

Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Is There a Nonlinear Subcritical MHD Beta Limit?¹ R.E. WALTZ,
General Atomics — Since the 2005 beta scan on Cyclone case [1], the GYRO code
has not been able to operate past about half the ideal MHD critical beta limit with
finite stationary transport levels. There appears to be a nonlinear subcritical MHD
beta limit [2] which maybe induced by the increased effective pressure gradients
from the nonlinearly driven zonal flows. The high- n ideal beta limit is defined as
the point where the growth rate extrapolated to the lowest possible wave number is
greater than zero. The subcritical point for Cyclone case is about 0.5 the ideal limit
($\beta_{crit} = 3.0\%$). Some GA-std cases with $\beta_{crit} = 1.4\%$ have the subcritical beta at
0.42-0.35 the ideal. However, some very high beta DIII-D shot manage to get past
the usually lower external kink beta limit and close to the ideal high- n limit with
good confinement. The remedy appears to be the addition of $E \times B$ shear sufficient
to reduce the transport at near zero beta by about half. GYRO simulations of the
shots reasonably match the low transport when the high experimental level of $E \times B$
shear is applied.

[1] J. Candy, Phys. Plasmas **12**, 072307 (2005).

[2] R.E. Waltz, Phys. Rev. Lett. **55**, 1098 (1985).

¹Work supported by the US DOE under DE-FG02-95ER54309.

Ron Waltz
General Atomics

Date submitted: 17 Jul 2009

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