SPECTRAL AND ANGULAR CHARACTERISTICS OF VAVILOV-CHERENKOV RADIATION FROM A DIALECTRIC TARGET IN THE MILLIMETER WAVELENGTH RANGE

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The physical nature of Vavilov-Cherekov radiation (VCR) is considered as a dynamical polarization of the target material with macroscopic permittivity ε by an electron electromagnetic field, followed by the propagation of this excitation in a target with velocity $v = c/n$, where c is the speed of light in vacuum, n is a refractive index. For a medium of infinite size the Cherenkov emission is confined to the surface of cone with the cone half-angle θ_{Ch} (the angle between a direction of observation and the electron trajectory) which is defined by the well-known condition $\cos\theta_{Ch} = 1/n\beta$, where β is the electron velocity in units of c.

On the other hand, for relativistic electrons the characteristic transverse dimension of the electromagnetic field $\gamma\lambda$ (λ is the radiation wavelength, γ is the electron Lorenz-factor) has macroscopic scale. Hence, the VCR can appear when an electron traveling in the vicinity of a dielectric target. This fact was theoretically investigated in papers [1-4] and experimentally confirmed in the work [5].

For the non-invasive beam diagnostics of modern accelerators is more preferred the radiation geometry without direct interaction of the electron beam with the target. Therefore, in this paper we experimentally investigated the characteristics of VCR produced by the motion of the electron beam near the Teflon triangular prism.

The measurement spectral dispersion of the target material in the millimeter wavelength range, we used an interferometer with separation of the radiation flux at the two reflecting plates. Using the inverse Fourier transforms of interferograms, the radiation spectra were calculated. The result obtained in our experiment indicated that in considered geometry the Teflon target has spectral-angular dispersion. This fact we can use to construct the radiation spectrum and measuring the coherence threshold of VCR which are necessary to measure of electron bunch length.

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