

Crab Cavity CM status towards SPS test

Frank Gerigk, 15 Sep 2016, 15th HL-LHC TCC



Overview

Status March 2016, Crab Cavity for SPS planning management review Actions taken

Status today, options for Crab Cavity SPS test





March 16, SPS planning baseline

October 2017	Nove	mber 2017		December	2017			Janu	uary 2018		February
2 WK 40, 2/ WK 41, 9/ WK 42, 1 WK 43, 23 W	K 44, 3 WK 45, 6/ V	NK 46, 1 WK 47, 2	WK 48, 2	WK 49, 4/ WK 50, 11	WK 51,	1 WK 52, 2	WK 1, 1/1	WK 2, 8/1	WK 3, 15,	/ WK 4, 22/	WK 5, 29/ WK
Cryomodule assembled (ready for cold te	est) 🔷										
Cryomodule Validation T	ests										
Installation of cryomodule i	n M7 🛛 🛛 🛛										
Vacuum p	umping 2d										
Q_Ext Measurem	ents at 300K]									
Cooldown to 2K and Cryo C	ommissioning	2 weeks									
	Low Power	Measurements	1 wee	ek							
	RF Cond	litioning (FPC + C	Coupler)	2 weeks							
		Cavity P	erforman	ice Measurements	3d						
				LLRF Gymnast	ics [2 weeks					
						НОМ	Efficiency	Measure	ements	1 weel	<
									He	eat Run	20
						Warm u	p to 300K	(warm H	le in bi–p	hase line)	3d
							Cryon	nodule va	alidated &	& ready fo	r SPS 🔷
					6	Start Insta	Ilation in	SPS <	>		
											11

- 100% success oriented baseline planning ~1 month late
- Testing over Christmas was assumed
- •Planning was based on top-down milestones but still late





March 16, SPS planning proposal

October 2017	N	ovember 2017				Decemb	er 2017			١
WK 41, 9/10 WK 42, 16/10 WK 43, 23/10 WK	44, 30/10 WK 45, 6/11	WK 46, 13/11	WK 47, 20/11 WK 48,	27/11 WK	49, 4/12	WK 50, 11/	12 WK 51, 18/1	2 WK 52, 25/12	WK 1, 1/1	WK 2, 8/1
Cryomodule assembled (ready for cold to	est)									
Cryomodule Validation T	ests									
Installation of cryomodule	in M7 2d									
Vacuum	pumping -2d-									
Q_Ext Measurem	ents at 300K 斗 🛛 —	\neg								
Cooldown to 2K and Cry	o Commissioning	2 weeks								
	Low	Power Measu	rements 3d -	ļ						
	RF Co	onditioning (F	PC + Coupler)	e weeks						
		Cavity Perf	Formance +Basic LL	RF + HOM	efficienc	y 4 da	ays			
						Heat R	un <mark>↓2d</mark>			
			Warm up t	o 300K (w	arm He i	n bi-phas	e line) 3 (lays		
										12

Compression by:

- •cutting LLRF tests in SM18,
- reduced HOM coupler testing,
- testing still over Christmas period & no difficulties at any stage
- using top-down planning milestones



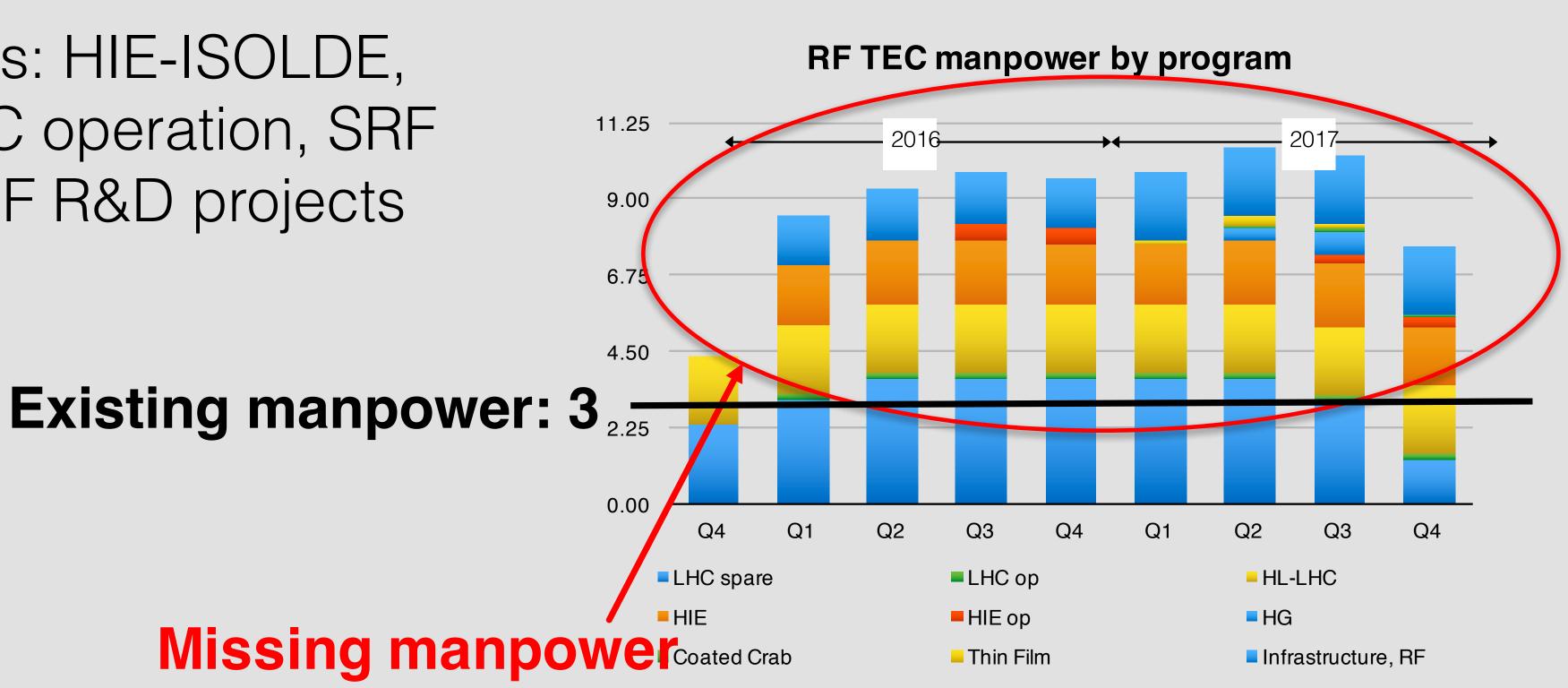
This option was still to be confirmed by detailed workflows and planning involving MME, RF, VSC





missing manpower

- •RF group has a serious lack of SRF technicians.
- •Their work also supports: HIE-ISOLDE, LHC spare cavities, LHC operation, SRF infrastructure, all the SRF R&D projects







Actions taken

- Start of Crab Cavity Technical Coordination meeting on 30 May, every 2 weeks, 8 meetings so far.
- •Development of detailed workflow and milestone plan:
 - clear responsibilities for each milestone
 - bottom-up time estimates,
 - tooling readiness plan,
- Planning support by EN-ACE (Aurelio Berjillos)
- Options for additional manpower





Establishment of workflow

- •A 94 step workflow details all cavity and CM production steps between the shaping of cavity pieces until transport to the SPS. Link person, location, concerned pieces, transport, and needed time has been identified for each step.
- •The steps have been divided into 22 activity blocks/milestones with 1 responsible person for each milestone.
- •QA is associated with milestones.
- •A milestone plan has been extracted.





sr 2 Li	Ta Separate pieces	ask	Loca	ation		Link			Activity black			Time	Transport	Total time
sr 2 Li	Senarate nieces				Object	person	Tests	Tools	Activity block/ Milestone	Milestone link person	Main group	estimation (days)	Time (days)	estimation (days)
	shaping		72		cavity pieces	Marco		Tools Available	Cavity pieces production	Marco	EN-MME	03/10/2016	0	0
	Light BCP		B118		cavity pieces	Leonel							0	
3 In	ntermediate welding		112		cavity pieces	Marco		Tools Under Production. No further input from stakeholders needed				20	0	
4 Те	ntermediate Leak Tests (Extremities, pefore last weld)		112					Tools being Designed. No further input from stakeholders needed				5	0	
5 RI	RF frequency		72		cavity pieces clamped (+ one HOM coupler, optional)	Rama		Clamps	Cavity trimming and welding	Marco	EN-MME	5	1	48
	1 st trimming		72		cavity pieces	Marco		Tools being designed.		Wareo			0	
	2nd last weld		72		cavity pieces	Marco						3	0	-
	RF frequency		72		cavity pieces clamped			Clamps				5	0	-
	2nd trimming		72		cavity pieces	Marco		Tools being designed.				-	0	-
LO RI	RF frequency		72		cavity pieces clamped	Rama		Clamps				1	0	
11 Li,	Light BCP for welds		B118		cavity pieces	Leonel						7	1	
12 Fi	Final welding		112		bare cavity	Marco		Tools Under Design/Production. No further input from stakeholders needed					0	
13 Ca	Cavity inspection		112		bare cavity	Marco		NO tools				0	0	
14 Le	Leak test		112									2	0	
15 RI	RF frequency		72		bare cavity	Rama						1	0	
16 Al	Alternative Tuning		72		bare cavity	Marco			Cavity finalization, inspection and metrology	Marco	EN-MME		0	11
17 RI	RF frequency		72		bare cavity	Rama						0		
	Vetrology		72		bare cavity	Marco, Mateusz	including bead-pull measurement of the electric center, visual inspection	Visual Inspection means Endoscope? If so needs to be procured				8.	0	
19 M	Mount handling frame		72		bare cavity + frame	Marco		Frame for handling				1	0	
20 CI	Cleaning + Heavy BCP		B102 + B118		bare cavity + frame	Leonel	bath etching speed vs bath speed (July to september)	PVDF/PVC flanges + Support at height to allow gravity emptying + tool for bath etching speed vs bath speed	ptying +			15	1	
	RF frequency, with antenna for cold tests		72		bare cavity + frame	Rama/ Alick?						1	1	
22 Al	Alternative Tuning		72		bare cavity + frame	Marco				Leonel	EN-MME	5	0	36.5
23 RI	RF frequency		72		bare cavity + frame	Rama								
24 M	Vetrology		72		bare cavity + frame	Marco, Mateusz						3	3 0	
25 CI	Cleaning		B102		bare cavity + frame	Leonel						1.5	0	

15 days for Cavity1 10 days for Cavity2



Bottom up planning l

- When all the steps were counted for the first time, we ended up with July 2018 as readiness date for the installation in the SPS...
- 1st planning iteration was done:
 - fabrication and testing steps (e.g. cold test of dressed cavity) for the 2nd cavity have been reduced in time.
 - time slots allocated for cavity fabrication, chemical treatment & cleaning, RF tests, transports have been reduced.
 - preparatory steps have been introduced to reduce time for critical path, e.g. preparation of BCP plumbing with printed cavity & preparation of different plumbing layouts for the different positions of BCP, LLRF is tested on DQW POP cavity, HOMs to be tested on BNL cavity before mounting on CERN Crabs, etc.
 - possible temporal overlaps have been identified and applied.
 - some activities can be done over weekends: heat treatments, cool down, warm up, etc.
 - last possible installation slot for SPS has been defined: 23 January 2018 (5 weeks before end of YETS) minimum cryogenic test period in SM18 is identified: 5 weeks

-> this brought us to 29. March... still 34 days too late











Bottom up planning II

• Further optimisation of clean room assembly & metrology checks proposed by Alick.

still t.b.c!

- Removal of any RF test on the completed CM, but maintaining the cryogenic cold testing of CM + service module. • Still to be fixed: CM is cold over Christmas, but no one has to work on non-working days.
- Some further optimisation on surface treatments possible but TE-VSC fears clash with other activities (TIDVG)

Strategy: aim for option 1 continue schedule optimisation

Option 1: YETS17-18

- No RF test of cold CM.
- Full cryo & vacuum qualification of CM before installation.
- Fully success oriented planning
- Some small margins still exist for fabrication (MME) and surface treatment (VSC), but it would be unrealistic to remove them at this point in time.
- Risks: RF performance unknown at time of installation. Potential repairs to be done in subsequent TS.



in case of delays:

Option 2: TS 18

- Installation in 1-2 technical stops after YETS 17-18.
- Full RF, cryo & vacuum qualification of CM in SM18 before installation.
- Take more time for preparation to ensure that everything works in the SPS.
- Risks: potential delays during SPS installation may kill the test. Less likely because of better preparation.







Manpower, etc.

- Ilan Ben-Zvi (BNL) at CERN to help optimising workflow, planning, assembly & test procedures • 12-13 October: Review of clean room procedures for the HL-LHC Crab Cavity Program (https://indico.cern.ch/event/ <u>555785/</u>) John Mammosser (ORNL), Stephane Berry (CEA), Mathieu Therasse (CERN), Vittorio Parma (CERN). • SM18 building extension will ease the space problems, but may not be usable by end of 2017.

- Manpower in SRF section (since March):
 - Technician (Ester Sancho Cabrera) started.
 - Fellow (Hernan Furci on cold temperature measurements) started in March 2016
 - Fellow (Anastasia Xydou, for LHC spares) started in September 2016
 - VISC (Nicolas Shipman on ???) started in June 2016, 1 year

 - Engineer from RRCAT (Kunver Singh) started last month to support cold test activities in SM18, 6 months stay - COAS/EXT to start in October/Nov for CRAB follow-up in SM18 for 1 year,
 - replacement of Pierre Maeson is agreed, date not yet clear (new hire or transfer from other group)
 - IFJ-PAN: meeting in June at CERN to get support for cold test preparations of cavities and cryo-modules. RF engineers will be available from early 2017 onwards (people who have worked for XFEL before). Agreement in preparation. - Option to prolong the external team working on HIE-ISOLDE CM assembly



Disclaimer: The elaborated workflow and planning represents the minimum time needed for consecutive steps. It assumes that nothing goes wrong and that there are enough skilled people to actually do the work.



Summary

- •Planning remains tight and relies on success at all stages.
- •Very few margins remain.
- extra activities. Sequence of steps and responsibilities are clear.
- •Milestones are defined and will be tracked in the CCTC meeting.
- test of the complete CM. Cavities will be cold tested and CM + service box will be cold tested.
- •Manpower issues are being tackled.



•Complete workflow exists, meaning there should be no surprises of unplanned •SPS installation date during YETS 17/18 can only be kept if we sacrifice the RF

•Alternative: install later, do the CM RF cold test and do some more testing to ensure that everything works before installation (or everyone works over Xmas).



complete work flow

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Extra slides



Version VIII

<table-container> Image: Problem Image</table-container>	1010	n VIII 15	5/09/2016									1				
Mayo, Mayo, Mayo, Marcian, Mar		Tas	sk	Loca	ation	Object		Tests	Tools				estimation	Time	Total time estimation (days)	
Image: margine series in the series in th	1			72		cavity pieces	Marco		Tools Available	Cavity pieces production	Marco	EN-MME	03/10/2016	0	0	
internal series internal series <td< td=""><td>2</td><td>Light BCP</td><td></td><td>B118</td><td></td><td>cavity pieces</td><td>Leonel</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td></td<>	2	Light BCP		B118		cavity pieces	Leonel							0		
i since intervention, where interventing interventind intervention, where interv	3	Intermediate welding		112		cavity pieces	Marco		further input from stakeholders				20	0		
Image Image <	4	Tests (Extremities,		112									5	0		
introde	5	RF frequency		72		(+ one HOM coupler,			Clamps	Cavity trimming and welding	Marco	EN-MME		1	48	
1 1	5	_							Tools being designed.							
0 0.0000 (Introduction of the series) 0.0000 (Internet of the series													3			
00 #fragency (mail regreence) (mail regreence) <td></td> <td>5</td> <td></td> <td></td>													5			
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image: series of the series	10	RF frequency		72		cavity pieces clamped	Rama		Clamps				1	0		
22 Final welding 112 bit re cavity Marco Marco <td>11</td> <td>Light BCP for welds</td> <td></td> <td>B118</td> <td></td> <td>cavity pieces</td> <td>Leonel</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>7</td> <td>1</td> <td></td>	11	Light BCP for welds		B118		cavity pieces	Leonel						7	1		
14 leak test 112	12	Final welding		112		bare cavity	Marco		No further input from	on.				0		
indication in the second se	13	Cavity inspection		112		bare cavity	Marco		NO tools				0	0		
4.6.1 Alternative Tuning Image: Second	14	Leak test		112								EN-MME		2	0	
4.6.1 Alternative Tuning Image: Second	15	RF frequency		72		bare cavity	Rama						E	0		
13 Metrology Metrology To bare cavity Marco, Mateus Induding bead-pull measurement of the elective procured Visual Inspection means procured Visual Inspection means pr	16										Marco			0	11	
13 Metrology Metrology To bare cavity Marco, Mateus Induding bead-pull measurement of the elective procured Visual Inspection means procured Visual Inspection means pr	17	RE frequency		72		hare cavity	Rama									
Image: Normal synchronization in the synchronizatio	18						Marco,	measurement of the electric	Endoscope? If so needs to be				8	0		
20 Cleaning + Heavy BCP B102 + B118 bare cavity + frame Leonel bath etching speed vs bath sp	19	Mount handling frame		72		bare cavity + frame	Marco		Frame for handling				1	0		
$\frac{1}{1} antenna for cold tests} 1/2 $	20	Cleaning + Heavy BCP				bare cavity + frame	Leonel		height to allow gravity emptying + tool for bath etching speed vs	ng +			15	1		
Alternative Tuning 72 bare cavity + frame Marco Image: Alternative Tuning Image: Alternating Image: Alternating	21			72		bare cavity + frame	Rama/ Alick?						1	1		
24 Metrology 72 bare cavity + frame Marco, Mateusz	22										Leonel	EN-MME		0	36.5	
24 Metrology 72 bare cavity + frame Mateusz 3 0	23	RF frequency		72		bare cavity + frame										
25 Cleaning B102 bare cavity + frame Leonel 1.5 0	24	Metrology		72		bare cavity + frame							3	0		
	25	Cleaning		B102		bare cavity + frame	Leonel						1.5	0		

15 days for Cavity1 10 days for Cavity2



Image: second				T						1	1	r		1
13 10 <td>26</td> <td>Heat treatment</td> <td>B153</td> <td></td> <td>bare cavity</td> <td>Leonel</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>3</td> <td>0</td> <td></td>	26	Heat treatment	B153		bare cavity	Leonel						3	0	
Image: Control of the second of the seco	27	Light BCP	B118		bare cavity + frame	Leonel						5	0	
10 10<	28	HP Water Rinsing	SM18		bare cavity + frame	Alick						3	1	
1000000000000000000000000000000000000	29	Assembly bare cavity	SM18	clean room	bare cavity + frame	Alick						1	0	
Name	30		SM18		bare cavity + frame	Alick						1	0	
3000 3010 1000 1000 1000 1000 1000 3000 <	31		SM18		bare cavity + frame	Alick						3	0	
	32	Cold RF test	SM18			Alick			Bare cavity validation	Alick	BE-RF	10	0	24
141 sinthy and space sinthy and space <td>33</td> <td>Warmup</td> <td>SM18</td> <td></td> <td>bare cavity + stiff.</td> <td>Alick</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>4</td> <td>0</td> <td></td>	33	Warmup	SM18		bare cavity + stiff.	Alick						4	0	
58. Macroshold enally subject (sheld Constrained (sheld <thconstrained (sheld<="" th=""> Constrained</thconstrained>	34	antenna and preparation for	SM18	clean room	bare cavity + frame	Alick						1	0	
8 Mit hank and magnetic hand Mark and magnet hand Mark and magnetic ha	35	RF frequency	72		bare cavity + frame	Rama						1	1	
9/0 9/000000000000000000000000000000000000	36	with tank and	72			Marco						25	0	
single best of the substrate of the subs	37		72			Marco								
98 80 Refrequency (1) 72 (1) (38	Pressure test	72 (?)		shield + tank	Marco			helium tank, pre-tuning,	Marco	EN-MME	2	0	38
41 8 frequency 9 main 72 9 main 9 main <th< td=""><td>39</td><td></td><td></td><td></td><td>shield + tank</td><td></td><td></td><td></td><td>fiducialization</td><td></td><td></td><td>1</td><td>0</td><td></td></th<>	39				shield + tank				fiducialization			1	0	
1 Normalization 1	40	Pre-tuning	72			Marco						_		
42 foldcalisation (All column binom bino	41		72		shield + tank							5	0	
43 if water kinding 3000 shield + tank Auck Call Auck Alck	42		72		shield + tank		Metrology: 3 days	Not for metrology				3	0	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	43	HP Water Rinsing	SM18			Alick						4	1	
45 Leak test SM18 SM18 shield + tank + HOM + pickup pickup Alick Image: Cavity + magnetic pickup Alick Image: Cavity + magneti	44	with HOM couplers	SM18		shield + tank + HOM +	Alick				Alick	BE-RF	2	0	7
46 RF cold test SM18 V3 shield + tank + HOM + Alick pickup Alick Image: Cold test (cold test) (cold test) (cold test) (cold test) (cold test)) Alick Image: Cold test (cold test) (cold test) (cold test) (cold test) (cold test) (cold test) (cold test)) Alick Image: Cold test (cold test) (cold	45	Leak test	SM18		shield + tank + HOM +	Alick						2	0	
47 Warmup SM18 V3 Shifted + tank + HOM + Alick Alick Image: Constraint of tank + HOM + Alick	46	RF cold test	SM18	V3	shield + tank + HOM + pickup	Alick				Alick	BE-RF	10	0	17
48 Preparation for cleanroom SM18 SM18 shield + tank + HOM + pickup Alick Image: Clean components of pickup SM18 Clean components of string assembly Alick Image: Clean components of rolley SM18 Clean components of string assembly Alick Image: Clean components of string assembly Alick Image: Clean components of string assembly Alick Image: Clean components of string assembly Image: Clean compon	47	Warmup	SM18	V3		Alick						4		
Install components on trolley SM18 SM18 String assembly Alick EDMS 1578808, chapter 3.4 Image: Second sec	48		SM18		shield + tank + HOM +	Alick						1		
50 trolley SM18 SM18 string assembly Alick Image: Comparison of the string assembly of the string asembly of the string assembly of the string assembly of	49	Mount FPCs	SM18	clean room	string assembly	Alick						2	1	
51 adjustment SN18 clean room string assembly Mateusz 3.4 3.4	50	trolley	SM18		string assembly	Alick						1	1	
SM18 clean room string assembly Alick String Assembly Alick BE-RF 22	51											3	0	
			SM18	clean room	string assembly	Alick			String Assembly	Alick	BE-RF			22



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		Transfer chariot to ISO5 and clean	SM18	clean room	string assembly	Alick								<i>LL</i>
52	Cavity string assembly	Transfer to ISO4	SM18	clean room	string assembly	Alick						8	0	
		Assemble string	SM18	clean room	string assembly	Alick								
		Transfer to ISO5	SM18	clean room	string assembly	Alick								
53	Alignment survey		SM18	1	string assembly	Mateusz						1	0	
54	Leak test		SM18	1	string assembly	Alick						5	0	
55	Alignment survey								Alignment check, RF			2		
			SM18		string assembly	Mateusz			frequency check	Mateusz	EN-ACE		0	3
56	RF frequency		SM18		string assembly	Rama						1	0	
57	Mounting tuner frame		CN410		string assembly +	Maraa								
<u> </u>			SM18		tuner frames string assembly +	Marco								
58	Mounting cryolines		SM18		tuner frames +	Marco								
					string assembly +				Assembly (pt.0) with tuners	Marco	EN-	9	0	9
59	Leak test				tuner frames +				and cryolines	Warco	MME	5	Ū	5
			SM18		cryolines									
60					string assembly +									
60	X-rays		SM18		tuner frames + cryolines									
			31110											
			CN410		Partially assembled	Manaa								
			SM18		cryomodule Partially assembled	Marco								
		string assembly + cryolines attached to top plate	SM18		cryomodule	Marco								
					Partially assembled									
61	Assembly Cryomodule	support for vacuum valves	SM18		cryomodule	Marco						11	0	
	pt. 1	thermalisations 2K from tank			Partially assembled									
		(HOM, tuner)	SM18		cryomodule	Marco			Assembly (pt. 1) of systems under top plate until		EN-			
		instrumentation + check	CN410		Partially assembled	Maraa			alignment survey of system	Marco	MME			15
		removal of string assembly	SM18		cryomodule Partially assembled	Marco			without trolley					
		trolley	SM18		cryomodule	Marco								
62					Partially assembled							1	0	
02	RF frequency		SM18		cryomodule	Rama							0	
63			61410		Partially assembled							2	0	
	Alignment survey		SM18		cryomodule Partially assembled	Mateusz			-					
64	Pre-tuning		SM18		cryomodule	Marco, Kurt						1	0	
					Partially assembled									
			SM18		cryomodule	Marco								
		RF lines (HOM top all +			Partially assembled									
		pickup/HOM bottom partial)	SM18		cryomodule	Marco								
65	Assembly Cryomodule pt. 2	thermalizations 70K (FPC + HOM top + supports)	SM18		Partially assembled cryomodule	Marco								
	pt. 2		51110		Partially assembled	Marco,	EDMS 1578808, chapter		Assembly (pt. 2) – first leak		EN-			
		BCAM tubes/targets			cryomodule	Mateusz	3.5		check	Marco	MME	19		19
					Partially assembled									
		cryolines bottom welding	SM18		cryomodule	Marco								
66	Leak test		CN410		Partially assembled									
			SM18		cryomodule Partially assembled									
67	X-rays		SM18		cryomodule									
					Partially assembled									
			SM18		cryomodule	Marco								
					Partially assembled									
		mounting jumper	SM18		cryomodule Doutielle	Marco			-					
	Assembly Cryomodule	tuner actuation	SM18		Partially assembled cryomodule	Marco								
68					ci yoniouule	IviaiCO		0			1			



00			-							1				
	pt. 3				Partially assembled									
		MLI 2K	SM18		cryomodule	Marco		Assembly (pt. 3) – second	Marco	EN-	20	0	20	
					Partially assembled			leak check		MME				
		thermal shield	SM18		cryomodule	Marco								
		welding pipe for thermal shield	SM18		Partially assembled	Marco								
		Silleiu	510110		cryomodule Partially assembled	IVIAICO								
69	Leak test		SM18		cryomodule									
			514110		Partially assembled									
70	X-rays		SM18		cryomodule									
					Partially assembled									_
			SM18		cryomodule	Marco								
		thermalizations 70K (HOM			Partially assembled									
		bottom + supports line cryo)	SM18		cryomodule	Marco								
					Partially assembled									
71	Assembly Cryomodule	instrumentation finalization	SM18		cryomodule	Marco								
	pt. 4				Partially assembled			Assembly (pt. 4) and closure		EN-				
		MLI 70K	SM18		cryomodule	Marco		of cryomodule	Marco	MME	14	0	14	
		incontion in upper upper	CN 41 0		Partially assembled	Marco								
		insertion in vacuum vessel	SM18		cryomodule Partially assembled									
		RF lines bottom (HOM + PU)	SM18		cryomodule	Marco								
72	Systems check for cryon		SM18		Partially assembled									
73	Cryomodule closure		SM18		Cryomodule	Marco								
	Leak tests		SM18		Cryomodule									
75		_	1			Mateusz	EDIVIS 1578808, chapter				2			
/5	Cryomodule fiducialisat	ion	SM18		Cryomodule	Wateusz	3.7				۷.	•		
76			CN 410		Converse during	Mateusz	EDMS 1578808, chapter				10			
	Alignment adjustment a	ind validation	SM18		Cryomodule		3.8 EDMS 1578808, chapter	Alignment validation of	Mateusz	EN-ACE		0	16	
77	Vacuum cycles survey		SM18		Cryomodule	Mateusz	3.9	closed cryomodule			3			
			510110		Cryomodule		EDMS 1578808, chapter							
78	Alignment adjustment		SM18		Cryomodule	Mateusz	3.10				1			
79	Welding of internal lines	s with CM & VM	SM18		Cryomodule+SM	Krzysztof								
80	Leak test of new conect	ions	SM18		Cryomodule+SM	Krzysztof								
81	Insulation and welding of	of interconnections	SM18		Cryomodule+SM	Krzysztof								
<u> </u>	external envelope		514110			NI ZYSZCOT		Cryogenic test preparation	Krzystof	TE-CRG			22	Including
82	Vacuum pumping		SM18		Cryomodule+SM	Krzysztof								
83	Leak test under vacuum		SM18		Cryomodule+SM	Krzysztof								
84	Cooldown and commiss	ioning	SM18		Cryomodule+SM	Krzysztof								
04			514110			Ki zysztor								_
85	RF power connections		SM18		Cryomodule+SM	Eric		RF test preparation	Eric	BE-RF	2		2	SKIPPED
					Cryomodule+SM+RF									
86	Low power measureme	nts	SM18		power	Alick								SKIPPED
87	RF conditioning		SM18		Cryomodule+SM+RF	Alick		Cryomodule RF validation	Alick	BE-RF			15	SKIPPED
			514110		power								15	
88	High power performanc	e	SM18		Cryomodule+SM+RF	Alick								SKIPPED
					power									
89	Cryomodule warmup		SM18		Cryomodule+SM	Krzysztof		Fuit for an inclusion	1/	TE CRO			-	
90	Cutting lines		SM18		Cryomodulo ISM	Kravestof		Exit from tests	Krzystof	TE-CRG			5	
					Cryomodule+SM	Krzysztof								
	Alignment survey AT401		SM18	bunker		Mateusz	EDMS 1578808, chapter	Final diamagnetic				0	4	
92 93	Alignment survey RF		SM18 SM18	bunker		Mateusz	EDMS 1578808, chapter	Final alignment steps	Mateusz	EN-ACE		0	1	
	Alignment adjustment		310110	bunker		Mateusz						U		
55	Transport preparation		SM18		Cryomodule+SM	Giovanna		Transport Preparation					2	

Including some weekends

