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Beam dynamics and injection condition in a ring-type dipole of a laser-accelerated electron beam for compact light sources

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We are developing a compact synchrotron light source using laser electron acceleration, focusing on creating a tabletop accelerator-based radiation system. Our approach involves a small ring-type dipole with block-shaped permanent magnets, prioritizing cost and weight reduction. Simple beam dynamic calculations revealed that a smaller electron beam divergence angle results in a more stable orbit and the field modulation of peak magnetic strength improves the stability without the additional quadrupoles. CST simulations shows that the magnetic field of the ring-type dipole includes the field modulation of peak magnetic strength along the orbit due to shape changes. The injection to the ring-type dipole is the one of the issues to be solved for a compact light source. In this paper, we present the studies on designing and optimizing the ring-type dipole including the injection of electron beam and the extraction of dipole radiation.

Footnotes

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Primary author: KIM, Keonho (Korea University)

Co-authors: LEE, Hyeon Woo (Korea University Sejong Campus); SHIN, Sang Yun (Chung-Ang University); PARK, Seong Hee (Korea University Sejong Campus)

Presenter: KIM, Keonho (Korea University)

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