Calculation of Spectral-Time Characteristics of SXR Pulses At Gamma-4 Facility

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This paper presents results of predictive calculations of soft x-ray radiation pulses parameters at «Gamma-4» facility. This facility is currently being developed at RFNC-VNIIEF, it has four modules and intended for operation into single plasma load (Z-pinch).

The paper presents design scheme of a current summation unit. Parameters of refined two-loop equivalent electro-technical circuit of «Gamma-4» facility are determined in the paper.

A series of optimization calculations of Z-pinch was carried out in the frameworks of 0D model KART [1]. In the result, we found configuration parameters of a cylindrical liner array made of thin tungsten wires.

Two-dimensional magneto-hydrodynamic (MHD) simulation of the optimum Z-pinch is carried out. MHD calculations were run with use of FLUX-rz code that was developed in RFNC-VNIIEF. The calculation model considers radiation transfer in a multi-group diffusion approximation and description of the liner wires ablation process in the regime of prolonged plasma formation [2, 3].

In the result of performed numerical simulation, the authors obtained predictive characteristics of final Z-pinch plasma and spectral-time characteristics of generated SXR pulse at «Gamma-4» facility.

Performed 3D RMHD calculations of nested wire array of «Gamma-4» facility confirmed efficiency of SXR pulse generation at implosion of an optimum load. The load was selected based on the results of two-dimensional calculated scaling. Besides, these calculations predict absence of the relative angle orientation of the external and internal stages influence on the generated SXR pulses parameters.

References

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