



Contribution ID: 162

Type: **Poster Presentation**

## Installation of the Multi Reflection Time Of Flight (MR-TOF) mass separator at the ANL CARIBU facility

*Monday, 11 May 2015 16:31 (0 minutes)*

Tsviki Y. Hirsh<sup>1,3,6</sup>, Nancy Paul<sup>2,3</sup>, Mary Burkey<sup>3,4</sup>, Shane Caldwell<sup>3,4</sup>, Jason A. Clark<sup>3</sup>, Anthony F. Levand<sup>3</sup>, Scott T. Marley<sup>2</sup>, Graeme E. Morgan<sup>1,3</sup>, Andrew Nystrom<sup>2,3</sup>, Rodney Orford<sup>5,3</sup>, Adrian Pérez Galván<sup>3</sup>, John Rohrer<sup>3</sup>, Guy Savard<sup>3,4</sup>, Kevin Siegl<sup>2,3</sup>, Kumar S. Sharma<sup>1</sup>

<sup>1</sup>University of Manitoba, <sup>2</sup>University of Notre Dame, <sup>3</sup>Argonne National Laboratory, <sup>4</sup>University of Chicago, <sup>5</sup>McGill University, <sup>6</sup>Soreq NRC

The low-energy beam line at the Californium Rare Isotope Breeder Upgrade (CARIBU) [1] was recently upgraded with the installation of a Multi Reflection Time-Of-Flight (MR-TOF) mass separator. The MR-TOF is a scaled-up version of the ISOLDE MR-TOF [2], realizing the same operation principle of a single in-trap lift electrode. The mass separation is performed by multiple reflections of the ions between two electrostatic mirrors, composed from 6 pairs of voltage-adjustable electrodes, in which different masses are separated by their time of flights in the kilometers-long folded trajectory.

Fission product beams from CARIBU <sup>252</sup>Cf source are extracted, thermalized, accelerated, and mass separated in the CARIBU gas catcher, RFQ cooler and the compact isobar separator that provides a mass resolving power of around 14000. The ~36 keV beam is then injected into the RFQ cooler-buncher that delivers pulsed beams of ~3 keV to the MR-TOF. A high mass-resolving power can be achieved in the MR-TOF by reflecting the ions back and forth in the device, and the desired mass is selected by using a fast Bradbury-Nielsen Gate (BNG) to deflect contaminate ions in the ejected beam.

To achieve high mass selectivity, precise voltages, to the level of ppm, have to be applied to the 6 pairs of electrodes. The optimization of the mirror voltages, as well as emittance matching, has been performed via SIMION simulations, showing a potential mass resolving power of more than 50000 following 1000 cycles.

The higher mass-separated beams provided by the MR-TOF and delivered to the Canadian Penning Trap (CPT) will provide access to further measurements of neutron-rich nuclei along the astrophysical r-process path [3].

\*This work was supported by the U.S. Department of Energy, Office of Nuclear Physics, under Contract No. DE-AC02-06CH11357

[1] G. Savard, et al., *Hyperfine Interactions*, 199(1-3), 301–309, (2011)

[2] R. Wolf, et al., *International Journal of Mass Spectrometry*, 349-350, 123–133 (2013)

[3] J. Van Schelt, et al, *Physical Review Letters*, 111(6), 061102. (2013)

**Primary author:** Dr HIRSH, Tsviki (University of Manitoba)

**Presenter:** Dr HIRSH, Tsviki (University of Manitoba)

**Session Classification:** Poster Session A