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Simulation of a passive longitudinal phase space synthesizer concept based on 3D-printed dielectric-lined waveguides

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Precise control over the longitudinal phase space (LPS) of electron bunches in accelerators can be of interest for example for bunch-compression, where in the ideal case a completely linear LPS is needed to reach maximum compression. We present a compact and completely passive way to alter the LPS of a given electron bunch in a way that arbitrary, pre-defined shapes can be achieved. The concept is based on 3D-printed dielectric-lined waveguides, which makes the devices cheap and enables rapid prototyping and production. Here we discuss the underlying physics, technology, as well as results of numerical simulations of the LPS synthesizer (LPSS) in action. Finally, challenges and prospects are discussed.

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