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Prototype design of an electro-optical diagnostic for longitudinal bunch profile measurements at FCC-ee

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The operation of the Future Circular Electron Positron Collider (FCC-ee) necessitates a robust longitudinal bunch diagnostics system for precise beam energy calibration and efficient top-up injection monitoring. As part of the FCC Innovation Study (FCCIS), an electro-optical (EO) bunch profile monitor is developed, based on the developments of the EO near-field monitor at the Karlsruhe Institute of Technology (KIT). The monitor at the Karlsruhe Research Accelerator (KARA) is used for turn-by-turn single shot bunch profile measurements with bunch lengths around 10 ps at a repetition rate of 2.7 MHz and studies are ongoing towards higher repetition rates. A new adapted design for FCC-ee is being developed to cope with the specific beam parameters at FCC-ee, such as bunch lengths of up to about 40 ps, higher charge density and the requirement to measure every individual bunch. In this contribution, the design of a first prototype of an EO near-field monitor for FCC-ee beam conditions is presented, which aims to address these challenges and serves as a proof-of-principle.

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