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Peering into electron beam 5D phase space with coherent optical transition radiation

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Few-fs electron bunches from wakefield accelerators possess a strong micro-bunched component, which can be critical in seeding free electron lasers. Spectrally multiplexed near-field (NF) imaging of the strong coherent optical transition radiation (COTR) that these bunches emit at wavelengths comparable in size to the bunch's internal features enables single-shot recovery of the bunch's coherently-radiating structure, using algorithms similar to those used in ptychography and coherent diffraction imaging. The multi-spectral image sets and reconstructed bunch shapes vary widely for different methods of injecting electrons into an LWFA, and will be important in designing and monitoring FELs based on LWFAs. Adding multi-spectral far-field (FF) imaging expands the diagnostic capabilities by providing transverse momentum information. Here we present experimental results of simultaneously measured multispectral NF and FF COTR from wakefield accelerated electron bunches and as well as a preliminary framework to derive a 5D phase space from such data.

Working group

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