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Development of the digital low level RF system for the LANSCE proton storage ring

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Abstract

As part of the modernization of the Los Alamos Neutron Science Center (LANSCE), a digital low level RF (LLRF) control system for the LANSCE proton storage ring (PSR) is designed. The LLRF control system is implemented on a Field Programmable Gate Array (FPGA). The high resolution tunable 2.8MHz reference RF is generated by a direct digital synthesizer (DDS) at the LANSCE front end and is transmitted to the PSR control system located half mile away. Since the digital LLRF control system is synthesized in the In-phase/Quadrature (I/Q) coordinate, the I/Q RF signals are generated by the Hilbert Transformer (HT) based finite impulse response (FIR) filter. For the stabilization of the cavity field, a Proportional-Integral (PI) feedback controller is implemented. In order to verify the performance of the LLRF control system before it is applied to the PSR, a FPGA based PSR cavity simulator is designed and its parameters are identified using the cavity field data obtained during the PSR beam operation. The low power LLRF testbench based on the simulator is constructed and the amplitude and phase stabilities of the digital LLRF system are verified.

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Footnotes

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Yes

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