ENHANCED FUSION PERFORMANCE DUE TO PLASMA SHAPE MODIFICATION OF SIMULATED ITER DISCHARGES IN DIII–D

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ABSTRACT. Based on several confinement scaling relations, the prediction has been made that tokamak performance, expressed as the volume averaged fusion triple product $<nT>\tau$, should increase as the plasma is elongated by reducing the horizontal minor radius from the outer (low-field) boundary with fixed heating power, safety factor and electron density. Experiments in DIII–D confirm this prediction, with performance enhancements of up to 40% observed as elongation is increased by 15%. It is recognized, of course, that such experiments do not consititute a simple test of elongation scaling, since the change to elongation was rather small, and other parameters, such as toroidal field, are allowed to change. Nevertheless, this "engineering test" of the effects of such small changes indicates possible advantages to the slightly modified shape. This enhancement appears most visibly as increased ion and electron temperatures. A surprising feature of the high elongation plasmas is the existence of a VH–mode-like "spinup," where the high elongation plasmas tend to rotate with velocities as high as twice those in the low elongation plasmas. The resulting region of enhanced toroidal rotation gradient is associated with significant reductions in transport.

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