

TRANSPORT OF THE BEAM FROM VINIS ION SOURCE

D. Ćirić

Laboratory for Physics, Boris Kidrič Institute
P.O.Box 522, 11001 Beograd, Yugoslavia

The beam guiding system for the transport of multiply charged heavy ions from VINIS ion source to the Vinča cyclotron is considered. In the preliminary design of this system a special attention was devoted to some specific features of the beam extracted from an ECR ion source. High value of the emittance of the beam (several hundreds mm mrad at 10 kV acceleration voltage) requires the application of high aperture-low aberration optical elements. As the momentum spread of the beam is also high ($\sim 1\%$ at 10 kV acceleration voltage), the achromatic systems for charge separation and beam bending are used. The ultra high vacuum in the beam guiding system is necessary in order to minimize the beam losses caused by the charge exchange processes.

The ion source VINIS is held on the high positive potential (~ 10 kV). By using the system of electrodes the beam is extracted from the source and accelerated to its final energy. The initial angular divergence of the beam is reduced with the system of electrostatic lenses. The beam is then deflected by 90° achromatic bending system. This subsystem enables the charge separation with the resolving power of $z/\Delta z \sim 50$. The emittance of the single charge ion beam is measured by an emittance measuring device. This beam can be deflected from the main guiding system (by an electrostatic deflector), to enable the use of low energy multiply charged ions for the experiments in atomic and solid state physics. The beam is transported in the vicinity of the cyclotron by using the telescopic system of quadrupole doublets. Finally, the beam is deflected by another 90° achromatic bending system and injected axially into the cyclotron through the bore in the upper part of the cyclotron magnet yoke.

Different subsystems of the beam guiding channel were calculated using the first-order optics. The required pressure in the 20 m long beam guiding channel was estimated to $\sim 4 \times 10^{-8}$ mbar.