Simulation of phase modulation for longitudinal emittance blow-up in J-PARC MR

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The J-PARC MR provides a coasting proton beam for nuclear physics experiments by slow extraction. The longitudinal emittance should be enlarged until the MR flat top to mitigate the microwave instability. We have investigated a Phase Modulation (PM) method[1,2,3,4] by using a High Frequency Cavity (HFC) to increase the emittance. We have performed extensive simulation studies to find the appropriate parameters of the PM through the particle tracking simulation.

We found that the effective HFC frequency has linear dependence with the PM frequency as shown in Fig. 1, where the emittance is smoothly enlarged. Furthermore, we found that the required HFC voltage is inverse proportional to the square root of the duration time of the PM as shown in Fig. 2. These PM properties will be used for the design of the HFC.

We describe the particle tracking simulation results of controlled emittance blow-up by the PM.

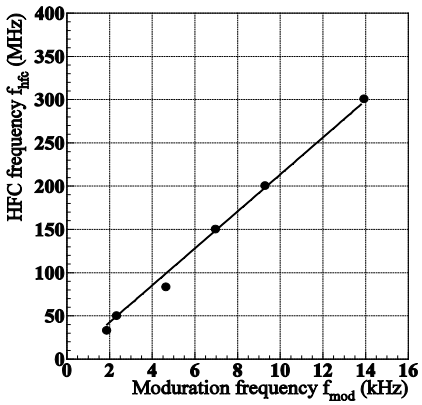

Fig. 1: The relation between the HFC frequency and the PM frequency.

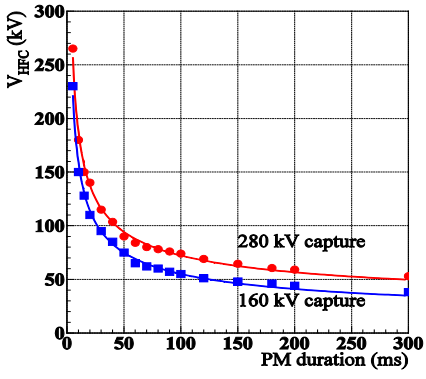

Fig. 2: The relation between the HFC voltage and the duration time.

References

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