OAK RIDGE National Laboratory | SECOND TARGET STATION

April 21, 2025

Introduction - Preliminary Design Review of the STS Vessel Systems & Target Station Shielding

Presented by

Mike Strong

Group Leader, Interface Systems

U.S. DEPARTMENT OF ENERGY

ORNL IS MANAGED BY UT-BATTELLE LLC
FOR THE US DEPARTMENT OF ENERGY

Participants

Project Team, Presenters

Chris Anton – Lead Engineer, Vessel Systems & Target Station Shielding

Cam Eiland – Mechanical Designer

Hogan Knott – Mechanical Design Engineer

Darren Dugan – Mechanical Design Engineer

Tom McManamy - Senior Analyst, Nuclear Engineer

Min-Tsung Kao – Engineering Analyst

Steve Schrick – Lead Engineer, Remote Handling

Igor Remec – Group Leader, Neutronics

Mike Strong – CAM and Group Leader, Interface Systems

Review Committee

Mike Dayton (Chair) – Section Head, RAD Target & Mechanical Systems

Wei Lu – Neutronics Scientist, NTD Neutronics Group

Jacob Platfoot – Accelerator Safety Program Lead, Nuclear & Radiological Protection Division

David Vandergriff – Sr. Project Engineer, US ITER

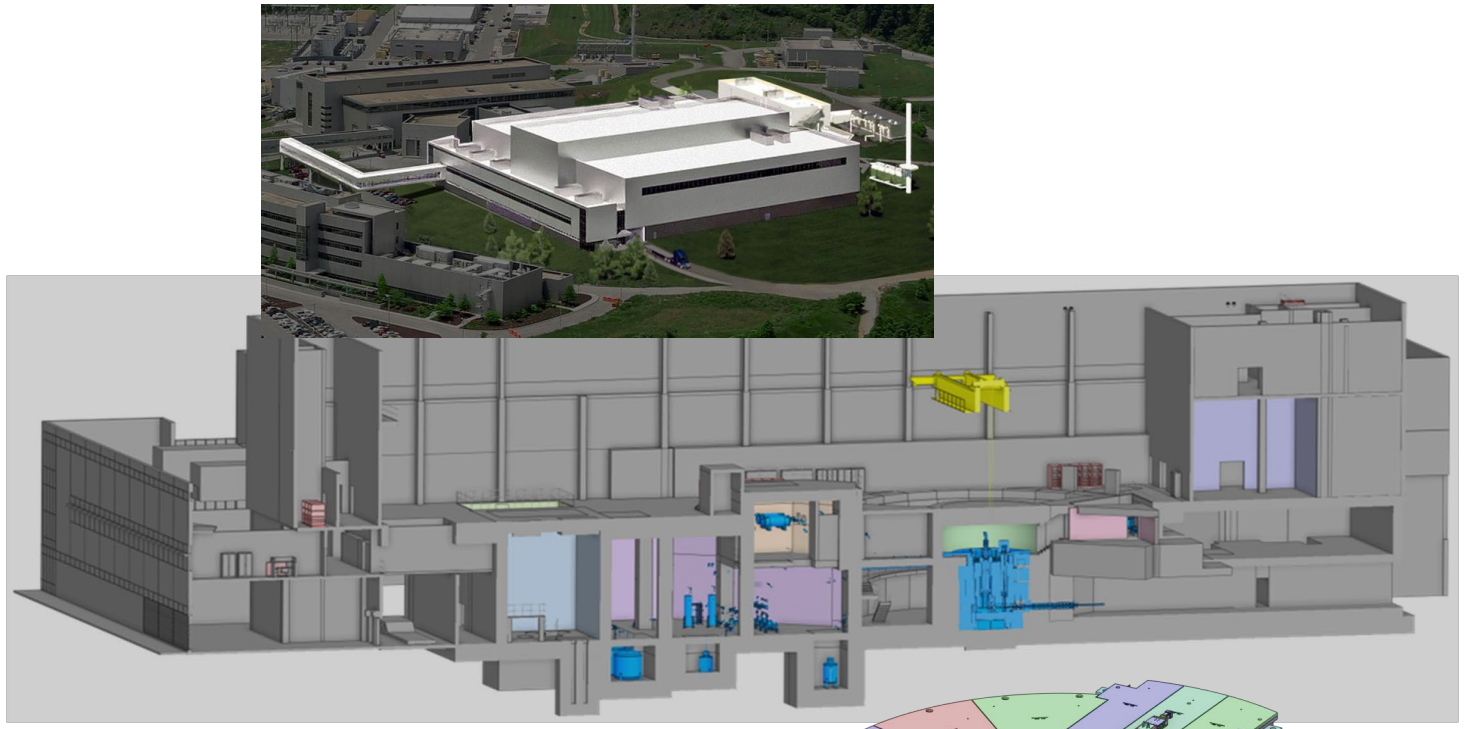
Other Collaborators

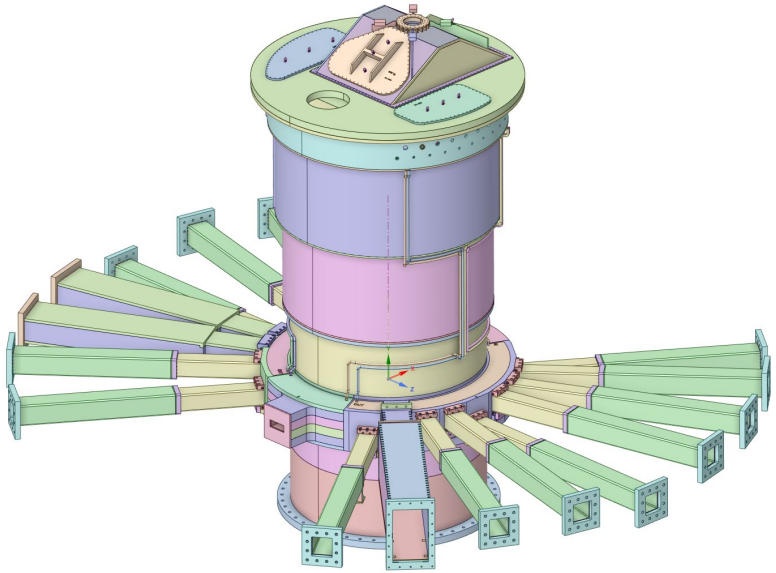
Lukas Zavorka, Thomas Miller, Tucker McClanahan and the rest of the STS Neutronics team

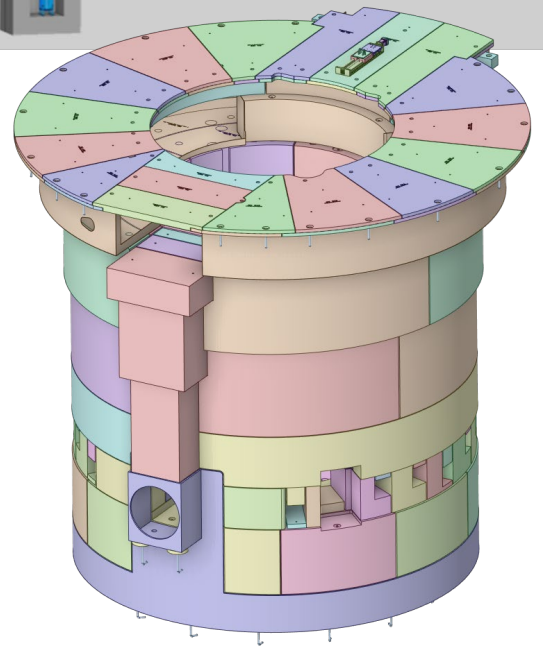
Devin Malone – Senior Structural Engineer

Getting us oriented

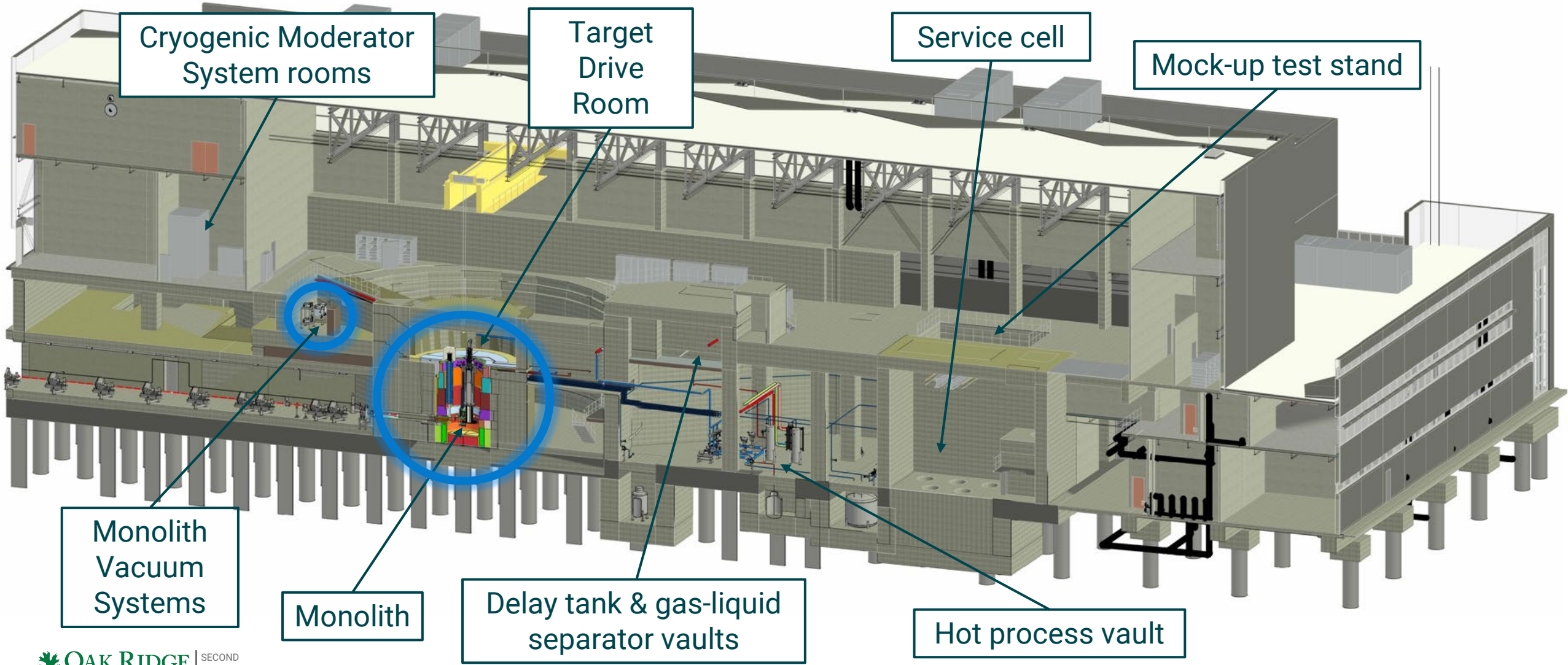
- Target Systems Scope and Location in the STS Target & Instrument Building
- Scope of this Preliminary Design Review
- What is a Preliminary Design Review?



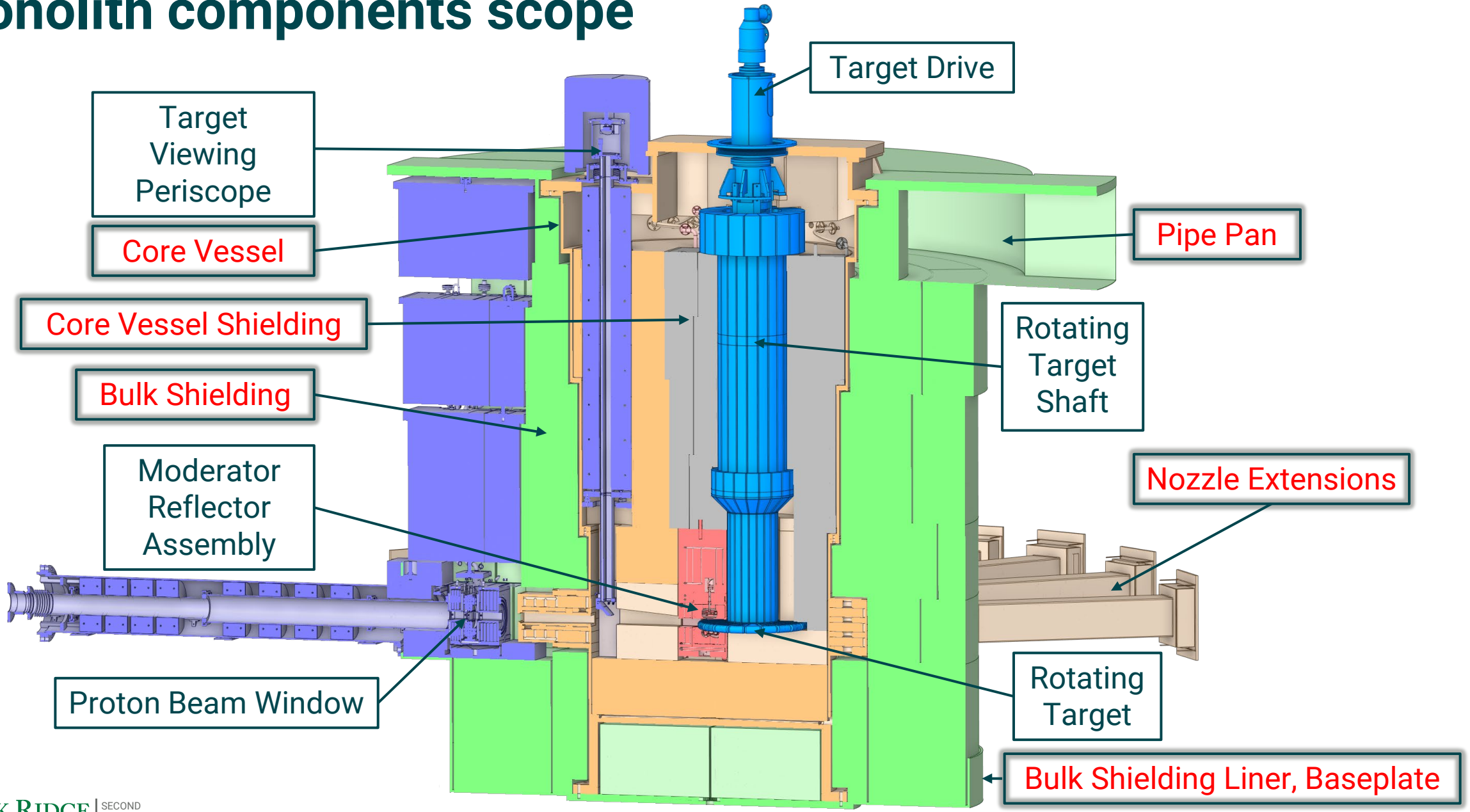




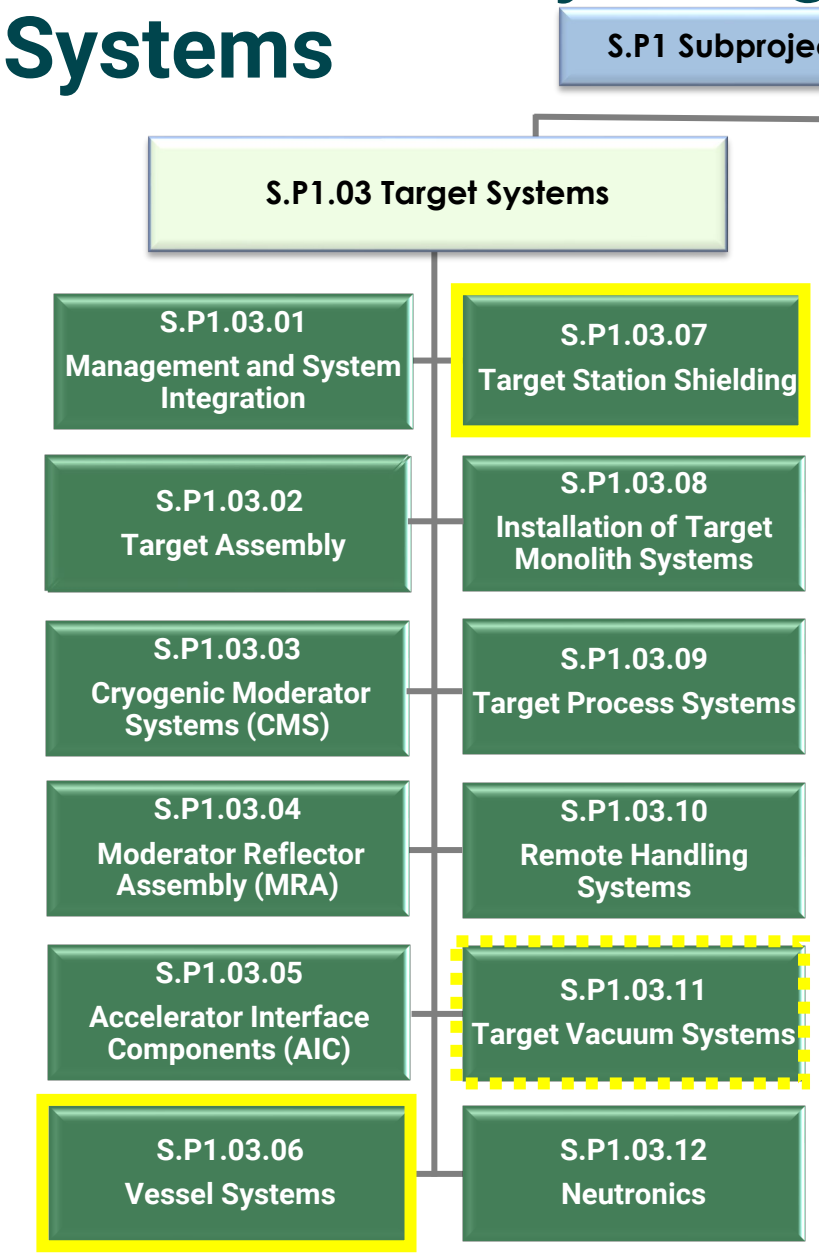
Target & Instrument Building



Monolith components scope



Scope of this Preliminary Design Review covers several parts of Target Systems

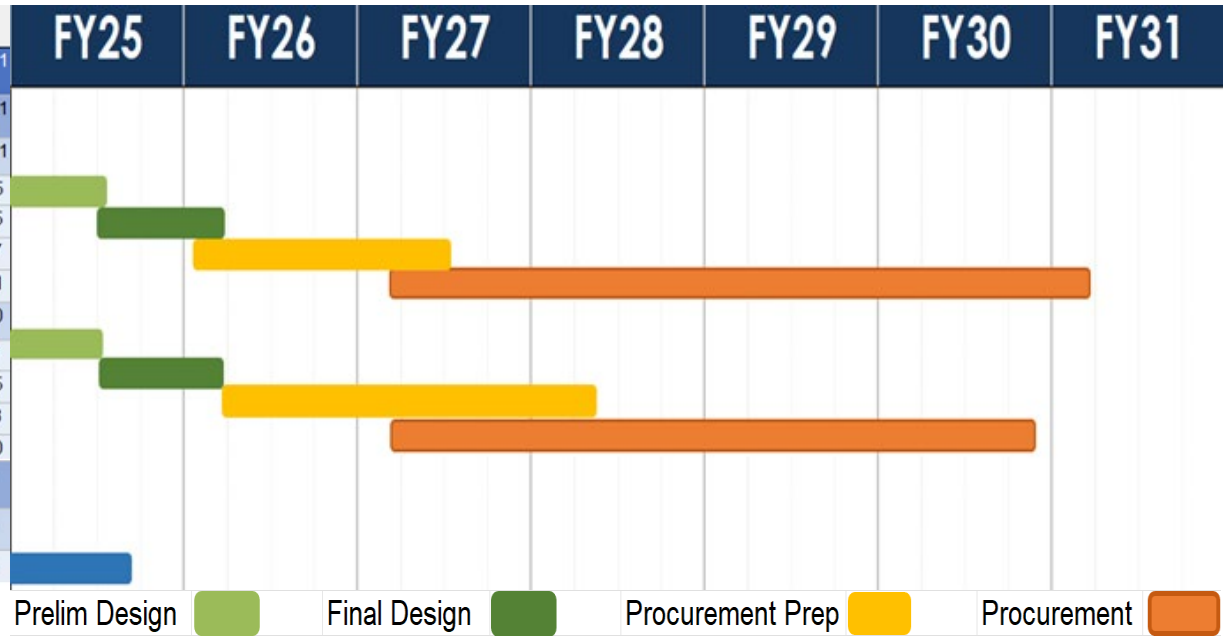


Vessel Systems (VS) and Target Station Shielding (TSS) design includes interfaces with all other Target Systems scope, and interfaces with all other STS technical groups with the exception of Accelerator Systems.

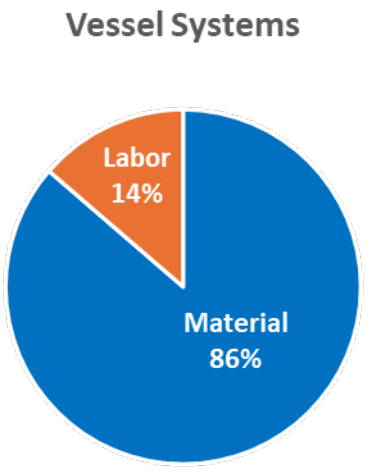
In addition to the VS and TSS, a portion of the Target Vacuum Systems covering Core Vessel Vacuum and the R&D studies conducted for Vessel Systems design will be presented.

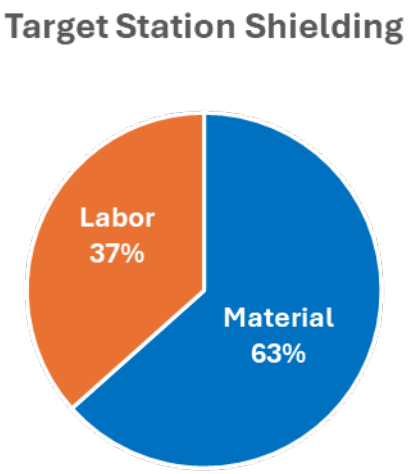
Cost estimates for VS and TSS have been developed and the schedule meets project milestones

Activity ID / Activity Name	RD	Start	Finish
Subproject 1 - Facility and Infrastructure	1693	01-Oct-20 A	30-Dec-31
Target Systems	1693	01-Oct-20 A	30-Dec-31
Vessel Systems	1693	01-Oct-20 A	30-Dec-31
Prel Design	15	01-Oct-20 A	22-Apr-25
Final Design	180	01-Apr-25	16-Dec-25
Procurement Prep	342	20-Oct-25	03-Mar-27
Procurement/Fabrication	1271	04-Dec-26	30-Dec-31
Target Station Shielding	1352	01-Oct-20 A	19-Aug-30
Prel Design	14	01-Oct-20 A	21-Apr-25
Final Design	162	22-Apr-25	10-Dec-25
Procurement Prep	553	11-Dec-25	25-Feb-28
Procurement/Fabrication	930	04-Dec-26	19-Aug-30
Research and Development	58	01-Oct-20 A	23-Jun-25
Target Systems Research & Development	58	01-Oct-20 A	23-Jun-25
R&D Vessel Systems	58	01-Oct-20 A	23-Jun-25



WBS Grouping	Estimate Total
S.P1.03 - Target Systems	
S.P1.03.06 - Vessel Systems	$23.4M
S.P1.03.06 - Target Station Shielding	$4.6M
S.P1.07.03 - Target Systems R&D	
S.P1.07.03.04 - R&D Vessel Systems	$326K





What is a PDR? STS Project Preliminary Design Definition

From S01020500-PIN10000:

DOE O 413.3B defines Preliminary Design as:

> *"This is the design that is prepared following CD-1 approval. Preliminary design initiates the process of converting concepts to a design appropriate for procurement or construction. All KPPs* [Key Performance Parameters] *and project scope are sufficiently defined to prepare a budget estimate. This stage of the design is complete when it provides sufficient information to support development of the PB* [Performance Baseline]*."*
>
> *- DOE O 413.3B Program and Project Management for the Acquisition of Capital Assets, Attachment 2*

Paraphrasing guidance from the SEBoK (the Guide to the Systems Engineering Body of Knowledge, a wiki owned by the International Council on Systems Engineering [INCOSE]) a Preliminary Design Review (PDR) is:

> *"A review conducted to evaluate the progress, technical adequacy, and risk resolution of the selected design approach for one or more [SSCs]; to determine each design's compatibility with the requirements for the [SSC]; to evaluate the degree of definition and assess the technical risk associated with the selected manufacturing methods and processes; to establish the existence and compatibility of the physical and functional interfaces among the [SSCs] and other items of equipment, facilities, software and personnel; and, as applicable, to evaluate the preliminary operational and support documents."*
>
> -ISO/IEC/IEEE. 2009. Systems and Software Engineering – System and Software Engineering Vocabulary (SEVocab). Geneva, Switzerland: International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC)/ Institute of Electrical and Electronics Engineers (IEEE). ISO/IEC/IEEE 24765:2009."

The Preliminary Design Review assesses whether the design has progressed enough to support the proposed performance baseline (CD-2) and is ready to proceed to the detailed/final design phase, in line with STS Design Development Procedure and Preliminary Design Definition.

- Sufficient design decisions have been made during the Preliminary Design phase for confidence that the design will meet requirements and will support the project's needs.
- Design change is expected to be minimal during the Final Design phase.

Charge to the committee: Preliminary Design Questions

1. Are the requirements as written sensible and verifiable?
2. Are interfaces adequately identified and defined?
3. Are relevant PHAR cases appropriately defined and addressed by the preliminary design?
4. Is the proposed design sufficiently mature to proceed to final design?

Committee deliverables

Prepare and present a closeout report

- Answers to charge questions
- Findings (statements of fact; what the project told the committee)
- Comments (the committee's opinion or assessment of what they heard)
- Recommendations, if applicable (specific actions recommended to fix a problem or strengthen the project, will be tracked by the project)

A PowerPoint template for the committee's closeout report is available on the Indico site

With the following presentations, we will show the preliminary design is complete, and we are ready to begin the final design phase

- The requirements for the Systems are known.
- Interfaces with other STS technical groups and within the Target Systems group are understood and being managed.
- The design can meet project schedule requirements.
- The design has satisfied the Preliminary Design Definition.

Materials for evaluating preliminary design status including all of today's presentations as well as relevant design documentation in EDRM can be found on Indico.

Agenda

Day 1 - Monday, April 21		
Time	**Topic**	**Speaker**
8:00 – 8:30am	Introduction	Mike Strong
8:30 – 9:00am	STS & Target Systems Overview	Peter Rosenblad
9:00– 10:00am	VS/TSS Project & Scope	Chris Anton
10:00 – 10:15am	Break	
10:15 – 11:30am	VS/TSS Requirements, Interfaces & Relevant PHAR Cases	Chris Anton
11:30am – 12:30pm	Working Lunch Requirements (cont'd), QA as needed	
12:30 – 1:45pm	VS/TSS Design	Chris Anton
1:45 – 2:00pm	Break	
2:00 – 3:00pm	VS/TSS Shielding Neutronics Analysis	Igor Remec
3:00 – 3:30pm	Core Vessel Vacuum System	Mike Strong
3:30 – 4:00pm	VS/TSS Remote Handling	Steve Schrick
4:00 – 4:30pm	Committee Session, Q/A as needed	

Day 2 - Tuesday, April 22		
Time	**Topic**	**Speaker**
8:30 – 9:15am	VS/TSS Thermal-Hydraulic Analysis	Chris Anton
9:15 – 10:30am	VS/TSS Structural Analysis	Chris Anton
10:30 – 10:45am	Break	
10:15 – 11:30am	Acquisition/Manufacturing Plan Core Vessel Manufacturability Study & Nozzle Extension Prototype	Chris Anton
11:30am – 12:30pm	Working Lunch Installation Sequence, Q/A as needed	
12:30 – 1:15pm	VS/TSS Budget Estimate	Chris Anton
1:15 – 1:30pm	Break	
1:30 – 2:00pm	Path to Final Design Completion & Verification Plan	Chris Anton
2:30 – 4:00pm	Committee Session, Q/A as needed	
4:00 – 4:30pm	Closeout	

Let’s get started!