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# Performance evaluation of mTCA.4 High speed ADC card for direct sampling of RF signals in linear accelerator systems

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Nowadays monitoring and control systems for linear accelerators require very complex high-precision RF detection and measurements systems that incorporate receivers with multichannel down-converters and low noise LO generation systems. Increasing requirements for speed, bandwidth and latency while maintaining precision reveal limitations of classical RF receivers. Modern advanced technology made it possible to design data acquisition modules allowing direct sampling of high frequency accelerator signals with sufficient resolution without the need for down-converters. This paper describes the measurements and applications of an eight-channel mTCA.4 card developed for direct sampling RF signals above 1.3 GHz for linear accelerators and High Energy Physics Experiments. The board is equipped with eight 800 MSPS, 12-bit ADC channels each with an input bandwidth up to 2.7 GHz. The boards were tested in a laboratory environment as well as at the FLASH accelerator at DESY, Hamburg and the ELBE accelerator at HZDR, Dresden and revealed very good results. The paper shows results of the measured sampling parameters, noise, latency as well as results of non-IQ sampling schemes for acquiring the amplitude and phase of the detected RF cavity-field signals determining the precision of the analysis for LLRF and monitoring systems. Achieved results satisfy precision requirements for machines like The European XFEL and ILC accelerators.

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