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Longitudinal bunch shaping using transverse deflecting cavities at Argonne Wakefield Accelerator Facility

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Longitudinal bunch shaping based on transverse deflecting cavities (TDCs) was first proposed in Tech. Rep. No. LBNL-2670E, 2009 and further elaborated in Phys. Rev. Accel. Beams 23, 072803, 2020. Bunch shaping takes place in a straight beamline configuration of TDCs and a shaping mask. Two potential advantages of TDC-based shaping, over other shaping methods, is that it does not use dipole magnets so it is CSR-free and it shapes an ultra-relativistic beam so space charge is minimized. In this paper, we will show a variety of longitudinal bunch shapes, and discuss the possible applications for high-gradient, beam-driven wakefield accelerators such as high-transformer ratio and quality preservation of the accelerated beam.

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