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Commissioning of the digital LLRF system at the KEK Photon Factory 2.5 GeV ring

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In 2023, the KEK-PF 2.5 GeV ring LLRF system was replaced from a conventional analog to an FPGA-based digital system. The hardware and software of our digital LLRF system were developed by customizing the LLRF technologies established at the SPring-8 and J-PARC. In our system, we adopted the non-IQ direct sampling method for RF detection. We set the sampling frequency at $8/13$ (307.75 MHz) of the RF frequency, where the denominator (13) is the divisor of the harmonic number (312) of the storage ring. This allows us to detect the transient variation of the cavity voltage that is synchronized with the beam revolution. To compensate this voltage variation, we plan to implement a feedforward technique. These functions will be useful to improve the bunch lengthening performance in a double RF system for KEK future synchrotron light source. The new digital LLRF system has been already installed and used for the user operation. At the nominal beam current of 450 mA, the variation of the cavity voltage amplitude and phase were within $\pm 0.06\%$ and $\pm 0.06^\circ$, respectively. In this presentation, we introduce the details of our new system and report on the commissioning results.

Footnotes

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LaTeX

Region represented

Asia

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