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A Python-based Control Software for the AIDA-2020 Trigger Logic Unit and Tests in High-Rate Test Beam Environments

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The AIDA-2020 Trigger Logic Unit (TLU) synchronizes different detector systems in test beams such as beam telescopes, time reference planes, and devices under test to identify tracks and accurately reconstruct particle trajectories.

The hardware offers a large set of features and provides flexible support for different test beam setups, including different trigger modes (legacy EUDET and AIDA mode) for communication with various detector DAQ systems.

It enables advanced trigger logic configurations and offers fine time stamping capabilities.

The AIDA-2020 TLU is integrated in the EUDAQ2 framework for slow control and data acquisition.

This contribution presents a new stand-alone Python-based control software, designed to simplify the configuration and provides a streamlined user-friendly workflow from configuration to data interpretation.

The TLU is configured with comprehensive configuration options and boolean expressions for the trigger logic.

Data from each trigger is stored in a human-readable and compressed HDF5 data format.

Improvements of the software regarding event and data handling enable operation at higher trigger rates compared to the existing EUDAQ2 implementation.

The newly-developed control software was tested in multiple test beam campaigns at the DESY test beam facility and trigger rate studies up to 90 kHz were conducted at the ELSA accelerator at the University of Bonn.

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