Numerical Simulations of Electron Beam Neutralization by Backstreaming Ions in LIA

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Numerical modeling of interaction between intense electron beam and target plasma in LIA accelerator is presented. Well-focused electron beam hit tantalum target that causes producing of high-density target plasma. This plasma consists of electrons and ions of tantalum and different contaminations adsorbed on the target surface [1]. Because of negative potential of the electron beam, ions from target plasma forms upstreaming flow. Interaction between electron beam and ions causes disrupting effect on beam’s focusing.

We used particle-in-cell code KARAT [2]. For modeling we used the next parameters: electron beam energy 2 MeV, current 2 kA, beam radius 2.5 cm, focusing length 10 cm. Numerical calculations showed, that significant defocusing of the electron beam occurs in about 10 ns for H+ ions emission and about 100 ns for Ta3+ ions emission. The final spot size is about 10-15 mm. In the space-charge limited mode H+ ions current is (3-6) A.

References

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