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Possible method of spatial sizes measurement of relativistic electrons beam with small longitudinal bunch length

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Possibility of practical realization suggested earlier methodic of electron beam sizes determination for electron bunches with short length by measurement of two-dimensional angular distributions of relativistic electrons coherent emission in a crystal for two distances between a crystal, where the radiation is born, and a coordinate detector [1] is analyzed. As an emission source the diffracted transition radiation is used. The minimum measured beam size is about 10–15 microns for electrons with energy above several GeV. The technique is weakly sensitive to pulse heating of the target if it does not destroy the crystal, and can be used on intense beams of linear accelerators creating x-ray free-electron lasers [2]. Influences of secondary electrons and photons outlet from a coordinate detector and the method applicability for different longitudinal bunch length are discussed. The limits of the technique applicability and sensitivity are presented.

References

1. I.E. Vnukov et al., // J. Surf. Invest.: X-ray Synch. Neutron Tech. 13 (2019) 515.
2. The European X-Ray Free-Electron Laser Technical Design Report, DESY 2006-097, 2007.

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