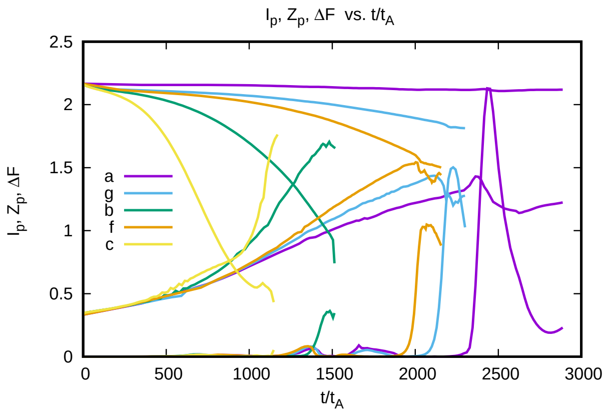
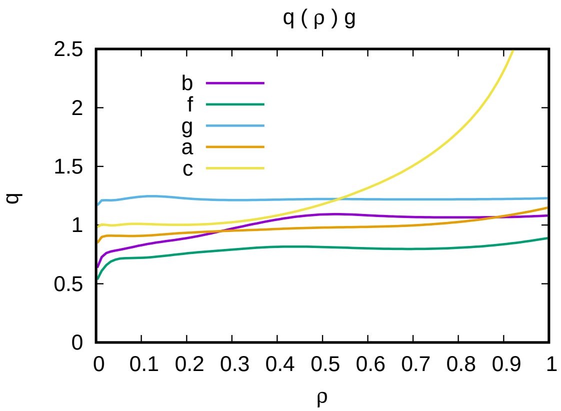
H. Strauss, 6-8-20

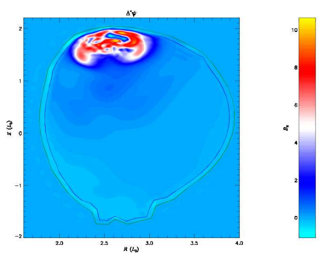
Wall force F_{wall}, τ_{CQ}, τ_{vde}



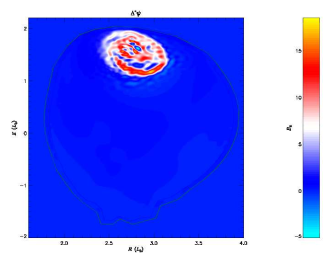
(a)



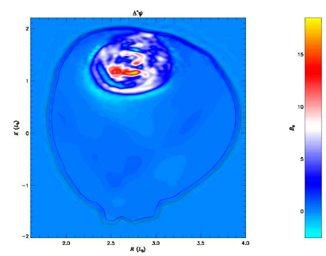
(b)



(c-b)



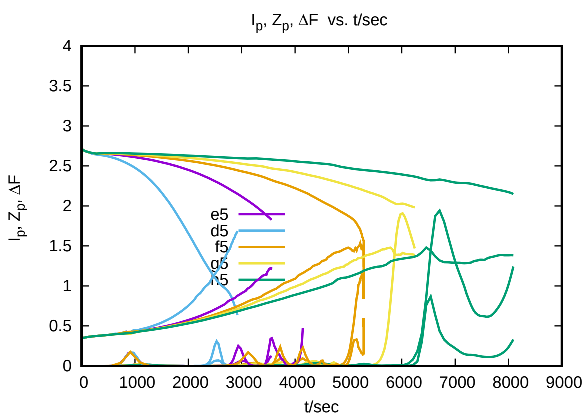
(c-f)



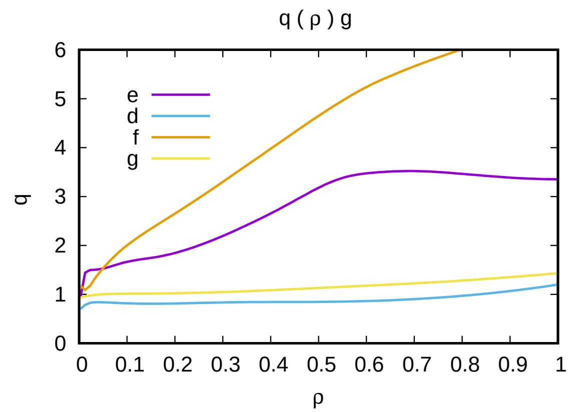
(c-g)

(a) Time history of current I, vertical displacement Z, and asymmetric wall force F_{wall}. (b) q value in cases in Fig. (a), after sideways force peaks. The q value relaxes to $q = 1$ when the sideways force is large. (c) contours of j_ϕ at peak force, labelled (b),(f),(g) as in (a),(b) The evolution of the q profile depends on the evolution of Z. For cases a, g, f in Fig.(a) the VDE saturates at at $Z \approx 1.5$, without reaching the wall, while cases b, c reach the wall at $Z \approx 1.7$. For the former cases, $q \approx 1$, while in the latter cases, $q > 1$.

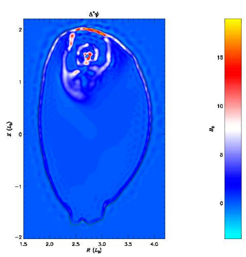
smaller η_{wall} - Dependence on q



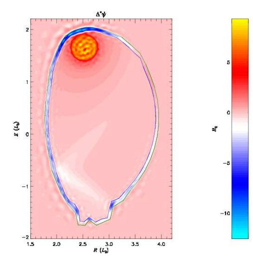
(a)



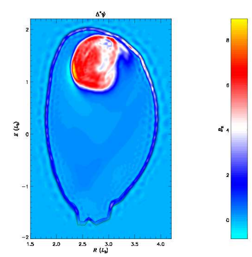
(b)



(c-f)



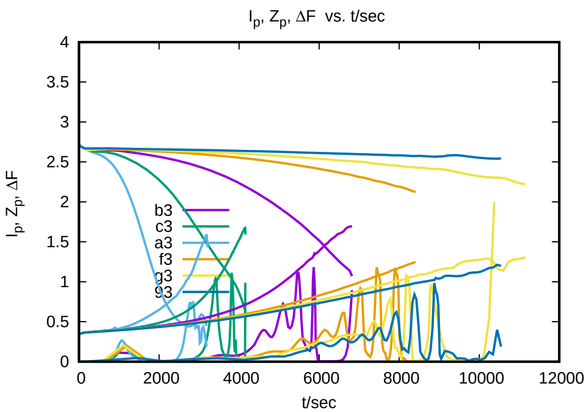
(c-d)



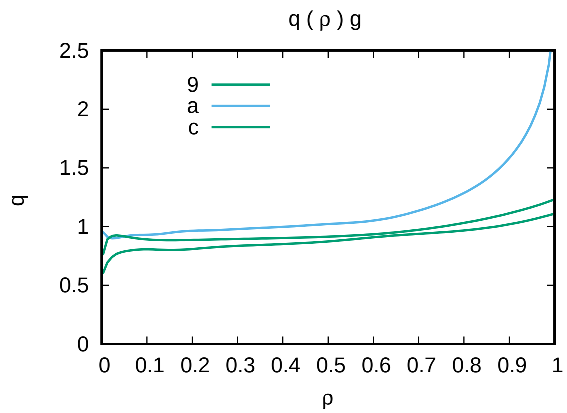
(c-e)

Decreasing η_{wall} $(1.e^{-4}$ the timescale is about 3 times longer. (a) in addition to the variables I,Z,F_{wall}, the magnetic energy B_{m1} is also plotted (with aritrary scaling). The $n = 1$ magnetic enery correlates with F_{wall}. (b) q profiles at the end of the runs. When $q = 1$ the force is large, when $q > 1$ the force is small.

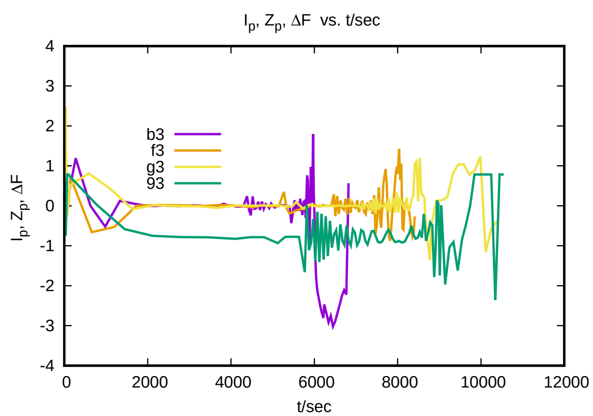
even smaller η_{wall} - Dependence on q



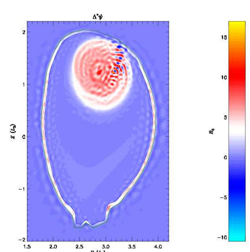
(a)

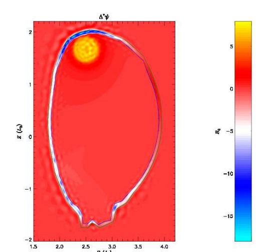


(b)



(c)

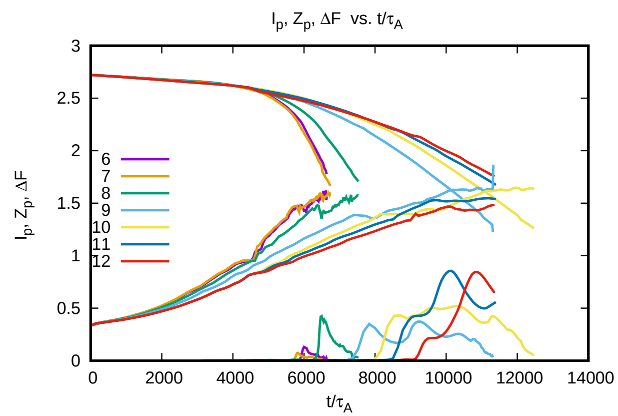

(d)


(f)

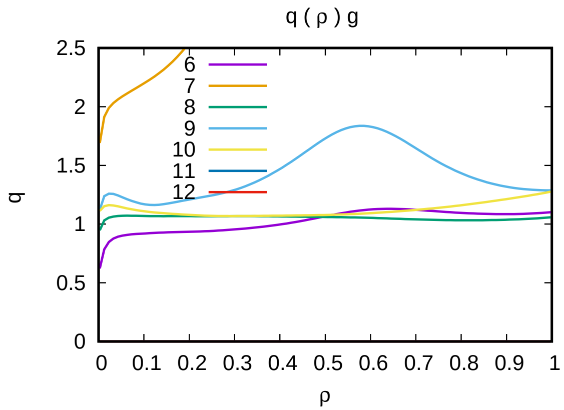
Decreasing η_{wall}, $(4.e^{-5})$ Now there are oscillations in the sideways force. Numerical noise or rotation? (c) $\tan^{-1}(F_y/F_x)(t)$. (a) Time history of current I, vertical displacement Z, and asymmetric wall force F_{wall}.

no external driving E field, vary η_{wall}

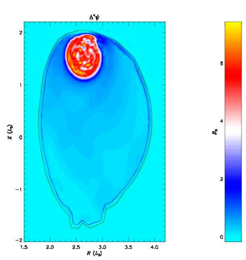
In these cases, the current decayed resistively, with the same η_{fac}. The current decay time is not constant, but depends on the wall resistivity. The sideways force seems to be smaller than when there is a driving electric field.



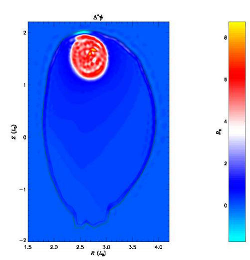
(a)



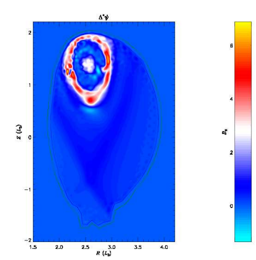
(b)



(11)



(12)

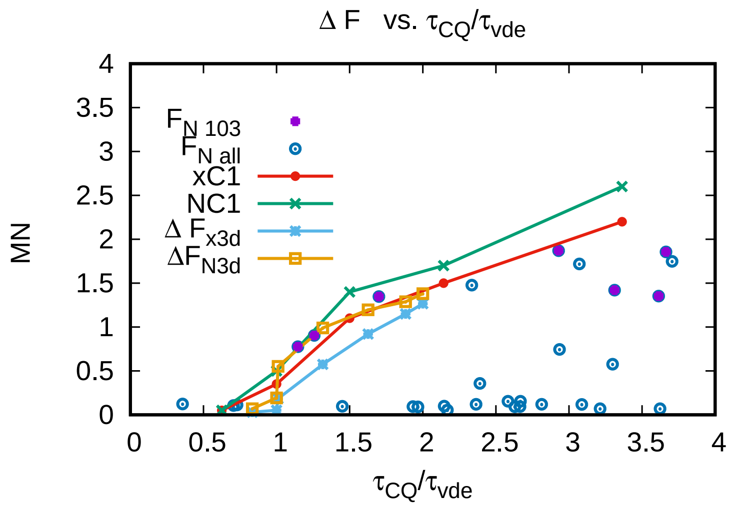


(7)

(a) Time history of current I, vertical displacement Z, and asymmetric wall force F_{wall}. (b) q profiles at end of runs.

Dependence of sideways wall force on τ_{CQ}/τ_{vde}

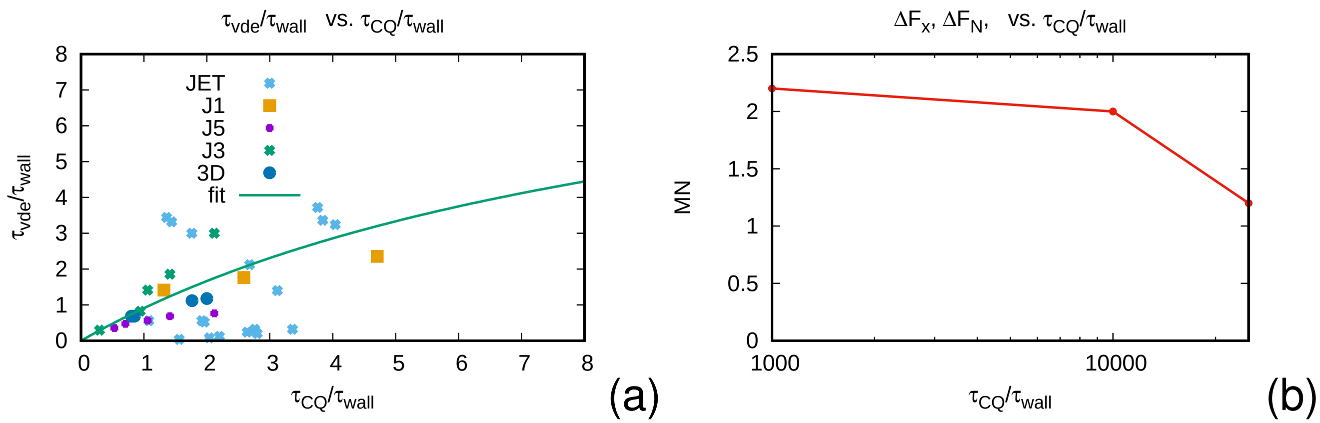
The runs were initialized with a reconstruction of JET shot 71985. The current quench time τ_{CQ} was controlled by the applied electric field. The resistive wall time τ_{wall} was held fixed, while τ_{CQ} was varied in different runs. The value of the asymmetric or sideways force in the wall ΔF was calculated as a function of time. The peak value of ΔF was found as a function of τ_{CQ}/τ_{wall}. The JET data is obtained from the Noll approximation for the sideways force $\Delta F_x \approx \pi B \Delta (IZ)$, where Δ is the amplitude of the asymmetric perturbation.



ΔF_x as a function of τ_{CQ}/τ_{wall}, The Noll force in the simulations is ΔF_{NC1}, and the force in the wall is ΔF_{C11}. The dots are JET data for the Noll force, ΔF_N. Simulation data is given for M3D-C1 wall force labelled $xC1$ and Noll force $NC1$, as well as M3D runs ΔF_{x3d} and F_{N3d} [Strauss *et al.*PoP 2017, PoP 2020]

JET task T17-13 on Wednesday 10th June

relation of τ_{CQ} to τ_{vde}, wall force F_{wall}



(a) relation of τ_{CQ} to τ_{vde}. Comparison of cases above and JET data. (b) Peak F_{wall} as a function of eta_{wall}. Is there a $\gamma\tau_{wall}$ effect? Data is preliminary.