Feasibility of Optical Cherenkov Radiation for a Detection of Tokamak Runaway Electrons with Energy up to a few MeV

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Recently authors of the work [1] proposed to use Cherenkov detectors to register runaway electrons generated in tokamak installations with energies from tens keV up to a few MeV. In the experiments [2, 3] we have measured Cherenkov radiation (ChR) characteristics generated by 400 keV electrons [2] and 6 MeV electrons [3] from thin quartz, leucosapphire and diamond plates. We have showed that for low energy electrons (less than 400 keV) a geometry of ChR detector can be chosen as traditional one with extraction of the ChR light through a plate surface perpendicular to an electron beam. Nevertheless, for relativistic electrons ($E_e = 6$ MeV) such a geometry doesn't allow to detect ChR and a plate has to be inclined respect to the electron beam. In the former case, a multiple scattering process in a plate leads to a significant "smoothing" of the ChR angular distribution, but for the latter one, this effect is suppressed. In the report we have simulated spectral-angular characteristics of ChR using GEANT4, compared with experimental data, and showed a necessity to choose measurements geometry for the required electron energy range, which depends on the radiator material also.

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References

[1] L.Jakubowski, M.J.Sadowski, J.Zebrowski, et al., Rev. Sci. Instrum. **81**, 013504 (2010).
[2] V.F.Tarasenko, V.I.Oleshko, M.V.Erofeev, et al., J. Appl. Phys. **125**, 244501 (2019).
[3] E.Kh.Baksht, A.V.Vukolov, M.V.Erofeev, et al. JETP LETTERS Vol. **109** No. 9 (2019).

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