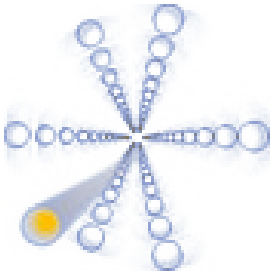

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Investigation of Optical Diffraction Radiation for Non-invasive Diagnostics in Circular Accelerators

Thursday, October 9, 2014 10:45 AM (15 minutes)

Diffraction Radiation (DR) is generated when a charged particle moves in the vicinity of a medium (e.g. passes through an opening in a conducting screen in vacuum). Non-invasive nature and a broad DR radiation spectrum enables to develop non-invasive beam diagnostics instrumentation for a variety of particle beam parameters, e.g. transverse beam size and position, emittance, bunch length, beam energy, arrival time, etc.

Optical DR (ODR) has intensively been investigated over the past two decades as a tool for non-invasive transverse beam size measurements [1-3]. In [1] the resolution as small as 14 μm was demonstrated. Later in [3] the authors have claimed to have achieved a similar resolution. However, modern and future accelerators require an order of magnitude smaller resolution, which informs us that new technological ideas and solutions need to be found.

Recently we have proposed an ODR technique for a Cornell electron synchrotron radiation Test Accelerator (CesrTA). Usually diagnostics based on synchrotron radiation are used in circular machines. One aim of the experimental work is to investigate the feasibility of ODR as an alternative method for beam size diagnostics. The second aim is to study the effect of a small slit onto the circulating beam.

We have designed the hardware system consisting of a vacuum vessel including a replacement chamber for normal operation and target assembly, optical light transport and detection system, and data acquisition. A series of experimental tests has been performed. In this report we shall present the experimental investigation of the beam lifetime, contribution of synchrotron radiation and its suppression, observation of ODR image and angular distribution (including ODR interference pattern produced by the SR suppression mask), prospects for the beam size measurement and the plan for the next three years.

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