Contribution ID: **342** Type: **Poster**

A LINEAR ELECTRON ACCELERATOR WITH AN ENERGY OF 8-50 MEV WITH INJECTION FROM AN ELECTRON SOURCE BASED ON CLUSTER PLASMA SYSTEMS

Wednesday, 13 July 2022 10:40 (20 minutes)

The problem of increasing of the acceleration rate in linear electron accelerators has been one of the key problems for modern accelerator physics for many years. The physical limit of the accelerating field strength for normal (50 - 100 MV/m) and superconducting accelerating structures (over 200 MV/m) has been practically reached, and therefore various new acceleration schemes are being considered, primarily plasma acceleration and wakefield acceleration [1].
It seems interesting to consider a system in which one can try to bypass the limitations inherent in photoguns (the dominant effect of the space charge in the near-cathode region during injection) and acceleration in the laser-plasma channel (low electron transmission coefficient in the acceleration mode, wide energy spectrum (up to 10%) and low repetition rate pulses, limited by the capabilities of laser systems) [2]. Many works have appeared devoted to the preliminary modulation of the beam in the plasma channel, which makes it possible to improve the spectrum of accelerated electrons by a factor of approximately 3–4 [3].
It is proposed to consider the possibility of using a bunch generated in a laser-plasma channel for injection into a traditional structure based on RF cavities. It is supposed to show that a plasma source of electrons based on cluster plasma can produce a short (from 0.1 to 1.0 ps) bunch of electrons with an energy of several hundred keV [4], which makes it possible to consider such a source as an alternative to the photocathode. Next, the beam must be captured into the acceleration mode in a normally conducting section operating on a standing wave and accelerated to an energy of 50 MeV with adjustable energy.
The features of such a source are considered, including the possible energy spectrum, and features of an electron bunch capturing with the achieved parameters in the acceleration mode will discuss in the report. All results of the beam dynamics simulation carried out using the BEAMDULAC package developed at the Department of Electrophysical Facilities of NRNU MEPhI [5].

1. Ya. Fineberg, Atomic Energy 6, p. 341 (1959)
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3. S. Polozov, V. Rashchikov, Cybernetics and Physics, 7 4 (2018), pp. 228–232.
4. A. Shkurinov et al., Journ. of the Optic. Soc. of America B, 38 11 paper 3515 (2021)
5. E. Masunov, S. Polozov, Nucl. Instrum. Meth. A 558, (2006)

The speaker is a student or young scientist

Yes

Section

1. Synchrotron and neutron radiation sources and their use in scientific and applied fields

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Session Classification: Poster session