Status of the advanced research under long-pulse operation in KSTAR

Yeong-Kook Oh[a], J. G. Kwak[a], K. R. Park[a], Y. S. Bae[a], S. W. Yoon[a], S. G. Lee[a], B. H. Park[a], Y. Chu[a], J. Hong[a], J. H. Choi[a], J. D. Kong[a], S. T. Kim[a], H. L. Yang[a], H. K. Kim[a], D. S. Park [a], H. Park[ab], W. H. Choe[c], Y.S. Na[d], G. S. Yun[e], S. Sabbagh[f], and KSTAR team

[a] *National Fusion Research Institute, Daejeon, Korea*
[b] *Ulsan National Institute of Science and Technology, Ulsan, Korea*
[c] *Korea Advanced Institute of Science and Technology, Daejeon, Korea*
[d] *Seoul National University, Seoul, Korea*
[e] *Pohang University of Science and Technology, Pohang, Korea*
[f] *Princeton Plasma Physics Laboratory, Princeton, NJ, USA*

Email: ykoh@nfri.re.kr

Korea Superconducting Tokamak Advanced Research (KSTAR) has a great potential in demonstrating the true limits of confinement and stability of fusion plasma using the most advanced and precisely engineered steady-state capable tokamak fusion research device. In 2014 campaign, the operation window of H-mode discharge has been extended; the H-mode discharge time has been extended up to 48s at 0.5 MA, the level of H-mode plasma current reached up to 1 MA for 9s, the normalized beta surpassed no-wall limit (β_N ~4.0) without any external error field correction [2]. To have more stable plasma discharge under long-pulse operation, PFC and divertor will be active-cooled from 2015 and in-vessel cryo-pump will be operated from 2016 campaign.

One of focused research in KSTAR is exploring the ELM suppression using magnetic perturbation. Recently we have discovered that there is a significant difference in ELM control by in-vessel control coils between mid-plans and off-midplane coils. The mid-plane coils played a major role in ELM suppression with strong density pump-outs. Meanwhile, the level of intrinsic error field was measured to be extremely low in the order of 10-5.

The near-term KSTAR research plans are to explore stability limits of edge/internal MHDs and associated confinement in the plasmas with extremely low error field and field ripple. This effort will be strongly coupled with the aid of advanced imaging diagnostics and dynamic control of error field control using modular in-vessel control coil.

This work is supported by Ministry of Science, ICT, and Future Planning (MSIP) under KSTAR project and is partly supported by NRF under A3 foresight program (Contract No. 2012K2A2A6000443)