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## Terahertz diagnoses bunch-to-bunch spacing for ultrafast electron bunch trains

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Ultrafast micro-bunched electron beams have broad applications, including wakefield-based acceleration and coherent Terahertz sources, where precise diagnosis of individual bunch-to-bunch spacings is critical. However, high-precision direct measurements of these spacings remain challenging. This paper introduces a novel method capable of measuring these spacings with femtosecond temporal resolution using a THz-driven resonator. Simulations on a 3 MeV electron bunch train demonstrate a temporal resolution better than 10 fs for the bunch-to-bunch spacings. This method facilitates in-depth investigation of the longitudinal characteristics of the bunch train, promising significant advancement in narrow-band Terahertz sources and compact accelerators.

### Footnotes

### Funding Agency

### I have read and accept the Privacy Policy Statement

Yes

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