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First Evidence of Intrabeam Scattering in an Electron Linac and Impact on Short Wavelength FELs

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To date, the main obstacle to the extension of free electron lasers' longitudinal coherence to the water window and beyond is the detrimental effect of spurious harmonic content in the longitudinal profile of electron bunches, namely the microbunching instability.

Intra-beam scattering is another (less known) collective effect that consists of multiple (small-angle) soft Coulomb scattering of electrons inside a bunch. The inclusion of this electronic scattering in MBI model has proved to be an essential step to more faithful predictions of the beam energy spread and characterization of spurious content.

Analytical expressions for intra-beam scattering in single pass linacs and multi-bend transfer lines are presented and included in two different semi-analytical description of microbunching. The overall modeling turns out to be a fast comprehensive tool for the optimization of linac-driven free-electron lasers.

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