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RF breakdown and dark current studies in short-pulse acceleration

Wednesday 13 August 2025 16:00 (2 hours)

Recent experimental studies at the Argonne Wakefield Accelerator (AWA) have shown that operating RF cavities with short pulses, only a few nanoseconds in duration, can raise the accelerating gradient to nearly 400 MV/m in a series of X-band structure tests. These results motivate further investigation into the breakdown physics underlying the short-pulse acceleration regime.
In this work, we present analytical models and numerical simulations of dark current dynamics in X-band cavities driven by short RF pulses. These studies explore key phenomena associated with RF breakdown across various time scales, including field emission, secondary electron emission, and plasma formation, with particular focus on their dependence on RF pulse length.
Building on these insights, we describe the design and experimental plan for a single-cell X-band RF cavity operating at 11.7 GHz, optimized for high-gradient operation with 6˜ns long RF pulses and integrated with RF breakdown diagnostics.
This work aims to deepen the understanding of RF breakdown physics in the short-pulse regime and support the development of compact linear accelerators for future applications.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

Yes

Footnotes

Funding Agency

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Yes

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