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Application of a high speed digitizer to high-precision nuclear
$\beta$-decay lifetime measurements LIXIN CHEN, JOHN HARDY, Cyclotron In-
stitute, Texas A&M University, College Station, TX 77843, USA — The objective
of this study is to probe the feasibility of applying a high-speed digitizer to precise
lifetime measurements of super-allowed nuclear $\beta$-emitters in order to improve the
achievable precision. Instead of using analogy modules to discriminate and count de-
cay events, we have developed a digital counting method based on an 8-bit digitizer
with a 1 GS/s sampling rate, which records the waveforms from our gas proportional
counter for later software analysis. The digitizer and our analysis software have been
extensively tested on the saved waveforms from off-line radioactive-source measure-
ments as well as from on-line experiments. A software filter has been designed, tested
and applied successfully to separate true $\beta$ events from spurious signals by pulse-
shape analysis. The methods used for, and the results obtained from, our first two
on-line test experiments in 2010 will be described in detail. This work demonstrates
the first successful application of a high-speed digitizer and off-line digital signal
processing techniques to high precision nuclear $\beta$-decay lifetime measurements.

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