HF launching system at the stage of the physical start-up of the t-15md tokamak [[1]](#footnote-1)\*)

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Along with the physic problems associated with Electron Cyclotron Resonance (ECR) plasma heating at the T-10 tokamak, a number of experiments were carried out on stabilization of the neoclassical tearing mode and control of sawtooth oscillations [1]. A steerable launcher (in toroidal and poloidal directions) for the ECH system have been designed and installed in one of the vacuum ports of the tokamak for this purpose. In order to increase HF power density in the ECR zone two mirrors with special profiles focused the launched beam. Calculations for this launcher system were made in the IAP RAS (Nizhny Novgorod city). The level of power density, in beam’s cross section, have reached a value of 250 kW/cm2 with a half-width of the focal spot equals to 0.8 cm at the power level e-1. Input power was about of 500 kW. Relatively small diffraction losses were estimated as 8%. This steerable launcher was later successfully used in experiments on microwave breakdown at the 2nd Harmonic of ECR in the X mode [2,3].

One 1 MW, 82.6 GHz gyrotron is planned to perform the pre-ionization of the gas, at the stage of the physical start-up of the T-15MD tokamak. T-10 ECH launcher is going to be used as a prototype for the launcher of this gyrotron. According to the estimations, which were made for the value of magnetic field at the geometric axis of the toroidal chamber Bt=1.3 T, breakdown should occur in the central region of the cross section of the torus. The distance from the second mirror to the ECR zone, in this case, will be 1.1 meters. The HF power density in focal spot is estimated as 300 kW/cm2 with a beam half-width of 1 cm at the power level e-1. Diffraction losses do not exceed 2%. The system also provides beam launching at various angles in toroidal and poloidal directions.

In addition to pre-ionization of the working gas, it is also possible to carry out experiments on ECR plasma heating. The maximum gyrotron pulse duration is about 30 s, therefore, after the breakdown of the gas, gyrotron can start to operate the ohmic stage of discharge and during the changing of toroidal magnetic field, in order to shift the region of the power deposition. Calculations performed using the DINA code [4] showed that the T-15MD electrical complex allows, for example, raising Bt from 1.2 T to 1.5 T in about 300 ms.

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References

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