A Digital Spectroscopy System for Charged Particle Studies at the RMS

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We have installed and commissioned a digital flash ADC electronics system for proton decay studies using the Double Sided Strip Detector (DSSD). This new system is based on the Digital Gamma Finder (DGF-4C) units produced by X-ray Instrumentation Associates (XIA) [1]. This system involves fitting the preamp signals via the on-board processors. The signal from the high energy recoil takes several tens of μsec to fall to the baseline, fast decays will then appear as a small "pileup" signal on top of the larger signal. By fitting the two signals, we are able to observe decays within ~500 nsec of implantation with a low-energy threshold of less than 300 keV.

Two modes of operation have been developed for the acquisition: "Standard Mode" and "Proton Catcher Mode". In the standard mode, signals from the preamps are analyzed and time stamped by the processors contained in the modules. Each event contains the energy amplitude of the signal and the time when it occurred. The proton catcher mode accepts only those events that occur within 10 μs of each other. In this mode, the processors record the entire signal waveform, which contains both the first (larger) recoil signal , and the second (smaller) decay signal lying on top of it.

The "proton catcher" mode has been used in several searches for short-lived proton emitters, and fine structure studies of ^{145}Tm [2]. The use of our new digital system has resulted in an order of magnitude gain in the rate for this short-lived isotope (3 μs) over previous work [2] performed at the Holifield facility.

[1]. M. Momayezi, *et. al.*, Proceedings of International Symposium on Proton-Emitting Nuclei, Oak Ridge, Tn, 1999, (ed. J.C. Batchelder), AIP **518**, 307 (2000).

[2]. M. Karny, *et. al.*, to be published.

[3]. J. C. Batchelder, *et. al.*, Phys Rev C **57**, R1042 (1998).