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High-Resolution Time To Digital Converters for the KM3NeT Neutrino Telescope

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Thirty-one high-resolution time-interval measuring channels have been implemented in Field-Programmable Gate Arrays for the KM3NeT high energy neutrino telescope. Time to digital Architectures with low resources occupancy are desirable allowing the implementation of other instrumentation, communication and synchronization systems on the same device. The required resolution to measure both, time of flight and timestamp must be 1 ns. A 4-Oversampling technique with two high frequency clocks and an asymmetric FIFO memory is used to achieve this resolution. The proposed TDC firmware is developed in Xilinx Kintex-7

Summary

The KM3NeT collaboration aims at the construction of a multi-km³ high-energy neutrino telescope in the Mediterranean Sea consisting of thousands of glass spheres, each of them containing 31 photomultiplier of small photocathode area. The readout and data acquisition system of KM3NeT has to collect, treat and send to shore, the enormous amount of data produced by the photomultipliers. For this purpose, thirty-one high-resolution time-interval measuring channels are implemented on the Field-Programmable Gate Arrays based on Time to Digital Converter. Architectures with low resources occupancy are desirable allowing the implementation of other instrumentation, communication and synchronization systems on the same device. The required resolution to measure both, time of flight and timestamp must be 1 ns. A 4-Oversampling technique with two high frequency clocks and an asymmetric FIFO memory is used to achieve this resolution. The proposed TDC firmware is developed in Xilinx Kintex-7

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