

MAGNETIC STRUCTURE OF VINIS ION SOURCE

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An electron cyclotron resonance (ECR) ion source is a plasma source of multiply charged ions with the magnetic confinement. Its magnetic structure is composed of two or more solenoids, forming a magnetic mirror, and a multipole. The solenoids enable the axial confinement of ions and electrons. The multipole is used to ensure the radial confinement of the charges in the whole system. Besides, the multipole considerably increases the plasma stability - it damps the low frequency plasma turbulence.

VINIS is a two stage ECR ion source. In the first stage the plasma is formed and in the second the multiply charged ions are generated. Its magnetic structure consists of three solenoids and a hexapole. All these magnetic elements are superconducting. The distance between the first and third solenoids is 120 cm while the radius of the vacuum chamber is 17 cm. The first and third solenoids have 560 kAt each and the second one has 200 kAt. The minimal and outgoing maximal values of the magnetic induction on the axis of the system are 0.47 and 0.98 T (the corresponding value of the mirror ratio is 2.1). The hexapolar coils have 320 kAt each. In the median plane the ratio of the values of the magnetic induction at the wall of the vacuum chamber and at the axis of the system is 1.9-2.0. The resonant frequency in the first stage is 28 GHz and in the second 20 GHz; the corresponding values of the magnetic induction are 1.00 and 0.71 T. The resonant surface in the second stage has an ellipsoidal form; its axial dimension is 57 cm and the radial one is 14 cm. For the resonant frequency of 14 GHz these dimensions are 20 and 8 cm, respectively. The variation of the magnetic field in the system is sufficiently small to satisfy the condition of adiabatic motion of the charges.