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Improving fast-ion confinement in high-performance discharges by suppressing Alfve´n eigenmodes

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The performance of steady-state DIII-D discharges is often reduced due to anomalous fast-ion transport that was observed to correlate with Alfv´en eigenmode (AE) activity. Fast-ion transport modeling using the kick model [1] shows that the observed mode activity can account for the observed fast-ion confinement degradation. Therefore, suppressing the AE activity will improve the plasma performance through improved fast-ion confinement. This can be achieved by modifying the magnetic safety factor profile. In these discharges the q profile has a minimum near r/a = 0.3, in the same region where the fast-ion pressure gradient, which drives the AEs, has its maximum. By moving q_min to a larger minor radius where the fast-ion pressure gradient is small, the drive for the reversed shear AEs weakens and conditions in the core become unfavorable for normal AEs. Experimental evidence will be presented that this solution is viable and that the fast-ion confinement can be restored to near classical levels.

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[1] M. Podesta, et al. (2014) Plasma Phys. and Contr. Fusion 56, 055003

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