

NON INVASIVE OPTICAL SYNCHROTRON RADIATION MONITOR USING A MINI-CHICANE



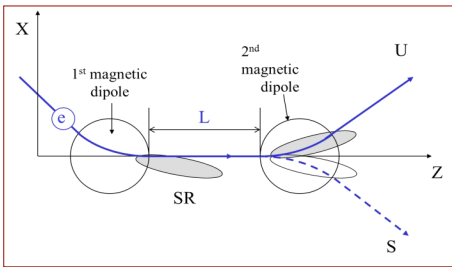
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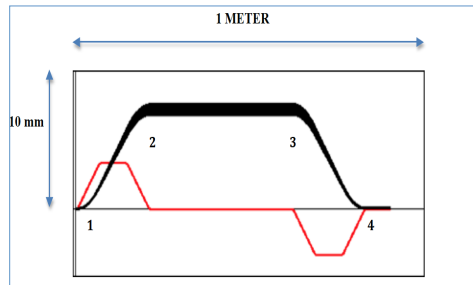
ABSTRACT

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.

OSR Interferometer Configurations: U and S Bends

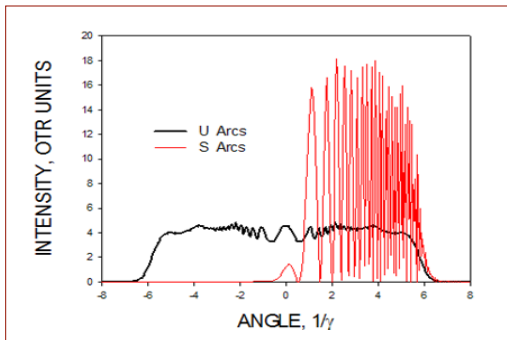


Diagnostic Mini chicane Design with (1,2) 'S' and (2,3) 'U' Interferometers

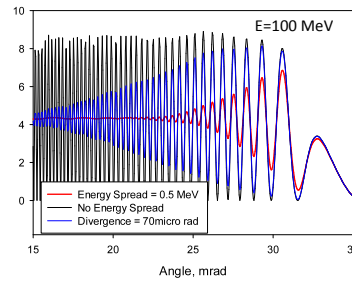


Properties of Chicane:
 B (100MeV) = 0.12 Tesla
 B(285 MeV) = 0.35 Tesla
 L @magnet = 100 mm
 L (2,3) = 600 mm
 Angle deflection = 35 mrad

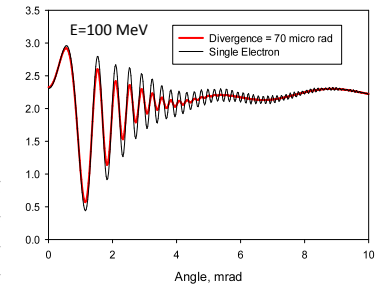
OSR Interferences from U and S Bends



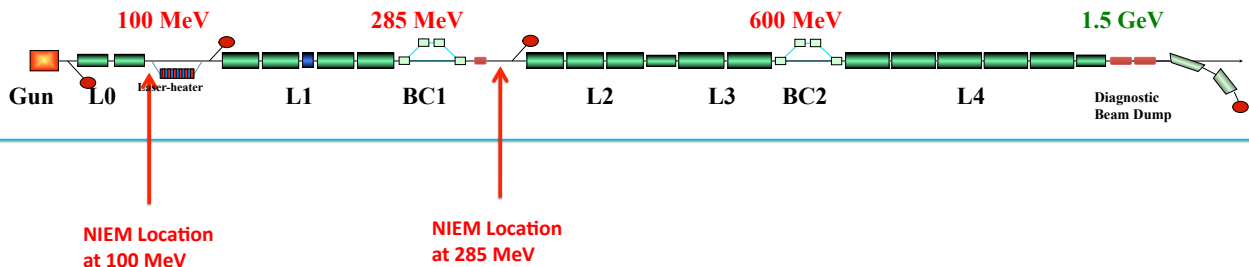
OSR Interferences from (1,2) shows sensitivity to dE/E (due to large angular dispersion)



OSR Interferences from (2,3) shows sensitivity to divergence (and essentially no sensitivity to dE/E)



FERMI Linac Tunnel (200m)



ELEGANT Beam Parameters Before and After Diagnostics Chicane for Two Beam Energies/Positions at FERMI@Elettra Demonstrates that NIEM is Non Invasive