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SP5: FPGA and Piezo controllers development for CW operation of SRF Cavities

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The level radio frequency (LLRF) control systems stabilize the accelerating field inside accelerating modules, and control the resonance frequency of the individual cavities. Modern LLRF control systems are designed as digital processing systems, and are based on the field programmable gate array (FPGA) technology.

In the continuous wave (CW) operation, a special high power RF amplifier is required, different than the pulsed klystron, such as currently used inductive output tube (IOT). This has a major impact on the RF controller development.

High loaded Q of cavities operating in the continuous wave (CW) mode, requires more accurate resonance control methods. However, mechanical characteristics of the cavities affects the controller design in such a way that the classical proportional-integral scheme is insufficient. In addition, learning feed forward methods, successfully applied in the pulsed accelerators are not suitable for the CW. To overcome those limitations, a novel real-time algorithm is implemented in the FPGA.

In this contribution, we report on recent development activities at DESY towards ultrahigh precision multi-cavity vector sum stabilization. Performance measurements of the proposed solution were conducted at the cryomodule test bench facility. Obtained results meet the stability requirements for the E-XFEL.

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