MONDAY

SEPTEMBER 28

4:00 P.M.

RM 124 NSH

The Ion Conveyor for the Cyclotron Gas Stopper

Dr. Antonio Villari, Facility for Rare Isotope Beams, MSU

The Ion Conveyor is a new apparatus devoted to transport ions fast and efficiently under moderate gas pressure. Such a device is particularly useful for long transition regions from relatively high pressures into vacuum. At the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University an Ion Conveyor will be used to extract rare isotopes from a new device to thermalize fast ions produced by the A1900 separator, called the Cyclotron gas Stopper [1,2]. Fast Ions (E/u ~ 100 MeV/u) produced by the A1900 are energy degraded and stopped in a gas-filled reverse-cyclotron filled with helium at ~100 mbar pressure, where they are collected and guided to a small exit orifice by traveling radio-frequency (RF) electric fields [3]. The transport of ions between the center of the cyclotron chamber and the external surface of the magnetic yoke, approximately 1 m distance with a strongly decreasing magnetic field, will use an Ion Conveyor with entrance and exit RF-carpets to span pressures between 100 and ~0.1 mbar. The concept of the Conveyor is based on similar devices used in mass spectrometry of heavy biochemical clusters [4]. The Ion Conveyor we developed for light and heavy ions is made by concentrical electrodes with central opening of 10 mm spaced by 1.4 mm and fed with a RF electric field in the range of 200 to 1000 kHz in traveling wave mode. This allows the ions to be transported rapidly and efficiently through the decreasing magnetic field, over the required distance. The present contribution describes the simulations, the mechanical design, the electronic circuitry, as well as the results obtained in off-line tests of the full-size Ion Conveyor for alkali ions. Measured efficiency in excess of 80% was demonstrated.

This work was supported by the National Science Foundation under Grants PHY-09-58726 and PHY-11-02511.

[1] G.K. Pang et al., Proceedings of PAC07, Albuquerque, New Mexico, USA (2007) 3588
[2] S. Schwarz et al., Nuclear Instruments and Methods in Physics Research B 317 (2013) 463
[3] M. Brodeur, et al., Intl. J. Mass Spec. 336 (2013) 53
[4] A.W. Colburn, et al., European Journal of Mass Spectrometry 10 (2004) 149