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## CAEN - Design of DAQ using SciCompiler and Open FPGA. FERS-5200: a distributed Front-End Readout System for multidetector arrays.

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The increasing usage of programmable logic devices in modern trigger and data acquisition systems emphasizes the advantages in having a general-purpose reusable mixed-signal platform, typically called open FPGA board, with custom processing algorithm implemented in firmware. The benefits of using programmable logic devices with respect to standard logic modules (like NIM logic modules) is remarkable: a single programmable logic device includes the potentiality of hundreds of thousands of standard logic modules merging in a single device analog and digital signal processing. Even if several ready-to-use FPGA board are available, learning a new language like VHDL or Verilog to develop a custom logic/readout system can be a difficult step for most people.

In this presentation, we show an innovative method to simplify the firmware development. The method is based on a graphical programming interface consisting of large ip-cores catalog developed ad-hoc for nuclear physics applications. As an example, any trigger logic could be implemented by connecting specific blocks in the graphical interface, as easily as physically connecting NIM modules in a rack. The SciCompiler software allows to develop with few clicks fully customized, readout system for nuclear spectroscopy, particle imaging, neutron physics, medical imaging, exploiting, ready to use, virtual instruments like scalers, counters, TDC, energy filters, charge integration, Pulse Shape Discriminators.

SciCompiler easy implements processing algorithms and also create all necessary readout interfaces and libraries to build up the full readout chain from the detector to the data storage. The SciCompiler focuses the development on the final application and does not require a any deep knowledge of FPGA programming, making the design of the firmware as simple as connect cables between real instruments. Several open FPGA boards are available, with or without ADCs, ranging from 1 to 128 channels up to hundreds MSPS.

Modern physics experiments usually rely on experimental setup where it is possible to find a wide variety of detectors: silicon microstrip trackers, plastic scintillator calorimeters, LAr cryostats readout by a Time Projection Chamber, spectrometers composed of several drift tubes and resistive plate chambers, etc. Nowadays, waveform digitizers and/or ASIC-based front-end cards are well-established readout electronics to build a reliable system hosting many readout channels.

The FERS-5200 is the new CAEN Front-End Readout System, answering the challenging requirement to provide flexibility and cost-effectiveness in the readout of large detector arrays. FERS-5200 is a distributed and easy-scalable platform integrating the whole readout chain of the experiment, from detector front-end to DAQ. It is based on compact ASIC-based front-end cards integrating A/D conversion and data processing, which can be ideally spread over a large detector volume without drawbacks on the readout performance. Synchronization, event building and DAQ is managed by a single Concentrator board, capable of sustaining thousands of readout channels.

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