

Successful Thermalization and Extraction of Projectile Fragment Ions from Gas*

D.J. Morrissey, G. Bollen, D. Davies, M. Facina, J. Huikari, G.K. Pang A. Prinke, R. Ringle,
J. Savory, P. Schury, S. Schwarz, C. Sumithrarachchi, and T. Sun
National Superconducting Cyclotron Laboratory
Michigan State University, East Lansing, USA-48824

The NSCL provides an extremely broad range of fast rare-ion beams by the projectile fragmentation process. We report on the successful stopping and extraction of a variety high-energy radioactive ion beams (~ 100 MeV/u) from a linear gas cell with static electric fields into a quadrupole ion-guide system [1]. The dramatic suppression of the extracted radioactive ion beam by space charge created by the stopping ions was found to be consistent with self-consistent particle-in-cell (PIC) calculations. The NSCL gas cell and ion-guide system has been used to study and then suppress molecular ion contaminants produced in the buffer gas. The complete system has been in operation for one year and measurements of the masses of short-lived neutron deficient calcium, arsenic, and germanium isotopes as well as neutron-rich arsenic, selenium and sulfur isotopes in the LEBIT Penning trap system have been completed. The results of an analysis of the ion yields from the NSCL and from other gas cells with different sizes and different incident particle energies [1-4] shows an overall consistency (cf. figure below).

* Supported by the US-DOE under DE-FG02-00ER41144 and NSF under PHY-0110253.

References:

- [1] L. Weissman, *et al.*, Nucl. Instrum. Meth. **A540** (2005) 245. [green squares]
- [2] M. Facina, *et al.*, Nucl. Instrum. Meth. **B226** (2005) 401. [blue triangles]
- [3] J.B. Neumayr, *et al.*, Nucl. Instrum. Meth. **B244** (2005) 489. [black circles]
- [4] A. Takamine, *et al.*, Rev. Sci. Instrum. **76** (2005) 103503. [red diamonds]

