DEVELOPMENT PROGRESS of the DUAL HEAVY ION BEAM PROBE DIAGNOSTIC at THE T-15MD TOKAMAK [[1]](#footnote-1)\*)

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The study of electric fields arising in magnetized fusion plasmas and their influence on energy and particle confinement is an important problem of plasma physics. Heavy Ion Beam Probe (HIBP) is a tool to measure the electrostatic potential and, as a consequence, the radial electric field, both at the periphery and at the center of the plasma column in tokamaks and stellarators [1, 2]. In addition, the HIBP diagnostic allows one to measure local oscillations of the electric potential and electron density simultaneously and independently at different spatial regions, which opens up opportunities for studying broadband turbulence, zonal flows [3] and Alfvén modes [4].

The dual HIBP diagnostic is proposed for the T-15MD tokamak, the largest in Russia, commissioned at the NRC “Kurchatov Institute” (major radius R = 1.48 m, minor radius a = 0.67 m, aspect ratio A = 2.2, toroidal magnetic field on the axis Btor ≤ 2 T, plasma current Ipl ≤ 2 MA) [5]. Two similar HIBP systems will be installed in different poloidal cross-sections, shifted 90 degrees around the torus [6]. The arrangement will allow studying both poloidal and toroidal correlations of the electric potential and electron density [7]. The development and design of HIBP diagnostic requires preliminary calculations of the probing ions trajectories in the magnetic field of a tokamak, which has a complex three-dimensional configuration. The equations of probing ions motion in the T-15MD magnetic field are solved with the 4th order Runge-Kutta method implemented in the HIBP SOLVER code [8]. Based on the results of the calculations, detector grids (plasma regions accessible for measurements) are obtained, and the probing beam attenuation when passing through the plasma is estimated. The concept of a double secondary beamline is proposed to detect secondary ions from both the peripheral and central regions of the plasma column. Additionally, the formation and focusing of the diagnostic beam in the injector is simulated, and the values of focusing and extracting voltages to obtain a quasi-parallel beam are determined. The simulation results will be tested on the experimental bench, which is being prepared for commissioning [9].

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