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Detailed simulation study of wakefield induced beam dynamics in the dielectric dechirper at CLARA

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Minimizing the energy spread within the electron bunch is essential for an optimal performance of free electron lasers. Wakefields from corrugated and dielectric structures have been demonstrated to be effective in bunch dechirping. However, the repercussions in beam quality are not yet well understood. Here, a dielectric wakefield structure, manufactured to be included at the CLARA facility, has been studied by simulations. It consists of two planar and orthogonally oriented dielectric waveguides with adjustable dielectric gaps. This structure allows the longitudinal wakefield to compensate the energy spread while controlling the undesirable effect of the transverse wakefields in the beam quality. Simulations have been performed using the in-house developed code called DiWaCAT. These simulations included different bunch lengths, beam energy spreads and dielectric gaps to allow a better understanding of longitudinal and transverse wakefields beam effects within the dechirper.

Footnotes

- Gong, YW. et al (2021). Beam performance of the SHINE dechirper. doi:10.1007/s41365-021-00860-8
- ** Antipov, S. et al (2014). Experimental demonstration of energy-chirp compensation by a tunable dielectric-based structure. doi:10.1103/PhysRevLett.112.114801
- *** Pacey, T. H. et al (2018). Simulation studies for dielectric wakefield programme at CLARA facility. doi:10.1016/j.nima.2017.12.038.

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