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Dielectric Concentrator for Cherenkov Radiation: Sensitivity and Field Near the Focus

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Recently we have reported on specific form of dielectric target that effectively concentrates Cherenkov radiation from a point charge into a small vicinity of the focus point [1]. It was shown that for decimeter-sized target made from typical dielectric (e.g., Teflon) and terahertz radiation frequencies, the field in focus can be around two orders of magnitude larger compared to the field at the surface of the target. In this report, we discuss the sensitivity of this device with respect to the deviation of charge's velocity from the designed velocity. We show that for terahertz frequencies and Teflon target the admissible perturbation in velocity is around hundredths of percent. With this deviation, we still obtain the expressed peak of the intensity near the focus. Stronger deviation results in absence of concentration. We also discuss the influence of frequency dispersion of the material. We derive asymptotic expressions for the field near the focus and consider radiation from finite length bunches.

[1] Galyamin S.N., Tyukhtin A.V. Phys. Rev. Lett. 2014. V. 113. P. 064802(1-5).

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