A three-dimensional code is developed to investigate the characteristics of the ion extraction systems for ion optical system. Charge-exchange (CEX) ions play a profound role in the failure of ion thrusters due to erosion of the accelerator grid. Immersed finite elements (IFE) and particle in cell methods are adopted to simulate the motion of ions. Numerical simulation represents the accelerator-grid impingement pattern and the beamlet profile on the accelerator grid. In order to accurately represent the neutral number density which is critical to CEX ion production rate and deduce the magnitude of background effects, background gas has been added to the simulation case in this paper for comparison. It is shown that the accelerator-grid impingement-current characteristics which take CEX affect into account agree well with the experiment result.