

HIFAN 1591a

**Improved neutralized compression and focusing of an intense  
ion beam using a final focus solenoid**

by

J.E. Coleman, P.A. Seidl, J.A. Duersch, E.P. Gilson, D. Ogata, P.K. Roy, A.B. Sefkow,  
K. Van den Bogert, D.R. Welch

from

Lawrence Berkeley National Laboratory (on behalf of U.S. HIFV-VNL)  
1 Cyclotron Road, Berkeley, CA 94720  
Accelerator Fusion Research Division  
University of California  
Berkeley, California 94720  
and  
Voss Scientific  
and  
Princeton Plasma Physics Laboratory

November 2007

This work was supported by the Director, Office of Science, Office of Fusion Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or The Regents of the University of California.

This work was supported by the Director, Office of Science, Office of Fusion Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

## **Improved neutralized compression and focusing of an intense ion beam using a final focus solenoid**

J.E. Coleman<sup>a</sup>, P.A. Seidl<sup>b</sup>, J.A. Duersch<sup>a</sup>, E.P. Gilson<sup>c</sup>, D. Ogata<sup>a</sup>, P.K.

Roy<sup>b</sup>, A.B. Sefkow<sup>c</sup>, K. Van den Bogert<sup>b</sup>, and D.R. Welch<sup>d</sup>

<sup>a</sup> *Department of Nuclear Engineering, University of California at Berkeley, 4155 Etcheverry Hall, MC 1730, Berkeley, CA 94720, USA.*

<sup>b</sup> *Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA.*

<sup>c</sup> *Princeton Plasma Physics Laboratory, New Jersey 08543, U.S.A.*

<sup>d</sup> *Voss Scientific, Albuquerque, NM 87108, USA.*

**Abstract.** Future target heating experiments with space-charge dominated ion beams require simultaneous longitudinal bunching and transverse focusing. An experiment to simultaneously focus a singly charged potassium ion beam has been commissioned at LBNL. The space charge of the beam must be neutralized so only emittance limits the simultaneous focusing. An induction bunching module provides a head-to-tail velocity ramp upstream of a beam neutralizing plasma column and a final focus solenoid. The beam is tuned with a four-solenoid lattice to transport the neutralized compressing beam into a final focus solenoid which transversely focuses the beam at the target plane. We have improved the axial focus (>100 axial compression, < 2 ns pulses) and made recent improvements to reduce the beam spot size. A comparison of experimental and calculated results are presented, including simultaneous measurements of the transverse distribution and the axially compressed beam.

(This work was supported by the U.S. D.O.E. under DE-AC02-05H11231 and DE-AC02-76CH3073 for HIFS-VNL)