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Advanced studies for the dynamics of high brightness electron beams with the code MILES

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High brightness electron beams enable a wide spectrum of applications ranging from short wavelength radiation sources to high gradient wakefield acceleration. The rich dynamics that are intrinsic in charged particles accelerated in complex systems require a careful description in the analysis and design of a given machine, particularly regarding its stability. Numerous computer codes are in use by the accelerator community for such purposes. In particular, MILES is a simple tracking code we have developed that allows fast evaluations of collective effects in RF linacs. In this paper we extend the simple models previously developed to describe specific, diverse applications that can benefit from the fast simulation tools developed in MILES. Examples of this kind include particle driven acceleration schemes in a plasma where driver and witness beams propagate in the "comb" pulse-train configuration. Specifically, we investigate the self-induced fields excited within both the rf-linac stage and the capillary. Further, we discuss additional advanced topics such as wakefield effects in planar FEL undulators and the emission of coherent synchrotron radiation in a magnetic chicane.

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