BEAM CONTROL AND MONITORING WITH FPGA-BASED ELECTRONICS: STATUS AND PERSPECTIVES

N. E. Eddy, Fermilab, Batavia, Illinois

Abstract

Modern FPGAs support designs using roughly 10^6 logic gates, pipeline speeds exceeding 200 MHz, internal SRAM, dedicated multipliers for signal processing, clock generation using phase-locked loops, and a variety of single-ended and differential I/O standards, including fast serial links. When interfaced with high-speed ADCs, DACs, and other components commonly found in telecom applications, FPGAs facilitate a wide range of beam control and monitoring applications. Examples include beam-position measurement, low-level RF control, instability damping, and manipulation of accelerator timing signals. Once signals of interest are in digital form, an instrument's FPGA logic and memory provide a natural means to capture data for remote diagnosis–both of beam behavior and of the instrument itself. Finally, FPGA-based solutions provide a flexible, reconfigurable, and reusable toolkit for instrumentation: existing modules are often adapted to implement new applications, and useful code fragments can be quickly copied from design to design.

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