Contribution ID: **627** Type: **Poster**

ITR/P1-35: Effects of ELM Control Coil on Fast Ion Confinement in ITER H-mode Scenarios

Tuesday 9 October 2012 08:30 (4 hours)

This paper reports the effects of the ELM control coil on fast ion confinement in ITER H-mode plasmas. The effects of the ELM coil on the loss of NBI-produced fast ions and fusion-produced alpha particles have been investigated using an orbit following Monte-Carlo code for an ITER 9MA non-inductive plasma, where the simulations have been performed for the vacuum fields produced by the ELM coils and then magnetic screening effects could influence the numerical conclusions. The effect of the ELM coil field dominates the loss of NBI-produced fast ions over the effect of magnetic field ripple by the toroidal field coils and the test blanket modules, leading to a significant loss of fast ions on the order of 16-17%. A significant transit particle loss occurs in the cases of the toroidal mode number n=4 in which magnetic surfaces are ergodic near the plasma periphery. Concerning the resonance of fast-ion trajectories, the anti-resonant surfaces of the main mode n=4 are very close to the resonant surfaces of the complementary mode nc=(9-4)=5 and vice versa. Since the effect of resonance on fast-ion trajectories dominates that of anti-resonance, a synergy effect of the main and complementary modes enlarges the resonant regions. The simulations also shows that the optimization of current phase of the ELM coils is not effective for the loss of fast ions for the n=4 case in this plasma.
The two-dimensional heat load on the first wall due to the NBI ion loss was evaluated. With a stationary magnetic field pattern the peak heat load near the upper ELM coils due to the NBI ion loss is as high as 1.0-1.5 MW/m^2, which exceeds the allowable level in ITER. The peak heat load can be reduced to 0.2-0.25 MW/m^2 by rotation of the ELM coil field pattern, a feature foreseen in the design of the ELM control system. Most loss particles hit the inner side of the torus of the dome in the ITER divertor, and the peak heat load averaged over the 9 toroidal sectors of ELM coils is in a range of 0.3-0.5 MW/m^2, which is in the acceptable level again. Simulations have been done also for 3.5 MeV alpha particles. The loss of alpha particles also increases due to the ELM coil field. However, the loss is still acceptably low at less than 1.0 %.

Country or International Organization of Primary Author

ITER Organization

Author: Mr OIKAWA, Toshihiro (ITER)

Co-authors: Dr LOARTE, Alberto (ITER Organization); Dr CAMPBELL, David (ITER Organization); Dr SNIPES, Joseph (ITER Organization); Dr TANI, Keiji (Nihon Advanced Technology); Dr SHINOHARA, Kouji (JAEA); Dr SCHAFFER, Michael (General Atomics); Dr PUTVINSKI, Sergei (ITER Organization); Dr SUGIE, Tatsuo (JAEA); CASPER, Thomas (ITER Organization); Dr KUSAMA, Yoshinori (JAEA); Dr GRIBOV, Yuri (ITER Organization)

Presenter: Mr OIKAWA, Toshihiro (ITER)

Session Classification: Poster: P1

Track Classification: ITR - ITER Activities