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A Fully Software-based Online Test-bench for LHCb

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This contribution describes the design and development of a fully software-based Online test-bench for LHCb. The current “Full Experiment System Test”(FEST) is a programmable data injector with a test setup that runs using a simulated data acquisition (DAQ) chain. FEST is heavily used in LHCb by different groups, and thus the motivation for complete software emulation of the test-bench is to enable running parallel tests by sharing resources and removing all dependency on detector-related hardware. The Timing and Fast Control (TFC) used in FEST, originally in hardware, is now completely replaced with a software module that emulates the behaviour of sending trigger decisions to the test-bench. The design of a monolithic structure encompassing the former data injector and the developed TFC emulator is described in detail, and the advantages of disconnecting the test-bench from the hardware are discussed. In particular, design details for emulating (user-defined) trigger decisions and multiple event data flags are shown, and the advantages of having complete control over every stage of the DAQ chain are demonstrated using measurements made on different configurations of the test-bench done through software. The integration of the full software emulator in the run-control of FEST completes the switch. The installation of a “development” computing farm is also shown in brief, which allows the allocation of resources to different groups so that instances of FEST may be run concurrently. Additionally, the setup allows the High Level Trigger algorithms to be benchmarked on different hardware with controlled input, due to the complete software emulation of all data. Results of performance tests on the independent test setup are presented to underline the data throughput levels in the DAQ chain and the utility of this modified design and implementation.

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