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Second Target Station (STS) Project Interface Sheet for Target Assembly Controls and Target Assembly Systems

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SECOND TARGET STATION (STS) PROJECT

Interface Sheet for Target Assembly Controls and Target Assembly Systems



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08/04/26

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Interface Sheet for Target Assembly Controls and Target Assembly Systems

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Revision	Description
00	Initial Release
01	The responsibility section, appendixes, and block diagrams were removed to eliminate specific solutions linked to each WBS because of design modifications. Two new sections are included to highlight the significance of the mock-up testing performance plan and the target assembly description document.

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1. PURPOSE

This document defines the interface between Target Assembly Systems (S.03.02) and ICS Target Assembly Controls (S.06.03.02). The interface described in this document will provide inputs to the design of Target Assembly Systems and Target Controls Systems. Requirements derived from this document are included in the Target Assembly Requirement Document and Target Controls Requirement Document.

2. SCOPE

The scope of this document is the complete interface definition for the interface between Target Assembly Systems and Target Controls Systems as identified in the parent Interface Control Document for Integrated Control Systems and Target Systems S01020500-IC0009.

No.	Components (Target Systems)		Components (ICS- Target Controls)	
	Name	Functional reference Number	Name	Functional reference Number
1	Target Assembly	N/A	Target Controls	N/A
2				

3. ACRONYMS AND DEFINITIONS

I&C	Instrumentation and Controls for Integrated Control Systems
ICD	Interface Control Document
ICS	Integrated Control Systems
IS	Interface Sheet
P&IDs	Piping and Instrumentation Diagrams
PCD	Process Control Description
PLC	Programmable Logic Controller
MPS	Machine Protection System
MUTS	Mockup Test Stand
SSC	Structure, System or Component
TPS	Target Protection System
WBS	Work Breakdown Structure

4. REFERENCES

4.1 DOCUMENTS APPLICABLE TO THE INTERFACING SSCS

Ref	Document Titles	Document Control System Location
[1]	Interface Control Document for Integrated Control Systems and Target Systems- S01020500-IC0009	EDRM
[2]	Integrated Control Systems Requirement Document - S06000000-SR000002	EDRM
[3]	Target Controls Requirement Document - S06030000-SR0001	EDRM
[4]	Target Assembly Requirement Document - S03020000-SR0001	EDRM
[5]	Target Assembly P&ID - S03090200-J8U-8800-A10003	EDRM

5. INTERFACE DEFINITION

5.1 TECHNICAL DESCRIPTION OF THE INTERFACE

The objective of the Target Assembly group is to design and build a tungsten-based spallation target composed of 20 individual replaceable segments rotating at 45rpm. The target will receive 1.3 GeV proton pulses at a rate of 15 Hz, totaling 700kW of beam power. Development of the software and electrical control hardware for the tungsten-based target sensor rotation and instrumentation will be under the responsibility of the ICS Target Control team, within the S06.03.02 WBS. Development of mechanical systems and sensor installation/selection will be under the responsibility of the Target Assembly group within the S06.03.02 WBS. Mechanical designs will identify sensor conduits and cables in locations covered by shielding or mechanically accessed areas to ensure they don't obstruct shield removal for maintenance. Details of the interfaces between Target Controls (S06.03.02) and Target Assembly (S03.02) are provided in the upcoming sections. Figure 1 below shows the various support systems of the tungsten-based rotating target.

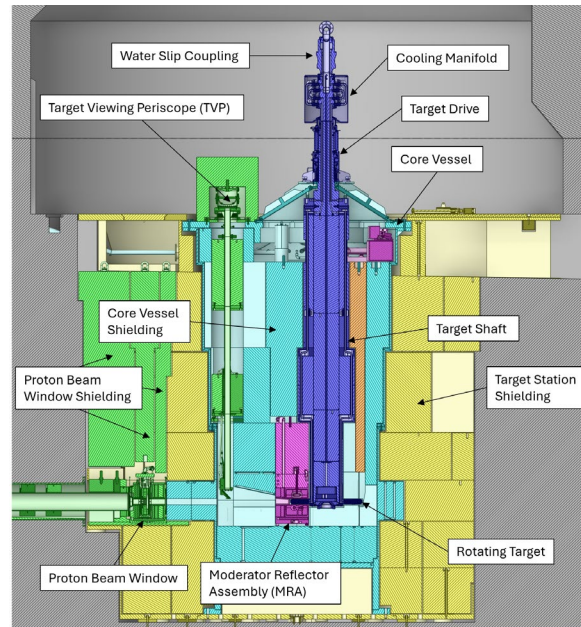


Figure 1: Representation of the tungsten-based spallation target

5.1.1 Target Assembly (S.03.02) responsibilities:

- Purchasing and selection of all sensors responsible for the target assembly. The electrical aspects of each sensor will be evaluated by Target Assembly Controls (S.06.03.02) and instrumented as such.
- Provide mounting interfaces for all the sensors on the target assembly.
- Provide mechanical adjustment features to allow positioning of all the sensors (thermal expansion, installation tolerances, etc.)
- Installation of the sensors during mock-up testing, factory acceptance testing, commissioning, and maintenance.
- Provide parameters for system rotation tuning and control in writing (torque, speed, inertia ratio, angular rotational resolution, etc.)
- Develop a written performance plan for the target rotation system on the mock-up test stand to assist with the verification and validation of the expected functions. ICS target controls (S06.03.02) will assist in the document's development.
- Develop a target assembly description document detailing the expected operation of the rotating target during maintenance and production activities. ICS target controls (S06.03.02) will assist in the document's development.
- Develop Operations Procedure Manuals (OPM) for mechanical systems that support the proper operation of the target assembly (motor cooling, lubing, vibration analysis, etc.).

5.1.2 Target Assembly Controls (S.06.03.02) responsibility

- Assist in the final selection of all electrical field devices and sensors associated with the target assembly.
- Define and provide junction boxes, connectors, and disconnects for connectors and leads for the target assembly, supplied sensors and devices.
- Develop electrical designs that allow Lock-Tag-Verify (TLV) points, ensuring electrical safety and full compliance with the ORNL–SBMS electrical standards.
- All the electrical field devices and electrical information will be captured under the ICS target controls drawings, bill of materials.
- Evaluate the mechanical and mounting interfaces of all electrical field devices and sensors.
- Develop and install electrical enclosures and software to support field devices, sensors, and motor rotation during mock-up and final installation.
- Coordinate penetrations, cable trays, and conduit installation for all electrical field devices and sensors with Conventional Facilities (CF).
- Coordinate grounding paths from the target assembly to facility ground with Conventional Facilities (CF).
- To specify, purchase, and install cable for all electrical field devices and sensors (main power, analog, and discrete signals).
- Develop or procure specialized software as needed to operate and calibrate the target motor servo drive.
- Using the target assembly description document as a guide, develop software, programming, and graphical user interfaces to validate/verify all motion control functions of the target rotation system. This includes modes during operations, maintenance, or other modes as described in the document.
- Develop Operations Procedure Manuals (OPM) for preventative maintenance and calibration requirements for all electrical field devices and sensors.

5.1.3 System Performance and Verification analyses

Developing analyses of the selected sensor performance and target rotation is essential to ensure the reliability and accuracy of the system. These analyses verify that the selected sensor operating parameters and the rotation mechanism function as expected under all operational modes. By proactively assessing these components, potential issues can be identified early, supporting safer operations and efficient maintenance practices.

- The analysis of sensor signal integrity and control system performance will be under the ICS Target Control's responsibility (S.06.03.02).
- The analysis of the selected sensors meets the target assembly performance requirements is under the Target Assembly responsibility (S.03.02). The control system performance bandwidth, latency, refresh rate, etc. is covered by ICS Target Controls (S.06.03.02).

5.2 FINANCIAL SCOPE

The financial scope includes the costs associated with coordinating and installing electrical field devices, sensors, cable trays, and conduits, as well as developing specialised software for system operation and calibration. It also includes expenses related to performance analyses, validation, and preventative maintenance procedures, ensuring all operational and maintenance requirements are met efficiently and reliably. Figure 2 shows the financial scope between the Target Assembly and ICS systems.

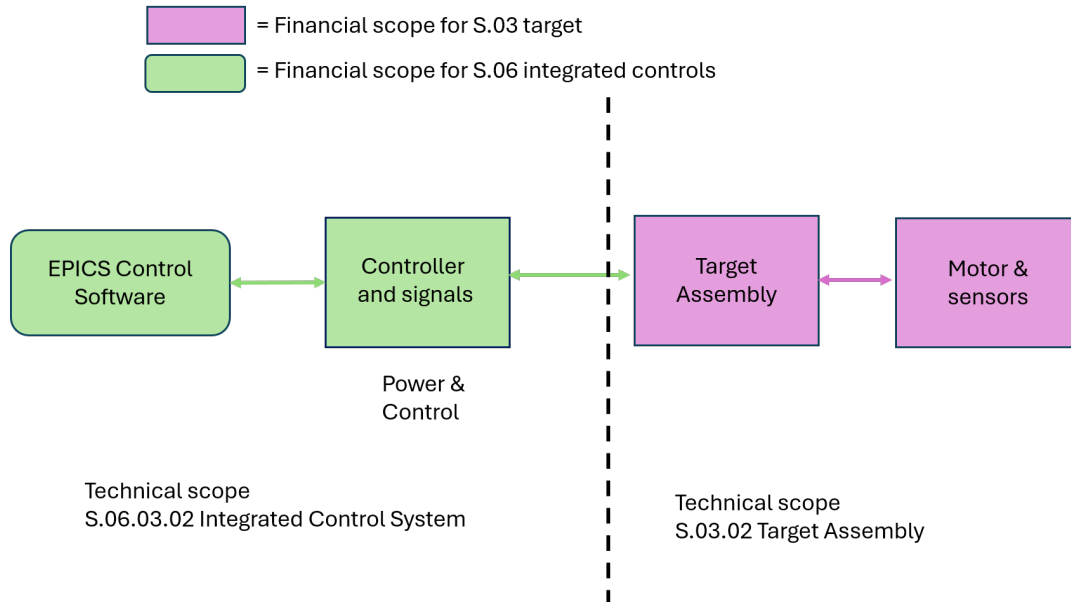


Figure 2: Financial scope between ICS and Target Assembly

5.2.1 Electrical hardware provided by Target

The electrical hardware that is projected to be incorporated into the Target assembly is listed in Table 1. Wiring and instrumentation of the hardware will be performed by ICS Target Controls Systems. The target description document will detail the hardware's operating parameters.

Note: The leak sensor on the manifold will be instrumented by the Activated Cooling Loop 1 system.

Note: The eddy current and vibration sensors may require specialized control hardware to be instrumented by the motion drive system.

Table 1: Electrical hardware provided by the Target and instrumented by ICS

Component	Quantity	Location
Motor	1	Drive (Motor)
Motor temperature	2	Drive (Motor)
Resolver	2	Drive (Motor)
Eddy Current Sensor	2	Drive (Motion)
Vibration Sensor	4	Drive (Bearing)
Temperature Sensor	1	Drive (Bearing)
Pressure Sensor	1	Drive (Bearing Lube)
Leak Sensor	1	Manifold (Shroud)