



EUROPEAN
SPALLATION
SOURCE

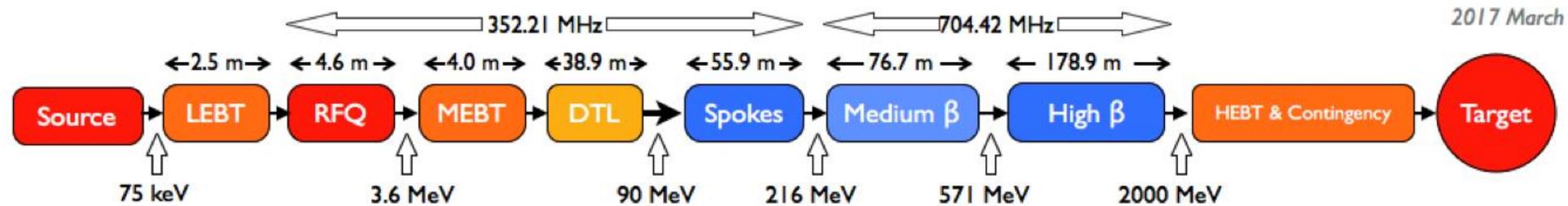
DE LA RECHERCHE À L'INDUSTRIE



ESS CEA BI ANNUAL MANAGERIAL COORDINATION

MEETING # 4

6TH DECEMBER 2017



Florence ARDELLIER & Pierre BOSLAND

www.cea.fr

On behalf of CEA-ESSI team

1. Overview

2. Status of CEA-ESSI Project : progress, passed milestones and AIK follow-up

1. Elliptical Cryomodules (AIK 5.1, AIK 5.2, AIK 5.3)
2. RFQ (AIK 3.4)
3. Diagnostics (AIK 7.1, AIK 7.2, AIK 7.3, AIK 7.9)
4. Control System (IIK 01, IIK 05)

1. Risks register status

Open discussions

Schedule number	Amount (k€)	Status
AIK 1.1 (management)	0	signed
AIK 5.1 : H-ECCTD	4294	signed
AIK 5.2 Components supply	38618	signed
AIK 5.3 & 5.4 Assemb Cryomodules & expertise	19395	signed
AIK 5.5 assistance to inst & commissioning	600	signed
AIK 3.4 RFQ	8710	signed
AIK 7.1 - EMU	311	signed
AIK 7.2 - Doppler	78	signed
AIK 7.3 - diag NPM	1546	signed
AIK 7.9 - nBLMs	1180	signed
IIK 01 - Source & LEBT Control System	850	signed
IIK 05 RFQ Control System	768	signed
Total Amount	76350	

Cryomodules

→ RFQ

Diagnostics

Integrated Control System

Diagnostics 3,1 M€

Juin 2016 : Doppler
Nov 2016 : EMU
Avril 2019 : nBLM
Juin 2019 : IPM



Control System 1,6 M€

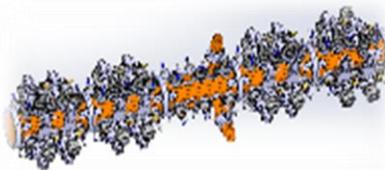
Mid-2016 : Proton Source & LEBT
2017 : RF power source
Mid 2018 : vacuum et thermalisation RFQ



RFQ : 8,7 M€

Mid 2018: delivery at Lund

- RFQ & support
- Cooling system
- Partial RFDS



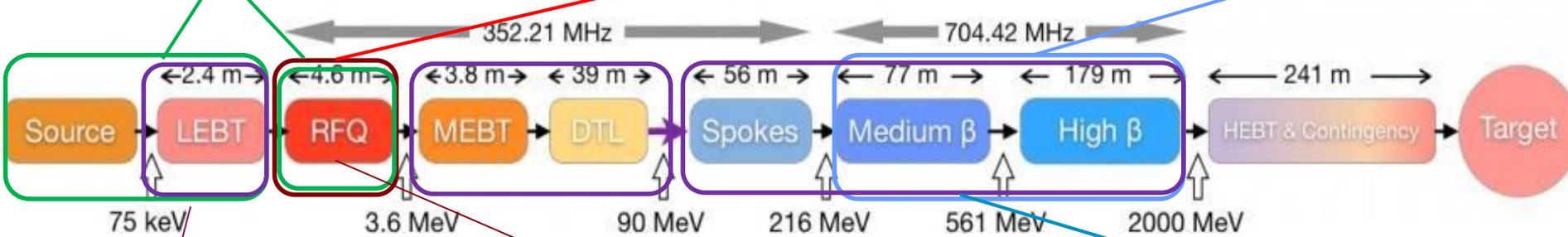
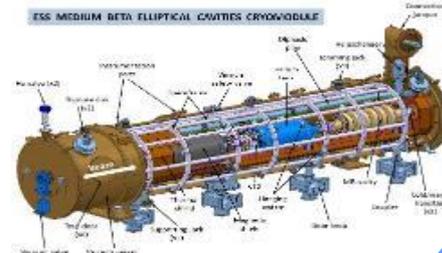
Cryomodules : 62,9 M€

2 demonstrators (M-ECCTD & H-ECCTD)

30 Elliptical cavities Cryomodules

- Components procurement and characterisation (except cavities)
- Cryomodules assembly and RF tests

2018-19 : 9 CM Med β
2019-22 : 21 CM High β

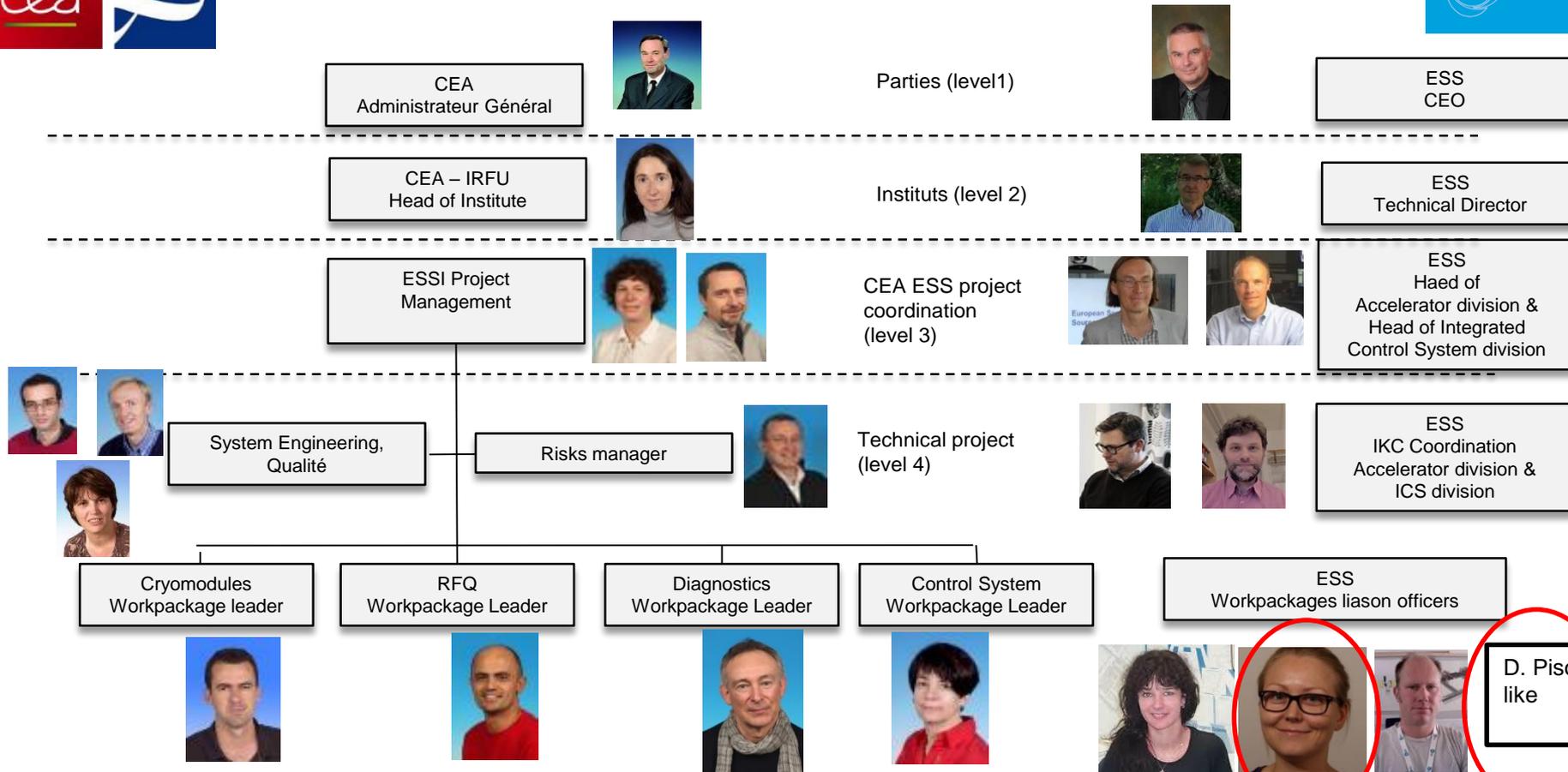


Mi 2016 :
Acceptance tests
Control system

2017 : 352 MHz RF couplers conditioning :

- Klystron & Modulator 352 MHz
- Control system

- Mi 2017 : Tests stand 704 MHz for couplers conditioning
- RF power tests of 6 Cryomodules



- **Level 1** : Strategic level : committee organised on demand,
- **Level 2** : ESS / CEA Coordination committee : 2 times / year,
- **Level 3** : Reporting & Technical coordination : 2 times / month,
- **Level 4** : Monthly report for technical progress & weekly exchanges

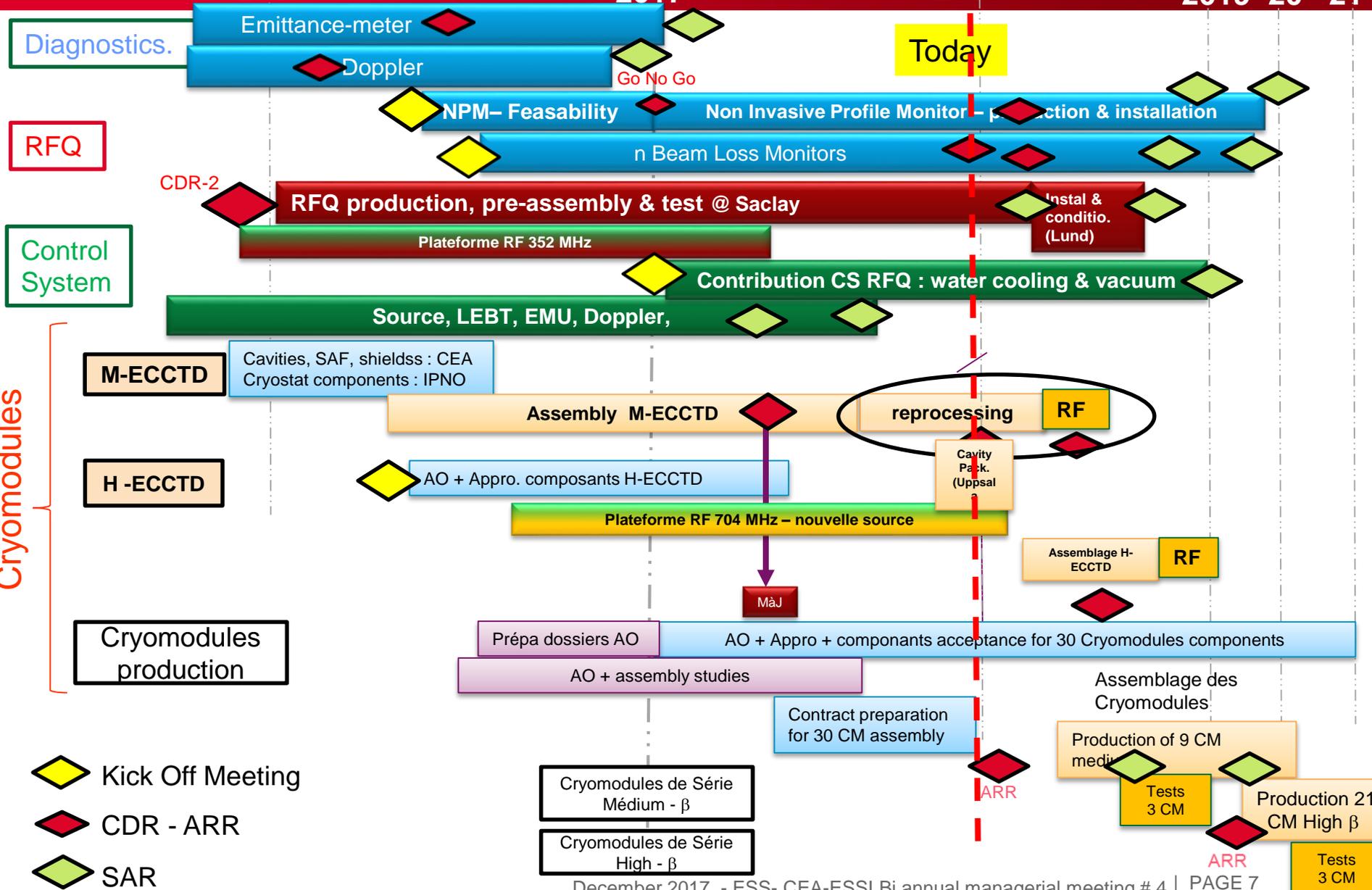
Milestones planned before end 2017 (4th july 2017)	Status on the 6th december 2017
<p>Management</p> <ol style="list-style-type: none"> 2nd risks workshop to organize in July 2017 	<ol style="list-style-type: none"> Held on the 5th july 2017 @ Saclay
<p>RFQ</p> <ol style="list-style-type: none"> FAT of the 1st section and machining of the 2nd, 3rd 4th sections Machining of the tuners and auxiliaries FAT of the test cavity & couplers conditioning at Saclay 	<ol style="list-style-type: none"> FAT of section 1 postponed on jan 2018. Section 2-3-4 machining on going On going FAT of the test cavity : ok. Couplers conditioning is just starting
<p>Cryomodules</p> <ol style="list-style-type: none"> M-ECCTD : RF power tests & transport tests CDR-M2 : sept 2017 704 MHz RF Power source FAT at Saclay High b cavity package tests in FREIA Signature of the Cryomodules Assemblies market 	<ol style="list-style-type: none"> & 2 : see Pierre Bosland slides FAT is postponed in january 2018 Tests are postponed in january 2018 Call for bid is running
<p>Control System (CS)</p> <ol style="list-style-type: none"> Finalisation of Sources & LEPT CS activities Start of RFQ CS activities Contract to be placed for nBLMs and NPMs CS 	<ol style="list-style-type: none"> SAR pronounced Scope and requirements agreed Contract ready to be signed for nBLMs
<p>Diagnostics</p> <ol style="list-style-type: none"> NPM : tests on IPHI beam with 3 different « readout » nBLMs : PDR 1.2 	<ol style="list-style-type: none"> Tests bench ready. 1st beam end of year 11st & 12st july at Lund

2016

2017

2018

2019 20 21



	Reviews passed	Status on the 6th Dec 2017	Next Milestone
Doppler	SAR-1 : 12/07/16 SAR-2 : 14/12/16	Delivered to ESS Accepted by ESS	IKRC # 14
EMU	SAR-1 : 7/12/2016 SAR-2 : 21/01/2017	Delivered to ESS Accepted by ESS	IKRC # 14
Contrôle Source & LEBT	Acceptance Tests Source (Catania) : 17/01/17 Acceptance Tests LEBT (Catania) : July 2017	Delivered to ESS Accepted by ESS in sept 2017	IKRC # 14 (tbc)
RFQ	CDR-2 : 8-9/12/2015	Realization on going	SAR-1 : mid 2018
RFQ Control System	KoM partiel : 30/01/2017 Final Kom : 22/11/2017	On going	
NPM	KoM : 26/5/2016 PDR 1.1 : 31/01/2017	Prototypes validation / qualification	CDR in april 2018
nBLMs	KoM : 25/7/2016 PDR 1.1 : 12/12/2016 PDR 1.2 : 10-11/7/2017 CDR 1.1 : 4-5th/12/2017	Design validation on going thanks to prototypes tests	CDR1.2
<i>Contrôle nBLMs, NPM</i>		<i>Contrat en cours de négociation (hors Inkind)</i>	
H-ECCTD	KoM : 13/3/2016	Components procurements	RFA (Ready For Assembly Review)
Cryomodules	CDR 1 : 3-4 / 04 / 2017	Components procurements on going M-ECCTD refurbishing on going	CDR-2 : TBD

RFQ couplers ready to be conditioned (352 MHz, 800kW)



RFQ coupler assembled

1st assembly and (partial) tests of a medium β Cryomodule (Demonstrator)





Fruitful exchanges with BI division and ICS divisions

Control System of Proton Source and LEBT delivered & acceptance tests passed

Jean-François Denis (JIRA) [jira@esss.se]

À : [Ardellier-Desages Florence](#)

Jean-François Denis a mis à jour une demande

ICS HW and Integration / ICSHWI-458
ESS ERIC Source control system Acceptance Test at Catania

Changement par: Jean-François Denis

Pièce jointe: [sorensenXG125120.pdf](#)

[Ajouter un commentaire](#)

Ce message a été envoyé par Atlassian JIRA (v7.3.6#73017-sha1:51437cf)

Source Acceptance Tests in Continuous Mode
 2017-07-05 17:54

Test	Description	Result
Setup HV power supply:		
	Setup HV power supply: Check HV power supply is off	Success
1	None	Success
	Setup HV power supply: Set HV power supply current limit to maximum	Success
2	None	Success
	Setup HV power supply: Set HV power supply voltage to 0V	Success
3	None	Success
	Setup HV power supply: Set to ramp mode	Success
4	None	Success
	Setup HV power supply: Set ramp to 1000V/s	Success
5	None	Success
Setup repeller 01 power supply:		
	Setup repeller 01 power supply: Check Repeller 01 Power Supply is Off	Success
6	None	Success
	Setup repeller 01 power supply: Set Repeller 01 Power Supply voltage to -3500V	Success
7	None	Success
	Setup repeller 01 power supply: Set Repeller 01 Power Supply current to -2mA	Success
8	None	Success
Setup repeller 02 power supply:		
	Setup repeller 02 power supply: Check Repeller 02 Power Supply is Off	Success
9	None	Success
	Setup repeller 02 power supply: Set Repeller 02 Power Supply voltage to -700V	Success
10	None	Success
	Setup repeller 02 power supply: Set Repeller 02 Power Supply current to -2mA	Success
11	None	Success
Setup coil 01 power supply:		

Source Acceptance Tests in Pulsed Mode
 2017-07-05 17:48

	Description	Result
Setup HV power supply:		
	Setup HV power supply: Check HV power supply is off	Success
None		Success
	Setup HV power supply: Set HV power supply current limit to maximum	Success
None		Success
	Setup HV power supply: Set HV power supply voltage to 0V	Success
None		Success
	Setup HV power supply: Set to ramp mode	Success
None		Success
	Setup HV power supply: Set ramp to 1000V/s	Success
5	None	Success
Setup repeller 01 power supply:		
	Setup repeller 01 power supply: Check Repeller 01 Power Supply is Off	Success
6	None	Success
	Setup repeller 01 power supply: Set Repeller 01 Power Supply voltage to -3500V	Success
7	None	Success
	Setup repeller 01 power supply: Set Repeller 01 Power Supply current to -2mA	Success
8	None	Success
Setup repeller 02 power supply:		
	Setup repeller 02 power supply: Check Repeller 02 Power Supply is Off	Success
9	None	Success
	Setup repeller 02 power supply: Set Repeller 02 Power Supply voltage to -700V	Success
10	None	Success
	Setup repeller 02 power supply: Set Repeller 02 Power Supply current to -2mA	Success
11	None	Success
Setup coil 01 power supply:		



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STATUS OF CEA- ESSI PROJECT :

PROGRESS STATUS,

MILESTONES PASSED,

SCHEDULES FOLLOW-UP

1. Product Assurance Plan

Delivered in june 2017 : no feed back from ESS

C.E. marquing is not taken into account

(cf ESS-60033356, TUV Nord, « pre-study of legal QC requirement for pressure equipment (cryo) », 12 oct 2015, rev 1, state released)



REVISOR	REVISION	VERIFICATION	APPROBATION
Edited by	Reviewed by	Approved by	
Product Assurance & Safety Officer	Quality Engineer	ESS-I Project Manager	

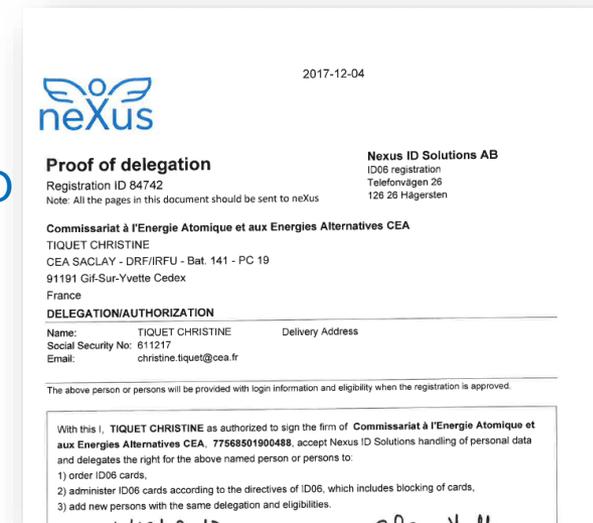
2. Interfaces documents management

- In place for cavities
- Under construction for Cryomodules

3. Bi mensual planning meeting : ESS, LASA, STFC, IPNO

4. Bi mensual bilateral call phones : ESS / CEA

5. ID 06 cards management : CEA is registered



2017-12-04

nexus

Proof of delegation

Registration ID 84742
 Note: All the pages in this document should be sent to nexus

Nexus ID Solutions AB
 ID06 registration
 Telefonvägen 26
 126 26 Hågersten

Commissariat à l'Energie Atomique et aux Energies Alternatives CEA
 TIQUET CHRISTINE
 CEA SACLAY - DRF/IRFU - Bat. 141 - PC 19
 91191 Gif-Sur-Yvette Cedex
 France

DELEGATION/AUTHORIZATION

Name:	TIQUET CHRISTINE	Delivery Address
Social Security No:	611217	
Email:	christine.tiquet@cea.fr	

The above person or persons will be provided with login information and eligibility when the registration is approved.

With this I, **TIQUET CHRISTINE** as authorized to sign the firm of **Commissariat à l'Energie Atomique et aux Energies Alternatives CEA, 77568501900488**, accept Nexus ID Solutions handling of personal data and delegates the right for the above named person or persons to:

- 1) order ID06 cards,
- 2) administer ID06 cards according to the directives of ID06, which includes blocking of cards,
- 3) add new persons with the same delegation and eligibilities.



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ELLIPTICAL CRYOMODULES

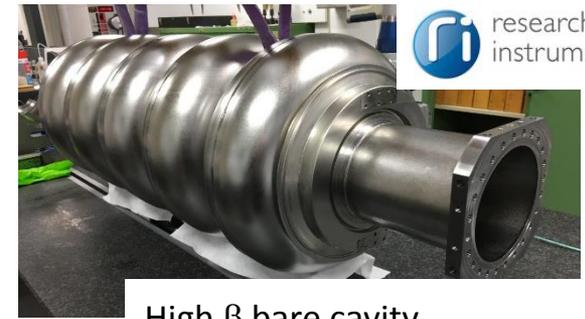
-AIK 5.1 : H-ECCTD

- AIK 5.2 : COMPONENTS SUPPLY

- AIK 5.3 : CM ASSEMBLY

- Five high- β cavities under manufacturing at RI (Germany)

- First bare cavity delivered in October 2017
- Chemical treatment and vertical tests will be performed at CEA
- Heat treatment will be performed at IPNO



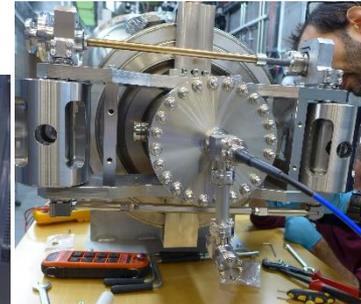
High β bare cavity

- Power couplers

- Four RF windows and antenna are already available
- RF power conditioning up to 1.1 MW : done on the 1st pair, 2nd pair is planned in January 2018

- Cavity package tests in HNOOS (Uppsala)

- Cavity package at Uppsala
- High power RF tests : January 2018
(vs Klystron availability)



Cavity preparation for tests



- Cryomodule components:

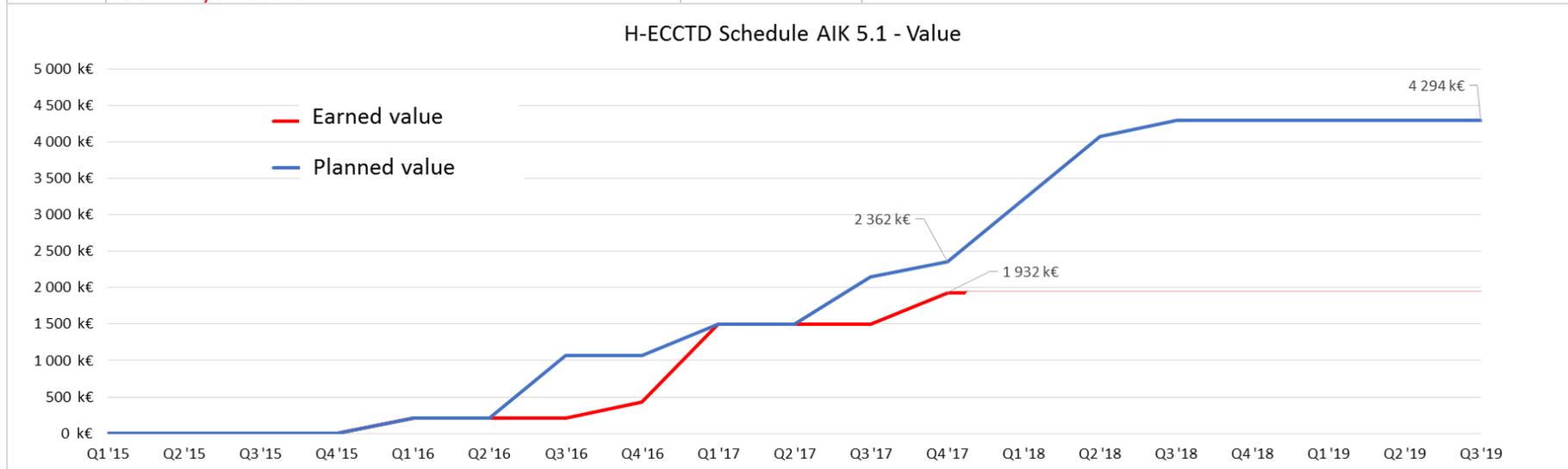
- Vacuum vessel, spaceframe and thermal shielding have been ordered, deliveries are expected in Q1 2018
- Magnetic shieldings, cold tuners, motors, piezos, RF cables and titanium bellows are **already available**
- Titanium diphasic tubes are under manufacturing in SDMS (small design changes must be done)
- Orders have been placed for bellows,
- **Cryo-piping** : offers planned on the 8th december

AIK #	Nom	Schedule milestones
AIK5.1	Ms#6 -Tests in vertical cryostat of the high beta prototype cavities	Ven 01/09/17
AIK5.1	Ms#7 -RF conditioning of 3 coupler pairs	Ven 01/09/17
AIK5.1	Ms#8 -Make operational RF test facility available at Uppsala	Ven 01/09/17
AIK5.1	Ms#9 -High beta cavity equipped with power coupler delivered at Uppsala University	Lun 02/10/17
AIK5.1	Ms#10 -Ready for assembly review of the Test report review to select 4 cavities and 4 couplers after RF processing and qualified for the assembly in the H-ECCTD cryomodule.	Lun 02/10/17

RI deliveries planned : january → may 2018

1st pair is conditioned, 2nde pair planned in january

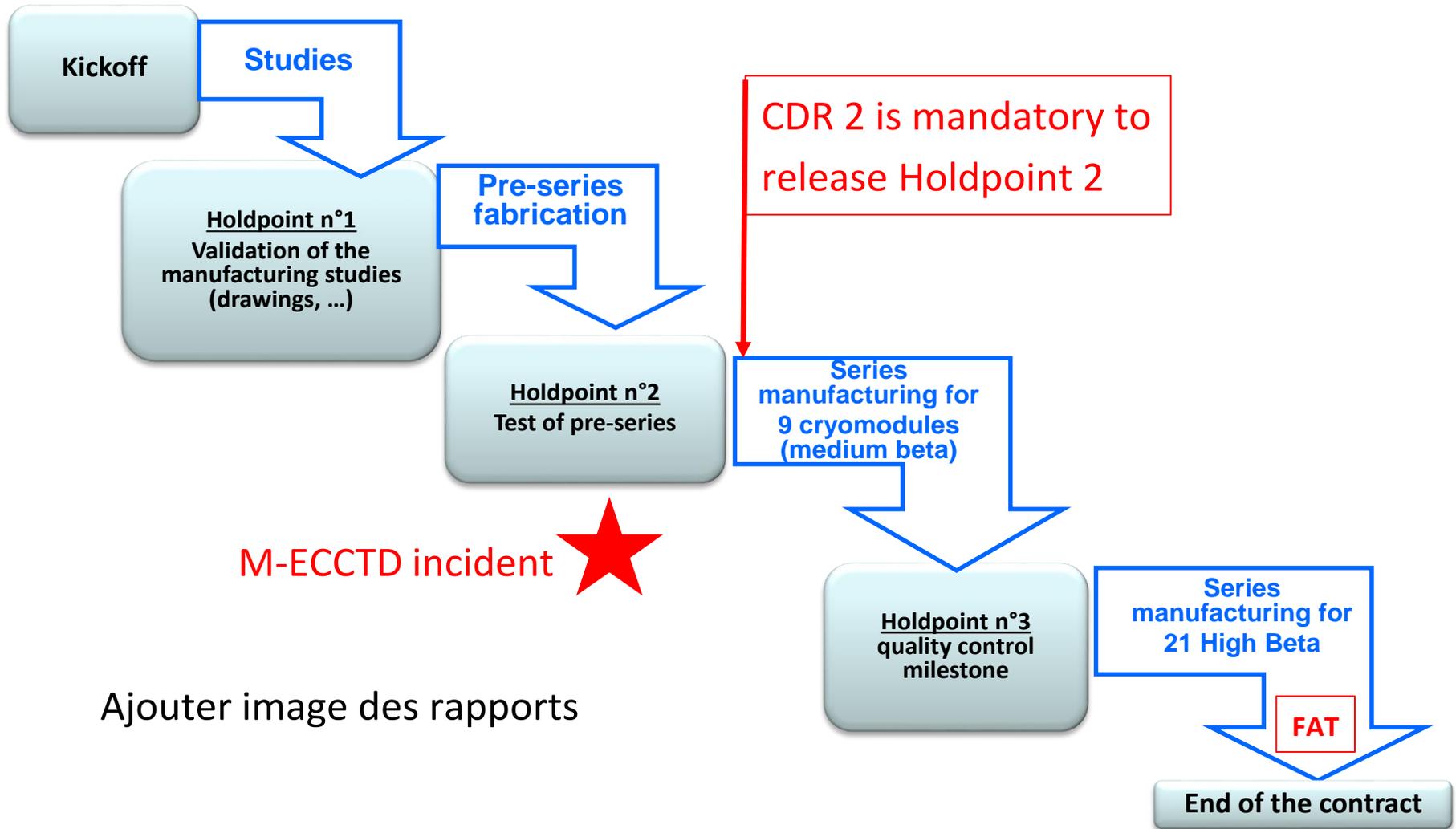
Postponed in april 2018



Milestones planned in the schedule	Schedule Milestones	Comments
Ms#11 -Completion of the H-ECCTD assembly	28/02/2018	Industrial selected for CM assembly will be observer Assembly end foreseen in september 2018
Ms#12 -Completion of the H-ECCTD tests	30/05/2018	Tests will start in sept 2018

Approach : H-ECCTD will be the first step for the industrialization.
Assembly industrial team will be present as observer

Signature of the contract between supplier firm and CEA



Ajouter image des rapports

SUMMARY OF THE TESTS OF THE M-ECCTD

PRELIMINARY RESULTS AND ANALYSIS

P. BOSLAND

ON BEHALF OF CRYOMODULES TEAM

THE M-ECCTD PROTOTYPE CRYOMODULE

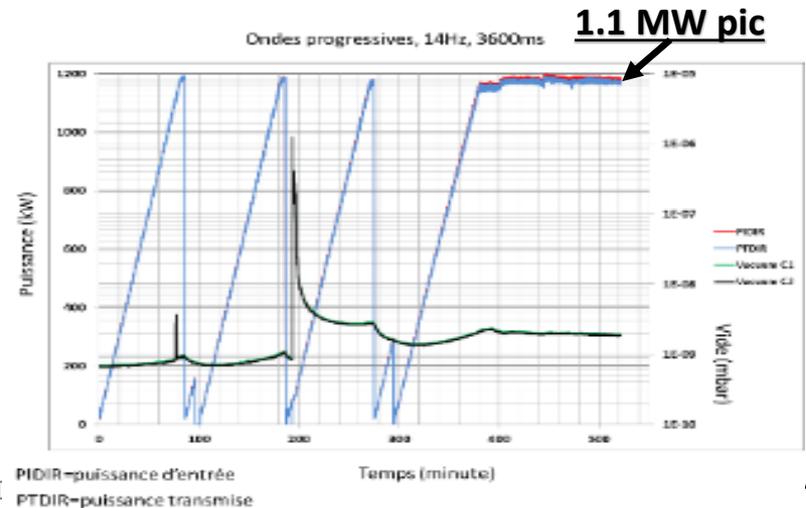
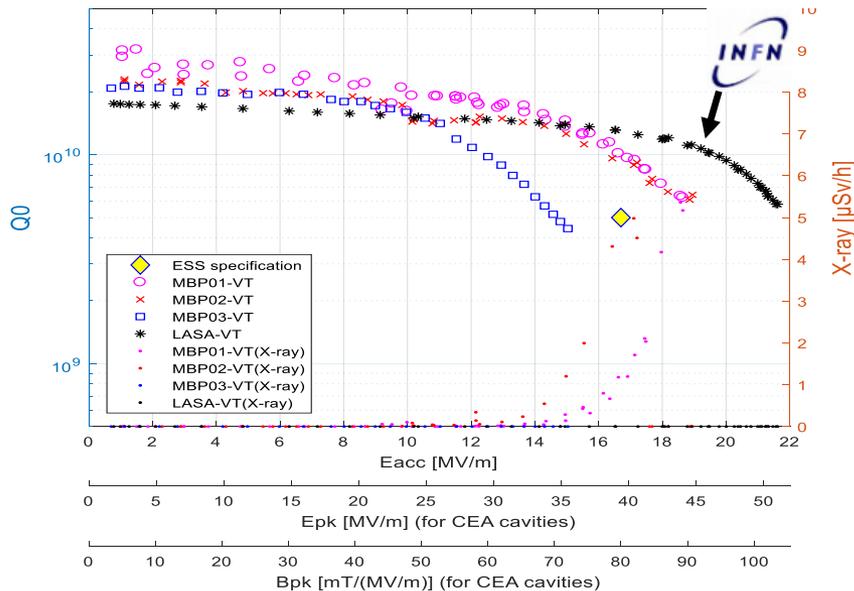


4 pairs of couplers conditioned up to
1.1 MW pic

4 couplers mounted in the M-ECCTD



- 3 "CEA" cavities
- 1 INFN LASA cavity

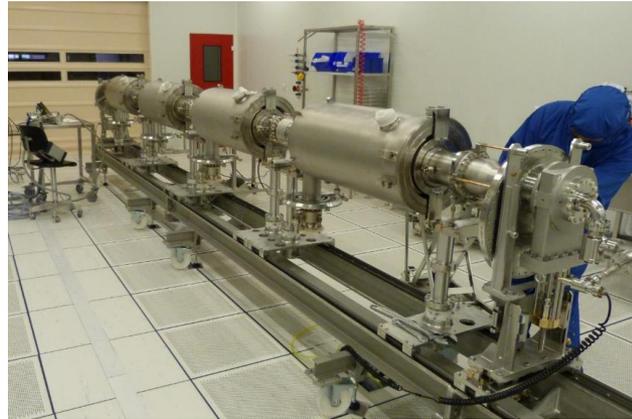


THE M-ECCTD PROTOTYPE CRYOMODULE



CAVITY STRING ASSEMBLY IN ISO 4 CLEAN ROOM

Jan. 2017

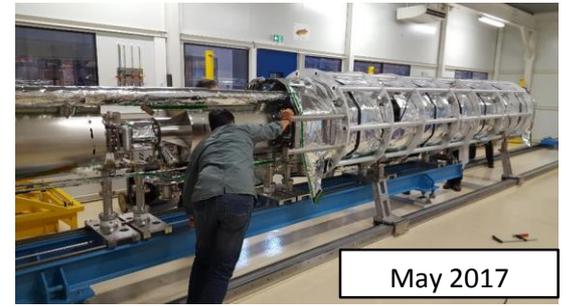


March 2017

ASSEMBLY OUTSIDE THE CLEAN ROOM



April 2017



May 2017



4th April 2017



procurement

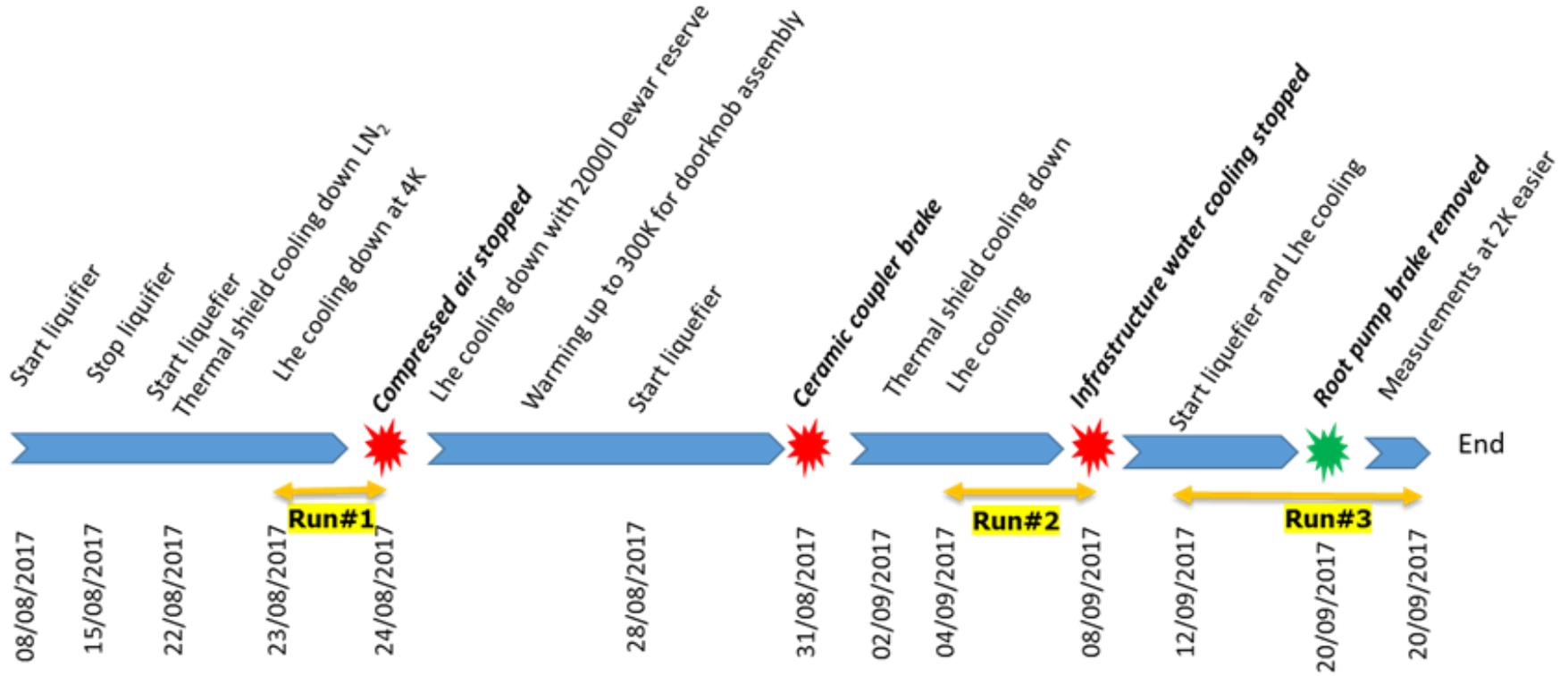




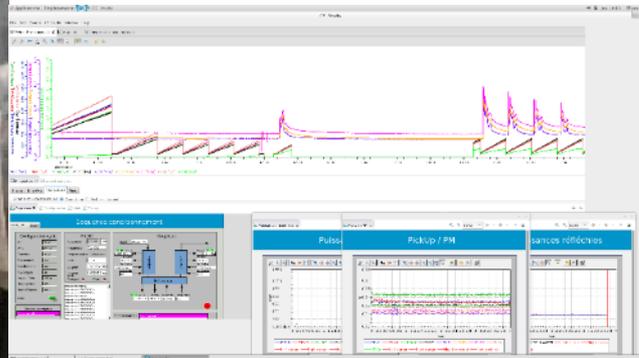
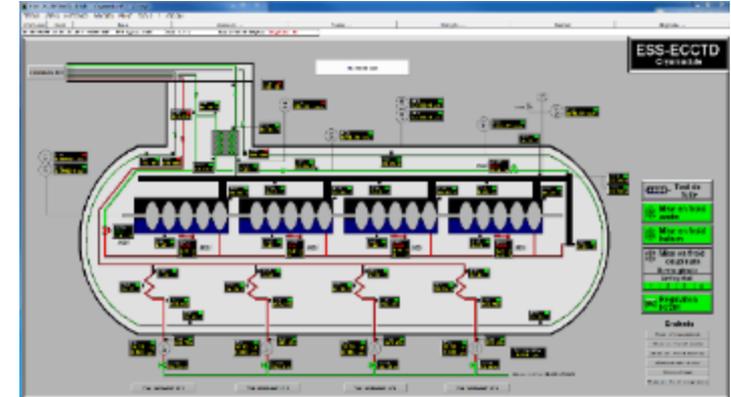
Installation in the test stand - July 2017

- **1st cool down to 4 K and 2K in Aug./Sept. 2017**
- **Break of the coupler ceramic window during the doorknob assembly**
 - => sudden refilling to PA of the cavities vacuum
 - => pollution of the cavities – High power RF tests forbidden
- **The broken coupler has been removed and replaced by a blank flange to close the cavity string. Cryogenic tests and measurements at low level RF could be performed with the polluted cavities**

TIME LINE OF THE TESTS OF THE M-ECCTD



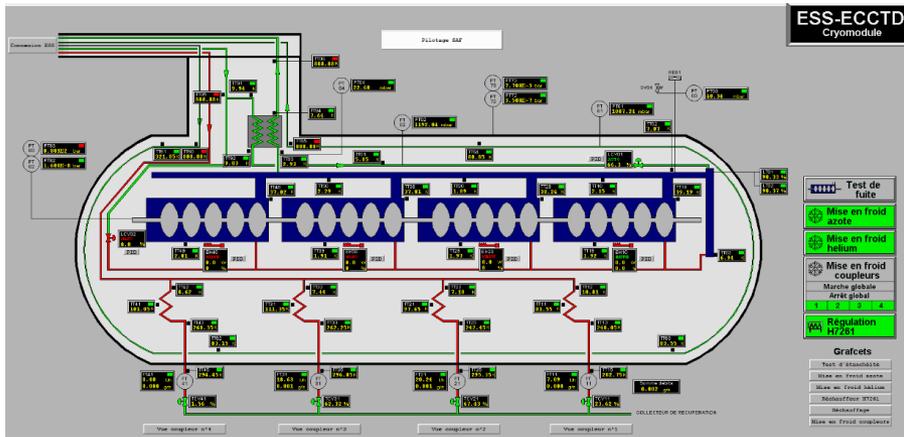
Muscade[®]: control system of cryogenics, vacuum



EPICS: control system for the RF

Cryogenic tests

Cryomodule kept at 2 K with a stable LHe level in the diphasic tube.



Measurements of cryogenic loads in a very short time (Values TBC!)

Loads at 2K: ~ 23W (estimations = 19,6W)

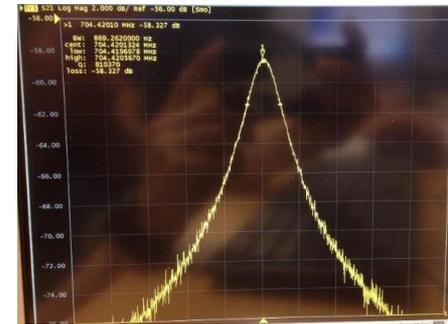
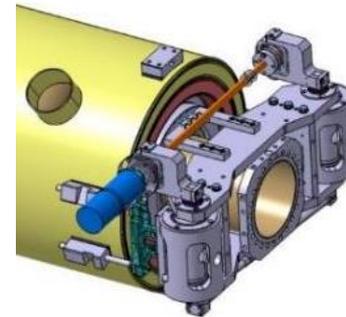
Without any optimisation and adjustment of the cooling conditions
Successfull

Loads on the thermal shield at 80K: ~73W (estimation = 50W)

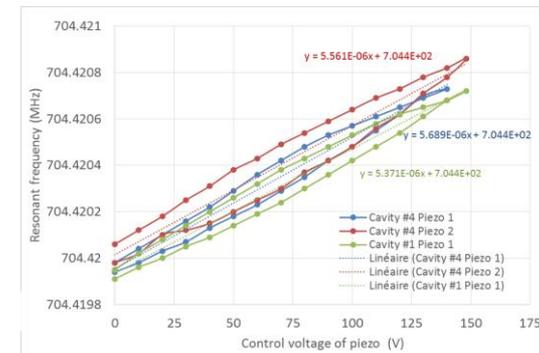
Analysis of the additional losses sources still in progress. Some possible causes identified and will be corrected during next assembly.

RF mesures at low level

Tuning the cavities at 704.42 MHz at 4.2 K and 2 K with the slow tuning system



Check of the correct running of the piezos stacks.
(their real efficiency can only be tested with high RF power)



The M-ECCTD has been dismantled. Dammmages on the cavities and couplers have been analyzed.

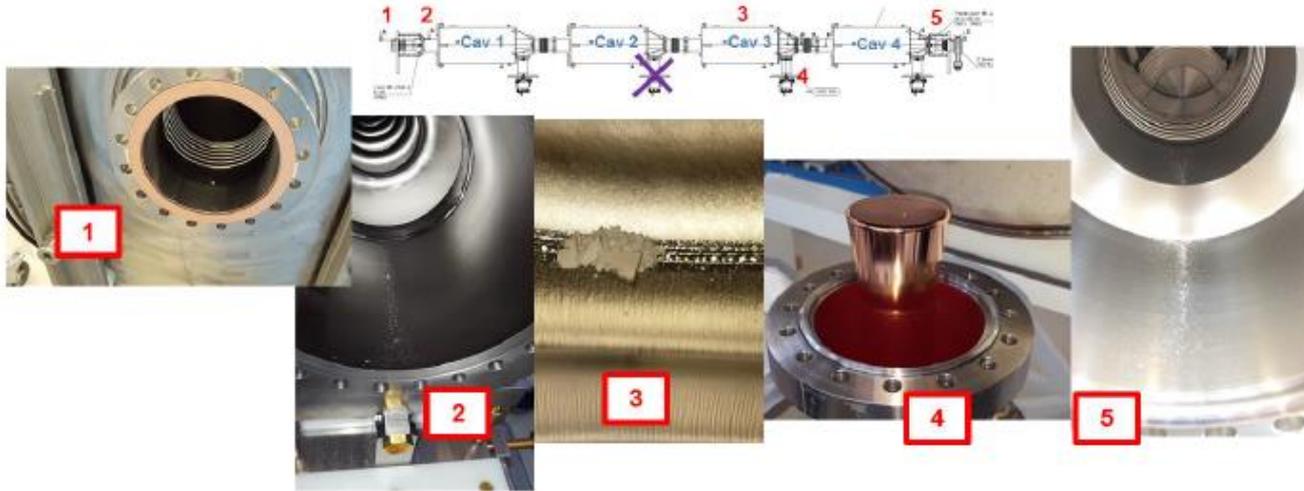


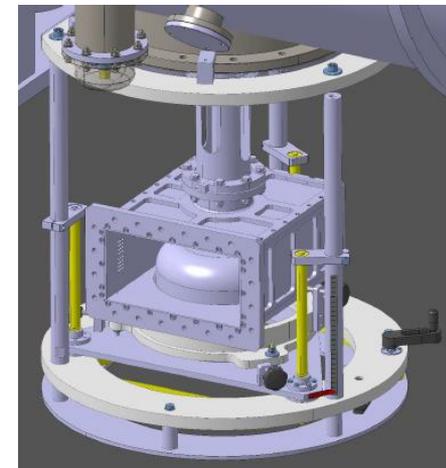
Figure 1: Inspection of cavity string components after disassembly

- Cavities and couplers will be reprocessed and tested before the next assembly of the cryomodule
 - 3 cavities will be reprocessed in the ZANON Company (One is the LASA cavity).
 - Saclay is also reprocessing the other cavities
- A first pair of couplers is being conditioned at high RF power
- Additionnal improvements will be also applied for cryogenic loads reduction and in the assembly procedure (For example cavities will be assembled at atmospheric pressure instead of being kept under vacuum).

- The production of the series has started
- Important effort for the 4 activities in parallel on the cryo
 - Prototype M-ECCTD : refurbishment and RF power at 2K tests in spring 2018.
 - 2 cavities have been sent to Zanon for reprocessing
 - Fabrication of the components for the 2nd prototype H-ECCTD in progress
 - Order in advance the components of the series. More than 80% of the contracts prepared or launched



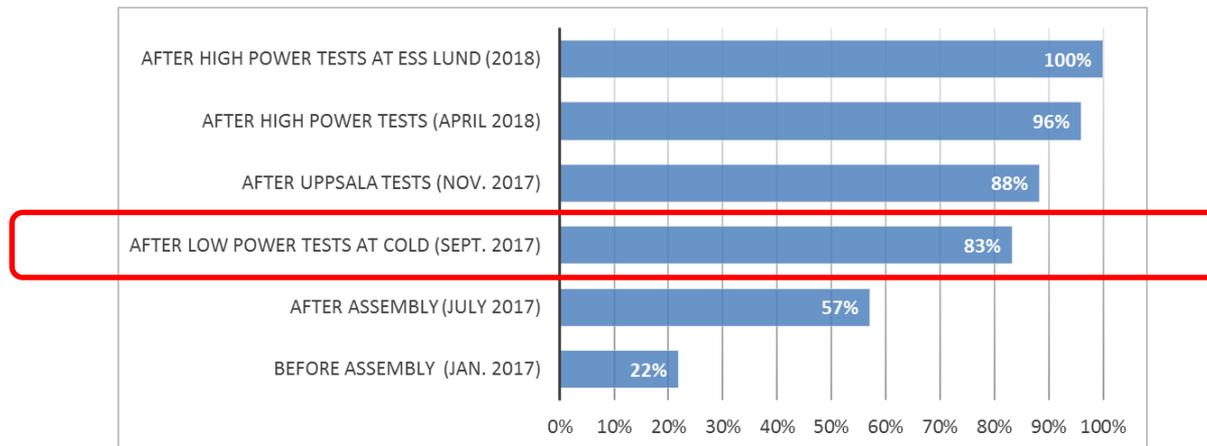
Dismounting phase was very useful to prepare the production components and toolings improvements are considered



Door Knob mounting tools designed and under review

1. M-ECCTD is now dismantled

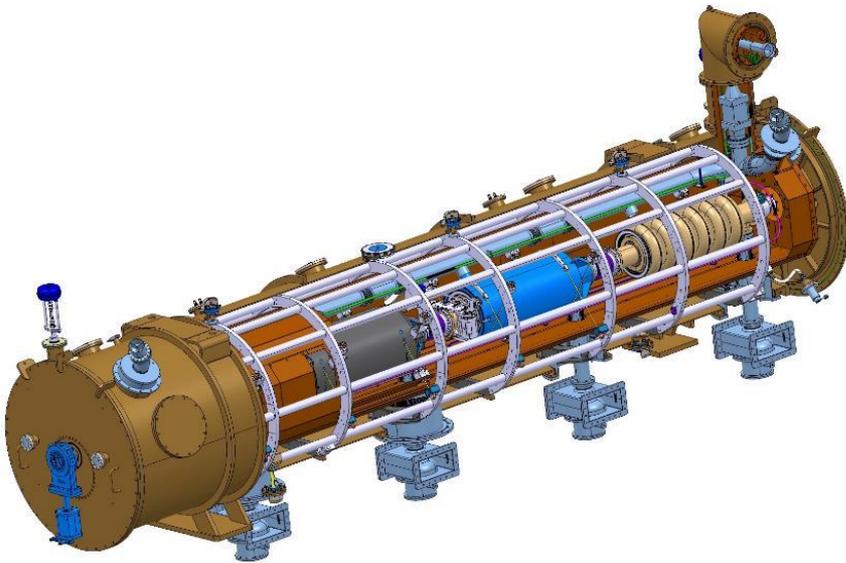
- Expertise and impacts analysis still on going
- Identification of reprocessings on going (cavities, couplers, bellows, ...)
- Design review of Door Knob mounting tooling planned before end 2017
- New M-ECCTD assembly is foreseen beginning of 2018 and RF power tests in april 2018



2. Minor delay impacts for series production

3. Medium Beta Elliptical Cryomodules assembly planned to start in sept. 2018

CONTRACTS ALREADY PLACED FOR 30 (+1) CRYOMODULES



***CE marking is NOT required in the signed contracts**

	Call for tender
Vacuum vessels (1+ 30)	Contract awarded to ACPP , manufacturing of the first unit in progress
Power couplers (120)	Contract awarded to PMB , manufacturing drawings validated and fabrication of the pre-series in progress
Coupling boxes for coupler conditioning	Contract awarded to SDMS , first unit expected within one months
Thermal shieldings (1 + 30)	Contract awarded to SDMS , manufacturing of the first unit in progress
Spaceframe (1 + 30)	Contract awarded to SDMS , manufacturing of the first unit in progress
Cold Tuning Systems (mechanical part)	Contract awarded to YVON BOYER kick-off meeting organized in September
Motors for cold tuning systems	Contract awarded to TSA (PHYTRON) , 24 motors received
Cryogenic heat exchanger (1 + 30)	Supplier chosen, order in progress
Magnetic shielding (1 + 30)	Contract awarded to MECA MAGNETIC , kick-off meeting organized in September
MLI (1 + 30)	Call for tender launched
Internal instrumentation (1 + 30)	Contract awarded to SODITECH , kick-off meeting organized in October 2017
Intercavity bellows, cold-warm transitions (30)	Cancellation of the tender after analyses of the offers received. New call for tender launched
Cryogenic circuits, diphasic tubes, coupler bells	Ready to launch call for tender
Cryogenic valves CV01 and CV02	Contract awarded to VELAN
Level sensors	Contract awarded to CRYOFORUM
Temperature sensors	Contract awarded to CRYOFORUM
Cryomodule assembly	Call for tender published . Offers waited for 21 st december

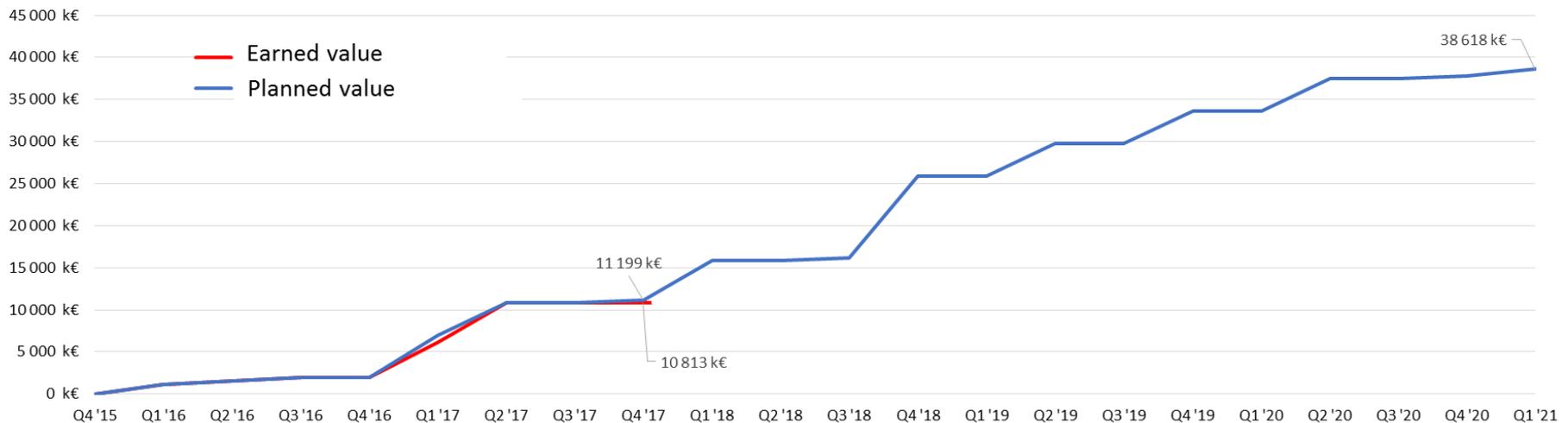
Milestones status planned S2-2017

Milestones	Milestone AIK 5.2	Comments
Ms8-Factory Acceptance Tests of RF power source (1%) Value : 386 k€	October 2017	Posponed in january 2018 (modulator issues)

Milestones planned during S1-2018

Milestones	MS#AIK 5.2	Comments
Ms9-Factory Acceptance Test of the Medium-b pre-series components Value : 3862 k€	February 2018	Pre-series FAT are planned from January until june 2018
Ms10-SAR for Medium-b pre-series components Value : 772 k€	February 2018	In charge of ESS

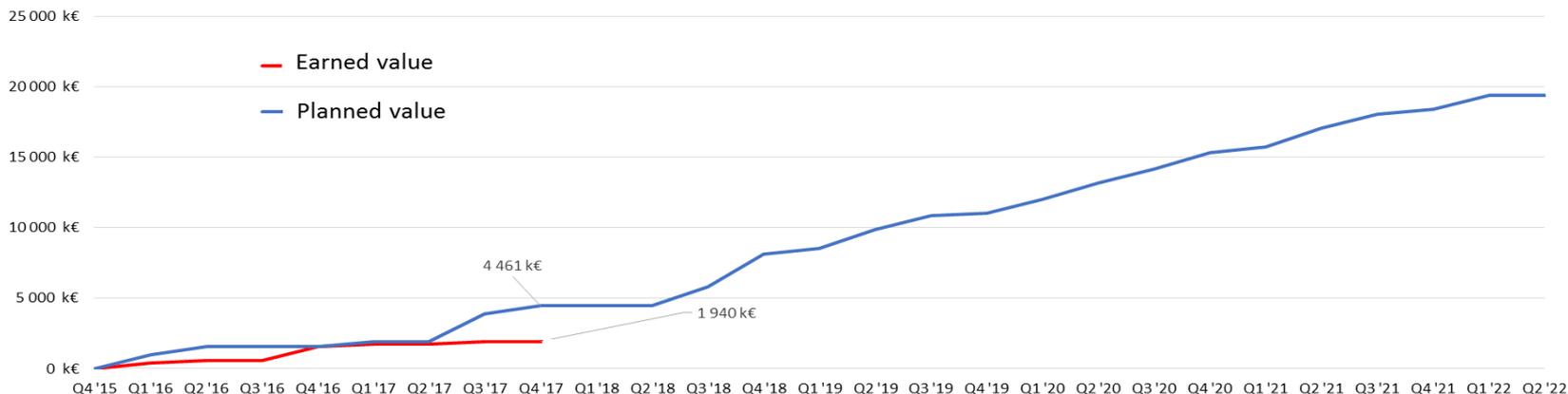
CM components Schedule AIK 5.2 - Value



Milestones planned during S2-2017

Milestones id.	Milestones AIK 5.3	Comments
#6-Stage 1 CEA Data Package (1746 k€)	Sept 2017	Linked to assembly phase start
# 7-ARR for Medium β Cryomodules (194 k€)	Oct 2017	Depending on the 6 first cavities delivery
# 8-High β cavities production launching: CEA recommendations for High-b cavities (194 k€)	Nov 2017	On going
# 9-CDR of High- β cavity for CEA assistance to ESS (194 k€)	Dec 2017	ESS is in charge to plan CDR
# 11-Delivery of the first set of 4 medium β cavities (ESS) (194 k€)	Nov 2017	See LASA schedule (oct 2018)

CM Assembly Schedule AIK 5.3+5.4 - Value



Milestones to be planned during S1-2018

Milestones id.	Milestones AIK 5.3	Comments
Ms6-Stage 1 CEA Data Package	30/08/2017	Beginning september 2018 ?
Ms7-ARR for Medium b Cryomodules	29/09/2017	End September 2018 ?
Ms8-High b cavities production launching: CEA-ESSI recommendations for Medium-b cavities	30/11/2017	On going
Ms9-CDR of High-beta cavity for CEA assistance to ESS	30/11/2017	To be planned by ESS

Total value planned to earn on S1-2018 : ~2,3 M€₂₀₁₃

Milestones are very dependant from components schedule deliveries

For Schedule signature, cavities were awaited in september 2017

1. CDR-2 to be planned after high RF power tests : May 2018 ?

2. Cryomodule assembly time schedule :

Production of Cryomodules will start when 6 tested cavities will be available at Saclay (october / november 2018)

- Buffer if an incident occurs
- Absorb the difference of cadence between LASA cavities production (2 per 3 weeks) and CEA CM production (1 per month)

3. Cavities & Cryomodules acceptance criteria are under discussion



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RFQ – AIK 3.4

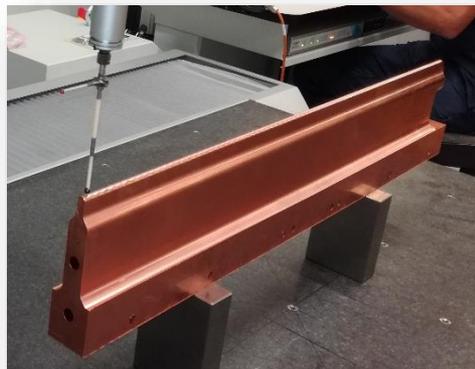
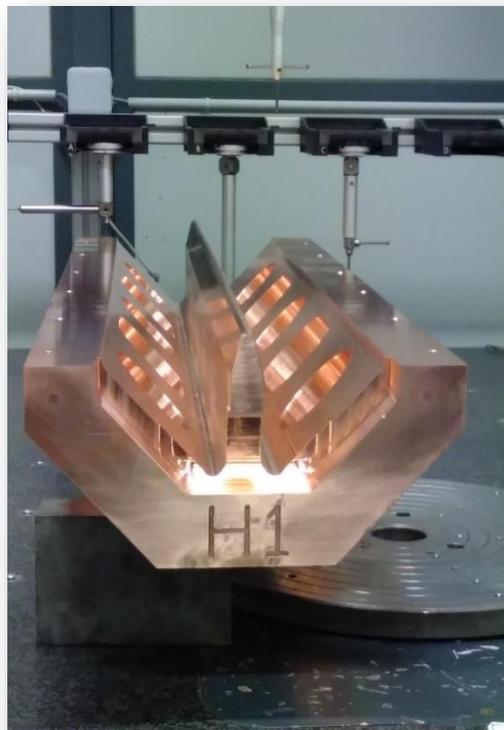
PROGRESS STATUS

TECHNICAL MILESTONES PASSED

AND AIK FOLLOW UP



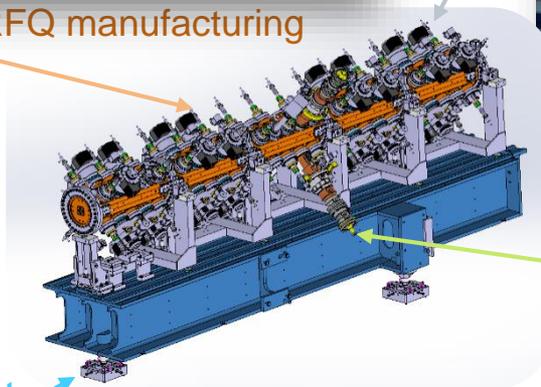
ESS RFQ : overview



RFQ manufacturing

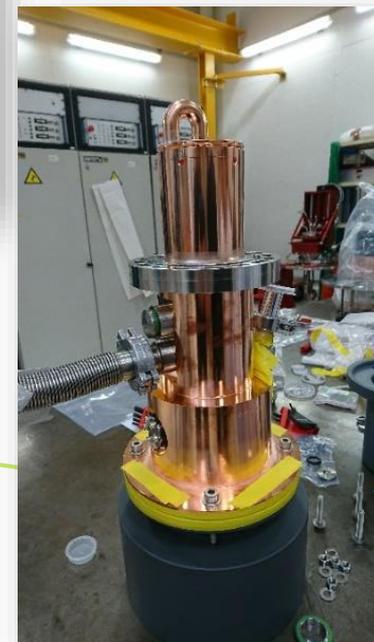


Tuners

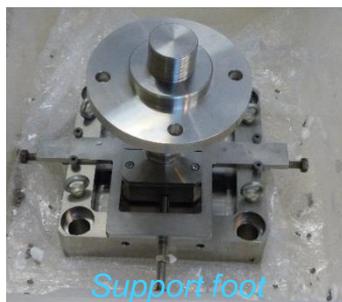


Support

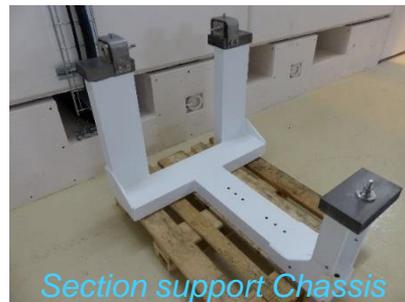
Couplers



Girders



Support foot



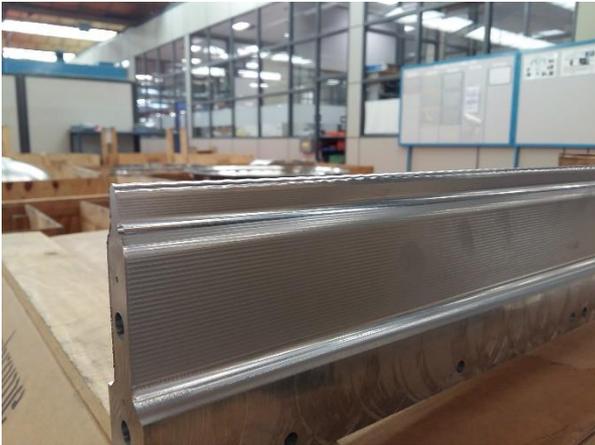
Section support Chassis



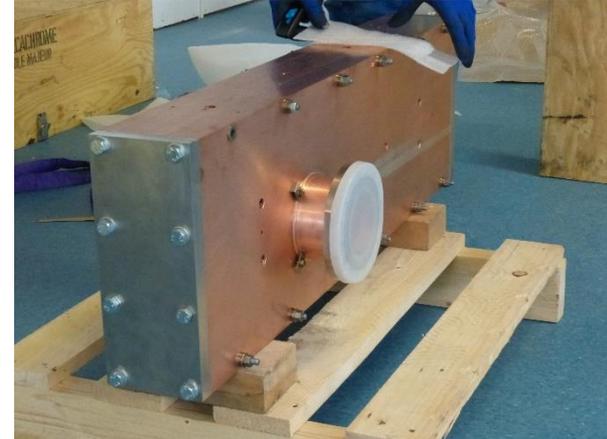
Bead-Pull

1) Qualification phase : 2 Mock up

- Machining and drilling mock-up (Alu): [Delivered at Saclay](#)
- Brazing mock up : [ok](#)



Machining and drilling mock up



Brazing mock up

2) Section 1

Brazing planned soon

3) Sections 2 to 5

Section 2 : annealing done. Final machining is starting

Section 3 : machining on going

Section 4 : machining on going

Section 5 : machining will start beginning of 2018

Weekly follow up to keep the time schedule on track

cea RFQ: COOLING SYSTEM ON TRACKS



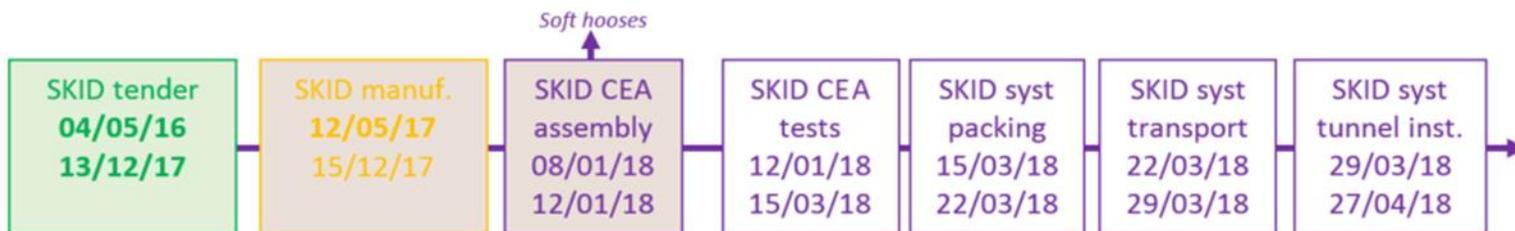
cea	ESS	ESS RFQ COOLING SYSTEM MIXING VALVES POSITION CHANGE REQUEST MEMORANDUM	CEA-ESS-RFQ-NG-001 V1.0
		ESS-I	

NOTE GÉNÉRALE - GENERAL NOTE

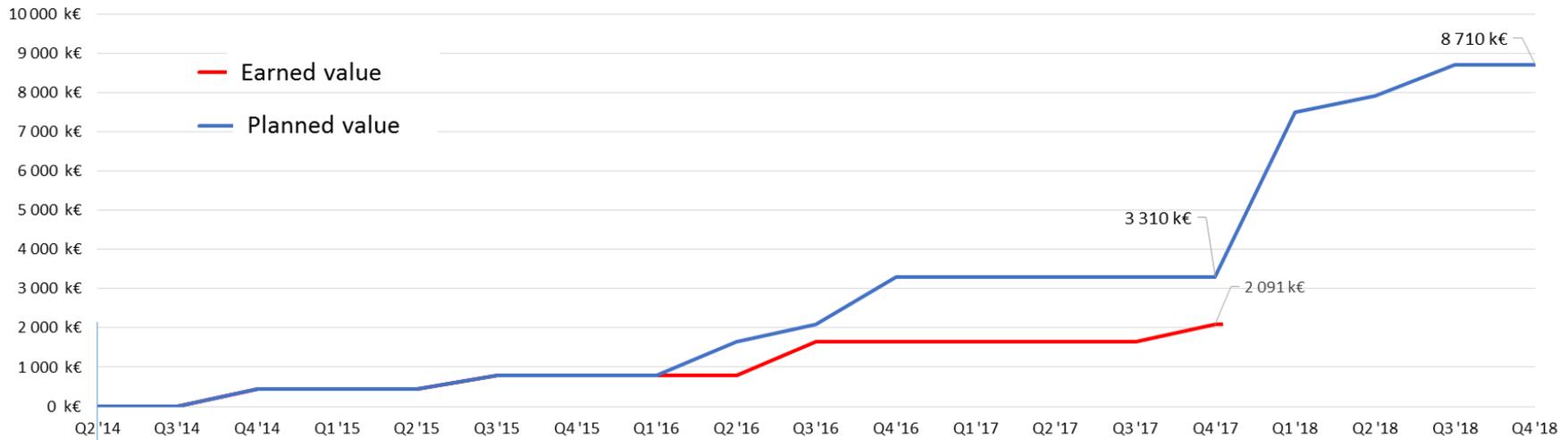
ESS RFQ COOLING SYSTEM MIXING VALVES POSITION CHANGE REQUEST MEMORANDUM

	REDACTEUR Edited by	VERIFICATEURS Reviewed by	APPROBATEUR Approved by	
NOM Prénom Name	CHAUVEAU A.C.	POTTIN B.	ARGELLIER F.	DANARÉD H.
Fonctions Functions	RFQ Deputy WPL	RFQ WPL	ESSI PL	ESS Accelerator Division, Linac Group Leader
Date et signatures Date and visas	18/04/17 <i>A. Chauveau</i>	18/04/17 <i>B. Pottin</i>	16 April 2017 <i>F. Argellier</i>	16 Apr. 2017 <i>H. Danaréd</i>

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RFQ Schedule AIK 3.4 - Value



EV since July 2017 : 436 k€

1. Manufacturing Process qualification (drilling and brazing)
2. Launch of the sections production

Main Delays

1. Couplers and plunger tests / Completion of the prototyping → Couplers conditioning will start in December 2017
2. FAT of the 1st RFQ section (10%) → January 2018
3. Cooling system FAT (3%) → January 2018



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DIAGNOSTICS –

AIK 7.1 : EMU

AIK 7.2 : DOPPLER

AIK 7.3 : IPM

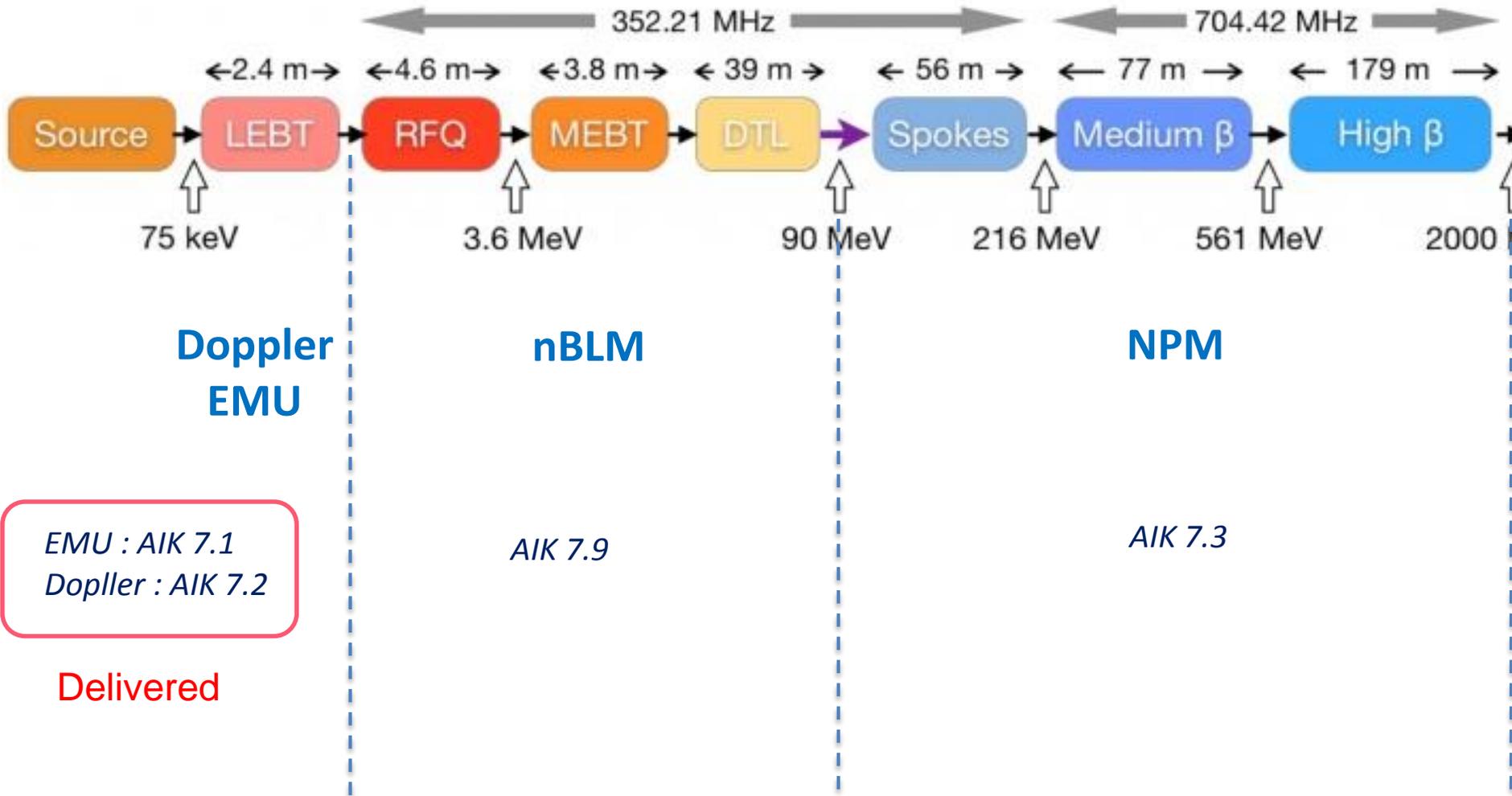
AIK 7.4 : NBLMS

PROGRESS STATUS

TECHNICAL MILESTONES PASSED

AND AIK FOLLOW UP

Optimus+ _2013_10_31



EMU and DOPPLER final report submitted @ IKRC # 14

Final report

AIK 7.1

Schedule to EMU In-Kind Agreement between CEA and European Spallation Source ERIC

Final report

DOPPLER SHIFT MEASUREMENT UNIT FOR THE LOW ENERGY

BEAM TRANSPORT LINE– AIK 7.2

Schedule to CEA In-Kind Agreement between CEA and European Spallation Source ERIC

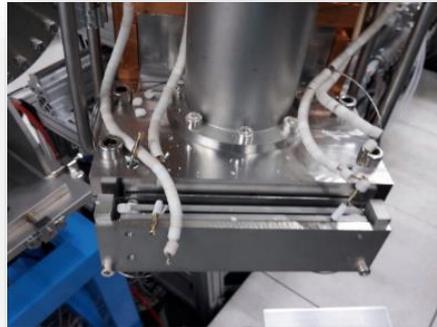
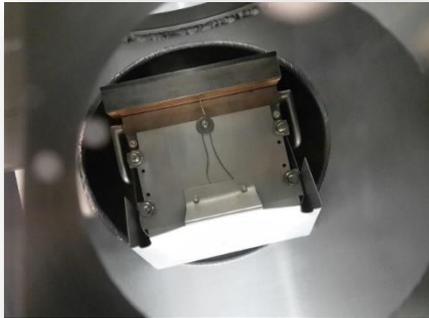
Feedback from BI is awaited.
CEA ready to sign

1. Planned :

Change of the EMU-2 bellows slightly damaged during the transportation to Catania : on going at Saclay

2. EMU-2 : Clash during translation through the permanent tank at Catania in July 17

Tank design interfaces were not validated by CEA



Repairs were carried out by INFN and ESS

3. EMU-2 : slots blocked during measurements at Catania : why ?

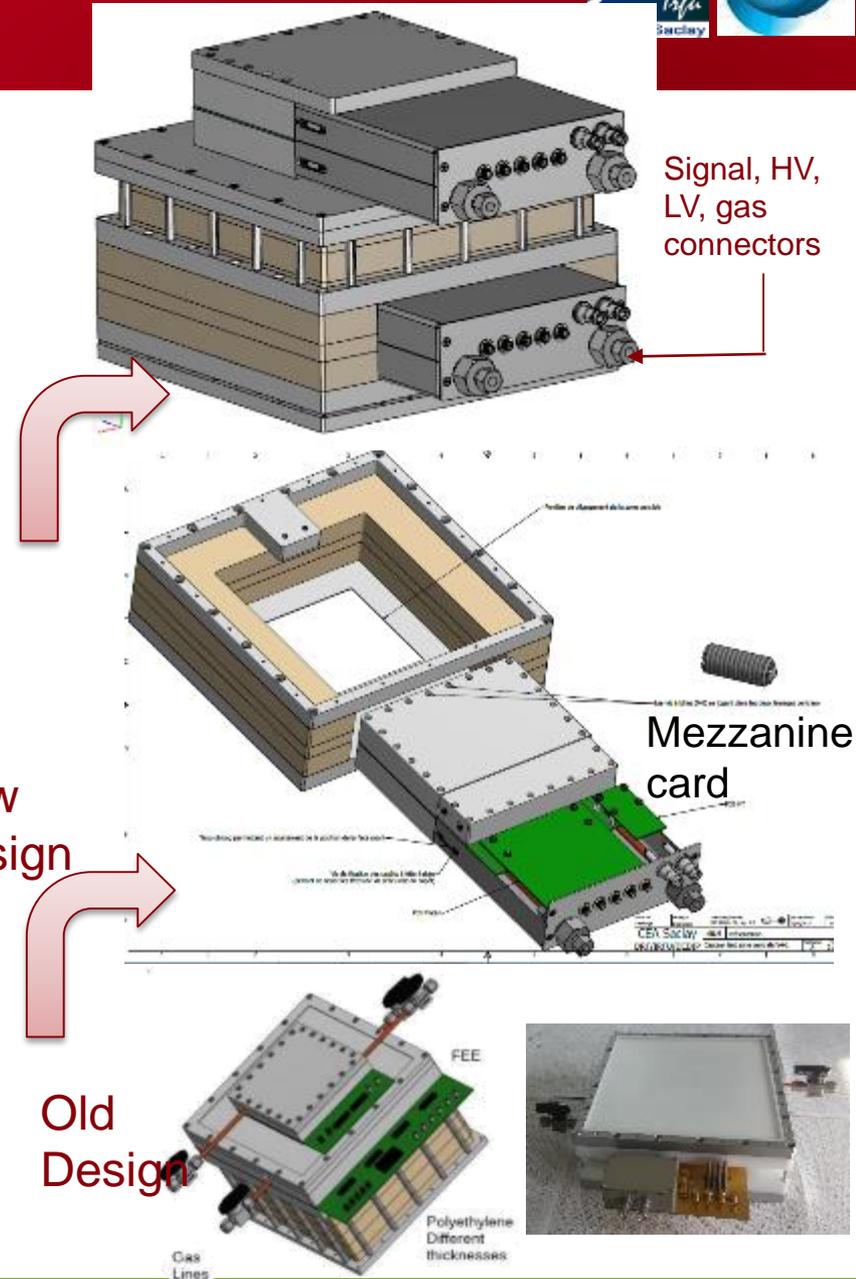
Investigation of the cause and expertise are asked to Saclay.

Investigation on going → it seems that it is repairable. Configuration of the event is still yet not known (30 mm beam instead of 60 mm?); Report is being written.

✓ Repair plan has to be defined by ESS

New detectors design

- New mechanics to improve electronic shielding
 - More compact, easier for installation, more “industrialized”
 - All connections in front
 - Same mechanics for fast /slow
- New electronics: mezzanine cards
 - One for signals + PAs; another for HV
 - Fast replacement
 - Easier to test different options → no need to change detector
 - More details in Philippe’s talk
- Design of closed gas recirculation system via an oxisorb filter
 - Needed for tests at LINAC 4



Mechanics

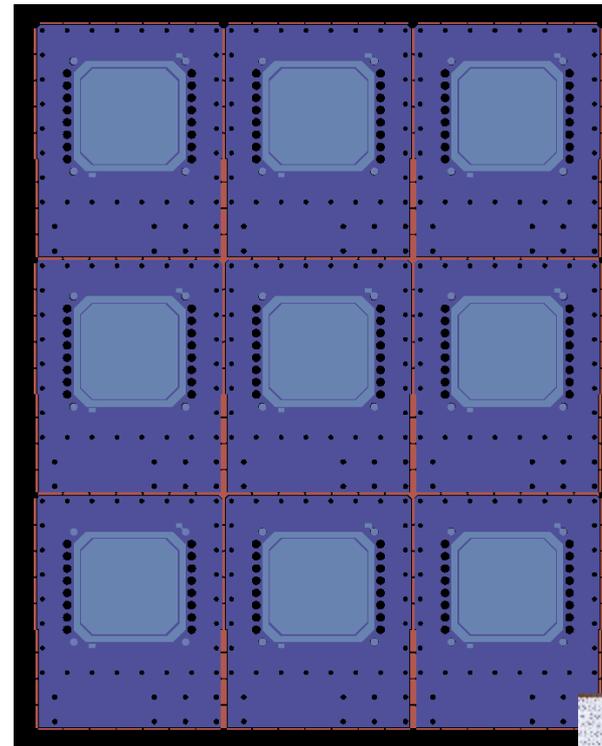
- Initially construct **4 chambers** → for Dec 2017
- When finalized, **~90 chambers**
- Production to start in ~June 2018

Micromegas

- 3x3 detectors per PCB (hopefully!)
- 2 boards** initially → for Dec 2017 – Jan. 2018
- 10-12 boards** by June 2018
- Bulking at DEDIP lab
- Pre-series production to start immediately

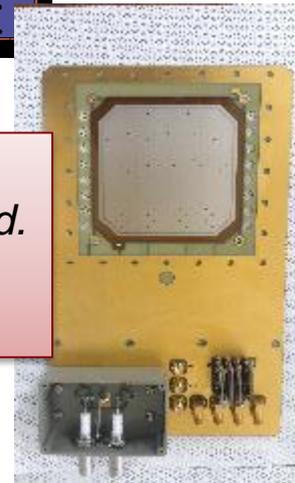
FEE + HV boards

- Design done (*more details in Philippe's talk*)
- First boards will be ordered soon



Gherber for 3x3 MMs board

Actual design with electronics on-board. The detector itself does not change



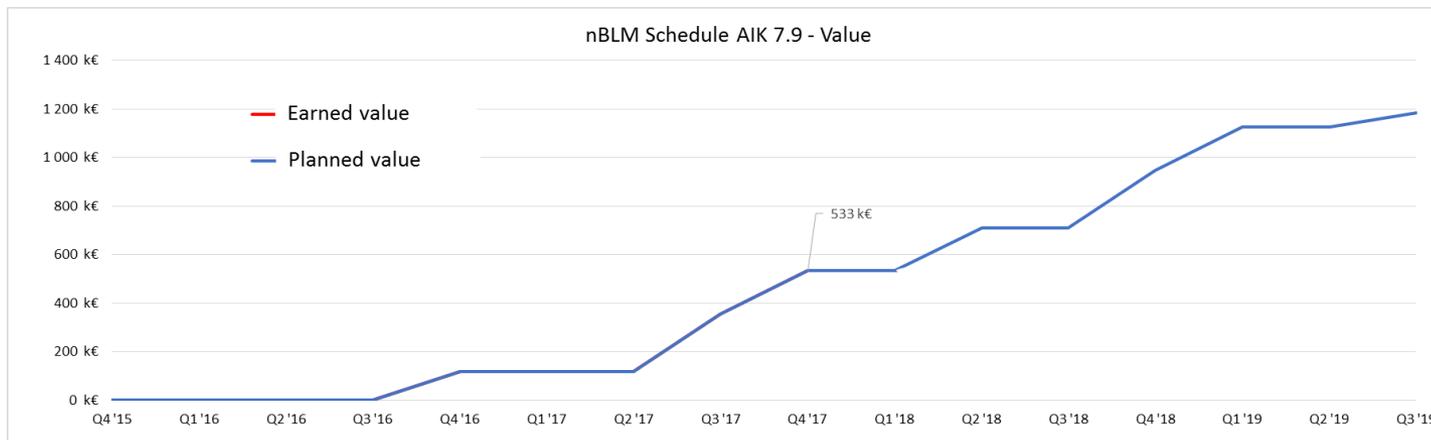
Test Facility	Particle	Test	Date
Birmingham MC40	Protons to material target	- Response under different loss scenarios - Electronics ageing	Nov-17 + in 2018
LINAC-4	Protons	RF backgrounds and response to losses	Feb-April 2018
ORPHEE CEA/Saclay	Thermal neutrons	Response to thermal neutrons	2018
Amande (CEA/Cadarache)	Mono-energetic neutrons	Efficiency studies. Different poly and convertors thickness	Feb or March 2018 (6days)
IPHI	Neutron production	Response study for different energies	From January 2018
Upssala + Saclay	Testing the ESS cryo- modules	Response to RF backgrounds	From January 2018

Milestones status S2-2017

Milestones Id	Milestones of AIK 7.9	Comments
MS#5-PDR 1.2	July 2017	Planned on the 10th / 11th july
MS#6-PDR 1.2	August 2017	Acceptance was sent by the review committee to ESS in Aug17 - recieved by CEA in Oct17
MS#7-Support interface doc. & the firmware design deployed on the FPGA located in the nBLM BEE	August 2017	Interface document V1 sent in Aug17.
Ms8-CDR 1.1 data package	November 3017	Sent 27th november 2017
Ms9-CDR 1.1	December 2017	4th & 5th december 2017

Milestones planned during S1-2018

Milestones Id	Milestones of AIK 7.9	Comments
MS#10 -CDR 1.2 data package	April 2018	
MS#11 – CDR1.2	April 2018	





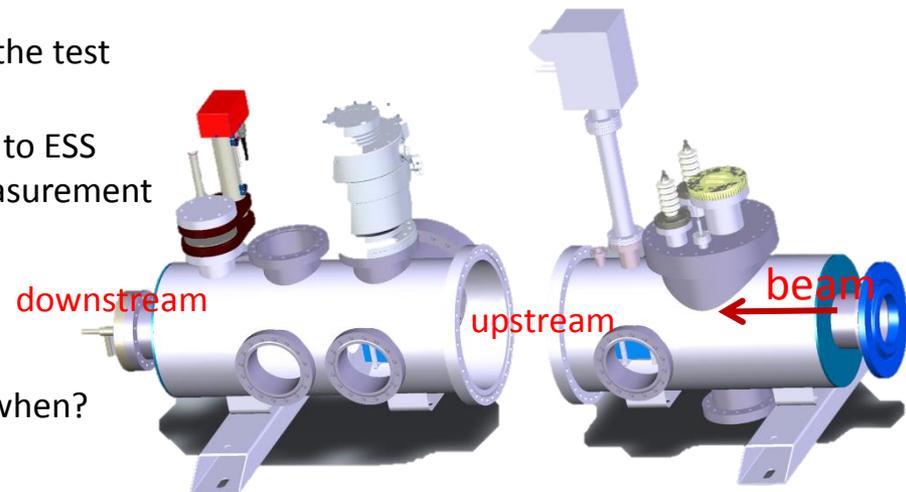
NPM status



We are
HERE!

Three scenarios may be foreseen for 2018

1. Keep on going on IPHI
2. "Half parts"
 - o IPHI with only the downstream part of the test bench
 - o LINAC4 with the upstream part (similar to ESS chamber), but only for background measurement
 - Need more vHV, another VC for MCP...
3. "Double tests" with the entire test bench
 - o IPHI: beginning 2018
 - o Juelich: people seems to be open, but when?
 - Validation of the signal strength...

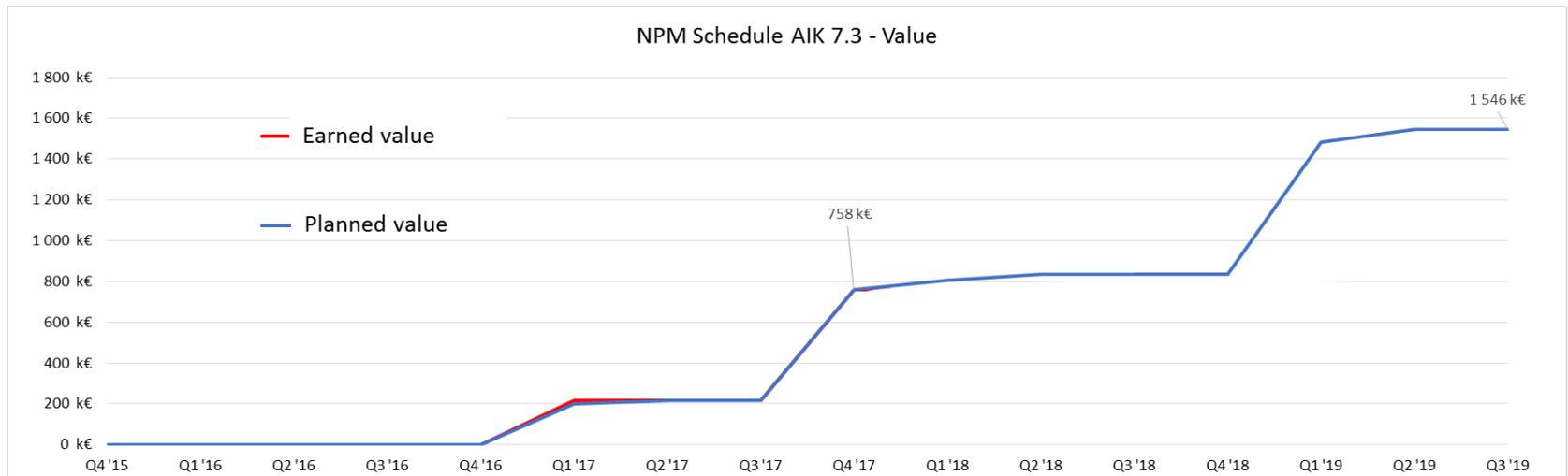


Milestones status S1-2017

Milestone Id	Date schedule ou contrat	Comments
#6-Experimental performance for the NPM Cold Linac ready to be started	oct-17	Ready to be installed on IPHI

Milestones planned during S2-2017

Milestone Id	Date schedule ou contrat	Comments
#7-NPM performance demonstration validated	Feb. 2018	3 scenario under discussions. Iphi tests will start in january





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CONTROL SYSTEM

- IIK 01 : CONTRIBUTION TO PROTONS SOURCE & LEBT CONTROL SYSTEM
- IIK 05 : CONTRIBUTIONS TO RFQ CONTROL SYSTEM



- ❑ **Source control Acceptance tests passed first week of July**
- ❑ Acceptance scenarios provided by INFN/Catania (L. Neri)
- ❑ ESSI software Acceptance test tool approved by ICS
- ❑ **LEBT commissioning done in July**
- ❑ LEBT control Acceptance test passed beginning september

Installation IRIS & CC July 2016

EMU1 : end 2016
EMU2 : July 2017

LEBT - iris

Drive only flat blades with this software !

Back of the iris

User inputs | **Motors status** | **Axis offset** | **Console**

Iris moving Init procedure is running (15 to 45 sec)

Aperture in mm:

Last aperture set:

Center in mm

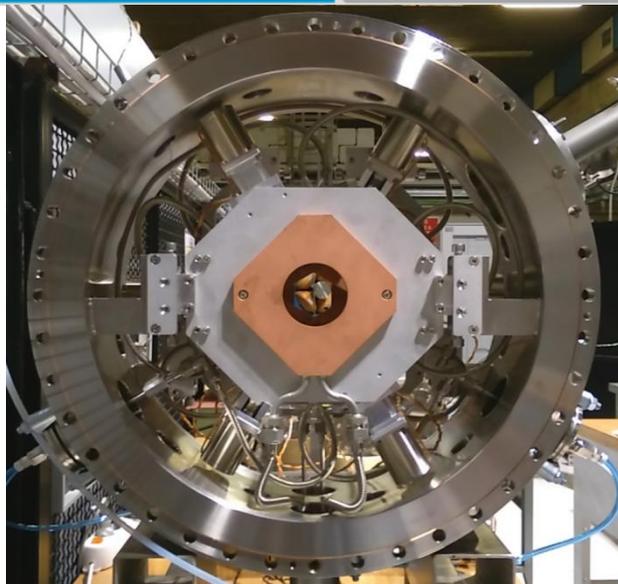
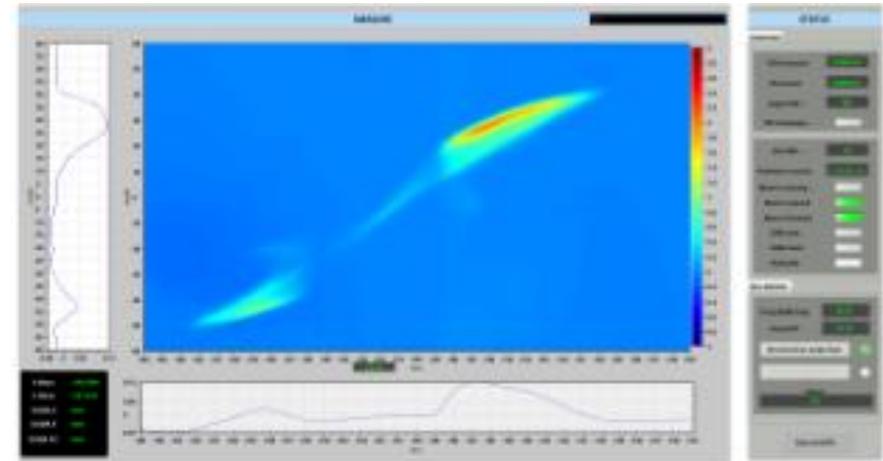
X: Absolute center

Y: New center

Velocity:

Legend

- No limits (hard and soft) hitten
- limit min or max hitten
- limit max hitten
- Switches not connected
- + Absolute center
- + New center
- Aperture limit



Doppler ICS deployment : end 2016

Doppler Shift INFN-LEBTx:PBI-DPL

Andor Detector

Sensor Size X: 1024 Y: 255

Pre-amp Gain: 1.00 1.00

ADC Speed: 0.05 MHz 0.05 MHz

Cooler: On On

Temperature: -75 -48.9 C

Status: Not reached setpoint

Image

Min Pixel Value: 299 Max Pixel Value: 356

Image Capture

Exposure Time (s): 5.000

Accumulate Period (s): 5.119

Acquire Period (s): 5.119

Image Mode: Continuous

Trigger Mode: External

Acquire: Start Stop

Detector State: Acquire

Image Counter: 331 Clear

Region Start X: 20 250

Region Size X: 150 150

Binning Y: 85 85

Data Type: Ulm32 Ulm32

Fitting

	H+	H2+	H3+
Amplitude	7 18	7 42	7 30
Mu	20 21	90 92	125 123
Sigma	15 4	15 5	15 5
Fraction	51.2 %	32.0 %	16.8 %

Energy (eV): 75 Background: 300 302

Original and Fitted Curves

Wavelength (nm): 645.58 647 647.5 648 648.5 649 649.5 650 650.5 651 651.5 651.99

Intensity: 300 310 320 330

Points

Shamrock Spectrograph

Slit Width (10,250µm): 300 300.00

Grating Wavelength (nm): 654 656.00

Min Wl: 637.67 Max Wl: 674.12

IIK 01 Milestones status S2-2017

Milestones Id	IIK 01 Milestones	Comments
#14-Delivery to ESS-ERIC of the Final Test Reports of the Proton Source and LEBT control system performed at INFN / Catania	Dependant of Source and LEBT availability	July 2017
#16-Validation of the Acceptance Test by European Spallation Source ERIC with a transfer of ownership to European Spallation Source	Dependant of Source and LEBT availability	September 2017

IIK 01 seems to be ready to be endorsed by IKRC

IIK 05 scope agreed

- Delivery of the RFQ Coupler Conditioning Test EPICS control system with its GUI and cabinet dedicated to this control **December 2017**
- RFQ vacuum software control taken in charge by ICS and **Replaced by modifications on ISrc gas injection system** (email from François Bellorini on October 18th 2017)

- CEA and ESS (tbc) agree to sign a « collaboration agreement » based on CEA/ESS IKCA but out of French Inkind financial envelop.
- Contract is ready to be signed for a total envelop of 250 k€ (agreed during the meeting between CEA and ESS on the 22nd november)
- CEA ICS group is already attending to nBLMs CDR1.1

		nBLM Control System Design	nr
		ESS-1	

NBLM CONTROL SYSTEM DESIGN
VERSION-1.0 2017/12/01

	REDACTEUR Edited by	VERIFICATEURS Reviewed by	APPROBATEUR Approved by
NOM Prénom	Nádol Victor Mariette Yannick Bertrand Quentin	Gougnaud Françoise Segul Laura	ESS-ERIC
Date et signature Date and vitas			

DISTRIBUTION LIST	
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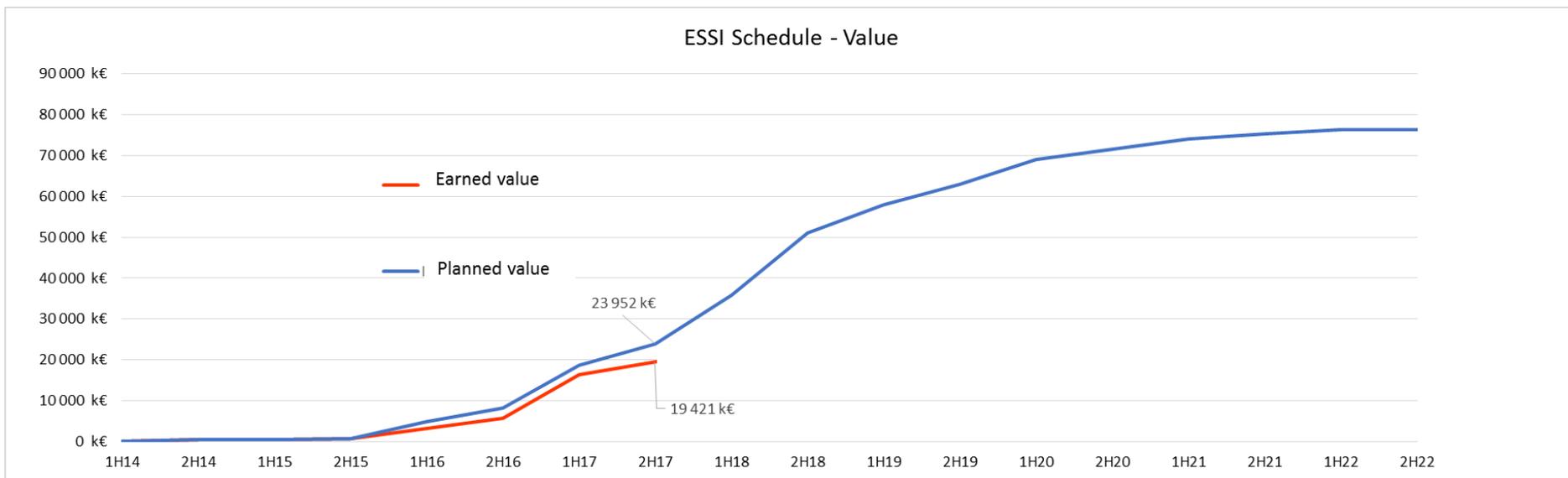


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FOLLOW UP OF ALL IKCA SCHEDULES

SIGNED BETWEEN ESS AND CEA

**Earned Value : 25 %
(+ 4% / july 2017)**



General slippage found, still compliant with ESS master schedule evolution.

The most important slippage comes from « Cryomodules assembly » schedule



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RISKS REGISTER

&

RISKS MITIGATION

STATUS

Currently : 4 risks in severe zone (-3)

ESSI All WP risks portfolio - before mitigation						ESSI All WP risks portfolio - under mitigation						ESSI All WP risks portfolio - after mitigation					
Very Likely (16)	-	1	-	-	-	Very Likely (16)	-	1	-	-	-	Very Likely (16)	1	-	-	-	-
Likely (8)	-	1	4	7	3	Likely (8)	1	1	1	1	-	Likely (8)	1	1	-	-	-
Not likely (4)	-	-	3	16	5	Not likely (4)	-	1	5	12	3	Not likely (4)	-	-	2	1	-
Unlikely (2)	-	1	4	7	3	Unlikely (2)	-	1	9	11	3	Unlikely (2)	-	6	16	4	2
Not Credible (1)	-	-	-	1	-	Not Credible (1)	-	-	1	4	1	Not Credible (1)	2	3	8	3	6
	Negligible (1)	LOW (2)	MEDIUM (4)	HIGH (8)	VERY HIGH (16)		Negligible (1)	LOW (2)	MEDIUM (4)	HIGH (8)	VERY HIGH (16)		Negligible (1)	LOW (2)	MEDIUM (4)	HIGH (8)	VERY HIGH (16)

4 most critical risks - in **severe** zone in red (CC64) - are currently :

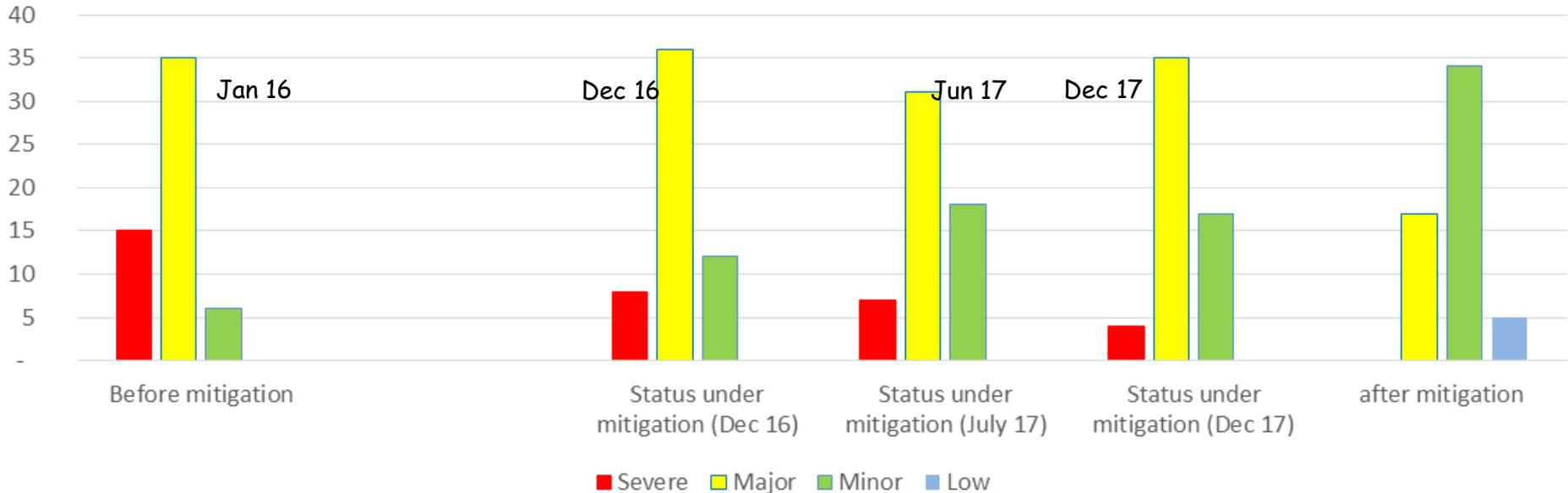
- Management & Engineering : Configuration control is not reliable - existing parallel baselines : **no progress**
- RFQ : Couplers not reaching specifications (800 kW): **no change**
- RFQ : RFQ compromised during conditioning : **no change**
- RFQ : RFQ manufacturer late delivery : **manufacturer issues confirmed**

CC= current criticality = Likelihood x Impact
In blue = evolution since last report

3 risks downgraded from **severe** (CC64) to **lower** - are currently

- Engineering : Unclear definition of interfaces (CC16) : **CM/cavity interface specified and external CM interfaces under specification**
- RFQ : Difficulties to perform RFQ sections brazing (CC32): **brazing process qualified**
- RFQ : No manufacturing acceptance of Couplers (CC32) : **couplers all manufactured except one sub-system**

Risk# per criticality zone at different status



■ Severe ■ Major ■ Minor ■ Low

18 severe risks
29 major risks
9 minor risks

8 severe risks
36 major risks
12 minor risks

7 severe risks
31 major risks
18 minor risks

4 severe risks
35 major risks
17 minor risks



			Risk numbering by criticality zone				Risk numbering by criticality zone					
			Status of Dec 17				Variance (Dec17 - July17)					
			Total risks #	Top level risks #	Severe zone	Major zone	Minor zone	Low zone	Severe zone	Major zone	Minor zone	Low zone
RR1	ESSI Management & Engineering	>>	7	3	1	6	-	-	-1	-1	0	0
RR2	ESSI RFQ	>>	11	6	3	5	3	-	-2	-1	2	0
RR3	ESSI Diagnostics	>>	13	0	-	8	5	-	0	1	1	0
RR4	ESSI Cryomodule components & exper	>>	7	4	-	3	4	-	0	0	-2	0
RR5	ESSI Cryomodule assembly	>>	15	8	-	11	4	-	0	1	-1	0
RR6	ESSI Control System	>>	3	1	-	2	1	-	0	1	0	0
ESSI risk portfolio			56	22	4	35	17	0	-3	1	0	0

Current status

- 56 risks (-1) in risk portfolio and 22 (-1) assumed top level
- Main WPs that change the most their criticality :
 - Engineering : [Unclear definition of interfaces \(PC64 > CC16\)](#)
 - RFQ : [section brazing \(PC64 > CC32\) & FAT couplers \(PC64 > CC32\)](#)
 - CM components & assembly (procurement and tests in progress) – [CDR1 passed – significant achievement – contract signed](#)
 - Control System (baseline document approved, good communication and development plan improved...) – [one closed risk](#)

New risks

- RFQ : Breaking coupler during assembly (CC8)
- Diags/NPM : Profile measurement may be affected too larger distortions than expected due to the Space Charge effect (CC16)
- Diags/nBLM : Full qualification of the nBLM prototype not ready for CDR (CC16)
- CM couplers : pre-series will not reach the expected performance during conditioning (CC32)
- CM string contamination during CM assembly (clone E5 if retention) and transferred
- ICS (scope changed) : Many software modifications (mainly FPGA) will have to be done during first beam tests (level detection) (CC 32)

Newly closed risks

- Engineering : No industry capitalization between prototyping and series phase
because risk is effective : procurement strategy is fixed and implemented in procurements > capitalization done by CEA (minor impact)
- RFQ : Vacuum and its control system not delivered on time by ESS
because one pumping group delivered
- RFQ : Auxiliaires + Tuner + couplers contracts not reaching RFQ contract on target time (from schedule point of view)
because contract signed and no contractual issue
- Cryostat comp.: Difficulty to consolidate the magnetic shield procurement schedule
because Raw material not difficult to procure
- Cryostat comp. : Instrumentation contractor sustainability
because He Heat Exchanger contract signed with new company
- CM/ Tuner motors) : Un-availability of tuner motors for assembly
because some motors lots already delivered and schedule confirmed

Coordination committee	Change requests or evolution	ESS impact	CEA impact
# 3	RFQ : RF charge and T-magic bought by ESS		50 k€
# 3	Cryomodule Vacuum vessel : add holes in feet	20 k€	
# 3	Cryomodule Vacuum vessel : added supports for alignments	37 k€	
# 4	<i>Procurement of all the Ti tubes from the same supplier (to be discussed)</i>	<i>20 k€</i>	



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NEXT SEMESTER CEA-ESSI PLAN

Management

- 3rd Risks analysis Workshop to organize

RFQ :

- FAT of the 1st, 2nd, 3rd, 4th sections and final machining of the 5th section
- FAT of the tuners and auxiliaries
- Couplers conditioning at Saclay
- Delivery of the SKID system at Lund

Cryomodules :

- M-ECCTD « refurbished » : RF power tests & transport tests to Lund
- CDR-M2 : may 2018 (tbc)
- 704 MHz RF Power Source FAT @ Saclay
- High β cavity package test in HNOOS
- H-ECCTD assembly
- FAT of most of the « pre-series » Cryomodules components
- Signature of the Cryomodules assembly market

Control System

- Start of the RFQ control system activities
- *Contrat signed for CEA contribution to nBLMs Control System*

Diagnostics

- IPM : tests on IPHI beam with 3 different « readout » & CDR
- nBLMs : tests at different radiation facilities & CDR 1.2

A. 2 Schedules have to be endorsed by IKRC # 14 : Doppler, EMU and Contribution to Control system if Proton Source and LEBT

B. Production phase is now launched both for RFQ and Cryomodules components

C. CE marquing could become a topic of concern :

Is it a decision ? Who is the pilote ? which components / systems are concerned ?
is the assembly concerned ?

→ XFEL feed back : organism of certification is required (TÜV)

CE marquing / Certificate of Conformance were directly managed by DESY (i.e. ESS)

→ Huge follow up / traceability from raw material until final system is required

→ Industrial contracts already signed between procurement firms and CEA
does not require CE stamp → change with overcost and delay



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OPEN TOPICS

