

A Wide-Range, 42ps Resolution Time-to-Digital Converter for the Electromagnetic Calorimeter of HIEPA

Saturday, December 14, 2019 2:50 PM (1 minute)

The 2-7 GeV High Intensity Electron-Positron Accelerator (HIEPA) is one of the three options for the new generation of particle physics test facility in China, which can help test Quantum Chromodynamics (QCD) in low energy regions and find new physics theory. As one of the important components in the accelerator, the electromagnetic calorimeter (EMC) needs to measure the time information of photons and electrons with sufficient resolution and dynamic range. Therefore, a two-step Time-to-Digital Converter (TDC) with high precision and wide dynamic range is presented in this abstract. The time interval measurement is implemented using a coarse counter, two Delay Locked Loops (DLLs) and a couple of coarse-fine interpolators. The DLL has been used to mitigate the effect of PVT on the proposed TDC. The interpolator consists of a coarse-fine synchronizer and a Vernier Delay Loop, which can minimize the integral non-linearity (INL) through cyclic sliding scale. The proposed TDC is going to be implemented with 0.18 μm CMOS technology, and is verified to be able to measure time intervals from 0 to 2.56 μs with bin size of 42 ps as well as rms precision of 7.1 ps. The TDC consumes 20mW with a 1.8-V supply, and the DNL and INL are both better than 1 LSB.

Submission declaration

Original and unpublished

Primary authors: Mr LIU, Chao (Northwestern Polytechnical University); Mr ZHAO, Ziwei (Northwestern Polytechnical University)

Co-authors: Mr ZHENG, Ran (Northwestern Polytechnical University); Mr WANG, Jia (Northwestern Polytechnical University); Mrs WEI, Xiaomin (Northwestern Polytechnical University); Mrs XUE, Feifei (Northwestern Polytechnical University); Mr LUO, Xuan (Northwestern Polytechnical University); Ms WANG, Guiling (Northwestern Polytechnical University)

Presenter: Mr LIU, Chao (Northwestern Polytechnical University)

Session Classification: POSTER

Track Classification: ASICs