OBTAINING POWERFUL X-RAY PULSES DURING IMPLOSION OF NESTED ARRAYS OF MIXED COMPOSITION AT ANGARA-5-1 FACILITY [[1]](#footnote-1)\*)

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The experimental results on the study of soft X-ray pulses generation (SXR, *h*ν>100 eV) during plasma compression of two-stage nested arrays from mixed composition with a different ratio of cascade radii carried out on Angara-5-1 pulsepower facility at a discharge current level up to 3.5 MA are presented. The outer cascade consisted from a substance with a small atomic number (thin plastic fibers), the inner cascade consisted from a substance with a high atomic number (thin tungsten wires). It was previously shown that in the case this design of nested arrays, it is possible to obtain a significant increase in the peak power of the SXR compared to single W-arrays with a same parameters as the W-array in the inner cascade [1, 2]. By optimizing linear mass of the outer cascade and the ratio of a cascades radii, powerful SXR pulses with a high amplitude up to 18 TW, an energy of ~ 140 kJ and a short duration of ~ 5 ns (see Table 1).

*Table 1. Optimal parameters of the SXR pulse.*

|  |  |  |  |
| --- | --- | --- | --- |
| Ratio of radii of cascades *rin*/*rout* | Linear mass of the outer cascade *mout*, μg/cm | Number wires of the internal cascade *Nout* and their linear mass *min*, μg/cm | Parameters of the SXR pulse |
| *PSXRmax*, TW | *ESXR*, kJ | *FWHM*, ns |
| 0.8 | 23-50 | 40W, 220 | 14-16 | ~140 | ~7.5 |
| 0.65 | 5-10 | 40W, 220 | ~17 | ~140 | ~6.0 |
| 10-17 | 60W, 330 | 17.5-18.3 | ~140 | ~5.3 |
| 0.5 | ~10 | 40W, 220 | ~15 | ~120 | ~5.0 |
| ~10 | 60W, 330 | ~18 | ~140 | ~6.0 |
| Note: cells with optimal parameters are highlighted in gray. The radius of the external cascade in all shots was *rout*=1.0 cm. |

At the same time, an increase in the share of X-ray energy in the spectral range λ∈(30, 40) Å was registered in the SXR shots optimal in output power, which is 30-100% higher compared to single W-arrays with similar parameters.

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References

1. *Mitrofanov K.N., Aleksandrov V.V., Branitski A.V., et. al.* // Plasma Physics Reports. 2021. V. 47. N. 10. P. 967-995.
2. *Mitrofanov K.N., Aleksandrov V.V., Branitski A.V., et. al.* // Plasma Phys. Control. Fusion. 2022. V. 64., N. 4. P. 045007-1-045007-24.
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/It/ru/DV-Mitrofanov.docx) [↑](#footnote-ref-1)