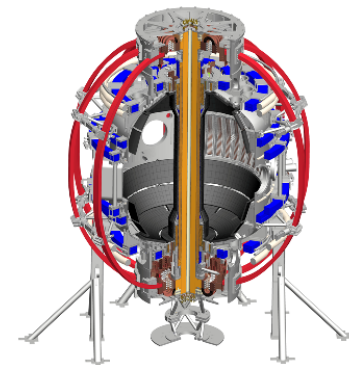




GAE/CAE Suppression Scaling with 2nd Neutral Beam Line Sources (and affect on Te profile peaking)

Author list

Meeting name
Meeting location
Meeting date

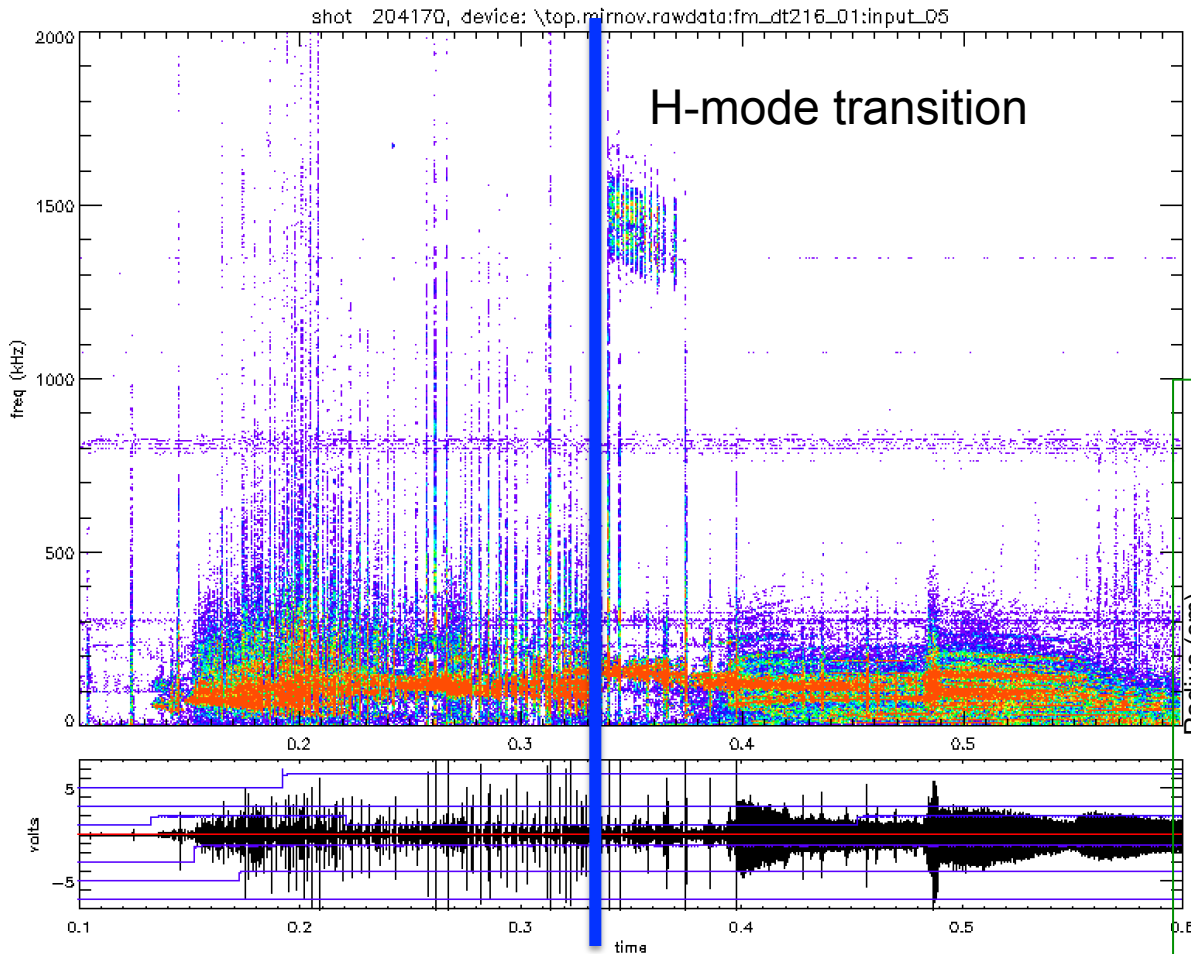


Goals and requirements

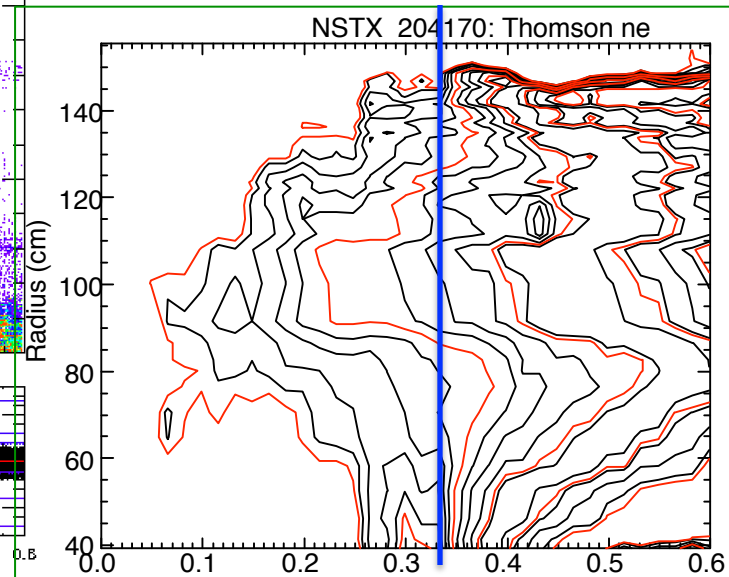
- Suppression of ctr-propagating GAE with BL#2 sources is well documented, but some questions remain:
 - Which outboard source is best?
 - Does beam voltage matter?
 - Will suppression still work for very unstable plasmas, like NSTX-like conditions?
 - Will this demonstrate a strong correlation between virulent GAE/CAE activity and core electron temperature flattening?
- Need BL#2 sources at reasonable voltage
- At least one BL#2 source should be at 90 kV
- Need to develop target plasma at 4 kG.

Near 'threshold' already

- Stability can change as plasma evolves (density?)
 - Here, transition to H-mode happens just before GAE appear.

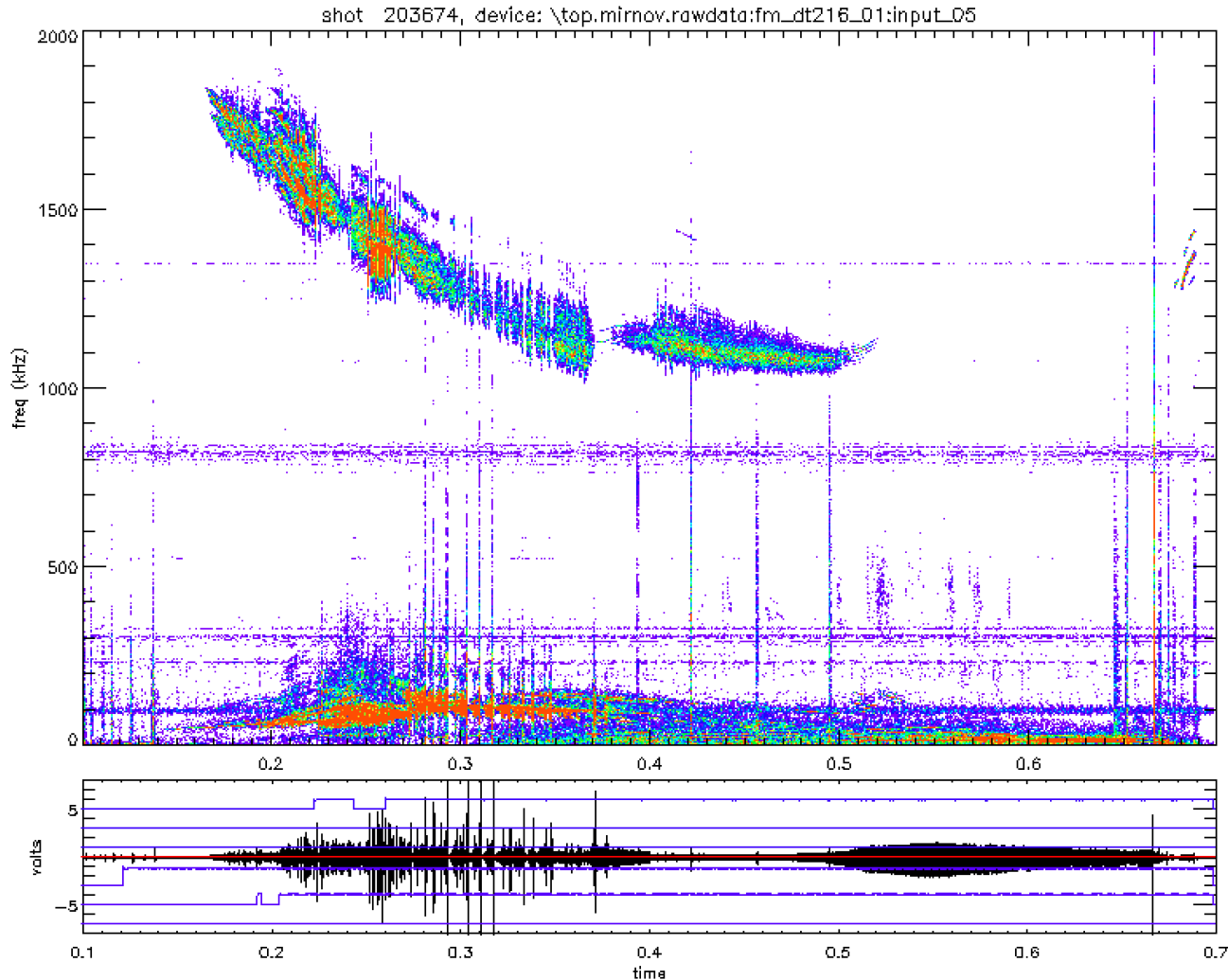


- Plan is to modulate beam through shot to monitor stability.



Need to avoid kink modes

- GAE can be suppressed by kinks.



We have some theoretical guidance

- Fast ions can be stabilizing/destabilizing depending:

Stable : $0 \leq k_{\perp} \rho_{\perp} \leq 2$ (Gorelenkov, NF 2003)

Unstable: $2 \leq k_{\perp} \rho_{\perp} \leq 4$

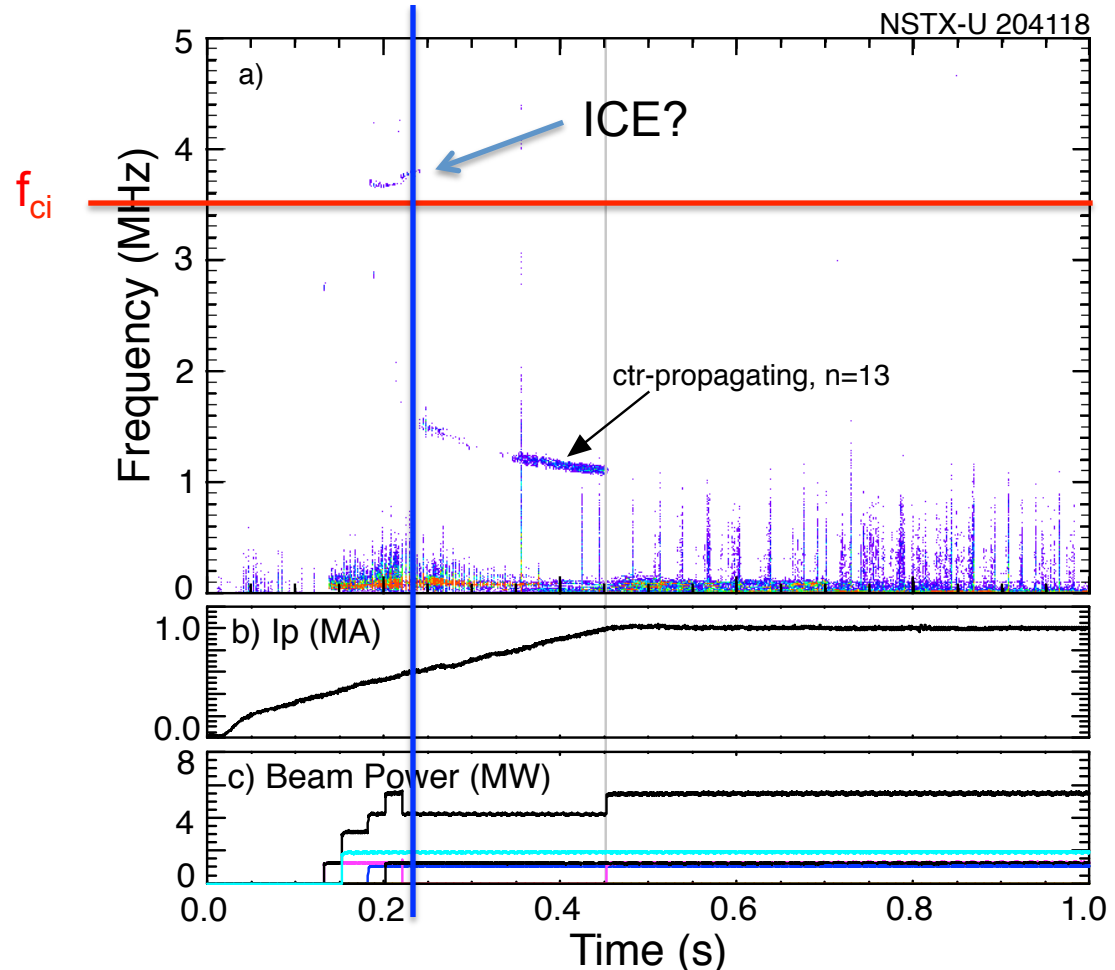
- NSTX parameter regime *might* be very different.

NSTX-U	BL 1	BL 2	
Btor	5.43	5.43	
Ebeam	90	70	
AMU	2	2	
Vbeam	2.94E+08	2.59E+08	
fci	4.13E+06	4.13E+06	
pitch	0.5	0.95	
Vperp/V	0.87	0.31	
rho_fast	9.82	3.12	
m	6	6	
radius	20	20	
kperrho			
per	2.95	0.94	

BL 1	BL 2	NSTX
3	3	kG
90	70	kV
2	2	
2.94E+08	2.59E+08	cm/s
2.28E+06	2.28E+06	MHz
0.5	0.95	
0.87	0.31	
17.77	5.65	cm
3	3	
20.0	20.0	cm
2.67	0.85	

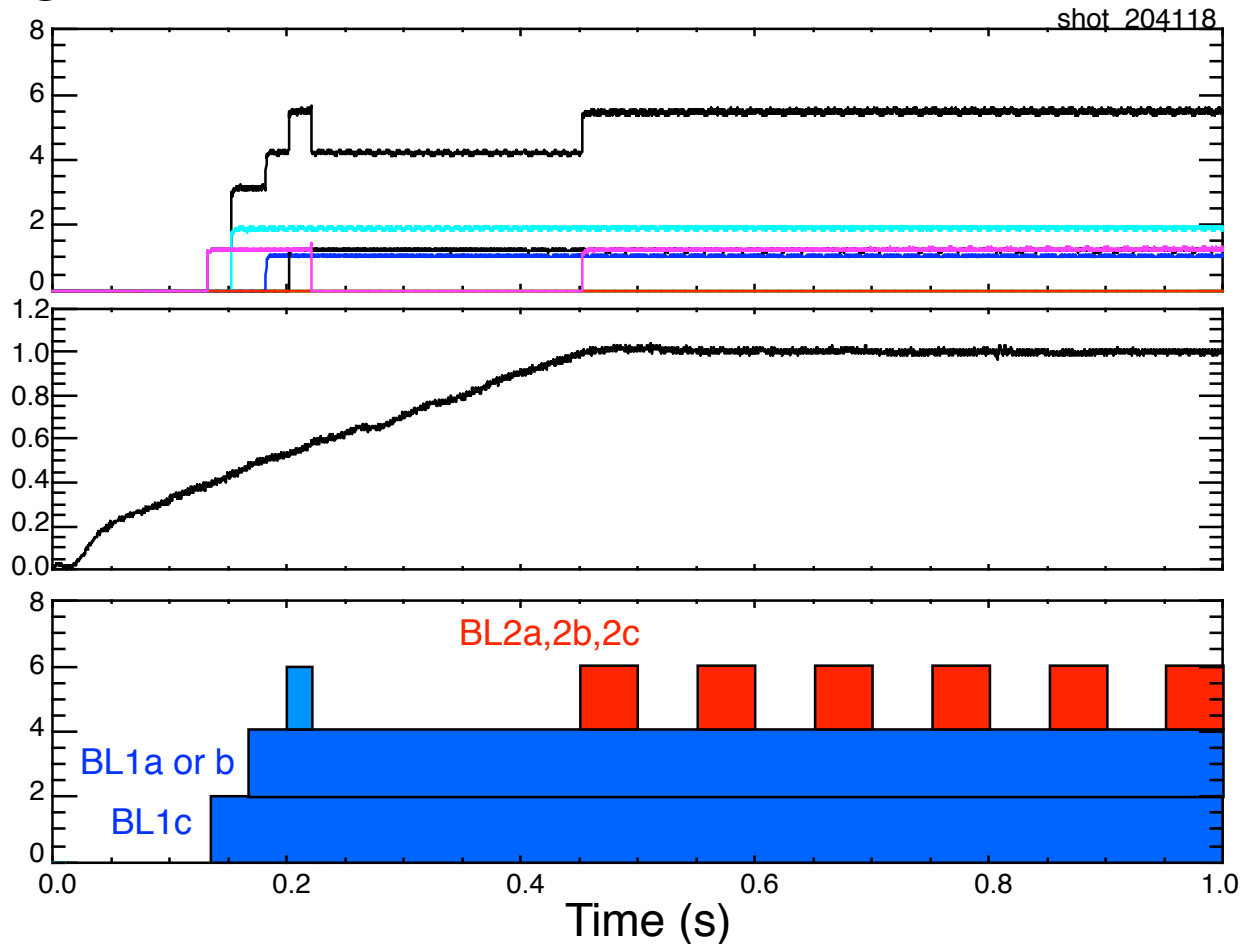
Potential 1 MA target plasma

- Spectrum of target plasma near marginal with 2a
- Need early sources to be BL#1.
 - hopefully stronger GAE without 2a early.
- Configuration should approximate this evolution in power, but depends on condition of sources on run day.



Target plasma based on shot 204118

- 1 MA target first choice to minimize beta-limit issues.



- Nominal beam waveform (4MW BL#1, 50ms blips BL#2).

Run Plan: Part 1 – Source Scan

- 0) Reproduce shot 204118 using only combination of sources 1a, 1b and 1c to total 4 MW. Ip flattop ends at 1s. Should be no kink mode.
If only weak GAE, increase power or try to lower density.
2-4 shots

All BL2 sources at 90kV, if possible, else all at 70kV.

- 1.1) Run target shot and add source 2c with 50ms on, 50ms off starting at 0.45s.
1.2) Run target shot and add source 2b with 50ms on, 50ms off starting at 0.45s.
1.3) Run target shot and add source 2a with 50ms on, 50ms off starting at 0.45s.

3 shots

If full suppression is not seen in any of these shots lower base power and repeat.

- 1.1a) Run target shot and add source 2c with 50ms on, 50ms off starting at 0.45s.
1.2a) Run target shot and add source 2b with 50ms on, 50ms off starting at 0.45s.
1.3a) Run target shot and add source 2a with 50ms on, 50ms off starting at 0.45s.

+3 shots

Run Plan: Part 2 – voltage scan

Use sources with significant voltage operational range. If not available, move to Part 3.

- 2.1) Run target shot and add source 2c with 50ms on, 50ms off starting at 0.45s.
- 2.2) Run target shot and add source 2b with 50ms on, 50ms off starting at 0.45s.
- 2.3) Run target shot and add source 2a with 50ms on, 50ms off starting at 0.45s.
3 shots

If full suppression is not seen in any of these shots lower base power and repeat with two sources per blip.

- 2.1a) Run target shot and add source 2b,2c with 50ms on, 50ms off starting at 0.45s.
- 2.2a) Run target shot and add source 2a,2c with 50ms on, 50ms off starting at 0.45s.
- 2.3a) Run target shot and add source 2a,2b with 50ms on, 50ms off starting at 0.45s.
+3 shots

Run Plan: Part 3 – lower field

Reproduce experiments at low field. Use BL2 sources at optimum voltage.

3.0) Develop 4kG, 1s version of target shot with strong GAE/CAE activity.
Should be no kink mode.

4 shots

3.1) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

3.2) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

3.4) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

3 shots

if suppression not seen, move directly to 3 source beam blips.

3.1a) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

3.2a) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

3.4a) Run target shot and add source 2c with 50ms on/off starting at 0.45s.

+3 shots