Jet Flow Target Design, Analysis, and Experiment

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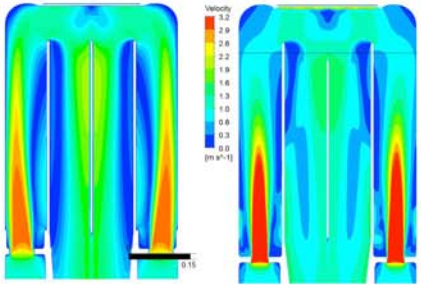
Cavitation damage erosion to mercury vessel inner wall occurs on the bulk side only, where the mean flow stagnates.

Photo by David McClintock

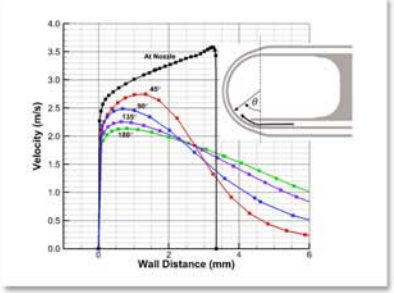
Two possible reasons why damage is less in the channel:

- Narrow gap in window channel reduces the cavitation damage
- Constant unidirectional flow in window channel suppresses damage

Velocity field predicted by CFD shows the wall jet at the target midplane.

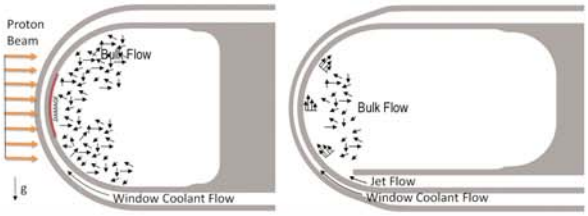


Computational fluid dynamics (CFD) predicts that the wall jet will persist across the target nose.

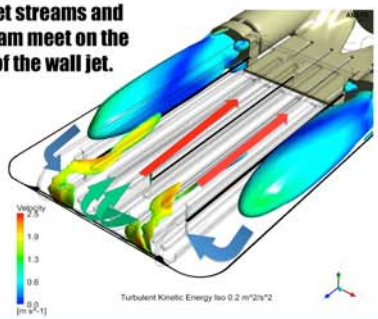


Original target design with mean-flow stagnation on center plane

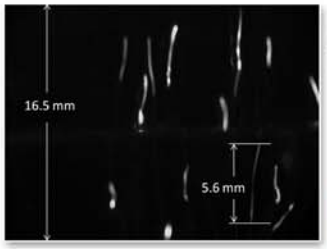
Jet-flow concept with internal wall jet.



The bulk inlet streams and wall jet stream meet on the outer edge of the wall jet.

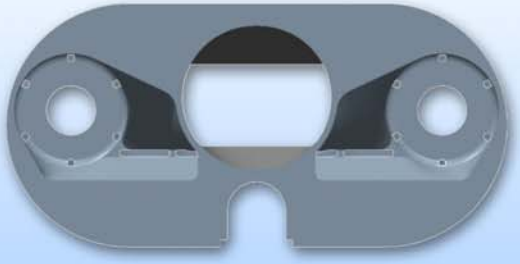


Flow-visualization experiment confirms the CFD-predicted wall jet.



Bubble streak lines with high-speed video image confirm the wall jet velocity on the target center-line is 2.5 m/s.

Design balances diverted wall jet flow and bulk side inlet flow.



Rendering of the SNS Jet-flow Target

The SNS jet-flow target design, analysis and testing work was accomplished by current and former ORNL/ISDD staff of the Neutron Source and Engineering Analysis Group. Main contributors were: Ashraf Abdou, Ken Gawne, Patrick Geoghegan, Jim Janney, Saulius Kaminskas, Bernie Riemer, Peter Rosenblad, and Mark Wendel.