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TRB3 Platform for Time, Amplitude and Charge Digitisation

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One of the most crucial parts of the particle physics experiments, data digitisation, is being driven by the higher specifications for better particle identification. This increasing push by the experiments motivates the developers for different and better solutions for time, amplitude and charge digitisation methods. In our work we explain our solution for the tasks: TRB3 Platform.

The TRB3 board consists of 5 large (150K LUTs) and economical Lattice ECP3-FPGAs, which can be used for different tasks (e.g. data digitisation and data concentration) and adapted to different requirements. Time measurements done by the TRB3 are based on FPGA-TDC technology with 265 channels on board and have time precision as low as 7.4ps on a single channel. The TDC channels can be altered to measure different edges of the input signals allowing ToF and ToT measurements as required. Having TDC-FPGA implemented allows also to build an analogue digital converter directly in the FPGA by using the internal FPGA-LVDS buffers as comparators for measured signals and predefined reference signals. First implementations suggest that an 8 bit ADC with a dynamic range of 0-2v is possible. Charge-to-Digital-Converters (QDCs) can also be realised by very simple analogue FEE together with the TDCs for detectors (e.g. Electromagnetic Calorimeters), which require precise charge information. The concept for the QDC is a modified Wilkinson-ADC, where the charge information is encoded in the pulse width and measured by the TDC. The specification we would like to reach is <0.5% charge precision.

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