Numerical simulation verification of the miniature linear accelerator

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Miniature linear accelerators (MLA) are widely used in various fields of science and technology, including neutron generators development [1]. In this paper, the numerical simulation verification of the miniature linear accelerator with a Penning ion source is described. Experimental equipment and measurement methods are described in detail in [2]. The MLA operating characteristics were determined– the amplitude-time characteristics of current pulses (discharge and extraction currents) were measured. The neutron flux and extraction current dependences on discharge current at various accelerating voltages are obtained. Numerical simulation was carried out using the PIC (Particle-In-Cell) and MCC (Monte-Carlo Calculation) method implemented in the Tech-X VSim 9.0 software package. Separately, a gas discharge in a Penning source and its quasi-stationary mode are simulated. After that, the charged particles motion in MLA ion-optical system is calculated taking into account kinetic processes, sputtering of MLA target, target heating and thermal desorption of hydrogen isotopes under ion irradiation. The simulation final result is to obtain the neutron yield dependence on time and the neutron flux dependence on the extraction current, as well as validation with experimental data.

[1] Valkovic V 2016 *14 MeV Neutrons. Physics and Applications* (London, New York: CRC Press Taylor and Francis Group, Boca Raton)
[2] Mamedov N V, Gubarev A V and et al 2020 *Plasma Sources Sci. Technol.* **29** 1–9