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Electron Stripping Rates of H^- Ion Beam in the 80 kV High Voltage Extraction Column and Low Energy Beam Transport Line at LANSCE

Ilija N. Draganic

Los Alamos National Laboratory, Los Alamos, NM, 87544, USA

Corresponding Author: Ilija Draganic, e-mail address:draganic@lanl.gov

Detailed vacuum calculations were performed for various operating conditions of the LANSCE H^- Cockcroft-Walton (CW) injector and the LANSCE Ion Source Test Stand (ISTS). The ISTS is used to simulate and study of the operational CW injector. The vacuum pressure was estimated for both the CW and ISTS at five different points: inside the H^- ion source, in front of the Pierce electrode, at the extraction electrode, at the column electrode and at the ground electrode. A static vacuum analysis of residual gases and working hydrogen gas was completed for the normal ion source working regime. Gas density and partial pressure of hydrogen gas were estimated for different gas injection mass flows. Negligible differences of vacuum pressures and gas densities at the CW H^- dome and at the ISTS were documented.

Using the concept of the total cross section from atomic collisional physics, the attenuation of H^- beam current and generation of electron current in the high-voltage acceleration columns and low energy beam transport lines of the CW and ISTS were calculated. The interaction of H^- ions (as a projectile in the energy range from 250 eV to 80 keV) on molecular hydrogen H_2 (as a target at room temperature) is discussed as a dominant collision process in describing electron stripping rates [1]. These results are used to estimate the observed increase in the ratio of electrons to H- ion beam in the low energy beam transport line at ISTS.

References

1) T. Tabata and T. Shirai, "Analytical Cross Sections for Collisions of H^+, H_2^+, H_3^+, H, H_2, and H^- with Hydrogen Molecules" *Atomic Data and Nuclear Data Tables,* **76**, p 1-25, (2000).