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AN ALGORITHM FOR PLASMA DENSITY RECOVERY BY HEAVY ION BEAM PROBING DEVELOPMENT AND ITS SENSITIVITY TO INPUT DATA ERROR STUDY BASED ON THE TJ-II STELLARATOR AS AN EXAMPLE *)

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The study of anomalous particle and energy transport across the confining magnetic field in closed magnetic traps – tokamaks and stellarators – is one of the most important problems in plasma physics. When analyzing the transport coefficients, it is necessary to know the plasma density n_e and temperature T_e stationary values radial distribution with an accuracy sufficient for gradient analysis. To improve the reliability of measurements, various diagnostic methods based on different physical principles are used [1-4].

This paper describes an algorithm based on minimizing the residual functional between the model and experimental distribution of the secondary beam current from the heavy ion beam plasma probing (HIBP). When reconstructing the density profile, the average density data obtained from the central chord of the interferometer are taken into account. In a numerical experiment, various types of plasma density profiles are simulated, from which the measured secondary beam current is calculated. Then, a random perturbation is imposed on the current and the inverse problem of the plasma density reconstructing from the perturbed parameters is solved. As a result of multiple repetitions of this procedure, the mathematical expectation and dispersion of the reconstructed local values of plasma density are found, which allows us to estimate the accuracy of reconstruction depending on the error of the input data.

The numerical study results of plasma density profile reconstructing accuracy are presented using as the example TJ-II stellarator. The developed algorithm for determining the density and estimating the error of reconstruction can be used in processing the experimental data of the HIBP on the T-15MD tokamak and other installations.

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