Contribution ID: **437** Type: **Oral talk (15 min + 5 min questions)**

MODELLING OF ION TRANSFER PROCESSES IN A MAGNETO-OPTICAL SYSTEM OF SOLENOIDS AND MAGNETIC QUADRUPOLE LENSES WITH DISCRETE FLOW COMPACTION

Friday, 15 July 2022 17:50 (20 minutes)

To optimize the processes of nuclear fusion on the ion-plasma generator [1], a model was constructed that describes the dynamics of particle motion inside the fusion chamber. The synthesis chamber is a magneto-optical system of solenoids and quadrupole lenses, thereby performing the functions of confining and focusing ion flows. Using known formulas for the magnetic field of a finite-dimensional solenoid [2] and solving these equations numerically, it is possible obtain the distribution of the magnetic field for a system of solenoids. Performing a similar calculation for magnetic quadrupole lenses, it is possible calculate the superposition of a system of such fields, thereby obtaining the general picture of the magnetic field inside the synthesis chamber presented in [1].
The plasma dynamics inside the synthesis chamber can be described using the equations of magnetohydrodynamics. In our case, the plasma moves in a magnetostatic field, but which varies discretely. Calculations have been made for individual magnetic quadrupole lenses consequence for charged particle flows compacting in strong magnetic fields, including pulsed ones, and their advantages have been well studied and known [3–5]. Ion fluxes are considered as an ideal gas when describing particle velocities and describe them by Maxwell's equation. By changing the parameters of the magnetic lens, it is possible to change the parameters of the currents inside the synthesis chamber, which just affect the distribution of particles in space, which leads to a more structured target for more accurate further analysis bombardment by other streams. As the result of the work, graphical dependences of the distribution of microcurrents and concentrations in the optimal sequence of solenoid and quadrupole magnetic fields are obtained.

1. Dolgopolov M.V., Radenko V.V., Zanin G.G. etc. 2022 Electronically Controlled Plasma Power Devices for Sustainable and Environmentally Friendly Electric Energy Technologies // Advances in Engineering Research. Issue 210. P. 197-205 2 Callaghan E. E., Maslen S. H. 1960 NASA Technical Note D-465
2. Watterson J I W, 2000 International Atomic Energy Agency 31 P. 5-14
3. Dolgopolov M V et al., 2019 EPJ Web of Conferences 222 02014
4. Tyrsa V E, Burtseva L P, 2003Technical Physics 48(7) P. 807-812

The speaker is a student or young scientist

Yes

Section

1. Design and development of charged particle accelerators and ionizing radiation sources

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Session Classification: Design and development of charged particle accelerators and ionizing radiation sources