Neutron production from structured targets irradiated by an ultrashort laser pulse [[1]](#footnote-1)\*)

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1,2S.G. Bochkarev, 1,3D.A. Gozhev, 1,2A.V. Brantov, 1,2V.Yu. Bychenkov

1P.N. Lebedev Physics Institute, Russian Academy of Sciences, 119991 Moscow, Russia,  
 [bochkaeevsg@lebedev.ru](mailto:bochkaeevsg@lebedev.ru)  
2All-Russia Research Institute of Automatics, ROSATOM, Moscow, Russia  
3International Laser Center of M.V. Lomonosov Moscow State University

The acceleration of charged particles and the generation of secondary radiation under the action of relativistically intense laser radiation is of great interest for fundamental research and possible applications in nuclear physics, medicine, inertial confinement thermonuclear fusion, and laboratory astrophysics, for creating compact sources of X-ray radiation, accelerated ions, and secondary neutrons [1-5]. The characteristics of laser-accelerated particles strongly depend on the interaction conditions and the type of target used. The demand for compact sources of secondary radiation prompts the search for acceleration mechanisms and laser-target interaction schemes in order to optimize the characteristics, increase the efficiency and energy of accelerated particles. An important role in this context is played by innovative micro- and nanoscale targets, including targets with ordered or random surface outgrowths in the form of micro-wires (micro-grass) of submicron size, targets with micro-channels, targets from nanotubes, as well as targets with a surface in the form of micro-layers, grooves, cones, spheres, etc.

In this work Laser-initiated generation of thermonuclear neutrons from targets with a microstructured surface in the form of deuterated micro-wires has been studied using three-dimensional numerical simulation, using the previously obtained results of large-scale structural optimization of the target, which provides its best heating by femtosecond laser pulses of moderate intensity. It is shown that, for modern laser technologies, femtosecond lasers of low (multi-mJ) energy are even more preferable for creating a neutron source than more powerful (~1 J) lasers due to the practically available mode of high (~1 kHz) pulse repetition rate. Micro-layers (relief) and cylindrical micro-holes on the irradiated side are considered as alternative microstructured targets. For the latter, the accumulation of ions on the axis of the holes was demonstrated, leading to an increase in the ion density above the initial value, and, as a consequence, to a possible increase in the yield of thermonuclear neutrons.

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References

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