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ES-PIC simulation of volume- and surface-produced H- ion trajectories

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Recent beam phase space measurement of the J-PARC negative hydrogen ion (H^- ion) source shows that the extracted beam involves several components: beam core, diverging halo, converging halo, and asymmetric components [1]. As the beam components except the core lead to beam losses after accelerating in the linac cavities, understanding of the halo formation is an important task. A 3D electrostatic Particle-In-Cell (ES-PIC) simulation [2] is applied to the J-PARC ion source to clarify the relation between the beam components and the H^- production processes in the plasma. The H^- ions in the model are produced in three different processes: (1) volume production, (2) surface production by H^0 atoms, and (3) surface production by protons. The transport of the H^- ions is calculated and associated with the beam components after being extracted from the ion source.
[1] T. Shibata, *et al.*, AIP Conf. Proc. **2373**, 050002 (2021).
[2] T. Shibata, *et al.*, J. Phys.: Conf. Ser. **2743**, 012007 (2024).

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