

Spallation Neutron Source Target Module Design Improvements

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The Spallation Neutron Source (SNS) at the Oak Ridge National Laboratory produces neutrons for scientific research by striking mercury with a short-pulse ($0.7\ \mu\text{s}$) proton beam with a 60 Hz rate. The mercury material flows through a stainless-steel target vessel, which is subjected to cyclic loadings and cavitation erosion. The target vessels are consumable components, but their reliability is critical to overall SNS reliability. The SNS has operated 18 target vessels. Of those, 7 have developed mercury leaks during operation. A mercury leak results in an unexpected target end-of-life which interrupts the scheduled user program.

After two targets developed leaks in 2014, a significant effort was undertaken to improve understanding of the targets and to implement new design features. These efforts are bearing fruit, as improved target designs have now been operating and more information is available for further improvements. The current state of SNS target vessel design will be presented along with recent performance data. Future designs for targets will be presented, including targets intended for use at 1.4 MW which are in various stages of fabrication and design, as well as conceptual designs for a target intended to operate at 2.0 MW. The overall multi-year operational plan for SNS target fabrication and operation will also be presented.

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