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The first implementation of active divertor heat flux feedback control in EAST PCS

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The divertor heat flux is one of the major concerns for high performance and long pulse plasma operation, since it may lead to unacceptable heat load and thus damage the divertor target material. EAST has achieved a total power injection up to 0.3 GJ with ITER-like water-cooled tungsten (W) mono-block divertor. The active divertor heat flux feedback control is urgently needed in EAST.
EAST has a number of impurity seeding systems, including gas puffing in the upper and lower divertor volumes, super molecular beam injection (SMBI) and pellet injection systems at the outer mid-plane, which can be commanded by PCS [1,2] and facilitate the heat flux control. The signals from Langmuir probes are also acquired by PCS in sampling rate 10KHz and then calibrated to provide either the divertor particle flux or electron temperature. The feedback control algorithm, similar to that developed in JET [3], has the flexibility to control the main density or the particle flux to reach partial detachment, which is a promising method for steady-state divertor heat flux control. The control algorithm based on the divertor particle flux worked effectively during the 2018 EAST experiments with D2 fuelling through low field side (LFS), SMBI-injection or divertor impurity seeding from the divertor volume in H-mode plasmas, without significant degrade of the core-plasma performance, i.e., exhibiting good core-edge-divertor integration. The algorithm implementation in PCS and experimental results will be reported in this paper. Further efforts will be made to extend active feedback control towards long-pulse H-mode detachment maintenance in the near future, which will benefit the high power, H-mode operation for ITER.

References

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