ESS Cask Assembly and Systems Engineering Methodology

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The European Spallation Source (ESS) in Lund, Sweden will be a 5 MW long pulsed neutron spallation research facility with planned commissioning 2022. The Cask Assembly, shall ensure the safety and protection of workers, property and the environment from the effects of radiation during Target Monolith maintenance and the internal transport of irradiated Target Monolith components.

The Cask Assembly will transport spent components in the high-bay from the Target Monolith to the Active Cells Facility (ACF), where the irradiated components will be dismantled, separated and prepared for disposal. The Cask Assembly will be lifted by the high-bay crane and, using gamma gates, it will dock to the Target Monolith and ACF to provide extended containment. All the cask internal lifting operations must be remote with no man access to ensure worker safety. The Cask Assembly will also transport new components from the Mock-Up and Test Stand (MUTS) to the Monolith Target for installation. The target station layout is shown in Figure 9.

Target Monolith components that will be handled by the Cask Assembly are: Proton Beam Window, Moderator Reflector Plug, Target Wheel and Shaft, Proton Beam Instrumentation Plug and the Target Monitoring Plug. To access the components, adjacent internal shielding blocks must also be handled.

The internal remote handling devices must provide adequate precision and accuracy to facilitate installation and removal of monolith components.

The Model Based Systems Engineering (MBSE) approach was selected to clarify the project requirements, improve communications, minimise changes during the project, allowing for more realistic time planning, and facilitate simply and appropriate verification and validation.

To apply MBSE effectively, it is essential to consider people, process and tools. One of the key best-practice techniques that have been employed for this project is to provide an Architecture that represents the overall System. The Architecture comprises a number of Views, each of which has its own purpose and delivers some sort of tangible benefit to whichever Stakeholder is using it. Not all Stakeholders will require access to all Views, so it is important to understand who will use each View, what information it should contain and, above all, why they are interested in the View. The Views cover all relevant aspects of the System, such as: requirements, analysis, design, verification and validation, deployment and process. The structure of the Architecture is defined by the Architecture Framework.

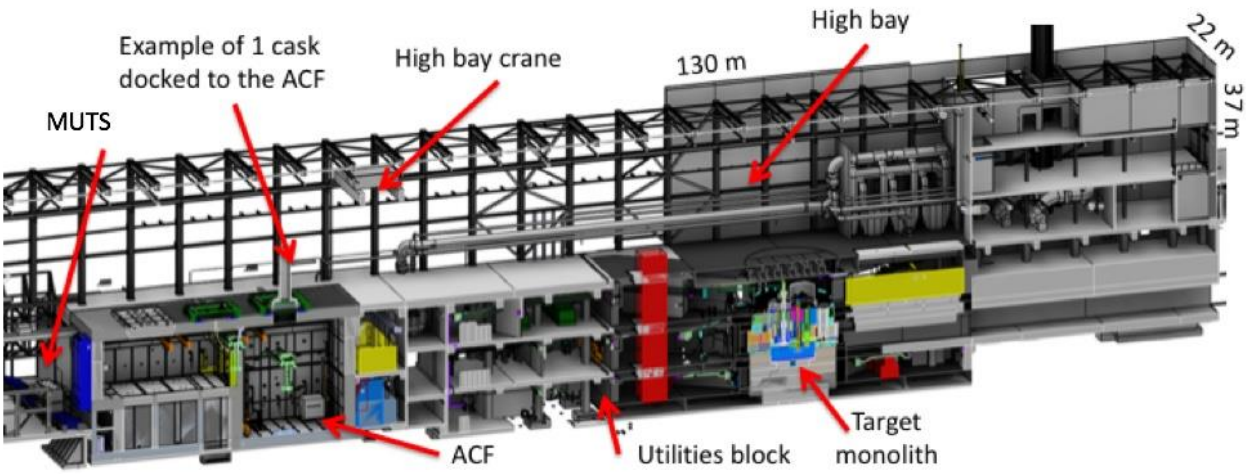

Figure 9. Layout of the target station

This Framework, including the Viewpoints and Ontology, compliant with ISO 15288 and ISO 42010, will be presented as part of this paper. The Framework is being used to provide requirements engineering, context and concept modelling, validation, traceability and procurement tools. The concept modelling includes System Overviews, System Configurations, Interface Definitions and Behaviour Views.