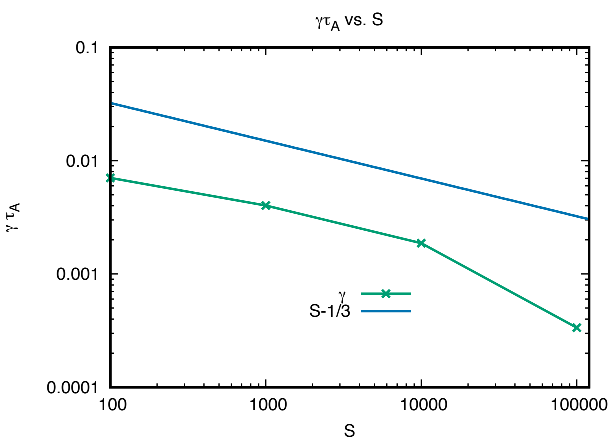
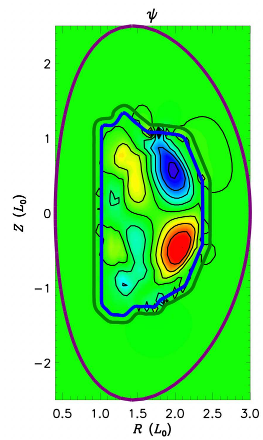
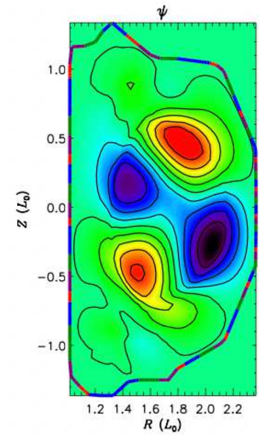
# Linear M3D-C1 resistive wall simulations of DIIID 154576



(a)



(b)



(c)

EFIT reconstruction with $q > 1$ to avoid $(1,1)$ mode. (a) $\gamma\tau_A$ in DIIID shot 154576 as a function of $S_{wall}$ from M3D-C1 linear simulations. $S_{wall}^{-4/9}$ scaling.

(b) perturbed $\psi$ in (a). The mode is $(2,1)$ and penetrates the resistive wall.

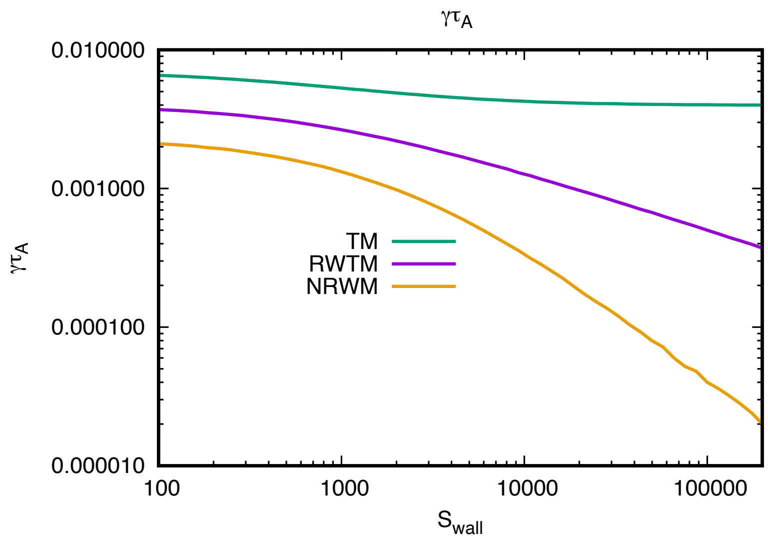
(c) ideal wall. The mode is stable.

## Linear resistive wall tearing mode theory

The RWTM dispersion relation is [Finn1995,Strauss2021]

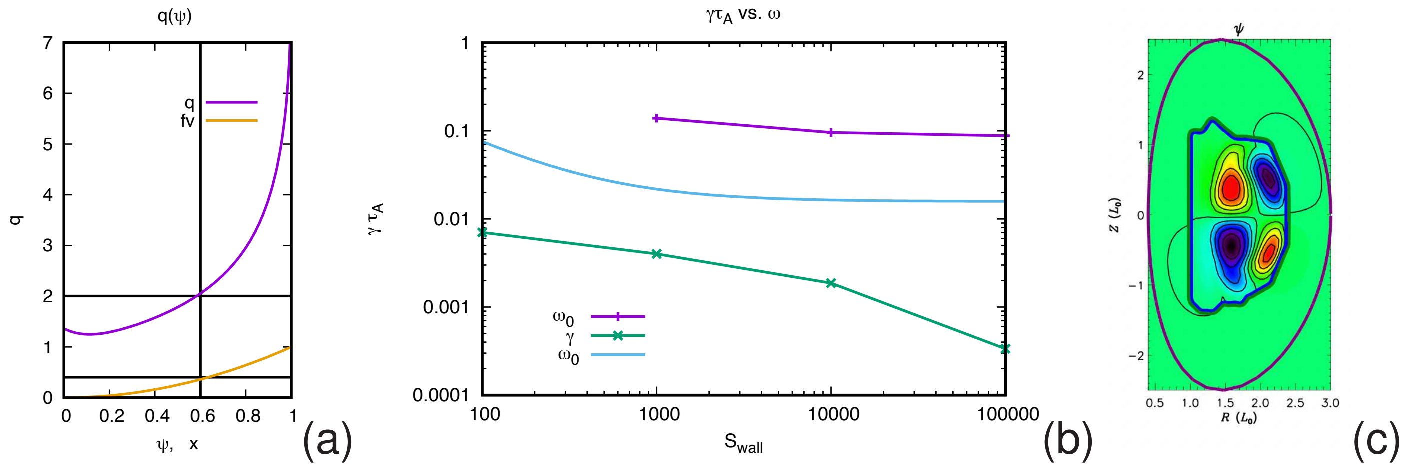
$$\hat{\gamma}^{5/4} S^{3/4} = \Delta_1 + \frac{\Delta_0}{\hat{\gamma} S_w + 1} \quad (1)$$

where $\hat{\gamma} = \gamma\tau_A$, $S_w = S_{wall}/(2m)$, $S_{wall} = \tau_{wall}/\tau_A$, internal drive $\Delta_1 = r_s \Delta'_w/m$, external drive $\Delta_0 = 2x/(1-x)$, $x = (r_s/r_w)^{2m}$, poloidal mode number $m$, rational surface radius $r_s$, wall minor radius $r_w$,



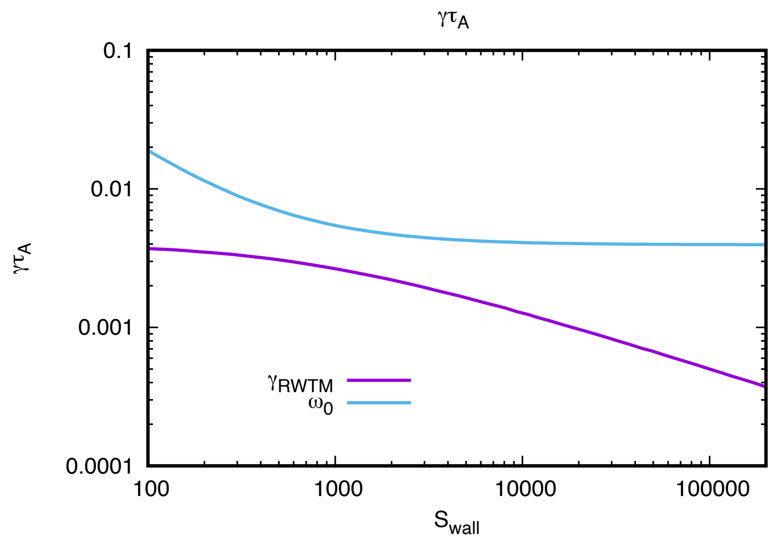

Solutions of (1) with $\Delta_0 = 1$,
TM : $\Delta_1 = 1$.
RWTM: $\Delta_1 = 0$, $\gamma \propto S_{wall}^{-4/9}$
NRWM: $\Delta_1 = -0.5$, $\gamma \propto S_{wall}^{-1}$
(neo RWM) If $\Delta_0 + \Delta_1 \leq 0$, there are no unstable solutions of (1).

# Linear M3D-C1 rotational stabilzation simulations of DIIID 154576




(a) $100 \times \alpha(\rho)$ and $q(\rho)$. $\omega(\rho) = \sqrt{2\alpha}/R_0$, $\alpha = v_0[(\psi - \psi_0)/(\psi_w - \psi_0)]^2$. The difference in $\alpha$ between the $q = 2$ surface at $\rho = 0.6$ and the wall is $\alpha_0 = .6v_0$. (b) marginally stable $\omega_0 = \sqrt{2\alpha_0}/R_0$ as a function of $S_w$. (c) perturbed rotating $\psi$.

# Linear resistive wall stabilzation theory




$\gamma_{rwtm}, \omega_0$, where $\omega_0$ is the rotation frequency required for marginal stability of RWTM, and $\gamma_{RWTM}$ is the growth rate in the absence of rotation. Dispersion relation for marginally stable rotating RWTM [Gimblett, NF 26, 617 (1986) , Bondeson & Persson, NF 28, 1887 (1988)]

$$(i\omega)^{5/4}[1 + iS_w(\omega - \omega_0] = \Delta_0 S^{-3/4} \quad (2)$$

$$\omega_0 = 0.46\Delta_0^{4/5} S^{-3/5} + 2.41 S_w^{-1}$$

$$\omega_0 \approx \gamma_{TM} + \gamma_{RWM}$$