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## Off-line production of transition metal ions for collinear laser spectroscopy at BECOLA/NSCL

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The production of stable isotopes using off-line ion sources for online reference measurements and development of atomic transition schemes is a critical aspect in collinear laser spectroscopy (CLS). A Penning Ionization Gauge (PIG) ion source [1] has been installed for offline production of metal beams at the BEam COoler and LAser spectroscopy (BECOLA) facility [2] at the National Superconducting Cyclotron Laboratory at Michigan State University. BECOLA is a CLS facility aimed at measuring hyperfine spectra for determining charge radii and electromagnetic moments of radioactive isotopes for nuclear structure studies. The PIG ion source is located downstream of the radio-frequency-quadrupole (RFQ) beam cooler and buncher [3]. Mass filtering of the PIG emissions was achieved by operating the separate cooling and bunching sections of the RFQ at differing RF frequency and amplitude, and He buffer-gas pressures. The performance characteristics of the PIG ion source for production of light transition metal ions Fe, Ni, V, and Co for CLS studies will be discussed.

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[1] Z. Nouri et al., Nucl. Instrum. Methods Phys. Res. A 614, 174 (2010).

[2] K. Minamisono et al., Nucl. Instrum. Methods Phys. Res. A 709, 85 (2013).

[3] B. Barquest, Ph.D. Thesis, Michigan State University (2014).

**Primary author:** RYDER, Caleb (NSCL)

**Co-authors:** MILLER, A. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA); ISHERWOOD, B. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA); ROSSI, D. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA); ASBERRY, H. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Chemistry, Michigan State University, East Lansing, MI 48824, USA); MINAMISONO, K. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA); MANTICA, P. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Chemistry, Michigan State University, East Lansing, MI 48824, USA); STRUM, R. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA)

**Presenter:** MINAMISONO, K. (National Superconducting Cyclotron Lab., Michigan State University, East Lansing, MI 48824, USA & Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA)

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