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Longitudinal phase space diagnostic for ultrashort bunches

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Ultrashort electron bunches of few femtoseconds length are highly desirable for a large number of applications such as ultrafast electron diffraction, free-electron lasers or for external injection into plasma wakefields. As the plasma wavelength determines the length scale in plasma accelerators, also the bunches produced by this technique intrinsically are very short.
A precise knowledge of the longitudinal phase space is crucial in order to optimize the acceleration process and bunch compression. However, measuring the longitudinal phase space becomes increasingly challenging for shorter bunches.
We will present a new method to diagnose ultrashort bunches and explore its limitations in terms of resolution in time and energy spread.

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