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Automated Passband Mode Resonance Peak Finding Algorithm Using MicroTCA.4-Based Digital LLRF System

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The vertical test (VT) stand at the KEK Superconducting RF Testing Facility (STF) uses an analog RF control system which is over 20 years old now. We are currently in the process of replacing this old system with a new digital LLRF system based on the MicroTCA.4 architecture. The digital system also allows for greater flexibility regarding configurability and software automation due to the integration of a CPU in the MicroTCA.4 crate. It is our goal to automate the VT process to improve measurement repeatability, reliability, and speed. One crucial step towards this goal is automated identification of multi-cell (3 and 9-cell) cavity passband modes. To accomplish this, we have developed an automated resonance peak finding algorithm which utilizes broadband noise injection and calculates the FFT spectrum of the cavity response. We have developed a method to combine multiple FFT measurements across different frequency ranges to improve frequency resolution and signal to noise ratio. To demonstrate the capabilities of this method for multi-cell cavity passband mode identification, we have successfully measured all the passband modes of a 3-cell cavity during VT.

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