ESS-0058846

# Philippe Lebrun

9/5/2016

# Report of the 13<sup>th</sup> Meeting of the ESS Technical Advisory Committee Lund, 6-8 April 2016

# 1. Introduction

The 13<sup>th</sup> meeting of the ESS Technical Advisory Committee (ESS-TAC) took place in Lund on 6-8 April 2016.

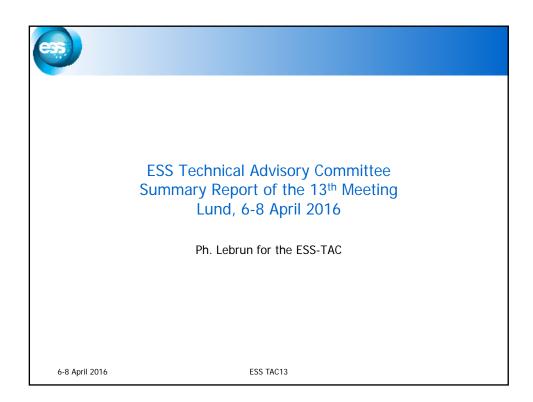
The meeting followed the agenda given in Annex 1. The Committee was given a specific charge (Annex 2), addressed in the meeting and answered in the oral report presented in the close-out session on 8 April 2016. The report proper constitutes section 3 of this document.

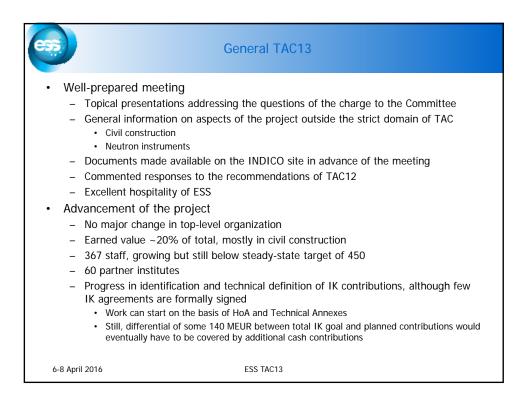
## 2. Participants in TAC

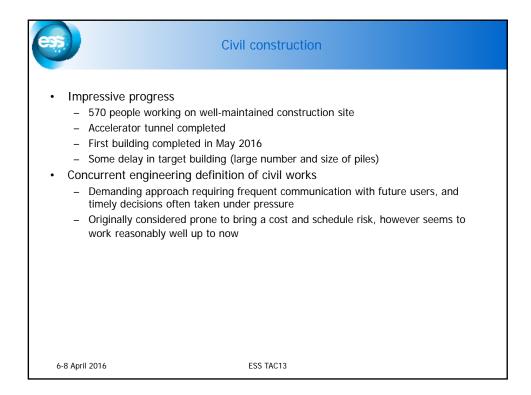
<u>Present:</u> Bertrand Blau (PSI), Michael Borden (LANL), Tim Broome (ISIS), Michael Butzek (FZJ), Alberto Facco (INFN), Philip Ferguson (ORNL-SNS) [t-TAC chair], Matasoshi Futukawa (J-PARC), John Galambos (ORNL-SNS) [a-TAC chair], Frank Gerigk (CERN), Mark Heron (DIAMOND), Philippe Lebrun (CERN) [TAC chair], Alessandra Lombardi (CERN), Alban Mosnier (CEA), Ralph Pasquinelli (Fermilab), Manuel Perlado (UPM), Robert Stieglitz (KIT), Szabina Török (MTA), Hans Weise (DESY), Karen White (ORNL-SNS), Michael Wohlmuther (PSI)

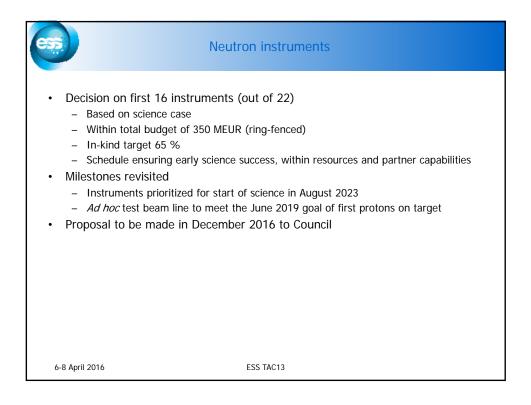
Excused: Anton Mösslang (KIT)

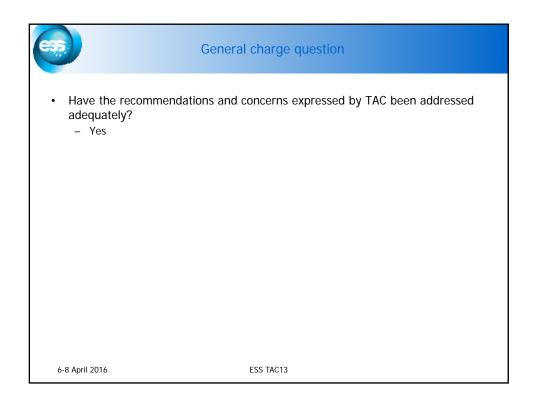
# 3. Report of TAC13

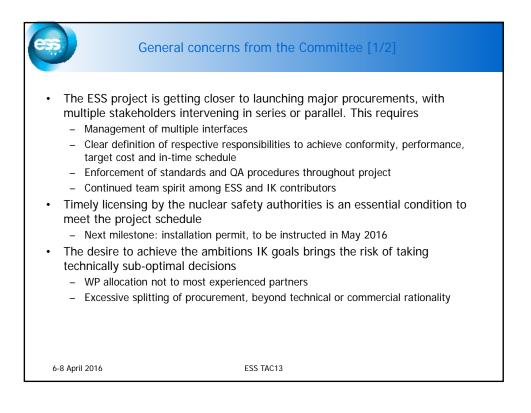


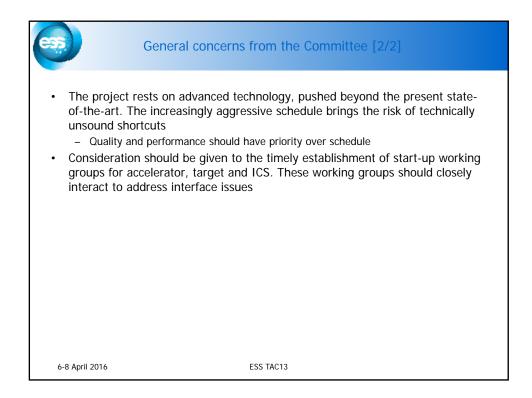


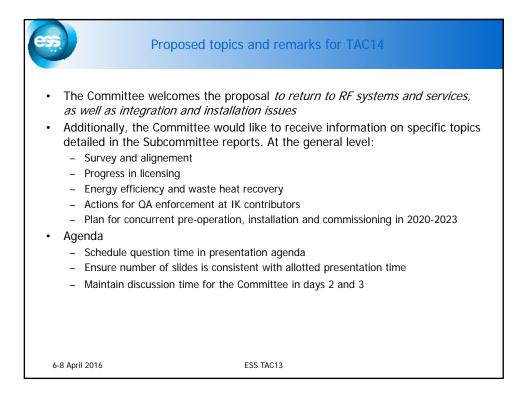


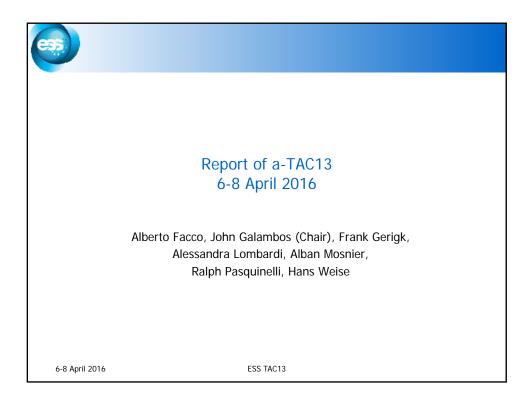


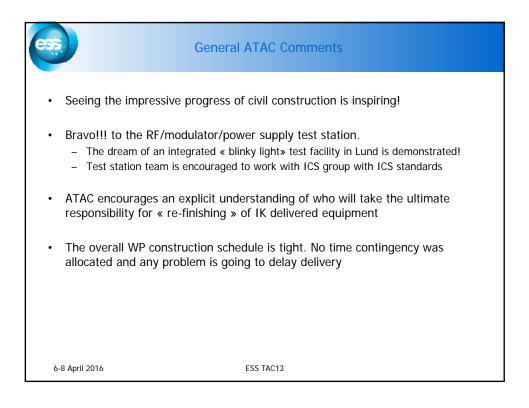


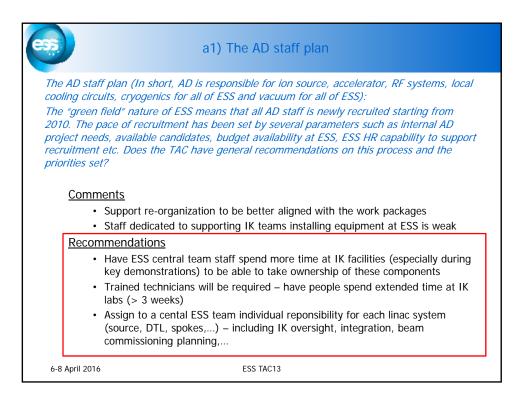


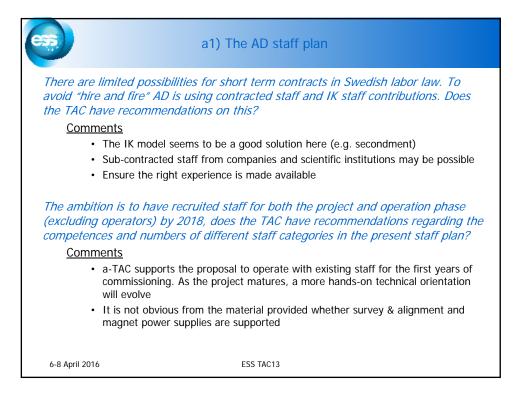


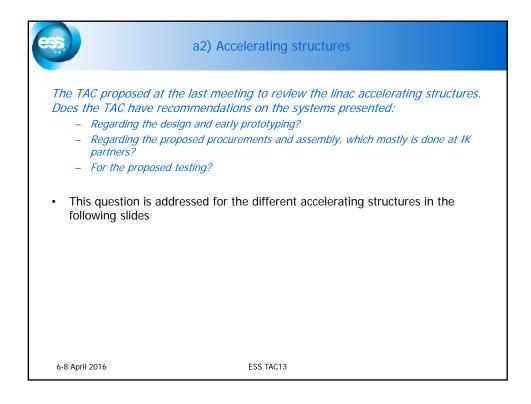






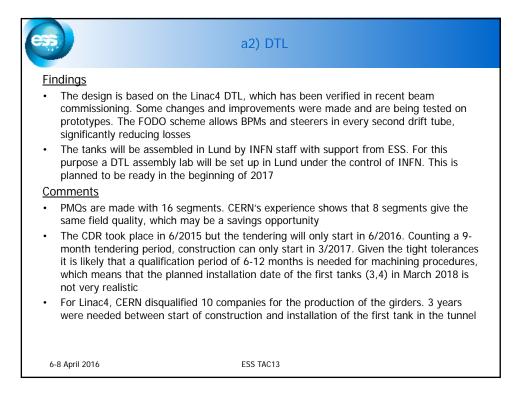


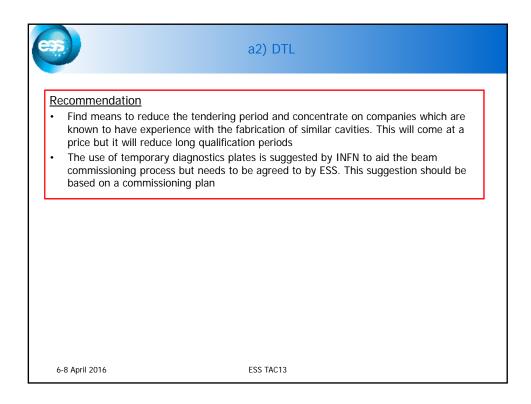




65	a2) Accelerating structures: RFQ
<u>Cc</u> • •	Water passages and vacuum integrity should be established at CEA for each of the modules. Resources at ESS to fix leaks may be limited. The schedule has little to no contingency for repair work The assembly and testing of the RFQ will take place in the ESS tunnel. Adequate « clean » space needs to be provided with ample room for bead pull aparatus The CEA design team of the RFQ should be present at ESS for the duration of assembly, tuning and commissioning The tuning slugs are threaded devices with an O-ring seal and have significant travel
• •	<ul> <li>(many turns)</li> <li>ecommendations</li> <li>Start RFQ LLRF/Resonance control modeling</li> <li>The mixing valve for the water tuning system should be installed as close to the RFQ as possible (i.e. 1-2 meters) to reduce system delay and allow for increased closed-loop gain</li> <li>Personnel responsible for the LLRF and resonance control (water) should be very tightly coupled</li> <li>CEA should execute a system model of the RFQ to predict thermal tuning constants of Hz/degree C. Both common-mode and differential (loop-to-body) thermal frequency and time constants are desirable. The LLRF/resonance control team will use this estimate in their modeling of the control loops for optimum performance.</li> <li>Ensure the movable RFQ tuning system meets vacuum requirements</li> </ul>
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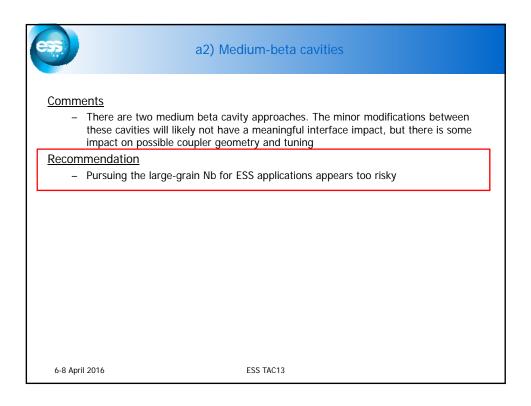
63	a2) MEBT
•	indings The quadrupoles with the integrated steerers and the bunchers are well defined, and the path for procurement is clear The chopper, dump and instrumentation are not yet fully defined It is not clear whether the chopper is a necessary element from the very beginning <u>omments</u> The MEBT is compact and includes many interconnected elements which have to be accurately aligned. A simple approach, which will save installation time at ESS Lund, is
• R	to mount and align all elements on a single girder and ship it as a whole The fast chopper is a challenging system ecommendations
•	Define a minimally acceptable baseline MEBT (possibly w/o chopper) to meet the beam test requirements for 2018 Clarify the specifications and function of the chopper – Do not use the chopper as a required machine protection device
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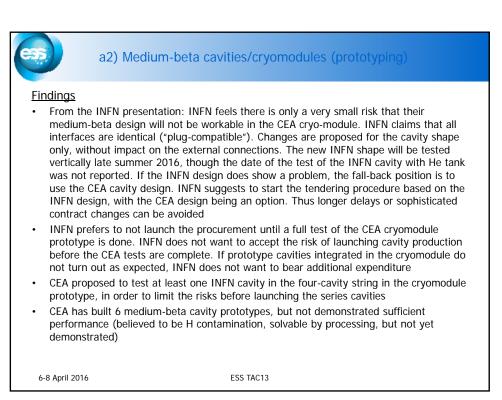


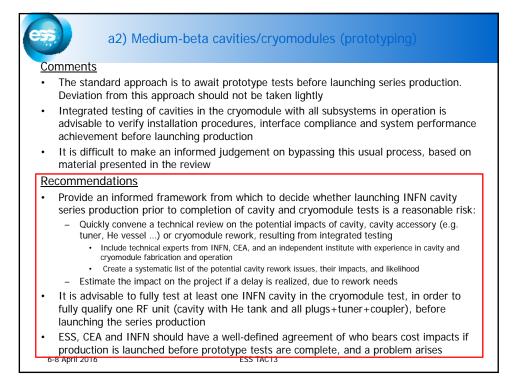


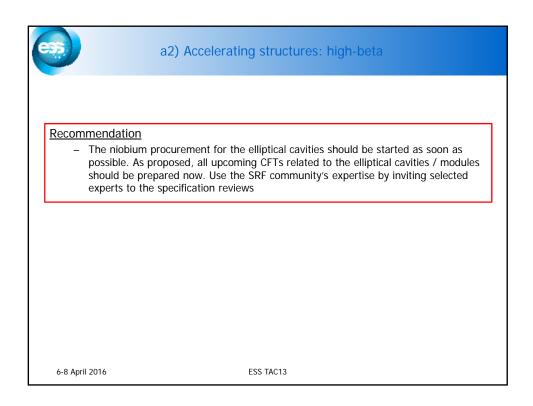
6	a2) Spoke cavity/cryo-modules
aspects are well a - Cavity developme processing are va - The Forward Pow caused a failure o which were not c - A new version of	tivities in general are proceeding according to plans. All important addressed. Validation of critical subsystems is not yet completed ent is completed with prototypes successfully tested. Design and lidated. Two vendors are qualified ere Coupler is prototyped, but first testing at high power on test bench of the ceramic window at 100 kW (the goal is 400 kW) for reasons learly pointed out. Tests are ongoing with other prototypes the FPC with DC bias is being developed as mitigation to the risk of
Comments – Excellent results I – Low T baking is p significantly – Integrated test of milestone before substantial before	In the baseline coupler in the real cavity. No extra time is allocated have been achieved with prototype cavities blanned to be tested, but not expected to improve performance f cavity with final coupler and tuner at full power will be the important launching production of couplers and tuners; risk of delays is that validation in addition to the 26 required appear to be an adequate safety margin
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<b></b>	a2) Spoke cavity/cryo-modules
Recommendations – Clarify in detail the – Continue bias cou	e causes of the failure at 100 kW of the first FCP to eliminate this risk pler development
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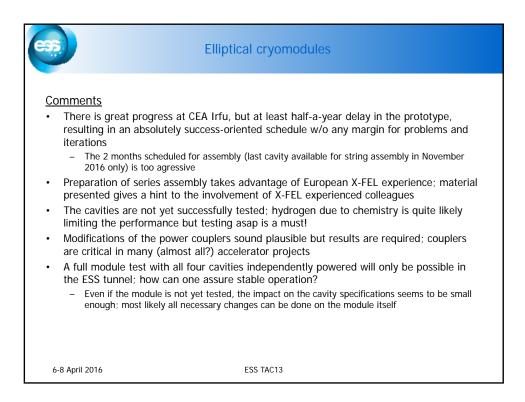


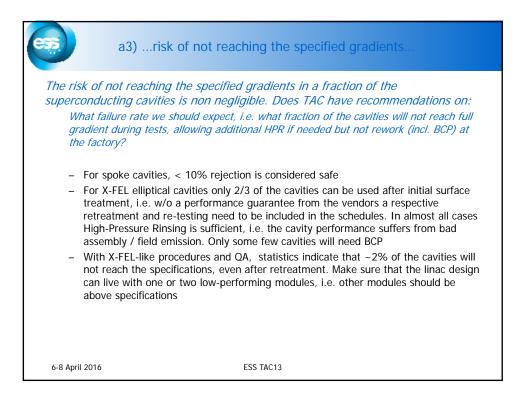


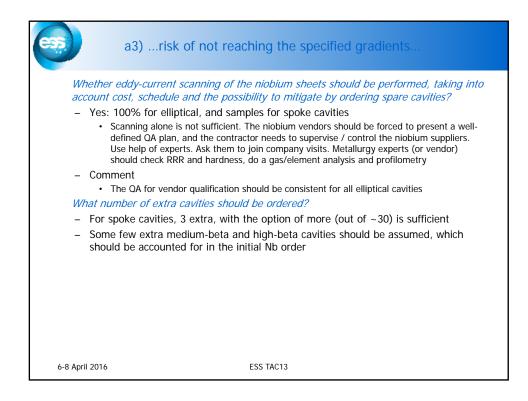


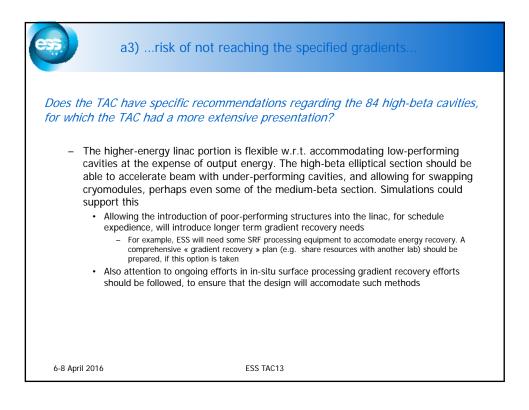


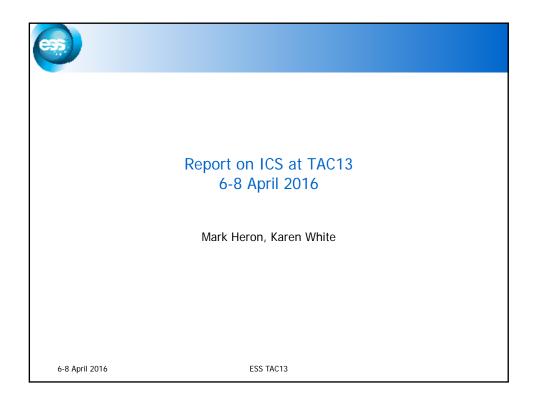
69	High-beta cavities
<ul> <li>working har</li> <li>STFC doesn the need fo</li> <li>In case of la mistakes an – E.g., use</li> <li>Take car are to b specifica</li> <li>The most u</li> </ul>	harkable progress in the infrastructure preparation / procurement, i.e STFC is d to be prepared for the cavity procurement and testing 't see an advantage in common Nb procurement; nevertheless the TAC sees a common strategy especially w.r.t. QA ow cavity performance, there is a need to distinguish between cavity vendor d STFC mistakes e a qualified cavity for infrastructure commissioning e of all details in the cavity specifications; QA, documentation and acceptance levels e defined; invite SRF experts for Production Readiness Reviews (final editing of tions) o-to-date specifications for Nb and cavity production should be handed over e STFC and INFN
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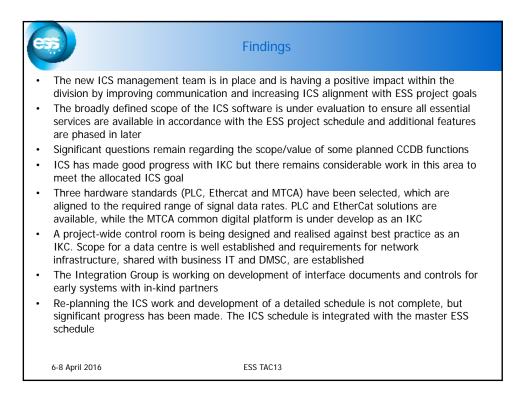


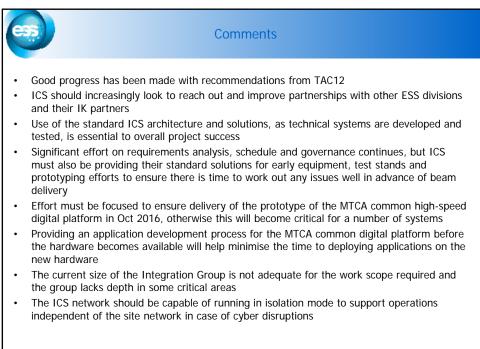








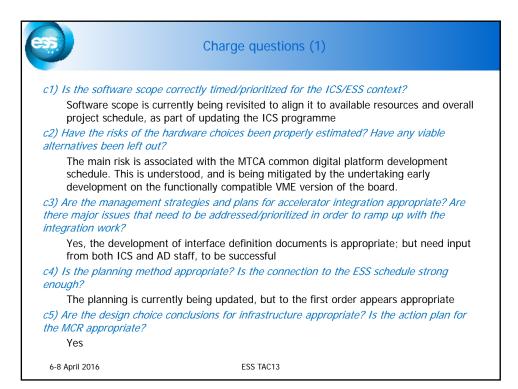


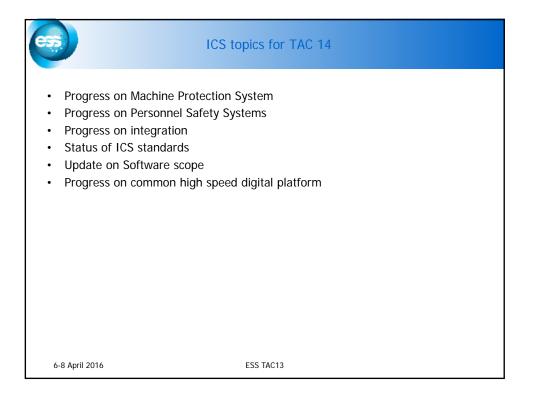


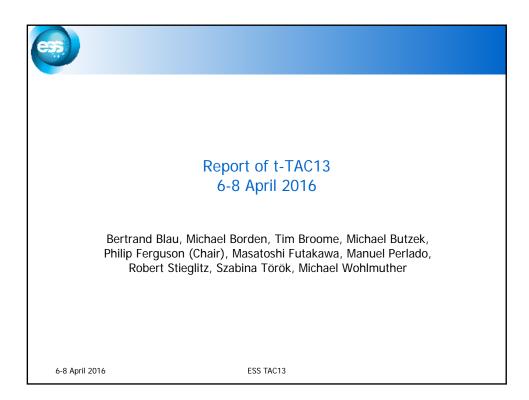
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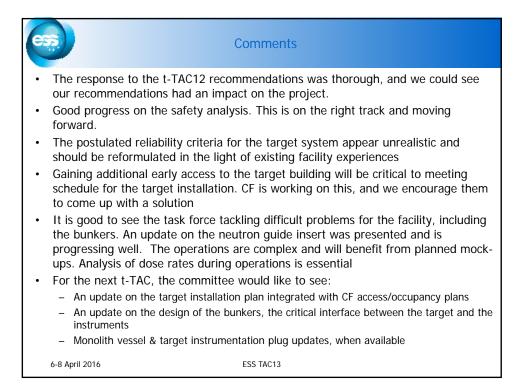
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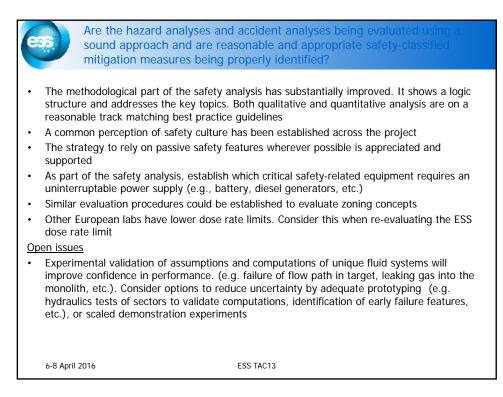
	Recommendations
1.	Design out dependencies on network services (e.g. LDAP or Active Directory) outside the operational ICS network to enable the machine to operate without an external network connection
2.	ICS should promote ICS solutions and standards within ESS and to IK partners
3.	Strengthen the ICS Integration Group, by adding a few <b>senior</b> engineers, in order to meet the overall ESS project schedule
4.	ESS senior management should support the enforcement of standards from ICS across the project. Failure to do so will incur technical debt and introduce unnecessary risk to the project.

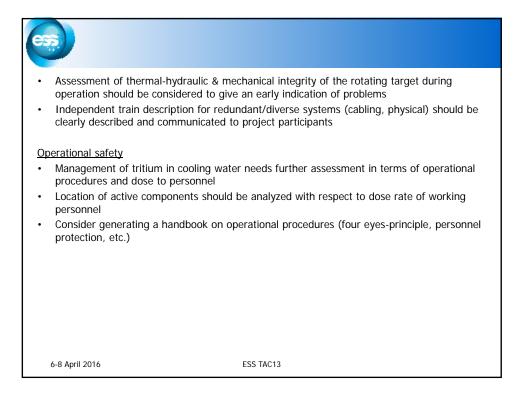


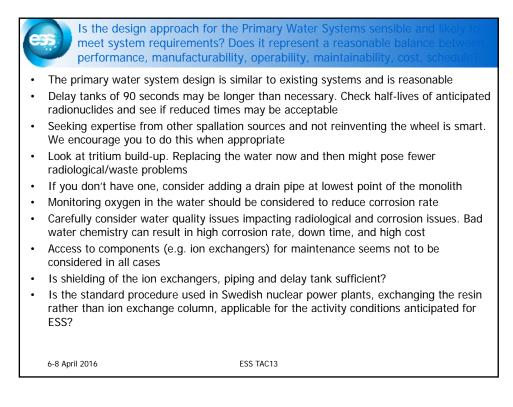


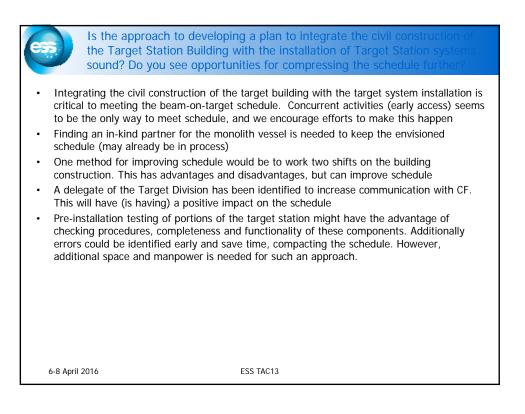


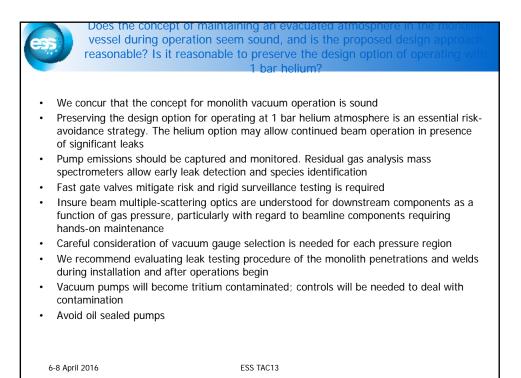












# Annex 1

30/03/2016 (HF) v09

# Agenda of 13<sup>th</sup> TAC meeting

#### Wednesday 6, April 2016 ESS Construction site

TAC closed Session (13h00 – 13h15)

13h00 TAC initial working session

#### Plenary Sessions (13h15 – 17h30)

13h15	Welcome and overall status of ESS – J. Yeck/R. Garoby (25'+5')
13h45	Plans for instruments – A. Schreyer (25'+5')
14h15	Status of Conventional facilities – K. Hedin (10')
14h25	Site view from panoramic room Tornado – K. Hedin (20') *TAC Only*

14h45: Coffee

15h00	Accelerator overview – M. Lindroos (40'+10')
15h50	Target overview – E. Pitcher (40'+10')
16h40	ICS overview – H. Carling (40'+10')

#### TAC closed Session (17h30 – 18h00)

17h30 TAC working session

19h00: Social Dinner (Gastro Gaspari, Flyinge)

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#### Thursday 7, April 2016 ESS, Tunavägen 24

#### Parallel Sessions (8h30 – 12h30)

	Accelerator
8h30	Accelerator staff plan – M. Lindroos/J. Weisend (15'+5')
	Linac design overview – H. Danared / S. Molloy (20'+5')
	RFQ – A. France (CEA) (20'+5')
	MEBT – I. Bustinduy (ESS Bilbao) (15'+5')
10h00	Coffee
10h30	DTL – A. Pisent (INFN Legnaro) (15'+5')
	Elliptical cavities cryomodules – P. Bosland, F. Ardellier (15'+5')
	Spokes cavities and cryomodules – S. Bousson (15'+5')
	High and Medium beta prototypes at CEA – F. Peauger (CEA) (15'+5')
	High beta series manufacturing and testing– P. Mcintosh, (STFC Daresbury)
	(15'+5')
	Medium beta series Manufacturing and testing – P. Michelato, (INFN) (15'+5')

	ICS
9h10	Control software scope – S. Regnell (30'+10')
	Hardware choices – T. Korhonen (20'+10')
10h20	Coffee
10h50	Progress in integration – D. Piso-Fernandez (20'+10') Infrastructure and MCR – R. Mudingay (20'+10') ICS project replanning – H. Novella (30'+10')

	Target
8h30	Responses to recommendations from TAC12 – E. Pitcher (15'+5') Hazards Analysis and Safety Classification Process – L. Coney (30'+10') Bounding Event: Loss of dynamic confinement in Active Cells – P. Nilsson (20'+10')
10h00	Coffee
10h30	Bounding Event: Stopped Wheel – P. Nilsson (20'+10') Installation Plan – (20'+10') T. Lexholm Design of the Primary Water Systems – H. Carlsson (20'+10') Operating the Monolith Vessel in Vacuum – R. Linander (20'+10')

12h30: Lunch at Ljusgården

#### Parallel Session (13h30 – 15h00)

	Accelerator
13h30	Visit to RF and modulator test stand – D. McGinnis/C. Martins

**TAC sessions (13h30 – 18h30)** with additional interviews on TAC request ~ *16h00 Coffee* 

19h00: TAC Dinner (Hotel Planetstaden)

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*Friday 8, April 2016 ESS, Tunavägen 24* 

**TAC sessions (8h30 – 12h00)** with additional interviews on TAC request ~10h30 Coffee

12h00 -13h15: Lunch at Inspira

#### Close outs (13h15 – 14h30)

13h15: Close out with DG and Technical Director - (if necessary) 13h45: Close out (open session) 14h30: End of meeting

*14h45: Transport to Site* 15h00: Tunnel topping out ceremony

# Annex 2

7/03/2016

## Charge to the TAC for its 13<sup>th</sup> meeting on April 6-8, 2016

## 1. Introduction

Since the last TAC meeting which took place on October 14-16 the ESS project has progressed and it is now close to 20% complete:

- Construction on site is well advanced.
- Additional work packages have been allocated as in-kind and technical work is actively progressing at the partners' premises as well as in Lund, as TAC will learn during its 13<sup>th</sup> meeting.

Changes have taken place in the ESS management:

- Agneta Nestenborg has succeeded to Matti Tiirakari as Director for Administration,
- Andreas Schreyer has succeeded to Dimitri Argyriou as Science Director,
- John Haines has been made responsible of the Integrated ESS schedule and took over, by interim, the position of Associate Director for ES&H and Quality after the departure of Patrik Carlsson.
- Eric Pitcher succeeded to John as Leader of the Target Project.

Beyond ensuring technical progress according the schedule, the following objectives are high priority in 2016:

- Signature of more in-kind agreements and negotiation of additional in-kind contributions.
- Submission of the "Installation Permit" in May 2016 (2<sup>nd</sup> step of licensing).

The 13<sup>th</sup> meeting of the TAC is an opportunity to put our progress in perspective. I have no doubt that the discussion with TAC and the advices and recommendations of the Committee will again be very precious.

# 2. Charge questions

Our first question to the Committee is:

Have the recommendations and concerns expressed by TAC been properly addressed?

More specifically, we would like the ESS Technical Advisory Committee to address the following questions:

- concerning the **Accelerator**:
  - *a1)* The AD staff plan (In short, AD is responsible for ion source, accelerator, RF systems, local cooling circuits, Cryogenics for all of ESS and vacuum for all of ESS):
    - The "green field" nature of ESS means that all AD staff is newly recruited starting from 2010. The pace of recruitment has been set by several parameters such as internal AD project needs, available candidates, budget availability at ESS, ESS HR capability to support recruitment etc. Does the TAC have general recommendations on this process and the priorities set?
    - There are limited possibilities for short term contracts in Swedish labor law. To avoid "hire and fire" AD is using contracted staff and IK staff contributions. Does the TAC have recommendations on this?
    - The ambition is to have recruited staff for both the project and operation phase (excluding operators) by 2018, does the TAC have recommendations regarding the competences and numbers of different staff categories in the present staff plan.
  - *a2) The TAC proposed at the last meeting to review the linac accelerating structures. Does the TAC have recommendations on the systems presented:* 
    - Regarding the design and early prototyping?
    - Regarding the proposed procurements and assembly, which mostly is done at IK partners?
    - For the proposed testing?
  - *a3)* The risk of not reaching the specified gradients in a fraction of the superconducting cavities is non negligible. Does TAC have recommendations on:
    - What failure rate we should expect, i.e. what fraction of the cavities will not reach full gradient during tests, allowing additional HPR if needed but not rework (incl. BCP) at the factory?
    - Whether eddy-current scanning of the niobium sheets should be performed, taking into account cost, schedule and the possibility to mitigate by ordering spare cavities?
    - What number of spare cavities should be ordered?
    - Does the TAC have specific recommendations regarding the 84 high-beta cavities for which the TAC had a more extensive presentation?
  - *a4)* The plan is to at next TAC return to RF systems and services as well as integration and installation issues. We would be happy to have your comments on that, in particular on what we should focus on.

- concerning the Target:

- *t1)* Are the hazard analyses and accident analyses being evaluated using a sound approach and are reasonable and appropriate safety-classified mitigation measures being properly identified?
- *t2)* Is the design approach for the Primary Water Systems sensible and likely to meet system requirements, and does it represent a reasonable balance between performance, manufacturability, operability, maintainability, cost, and schedule?
- *t3) Is the approach to developing a plan to integrate the civil construction of the Target Station Building with the installation of Target Station systems sound? Do you see opportunities for compressing the schedule further?*
- *t4)* Does the concept of maintaining an evacuated atmosphere in the monolith vessel during operation seem sound, and is the proposed design approach reasonable? Is it reasonable to preserve the design option of operating with 1 bar of helium?

- concerning the Integrated Control System:

- *c1) Is the software scope correctly timed/prioritized for the ICS/ESS context?*
- *c2) Have the risks of the hardware choices been properly estimated? Have any viable alternatives been left out?*
- *c3)* Are the management strategies and plans for Accelerator integration appropriate? Are there major issues that need to be addressed/prioritized in order to ramp up with the integration work?
- *c4)* Is the planning method appropriate? Is the connection to the ESS schedule strong enough?
- *c5)* Are the design choice conclusions for infrastructure appropriate? Is the action plan for the MCR appropriate?

The Committee is encouraged to provide also suggestions/comments and recommendations on any other subject it would find relevant.

A preliminary version of the Committee report is expected at the end of the meeting, in the afternoon of Friday 8, April. The final report is expected two weeks later. The TAC Chair will be asked to present it to the ESS Council on June 9-10.