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From particles to timed tracks - The next generation of hard and software for test beams

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Test Beam characterisation is the gold standard test to prove novel detector concepts based on precisely reconstructed and time-tagged particle trajectories. This is done by beam-telescopes that are expected to have high spatial and good temporal resolution. Telescopes data needs to be synchronised with various readout types: Triggered readout architectures, data-driven approaches and devices with fixed shutter intervals. This flexibility is realised with a trigger logic unit (TLU) providing a common clock, trigger and trigger IDs. Steering of the TLU and beam telescopes can be provided in the EUDAQ2 DAQ framework. Upgrades of the telescope are currently being developed based on the successful existing systems, to cope with increasing rate and precision requirements. An additional region of interest triggers with a time resolution of a few nanoseconds and LGADS as high precision timing layers with a resolution below 100ps are being commissioned.

To reconstruct the data recorded at test beams, the Corryvreckan framework has been developed and is provided to users. It is an open source project, allowing for flexible event building supporting all kinds of readout modes of new prototypes. It can natively read in data recorded with EUDAQ2 and hence telescope and TLU data from the DESY II test beams. Additionally Corryvreckan features modules for clustering in space and time, basic correlations, track reconstruction, detector alignment and device under test efficiency study.

The contributions aims to introduce the current status and upgrade projects of the DESY infrastructure to motivate the need for flexible reconstruction frameworks. Afterwards the Corryvreckan framework will be presented with an emphasis on the event building, track reconstruction and alignment capabilities. Finally selected characterisation results of timing layer upgrades for the telescopes are presented to showcase the capabilities of Corryvreckan and an outlook towards future improvements of the facilities and software framework will be given.

Submission declaration

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Author: HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

Co-authors: HERKERT, Adrian (Deutsches Elektronen-Synchrotron (DE)); WINTLE, Arianna; FEINDT, Finn (Deutsches Elektronen-Synchrotron (DE)); GREGOR, Ingrid-Maria (DESY & Bonn University); STANITZKI, Marcel (Deutsches Elektronen-Synchrotron (DE)); MEYNERS, Norbert (Deutsches Elektronen-Synchrotron (DE)); SCHÜTZE, Paul (Deutsches Elektronen-Synchrotron (DE)); DIENER, Ralf; SPANNAGEL, Simon (Deutsches Elektronen-Synchrotron (DE))

Presenter: HUTH, Lennart (Deutsches Elektronen-Synchrotron (DE))

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