SCHEDULE NIK 3.8#2: LABORATOIRE LEON BRILLOUIN (LLB)'S CONTRIBUTION REGARDING THE DESIGN, PROCUREMENT, MANUFACTURING, AND DELIVERY OF A VERTICAL 8T MAGNET, LOW-TEMPERATURE INSERTS, AND 2.5T WARM BORE CRYOMAGNET TO EUROPEAN SPALLATION SOURCE ERIC.

ANNEX TO THE IN-KIND CONTRIBUTION AGREEMENT BETWEEN EUROPEAN SPALLATION SOURCE ERIC (ESS) AND THE COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA) AND THE CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (CNRS) REGARDING THE CONSTRUCTION PHASE OF INSTRUMENTATION.

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1. SCOPE

This document "Schedule 3.8#2" describes the Scope of Work (SoW) that will be completed by CEA and CNRS acting on behalf of LLB, hereinafter the "Partners", in respect of design, procurement, manufacturing and delivery of an 8T vertical magnet and three low-temperature inserts to the ESS, hereinafter the "Project". It is an integral part of the In-kind Contribution Agreement entered into by and between ESS, CEA and CNRS on 17th July 2019 and the Incorporation Agreement as amendment n° 1 on …… 2019 .

The SoW contains an appropriate level of detail so all parties clearly understand what work is required, the duration of the work involved, the deliverables and the conditions of acceptance of the Partners' contribution.

2. RELATED DOCUMENTS

2.1 Applicable Documents

The following documents and data are necessary to complete or support the execution of this SoW.

A. [DRP] ESS-0008910 ESS Design Review Standard Operating Procedures, March 2, 2016, Rev. 1, Released
B. ESS-0100666 ESS Generic Requirements for Electrical Systems and Components, Rev.1 Released
C. ESS-0094092 ESS Generic Requirements for Documentation of Technical Systems, Rev.2 Released

2.2 Reference documents

The following documents listed here provide guidance for executing the SoW and are non-legally binding.

A. [CCP] ESS-0001879 Change Control Process, May 16 2014, Rev. 5, Released
B. [PND] ESS-0051706 Process for Neutron Instrument Design and Construction, Sept. 20, 2016, Rev. 1, Released
C. [CMP] ESS-0003688 Configuration Management Plan, June 9, 2016, Rev. 2, Released
D. [ESM] ESS-0013139 EV-Schedule-Milestone Template and Instructions, June 9, 2016, Rev. 2, Released
E. [IMP] ESS-0002917 Interface Management Plan, September 21, 2016, Rev.1, Released
F. [ISS] ESS-0017560 TS, AD, NSS and ICS Plan and Implementation Strategy for Hazardous Materials and Sustainability, Jan 18, 2017, Rev. 1, Released
G. [LOG] ESS-0042559 Guideline: Shipping Instruction / Pre-Advice - In Kind shipping instructions for IKC Partners, June 9, 2016, Rev 1, Released
H. [OLH] ESS-0048868 ESS Procedure for Offsite Lending of Hardware, Sept. 20, 2016, Rev. 1, Released
I. [PQP] ESS-0037830 ESS Template for Project Quality Plan, Sept. 27, 2016, Rev. 1, Released
J. [RMP] ESS-0000263 ESS Process for Risk Management, Sept. 20, 2016, Rev. 4, Released
K. [SEM] ESS-0002908 System Engineering Management Plan, Sept. 21, 2016, Rev. 1, Released

3. TERMS AND DEFINITIONS

Short name	Description
CDR	Critical Design Review
SOMM	System Operation and Maintenance Manual
DAP Incoterms	Delivered at Place. ESS is responsible for any import clearance and applicable taxes.
EOR	Engineering and Operation Review
ESS	European Spallation Source ERIC
EV	Earned Value, the value of the work completed.

Facility element	This item corresponds to the product contribution of the Partners. It is an element of the ESS PBS and/or WBS
FAT	Factory Acceptance Test
IKC	In-Kind Contribution
IRR	Installation Readiness Review
NSS	Neutron Scattering Systems
NCR	Non-Conformity Report
ORR	Operational Readiness Review
P&ID	Literally 'Piping and Installation Diagram' or 'Piping & Instrumentation Drawings' but P&ID may also refer to electrical circuit diagrams, logic diagrams, flow diagrams and any other such design descriptions as schematic representation.
PDR	Preliminary Design Review
PBS	Product Breakdown Structure
PSS	Personnel Safety System
QC	Quality Control
RAMI	Reliability, Availability, Maintainability, Inspectability
SAR	Safety System Acceptance Review
SAT	Site Acceptance Test
SoW	Scope of Work
TG	Tollgate
TRR	Test Readiness Review
WBS	Work Breakdown Structure
WP	Work Package
WU	Work Unit

Table 1. Terms and Definitions

4. PROJECT DEFINITION

4.1 Deliverable Item Definition

The Partners' contribution consists of delivering components that are identified with their Product Breakdown Structure (PBS) identifier and the associated documentation. They are listed as Deliverables and Documents Deliverables in Table 2.

Start date: February 2018
Estimated end date: January 2023

Task no.	Deliverables	PBS reference #	Estimated delivery date
1	Vertical 8T large aperture split-pair magnet	13.3.8.2.2	01/2023

2	2 x low-temperature ^{3}He/^{4}He dilution inserts	13.3.8.2.2	01/2023
3	1 x low-temperature ^{3}He sorption stick	13.3.8.2.3	01/2023
4	1 x 2.5 T warm bore cryomagnet	13.3.8.2.4	07/2022
Task no.	**Document Deliverables**		**Estimated delivery date**
1	Final Data Package CTR		06/2020
2	Final Data Package CDR		12/2020
3	Final Data Package IRR		10/2022
4	Final Data Package SAR		01/2023

Table 2. The Partners' deliverables

The Partners contribution is set to the ESS Cost Book value of 1 950 000€$_{2013}$ (Euro) for the completion of the Project. The 8T magnet and low temperature inserts (tasks 1-3) form a single package, with a budget of 1 650 000€$_{2013}$. The relevant milestones given in table 4. The warm bore cryomagnet (task 4) has a separate set of milestones and deliverables detailed in table 5 and a budget of 300 000€$_{2013}$.

4.2 Overview description of the Project Deliverables

4.2.1 Vertical 8T large aperture split-pair magnet

This is a **Cryomagnet** to be used primarily on MAGiC, but also compatible with other diffraction instruments (**DREAM**, **HEIMDAL**) as part of the SE pool equipment. The coil geometry is based on a vertical field split-pair coil, with a wide scattering aperture in the horizontal plane. Opening angles will be matched to detector geometry on the relevant instruments and take advantage of the coordinated positioning of all detectors to the left of the beam. This will allow an asymmetric support structure with a view to maximizing the field subject to the required aperture, with openings for the beam to enter from a number of different angles appropriate for different instrument layouts. It is expected that a central field of 8T or more can be achieved with this geometry. Scattering from material in the beam is minimised with use of single crystal silicon windows on the input side and thinned sections of aluminium on the outgoing beam path.
The magnetic field is remotely controlled by a **magnet power supply** which provides all safety aspects during operation (i. e. ramping speed, max. current, SC-switch for persistence mode, quench mode detection, LHe level standings). The magnet cryogenics can be based on a wet, recondensing or dry system.
Equipped with a variable temperature insert (VTI) a sample tube allows top-loading access for sample sticks. Various versions of sample stick equipped with heater and thermometry provide controlled sample temperatures from ~1.5 K up to ~300 K. Temperature regulation and control will be ensured by a **LAKESHORE mod. 336 or equivalent** device using calibrated CERNOX thermometer. A set of **2 sample sticks** is required to ensure high scientific throughput. The top plate is equipped with remote control sample orientation via a phi-rotation mechanism of the sample stick and a vertical z-alignment (up to ±3 cm).
The central sample tube is capable of operating a VLT insert system such as the OI-HELIOX or a dilution insert system such as the OI-KELVINOX stick providing continuously controlled sample temperatures for T = 0.025 K to ~30 K.
Reliable operation of the variable temperature inserts (VTI) is provided by **remote control of the cold valve** adjusting the flow of LHe to the heat exchanger according to the cooling power needed in a specific temperature range. Complementary, a **GHe pumping stand** with pressure gauge read-out is needed in order to provide sufficient Joule-Thompson cooling below 4.2 K and down to minimum ~1.5 K.
The cryomagnet will be fitted with the ESS kinematic mounting interface to ensure accurate and repeatable sample positioning.

4.2.2 Low-temperature ^{3}He/^{4}He dilution inserts

This is a **^{3}He/^{4}He Dilution Cryostat Insert** to be used for experiments below 1 K on a wide range of instruments as part of the SE pool equipment. The insert needs an outer cryostat environment with a VTI based sample tube of matching physical dimensions. Typically, an ORANGE-type cryostat or cryomagnet is the matching system for providing the operation conditions necessary to run a ^{3}He/^{4}He dilution process, i. e. an environmental temperature T_{cryo} about ~3K. Samples with appropriate small dimensions have to be mounted at RT inside the inner vacuum can (IVC) to the mixing chamber of the dilution stick. Sample temperature can be achieved for continuous operation in a temperature range from ~0.03 K up to ~30 K. Sample temperature regulation and control will be performed by a temperature controller (**LAKESHORE mod. 372**) using calibrated CERNOX and RuO2 thermometers. A remotely controlled **^{3}He Gas Handling System** is used to continuously operate the ^{3}He dilution cooling process due to control of ^{3}He circulation (flow rate, pressure and temperature) via various valves, pumps and heater systems.

4.2.3 Low-temperature ^{3}He sorption stick

This is a **^{3}He Sorption Cryostat Insert** to be used for experiments below 1.5 K on a wide range of instruments as part of the SE pool equipment. The insert needs an outer cryostat environment with a VTI based sample tube of matching physical dimensions. Typically, an ORANGE-type cryostat or cryo-magnet is the matching system for providing the operation conditions necessary to run a re-condensing ^{3}He sorption pump process, i. e. an environmental temperature T_{cryo} about ~3K.
As with a single shot system, controlled ^{3}He sorption pumping can be operated for ~40 hours in a temperature range ~0.25 K to ~1.2 K followed by a period of about 45 minutes for 3he re-condensing.
Samples with appropriate small dimensions have to be mounted at RT inside the inner vacuum can (IVC) to the ^{3}He chamber of the sorption stick. Sample temperature can be achieved for continuous operation in a temperature range from ~0.25 K up to ~30 K.
Sample temperature regulation and control will be performed by a temperature controller (like **LAKESHORE mod. 336**) using calibrated CERNOX and RuO2 thermometers. A fully electronically operated **^{3}He Sorption Control System** is used to continuously operate the ^{3}He sorption pumping process via various thermometer and heater systems.

4.2.4 Warm bore 2.5T cryomagnet

A 2.5 T warm bore primarily is intended for **ESTIA instrument** but useable on other instruments with floor mounting and sufficient space.

Three 80mm diameter room temperature bores, angular aperture ± 20° (along field direction) 150° (perpendicular to field). Vertical or horizontal field orientation possible by rotating the entire magnet system. Dry cooling system. Passively yoked stray field containment. The cryomagnet will be fitted with the ESS kinematic mounting interface to ensure accurate and repeatable sample positioning.

This WP includes the magnet with the associated cryocooler, compressor, power supply and magnet system controller.

4.3 Overall Activities and Responsibilities of the Partners in the Project

4.3.1 Phase 1 - Preliminary Design

During Phase 1 of the Project, the Partners will carry on the following activities, only with respect to the components which are expressly listed as Deliverables in Table 2 above:

i. the preliminary design and engineering of such components;
ii. the preliminary planning for manufacturing and procurement of such components, which will be executed during phase 3 (manufacturing and procurement);
iii. the detailed FAT and SAT of such components;

Phase 1 will culminate in a Call for Tender Review held at ESS Head Quarters. The Documentation Deliverables shall be delivered to ESS by CTR and are considered to be accepted by ESS except if otherwise expressly mentioned by ESS within a one-month period after CTR.

4.3.2 Phase 2 – Detailed Design

During Phase 2 of the Project, the Partners will carry on the following activities, only with respect to the components which are expressly listed as Deliverables in Table 2 above:

i. the detailed design and engineering of such components;
ii. the detailed planning for manufacturing and procurement of such components, which will be executed during phase 3 (manufacturing and procurement);
iii. the preliminary planning for delivery of such components, which will be further developed in phase 3 and executed in phase 4.

Phase 2 of the Project culminates in a Critical Design Review (CDR). No manufacturing or procurement is to be undertaken by the Partners during this phase 2. However, exceptions can be made for long lead-time items and shall be discussed case by case and approved by NSS Management and the Partners.

4.3.3 Phase 3 - Manufacturing and Procurement

During Phase 3 of the Project, the Partners will carry on the following activities, only with respect to the components which are expressly listed as Deliverables in Table 2 above:

i. The manufacturing and procurement related to such components;
ii. The detailed planning for phase 4 (delivery)

Phase 3 of the Project is split into two (2) stages and formally culminates with the Installation Readiness Review:

- Several Factory Acceptance Tests ("FATs") at Partners or their subcontractors' premises, as individual components are concerned,
- Installation Readiness Reviews ("IRRs") of the individual components

The IRRs of the individual components assess whether the maturity of the individual components is such that packing and shipping of such individual components to the ESS site in Lund can commence.
The Documentation Deliverables shall be delivered to ESS by IRR and are considered to be accepted by ESS except if otherwise expressly mentioned by ESS within a one-month period after IRR.

4.3.4 Phase 4 – Delivery and Installation

During Phase 4 of the Project, the Partners will carry on the following activities, only with respect to the components which are expressly listed as Deliverables in Table 2 above

i. On-site delivery – the individual components of the Project are delivered at ESS main site.
ii. Site Acceptance Tests ("SATs") – the individual components of the Project are tested and their functionalities are demonstrated.

Phase 4 of the Project formally culminates in Site Acceptance Review (SAR).
The Documentation Deliverables shall be delivered to ESS by SAR and are considered to be accepted by ESS except if otherwise expressly mentioned by ESS within a two months period after SAR.

4.3.5 Interfaces with ESS

Additional equipment is required for operation, Site Acceptance Tests (SATs) and development:

1) A docking station cryostat
2) A **high-vacuum turbo-molecular pumping stand** with oil-free 2-stage rotary pump
3) A h**elium leak detector**
4) A **computer-based control system**.

This additional equipment will be procured, commissioned, installed and operated by ESS (Scientific Activity Division).

The installation procedure will involve tasks from ESS-ERIC and the Partners, according to the following sequence:

a) ESS will be in charge of providing required equipment for installation and operation of the delivered components;
b) ESS will transfer the stored crates to the installation location;
c) The Partners will open the crates and check their content;
d) ESS will be in charge of the lifting of heavy elements;
e) The Partners will install the components of the system, connect them together;
f) The Partners will connect the system to utilities panel if relevant;
g) ESS will be in charge of the safety operations;
h) The Partners will configure and test the system;
i) The Partners and ESS will proceed with the SAT.

As a general rule, operations that involve ESS safety elements shall be accomplished by ESS.

4.4 Project Schedule and Key Milestones

Milestone ID	Short description	Planned/Baseline date
#E01	Beam on Target	07/07/2022
#E02	ESTIA TG5	07/2022
#E03	MAGIC TG5	07/2022
#E04	Start of User Program	12/2023

Table 3. ESS Milestones (MS 4.1 as of November 2018). Milestones #E02 and #E03 are instrument milestones aligned to the MS 4.1 and not ESS milestones.

WP 1 (Tasks 1 to 3) :

Milestone ID	Short description	Planned/Baseline date	Location	Responsible and actions	EV [%]
#1	Kick-Off meeting	13/02/18	LLB	ESS: provide framework and requirements to Partners.	0
#2	8T Magnet CTR	T0 + 1 month	NA	Partners: send Call for Tender (technical content) and Schedule documents to ESS.	0
#3	8T Magnet CTR	#2 + 2weeks	Visio	ESS: review and validate Call for Tender documents.	2

#4	Low temperature CTR	T0 + 1 month	NA	Partners: send Call for Tender (technical content) and Schedule documents to ESS.	0
#5	Low temperature CTR	#4 + 2 weeks	Visio	ESS: review and validate Call for Tender documents.	2
#6	8T Magnet CDR	#3 + 6 months	NA	Partners: send Detailed Design, Detailed Schedule and CAD document to ESS.	0
#7	8T Magnet CDR	#6 + 2 weeks	ESS	ESS: review and validate CDR documents.	6
#8	Low temperature CDR	#5 + 6 months	NA	Partners: send Detailed Design, Detailed Schedule and CAD document to ESS.	0
#9	Low temperature CDR	#8 + 2 weeks	ESS	ESS: review and validate CDR documents.	3
#10	8T Magnet IRR	#7 + 24 months	NA	Partners: send Documentation and FAT results to ESS.	0
#11	8T Magnet IRR	#10 + 1 month	ESS	ESS: review and validate documents.	30
#12	Low temperature IRR	#9 + 18 months	NA	Partners: send Documentation and FAT results to ESS.	
#13	Low temperature IRR	#12 + 1 months	ESS	ESS: review and validate documents.	20
#14	8T Magnet SAR	#11 + 3 months	NA	Partners: deliver, unload and perform SAT on component.	0
#15	8T Magnet SAR	#14 + 1 month	ESS	ESS: receive, store, integrate and perform SAT on component. Validate delivery.	18
#16	Low temperature SAR	#13 + 3 months	NA	Partners: deliver, unload and perform SAT on component.	0
#17	Low temperature SAR	#16 + 1 month	ESS	ESS: receive, store, integrate and perform SAT	14

				on component. Validate delivery.	
#18	Final SAR	The latest of #15 + 1 month or #17 + 1 month (Estimated: 01/2023)	ESS	ESS: review of the Project and final decision.	5
TOTAL:					**100%**

Table 4. Project Schedule and Key Milestones for Tasks 1-3. EV [%] = percentage of ESS Cost Book value to be allocated to the Partners for crediting purposes, once the corresponding Milestone is reached. "T0" refers to the date of signature of this Technical Annex between ESS, CEA and CNRS.

WP 2 (Task 4) :

Milestone ID	**Short description**	**Planned/Baseline date**	**Location**	**Responsible and actions**	**EV [%]**
#1	Kick-Off meeting	9/9/2019	LLB	ESS: provide framework and requirements to Partners.	0
#2	Warm Bore Cryomagnet CTR	T0 + 2 months	NA	Partners: send Call for Tender (technical content) and Schedule documents to ESS.	0
#3	Warm Bore Cryomagnet CTR	#2 + 2weeks	Visio	ESS: review and validate Call for Tender documents.	10
#4	Warm Bore Cryomagnet CDR	#3 + 4 months	NA	Partners: send Detailed Design, Detailed Schedule and CAD document to ESS.	0
#5	Warm Bore Cryomagnet CDR	#4 + 2 weeks	ESS	ESS: review and validate CDR documents.	10
#6	Warm Bore Cryomagnet IRR	#5 + 18 months	NA	Partners: send Documentation and FAT results to ESS.	0
#7	Warm Bore Cryomagnet IRR	#6 + 1 month	ESS	ESS: review and validate documents.	45
#8	Warm Bore Cryomagnet SAR	#7 + 3 months	NA	Partners: deliver, unload and perform SAT on component.	0
#9	Warm Bore Cryomagnet SAR	#8 + 1 month	ESS	ESS: receive, store, integrate and perform SAT	30

				on component. Validate delivery.	
#10	Final SAR	#9 + 1 month (estimated 07/22)	ESS	ESS: review of the Project and final decision.	5
TOTAL:					**100%**

Table 5. Project Schedule and Key Milestones for Task 4. EV [%] = percentage of ESS Cost Book value to be allocated to the Partners for crediting purposes, once the corresponding Milestone is reached. "T0" refers to the date of signature of this Technical Annex between ESS, CEA and CNRS.

The estimated dates indicated in Table 4 & 5 are linked to the ESS Master schedule 4.1, released in November 2018, applicable at the time of signing the Schedule.

4.4.1 Kick-off meeting

The meeting held during IKON 14 at LLB represents the Kick-off meeting for the Schedule 3.8#2 project.

4.4.2 Status meetings

A status meeting shall be held between ESS and the WUC at least every three (3) months during the whole duration of the Schedule 3.8#2 project.
The purpose of the meeting is to review progress, risks, discuss/decide on change requests provided that it does not lead to exceeding the validated Partners IKC mentioned in 4.1, and without prejudice of the provisions of the articles 6 (Organization) and 8 (Variations) of the IKCA, and discuss upcoming activities and potential challenges.
The Partners shall provide a written progress Monthly Status Report at least 3 working days in advance of the meeting.
The participants shall take the minutes of the meeting and record the action items.
In case the change request should lead to exceeding the IKC value defined in 4.1, an additional meeting will be convened by the Coordination Committee.

4.4.3 Reviews

4.4.3.1 *Call for Tender Review (CTR)*

The Call for Tender Review concludes Phase 1. The CTR applies to components which detailed design, and not only the manufacturing, will be outsourced.

ESS holds the responsibility to verify various project aspects:

- The involved ESS Reviewer Group revises the technical content of the call for tender. They do not provide feedback, only if there is an issue.
- The technical specification should comply with the requirements established by the relevant ESS Reviewer Team.
- ESS will evaluate if the planning is compatible with NSS schedule, as well as global resource plan of the instrument suite

The technical parts of the contract/tender relevant for the requirements above shall be translated to English.
If the ESS completeness requirements are not compatible with the Partners institutes rules, then the specific issue has to be discussed and addressed by a common agreement. If the components schedule or resource plan is conflicting with NSS project planning, then the issue has to be discussed between ESS and the Partners and the consequences have to be evaluated.
ESS shall respond (approval or request for further details) within 14 working days after receiving all the document(s), including the technical content of the call for tender. If no answer has been received within such period, ESS approval shall be deemed granted.

4.4.3.2 *Critical Design Review (CDR)*

The Critical Design Review concludes Phase 2. The CDR assesses if the design meets all facility element requirements with acceptable risk and within the cost and schedule constraints.
The CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, test, and future operation and decommissioning.
The review shall be organized by European Spallation Source ERIC and will involve the Parties' work-unit Coordinators and any other stakeholders at the discretion of the review chairman, including representatives from the Partner's manufacturer and any required subject matter expert. The chair of the review board is appointed by European Spallation Source ERIC. The membership of the board is communicated to the review participants at the earliest possible time.
The CDR data package shall contain all deliverables as specified in 4.5.2.2.
The review shall be organized as defined in the ESS Design Review Standard Operating Procedure [DRP].
The agenda of the review meeting shall be communicated to the Parties no less than 1 week before the review meeting. The review meeting may include in depth presentations by the Partners of the work undertaken and responses to the review findings.

4.4.3.3 *Installation Readiness Review (IRR)*

The Installation Readiness Review concludes Phase 3. During the IRR, the reviewers assess the following aspects and related documentation:

- Safety and Security requirements (such as relevant safety training, registration for the access card ID06, office and IT support)
- Output from the Design phase (CDR, related controlled documentation approved and stored in CHESS, related SSM licensing documentation submitted)
- All preparation related to specific installation package done and documented in the installation binder (Scope of work, Organisation, Time Schedule, Risk Assessment, Temporary services, Drawings, Installation procedures, Work permits, Daily Dairy, NCRs, QC – Installation & test documentation, List of components and materials)
- Required activities at site scheduled or been performed.

The output is the Installation Readiness Review report (check-list), with the conclusion to either recommend or not installation, and the Approved Installation Plan. This is signed by the Installation Coordinator. The recommendation could also contain pre-start and post-start items. The pre-start items shall be completed before the start of installation.

4.4.3.4 *Site Acceptance Review (SAR)*

The Site Acceptance Review concludes the project. The SAR examines the system(s) and its documentation, and inspection, demonstration, test data and analyses that support its verification as defined in the Verification Plan and Report. The SAR ensures that the all system requirements have been satisfied and that the integration can start as defined in the facility element Integration Plan.
The review shall be organized by European Spallation Source ERIC and will involve the Parties' work-unit Coordinators, as well as any other stakeholders at the discretion of the review chairman including representatives from the Partners' manufacturer and any required subject matter expert. The chair of the review board is appointed by European Spallation Source ERIC. The membership of the board is communicated to the review participants at the earliest possible time.
The SAR data package shall contain all deliverables as specified in section 4.5.2.4
The review shall be organized as defined in the ESS Design Review Standard Operating Procedure [DRP].
No detailed schedule of a review meeting is requested but for planning purposes it can be expected that a review may last 1 to 2 working days.
The review board shall review the documentation provided and submit written comments no less than 3 working weeks before the review meeting. The Partners shall consolidate the comments and provide written answers to the board no less than 1 working week before the review meeting.

The agenda of the review meeting shall be communicated to the review participants no less than 1 week before the review meeting. The review meeting may include in depth presentations by the Partners of the work undertaken especially the results of the performance tests SAT and FAT and responses to the review findings.

4.5 Description of Data and Document Deliverables

4.5.1 Status reports

During the execution of the SoW, the Partners shall submit to the European Spallation Source ERIC status reports containing (as according Annex 5 to the In-Kind Contribution Agreement: Status Report) at least every three months:

1. The status of the SoW since the preceding report;
2. The progress expected to be made in the next following period and any other pertinent issues related to the Project Results;
3. Updated Milestone Tracking Table;
4. Desired changes to existing baseline;
5. Risk Management;
6. Updated electronic versions of the Partners plans.

4.5.2 Technical Data Package(s)

4.5.2.1 *CTR Data Package*

The Call for Tender Review Data Package is made of the following documents:

- Technical part of the Call for Tender documentation
- Preliminary System Description
- Preliminary Schedule

4.5.2.2 *CDR Data Package*

The Critical Design Review Data Package is made of the following documents:

- Finalized System Description
- Manufacturing and delivery schedules
- Finalized 3D model of all delivered goods

4.5.2.3 *FAT Data Package*

The Factory Acceptance Test Data Package is made of the following documents:

- Report of tests performed; the tests are to be defined as part of the CTR.
- Final documentation, including as-built drawings and 3D models.
- Report on conformity with ESS authorized materials
- Documentation for all control software and hardware.

4.5.2.4 *SAT Data Package*

The Site Acceptance Test Data Package is made of the following documents:

- Report of tests performed; the tests are to be defined as part of the CTR.

4.5.3 Final Report

The Partners shall issue a final written report to the European Spallation Source ERIC within four (4) weeks of the earliest occurrence of the following: (a) completion of the stages, or (b) the expiration of the In-Kind

Contribution Agreement (IKCA), or (c) prior termination of - the IKCA. Such report shall include a comprehensive summary of the contributions made, works and services undertaken and Project Results achieved.

4.5.4 Documentation package to supply

The Partners shall deliver at the completion of the project:

- Phase 1-4 data package(s);
- Data sheets for systems and components delivered;
- Certificates for inspections, and qualifying / certifying / regulatory assessments;
- All CAD models.

5. TASKS APPLICABLE TO ALL PROJECT STAGES

5.1 Project management and control

ESS uses Earned Value Management as a tool for managing progress and performance. This translates into a requirement for tracking deliverables from Partners. Below, Chapter 5.1.1 - 5.1.6, the requirements concerning scheduling and progress reporting in order to comply with this requirement.

5.1.1 Use of a Planning Tool

The Partners should use a planning tool (MS Project, Oracle Primavera, Deltek Open Plan or similar). The purpose with this requirement is to enforce a systematic approach to planning, both creating and maintaining the plan.
As part of the monthly status report, the current schedule should be made available for ESS (electronic format).

5.1.2 Monthly Forecasting

In conjunction with the status reporting, the Partners should also provide an updated forecast for the upcoming milestones, as well as the final delivery milestone.

5.2 Risk Management

ESS uses Risk Management as one of the Project Management tools to assist the execution of the Programme. The Partners' contribution in this field is vital and shall therefore form a part of ESS Risk Management Process.
The contribution shall be characterized by risk awareness and open communication regarding risks. The common view of risks and uncertainties are utilized as a stepping-stone to the identification and exploitation of opportunities.

5.2.1 ESS Risk Management Process

Risk Management shall be incorporated as a part of the day-to-day work with the contribution. The Partners shall work according to ESS Risk Management Process, including:

a. Plan Risk Management;
b. Identify risk;
c. Analyse risk;
d. Risk treatment; and
e. Monitor and control risk.

5.2.2 ESS Risk Criteria

When analysing risk, ESS's risk criteria should be used. Using ESS's criteria for likelihood and consequence enables Partners and ESS to analyse risks in a uniformed way.

The ESS acceptance criteria clarify what risk level that ESS accepts, and when risk treatments are required. All combinations of likelihoods and consequences correspond to a risk level, either being high, medium or low. This is graphically presented in the ESS risk matrix.
Risk treatments are the measures being taken in order to treat the risk to an acceptable level. High-level risks can never be accepted and require treatment. Medium-level risks can be accepted without treatment if the treatment is not proportional to the gained improvements. Low-level risks can be accepted without treatments.

5.2.3 Risk Register

The risk register shall contain the gathered knowledge of identified risks, including the assessed risk exposure. The register shall show identified risks in order of priority, including risk treatment plans.
The Partners should preferably use ESS Risk Management software system, used for systematic documentation of risk registers. If not, the Partners risk register format shall be according to ESS's requirements.

5.2.4 Risk Status Report

Risk status reports shall include summary describing news and relevant changes to the risk exposure, including on-going Risk Management activities. It shall furthermore contain an updated risk register including risk treatment status.

5.3 Configuration management

The ESS programme participants shall develop the baseline of the facility elements and may redefine the architecture of the facility elements. Full and part delivery milestones should be under change control. This means that the parties need to agree on changes to the milestones in accordance with the article 8 (Variations) of the IKCA. Each baseline change shall be documented as defined in the [CCP].
The ESS programme participants shall follow the principles of configuration management as laid down in the ESS configuration management plan [CMP], or equivalent best practices. In particular:

1. The ESS programme participants shall identify each document, drawing, subsystem or part, establishing the item configuration and relation to the hardware and software at any time in the study.
2. The ESS programme participants shall apply the change control process [CCP], in agreement with best practices.
3. The ESS programme participants shall ensure that all personnel that use or generate information can easily access in the tools implemented to ensure configuration control. ESS shall provide a central repository for all information and that this repository is properly backed up.

5.4 Organization

The persons nominated as the Work-Unit Coordinator according to Article 6 of the In-Kind Contribution Agreement [IKCA] are:
For the Partners (local coordinator): FABREGES Xavier
For European Spallation Source ERIC: HOLMES Alexander

5.5 Product & Quality assurance and safety

5.5.1 Applicable law, legislation and standards

All Partners national safety laws and legislation applicable to the design, development, manufacturing, installation, testing and operation of the supply shall be followed and fulfilled. Further, and without limiting the foregoing, the Partners are responsible for checking that the components delivered or supplied to ESS ERIC meet EU safety, health and environmental protection requirements. It is the Partners' responsibility to ensure that all such components are compliant with European Directives 2006/42/EC, 2014/35/EU, 2014/30/EU, 2014/68/EU and 2014/34/EU, and CE marked if applicable, and that the following obligations have been carried out and complied with:

a. Identify the applicable directive(s) and harmonized standards;
b. Perform a documented risk assessment;
c. Identify whether an independent conformity assessment (by a notified body) is necessary;
d. Test the component and check its conformity;
e. Verify component specific requirements;
f. Draw up and make available, upon request, all the required technical documentation (in English). Keep such technical documentation for the time periods specified in the applicable directives;
g. Draw up and issue an Operations Manual or Instructions for incorporation (in English);
h. Draw up and issue the EU Declaration of Conformity (in English);
i. Affix CE marking, if applicable.

The Partners acknowledge that the above steps may differ by component as the conformity assessment procedures vary, in which case the Partners shall comply with all the relevant procedures and applicable legal requirements.

All operator national safety laws and legislation applicable to the design, development, manufacturing, installation, testing and operation of the supply shall be followed and fulfilled as defined in the requirement document for the facility element by European Spallation Source ERIC.

The Parties shall implement and maintain throughout the Project a quality assurance and safety approach with respect to the scope of the IKC delivery and all specified reliability, quality assurance and safety requirements.

5.5.2 Safety

The Partners are responsible, in accordance with applicable European and national regulations for safety and health at work, for the safe conduct of the activities to perform this SoW.
The Partners are also responsible for any Hazard analysis identified as scope in Chapter 4.2, and Hazard analysis Report(s) identified as deliverables in Chapter 4.4.
ESS is responsible, in accordance with applicable European and Swedish regulations for safety and health at work, for the safe conduct of all activities on-site at ESS Lund. The radiological safety at ESS site and facility remains under the exclusive and sole responsibility of ESS.
It is also the responsibility of ESS to identify and describe any specific requirements, any specific Partners deliverables and any specific process(es) to be followed by the Partners to enable ESS Facility to operate safely.

5.5.3 Quality

The Partners shall prepare a consistent and comprehensive Project Quality Plan which should generally conform with ESS template for [PQP]. See Chapter 2.1.
Planning and compliance documentation required might be principally generated from the Partners' own quality management system when applying a system manual with defined procedures. However, a quality plan does not replace and is not a substitute for such a quality management system.

5.5.4 Licensing

Licensing refers to the granting of permits to ESS by Swedish Radiation Safety Authority (SSM) to, progressively:

a. Construct the ESS facility buildings;
b. Procuring and possessing technical devices and other Components that could generate ionizing radiation or have a radiation safety function;
c. Installing and commissioning these devices in ESS facility buildings; and
d. Operating and maintaining these devices for neutron science users.

Unless otherwise described in the SoW including documents specified in Chapter 2.1, the licensing for systems and components that are either the Partners' deliverables or ESS deliverables is under ESS responsibility.

ESS remains directly responsible to SSM for licensing and it is the responsibility of ESS to identify and describe in this SoW and/or documents specified in Chapter 2.1, any specific requirements for the Partners, any specific deliverables to be provided by the Partners and any specific process(es) to be followed by the Partners which enable ESS to achieve SSM licensing. ESS may at a later stage, request of the Partners additional information required by, or in support of ESS's responsibilities for SSM licensing.

6. DOCUMENTATION

6.1 Documentation format

a. All documentation and correspondence shall be in English.
b. All office documents shall be in a MS Word and PDF format.
c. The electrical drawings shall be in EPlan format.
d. All mechanical models and drawings shall be editable and linked and in Catia V6. Drawings shall be also provided in PDF.

6.2 Documentation package for supply

The Partners shall deliver at the completion of the project:

a. Detailed Design (CDR) data package;
b. Manufacturing (IRR) data package;
c. Data sheets;
d. Certificates, as specified in the detailed scope of work;
e. CAD models, as specified in the detailed scope of work.

7. TRANSPORTATION AND DELIVERY

All tangible Deliverables of the Partners shall be delivered DAP 2010 Incoterms, delivered at the final destination in Lund defined by ESS.

All deliveries shall also be accompanied by an appropriate pro-forma invoice (evidencing the replacement value of the delivered equipment) and such other delivery documentation to enable ESS ERIC to properly store and insure the equipment.

8. WARRANTY

For individual components procured by the Partners from commercial suppliers (the "**Procured Components**"), the Partners shall acquire (and maintain) industry standard warranties, which are commercially available and applicable to such components.

For clarity, the Partners shall be responsible for ensuring that the warranty period for all Procured Components is the same as the warranty period the Partners would negotiate and secure in case of components procured for its own use.

The Partners shall provide a copy of all warranty terms applicable to Procured Components to the ESS ERIC WU Coordinator (in this case coinciding with the Instrument Class Coordinator) for information, as soon as reasonably possible after such details become known to the Partner.

The Partners shall be responsible for handling and managing any warranty claims (directly with its suppliers or manufacturers) related to Procured Components, which may arise during the warranty period.

9. EXCLUDED BACKGROUND

No Partners' Background is excluded.

IN WITNESS WHEREOF, the Agreement has been executed in three (3) originals, of which the Parties have received one (1) each.

European Spallation Source ERIC

_____
Date

_____
Signature

_____
Name (in block letters)

_____
Position

CEA

_____

Date

_____

Signature

_____

Name (in block letters)

_____

Position

CNRS

_____
Date

_____
Signature

_____
Name (in block letters)

_____
Position