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Simplified Firmware Development for Open FPGA Platforms in DAQ Systems using SciCompiler

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In the realm of modern trigger and data acquisition (DAQ) systems, the adoption of programmable logic devices underscores the advantages of versatile, reusable mixed-signal platforms, known as open FPGA boards. These boards enable seamless integration of custom processing algorithms into firmware, enhancing their appeal across diverse applications. However, FPGA development languages like VHDL or Verilog for custom logic and readout system development can be daunting. In this presentation, we introduce an innovative approach to simplify firmware development. We present a user-friendly graphical programming interface featuring a catalog of IP cores tailored for nuclear physics applications. This interface allows users to effortlessly connect blocks to implement trigger logic, akin to assembling physical NIM modules. SciCompiler software revolutionizes firmware development, empowering users to create customized readout systems for applications like nuclear spectroscopy, particle imaging, and more. It leverages virtual instruments such as scalers, counters, TDCs, energy filters, and Pulse Shape Discriminators. SciCompiler streamlines processing algorithm implementation and generates essential readout interfaces and libraries for the complete data acquisition chain—from detector to data storage. This streamlined process is further enhanced through the introduction of the new SciSDK library, which facilitates seamless interfacing with compatible SciCompiler hardware using consistent instructions from virtually any modern programming language. It refocuses development on the application, eliminating the need for deep FPGA programming knowledge. Open FPGA boards, with or without ADCs, cater to diverse needs, ranging from single to 128 channels per module with sampling rates up to 5 GSPS.

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