



Contribution ID: 1092 Contribution code: TUPR11

Type: **Poster Presentation**

Dark current simulations in accelerating structures operating with short RF pulses

Tuesday, 21 May 2024 16:00 (2 hours)

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

Funding Agency

This research was supported by the U.S. Department of Energy, Office of Science, Office of High Energy Physics under Award DE-SC0021928.

Paper preparation format

LaTeX

Region represented

North America

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Session Classification: Tuesday Poster Session

Track Classification: MC7: Accelerator Technology and Sustainability: MC7.T06 Room Temperature RF