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The flow through a long rectangular channel and the angular distribution of the emitted molecules

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In order to realize a non-destructive and fast 2D profile monitor for an accelerator, we are now developing a dense gas sheet target in a vacuum, applying the beaming effect as used in the field of vacuum technology.
Test-particle Monte Carlo simulations revealed that the long rectangular channel with the very small ratio of the gap to the width is effectual to form the thin gas sheet.
For example, the fraction of outgoing molecules within the azimuth of 0.01 rad becomes 25% of all molecules with the parameter set of L : a : b = 100 : 50 :0.1. Here, the letters a, b, and L represent the length of the long and short sides, and the length of the channel, respectively.
By the way, when the flow through the rectangular channel is increased to obtain a dense gas target, the intermolecular collisions in the channel will increase and change the characteristics of the flow. Actually, many authors simulated the long channels as well as a capillary, and discussed about the influences of the intermolecular collisions in the channels. However, there are not so many experiments.
Thus, we have examined the flow through the long rectangular channel, especially to survey the influences on the performances of the gas sheet.
1) In the relation of the flow rate and the inlet pressure, the conductance decreases from the value for the perfect molecular flow and reaches at the Knudsen minimum as the pressure increases. The value at the Knudsen minimum is about a half of the molecular-flow conductance.
2) Angular distributions of the emitted molecules from the rectangular channel have been examined as a function of the inlet pressure. The distribution, which has an influence on the thickness, changes synchronizing with change of conductance.
The experimental details of the rectangular channel will be shown in the conference.

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