Opportunities for REFLECTOMETRY ON THE T15-MD tokamak [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2021.48.1.062

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Studies of transport processes in high-temperature plasma of tokamaks shows that nondiffusion transport and turbulence play an important role in the transport of particles and heat in a discharge. To study turbulent processes in plasma, various diagnostics are used: plasma probing with a beam of heavy ions, active recombination spectroscopy, reflectometry, Langmuir probes, etc. Reflectometry is an active diagnostic that uses the reflection of a probe signal from the plasma in the microwave range. An electromagnetic wave of a given frequency is reflected from a plasma layer, the position of which depends on the local values ​​of the electron density, temperature, and magnetic field. Analysis of the reflected signal allows one to estimate the parameters of the plasma. The main contribution to the signal is made by disturbances in the plasma region near the critical layer, which allows measurements with a high spatial and temporal resolution. Modern microwave generators can change the frequency of the probe signal at high speed. This makes it possible to change the frequency during the discharge and to carry out measurements in different regions of the plasma column during one discharge. Previously, fast scanning systems have been implemented to measure plasma electron density profile.

Both reflectometry at a constant frequency and a system with a variable frequency of the probing signal during the discharge are supposed to be used at T-15 MD tokamak. To determine the optimal parameters of the system, the positions of the reflection region of the probing signal were estimated for the ordinary and extraordinary waves in the regime with magnetic fields of 1, 1.5, and 2 T. The analysis showed that measurements using an ordinary wave during the main operating mode of the plant (2T) can be held on the side of the high magnetic field and part of the gradient region on the side of the low magnetic field. In this case, there is a region on the side of a weak magnetic field, which is inaccessible for observation due to the presence of resonance at the electron cyclotron frequency. It should be noted that it will be possible to carry out measurements from the side of a weak magnetic field at an ordinary wave in this region in case of small attenuation of the signal due to absorption in the electron cyclotron resonance. Using the lower cutoff of the extraordinary wave, most of the plasma column is available for observation. Also, at lower values ​​of the magnetic field, it is possible to carry out measurements using the upper cutoff of the extraordinary wave.

It is proposed to use 4 antenna units (3 from the side of the low magnetic field and 1 from the side of the high magnetic field), which will allow both correlation measurements of turbulence parameters and measurements with a fast changing probe frequency in several ranges to measure the electron density profile. Using the equipment previously used at the T-10 control systems and microwave generators, it is possible to carry out measurements in the range from 9 to 60 GHz. One of the promising possibilities of reflectometry at the T15 is a slow scanning mode for determining the spectra of fluctuations of the electron density at various radial positions in a short period of time (tens of milliseconds). For this, the data acquisition system includes 16-bit ADCs with a 10 MHz bandwidth.

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