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| System Review of the ESS Cryomodule TestsNovember 30, 2017 |
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| **Charge for the System Review**  |
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Purpose of this review

 The system review will examine the planned testing of the ESS cryomodules. The goal of the review is to ensure that these tests are sufficient to allow predictions to be made about the performance of the cryomodules once installed in the ESS linac and sufficient to serve as the Site Acceptance Test (SAT) of the cryomodules. The review also examines the time allotted for these tests. It is not meant as a detailed design review of the cryomodules as that is dealt with during the cryomodule PDR and CDR.

**Charge to the Committee**

 The Review Committee is composed of the Chairman and members as identified in Appendix 2. This list also shows reviewers, who provide comments and review but are not on the formal committee and presenters.

 The Review Committee is asked to:

1. REVIEW: Scrutinize and assess the deliverables listed in Appendix 1 and the presentations given during the Review.

2. ANSWER: Answer each question listed in Appendix 3.

3. DECIDE: The Review Committee is to elaborate and deliver at the conclusion of this review, a clear recommendation to ESS about the suitability of the cryomodule tests to serve as the FAT for the cryomodules and their ability to predict cryomodule behaviour in the ESS linac.

Suggested forms for the decision are:

* Approved, without qualifying comments or further actions.
* Approved, but with recommended actions and or clarifications.
* Not approved, but with recommended actions, for further inputs and activities, and a proposal for a follow-on review.

4. REPORT: The Review Committee is to document in a short report to be delivered as soon as possible after the System Review, its recommendation and any specific actions and other guidance for assisting planning and future success of the Work Unit in for its scope and deliverables.

If the System Review is “Approved but with recommended actions”, there shall be a summary list of requested actions defined .

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| Appendix 1**Scope and Deliverables for Review** |
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Scope

The review will examine the test plans and schedules for both the ESS Spoke Cavity Cryomodules tested in the FRIEA facility at Uppsala University and ESS Elliptical Cavity Cryomodules tested at the Cryomodule Test Stand on the ESS site.

Deliverables for System Review - Information to be reviewed

The information identified below is to be described and communicated through presentation at the System Review, and the source information is to be available to reviewers for reference during the System Review.

The associated work packages should deliver to the Review Chairman for distribution to the Review Committee and other reviewers, an agreed subset of the following information for pre-review and comments no later than Five (5) working days prior to the Review.

1. Test Plan for Cryomodule testing at ESS Test Stand 2
2. Test Plan for Cryomodule testing at Uppsala University FREIA facility
3. Integrated controls system design and documentation sufficient to answer charge questions.
4. Description of ESS Test Stand 2
5. Description of FREIA Facility
6. Testing Schedules for ESS Test Stand 2 and FREIA facility
7. Plans for collection, storage and dissemination of test results.
8. Procedure for formal acceptance of a cryomodule.

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| Appendix 2**Review Committee and other Reviewers, Presenters and Observers** |

The System Committee conducts this review of design with the authority of ACCSYS Project Leader, Mats Lindroos, and ESS Chief Executive Officer, John Womersley.

The Committee serves in an advisory capacity to:

* the ACCSYS WP4, WP5 and WP10 Leaders, and
* the ACCSYS management team

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| Name | Organisation | Appointment for IRR |
| John Weisend II | ESS, ACCSYS Deputy Project Leader | Chairman of the Review Committee  |
| Mats Lindroos | ESS, ACCSYS Project Leader | Review Committee member |
| Hakan Danared | ESS, Linac Group Leader | Review Committee member |
| Duy Phan | ESS, ACCSYS Safety Group  | Review Committee member |
| Mattias Skafar | ESS, Quality Division | Reviewer Committee member |
| Paolo Pierini | ESS, SCRF Section | Review Committee member |
| Serena Barbanotti | DESY Laboratory | Review Committee member |
| Kay Jensch | DESY Laboratory | Review Committee member |
| Joseph Preble | Jefferson Laboratory | Review Committee member |
| Michael Drury | Jefferson Laboratory | Review Committee member |
| Younguk Sohn | ESS, Linac Group | Reviewer |
| Enric Bargallo | ESS, RAMI  | Reviewer |
| Anders Sunesson | ESS, RF Group Leader | Reviewer |
| Stephane Berry | CEA Saclay | Reviewer |
| Pierre Bosland | CEA Saclay | Reviewer |
| Guillaume Olry | IPNO | Reviewer |
| Wolfgang Hees | ESS, WP10 Work Package Manager | Presenter |
| Roger Ruber | Uppsala University, FREIA | Presenter |
| Morten Jensen | ESS, WP8 Work Package Manager | Presenter |
| Christine Darve  | ESS, WP4/5 Deputy WP Manager | Presenter |
| Emilio Asensi | ESS WP10 | Presenter |
| Wojtek Fabianowski  | ICS Division | Presenter |
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| Appendix 3**Cryomodule Testing System Review Charge Questions** |

1. Will the tests proposed provide useful predictions regarding the performance of the cryomodules in the ESS Linac?
2. Are the tests proposed sufficient to serve as the Site Acceptance Test (SAT) of the cryomodules?
3. Has a suitable process been developed to formally accept a cryomodule for use in the ESS linac? Who makes this decision?
4. Is the time allotted for these tests appropriate?
5. Has an integrated control system (both hardware and software) been developed that permits control of the tests and ancillary systems, collection of data and storage of this data in a form that permits future practical use?
6. Have all safety issues been defined and dealt with? Are additional separate safety reviews or inspections required?
7. Have all QA/QC plans been defined and implemented? What is the testing role in the generation of a Certificate of Compliance?
8. Has the reliability and maintainability of the test stands and ancillary systems been optimized? Have all the spare parts required from the first day of operation been identified and procured?
9. Has a suitable strategy been developed for the collection and dissemination of documentation resulting from these tests? Is this approach consistent with ESS Wide standards?