Implementation of a sensitive, narrow-band Fourier-Transform Ion-Cyclotron-Resonance (FT-ICR) detection for short-lived radionuclides at SHIPTRAP

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SHIPTRAP at GSI Darmstadt can provide cooled and isobar-pure beams of singly charged radioactive ions, produced in a fusion-evaporation reaction and separated in-flight by the velocity filter SHIP [1, 2]. The scientific goals include mass spectrometry, atomic and nuclear spectroscopy, as well as ion chemistry of transuranium elements which are not available at ISOL- or fragmentation facilities. High precision Penning trap mass spectrometry on radionuclides was up to now only performed applying the destructive Time-of-Flight-ICR method. One of the main limitations to the experimental investigations of most of the transuranium nuclides is the low production rate, for which this destructive detection scheme is not applicable. A non-destructive method with single ion sensitivity, like the narrow-band Fourier Transform-ICR technique [3], is then ideally suited for the identification and characterization of these species. For the first time a direct mass measurement will then be feasible in many cases, where up to now only spectroscopic information is available. Therefore, a cryogenic Penning trap setup has been built. It consists of a cylindrical trap for isobaric cleaning under presence of a helium buffer gas at a pressure of 10^{-4} mbar and a hyperbolically shaped trap for the mass determination. In the SHIPTRAP setup both traps are placed 20 cm apart from each other. In order to guarantee the vacuum conditions of better than 10^{-9} mbar required for a coherent ion motion while transient recording, they have to be separated by a diffusion barrier. An overview of the current status of the setup, as well as the FT-ICR electronics and its sensitivity will be presented.

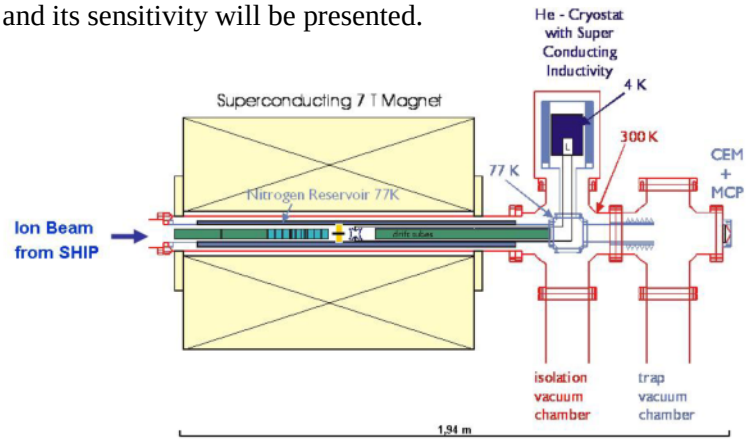

Figure 1: Cryogenic Penning trap setup for a non-destructive detection of image currents.

[1] J. Dilling *et al*. Hyp. Int. **127**, 491 (2000)
[2] M. Block *et al*., Eur.Phys. J. A. **25**, S01, 49 (2005)
[3] C. Weber *et al*., Eur. Phys. J. A. **25**, S01, 65 (2005)