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Single-shot detection of short electron bunch shapes at MHz repetition rates using diversity electro-optic scheme with advanced reconstruction algorithms at EuXFEL and FLASH.

Wednesday 10 September 2025 16:00 (2 hours)

To surpass limitations in sub-picosecond electro-optic electron bunch length diagnostics[1], we present an innovative detection method utilizing diversity schemes[2].

This approach employs simultaneous multi-output measurements of the chirped optical probe modulated by the electron bunch's field. We introduce a novel inversion algorithm that automatically recognizes and compensates for imperfections in the probe laser spectrum and chirp, enabling high-fidelity retrieval of bunch shapes, particularly for broadband THz radiation over a long temporal window.

Numerical simulations and initial experimental results demonstrate the system's potential for advanced, real-time bunch shape monitors at FLASH and EuXFEL, and can be extended to THz CTR or FEL based THz sources.

[1] F. Sun, Z. Jiang, and X.-C. Zhang, Appl. Phys. Lett. 3, 2233 (1998)
[2] E. Roussel et al., Light: Science & Applications 11, 14 (2022)

Footnotes

Funding Agency

I have read and accept the Conference Policies

Yes

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