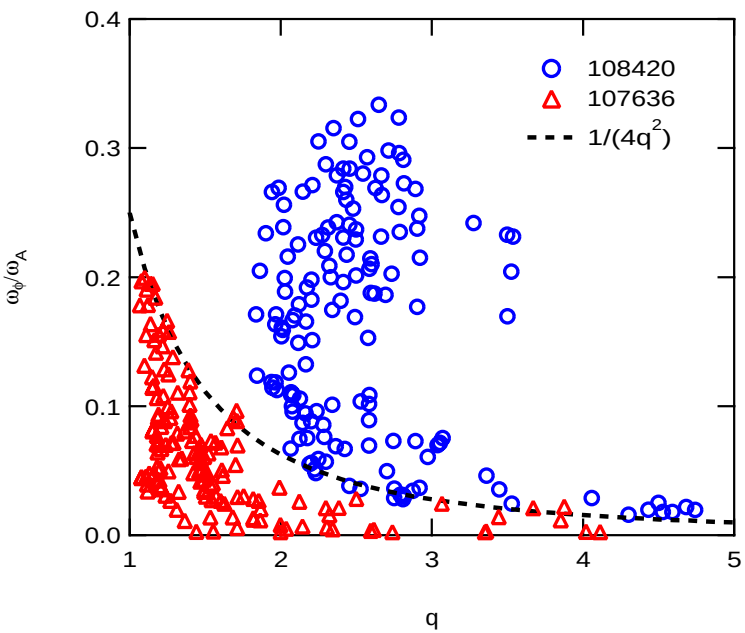
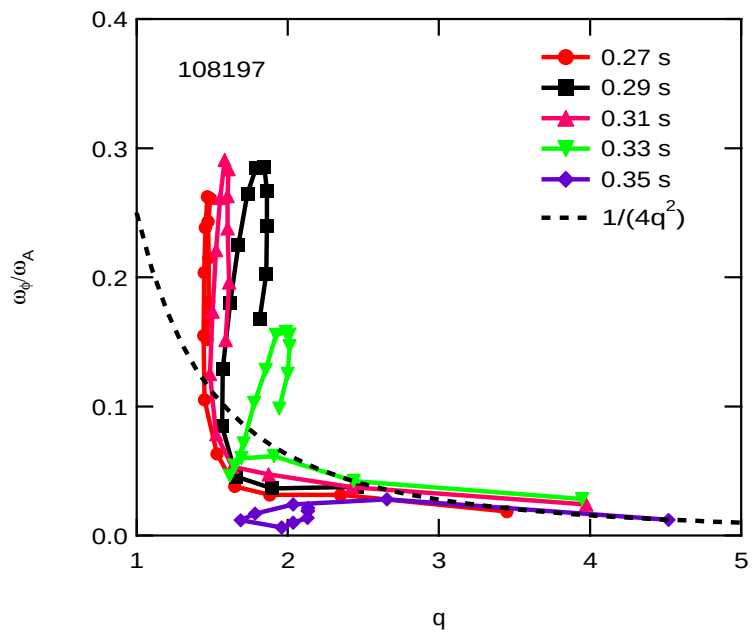
XP 428 - RWM Dissipation and Inertial Effects: Goals

- examine q dependence
  - toroidal inertial enhancement strongly q dependent
  - $\omega_{crit}/\omega_A \sim 1/q^2$
- evaluate dissipation mechanisms
  - sound wave dissipation
    - $\propto k_{\|} v_{ti} \rho$
  - ion Landau damping
    - significant if $\omega_{rot} > \varepsilon^{1/2} v_{ti}/qR$
- determine relative importance of dissipation and inertial effects
  - scan B_0 at constant q
  - scan density
  - scan m_i

RWM Stability Strongly q Dependent in NSTX

- 108420 - $\beta_N > \beta_{N\ no\text{-}wall}$ for over $10\tau_{wall}$
- 107636 - 3 collapses when $\beta_N = \beta_{N\ no\text{-}wall}$
- 108197 - $\beta_N > \beta_{N\ no\text{-}wall}$ for ~ $3\tau_{wall}$





Parameter Scans

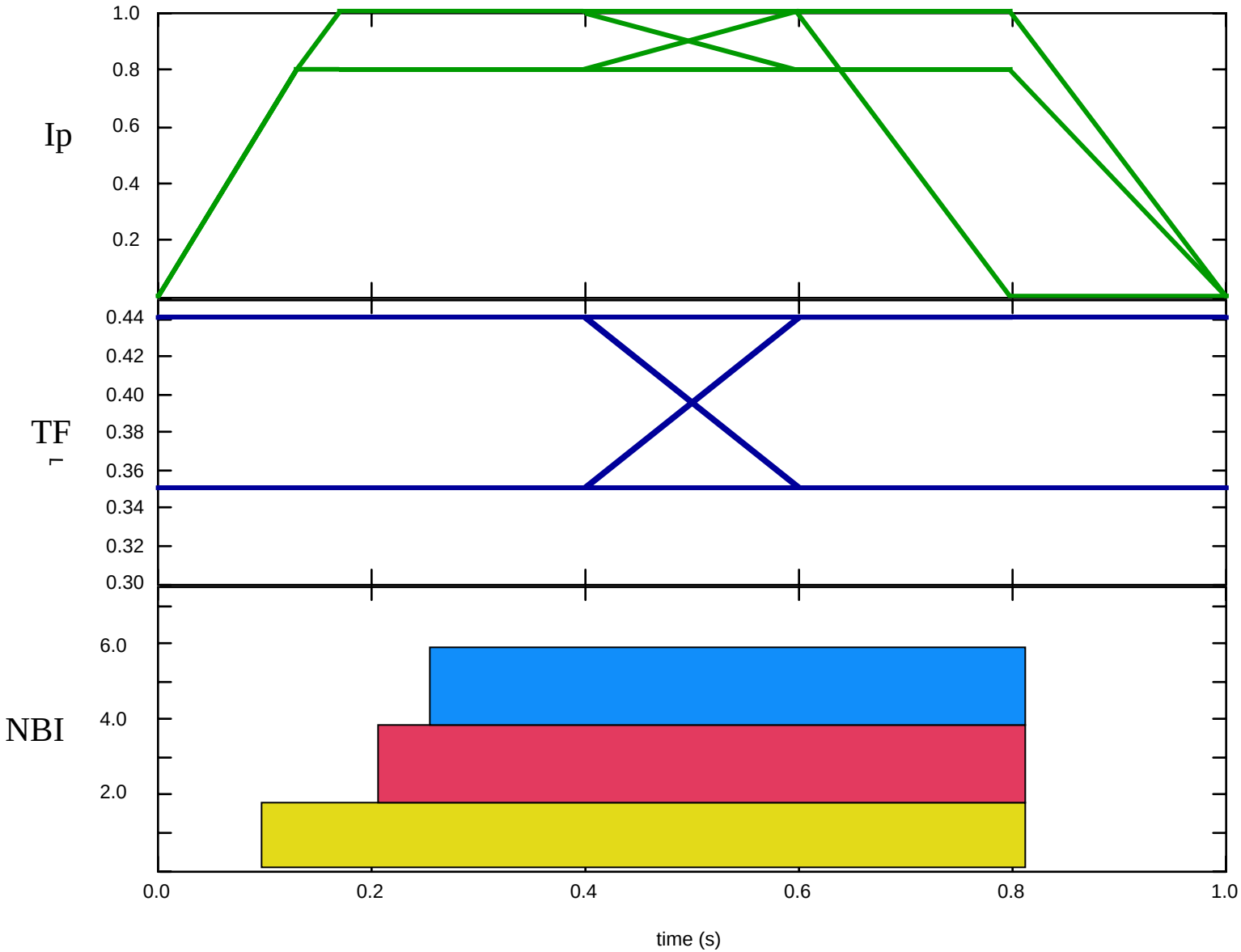
- At fixed q_a scan $B_t \rightarrow$ vary inertial enhancement
  - $v_A \sim B/n^{1/2}$ $\quad v_{ti} \sim T_i^{1/2} = n^{-1/2}$
  - vary I_p and B_t simultaneously
- Delay mode onset $\rightarrow$ effective density scan
  - ~60% increase in n_e at collapse in long-pulse case
- RWM in He plasma - m_i scan
  - strongly affect sound wave damping
  - rotation damping alterations?
  - discharge development required

XP 428 Shot List

	Task	Number of Shots	
A.	Control Shots		3
	($\beta_N > \beta_{N\ no\text{-}wall}$, $F_p < 2$, long-pulse, RWM collapse, LSN)		
	❑ restore 112402 I_p=1 MA, B_t = 0.44T, q_{95}=7		
	❑ reproduce RWM collapse		
B.	Examine ion Landau damping vs inertial enhancement		24
	- *constant q scan: vary I_p and B_t together*		
	❑ Constant I_p & B_t: Ip = 1.0,0.9,0.8,0.7 MA	6	
	❑ *may need to ramp down after reaching high performance*		
	❑ I_p & B_t ramp down before mode onset	6	
	❑ *maintain $q_0 > 1$*		
	❑ *1.0 MA $\rightarrow$ 0.9, 0.8, 0.7, 0.6 MA*		
	❑ repeat at lower q	12	
C.	Enhance sound wave dissipation w/ density increase		3
	- *delay mode onset until density has increased*		
	- *~60% n_e increase in longer pulse shots*		
	❑ I_p & B_t ramp up to delay mode onset	3	
D.	He plasmas to change sound wave damping - m_i variation		10
	- *need development to reach high performance*		

Total shots: 40

Waveforms


Ip
1.0
0.8
0.6
0.4
0.2
TF
0.44
0.42
0.40
0.38
0.36
0.34
0.32
0.30
NBI
6.0
4.0
2.0
0.0
0.2
0.4
0.6
0.8
1.0
time (s)