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Application of a dielectric lined waveguides for longitudinal phase space manipulation in an energy recovery linac

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The PERLE (Powerful Energy Recovery Linac for Experiments) project requires an injector which is capable of delivering a high beam current and a high bunch charge at an energy compatible with useful energy recovery. A key challenge is therefore to deliver a high quality beam which matches the specification for the main ERL. One possibility to delivering higher quality beams is greater control of the longitudinal phase space of the bunches. This study investigates the feasibility of employing a dielectric lined waveguide (DLW) as a passive device for this level of control within the PERLE injector. DLWs can generate wakefields which can subsequently be utilised to reduce the energy spread of the bunch and linearise the longitudinal phase space. A preliminary study has been undertaken to asses potential configurations for a DLW suitable of PERLE's specification. This initial study evaluates various material thicknesses, and geometries, and considers their effects on wakefield generation and the resulting beam dynamics. Further computational studies are required to refine these findings and establish operational feasibility within the injector layout constraints.

Footnotes

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