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Robust control of long-pulse, high performance plasmas in KSTAR tokamak YOUNGMU JEON, S.H. HAHN, H.S. HAN, M.H. WOO, M. JOUNG, JAYHYUN KIM, Y.S. BAE, H.-S. KIM, S.W. YOON, Y.K. OH, National Fusion Research Institute, Y.S. NA, Seoul National University, N.W. EIDIETIS, M.L. WALKER, M.J. LANCTOT, A.W. HYATT, General Atomics, D.A. MUELLER, Princeton Plasma Physics Laboratory, KSTAR TEAM — The goal of KSTAR is to achieve and demonstrate high performance, steady state tokamak operations in long pulse up to 300 s. In recent years, we made significant progresses on plasma control and performance for this advanced tokamak (AT) operation. First of all, the plasma equilibrium magnetic control has been substantially improved by applying fully decoupled multi-input-multi-output (MIMO) isoflux shape controllers [1]. The MIMO shape controllers were designed using a newly developed design method by taking the plasma equilibrium response into account self-consistently. More than eight shape control variables including plasma currents are controlled independently on each other with high accuracy (less than 1cm error on average) and with wide variations of plasma shape. By virtue of this robust control, various long pulse H-mode discharges have been operated up to 60 s, which was the maximum pulse length allowable in current KSTAR system. Also, plasma performance has been improved accordingly. A fully non-inductive H-mode operation [1] was achieved for the first time in KSTAR, through the so-called 'high betap' operation with betap˜3.0. In addition, various experimental attempts for advanced scenario development have been conducted such as the 'hybrid' [2] and 'high li' scenarios [3].

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