Recent progress towards steady state operation with high performance on EAST

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Abstract. The exploration of steady-state operation (SSO) is one of the scientific goals on the Experimental Advanced Superconducting Tokamak (EAST). Since 2013, new capabilities including auxiliary heating power (ICRF,LHW,NBI), diagnostics, ITER-like monoblock W upper divertor, two inner cryo-pumps and RMP coils have been developed and installed. Significant progress has been recently made towards SSO with RF dominant heating and low torque NBI in the EAST campaign 2014.

H-mode plasmas were firstly achieved by new LHW @ 4.6GHz alone in EAST. Long pulse high performance H-mode have been obtained by LHCD alone up to 28 s with $H_{98y,2}$>1.0. No or small ELMy was found in RF plasmas, which is essential for state steady operation in the future tokamaks. The maximum achieved β_N~2.0 will be shown by using the NBI, as well as the non-inductive current drive fraction. Meanwhile, non-inductive scenarios with high bootstrap current fraction have been demonstrated for long-pulse operations by combined LHCD and NBI. A near fully non-inductive current drive discharge with grassy ELMy has been achieved by using LHCD and NBI (P_{LH}= 2.2MW and P_{NBI}=1.0MW) with the line averaged density about $f_{Greenwald}$=50% (Ip=400KA,V_{loop}~0V, Bt=2.5T, $H_{98y.2}$>1.2, β_N~1.6). Attempts to broad pressure and current density profiles by using NBI pre-heating and off-axis LHCD on EAST were made. More detailed data analysis and predictive modeling of the equilibrium profiles and non-inductive current drive will be carried out soon to assess the need for additional auxiliary current drive power and flexibility for the coming SSO experiment.