Second Target Station Vessel Systems Preliminary Design Update

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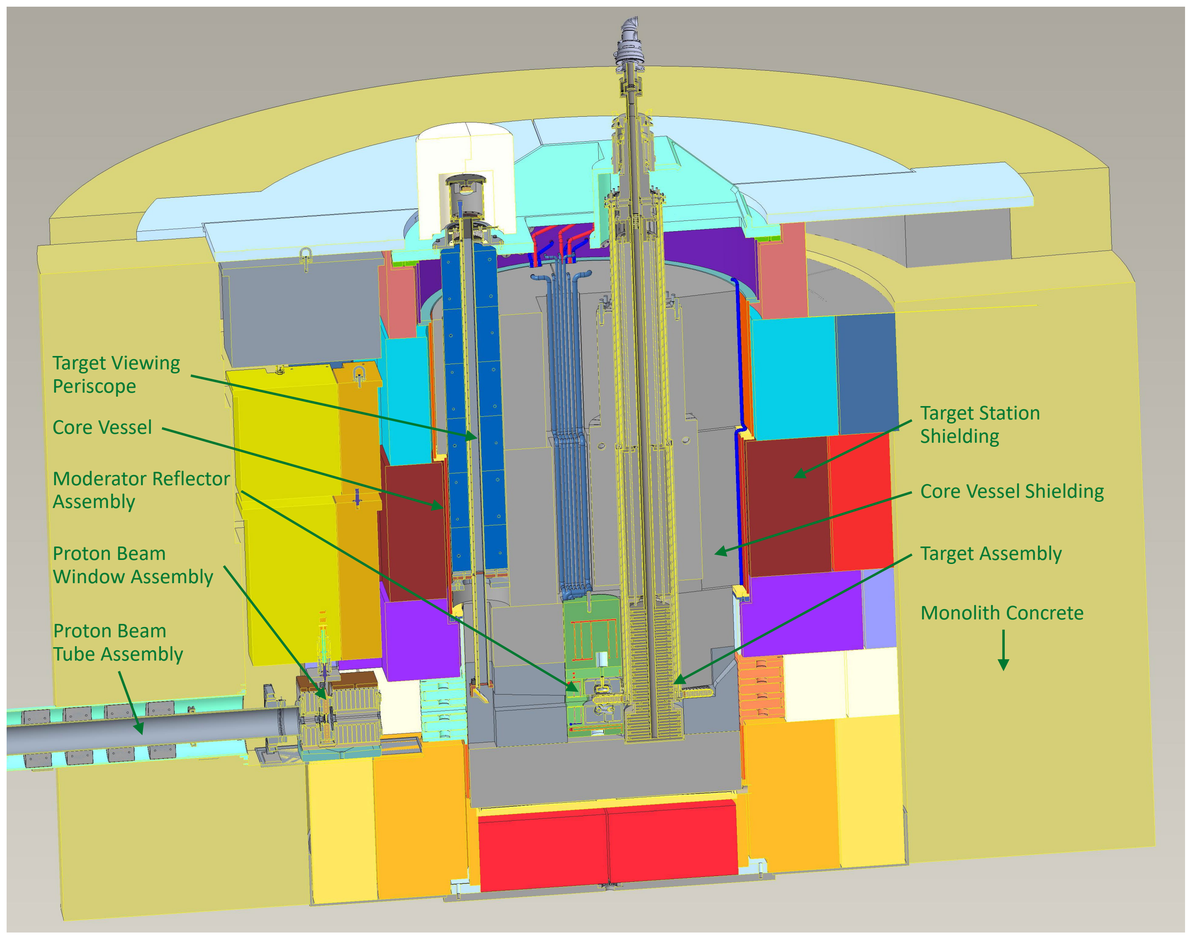
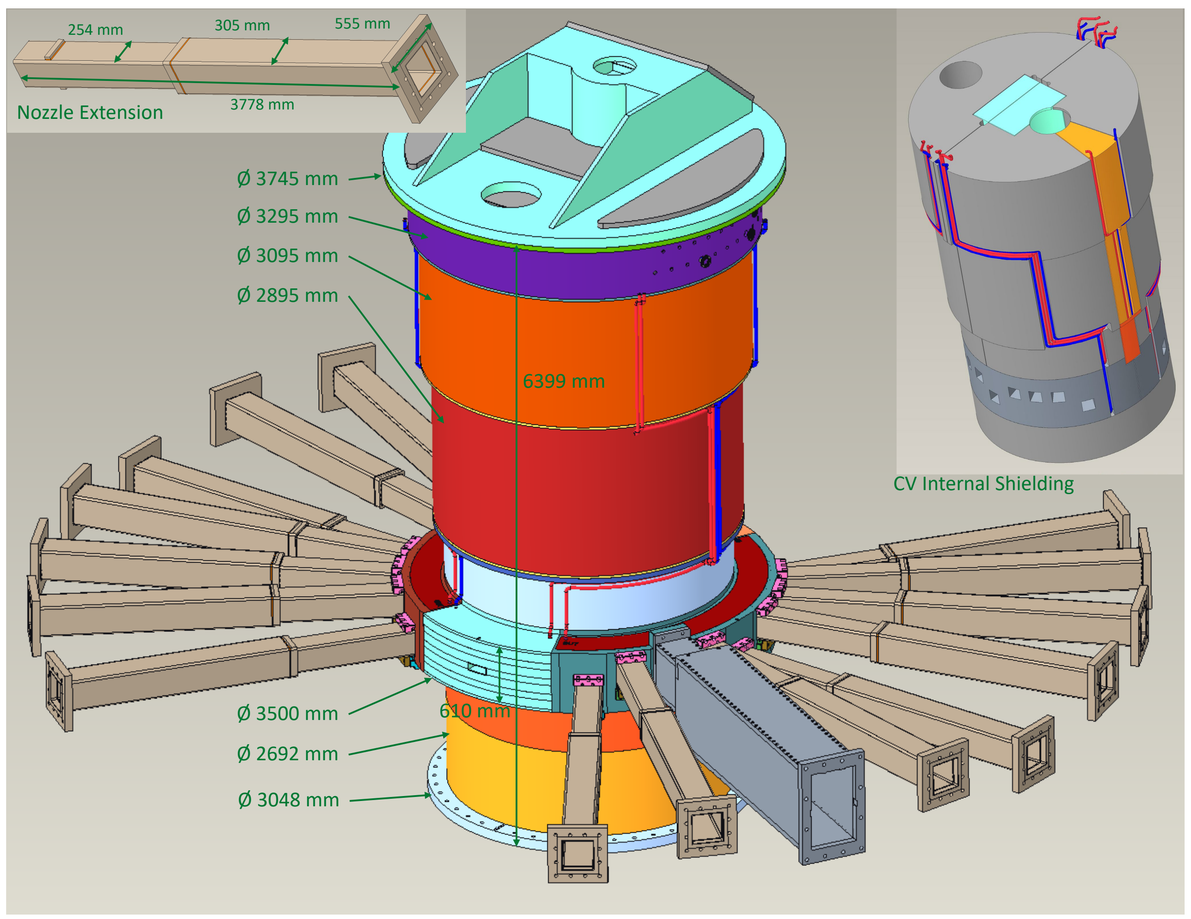
Introduction

- The Second Target Station (STS) is currently under preliminary design at Oak Ridge National Laboratory (ORNL)
- STS will significantly expand the existing capabilities of the Spallation Neutron Source (SNS) at ORNL by constructing a second target station that utilizes the existing SNS accelerator and provides a world leading source of cold (long wavelength) neutrons
- The Vessel Systems scope within STS consists primarily of the Core Vessel, Core Vessel Shielding and Core Vessel Nozzle Extensions

Target Monolith Layout



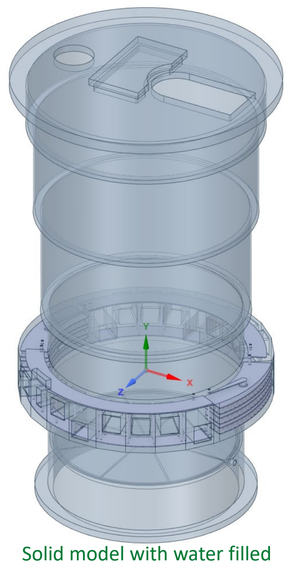
Vessel Systems Layout

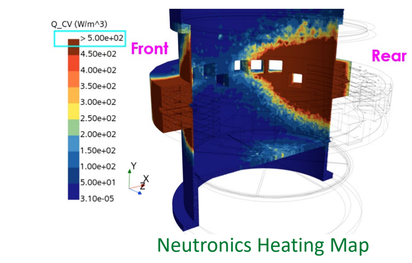


Design Highlights

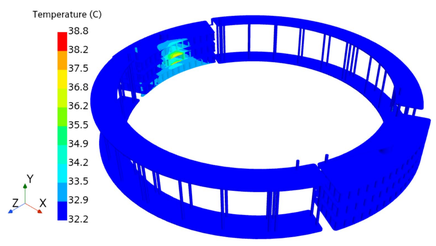
- Core Vessel and Nozzle Extensions constructed of 316L SS
- Core Vessel environment will be rough vacuum or sub-atmospheric helium
- Core Vessel mass = 44 metric tons
- Nozzle Extension mass = 0.42 metric tons each (Qty 18 total, with 1 custom nozzle)
- Core Vessel Shielding total mass = 199.2 metric tons
- Bottom 3 shielding layers of shielding and Core Vessel beltline are water cooled

Core Vessel Thermal Analysis

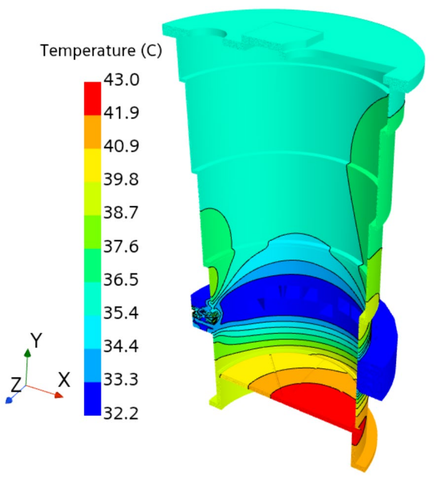

Solid model with water filled



Neutronics Heating Map



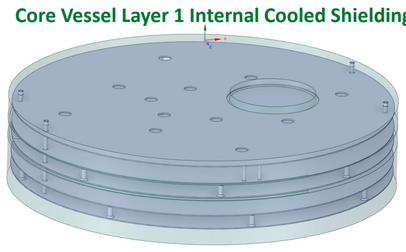
Internal Water Temperature

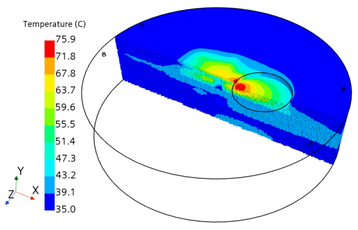


Stainless Steel Temperature

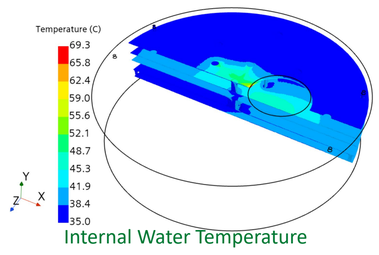
Internal Shielding Thermal Analysis

Core Vessel Layer 1 Internal Cooled Shielding


Solid model with water filled

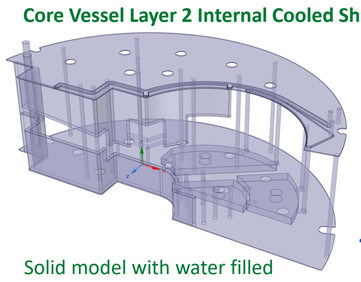


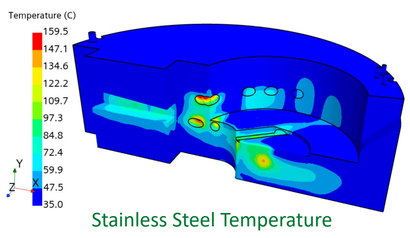
Stainless Steel Temperature



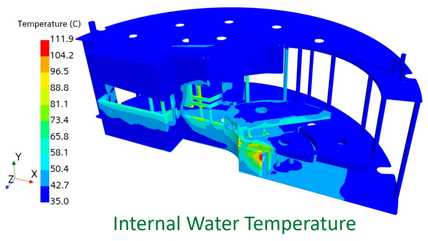
Internal Water Temperature

Core Vessel Layer 2 Internal Cooled Shielding


Solid model with water filled

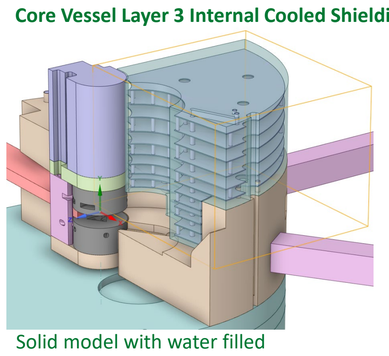


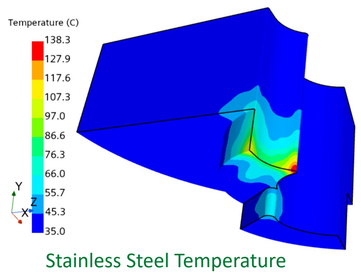
Stainless Steel Temperature



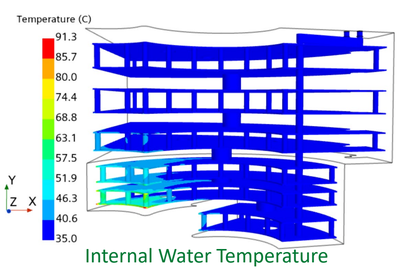
Internal Water Temperature

Core Vessel Layer 3 Internal Cooled Shielding


Solid model with water filled



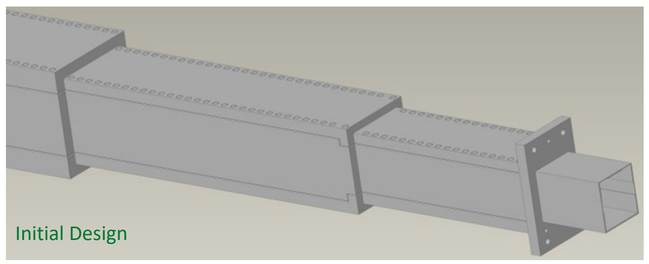
Stainless Steel Temperature

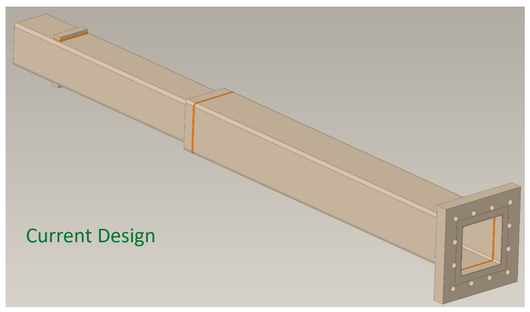


Internal Water Temperature

Nozzle Extension Development

- Initial nozzle extension design was bolted and welded, with a cost of $600k ea.
- Current nozzle extension design is welded tube, with a cost of $125k ea.
- Nozzle extensions contain core vessel environment
- Seal welded to the Core Vessel beltline
- Provides alignment of neutron optical guides


Initial Design


Current Design