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Development of high poloidal beta, steady-state scenario with ITER-like W divertor on EAST

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Experiments on EAST [1] have started to adapt the fully-noninductive high poloidal beta scenario developed on DIII-D [2,3], in order to demonstrate, in principle, steady state tokamak operation at high performance on metal walls. The electron density is systematically varied in order to vary the deposition profile of the external lower hybrid current drive (LHCD), while keeping the plasma in fully-noninductive conditions to achieve a broad current profile that could enable improved core confinement, similar to the scenario on DIII-D. On DIII-D, a broad current profile is sustained by a large fraction of the off-axis bootstrap current, obtained with $\beta_p \geq 3$. On EAST, a broad current profile can be sustained at lower $\beta_p \geq 2$ using a large fraction of current drive from LH. The LHCD profile is expected to become more off-axis with higher density. With only LHCD and bootstrap as sources of plasma current (keeping the loop voltage near zero for several current relaxation times effectively removes the Ohmic current), the total current profile should become broader at higher density. As expected, at higher density the experimental results showed broader current profiles indicated by lower values of the internal inductance. Using the newly commissioned POINT (polarimeter-interferometer) diagnostic coupled with the EFIT algorithm that uses the POINT data for q-profile reconstruction, these experiments will enable strict tests of LHCD deposition models, and will strengthen the physics basis for achieving high performance, steady state discharges in future burning plasmas. Work supported by U.S. DOE under DE-SC0010685,DE-AC02-09-CH11466, DE-AC52-07NA27344, DE-AC05-06OR23100, and by the National Magnetic Confinement Fusion Program of China (No. 2015GB102000, 2015GB101000, 2015GB110001 and 2015GB103001)

[1] Baonian Wan, et al., Nucl. Fusion 55 104015 (2015) [2] A.M. Garofalo, et al., Nucl. Fusion 55 123025 (2015) [3] Q.Ren et al., Bull. Am. Phys. Soc., 60 (2015), http://meetings.aps.org/link/BAPS.2015.DPP.KI2.4, submitted to Phys. Plasmas

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