Off Axis Electron Orbits in Realistic Helical Wiggles
for Free-Electron Laser Applications

J. Fajans, D. A. Kirkpatrick, G. Bekefi

Department of Physics and Research Laboratory of Electronics
Massachusetts Institute of Technology
Cambridge, MA 02139

Abstract

Off-axis electron orbits in free-electron laser (FEL) beams of finite thickness, subjected to combined helical wiggler and axial guide fields, have been studied analytically. A semi-empirical equation for the electron velocity components, averaged over the electron’s oscillatory (betatron) motion, has been derived as a function of the radial displacement of the electron guiding center. The predictions from the equation are compared with single particle numerical simulations, and with free-electron laser experiments. Good agreement is found.