Effects of particle drift and collision on divertor trace

Y. Asahi[a], Y. Suzuki[a,b], K Y. Watanabe[a,b], T. Morisaki[a], S. Masuzaki[a,b], M. Kobayashi[a]

[a] *The Graduate University for Advanced Studies,322-6 Oroshi-cho, Toki 509-5292, Japan*
[b] *National Institute for Fusion Science,322-6 Oroshi-cho, Toki 509-5292, Japan*

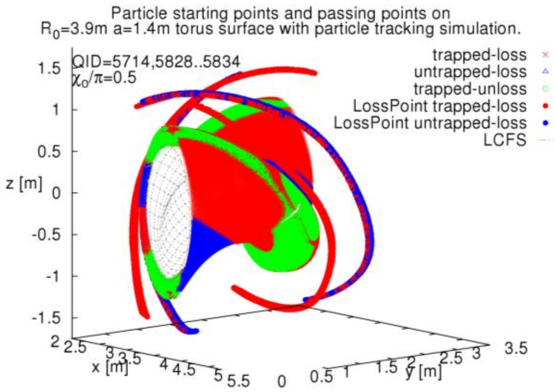
e-mail asahi.yoshimitsu@nifs.ac.jp

In a fusion reactor, the particle flux intensity and heat load, which should be controlled, are important research issues. The divertor trace, which means strike point distributions on divertor plates, will be affected by magnetic field structures in the peripheral region. Especially in non-axisymmetric devices such as helical devices, there are not many researches because of its complicated magnetic field structures outside the last closed flux surface (LCFS) which called a stochastic region.

In previous works, the relationship between field lines and the heat load in the Large Helical Device (LHD) were investigated for the vacuum field[1, 2]. These studies are based on an assumption which a particle trajectory corresponds to a field line. However, a particle trajectory which plays a role in the heat transport is different from a field line. Also theoretical studies indicate that the stochastic region spreads with increasing β value[3]. Therefore, a finite β magnetic field is required for calculating accurate particle orbits in order to obtain the heat load.

This presentation is intended to show the qualitative functions of plasma equilibria for any plasma parameters. In order to study a divertor trace, particle orbit and trapping state are systematically investigated for various pitch angles with solving guiding center equation. Strike point distributions on divertor plates are evaluated by tracking a lot of particle orbits of which starting points are in the stochastic region. As a first step, we show effects on divertor traces due to particle orbits in several vacuum field configurations.

The results indicate that the pitch angle $\chi_0=\arcsin(v_\perp/v)$ considerably affects the distribution profile of strike points. And for particles with $\chi_0\sim\pi/2$, trapping state depend on its starting points, even though these starting points lie in the same flux surface. For $\chi_0\sim0$ or π, in contrast, trapping state does not depend on starting point. These results suggest that the plasma has anisotropic pressure, and the anisotropy $p_\parallel/p_\perp$ is not constant on a flux surface.



Results of finite β field and particle collision will be compared with that of vacuum field. Effects of finite β and collisionality are also discussed.

[1] T. Morisaki, *et al*. Contrib. Plasma Phys. **43** (2002) 2-4, 321-326
[2] S. Masuzaki, *et al*. Nucl. Fusion **42** (2002) 750-758
[3] K Y Watanabe, *et al*. Plasma Phys. Control. Fusion **49** (2007) 605-618