



AUG Monday Morning Meeting 24/07/2017

# Magnetic reconnection measurements with the Imaging Motional Stark Effect diagnostic.

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# IMSE + Sawteeth: Objective

## Objectives:

- 1) Measure  $q$ -profile change inside  $q=1$  over sawtooth crash  
Requires sensitivity in  $\delta q < 0.05$ .
- 2) Determine if reconnection is complete --> Does current profile change at  $\rho=0$ ?
- 3) Investigate effect of  $q=1$  surface elongation on reconnection [M. Yamada]

## Requires:

- 1) Shot program to produce large, repetitive, long-period sawteeth.
- 2) At least 1 second of identical sawteeth for good statistics.
- 3) IMSE Calibration shots ( $\pm B\phi$ , USN, Raxs Scan) on same day.

# IMSE + Sawteeth: Attempt #1, #2

Large sawteeth have been difficult with Q8.

Started from existing low-density L-mode sawteeth transport program

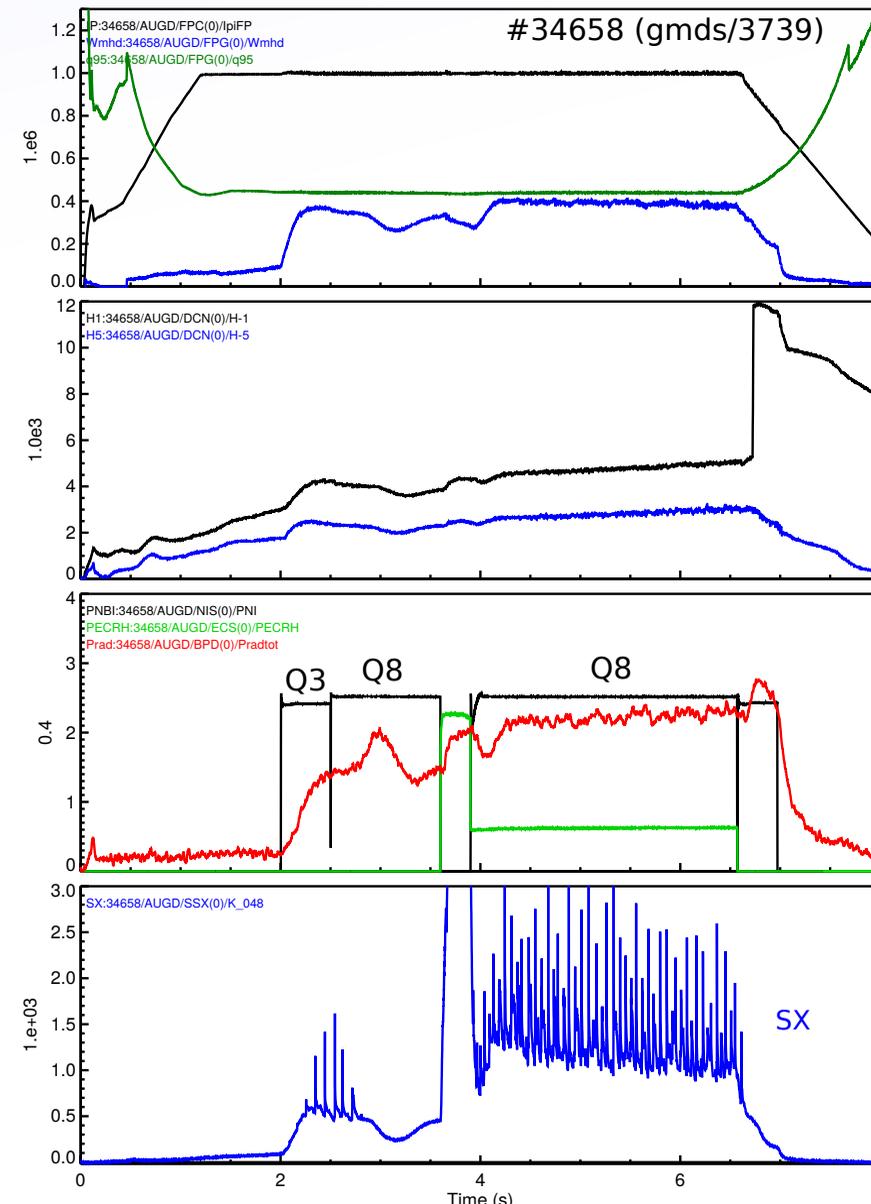
[R. McDermott, B. Geiger]

- Add on-axis ECRH in 2nd phase to increase sawteeth size and period.

34657: Q8 Technical problem.  
Q3 HST trip. Needed more gas.

34658:

- Unable to stay in L-mode
- Phase 1: Large but irregular sawteeth, disappeared after 1s.
- Phase 2: ECRH creates fast small sawteeth. ECRH was possibly too far off-axis.



# IMSE + Sawteeth: Attempt #3

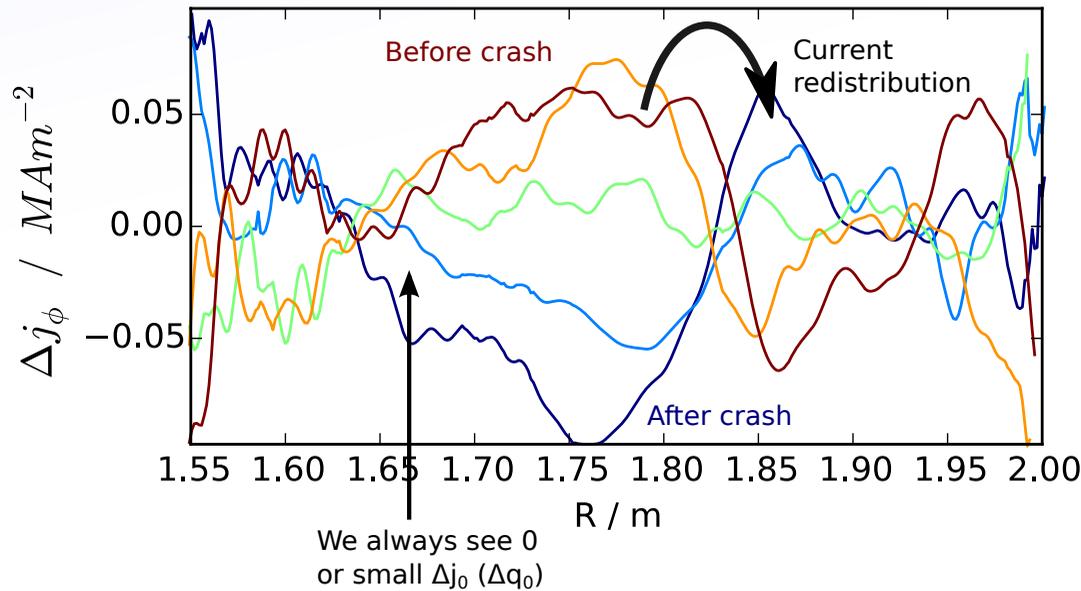
34660:

- Repeat, but remove ECRH in phase 2.

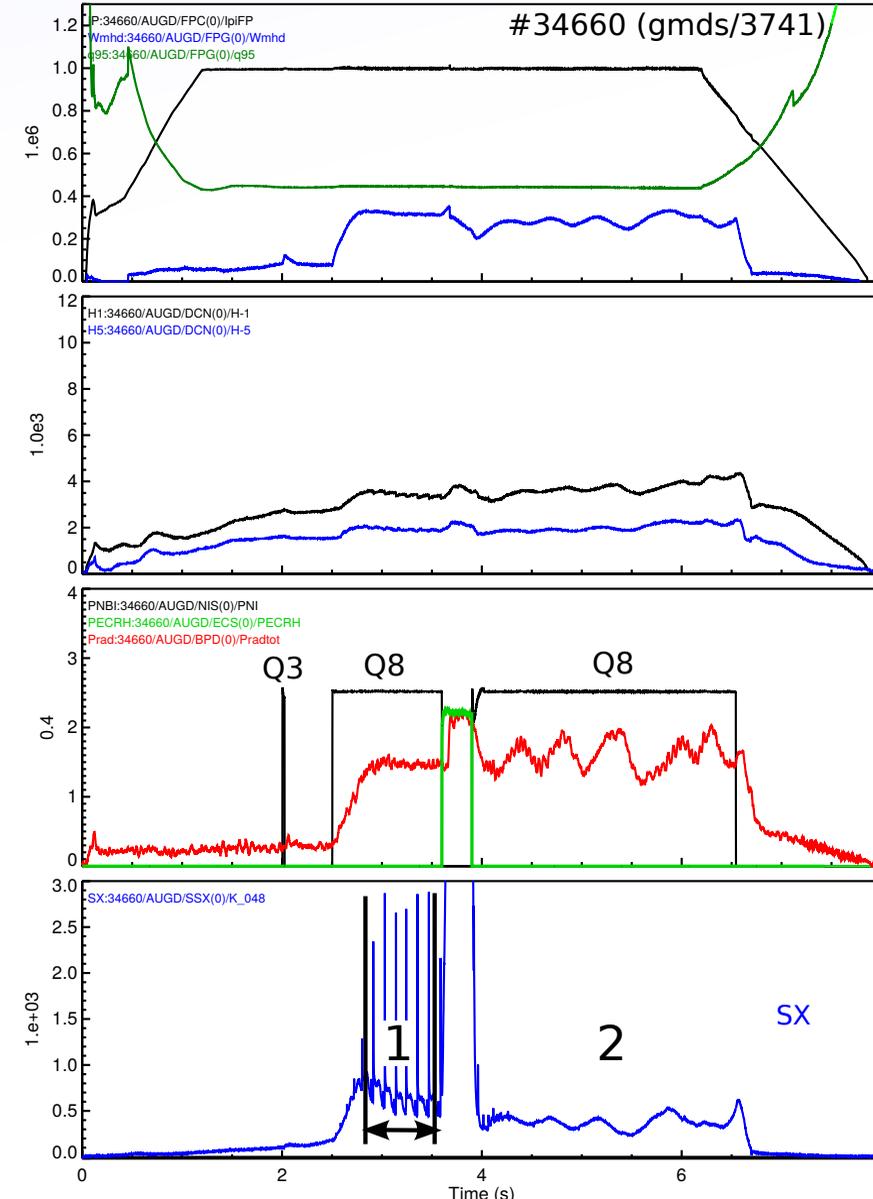
- Q3 tripped after 25ms

- Delay to NBI start seems to help.

Phase 1: **Good sawteeth, OK data:**



Phase 2: **No sawteeth**

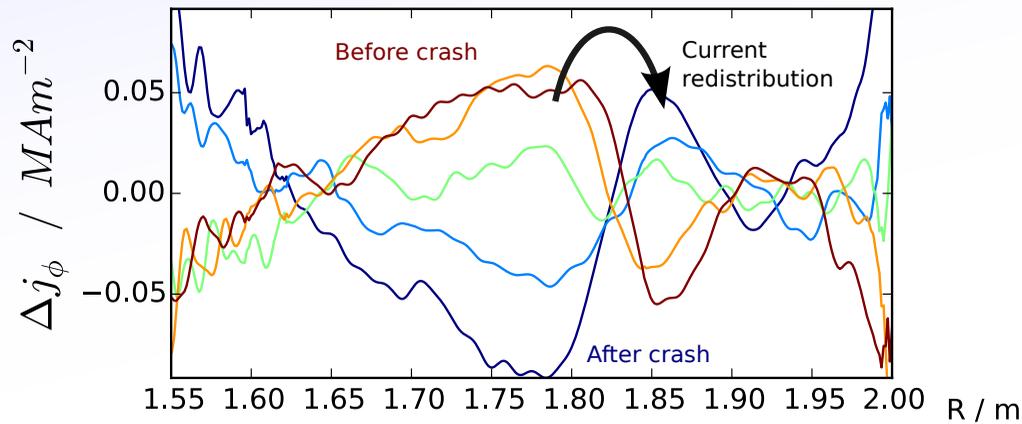


# IMSE + Sawteeth: Attempt #4

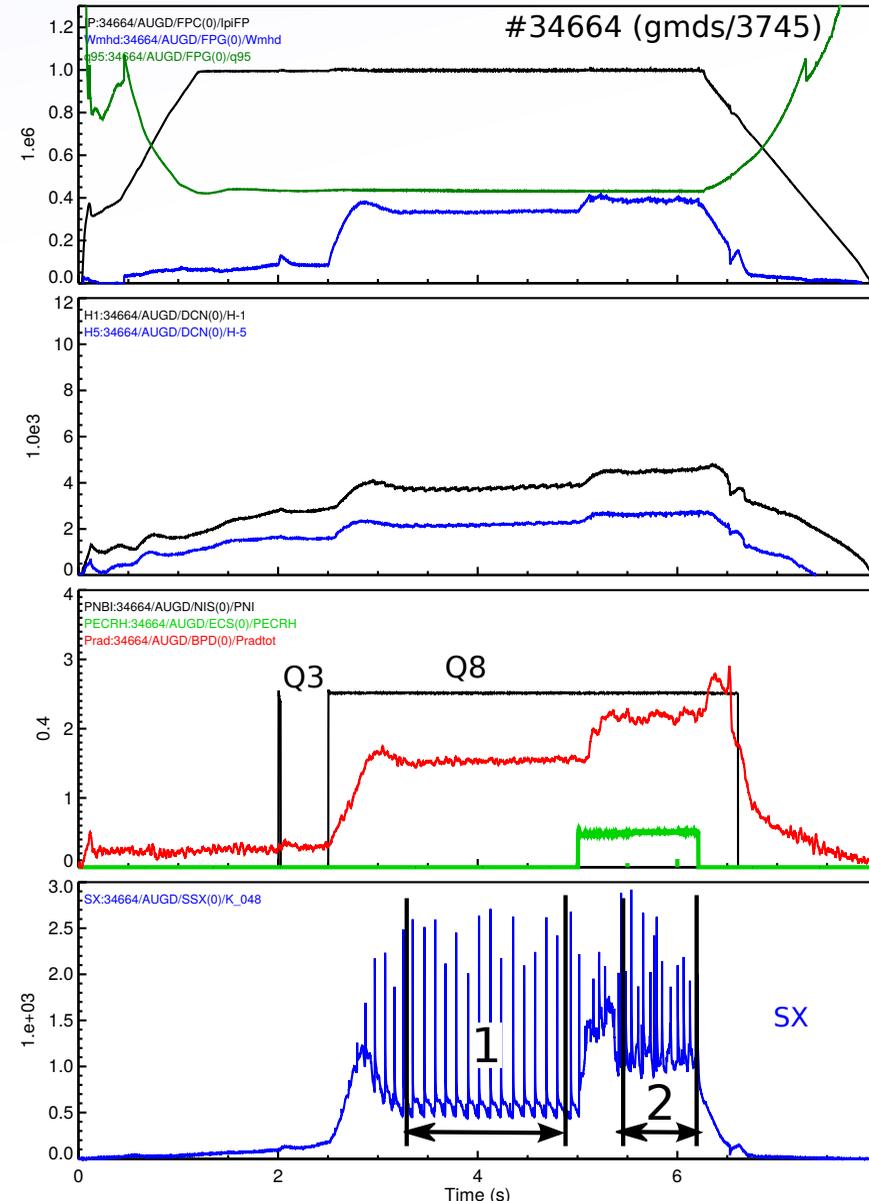
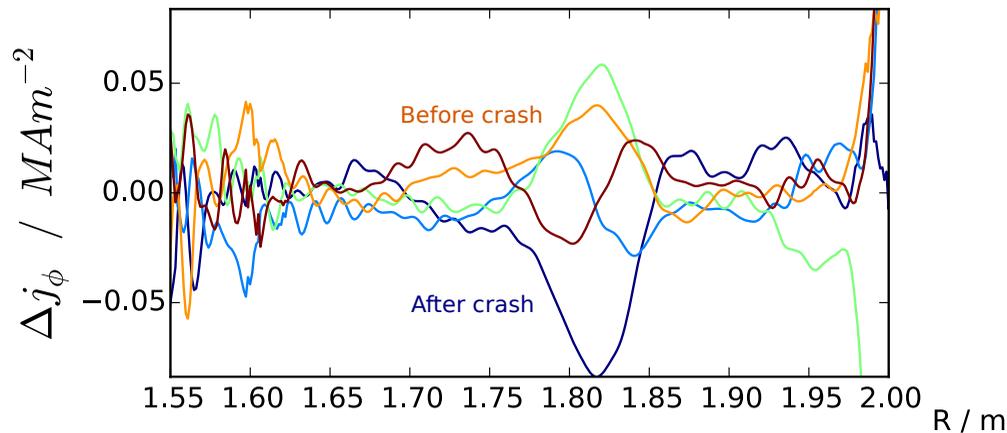
34664:

- Repeat without gap in Q8,
- try to hold phase 1 sawteeth for 2.5s
- Reintroduce ECRH on axis to see effect.

Phase 1: Large, slow regular sawteeth, Good Statistics.



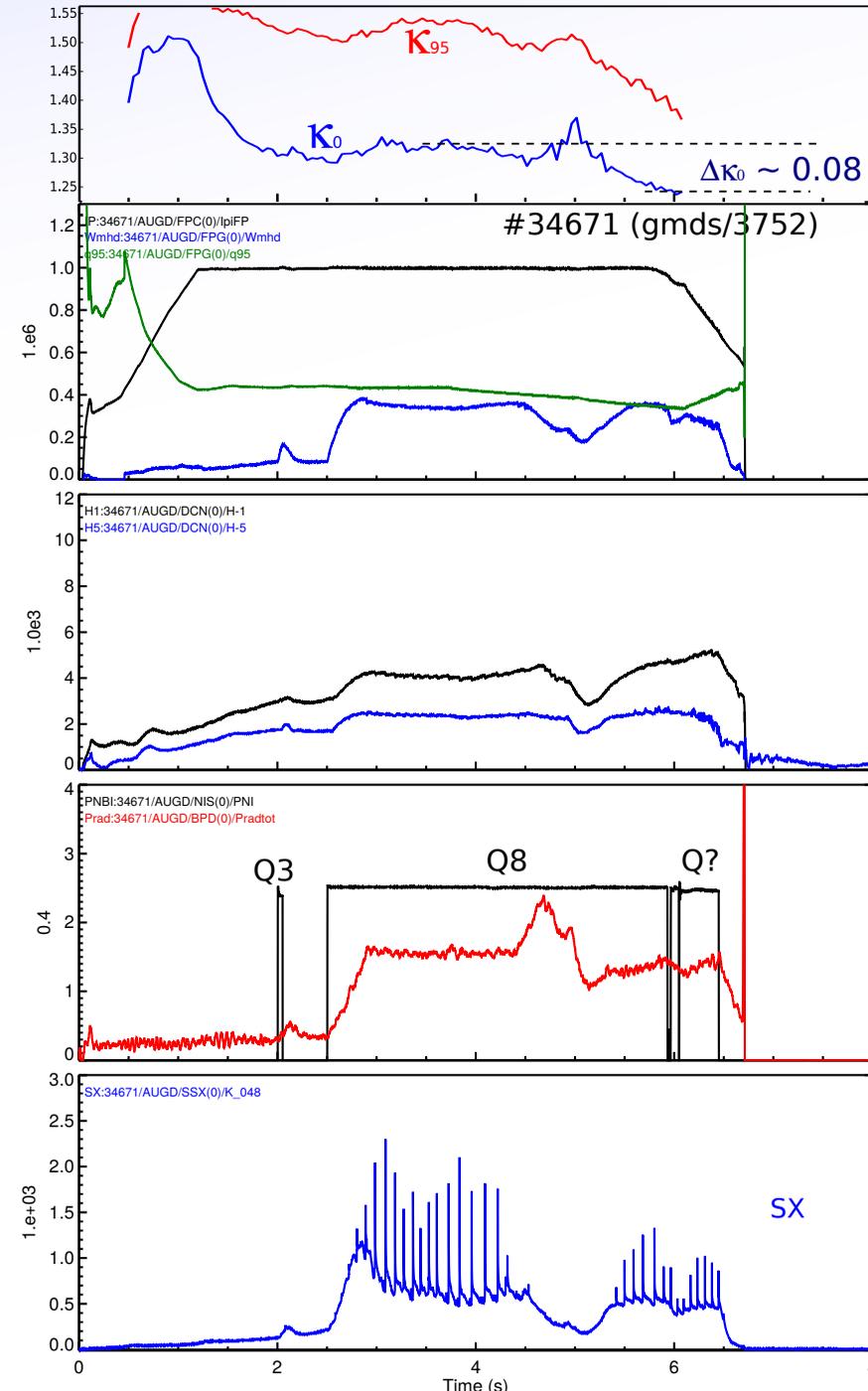
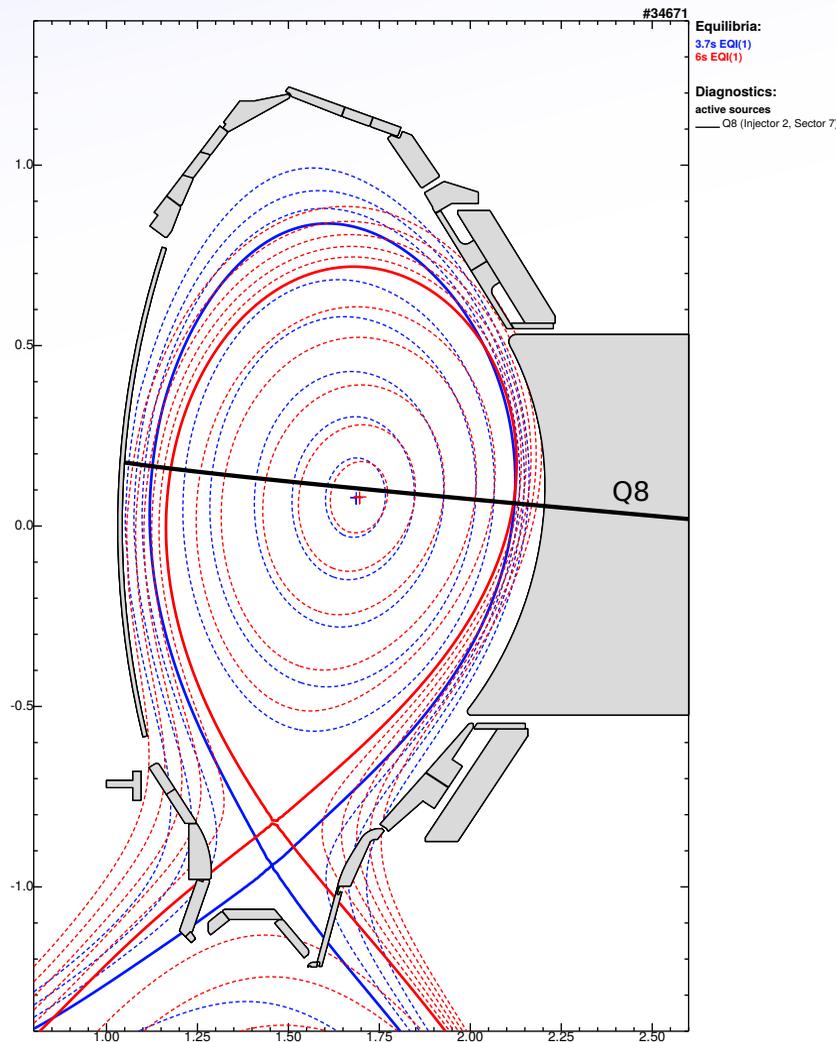
Phase 2 (ECRH): Fast irregular sawteeth. Not good data.  
Current change appears to be more localised near inversion radius:



# IMSE + Sawteeth: Elongation

34671:

- Remove ECRH.
- Develop elongation scan:
  - Raise strike points (rather than lowering axis) in order to keep Q8 deposition similar.
  - No compensation for q profile change, may need to add Ip ramp later.

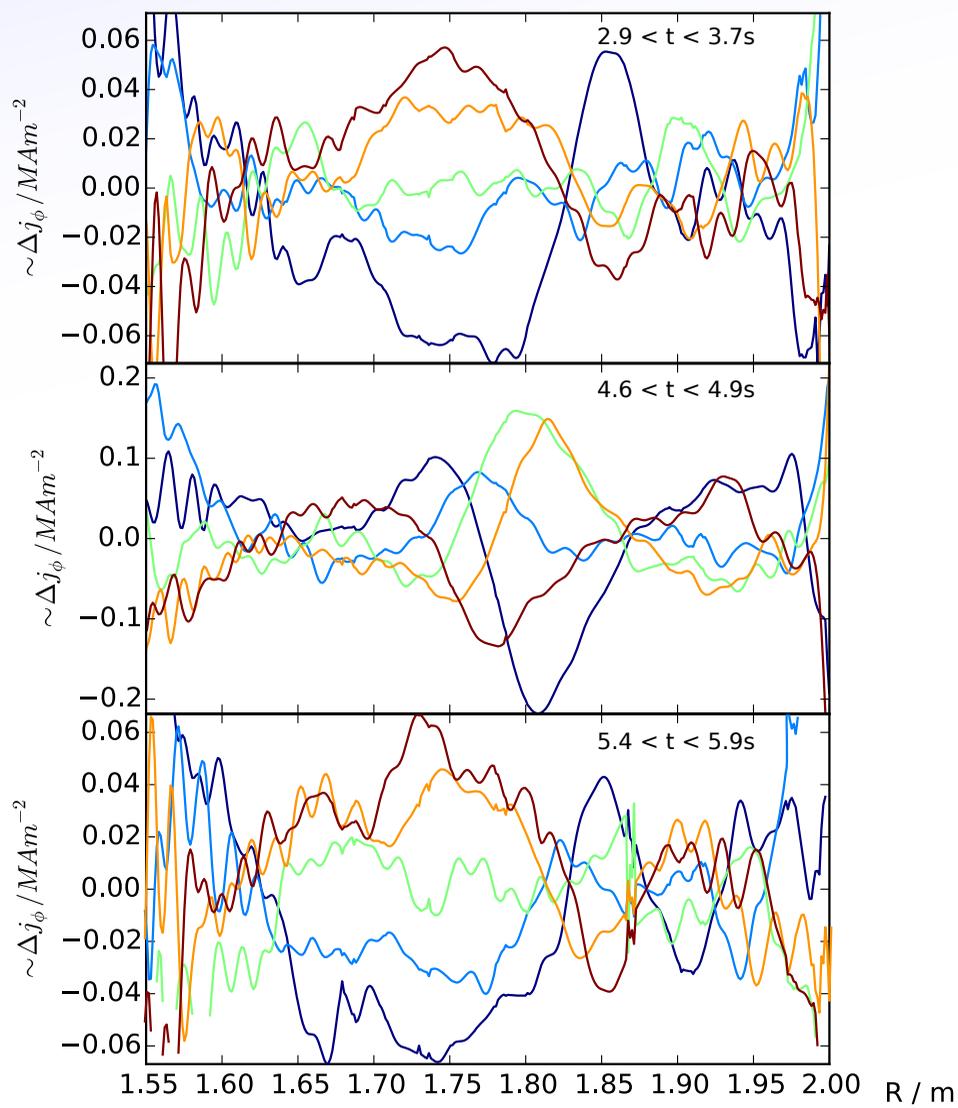


# IMSE + Sawteeth: Elongation

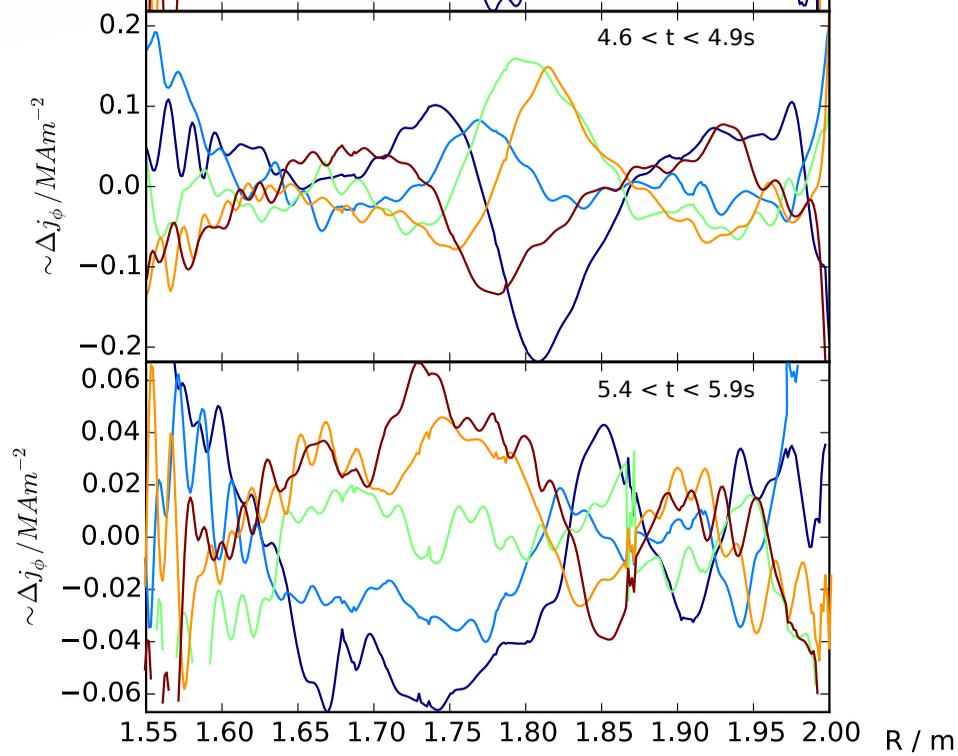
34671:

- Dropped to L-mode during scan, sawteeth move.
- Scanned small range of  $\kappa_0$  ( $\sim 0.08$ ).
- Q8 Tripped before end of scan (so no IMSE)
- Some changes in sawteeth, but need to examine everything else that is changing.

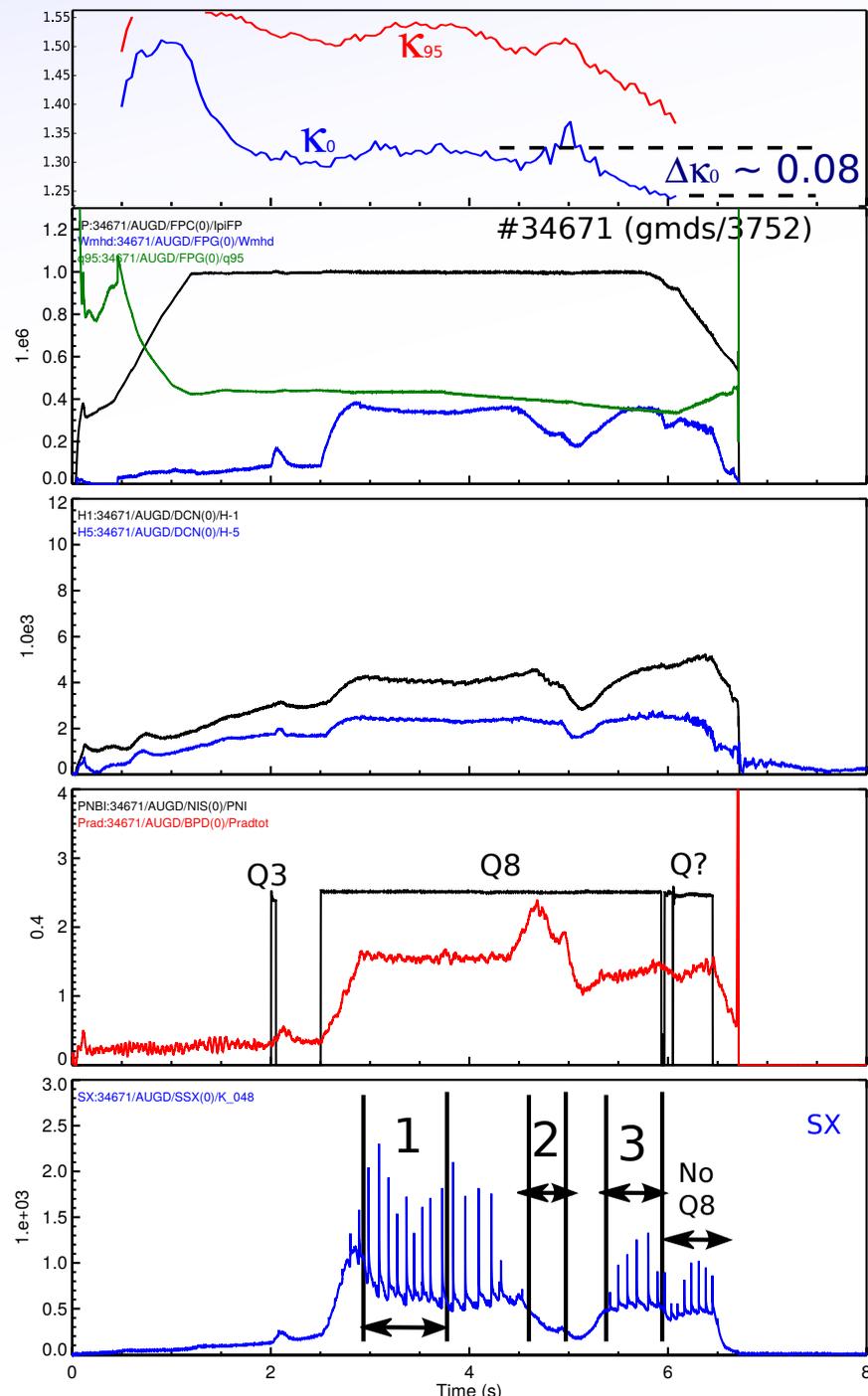
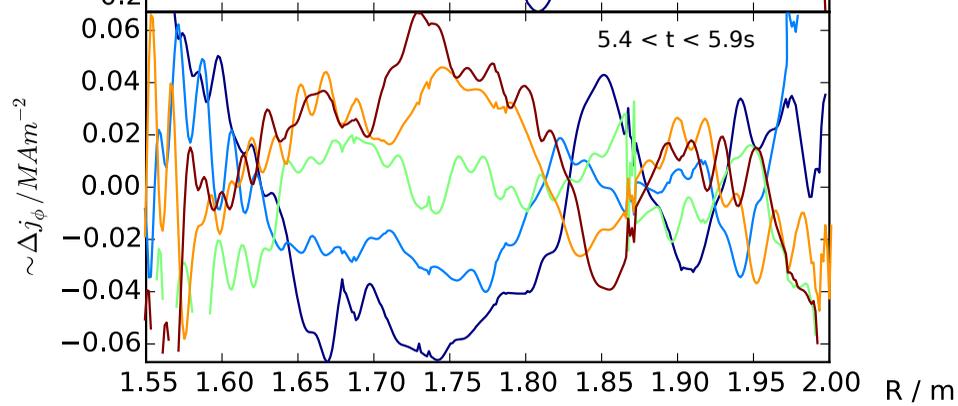
1:



2:



3:





# IMSE + Sawteeth: Future

To be done...

- 1) Derive absolute  $q$  profiles: IDE + calibration shots.
- 2) Determine if  $j_0(q_0)$  is really not changing.
  
- 3) Development of elongation scan.
  - Need  $I_p$  ramp to compensate  $q$ -profile change?
  - What else changes? Can it be avoided?  
(Suggestions welcome)
  
- 4) ECRH Behaviour
  - Identify exactly when/how ECRH helps and when it hinders the sawteeth.
  - Scan ECRH across  $q_0$  surface from outside.
  - Stepped scan to see the ECRH effect on the current profile with IMSE.