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High Power Arbitrary RF Pulse Shaping Tests with NG-LLRF and C3 Prototype Structure

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RF pulse modulation techniques are widely applied to shape RF pulses for various types of RF stations of particle accelerators. The amplitude and phase modulations are typically implemented with additional RF components that require drive or control electronics. For the RF system-on-chip (RFSoc) based generation LLRF (NG-LLRF) platform we developed in the last several years, the RF modulations and demodulations are fully implemented in digital domain. Therefore, arbitrary RF pulse shaping can be realized without any additional analogue components. We performed a range of high-power experiments with the NG-LLRF and a prototype Cool Copper Collider (C3) structure. In this paper, the RF field measured at different stages with different pulse shapes and peak power levels up to 16.45 MW will be demonstrated and analyzed. The high precision pulse shaping schemes of the NG-LLRF can be applied to realize the phase modulation for a linear accelerator injector, the phase reversal for a pulse compressor, or the modulation required to compensate for the beam loading effect.

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