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Low-power model tests of the wide-band cavity to compensate the transient beam loading in the next generation light sources

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In the next-generation light sources, the bunch lengthening using the combination of the fundamental and harmonic cavities is a key technology to generate ultra-low emittance beam. Since the performance of the above bunch lengthening is limited by the transient beam loading (TBL) effect on the cavities, we proposed a TBL compensation technique using a wide-band longitudinal kicker cavity [1]. Then, we considered the kicker design based on the KEK-LS storage ring as an example of the next-generation light sources [2]. We employed a frequency of 1.5 GHz (third-harmonic) and the single mode (SM) cavity concept where harmful HOMs are damped by rf absorbers on the beam pipes. The SM-type concept has two advantages. One is its simple structure where it has no HOM dumper on the cavity and another is its low R/Q which reduces the TBL effect in the kicker itself significantly. The RF power is supplied with two large coupling holes whose total external Q is 300. The small external Q is essential to provide a voltage of 50 kV with a -3dB bandwidth (BW) of about 5 MHz which is needed to compensate for the TBL effects sufficiently. To verify the small external Q and damping of HOMs, we fabricated the low-power model of the kicker and measured its performance. In this presentation, we introduced the kicker's design and the performance tests' results.

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Footnotes

[1] N.Yamamoto et al.,Phys. Rev. Acc. Beams 21, 012001(2018)
[2] D. Naito et al., Proc. IPAC21, MOPAB331

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