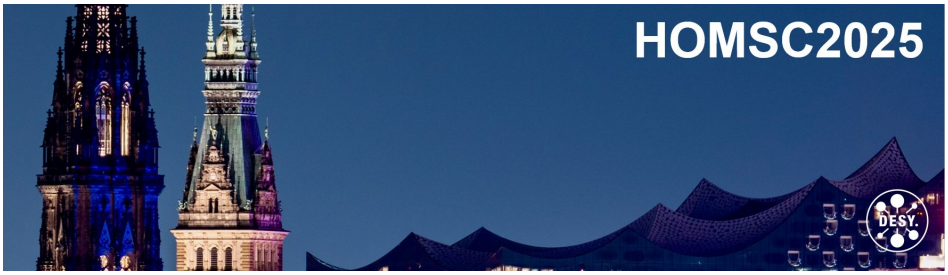

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Observation and simulation on the fill-pattern dependence of HOM power in the SuperKEKB superconducting cavity

Wednesday 8 October 2025 10:00 (30 minutes)

SuperKEKB is a luminosity frontier collider for electron and positron beams. One of the highly challenging targets is the RF system handling extremely large beam loading. The design beam current of the 4 GeV positron beam is 3.6 A and that of the 7 GeV electron beam is 2.6 A. The positron beam is accelerated by twenty-two normal-conducting ARES cavities, which are three-coupled cavity systems. On the other hand, the electron beam is accelerated by the eight ARES cavities and eight single-cell superconducting cavities. The superconducting cavity has beam pipes with relatively large diameters so that higher-order modes (HOMs) propagate into the beam pipes. The harmful HOMs are strongly damped by ferrite dampers attached to the beam pipes. In the upgrade from KEKB to SuperKEKB, we added SiC dampers for mitigating power loads of downstream cavities. In recent operations, we observed a strong dependence of power absorbed by the dampers on bunch fill patterns. This implies some resonance effects between the HOM spectrum and beam spectrum. In order to investigate this phenomenon, we studied the dependence of absorbed power on the fill pattern using CST Wakefield Solver. We have developed a new method for evaluating absorbed power. Our method utilizes not wake potentials or loss factors but the electromagnetic field inside the absorbers. By this method, we are able to accurately evaluate power load of each absorber. In our presentation, we report the operation experiences especially on HOM power of the superconducting cavity and our recent simulation study.

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