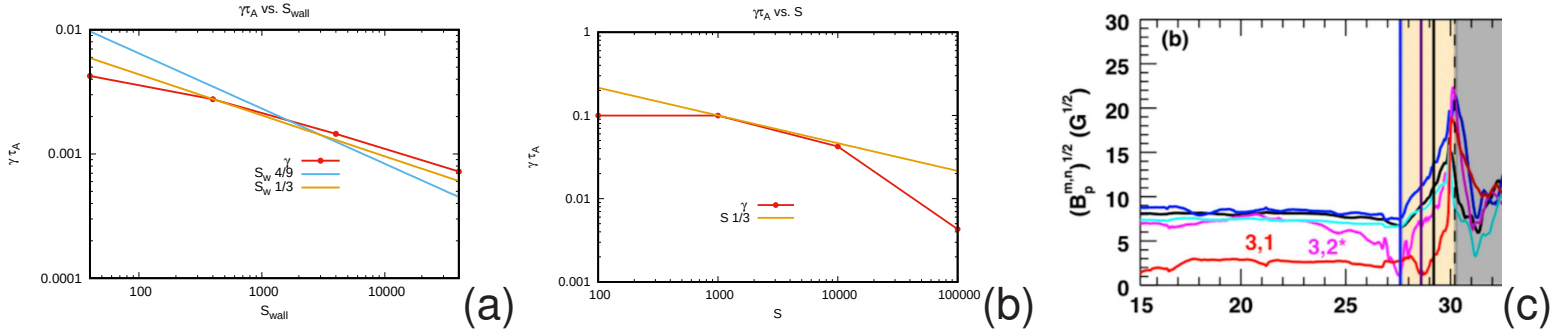
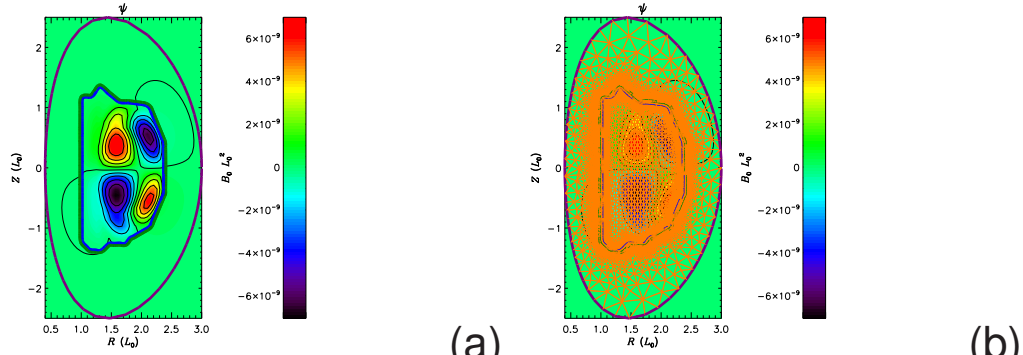
Resistive wall tearing mode in DIIID disruption shot 154576

H. Strauss, 2/28/22



(a) $\gamma\tau_A(S_{wall})$ in DIIID shot 154576 ($S_{wall} = \tau_{wall}/\tau_A$) (b) $\gamma\tau_A(S)$ (c) [Sweeney *et al.*NF 2018] Disruption precursor is tearing modes, disruption time $\approx .5\tau_{wall}$, could be RWTM

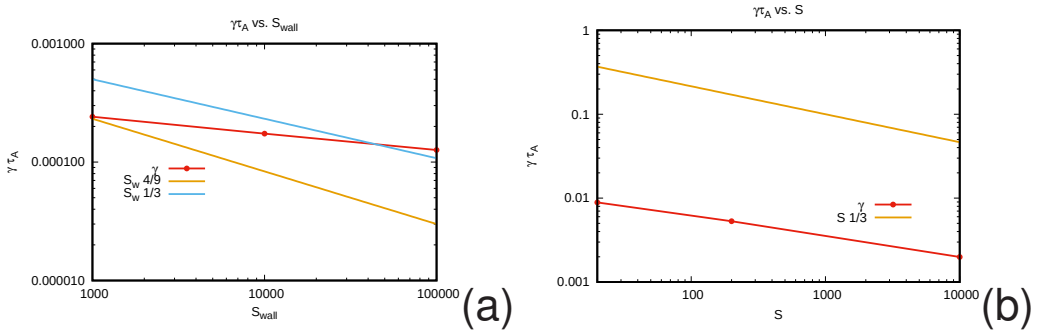
$$\gamma\tau_{wall} = c_0 S^{-1/3} S_{wall}^{5/9} \sim 1$$



(a) perturbed ψ in (a) above (b) mesh. The coil.dat and current.dat files are not the exact ones, might not be intended equilibrium reconstruction. Wall may be under resolved, affecting the η_{wall}

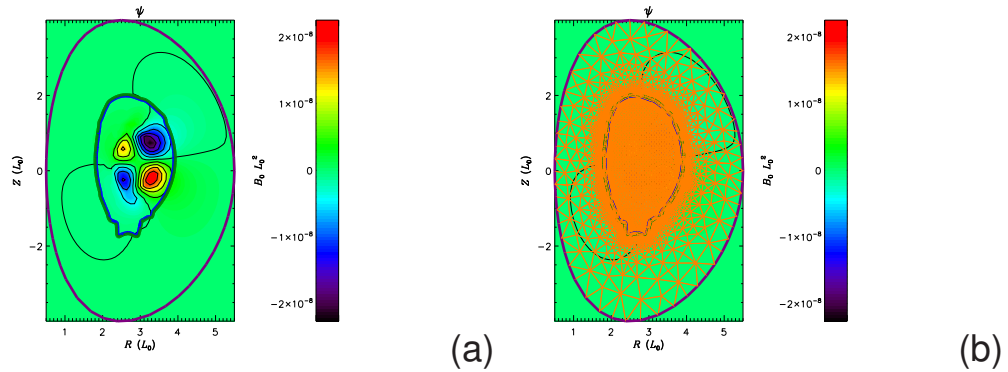
dependence. Or, there is coupling of RWTM and TM. Will need nonlinear simulations. RTWM may saturate at a larger amplitude than TM.

RWTM in JET disruption shot 81540



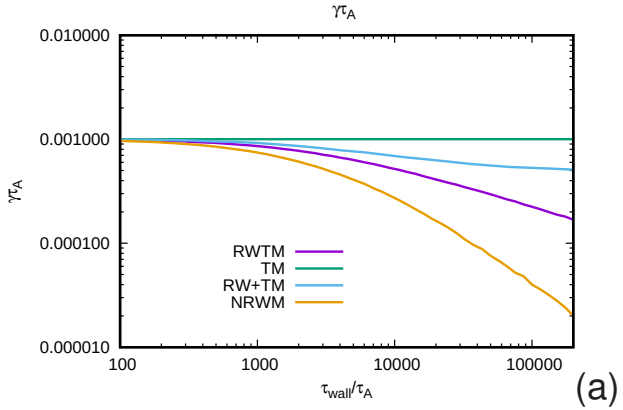
(a) $\gamma\tau_A(S_{wall})$ in JET shot 815406 (b) $\gamma\tau_A(S)$

In the JET runs, the coil.dat and current.dat are not the right ones, and the wall may be under resolved. Or, there is coupling of RWTM and TM.



(a) perturbed ψ in (a) above (b) mesh

RWTM dispersion relation includes TM and NRWM



(a)

The RWTM dispersion relation is

$$S_w(\gamma\tau_A)^{9/4} + 4(\gamma\tau_A)^{5/4} - \frac{\Delta_1 S_w}{S^{3/4}}(\gamma\tau_A) - \frac{\Delta_0}{S^{3/4}} = 0$$

$\Delta_0 = 2m(r_s/r_w)^{2m}[1-(r_s/r_w)^{2m}]^{-1}$. where m is the poloidal mode number, r_s is the rational surface minor radius, and r_w is the wall minor radius, in a cylindrical geometry model.

NRMW: $\Delta_1 < 0$, then $\gamma\tau_A = -(\Delta_0/\Delta_1)S_w^{-1}$.

TM and RWTM are coupled when $\Delta_0, \Delta_1 > 0$.

H. Strauss and JET Contributors, Effect of Resistive Wall on Thermal Quench in JET Disruptions, Phys. Plasmas **28**, 032501 (2021)