MATTER AND TECHNOLOGIES

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Terahertz Sampling Rates With Photonic Time-Stretch for Electron Beam Diagnostics

To understand the underlying complex beam dynamics in electron storage rings often large numbers of single-shot measurements must be acquired continuously over a long period of time with extremely high temporal resolution. Photonic time-stretch is a measurement method that is able to overcome speed limitations of conventional digitizers and enable continuous ultra-fast single-shot terahertz spectroscopy with rates of trillions of consecutive frames. In this contribution, a novel ultra-fast data sampling system based on photonic time-stretch is presented and the performance is discussed. THERESA (TeraHErtz REadout SAmpling) is a data acquisition system based on the recent ZYNQ-RFSoC family. THERESA has been developed with an analog bandwidth of up to 20 GHz and a sampling rate of up to 90 GS/s. When combined with the photonic time-stretch setup, the system will be able to sample a THz signal with an unprecedented frame rate of 8 Tf/s. Continuous acquisition for long observation times will open up new possibilities in the detection of rare events in accelerator physics.

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