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Ultra-broadband Direct THz Detectors for Longitudinal Beam Diagnostics

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Many currently operating and future FELs can generate broadband radiation at MHz repetition rate, requiring a fast diagnostic tool(response time at least on a single-digit ns scale),ultra-broadband, & robustness. We develop ultrafast-operating THz detectors based on Schottky diodes [1,2], and field-effect transistors (FET) [3] operating at room temperature.
This work presents four aspects of our newly developed detectors: (1) frequency coverage: ultra-broadband single-pixel THz detectors (based on both technologies) covering 0.05 to 54.8 THz, which essentially covers full operational spectral range of the ELBE facility in Dresden-Rossendorf, Germany, (2) ultra-wide band IF bandwidth up to ~50 GHz: this enables single shot detection of ps-scale THz pulses with response time in ps range (overcome the pile up issue faced by its counterparts), (3) bunch compression monitoring capability from single-digit pC to ~220 pC: this is essential for precise machine settings for desired beam parameter output, and (4) Radiation hardness examination of the developed detectors for their smooth operation at accelerator facilities. These detectors are tested at the ELBE facility and can be implemented at other FEL facilities.

Summary

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