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Object-oriented industrial I/O for EPICS on NI cRIO: reusable LabVIEW-FPGA bitfiles via the NI C API

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Abstract
The Los Alamos Neutron Science Center (LANSCE) has completed a significant modernization effort, migrating from the legacy RICE control system to an entirely EPICS-based infrastructure. A key enabler of this transition has been the development and deployment of modular, object-oriented Industrial I/O (IIO) architectures on National Instruments (NI) cRIO platforms. The Industrial I/O framework provides a reusable and scalable system for controlling and monitoring sensors and instruments. It is built around precompiled FPGA bitfiles accessed through NI's C application programming interface. Where necessary, LabVIEW real-time code integrates seamlessly with EPICS IOCs. This architecture enables clear separation between control logic and hardware interfaces, supports future maintenance with minimal overhead, and accommodates both modern Linux RT cRIO and legacy VxWorks systems. The result is a flexible and resilient method for managing and improving complex control architectures across LANSCE.

This contribution outlines how IIO enables hardware reuse by treating NI cards as modular components with shared logic, abstracting low-level FPGA interaction, and standardizing configurations through parameterized bitfiles and EPICs startup files. The poster and discussion focus on how this approach supports object-like behavior to improve maintainability, scalability, and cross-platform deployments of EPICS-compatible systems.
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Footnotes

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