First high-precision Penning trap mass measurements of short-lived isotopes from fast-beam fragmentation

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The Low-Energy Beam and Ion Trap facility LEBIT at the NSCL at MSU was used for the first time to demonstrate that rare isotopes produced by fast-beam fragmentation can be slowed down and prepared for precision mass measurements. The system employs a high-pressure gas-stopping concept [1] combined with advanced ion manipulation techniques. The first Penning trap mass measurements on short-lived rare isotopes have been performed with a 9.4 Tesla Penning trap mass spectrometer. Example nuclides are ^{66}As, with a half-live of only 96 ms, and ^{38}Ca, for which a mass accuracy of 8 ppb (280 eV) has been achieved [1]. ^{38}Ca is a particular interesting case as it is super-allowed Fermi-emitter and the high accuracy of its new mass value makes it a new candidate for the test of the Conserved Vector Current hypothesis. In addition, other measurements using LEBIT have drastically improved the mass values for ^{37}Ca, ^{40,42}S, ^{67}As and ^{65}Ge and the capability to resolve isomers was demonstrated by the observation of $^{81m+g}$Se. The LEBIT system and its first results will be presented. Future plans for laser spectroscopy experiments with thermalized beams from fast beam fragmentation will be briefly addressed.

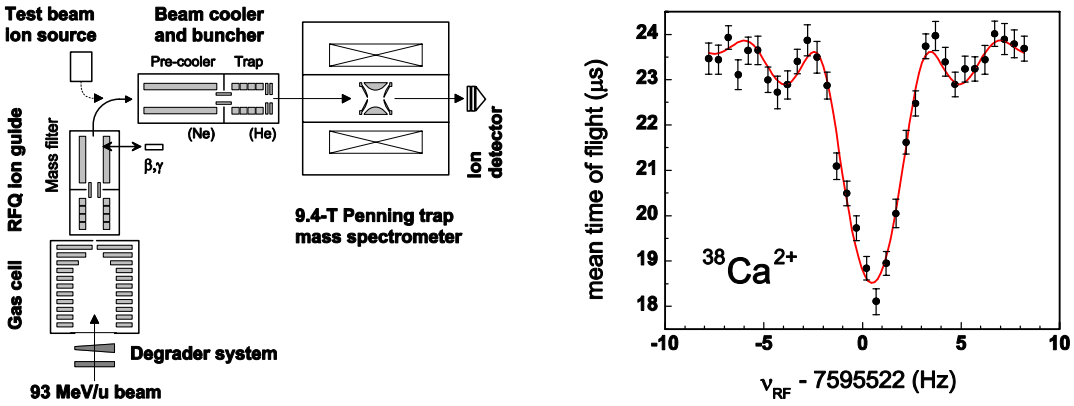

Figure 1*: Schematic of LEBIT at NSCL/MSU (left) and cyclotron resonance curve obtained for ^{38}Ca ($T_{1/2}$=440 ms) (right).*

[1] L. Weissman et al., Nucl. Instr. Meth. A531 (2004) 416
[1] G. Bollen et al., Phys. Rev. Lett. in press (2006) .