IBIC2024 - 13th International Beam Instrumentation Conference



Contribution ID: 260 Contribution code: WEP67

Type: Poster Presentation

## Design and inplementation of a high-precision time to digital converter based on ZYNQ 7000

Wednesday, 11 September 2024 14:20 (1h 30m)

Time measurement technology is widely used in modern nuclear physics and partical physics experiments, aerospace and laser ranging etc. As its core technology, time to digital converter (TDC) is increasingly important. This paper presents a high-resolution TDC implemented in Xilinx ZYNQ 7000 device with a new encoder. This design introduces a novel pipeline-multiplexer encoder that realises 'bubble\_proof' by using a coarse-fine counter method based on the FPGA carry chain. In comparision to the conventional Wallace tree encoder, the proposed design exhibits reduce hardware and area requirments, as well as a shorter critical path. Additionally, the propagation delay time per delay cell(bin width) is dependent on the temperature and power supply voltage of the hardware circuit, automatic calibration of the ARM is necessary to ensure optical performance. The resolution of differential nonlinearity (DNL) and integral nonlinearity (INL) is approximately 11ps. Gaussian fitting indicates that the precision of this system is within 50ps, which is in accordance with the desired design specification.

## Footnotes

## **Funding Agency**

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Session Classification: WEP: Wednesday Poster Session

Track Classification: MC7: Data Acquisition and Processing Platforms