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Dark current simulations in accelerating structures operating with short RF pulses

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The attainable acceleration gradient in normal conducting RF accelerating structure is limited by RF breakdown, a major challenge in high gradient operation. Some of the recent experiments at the Argonne Wakefield Accelerator (AWA) facility suggest the possibility of breakdown mitigation by using short RF pulses (on the order of a few nanoseconds) to drive the accelerating structures. To understand the physics of RF breakdown on a nanosecond time scale, we simulated the dark current in few accelerating structures in both long-pulse and short-pulse regimes comparatively, and studied multiple potential breakdown initiators, including field emission and multipacting. Our simulations suggest the potential of a class of accelerators designed to work in the short-pulse regime.

Footnotes

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