

DOI: 10.34854/ICPAF.51.2024.1.1.072

## MODELING OF ION-OPTIC SYSTEM OF ACTIVE CORPUSCULAR PLASMA DIAGNOSTIC SYSTEMS WITH CONSIDERATION OF ION BEAM SPATIAL CHARGE <sup>\*)</sup>

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Intensive ion beams are used in heavy ion beam probing (HIBP) diagnostics [1] and beam emission spectroscopy (BES) [2]. The T-15MD tokamak is being designed for HIBP diagnostics based on solid-state thermionic sources.

The absolute value of the ion beam current determines the level of the obtained signal, while the transverse size determines the spatial resolution. Due to the presence of spatial charge, the increase of intensity leads to the increase of beam defocusing and deterioration of measurement localization. The beam parameters (ion current, energy, diameter and angular divergence) are controlled by an ion-optical system (IOS). Preliminary modeling in computer-aided engineering (CAE) systems is a necessary stage of IOS design, because it allows selecting optimal parameters of its geometry: dimensions, shape of electrodes and distances between them.

When modeling the IOS, it is necessary to take into account the spatial charge distribution along the beam trajectory and the spallation created by it. The existing software does not have sufficient functionality for solving the problem of ion beam tracing in the IOS of HIBP and BES. The problems are related to the difficulty of integration of calculation results into existing diagnostic codes, low degree of automation, high requirements to computing power of computers, impossibility to model partial neutralization of the beam in situ, etc. The report presents a method of modeling and simulation of ion beam in situ.

The report presents a method of modeling the ion-optical system of active corpuscular diagnostics based on the calculation of the stationary envelope of the ion beam and compatible with the existing computer program HIBP-SOLVER [3]. It allows calculation under conditions of partial neutralization of the beam. The work was carried out within the state assignment of NRC «Kurchatov institute».

### References.

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<sup>\*)</sup> [abstracts of this report in Russian](#)