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Contributions of plasma-wall interaction and dust transport simulation analyses to the enhancement of the transition to the increased plasma confinement regime by boron powder injection using an impurity powder dropper in the Large Helical Device

M. Shoji[1,2], G. Kawamura[1,2], J. Romazanov[3], A. Kirschner[3], R. Smirnov[4], F. Nespoli[5], R. Lunsford[5], E. P. Gilson[5], S. Masuzaki[1,2], N. Ashikawa[1,2], T. Oishi[1,2], C. Suzuki[1,2], M. Yoshinuma[1], S. Brezinsek[3], D. A. Gates[5], K. Ida[1,2], and the LHD experiment group[1]

[1] Department of Helical Plasma Research, National Institute for Fusion Science, National Institutes of Natural Sciences, [2] Department of Fusion Science, Graduate University for Advanced Studies (SOKENDAI), [3] Institut für Energie- und Klimaforschung- Plasmaphysik, Forschungszentrum Jülich GmbH, [4] Department of Mechanical and Aerospace Engineering, University of California at San Diego, [5] Princeton Plasma Physics Laboratory, Princeton University

e-mail (speaker): shohji.mamoru@nifs.ac.jp

It is well known that wall conditioning is indispensable for achieving high-performance plasma discharges in the present magnetic plasma confinement devices.[1] An Impurity Powder Dropper (IPD) has been installed in one of the upper ports in the Large Helical Device (LHD) from the fiscal year 2019. The IPD has been used for the so-called real-time boronization during plasma discharges to reduce the impurity content in the plasma.

Before the installation of the IPD, a full-torus simulation of boron transport and migration was carried out to find the plasma discharge condition to perform the effective real-time boronization using three sophisticated codes (EMC3-EIRENE, DUSTT, and ERO2.0).[2] Figure 1 shows the simulations of the full-tours boron flux density profile, which proves that a low plasma density operation is effective to realize toroidally uniform boron deposition on the plasma facing components.

References
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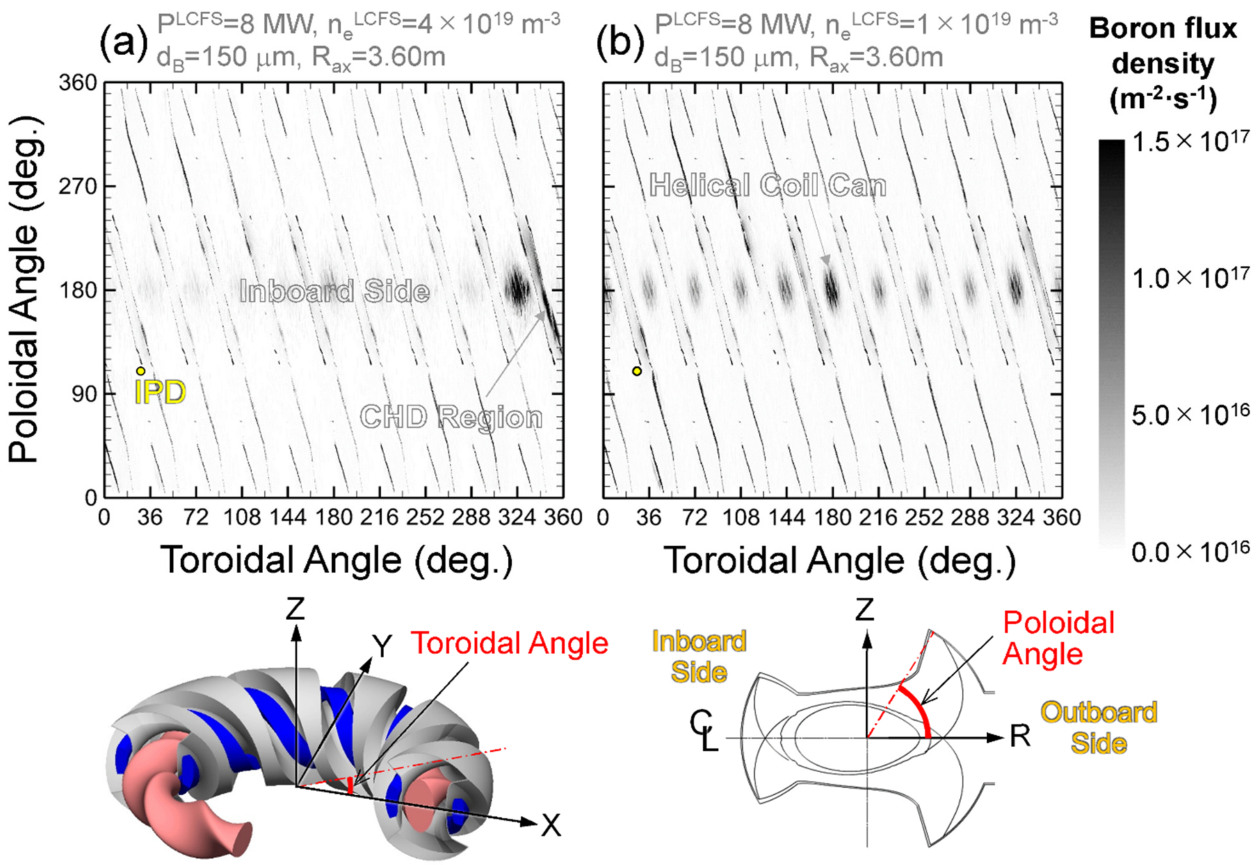

Figure 1. The simulations of the boron flux density profile projected onto the full-torus toroidal and poloidal plane for low (a) and high plasma density operations (b), respectively.