Simulation of magnetic configurations with negative triangularity for the T-15MD tokamak [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.040

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Most modern tokamaks, including the ITER tokamak-reactor that is under construction, have a divertor magnetic configuration with a D-shaped plasma wire. Typical values of plasma cross-section elongation are ε = 1.8-2.5 and triangularity δ = 0.2 – 0.4.

In 1997, on the TCV tokamak a discharge with negative triangularity was obtained for the first time, which was characterized by some improvement in confinement [1]. In 2019, TCV and DIII-D devices produced configurations with a significant improvement in plasma confinement in discharges with negative triangularity compared to similar configurations with positive triangularity [2, 3]. It is known that the transverse transport of energy and particles in a tokamak is anomalous and is associated with turbulent processes. The causes and mechanisms of the negative triangularity effect on plasma turbulence, which leads to improved confinement, have not been investigated yet and are an relevant problem of modern research in the field of magnetic plasma confinement.

Currently, a modernized tokamak T-15MD is under construction in the NRC “Kurchatov Institute”, the basic single-zero divertor configuration of which will have a small radius a = 0.67 m; ε = 1,75; δ = 0,317 [4]. Preliminary calculations have shown that this installation has sufficient flexibility, the ability to change configuration parameters, including the position of the x-point of the separatrix and the the intersection point of the separatrix with the surface of divertor [5], and the plasma volume [6]. An important part of the T-15MD scientific program is the study of stationary and variable electric fields (zonal flows and GAM) and their influence on turbulence and plasma transport [7].

The possibility of creating configurations with negative triangularity on the T-15MD using the existing system of poloidal field coils is of interest to the scientific device program and is the aim of this work.

The study of the influence of currents in poloidal field coils on the triangularity of the plasma wire section in T-15MD using calculations of stationary magnetic configurations using the TOKAMEQ code [8] has shown the possibility of obtaining equilibrium configurations with different values of negative triangularity. Pairs of configurations were found that are identical in basic geometric parameters (plasma volume, small radius, elongation, etc.) and equal in absolute value of triangularity, differing only in its sign. Based on estimates of the maximum heating of poloidal coils [9], the possible discharge duration for the found pairs of configurations was estimated.

Further research is aimed at analyzing the stability of the found configurations.

The work was supported by the RSF, project 19-12-00312.

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