

## Study on the effect of the plasma current overshoot in KSTAR

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In this study, we report the effect of plasma current overshoot in KSTAR. In 2020 KSTAR campaign, we use the current overshoot recipe to create a broader current profile and observe the confinement enhancement in the discharges. Such improvement is analyzed in terms of the core region and the edge region. Numerical analyses using a linear gyro-kinetic code [1, 2] reveal that the core confinement is enhanced due to the favorable magnetic shear configuration induced by a current overshoot. This result is consistent in that confinement degrades as the core magnetic shear weakens. However, the improvement is vanished as the change in magnetic shear disappeared. For the edge region, the pedestal density decreases as the ELM frequency increases when the current overshoot is applied, followed by a decrease in the core density and an increase in the fast particle content. This leads to core MHD mode transitions from sawtooth to fishbone-like mode, resulting in irreversible performance improvements. Based on these findings, we conclude that the confinement enhancement results from both core and edge, the enhancement by the favorable magnetic shear disappears, and the enhancement by MHD mode change is maintained.

### Reference

[1] Guo S.C. and Romanelli F. 1993 *Phys. Plasmas* 5 520

[2] Peeters A.G., Camenen Y., Casson F.J., Hornsby W.A., Snodin A.P., Srintzi D. and Szepesi G. 2009 *Comput. Phys. Commun.* 180 2650–72