Influence of the spatial inhomogeneity of X-ray heating of indirectly irradiated capsules on their compression and burning [[1]](#footnote-1)\*)

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G.A. Vergunova, S.Yu. Gus’kov, R.A. Yakhin

Lebedev Physics Institute of the Russian Academy of Sciences, 119991, Moscow, Russia, [vergunovaga@lebedev.ru](mailto:vergunovaga@lebedev.ru)

In this work, we study the compression and burning of indirect drive targets at various degrees of X-ray irradiation asymmetry. We consider targets that correspond to studies at the NIF facility and are relatively stable compressed under the action of an X-ray pulse. To initiate an X-ray pulse, a laser pulse with an increased intensity in its initial part (the so-called “high foot” pulse) was used. The use of such a pulse leads to a faster compression of the capsule with a shorter development time of hydrodynamic instabilities and a lower level of the amplitude of the initial perturbations due to thermal equalization. However, ignition has not yet been achieved, the maximum neutron yield is 2 x 1016.The main reason why ignition has not yet been achieved is considered to be an insufficient level of uniformity of the compression of a thermonuclear capsule at the energy delivered to the target by an X-ray pulse.

The simulation of the effect of low-mode violations of the spatial homogeneity of heating on the compression and burning of a thermonuclear capsule was carried out in a hybrid formulation [1]. Based on several one-dimensional (1D) calculations using the RADIAN code of radiation hydrodynamics [2], the distributions of temperature, density, and velocity of matter were obtained for different energies of the X-ray pulse at the moment of its termination. Based on these data, with a different choice of disturbance harmonics, the initial conditions for 2D calculation of further compression and combustion of a thermonuclear capsule were formed. Investigations carried out on the basis of two-dimensional numerical modeling using the NUTCY program [3] have shown a strong negative role of low-mode violations of the spatial homogeneity of heating of an indirectly drive thermonuclear capsule on the efficiency of its compression and burning. The main reason for this effect is the spatial shift of the regions of heated and compressed plasma at the end of the implosion. It is this effect that leads to the absence of a region of compressed plasma in which the ignition condition would be achieved - the plasma ion temperature exceeded 5 keV in the region with a surface density of at least 0.35 g / cm2. The neutron yield closest to the experimental value corresponds to the 2nd and 4th harmonics of the violation of the uniformity of the heating of the capsule with disturbance amplitude of about 3.4%. At the indicated disturbance amplitude, the negative influence of the 6th harmonic is much weaker. The influence of this harmonic, which is capable of lowering the neutron yield to the experimental value, manifests itself when the amplitude of perturbations of the heating inhomogeneity is approximately 2 times greater - about 7%. The research and numerical calculations of work was supported by the Russian Foundation for Basic Research (grant No. 19-02-00299-a).Research and numerical calculations of the work was supported by the Russian Foundation for Basic Research (grant No. 19-02-00299-a).

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/It/ru/DQ-Vergunova.docx) [↑](#footnote-ref-1)