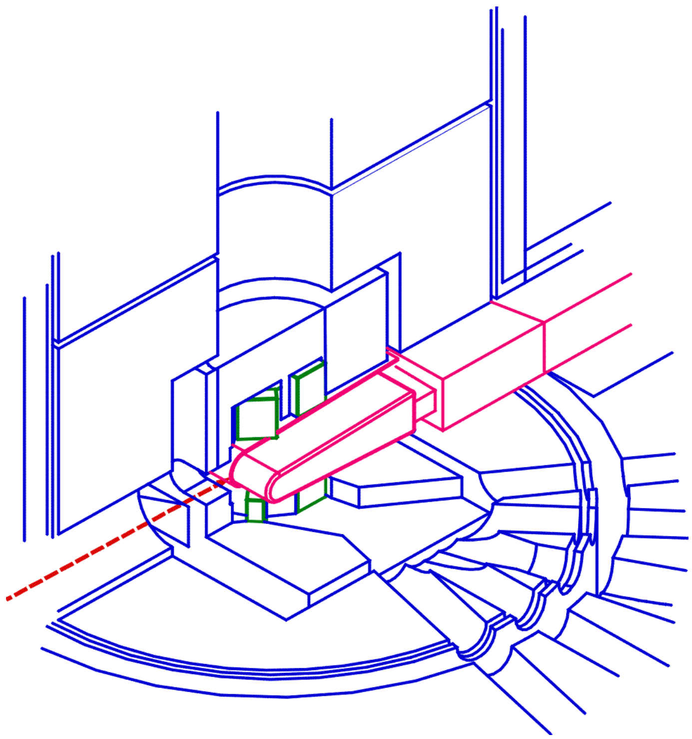
SNS/TSR-0031

Spallation Neutron Source



Neutronic Consideration in the Design of the National Spallation Neutron Source (NSNS) (Abstract)

L. A. Charlton, J. M. Barnes, J. O. Johnson, and T. A. Gabriel

Abstract submitted to the 1998 ANS Radiation Protection and Shielding Division Topical Meeting, Nashville, TN April 19-23, 1998

Neutronic.Considerations in the Design of the National Spallation Neutron Source (NSNS)

L. A. Charlton, J. M. Barnes, J. O. Johnson, and T. A. Gabriel
Oak Ridge National Laboratory*
Computational Physics & Engineering Division
P. O. Box 2008
Oak Ridge, Tennessee 37831-6363
Phone: 423/574-0628
E-Mail: lac@ornl.gov

Paper to be Presented at the
1998 ANS Radiation Protection and Shielding Division Topical Conference
April 19-23 1998
Nashville, Tennessee

---

*Managed by Lockheed Martin Energy Research Corp. for the U.S. Department of Energy under Contract No. DE-AC05-96OR22464.

NEUTRONIC CONSIDERATIONS IN THE DESIGN OF THE NATIONAL SPALLATION NEUTRON SOURCE (NSNS)

L. A. Charlton, J. M. Barnes, J. O. Johnson, and T. A. Gabriel
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831-6363

ABSTRACT

The National Spallation Neutron Source (NSNS) will provide a very intense source of neutrons for a large variety of experiments. It consists of a high-energy (~1-GeV) and high-power (~1-MW) proton accelerator and accumulator ring and a target station that produces low-energy (<2-eV) neutrons. This paper deals with the second part of the facility (i.e., the target station). The conceptual design for the target station has been completed, and a more detailed study to determine the optimum configuration is now in progress. Among the issues being considered are the location of the neutron moderators relative to the target and the composition of the neutron reflector surrounding the moderators and targets.

If a single moderator is positioned above or below the target, there will be a single location for which the moderator neutron output will be maximized. However, the current NSNS design has two cryogenic H_2 moderators above the target (one decoupled and poisoned and the other coupled) and two ambient H_2O moderators (both decoupled and poisoned) below the target. This configuration raises a number of issues as to the best optimization strategy. These issues will be discussed, and relevant neutronic calculational results will be presented.

At least two reflector arrangements are commonly considered: one is a single reflector; the other consists of (1) an *inner* reflector, which returns the low-energy neutrons to the target station interior and (2) an *outer* reflector, which returns the higher-energy neutrons to the interior. Beryllium and lead are being considered for the single-reflector configuration and for the inner reflector in a two-component system; nickel is being considered for the outer reflector. Calculations will be presented which illustrate the advantages of each arrangement and material.

Many other issues are also under study and will be discussed as time permits.