Comparative study of the ELMs between the ECEI observations and BOUT++ simulations in KSTAR H-mode plasma

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An electron cyclotron emission imaging (ECEI) system on KSTAR has played an important role in the study of the edge localized mode (ELM) dynamics [1]. However, the interpretation of the EC emission at the plasma edge where the optical thickness is rapidly changing, requires attention in construction of the image. To investigate the dynamics of the edge emission, the observed image was directly compared with the synthetic image based on the mode structure derived from the two-fluid simulation code, BOUT++ [2]. Synthetic process takes into account spatial resolution of the ECEI system, intrinsic broadening of ECE and background noise of the system. The observed image was successfully reproduced by synthetic diagnostic process, providing a confidence on the observed ELMs. During the course of study, a wide range of toroidal mode numbers \((4 < n < 14)\) of the ELMs were observed and the toroidal mode number \(n\) is related to \(n = 2\pi R_\ast \tan \alpha_\ast / \lambda_\ast\), where \(R_\ast\) is the mode position, \(\alpha_\ast\) is the pitch angle of the field line and \(\lambda_\ast\) is the poloidal mode spacing; subscript asterisk indicates that each quantity is from LFS mid-plane on mode position. Based on the observed mode behaviours together with pedestal characteristics, the peeling-ballooning stability model has been examined using both the edge stability simulation codes and BOUT++. This research was supported by NRF of Korea under contract no. 2009-0082507 and US DOE under contracts DE-AC52-07NA27344 at LLNL, DE-FG02-99ER54531 at UC Davis, and DE-SC0006629 at Tech-X.

References
