

Optics of ion beams for the neutral beam injection system on HL-2A Tokamak

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The ion beam optics for the neutral beam injection system on HL-2A Tokamak is studied by two-dimensional numerical simulation program firstly, where the emitting surface is taken at 100 Debye lengths from the plasma electrode. The mathematical formulation, computation techniques are described. Typical ion orbits, equipotential contours, and emittance diagram are shown. For a fixed geometry electrode, the effect of plasma density, plasma potential and plasma electron temperature on ion beam optics is examined, and the calculation reliability is confirmed by experimental results. In order to improve ion beam optics, the application of a small pre-acceleration voltage (~ 100 V) between the plasma electrode and the arc discharge anode is reasonable, and a lower plasma electron temperature is desired. The results allow optimization of the ion beam optics in the neutral beam injection system on HL-2A Tokamak and provide guidelines for designing future neutral beam injection system on HL-2M Tokamak. © 2012 American Institute of Physics. [<http://dx.doi.org/10.1063/1.4737184>]