Contribution ID: **438** Type: **Oral**

New control ability on EAST PCS for steady-state operation

Monday 5 June 2017 17:20 (20 minutes)

EAST (Experimental Advanced Superconducting Tokamak), a toroidal device with a D- shaped poloidal cross section, aims at high confinement and steady-state operation with plasma current up to 1 MA and pulse length to 1000 s. To accomplish EAST physical targets, the plasma control system PCS, adapted from DIII-D PCS [1] and deployed on EAST in 2005, keeps in continuous development. Some new control abilities for steady-state operation has been achieved. One is the long pulse data acquisition/archiving using data segment technology of Mdsplus. The acquired raw data and calculated result of PCS can be read or analyzed by physical operators in real time, which will provide the possibility to adjust the control scenario during the plasma discharge [2]. Another is the loop voltage feedback controlled to realize the non-inductive operation. In 2016 EAST campaign, loop voltage is well controlled using low hybrid wave (LHW). Besides, another two control algorithms are implemented to reduce the divertor heat flux. One is radiation power control, which is successfully feedback controlled by using divertor inert gas puff and mid-plane supersonic molecular beam injection (SMBI). The other is quasi-snowflake (QSF) shape control using PEFIT/ISOFLUX, which shows significant heat load reduction to divertor target [3] according to the modeling and experiment result. In this paper, the strategy and implementation detail will be introduced. The steady-state ELM-free high confinement QSF discharge has been achieved with the pulse length up to 20s, about 450 times the energy confinement time. The present EAST PCS has become a huge system capable of long pulse, high performance advanced plasma control operation, which is ready to demonstrate ITER-like control contents.

[1] J.R. Ferron, B. Penaflor, M.L. Walker, et al., Fusion Engineering, vol. 2, p870 (1996);
[2] H. Wang, J.R. Luo, G.M. Li, P.J. Wei, Cryogenics and superconductivity, 34(1), p26 (2006);
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Eligible for student paper award?

No

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Session Classification: M.OP1: Plasma Operation and Control

Track Classification: Plasma operation and control