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Estimation of coupled-bunch instability induced by high-order modes of bell-shaped cavity in high current operation at SPring-8-II

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At the large synchrotron radiation facility SPring-8, the upgrade project "SPring-8-II" is underway to increase the radiation brightness by 100 times. In SPring-8-II, the beam energy will be reduced from 8 GeV to 6 GeV and the beam current will increase from 100 mA to 200 mA. The bell-shaped 509 MHz cavities will remain in place at SPring-8-II, with the number of cavities reduced from 32 to 16. Currently, the longitudinal coupled-bunch instability (CBI) is not observed. However, the CBI may occur due to high-order modes (HOMs) in some cavities because of the parameter changing at SPring-8-II. We estimated the threshold shunt impedance and Q-value for the CBI by using Ansys HFSS. Especially, TM₀₁₁ mode at 900 MHz has a large impedance and the threshold impedance is 0.8 MΩ, which corresponds to QL²12,000 when R/Q=65Ω. On the other hand, we measured the actual QL-value of the cavities using single-bunch beam. The spectra and its Q-values of the HOM induced by the beam were measured. The results show that most cavities are below the threshold, but some cavities are over threshold. If the HOM causes instability, we plan to adjust two tuner plungers to shift them off the peak.

Footnotes

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LaTeX

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