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Monochromaticity of Transition Radiation and Diffraction Radiation from Grating

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High interest in developing intense monochromatic THz sources is explained by its unique features, such as ionization absence and weak absorption in dielectric samples.

The linac at ATF KEK (Japan) can provide generation of electron bunches with length less than 0.15 mm. Therefore, it can produce THz/sub-THz radiation via coherent transition/diffraction radiation (TR/DR) mechanism. In order to produce monochromatic radiation, we investigated spectral characteristics of coherent TR/DR in the geometry where bunches interact/pass nearby with a periodical target (grating) instead of a flat metallic foil as for conventional TR/DR. As a result, a continuous spectral distribution, which is typical for TR/DR, is transformed into a spectrum with narrow spectral lines, so-called Grating Transition Radiation (GTR) [1] and Grating Diffraction Radiation (GDR).

We experimentally investigated a GTR/GDR spectral line shape for different grating tilting angle with respect to an electron beam and observed that for orientation angles much more than the inverse Lorentz factor there is some line splitting. In this report, we present spectral measurement results for two polarization components both cases and compare them with the preliminary simulation results.

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[1] G. Naumenko, A. Aryshev, A. Potylitsyn et al. NIM B 402, 153 (2017)

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