ABSTRACT

We are developing a design for a minimally perturbing mini-chicane, which utilizes the optical synchrotron radiation (OSR) generated from magnetic bends, to measure the rms emittance and other optical parameters of the beam. The beam is first externally focused at the first bend and the OSR generated there is used to image the beam. Subsequently, any pair of bends produces interferences (OSRI) whose visibility can be used to determine the beam divergence. The properties of different configuration of bends in the chicane have been analyzed to provide an optimum diagnostic design for a given set of beam parameters which: 1) provides a sufficient number of OSRI fringes to allow a measurement of the beam divergence; 2) minimizes the competing effect of energy spread on the fringe visibility; 3) minimizes the effect of coherent synchrotron radiation and space charge on the beam emittance; and 4) minimizes the effect of compression on the bunch length, as the beam passes through the chicane. Diagnostic designs have been produced for 100-300 MeV beams with a normalized rms emittance of about 1 micron for application to FERMI@Elettra and similar high brightness free electron lasers.