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Developing a Hybrid Accelerating Structure Based on Short-Pulse Structure Wakefield Acceleration

Wednesday 13 August 2025 16:00 (2 hours)

Structure Wakefield Acceleration (SWFA) powered by -short RF pulses (˜10 ns) generated by Two-Beam Acceleration (TBA) at the Argonne Wakefield Accelerator (AWA) has demonstrated effective suppression of RF breakdowns and achieved gradients exceeding 400 MV/m at X-band (11.7 GHz) frequencies. To fully exploit the benefits of this short RF pulse operation, an accelerating structure must simultaneously achieve two goals: high group velocity (Vg) to ensure rapid RF filling (need for high efficiency), and simultaneously maintain high shunt impedance (R) (need for high accelerating gradient). Conventional accelerating structures involve inherent tradeoffs between these parameters, limiting their effectiveness in the short-pulse regime. To this end, we developed a hybrid structure composed of two co-optimized sub-structures fed by one coupler at the middle: one backward wave (BW) filling and one forward wave (FW) filling sub-sections.This design not only preserves the short-pulse advantage, it also simplifies the setup (one input coupler for two structures) and enhances the beam's energy gain by doubling the acceleration length without requiring extended RF pulse duration. In this work, we present the detailed RF design with preliminary beam dynamics simulations demonstrating efficient energy gain within a compact acceleration length.

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No

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

No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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