STUDY OF THREE-DIMENSIONAL CUMULATION OF ENERGY AND SEARCH optimal configuration of quasi-spherical wire array at the Angara-5-1 [[1]](#footnote-1)\*)

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In studying the fundamental properties of matter at a high energy density in the range 105–106 J/cm3, including in works on controlled thermonuclear fusion, the spatial concentration of energy flows generated by powerful energy sources - energy drivers is used. One of them is a powerful X-ray source based on a Z-pinch discharge. The possibility of increasing the power flux from such a driver on the target surface is associated with the transition from cylindrical to spherical compression geometry. This will make it possible to concentrate the kinetic energy flux of the wire array not only along the radius, but also along the axis of the facility, as well as to obtain a more symmetric radiation flux to the target, which will give an additional gain in the concentration of the kinetic energy of the wire array and the retention of radiation energy. Studies were conducted on new configurations of quasispherical wire arrays, continuing a series of works performed on the Angara-5-1 facility [1]. In these works, quasispherical arrays with a diameter of 20 or 26 mm were used. Experiments with cylindrical arrays show that when the diameter is reduced from 20 mm to 10-12 mm, the power of soft X-ray radiation (SXR) of the Z-pinch triples on the Angara-5-1 facility. A significant increase in the power of SXR occurs when using nested arrays. Therefore, experiments were conducted with quasispherical arrays of small diameter, up to 13 mm, and nested quasispherical arrays, where the outer array was quasispherical and the inner one was cylindrical. In experiments with quasispherical arrays of small diameter, a decrease in the diameter of the pinch (on average from 3.4 mm to 2.5 mm), close in shape to the sphere, and an increase in the power of SXR (on average more than threefold) were recorded with a slightly lower compression ratio. This led to an increase in the energy density in the pinch to 7400 kJ/cm3. This is more than four times more than for cylindrical arrays with a diameter of 12 mm. When studying the implosion of nested arrays at peak currents of up to 3.5 MA, a more than threefold increase in the power density of soft X-ray radiation on the pinch surface at the maximum of the SXR pulse (up to 2 TW/cm2) was also obtained compared to a cylindrical array (0.54 TW/cm2). Note that in these experiments the maximum observed earlier [1] (in the region of 150 eV), associated with an additional contribution due to three-dimensional compression, axial plasma motion to the energy of the radiation source, is clearly manifested in the emission spectrum of quasispherical arrays.

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References

1. V.V. Aleksandrov, V.A. Gasilov, E.V. Grabovski, A.N. Gritsuk et al. Plasma Physics Reports, 2014, Vol. 40, pp. 939–954.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/It/ru/CY-Gritsuk.docx) [↑](#footnote-ref-1)