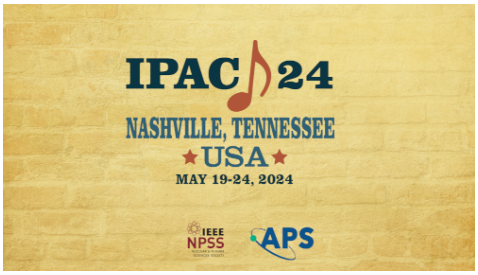

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Upgrade of LLRF control systems for infrared free-electron laser

Thursday, 23 May 2024 16:00 (2 hours)

Hefei Infrared Free-Electron Laser device (IR-FEL) is a user experimental device dedicated to energy chemistry research that can generate high brightness mid/far infrared lasers. It is driven by an S-band linear accelerator with a maximum electron energy of 60 MeV. The stability of the final output laser is determined by the energy of the electron beam, and optimizing the Low-Level RF control system (LLRF) can improve the energy stability of the electron beam. There are two klystrons in the linear accelerator of IR-FEL, and the power output of the klytrons exhibits periodic oscillation. This leads to fluctuation of the microwave field in the accelerator tube (approximately ±5%). In this optimization, we exchanged the filament power supplies of two klystrons to change the oscillation period. We used pulse-to-pulse feedforward method to compensate for the periodic fluctuations of the microwave signal, and changed IQ demodulation to Non-IQ demodulation. After optimization, the 3rd harmonic noise of the klystron is reduced to -50 dBc. The in-pulse feedback stability of LLRF has improved from 0.3%/0.3°(rms) to 0.12%/0.12°(rms).

Footnotes

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