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Adaptive Resonance Control for LANSCE-R

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Resonance control of the low level RF control of the linac accelerator system achieves the match between the driving RF frequency and the cavity resonance frequency, the match between the cavity resonance frequency and the linac design operating frequency. First of all, these matches are obtained by adjusting the driving RF frequency to the cavity resonance frequency. When the driving RF frequency is far from the cavity resonance frequency, the frequency difference is estimated. This frequency error estimate programs the NCO whose output is used for the carrier frequency of the IQ modulator in the low level RF system. When the adjustment of the driving RF frequency to the cavity resonance frequency is successful and hence the frequency error estimate is within the design specification, the water resonance cooling control system (RCCS) begins to tune water system such that the cavity resonance frequency tracks the linac design operating frequency while the driving RF frequency continuously tuned to follow the cavity resonance frequency as well. As tunes proceed further successfully, the driving RF frequency and the cavity resonance frequency enter the region of frequency within the specified boundary of the design linac operation frequency. The

driving RF frequency is locked to master oscillator which runs at the linac design operating frequency and only the RCCS tunes the cavity resonance frequency to follow

the design linac operation frequency.

In this paper, we propose an adaptive algorithm that estimates the frequency difference between the generator frequency and the cavity frequency, the tracking scheme of the generator frequency to the cavity frequency, the system level design of the hardware in the ALTERA DSP Builder Environment, implementation of the whole scheme on the ALTERA STRATIX II FPGA, and the system test on the LANSCE low power RF system test-stand.

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