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Feasibility of using optical Cherenkov radiation for non-relativistic ion beam diagnostics

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Optical transition radiation (OTR) is widely used for relativistic beam diagnostics. Recently such a technique was applied for transverse profile measurements at the GSI non-relativistic ion beam [1]. Authors of the paper [2] proposed a new method for measuring the ion energy based on the monochromatic optical Cherenkov radiation (ChR) from radiators with frequency dispersion.
This report considers whether these results could be applied to ion beams with finite transversal sizes, i.e., to more realistic Gaussian-like beam profiles. The consideration is done threefold –using different wave-nature-based ChR models [3,4] and using the standard corpuscular model via the Geant4 toolkit [5]. Besides ChR, the simultaneous registration of optical transition radiation is proposed as a tool for ion beam monitoring.
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[2] A.P. Potylitsyn et al. JETP Letters,115,p.439 (2022)
[3] V.E. Pafomov. Proc. P.N. Lebedev Phys. Inst. 44 25 (1971)
[4] S. Gogolev, A.Potylitsyn. Phys.Lett.A, 383, p.9 (2019)
[5] S. Agostinelli et al Nucl. Instr. Meth. A 506 p.250 (2003)

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