## Speed Poster: Linearization of the longitudinal phase space without higher harmonic field

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Accelerator applications like free-electron lasers, time-resolved electron diffraction, and advanced accelerator concepts like plasma acceleration desire bunches of ever shorter longitudinal extent. However, apart from space charge repulsion, the internal bunch structure and its development along the beamline can limit the achievable compression due to non-linear phase space correlations. In order to improve such a limited longitudinal focus, a correction by properly linearizing the phase space is required. At large scale facilities like FLASH at DESY or the European XFEL a higher harmonics cavity is installed for this purpose.

In this poster we present a new method – based on ballistic bunching: Expanding the beam after the electron source enables a higher order correction of the longitudinal focus by a subsequent accelerating cavity which is operated at the same frequency as the electron gun.

An analytic model describing this approach has been developed, which is verified by simulations, predicting possible bunch length below 1 fs at low bunch charge. Minimizing the energy spread down to  $dE/E < 10^{-5}$  while keeping the bunch long is another interesting possibility, which finds applications e.g. in time resolved transmission electron microscopy concepts.

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