

TRANSVERSE BEAM EMITTANCE MEASUREMENT BY UNDULATOR RADIATION POWER NOISE*

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Abstract

Generally, turn-to-turn power fluctuations of incoherent spontaneous synchrotron radiation in a storage ring depend on the 6D phase-space distribution of the electron bunch. In some cases, if only one parameter of the distribution is unknown, this parameter can be determined from the measured magnitude of these power fluctuations. In this contribution, we report the results of our experiment at the Integrable Optics Test Accelerator (IOTA) storage ring, where we carried out an absolute measurement (no free parameters or calibration) of a small vertical emittance (5–15 nm rms) of a flat beam by this new method, under conditions, when the small vertical emittance is unresolvable by a conventional synchrotron light beam size monitor. This technique may be particularly beneficial for existing state-of-the-art and next generation low-emittance high-brightness ultraviolet and x-ray synchrotron light sources.

Please see our Letter [1] for the details about our measurements of the transverse electron beam emittances using the turn-to-turn fluctuations of the undulator radiation power at the Integrable Optics Test Accelerator (IOTA) storage ring at Fermilab. The theoretical foundations of this method are described in Refs. [2, 3]. The design and the experimental program of the IOTA ring are described in Ref. [4].

REFERENCES

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