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A Pathway toward a SWFA-based Compact Coherent Light Source

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Structure wakefield accelerators (SWFAs) offer a path to high accelerating gradient using either collinear wakefield acceleration or two-beam acceleration (TBA). In the past five years, significant progress has been made in operating accelerating structures powered externally by short radiofrequency pulses generated from the wakefield of decelerating bunches. Such a TBA approach has demonstrated the operation of X-band accelerating structures with surface electric fields approaching GV/m, including a radio-frequency photoinjector with photocathode field close to 0.4 GV/m. Correspondingly, efforts are currently underway to integrate these advancements into a water-window free-electron laser (FEL) demonstration experiment.

This presentation charts a path toward an SWFA-based FEL. It will particularly address the beam dynamics challenges associated with generating bright electron bunches for FEL applications and high-charge bunches for wakefield generation. We will also describe ongoing experimental activities aimed at achieving reliable short-pulse operation of high-gradient accelerating structures and the generation of bright electron bunches. Additionally, we will discuss potential designs for accelerating structures operating in the short-pulse regime and explore options for an integrated accelerator supporting the operation of a compact FEL operating in the water-window regime.

Working group

invited speaker

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