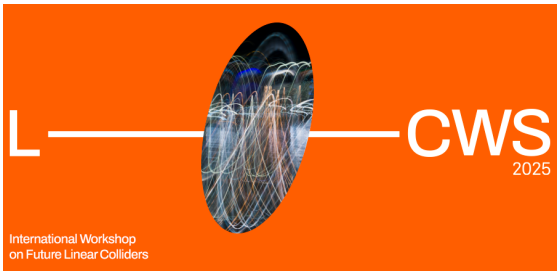

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Progress and challenges in RF structures for short-pulse SWFA

Thursday 23 October 2025 10:00 (20 minutes)

Recent experiments in short-pulse structure-wakefield acceleration (SWFA) have shown that nanosecond-scale RF drive pulses can sustain unprecedented gradients while mitigating breakdown probability compared with conventional long-pulse operation. Building on studies at the Argonne Wakefield Accelerator (AWA), we report results on high-gradient performance, RF breakdown behavior, and dark current generation in copper structures under short-pulse conditions. A key hypothesis is the existence of a novel regime, we name breakdown-insensitive acceleration regime (BIAR), which enables gradients of 300 MV/m in X-band structures. Preliminary simulations suggest that BIAR may arise because processes such as field emission, multipacting, and plasma expansion cannot fully develop on nanosecond time scales. This presentation will highlight both the opportunities and the challenges of advancing short-pulse RF structures toward collider-relevant applications.

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