TRIUMF E-823 — Pure Fermi Decay in Medium Mass Nuclei

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The primary goal of the E-823 experimental program is to measure precise half-lives and branching ratios for superallowed $0^+ \rightarrow 0^+$ beta transitions in medium-mass ($A > 60$) nuclei produced by the new ISAC1 radioactive-beam facility at TRIUMF. These data, together with accurate experimental Q-values expected to be measured with the Canadian Penning Trap (CPT) Mass Spectrometer at the ATLAS facility [1], will be used to extract precise *ft*-values for the superallowed transitions. The *ft*-values will add to the body of data now accumulating for nuclei with $A \leq 54$, improving our knowledge of isospin symmetry-breaking effects in nuclei and possibly improving the precision with which these data can test CVC and the unitarity of the Cabibbo-Kobayaski-Maskawa (CKM) matrix [2]. The experiment at TRIUMF is undertaken as a collaboration among scientists from TRIUMF, Lawrence Berkeley National Laboratory, Simon Fraser University, Argonne National Laboratory, Queen's University and Texas A&M.

The first phase of E-823 was a measurement of the half-lives of the first beams available from ISAC1 in early 1999, namely ^{36,37,38m}K. In particular, the ^{38m}K half-life is well known ($t_{1/2} = 923.95 \pm 0.64$ ms), and provides an important test of the experimental apparatus. In addition, an equally precise measurement of the half-life for ^{37}K is required for an independent test of the Standard Model that is underway at TRIUMF, an experiment which is intended to measure polarization asymmetries in the beta-decay of that nucleus. The next phase of the experiment will be to measure the half-life of ^{74}Rb, an odd-odd, $T_z = 0$ superallowed emitter expected to be available from ISAC1 in late 1999.

Most of the experimental equipment required for the half-life measurements — a tape-transport system and 4π proportional gas counter with its associated electronics — was salvaged from the now-defunct TASCC laboratory at Chalk River, where it had been used for precision half-life measurements of light superallowed emitters in the past. In addition, however, a new 4π proportional counter built at Texas A&M [3] is being added as a control to reduce possible systematic errors.

Two periods of potassium beam time have already been used at ISAC, in late April and early May, 1999. A large number of independent half-life measurements were made for all three potassium isotopes under a wide variety of experimental conditions. Preliminary analysis shows a high degree of consistency amongst the measurements for each isotope and, for ^{38m}K, there appears to be good agreement with its well-known half-life.

References

[1] J.C. Hardy, *Progress in Research 1998-1999*, Cyclotron Institute, TAMU.

[2] J.C. Hardy and I.S. Towner, *Progress in Research 1998-1999*, Cyclotron Institute, TAMU.

[3] V.E. Iacob and J.C. Hardy, *Progress in Research 1998-1999*, Cyclotron Institute, TAMU.