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Requirements for longitudinal HOM damping in FCC-hh

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Longitudinal coupled-bunch instability (CBI) can be driven by not sufficiently damped high-order modes of rf cavities or/and other machine elements. To prevent them in hadron machines, where synchrotron radiation is weak, one has to rely on Landau damping. Unlike the case of accelerators with relatively low number of bunches, in which the instability thresholds can be obtained from macro-particle simulations, only semi-analytical methods can be applied for the Future Circular hadron-hadron Collider (FCC-hh) with up to 10400 circulating bunches per beam. In this work, calculation of the longitudinal CBI threshold for particle distributions of binomial family during the acceleration cycle of the FCC-hh is presented. It is compared with HOMs of different crab cavity designs proposed to be used in the FCC-hh and in the High-Luminosity Large Hadron Collider (HL-LHC). As the result, we define the requirements for the HOM damping, so that the longitudinal CBI can be suppressed.

Author: KARPOV, Ivan (CERN)**Co-author:** SHAPOSHNIKOVA, Elena (CERN)**Presenter:** KARPOV, Ivan (CERN)**Session Classification:** SRF**Track Classification:** Superconducting RF & associated technologies