AIP Publishing Review of Scientific Instruments

No Access
Submitted: 10 July 2012
Accepted: 13 August 2012
Published Online: 04 September 2012

Optical transition radiation used in the diagnostic of low energy and low current electron beams in particle accelerators

Review of Scientific Instruments **83**, 093301 (2012); https://doi.org/10.1063/1.4748519

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ABSTRACT

Optical transition radiation (OTR) plays an important role in beam diagnostics for high energy particle accelerators. Its linear intensity with beam current is a great advantage as compared to fluorescent screens, which are subject to saturation. Moreover, the measurement of the angular distribution of the emitted radiation enables the determination of many beam parameters in a single observation point. However, few works deals with the application of OTR to monitor low energy beams. In this work we describe the design of an OTR based beam monitor used to measure the transverse beam charge distribution of the 1.9-MeV electron beam of the linac injector of the IFUSP microtron using a standard vision machine camera. The average beam current in pulsed operation mode is of the order of tens of nano-Amps. Low energy and low beam current make OTR observation difficult. To improve sensitivity, the beam incidence angle on the target was chosen to maximize the photon flux in the camera field-of-view. Measurements that assess OTR observation (linearity with beam current, polarization, and spectrum shape) are presented, as well as a typical 1.9-MeV electron beam charge distribution obtained from OTR. Some aspects of emittance measurement using this device are also discussed.

ACKNOWLEDGMENTS

The authors would like to thank Dr. Ralph Fiorito, from UMER, for his useful suggestions and discussions, to Dr. Roberto Onmori, and Mr. Celso Silva, from LME-POLIUSP, for the target manufacturing, and to Dr. Manfredo Harri Tabacnicks, Dr. Nemitala Added, and Dr. Marcel Dupret,

Brazilian funding agencies: FAPESP, CNPq and CAPES.

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