

Simulation Study of Space Charge Compensation in Negative Hydrogen Ion Beam

Ailin ZHANG,^{1,2} Shixiang PENG,^{1,a)} Tao ZHANG,¹ Jingfeng ZHANG,¹
Haitao REN,¹ Yuan XU,¹ Zhiyu GUO¹ and Jia'er CHEN^{1,2}

¹ SKLNST & IHIP, School of Physics, Peking University, Beijing 100871, China

² University of Chinese Academy of Sciences, Beijing 100049, China

^{a)}Corresponding Author: PENG ShiXiang, e-mail address : sxpeng@pku.edu.cn

Negative hydrogen ion beam can be compensated by the trapping of ions into the beam potential. However, high gas pressure may cause serious negative hydrogen ion beam loss and low gas pressure may lead to ion-ion instability, which means practically total decompensation of the beam and unacceptable angular scattering. In this paper, we presented the study results of space charge compensation in negative hydrogen ion beam using an improved PIC-MCC code, which has been successfully applied to H⁺ beam compensation with Ar gas [1]. All impacts are carefully treated in order to help us to understand the compensation process. The results of the beam simulations was compared with current and emittance measurements of an H⁻ beam from a 2.45 GHz microwave driven H⁻ ion source in Peking University. Compensation gas such as He, Ar were injected directly into the beam transport region to modify the space charge compensation degree. The simulation results were in good agreement with the experimental results.

References

[1] ZHANG AiLin, PENG ShiXiang, REN HaiTao, XU Yuan, ZHAO Jie, ZHANG Tao, GUO ZhiYu & CHEN JiaEr, Simulation Study of Space Charge Compensation in Low Energy Beam Transport. CPAC'14, 2014, WuHan, China, Huazhong University of Science and Technology.