Lawrence Berkeley National Laboratory
Recent Work

**Title**
Enhancing surface ionization and beam formation in volume-type H- ion sources

**Permalink**
https://escholarship.org/uc/item/485941w0

**Author**
Thomae, R.

**Publication Date**
2002-03-21

eScholarship.org Powered by the California Digital Library
University of California

# Enhancing Surface Ionization and Beam Formation in Volume-type H- Ion Sources*

R. Welton, M. Stockli, ORNL, Oak Ridge; R. Keller, R. Thomae, LBNL, Berkeley

The ion source for the Spallation Neutron Source (SNS) is a radio frequency, multi-cusp, volume-type source equipped with a conventional cesiated collar re-entrant into the plasma chamber and surrounding the outlet aperture. The source is capable of delivering 35-50 mA of H- with a normalized rms emittance of less than 0.2 p mm mrad to the SNS accelerator. Design studies utilizing Cs flow, H- ion formation and plasma transport calculations have been performed to optimize the H-yield with respect to the position and shape of the re-entrant Cs collar. Likewise, design studies to determine the optimal shape of the source outlet aperture have also been performed using the code PBGUNS. The shape of the outlet aperture has been altered with respect to the current design to (i) minimize rms emittance values, (ii) significantly reduce beam halo (iii) increase the stability of the plasma meniscus and (iv) improve suppression of the co-extracted electron beam. By integrating the source outlet aperture and Cs collar assembly into a single mechanical unit both improvements can be implemented by retrofitting a single component to the source and a slight modification of another. This report provides details of the design studies, the physical design of the integrated collar/outlet aperture assembly and experimental results obtained from initial tests of the new system.

*SNS is a collaboration of six US National Laboratories: Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), Thomas Jefferson National Accelerator Facility (TJNAF), Los Alamos National Laboratory (LANL), Lawrence Berkeley National Laboratory (LBNL), and Oak Ridge National Laboratory (ORNL). SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy.