PARAMETERS OF high-ENERGy ELECTRON COMPONENT of PLASMOIDS GENERATED UNDER AUTORESONANCE CONDITIONS IN A LONG MAGNETIC MIRROR

Andreev V.V., Novitsky A.A., Umnov A.M.

Peoples’ Friendship University of Russia, Moscow, Russia, temple18@mail.ru

The aim of the work was to determine the temporal characteristics of the energetic electronic component of plasmoids formed under gyromagnetic autoresonance (GA) conditions in a long magnetic mirror with a variable magnetic field profile experimentally and by computer simulation as well.

The experimental stand is an axisymmetric system in which a cylindrical high-frequency resonator (TE118) is placed in a stationary magnetic mirror created by three pairs of coils. Independent pair-wise feeding of the magnetic field coils allowed to reconstruct the topology of the magnetic field in accordance with the requirements of the experiments being performed. In the antinodes of the electric field of a standing wave, axisymmetric coils of a pulsed magnetic field are installed. The direction of the current in the pulsed coils ensures the creation of a magnetic field with a direction opposite to the stationary one. The change in the induction of a pulsed magnetic field in time provides:

• «reducing» of the stationary magnetic field to the level corresponding to the ECR value for the operating frequency of the resonator and the formation of plasma in two local zones;

• restoration of the initial profile of a stationary magnetic field, as a result of which the trapping and acceleration of electrons of the produced plasma is realized in two symmetric zones of the installation;

• dumping of generated plasma bunches into the central region of the trap.

The resonator was powered by a magnetron generator (2.45 GHz) with a power in the range 1.0 ÷ 2.5 kW in the mode of periodic rectangular pulses with a duration of 1 ms. The parameters of the generated plasma were diagnosed by scintillation spectrometry, and computer simulation was performed using a 3D numerical model based on the particle-in-cell method.

We experimentally determined the changes in the bremsstrahlung spectra from a gas target at different time intervals of the acceleration and confinement stages. A detailed analysis of the results obtained, together with the results of a computer simulation, made it possible to define the optimal parameters of the generated plasma bunches.

The analysis of the results obtained experimentally and by computer simulation made it possible to interpret their interrelation under the conditions of the real-life experiment scenario implemented.

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References

1. Andreev V.V., Novitskiy A.A., Umnov A.M., Chuprov D.V. Instruments and Experimental Techniques. 2012. Vol. 55. № 3. p. 301–312.
2. V.V. Andreev, A.A. Novitsky, A.M. Umnov IOP Conf. Series: Journal of Physics: Conf. Series 1094 (2018) 012013.