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Design of a 3-cell rectangular deflecting cavity for a compact THz-FEL

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In this paper, we present the design of a multipurpose 3-cell deflecting RF cavity for a compact terahertz (THz) free electron laser (FEL) facility. The 3-cell deflecting RF cavity is mainly used for longitudinal bunch length measurement and a chopper system to cut off the bunch tail caused by the thermionic gun. Single-cell cavities suffer from orbit offset, while a 3-cell cavity is possible to eliminate the offset effect. In addition, rectangular deflector is decided for its superiority in fabrication and mode separation when compared to a cylindrical deflector. We used CST for cavity design and placed the results of the analysis of the cavity in this paper. Particle tracking is performed with the Astra code, and space charge effect is taken into account. It is shown that the time resolution are 500fs when used as a longitudinal bunch length measurement. When used as a beam chopper, the beam orbits are free of offset while cutting off the tail particles, which has less impact on the subsequent beam transport.

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Primary author: LUO, Ruiying (Huazhong University of Science and Technology)

Co-authors: LEI, Anlin (Huazhong University of Science and Technology); CHEN, Qushan (Huazhong University of Science and Technology); XIONG, Yongqian (Huazhong University of Science and Technology)

Presenter: LUO, Ruiying (Huazhong University of Science and Technology)

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