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Simulations study of transverse wakefields in a dielectric wakefield acceleration scheme

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Novel acceleration schemes aim to address the need for higher acceleration gradients which enable to minimise the size and costs of particle accelerators. One of these novel accelerator schemes is the dielectric wakefield acceleration (DWA), where an electron bunch is accelerated by the longitudinal wakefields generated within a dielectric lined waveguide by a leading drive bunch with higher charge. The advantages of this novel acceleration method include high accelerating field strength, the simplicity of its structure and the stability of the wakefield generated which is synchronous with the electron bunch. However, the drive bunch propagation length, and hence the achievable energy gain, is limited by the effect of the transverse wakefields. These fields deflect the bunch towards the dielectric, leading to charge losses, a phenomenon commonly referred to as beam break-up (BBU) instability. This study uses simulations to investigate the transverse wakefields and their impact on the beam dynamics in a DWA scheme with drive and witness (main) bunches. The findings will be further explored experimentally at the CLARA facility in Daresbury Laboratory.

Footnotes

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