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Simulation study of a planar dielectric-lined waveguide structure for manipulation of femtosecond high brightness electron beam in longitudinal phase space

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In many advanced accelerator facilities such as e+e−linear colliders and high gain free electron lasers, magnetic bunch compressors are often used for enhancement of beam brightness. However, the energy chirp (correlated energy spread) introduced into the beam by the chirper linac remained after bunch compression is undesirable in some applications. In this report, we present our study of a planar dielectric-lined waveguide (DLW) structure that can be used to remove the remaining energy chirp after bunch compression. As revealed from ELEGANT simulation of the high brightness driver linac system, a residual energy chirp of about 42 keV/m is left after bunch compression. We successfully used a 1-m long corrugated pipe dechirper to remove the residual energy chirp in ELEGANT simulation. However, fabrication of this 1-m long corrugated pipe structure is not an easy task. In order to save space, we consider to use planar DLW structures to remove residual energy chirp after bunch compression instead. Wake potential due to this DLW dechirper has been calculated by CST code. An optimized geometry will be presented in this report. Wake potential as calculated form CST code is de-convoluted to obtain a wake function. The effect of the dechirper on beam distribution can be studied by particle tracking using this wake function in ELEGANT. We expect the performance of the DLW dechirper will be equivalent to the 1-m long corrugated pipe dechirper but with a much more compact size.

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Footnotes

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