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High speed readout electronics for new generation Pulsed Muon Spectrometers

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The next-generation muon spin spectrometers at the ISIS pulsed source, particularly 'Super-MuSR,' are poised to efficiently utilize the increased source intensity, achieving an impressive 1 G-event-hr⁻¹ counting rate. This advancement hinges on the development of highly pixelated, high-density detector arrays covering a significant solid angle, each element fine-tuned for high-rate data acquisition.

Innovative strategies include full digitization of analog waveforms from SiPMs using digital signal processing (DSP), both at the software and firmware levels. This process is realized through the Xilinx Zynq® UltraScale+™ system on a chip, paired with 1 GHz sampling ADCs, leveraging event streaming technology and novel DSP data correction methods.

A critical enhancement is the digitizer's integration of a Kafka node in its firmware, enabling direct data transmission to the readout system and a ZeroMQ-based server for efficient slow control. These features underscore the system's seamless data processing and control capabilities.

Our discussion will explore this concept and its preliminary results, focusing on the prototype digitizing data acquisition system crucial for the 'digital data pipeline' (DDP). This advancement not only marks a technological milestone in detector design and data processing but also heralds new research avenues in muon spin spectroscopy.

Minioral

Yes

IEEE Member

No

Are you a student?

No

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