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Estimation and scaling laws of impedances and beam instabilities from LHC to FCC-hh

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Beam instabilities caused by electron clouds and the resistive wall impedance are potential intensity limitations for the FCC-hh. Similar to the LHC, electron cloud build-up results in heat load and possibly beam instabilities. Consequently, the FCC-hh beam screen will be coated partially with a low secondary emission yield (SEY) layer, which will affect also the impedance. The impedances and the electron cloud build-up thresholds are estimated, using the detailed geometry of the FCC-hh beam screen, additional coating, and different SEY models. The simulation results are compared to the LHC. In addition, such resulting effects as instability growth rate, TMCI threshold, and heat load are analyzed. The numerical and analytical results of the heat load due to the electron cloud build-up scaling with beam energy are presented.

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