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Design of the digital LLRF system for TRIUMF ISIS buncher

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The ISIS buncher system at TRIUMF operates at frequencies of 23MHz, 46MHz, and 4.6MHz. The 23MHz and 46MHz signals drive two buncher cavities, while the 4.6MHz signal drives the 5:1 selector. The previous analog-digital hybrid system has been replaced with a new digital LLRF system due to occasional drifts in the setpoints of the control loops during operation. The reference signal for the LLRF system is obtained from the pickup signal of the cyclotron's cavity, ensuring that all frequencies are synchronized with it. In the event of a spark occurring in the cyclotron's cavity, the LLRF system may lose its reference signal. To address this, a phase-locked loop with a track and hold function is designed to maintain the frequency when the reference signal is absent. The 4.6MHz frequency is derived by dividing the 23MHz reference signal frequency by 5. Designing the divide-by-5 circuitry posed specific challenges in a binary system. The LLRF system is built upon TRIUMF's versatile digital LLRF hardware system, with firmware optimized specifically for the ISIS buncher system. This paper will delve into the details of the system.

Keyword

LLRF, FPGA, firmware, Linux

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