Introduction to ESS and to the i-CDR

PETER RÅDAHL, ESS CHIEF ENGINEER, CHAIR OF THE I-CDR
DR. BERTRAND NICQUEVERT, ADVISOR TO THE ESS TECHNICAL DIRECTOR, SECRETARY OF THE I-CDR
DR. SARA GHATNEKAR NILSSON, WORK PACKAGE MANAGER, MONOLITH SYSTEMS, ESS TARGET DIVISION

2021-03-11

Agenda

1 ESS Basics

2 Deliverables and Charge for the Committee

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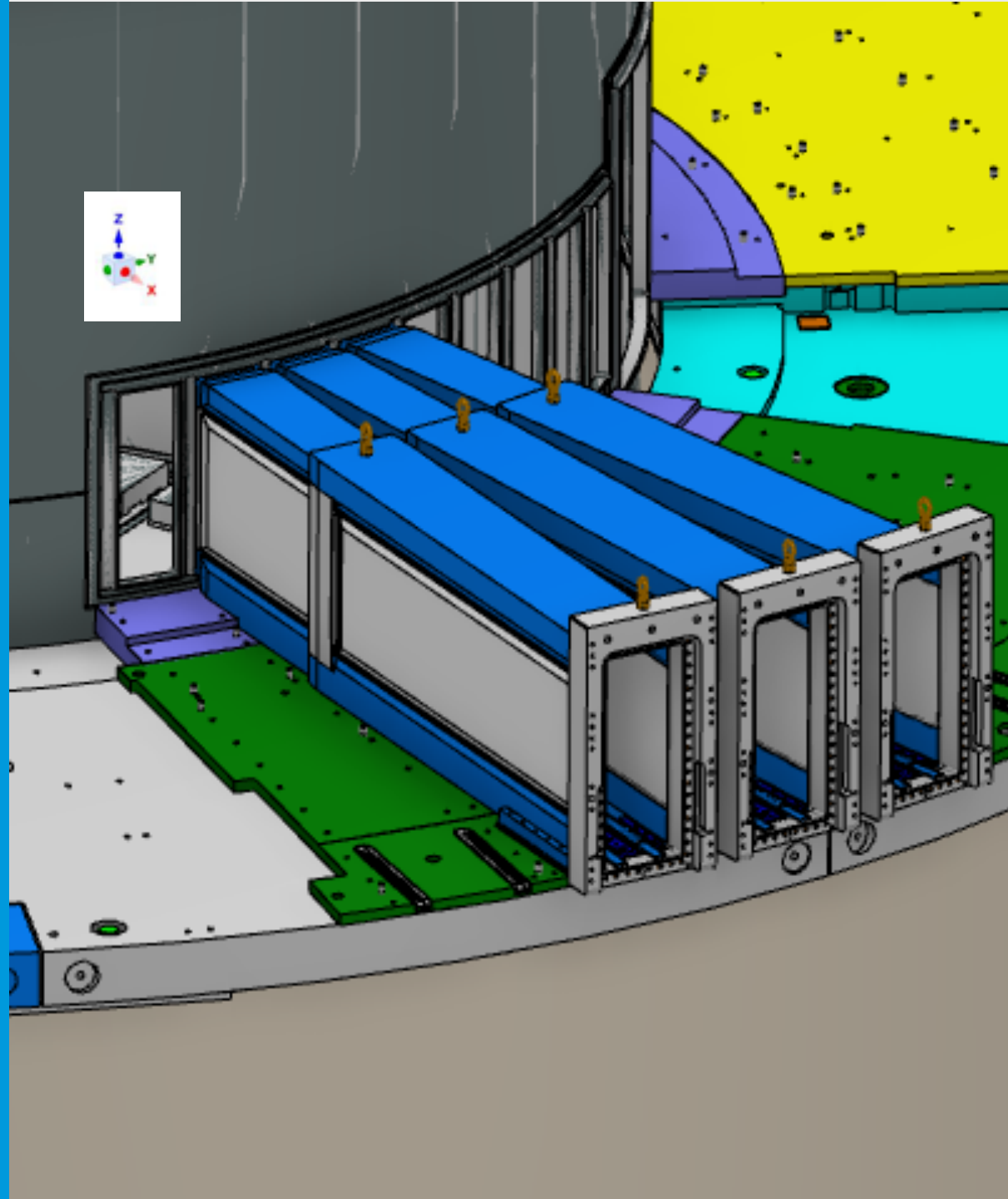
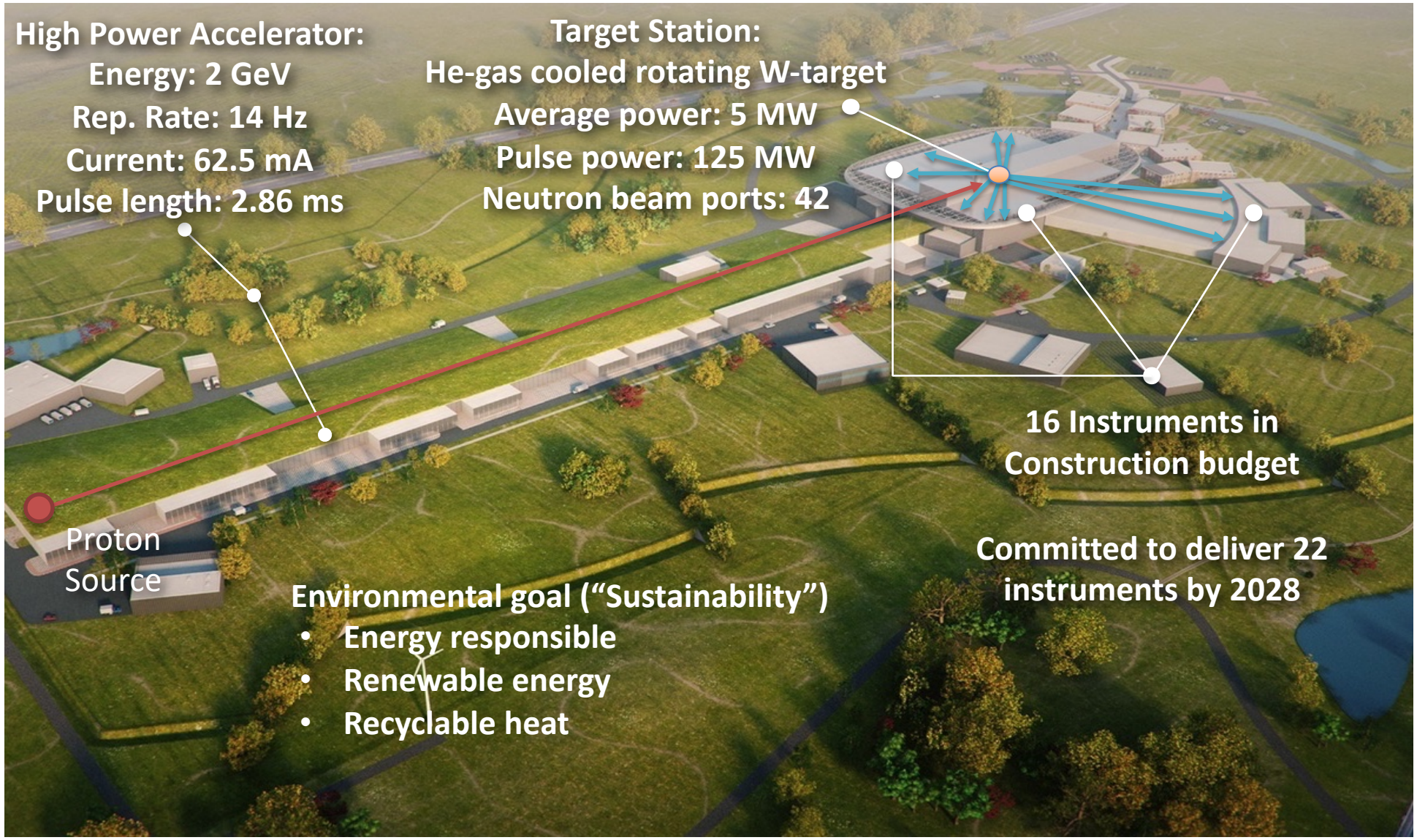
ESS Basics

DR. SARA GHATNEKAR NILSSON

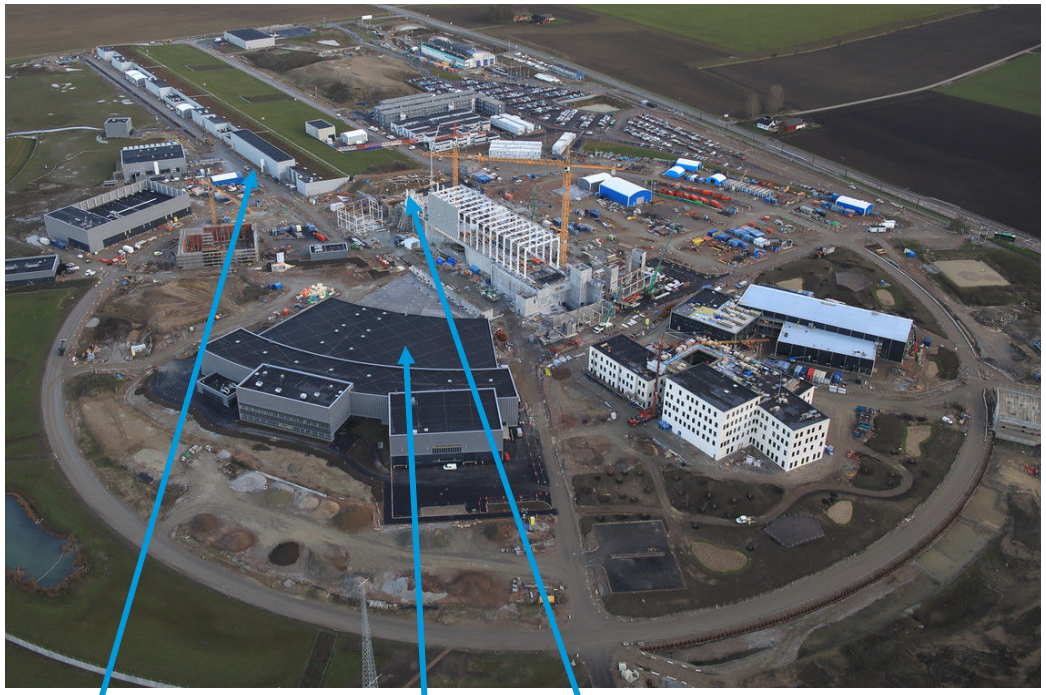


ESS Basics


High Power Accelerator:
Energy: 2 GeV
Rep. Rate: 14 Hz
Current: 62.5 mA
Pulse length: 2.86 ms
Target Station:
He-gas cooled rotating W-target
Average power: 5 MW
Pulse power: 125 MW
Neutron beam ports: 42
16 Instruments in Construction budget
Proton Source
Committed to deliver 22 instruments by 2028
Environmental goal (“Sustainability”)
• Energy responsible
• Renewable energy
• Recyclable heat

ESS Basics

Photo 2020



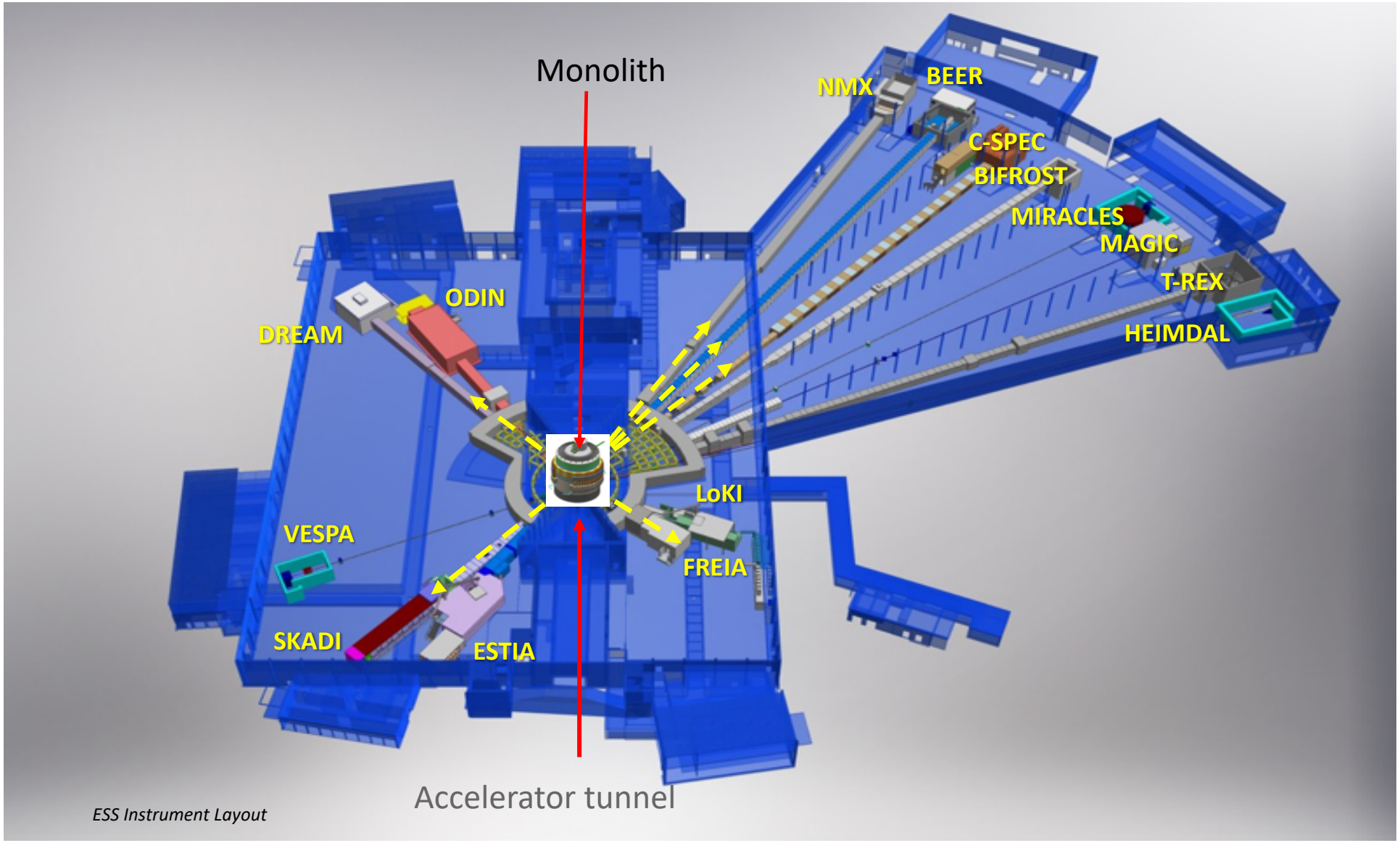
Accelerator tunnel

Target area

Instrument hall
West sector

Photo 2021

ESS Basics, Target and Instruments

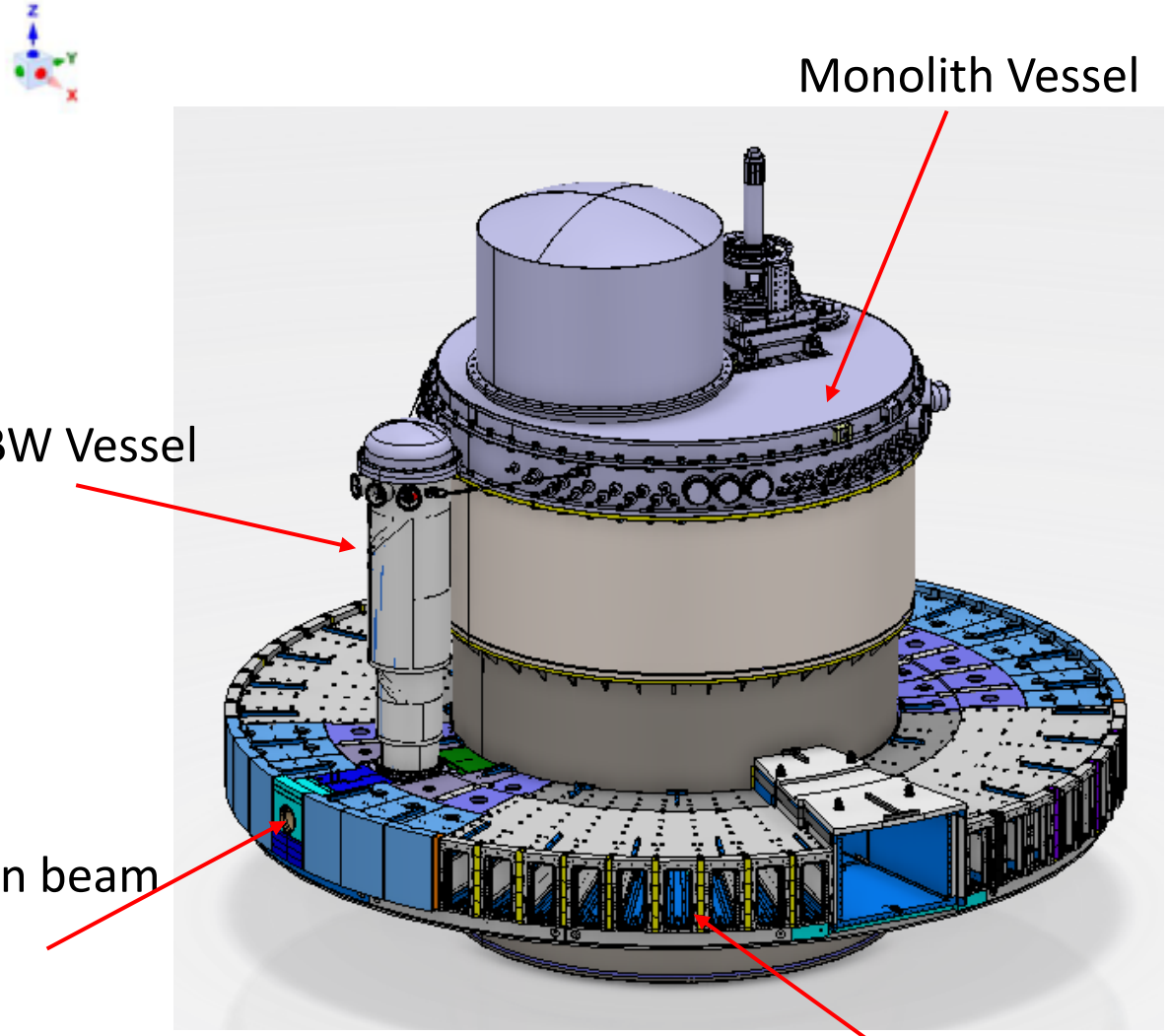


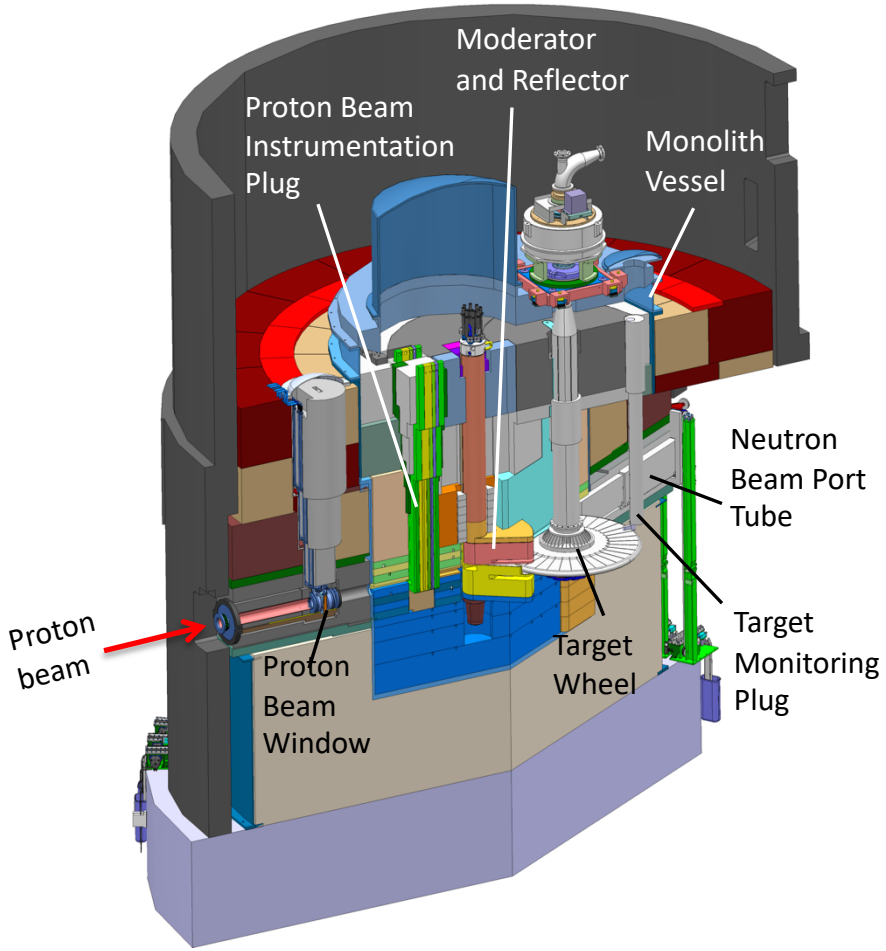
ESS Instrument Layout

Instrument hall
West sector

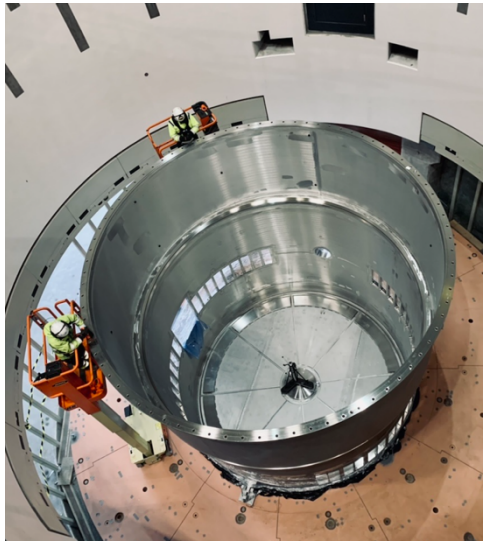
Instrument hall
North sector

ESS Basics, Monolith Vessel and Port Tubes





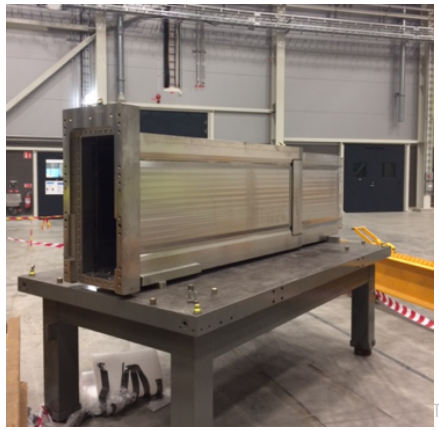
ESS Basics, Monolith Vessel and Port

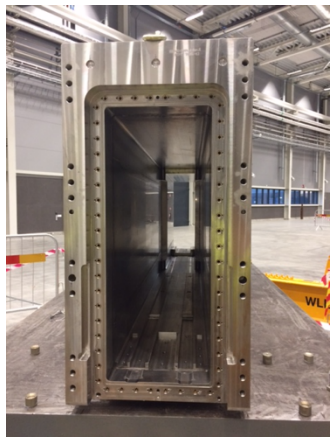


Manufacturer Vessel: AVS and Cadinox
Method: Submerged arc-weld and TIG weld towards vacuum side
Facts: Diameter≈6m, H:6m, W:40 tons

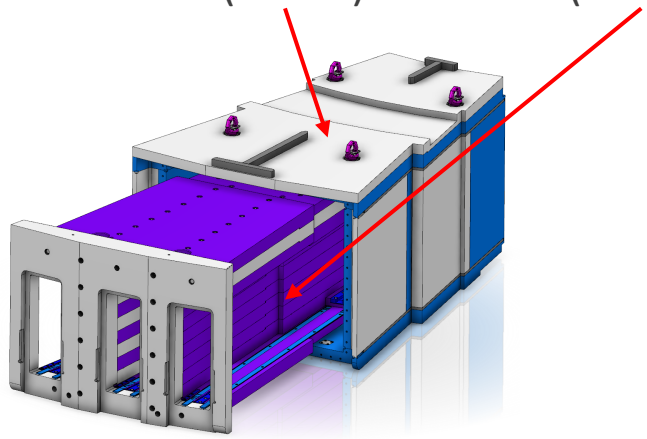
Manufacturer tubes and nn-bar: Ensa and Asturfeito
Method: Laser weld

Facts tubes at Vessel side:
L:2.7m, H:0.7m, Width:0.2m
W:1.2 tons





Facts nn-bar:
L: 2.7m, H:0.9m, Width:1m
W:11 tons (frame) + 18 tons (adapter)



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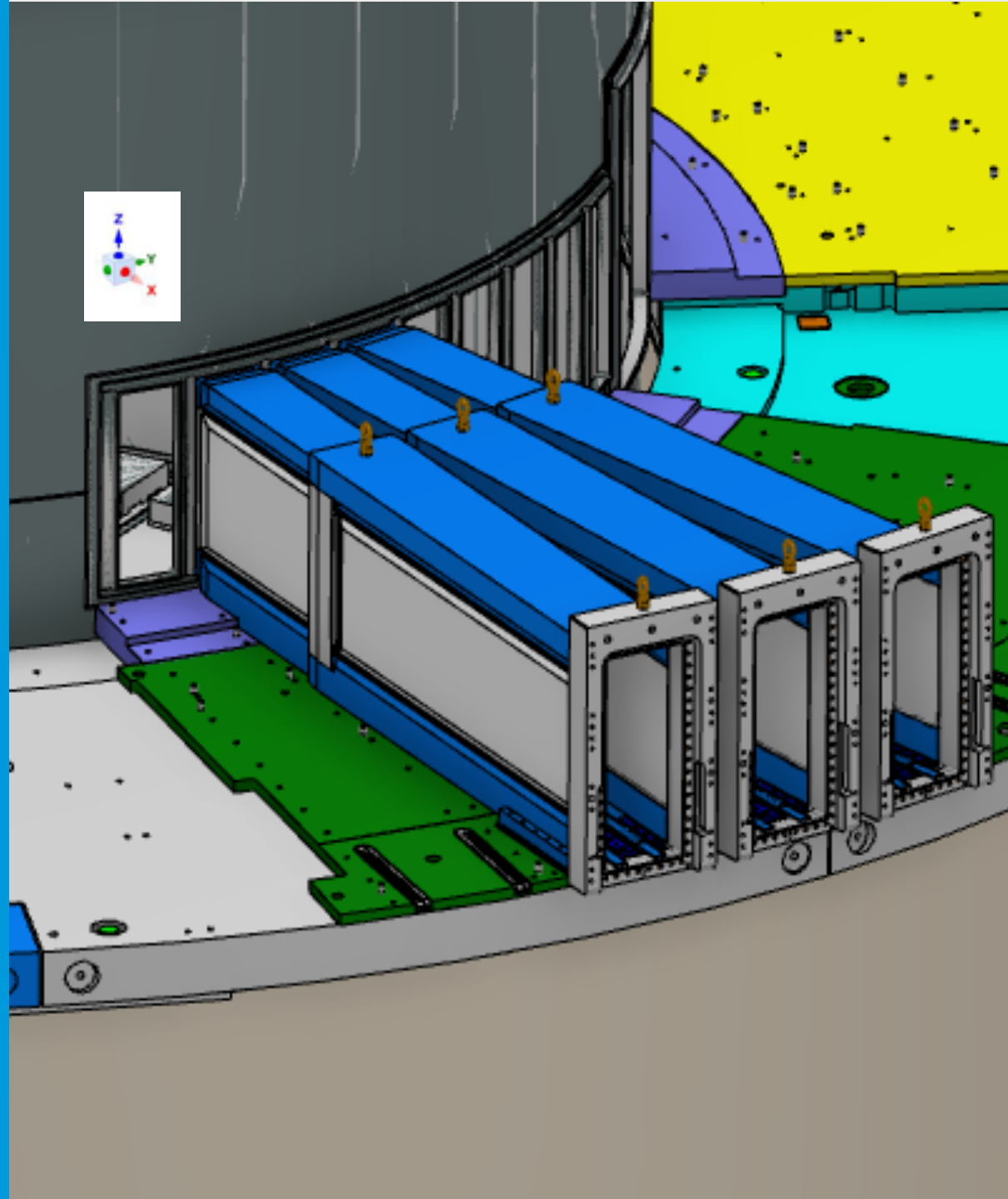
Deliverables and charge for the committee

DR. BERTRAND NICQUEVERT



Scope of the work under review

In the framework of the **agreement (TIK 4.5 revision 2)** signed between ESS ERIC (Lund) and ESS Bilbao on December 11, 2017:

"The division of responsibilities and tasks for the installation of the Monolith Vessel (all components included) is the following: […]

- *ESS ERIC is responsible for the installation and placement of each part of the Monolith Vessel including the PBW port block, in its final location, meeting the alignment requirements needed for the final welding*
- *ESS-Bilbao will be responsible for the **final welding** of each of the pieces of the Monolith Vessel and the **in-situ welding test**, including the Neutron beam port block welds."*

Purpose for this iCDR

i-CDR: *integrated* critical design review

Scope: WELDS OF PORT TUBES ON MONOLITH VESSEL

Objective and purpose of the review:

Confirm that

- the requirements on the activities are sufficiently well defined and complete, with clearly stated acceptance criteria;
- the design of the welding of the port tubes to the monolith vessel tank is likely to meet all these requirements and is specified in sufficient details to allow preparation of the installation phase details.

Deliverables for this iCDR

Regarding ESS ERIC Requirements

1) Interface and functional requirements described in the relevant interface control documents and the system requirement documents (including the tolerance budget), and the related functional drawings;
2) Requirements coming from the Applicable Law, including but not limited to: European Directives, relevant standards, and Notified Body.
3) Reminder on the choice of the welded solution against other design variants for the connection between port tubes and monolith vessel.

Regarding ESS Bilbao Activities

4) Global procedure and installation scheme, including port tube installation sequence and alignment strategy, and fastening method
5) Project schedule
6) Update of the Safety Analysis Report
7) Results and analysis from the welding on the two prototypes at ENSA
8) Preparation: bevel preparation, WPS (Welding procedure specification), PQR (Procedure Qualification Records), production coupons, protection gas
9) Execution: welding process order and realisation scheme
10) Verification and validation plan, including inspection plan
11) Estimation of the deformations produced during the welding process, and of the compliance with tolerance budget
12) Detailed Risk Analysis

Committee Charge

Global project questions

1) Is the plan complete, consistent, and in line with the scope of the TIK 4.5 rev.2?
2) Have risks been properly identified, analysed, and appropriately addressed?
3) Are the mitigations well defined in case of major Non-Conformity?
4) Are the quality assurance and quality control activities properly planned?
5) Does the design satisfy all functional, performance and safety requirements?

Specific technical questions

1) Is the welding process specification sufficiently defined and documented in order to provide a sufficient technical basis to start the preparation of the on-site welding?
2) Are the estimations on welds deformation and vessel shrinkage realistic?
3) Is the way to proceed in order to minimize deformations satisfactory?
4) Are the residual stresses in the welds a concern, is the configuration too constrained?
5) Are the defined non-destructive inspections considered enough to ensure the quality of the welding?

Finish presentation