Study of the edge-localized modes (ELMs) in 2/3-D via ECEI systems in KSTAR

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Magnetic perturbations (MPs) with toroidal mode $n = 1$ were introduced to control the edge-localized modes (ELMs) through three sets of field error correction (FEC) coils [1] in 2012 KSTAR campaign. The n=1 MPs modified both the spatial structure and temporal dynamics of the ELMs, which were visualized in 2-D using an electron cyclotron emission imaging (ECEI) system [2,3]. One of the most interesting observations is the clear filamentary perturbation structure still remaining in the edge without burst even when the ELM crash was suppressed by resonant MP. To improve the understanding of the 3D ELM structure, ELM filaments were visualized in quasi 3D for the first time using two independent ECEI systems toroidally separated by 1/16\textsuperscript{th} of the torus. The diagnostic importance of 3D images is discussed in several perspectives such as determination of the edge pitch angle ($\sim$6-10°) and thereby the toroidal mode number of ELMs and study of toroidal asymmetry in ELM structure.

*Work supported by NRF of Korea under contract No. 20120005920 and the U.S. DoE under contract No. DE-FG-02-99ER54531.

