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| IRR for the Ion Source and LEBT Charge Document |
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| Installation Readiness Review for the Ion Source and LEBT  September 15, 2017 |
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| **Charge for the IRR** |
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Purpose of this IRR

The IRR is meant to be the final technical review of the system prior to the start of installation. As such, it examines the final technical design of the integrated system with an emphasis on interfaces between components and subsystems, controls integration and a detailed look at the plans, staff and tooling required for the installation work itself.

This IRR is for the Ion Source and LEBT. It covers in detail the installation of all Ion Source and LEBT equipment in the accelerator tunnel and FEB Level 90.

**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, presented through the material presented and discussions, at the IRR. Note that the presentations themselves are means of communication only, and it is the documentation which must be reviewed.

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

3. DECIDE: The Review Committee is to elaborate and deliver at the conclusion of this IRR, a clear recommendation to ESS about the readiness of the Ion Source and LEBT and its associated systems to be installed at the ESS site and the readiness of the ESS site to receive such an installation.

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.

(If the committee rules for “Approved with recommended actions” or “Not approved” of the IRR, it is of essence that the actions/comments requested are very precise in their formulation and that the fulfilment decision is transferred to INFN-LNS and ESS, all this due to time constraints in the manufacturing schedule and sequence).

4. REPORT: The Review Committee is to document in a short report to be delivered as soon as possible after the IRR, 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 IRR 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 scope for the review includes:

* All the components of the Ion Source and LEBT that will be installed at the ESS site in Lund in November-December
* Installation plans including: required permits, tooling, cranes, personnel requirements, training, schedule, alignment issues, material transport, laydown area requirements
* Readiness of supporting utilities (water, electrical power, instrument air). This will be provided by ESS staff.
* Quality Assurance and Quality Control Organisation and activities.
* Safety aspects
* Reliability

Deliverables for IRR - Information to be reviewed

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

INFN-LNS is requested to deliver to the IRR 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 Fifteen (15) working days prior to the IRR.

1. Relevant standards and European Directives applied in the system design
2. Technical file:
   1. Update of all related engineering documentation
   2. Mechanical design documentation at a sufficient detail to answer interface, performance, alignment and installation questions below.
   3. Applicable Electrical design including single line drawings, instrumentation lists, cable designs and connector pin outs, calibrations etc.
   4. Integrated controls system design and documentation sufficient to answer charge questions.
3. Results of relevant component and subsystem testing
   1. Factory Acceptance Tests of subsystems (where applicable)
   2. Summary of testing and commissioning in Catania
   3. Leak tests
   4. Non-Conformity Reports
4. Hazard analysis and residual risks for component and installation work.
5. A strategy for System Verification except beam commissioning
6. Installation schedule
   1. Detailed Installation plan including alignment strategy
   2. List of needed spares for installation
7. Work & Safety Coordination Plan including all its Annexes (Area Hazard Analysis, Job Hazard Analysis, System Deliverables, Equipment List etc.)
8. First draft of Operation manuals of all delivered equipment in English
9. Maintenance manuals of all delivered equipment in English
10. Transport and delivery plan including package sizes, weights, identification and handling instructions.

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

The IRR 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 WP 3 Leader, 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 |
| Kent Wigren | ESS, ACCSYS QA Lead | Review Committee member |
| Mattias Skafar | ESS, Head of Quality Division | Review Committee member |
| Duy Phan | ESS, ACCSYS Safety Group | Review Committee member |
| Nick Gazis | ESS, Installation Manager | Review Committee member |
| Daniel Piso/Hector Novella | ESS, Integrated Controls Systems | Review Committee member |
| Dennis de Wit | ESS, Area Supervisor, Tunnel | Review Committee member |
| Santo Gammino | INFN-LNS, WP3 Leader | Reviewer |
| Håkan Danared | ESS, Linac Group Leader | Reviewer |
| Liviu Penescu | Consultant | Reviewer |
| Fabien Rey | ESS, Survey, Alignment & Metrology Group Leader | Reviewer |
| Simone Scolari | ESS, Vacuum Systems Engineer | Reviewer |
| Thomas Shea | ESS, Beam Instrumentation Section Leader | Reviewer |
| Frithiof Jensen | ESS, WP15 (Electrical Support) Leader | Presenter |
| Evangelia Vaena | ESS, WP15, Electrical Engineer | Presenter |
| Anton Lundmark | ESS, WP16 (Cooling Support) Leader | Presenter |
| William Ledda | ESS, ICS, Control System Integrator | Presenter |
| Nour Akel | ESS, ICS Installation Coordinator | Presenter |
| Edgar Sargsyan | ESS, WP3 Deputy Leader | Presenter |
| Øystein Midttun | ESS, ISRC & LEBT System Leader | Presenter |
| Jörgen Larsson | ESS, Warehouse & Logistics Group Leader | Presenter |
| Luigi Celona | INFN-LNS | Presenter |
| Lorenzo Neri | INFN-LNS | Presenter |
| Andrea Miraglia | INFN-LNS | Presenter |
| Ornella Leonardi | INFN-LNS | Presenter |
| Frank Hellström | ESS, WP3 Liaison | Observer |
| Åsa Alström Johannesson | ESS, CF/Skanska Senior Occupational Health & Safety Engineer | Observer |
| Maria Romedahl | ESS, Integrated Controls Systems | Observer |

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| Appendix 3  **IRR Charge Questions** |

1. Will the Ion Source & LEBT system meet its technical specifications? Do we know how to verify this?
2. Are the interfaces between the various components and subsystems that compose this system completed defined in terms of: a) physical connection – location and type of mating flanges, location and type of power and cable connections, support stands etc. and b) physical parameters (flows, pressure, temperatures, current, voltage, data acquisition formats and rates etc.)
3. Have all interfaces between this system and other systems been completely defined and agreed. Are all the connections on the ESS site in place? This applies to physical connections, physical parameters (flows, pressure, temperatures, current, voltage, UPS requirements) and data exchange.
4. Has an integrated control system (both hardware and software) been developed and tested that permits control of the system, collection of data and integration of this system into accelerator operations?
5. Have all safety issues been defined and dealt with? Are additional separate safety reviews or inspections required?
6. Have all QA/QC plans been defined and implemented?
7. What standards (European Directives or other) were used in the design?
8. Is there sufficient information available for ESS to issue a Declaration of Conformity and if not what is missing?
9. Is the planned document delivery in accordance to the In-Kind Agreement in terms of format and scope?
10. Will the system fit within its allocated space and can be transported there within the give transport path (height of doors, pass by other equipment) with the available transport means?
11. Are the alignment requirements agreed upon and can the system components be aligned within these requirements?
12. Is the installation plan for the system adequate? Have all tools, including cranes, movement devices, stands, alignment fixtures etc. been defined. Has the staff for this work been identified? Is the installation sequence consistent with the overall installation plan?
13. Has the reliability and maintainability of the system been optimized? Have all the spare parts required from the first day of operation been identified and procured?
14. Have all inspections and permits required prior to installation been carried out? Have the inspections and permits required between installation and the Accelerator Readiness Review been identified?
15. Have all recommendations from component design reviews been addressed?