Low-ASPECT Ratio SUPERCONDUCTInG TOKAMAK WITH A FIELD OF 5 T [[1]](#footnote-1)\*)

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At present, a low-aspect elongated T-15 MD tokamak with the water-cooled toroidal field coils is under construction at the Kurchatov Institute [1,2]. This machine has the following parameters: *R* = 1.5m, *a*=0.67 m, *B* 2T, *Ip* 2 MA, plasma elongation 2 and discharge duration 10 sec. Unfortunately, four devices in the world (DIII-D, ASDEX, HL-2A, KSTAR), which have been operating for 10-30 years, have similar parameters. In order not to lag further in the development of the program, we need to provide for the construction in the near future of a superconducting machine with an increased field and significantly longer plasma shots. Estimates show that using our wide experience, this may be a machine with superconducting coils of the same size as the T-15MD, but with a steady-state field of about 5 T. For this, it is necessary to use the technology that we proposed for the TIN magnet in a report [3], where. the windings takes up part of the load on the coil case that helps the case withstand enormous loads from a high magnetic field in the central part of the magnet. We propose to use a Rutherford-type flat cable which consists of three-core subcables and additionally folded along the axis. Cables contain three types of superconductors: HTSC at the high field region of 9 – 12.5 T, Nb3Sn in the middle (4 – 10 T), and NbTi outside. The outer cryostat housing is welded from 3-4 mm stainless steel plates. Thermal insulation made of multilayer mylar. The nitrogen screen consists of two steel sheets, welded by spot welding and hydraulically inflated. The coils inside the cryostat are in vacuum. Cables, screening and insulation technologies are widely used in accelerators.

The coils are cooled by low-pressure flow of liquid He through numerous thin channels. It is possible to use numerous coolers instead of a large cryogenic system. A 20 cm shift of the outer part of the coils relative to that installed in the T-15MD leads to a decrease of the toroidal field ripple at the outer plasma boundary from 1% to 0.35%. Changing the shape of the coil will increase the horizontal angles of access to the ports that crucial for heating beams and several diagnostics. The magnetic system will use the experience obtained during creation and launching of magnets in China, Korea and India with our assistance.

References

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2. Melnikov, A.V., Sushkov A.V., et al. Fusion Eng. Design 98-99 B (2015) 306-310
3. Ivanov D., Anashkin I., and Kolbasov B. 25th Fusion Energy Conf. (FEC 2014) FIP/P7-10
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVII/Mu/ru/BC-Ivanov.docx) [↑](#footnote-ref-1)