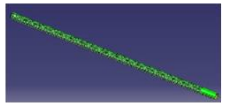


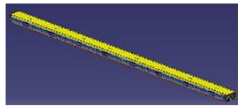
MQXF Section



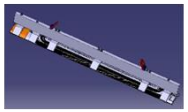
MQXFB Magnet

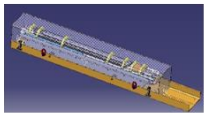
Tooling for dipole and quadrupole (for Nb3Sn cable)



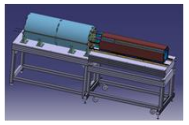


winding, curing, reaction and impregnation tooling



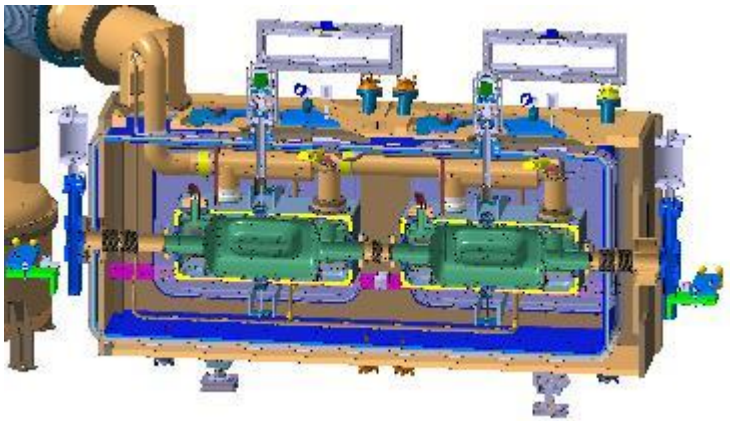


lifting and handling tools

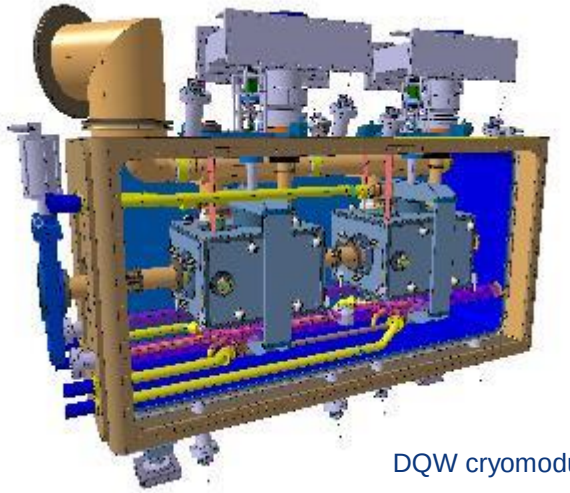


assembly tools

Design WIP HL-LHC crab cavities



Crab cavity RFD



DQW cryomodule

- It is important that crab cavities are validated with beam in SPS, before LS2. Only after this validation we will be able to start the production for HL-LHC.
  - The 1st cryomodule will have to be assembled in SM18 by end of 2016, the 2nd to be assembled by mid-2017.
  - They will be cold tested (one after the other) in SM18 during 2017. The best performing will be installed in SPS end of 2017 and has to be tested with beam during 2018.

PLAN for MME

- MME uses JMT to manage its workload: PLAN and JMT are not synchronised
- Users can help:
  - Consistency between PLAN and JMT in Username and title
  - Link to JMT Job if existing
- Be clear with “request-by date”
  - Specify date for “job finished by MME” (not installation date)
- Deliverables:
  - If fabrication is “internal MME” or “Sub-contracting MME”, then “job finished” = fabrication drawings ready (include time to iterate with Workshop)
  - If fabrication is “responsibility of Users”, then “job finished” = Tender drawings
    - ➢ User with Design Office to discuss fabrication strategy early
  - Avoid “responsibility of User” becoming “MME subcontracting”.
- Work priorities:
  - Better to discuss early at the Design stage (working back from Installation date minus semester(s) fabrication time): i.e. Design Office workload for S1 2016 will be based on October 2015 PLAN requests, with priorities discussed if needed.

Fabrication Work-in-Progress

	Milling	Turning	Electro-erosion	Sheet Metal work & welding	Electron Beam welding	Metrology	Total
Work done Jan. to June 2015 (h)	12 200	5 450	1 500	11 450	1 300 2 machines	3 450	36 750
WIP (h)	11 900	4 200	1 400	9 400	2 800 (43% LINAC4 PIMS)	2 700	35 100
WIP equivalent months	5.9	4.6	5.6	4.9	8.6 3 machines	4.7	5.7

Source JMT, situation 30/06/2015 except FE and vacuum brazing

- In PLAN sufficient to detail if the following activities are needed:
  - Machining
  - Sheet metal work & welding
  - Electron beam welding
  - Vacuum brazing & Heat Treatments
  - MME subcontracting

Delivery of new, retrofit Leybold&PTR EB machine
ACC/CONS consolidation

Fabrication examples

J3002344
BE/RF
12 PIMS Cavities
LINAC4

J3011101
BE/BI
54 Pick-ups
LINAC4

- First LIU fabrications started S2 2015, e.g.
  - J3025786 TE/ABT 9 bobines SEPTUM SMV10 - SMV20 for LIU-PSB
  - J3025461 BE/OP HALF SECTOR TEST VACUUM CHAMBERS for LIU-PSB

RP workshop in Bldg. 109

- The only general purpose RP workshop
- Equipped with milling machine, lathe, saw, drill, TIG welding, fume extraction
- Is the capacity of the RP workshop enough for LS2?
  - Dec. 2014 “survey” by E. Jensen:
    - LIU-SPS:
      - BE-RF: modify some supporting systems of both 200 MHz and 800 MHz cavities – work to be checked with RP as the supports come from the SPS machine but are not activated
      - BE-BI: some 10 days of work for SPS and other consolidation activities
    - LIU-PSB:
      - TE-ABT: reserve a generic slot of turning/ milling for a couple of weeks for magnet upgrade work
      - TE-VSC: block B109 for 1-2 weeks during LS2 for PSB vacuum work
      - BE-BI: BI.BTV30 - 2 days for vacuum chamber modification and 2.5 days for tank modification. BT.BTV30 - 2 days for vacuum chamber modification.
    - LIU-PS:
      - TE-ABT group: Small tasks to be done in the RP workshop in bldg. 109 during LS2. But the tasks will be limited to small works to adapt old parts to the newly to install septa
      - TE-MSC: radioactive workshop will be needed sporadically, but can’t provide a schedule since it is based on a case by case principle
  - Conclusion: yes it is enough.
- Is the Free Access Workshop enough? If not, need to raise the issue …
- But need GS-consolidation and ACC-CONS support to finish Workshop Bldg. 109 before LS2.

Mechanical Measurements Laboratory

- Request HL-LHC: during LS2 monitor the vibration induced in the tunnel by the civil engineering work (will help decide what could be done during Run 3 in case of delays)
  - Acquire the data from the instrumentation already installed in the triplet area (LMC action);
  - Place a few more instruments in the LHC tunnel areas where crab cavities will be installed as this could be the nearest and latest place to be excavated.

Metallurgy and NDT

- X-ray support to EN/CV work
- No advanced requests

Thank-you for your attention

EN (ATS) priorities

PRIORITÉS EN-MME

(SUIVANT DOC EDMS 1498960)

1. Completion of the LS1

2. Operation

- Infrastructures
- LHC, its injectors & the associated experiments
- The fixed target programme

3. Projects

- LHC Upgrade (Linac4, HL-LHC, LIU, LHC Detectors)
- Neutrino Facility (Extension of EHN1, Icarus, Nessie)
- Diversity Activities (HIE-Isolde, ELENA, AWAKE)

4. Studies

- Energy Frontier (ILC, CLIC, FCC)
- Diversity Activities (TSR, R&D for accelerators and detectors)

1	Operation of infrastructures
1	Operation of LHC, its injector & the associated experiments, the fixed target experimental areas
1.1	Preparation for LS2 -> LIU, HL-LHC
1.2	Completion of Own infrastructure /Equipment Consolidation Projects
1.3	Preparation for LS3 -> HL-LHC
2	Consolidation of the fixed target experimental areas
3	Completion of HIE-Isolde Phase 1 & 2
3.1	Completion of ELENA
3.2	Completion of AWAKE
3.2	Completion of Neutrino Facility
3.2	Studies for Energy Frontier (CLIC, FCC)
4	Studies for Diversity Activities (TSR, R&D for accelerators and detectors, medical applications)

MME priorities wrt LS2

1.1 Preparation for LS2 -> LIU, HL-LHC

LIU:

Mechanical design and fabrication (internal and subcontracting) for:

- Linac4 source
- Linac4 to PSB connection line and equipment
- Electron beam welding of Linac4 PIMS
- PSB H- injection
- BI for LIU (New Wire Scanner, BTV, BGI, BGV…)
- BDIs for LIU (L4 dump, PS dump, SPS TIDVG, …)
- Crab cavities and cryo-module design and manufacturing for tests in SPS before LS2.

HL-LHC:

Engineering and mechanical design for:

- Crab cavities and cryo-module design
- HL-LHC Secondary Collimators (TCSPM also for LS3)
- DS (11T) Collimators (TCLD)
- HiRadMat experiments related to Collimation project
- BBLRC demonstrator (TCTW)
- Advanced materials for collimators upgrade (thermo-mechanical characterization and HiRadMat Tests)
- Hollow electron lens.

1.2 Completion of Own infrastructure/Equipment Consolidation Projects

- Consolidation of equipment/Productive Technical Assets for the mechanical workshops, laboratories etc.
- ERP studies.
- Need to complete RP workshop consolidation before LS2.

1.3 Preparation for LS3 -> HL-LHC

Engineering, mechanical design and fabrication (internal and subcontracting) for:

- Crab cavities and cryo-module
- New collimators in the experimental insertions (TCLx etc.)
- Hollow Lens Beam Collimation
- R&D for LHC Collimation Advanced Materials.

Mechanical design and follow-up for:

- HL-LHC 11 T Magnets and cryo-assembly
- Nb3Sn triplets (including magnets and BI)
- HL-LHC new magnet development phase
- Design SC links (cables and test stations).