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Optical diffraction radiation experiment at KEK-ATF2

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For future high current linear lepton machines, non-invasive beam size measurement systems based on Optical Diffraction Radiation (ODR) have been the subject of extensive research in the past years. We report here the installation and commissioning of a high resolution Optical Diffraction Radiation (ODR) experiment on the KEK-ATF2 electron beam-line in Tsukuba (JP). The experimental apparatus allows the observation of both transition radiation (OTR) and diffraction radiation (ODR). The aim is to develop beam size and beam position measurement systems that combines sub-micron resolution OTR for single bunch operation, and non-invasive ODR for full intensity beams with a typical resolution of 15 microns or better.

The setup being very versatile with a set of target slits and mask slits covering widths from 50 to 400 microns, multiple aspects of the ODR physics can be studied through a systematic study of the parameters (eg. target/mask size combination, ODR wavelength and polarisation etc.) to achieve the best beam-size sensitivity. The set of masks is positioned a few centimetres upstream the target to reduce the unwanted synchrotron radiation contribution generated by the ATF2 magnets. The mask also acts as a second source of light (forward ODR) and leads to the creation of an interference pattern together with the target signal (backward ODR) [2]. The beam size measurement is performed using the visibility of the angular interference pattern recorded in the far field region, while the observation of the target in imaging conditions can be used as a beam position monitor. The very first results of this ODR/OTR experiment will be presented by the author.

References

- [1] P. Karataev et al., "Application of optical diffraction radiation to a non-invasive low-emittance high-brightness beam diagnostics" In Hiroshima 2003, *Quantum aspects of beam physics* 111-118.
- [2] A. Cianchi, M. Castellano, L. Catani, E. Chiadroni, K. Honkavaara, and G. Kube "Non-intercepting electron beam size monitor using optical diffraction radiation interference" *Phys. Rev. ST Accel. Beams* 14, 102803 Published 28 October 2011.

Summary

We report here the installation and commissioning of a high resolution Optical Diffraction Radiation (ODR) experiment on the KEK-ATF2 electron beam-line in Tsukuba (JP).

Primary author: Dr KIEFFER, Robert (CERN)

Co-authors: Dr ARYSHEV, Alexander (KEK); KRUCHININ, Konstantin (Tomsk Polytechnic University); Mr BERGAMASCHI, Michele (RHUL); Dr TERUNUMA, Nobuhiro (KEK); Dr KARATAEV, Pavel (Royal Holloway, University of London); Dr MAZZONI, Stefano (CERN); Dr LEFEVRE, Thibaut (cern)

Presenter: Dr KIEFFER, Robert (CERN)

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