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An FPGA-based timing system for MRTOF

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Multireflection time-of-flight mass spectrographs (MRTOF-MS) are essential tools for high-precision mass spectrometry of short-lived nuclides. Three such devices are currently in online operation at the GARIS, BigRIPS, and KISS facilities of RIKEN RIBF, enabling accurate mass determinations of exotic nuclides such as Ti-58 [1], Db-258 [2], and U-241 [3], and others [4]. A key component of the MRTOF system is the timing sequencer, which controls the entire sequence of measurement operations. We have developed a universal, programmable pulse generator based on a field-programmable gate array (FPGA), enabling the execution of advanced measurement protocols. This system supports sophisticated methods such as concomitant referencing [5], ion-bunch stacking, the In-MRTOF mass filter [6], and rare-event veto triggering [7]. In this presentation, we report on the pulse-train formalism required for these applications and its implementation using an FPGA device.

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