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## Proof-of-principle experiment for a sub-femtosecond electron bunch length diagnostic

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With electron beam durations down to femtoseconds and sub-femtoseconds achievable in current state-of-the-art accelerators, longitudinal bunch length diagnostics with resolution at the attosecond level are required. In this paper, we present such a novel measurement device which combines a high power laser modulator with an RF deflecting cavity in the orthogonal direction. While the laser applies a strong correlated angular modulation to a beam, the RF deflector ensures the full resolution of this streaking effect across the bunch hence recovering the temporal beam profile with sub-femtosecond resolution. A first proof-of-principle experiment of this concept was conducted at the Accelerator Test Facility (ATF) at Brookhaven National Laboratory (BNL) recently, the results of which are presented and discussed here. Moreover, a possible application of the technique for novel accelerator schemes, such as plasma-accelerated electron beams, is examined based on simulations with the particle-tracking code ELEGANT and our beam profile reconstruction tool. Effects limiting the device resolution, in particular the bunch energy spread and initial divergence, are considered in detail in this context.

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