Ion beam diagnostics via optical Cherenkov radiation from a CVD-diamond radiator

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In this report, the potential of using optical Cherenkov radiation for diagnostics of the extracted ion beam at the NICA facility is investigated. A CVD-diamond plate, which exhibits dispersion of the refractive index, is used as the Cherenkov radiator. This ensures the formation of a narrow spectral line of radiation when observed at a fixed angle. Using GEANT4 simulation, the spectral characteristics and photon yield of the Cherenkov radiation have been determined, taking into account the configuration of the measurement setup in the SPD test zone. The spectrum is recorded at a 90 degrees angle relative to the beam using a Hamamatsu spectrometer via an optical path with a 4.5 mm diameter lens located 270 mm from the radiator. The simulation results for xenon ion beams with energies of 1–4.5 GeV/nucleon demonstrate the feasibility of monitoring the beam energy and its physical dimension using a single diamond plate. Experimental verification of the method is planned during the Nuclotron run in 2025–2026.