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Optimal beam dilution pattern of the FCC-hh ring using beating frequencies

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In order to avoid the damage of the dump target of the FCC-hh ring, the beam will be swept over its surface in a spiral pattern, using dilution kickers oscillating in the x/y planes with 90 degree phase difference, and an amplitude changing with time. Whereas the natural time-dependence of the amplitude is a convex function (the exponential decay of a damped oscillating circuit $\exp(-t/\tau)$), the optimal shape can be shown to be concave, i.e. have a steeper slope towards small radii, producing a flat energy deposition. This waveform is difficult to realize directly with a dedicated electric circuit. Deviations from the optimal shape lead to areas with an energy deposition density over the damage threshold, or if this is to be respected, to the necessity of the overspecification of the kickers and the absorber in terms of bending power and size, respectively. We propose the realization of the optimal pattern using two beating frequencies. This method has the advantage of using very simple circuitry (independent damped oscillators) which interfere only in their effect on the beam. Besides the demonstration of the concept, a sensitivity analysis to the circuit parameters will be presented.

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