



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) Accurately measure  $q$ -profile change inside  $q=1$  over sawtooth crash ( $\delta q \ll 0.1$ ).
- 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 2 seconds of identical sawteeth for good statistics.
- 3) IMSE Calibration shots ( $\pm B\phi$ , USN, Raxs Scan)

# IMSE + Sawteeth: Attempt #1, #2

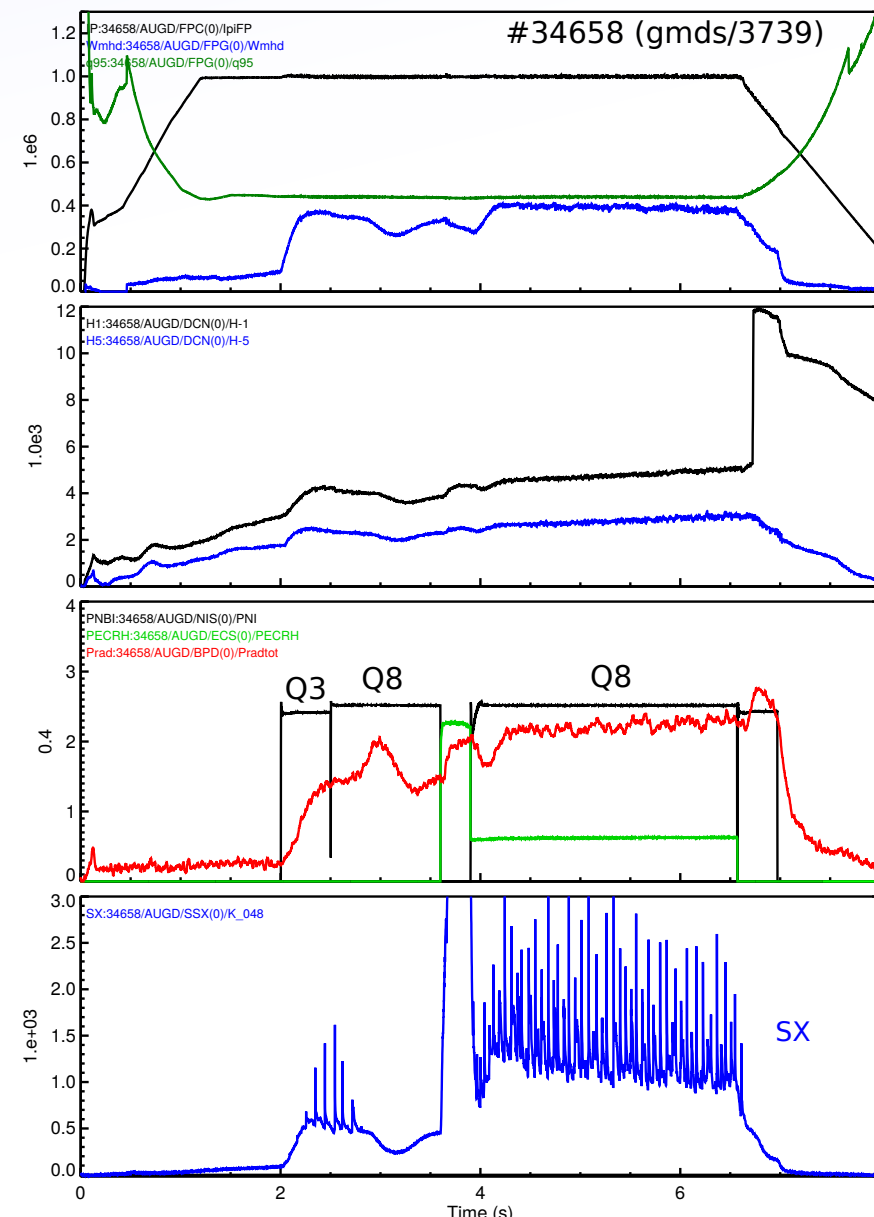
Large sawteeth were difficult with Q8, started from existing low-density L-mode sawteeth transport program [R. McDermott, B. Geiger]

- Add on-axis ECRH to 2nd phase to try to increase sawteeth size.

34657: HST trip. Needed more gas.

34658:

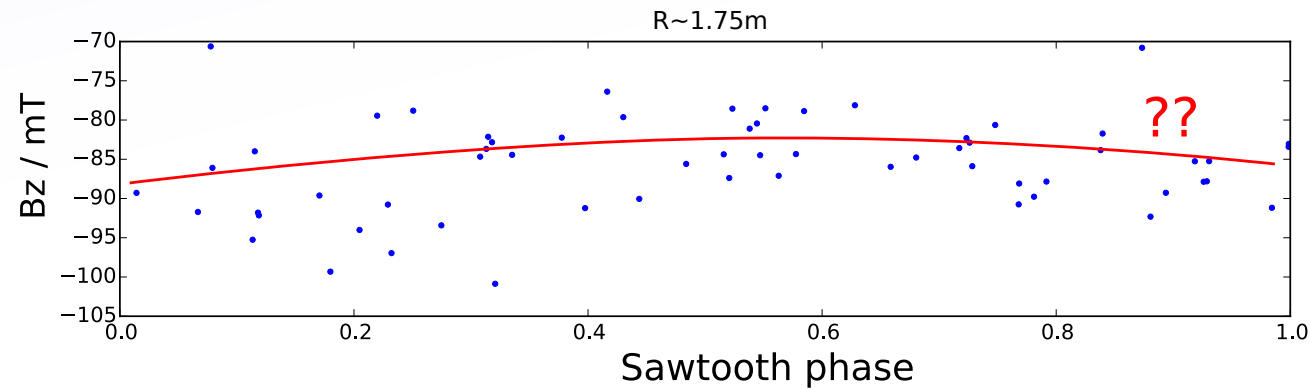
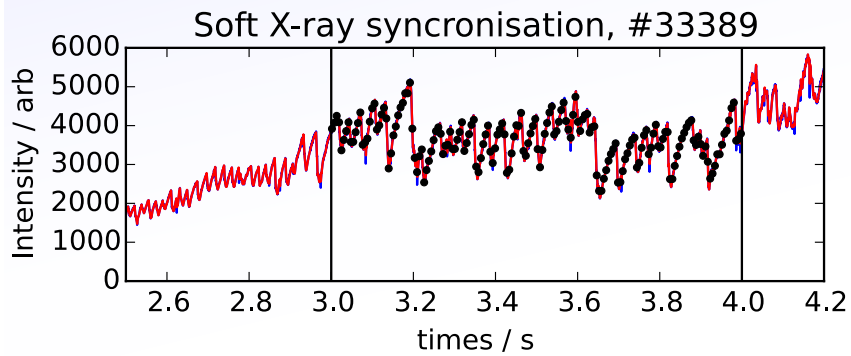
- Unable to stay in L-mode
- Large and slow but irregular sawteeth in phase 1.
- ECRH creates faster smaller sawteeth in phase 2. ECRH was probably too far off-axis.



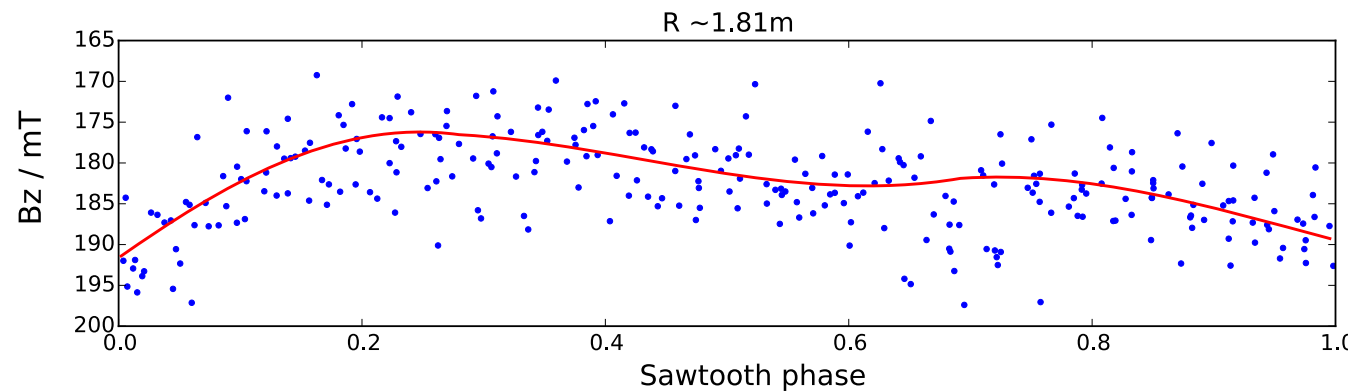
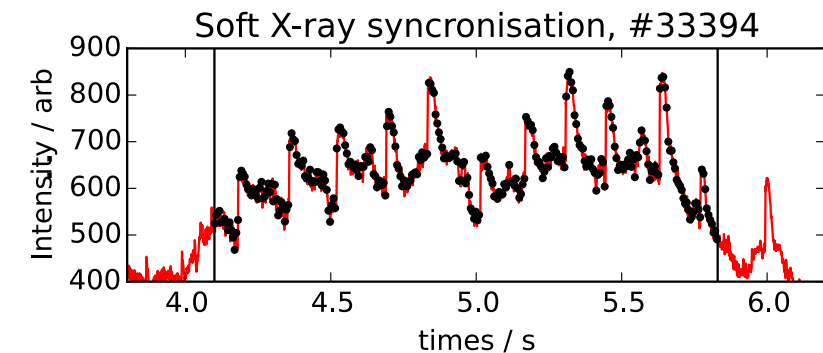
# IMSE + Sawteeth: 33389

Pitch / Polarisation changes with Sawteeth are VERY small  
- Need many identicle large sawteeth to average.

33389 - Some sawtooth but no clean SX or IMSE signatures - difficult to average sawteeth:  
No clear sawtooth like behaviour in Bz measurement.



33394 - Clear sawteeth during ICRH period - only 2s, but relatively good IMSE signal.



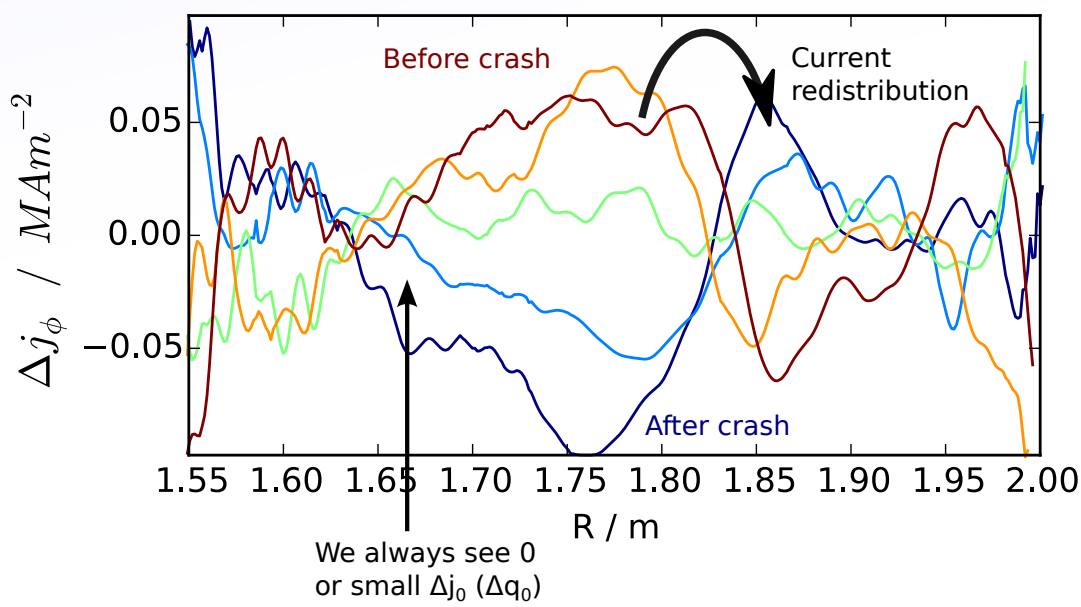


# IMSE + Sawteeth: Attempt #3

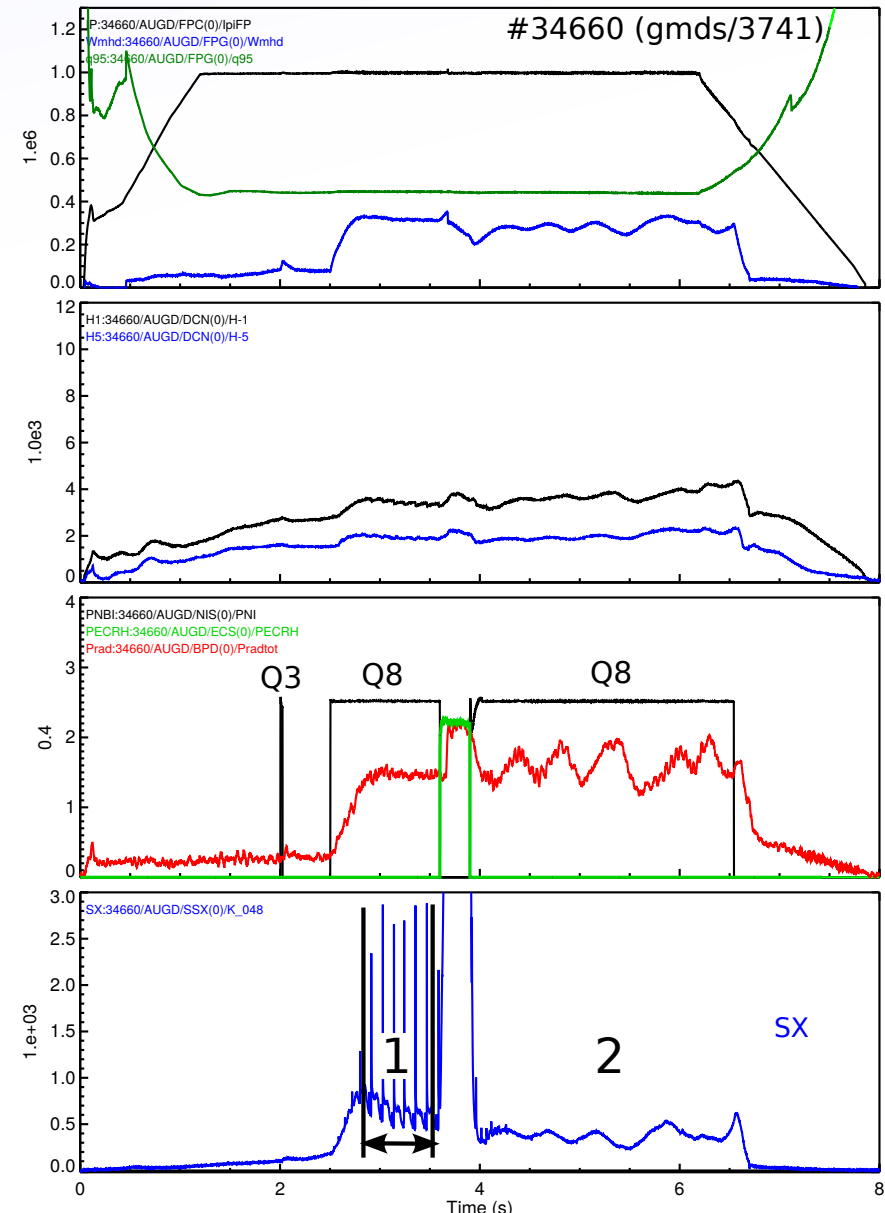
34660:

- 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

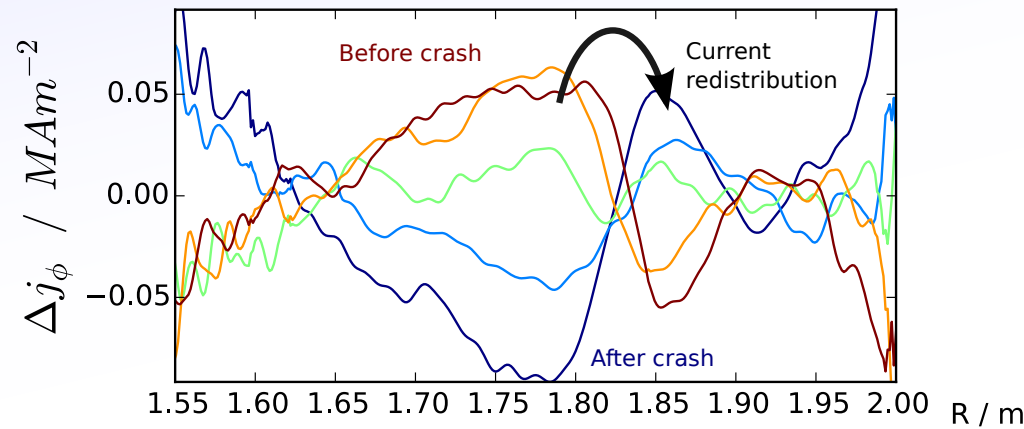


# IMSE + Sawteeth: Attempt #4

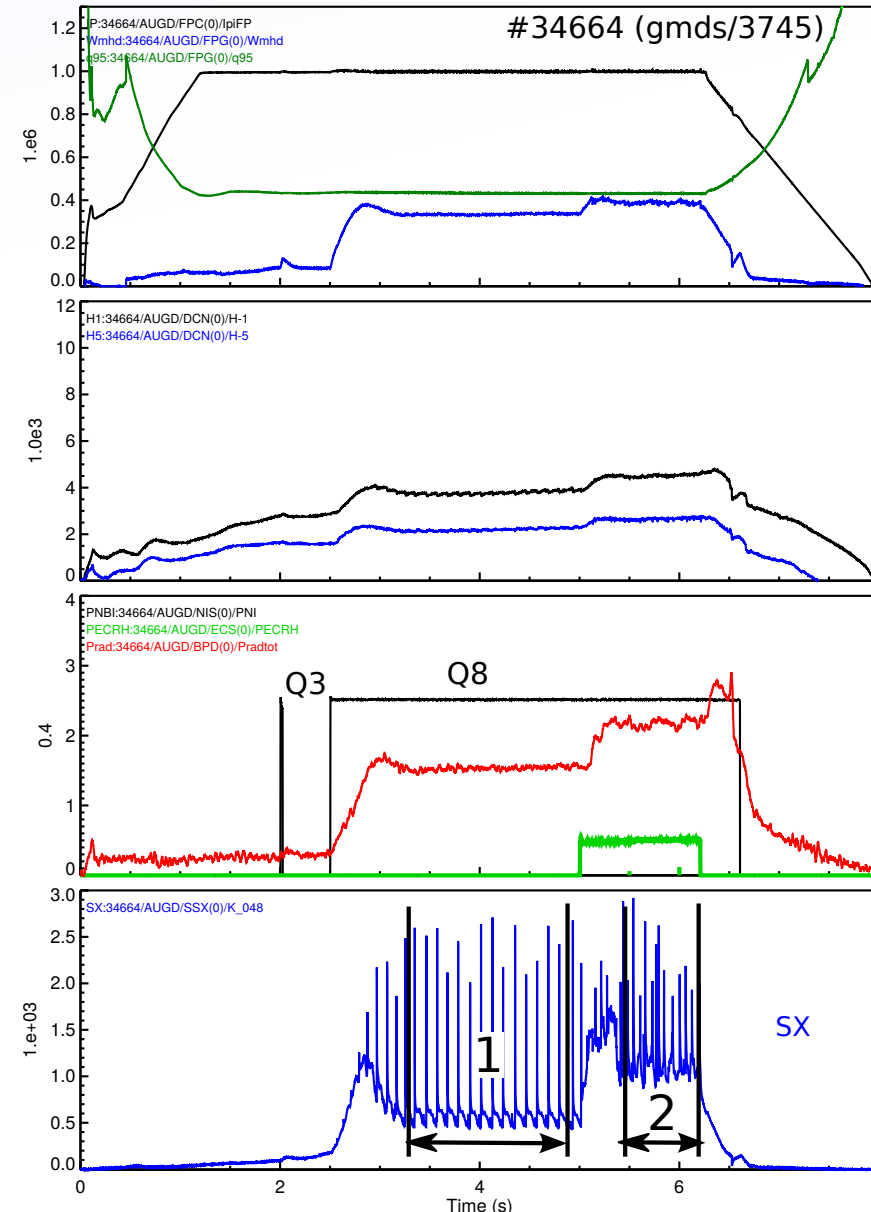
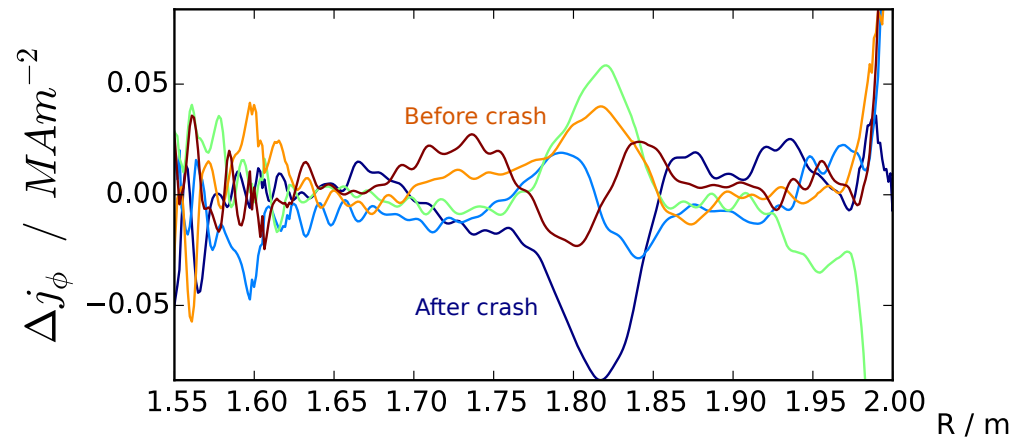
34664:

- 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:

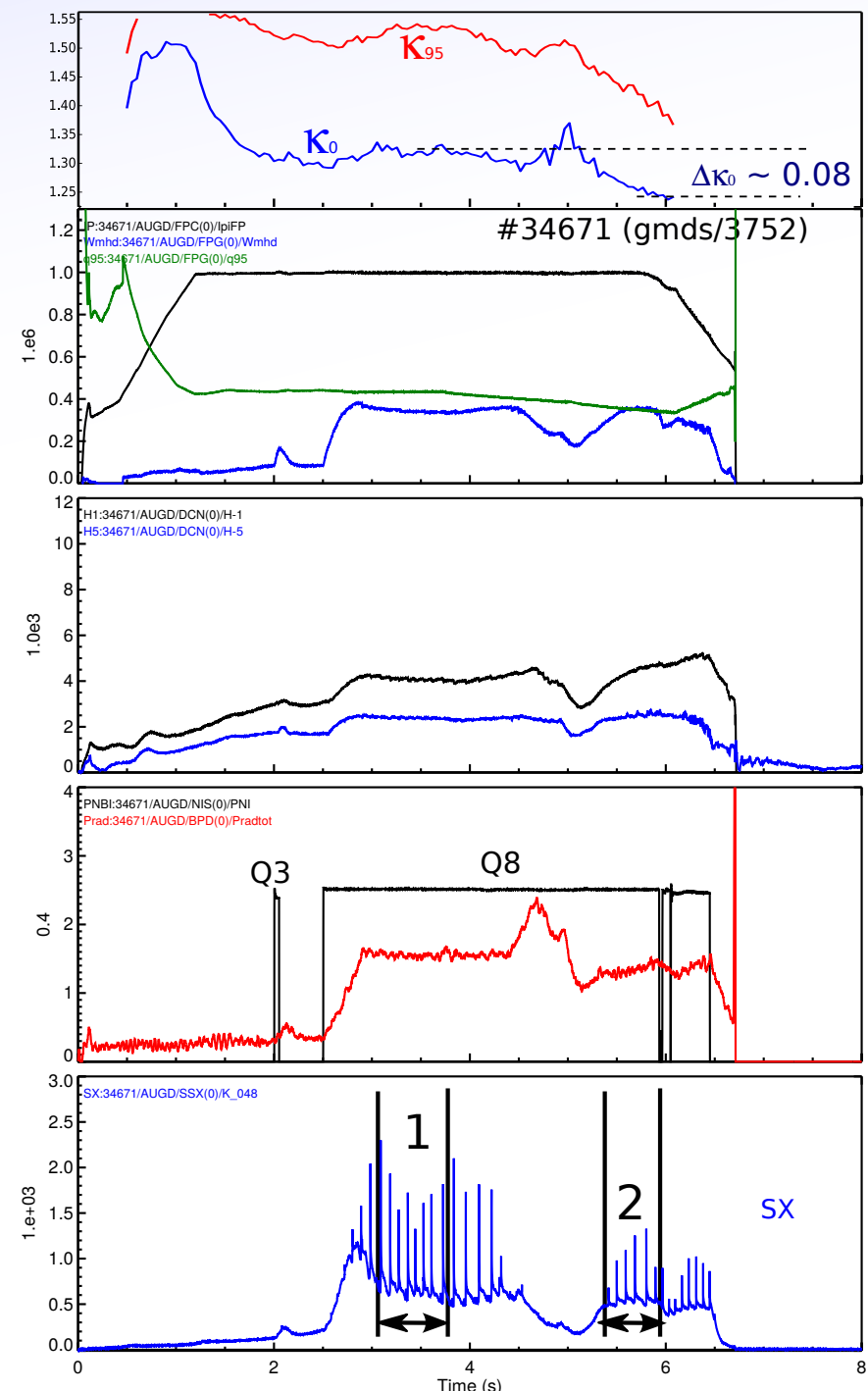
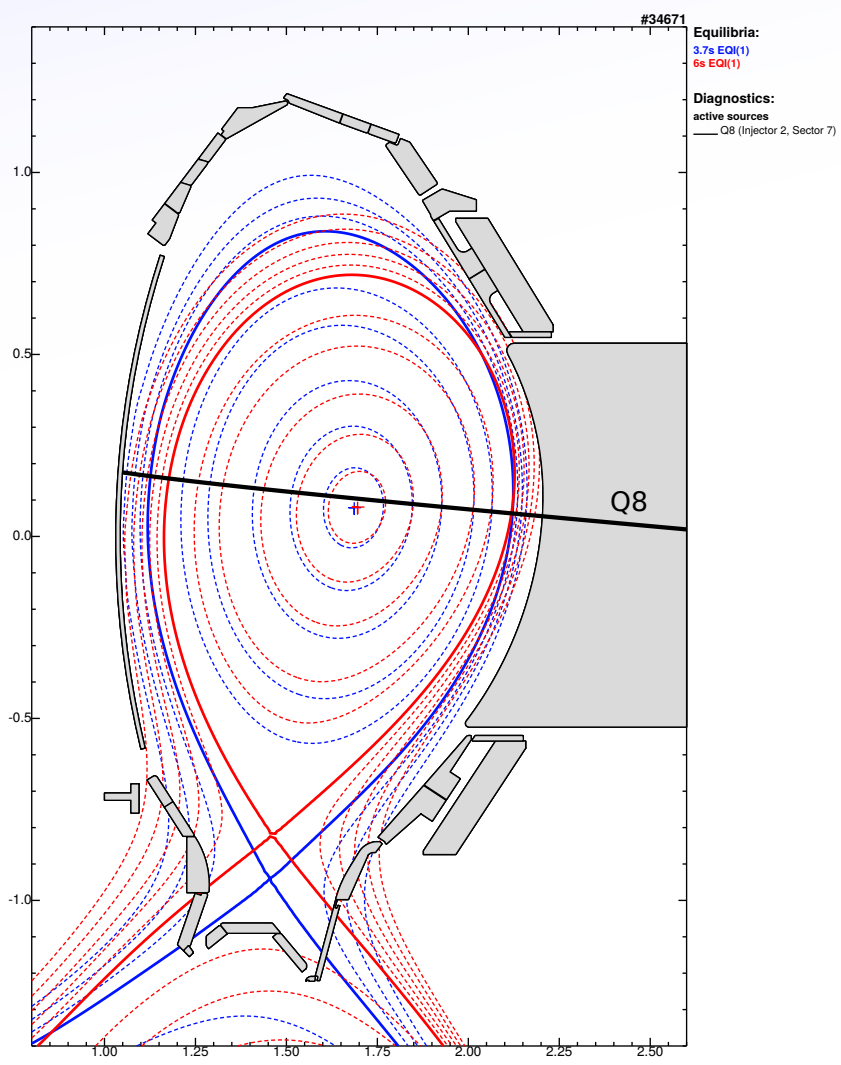




# IMSE + Sawteeth: Elongation

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.

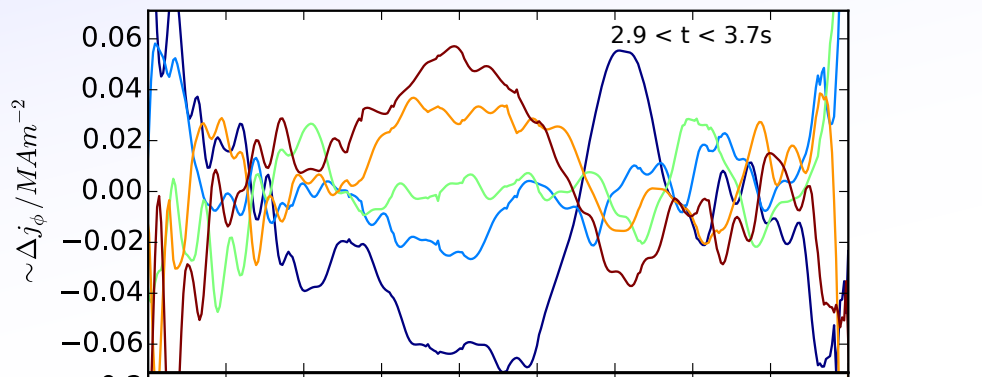


# IMSE + Sawteeth: Elongation

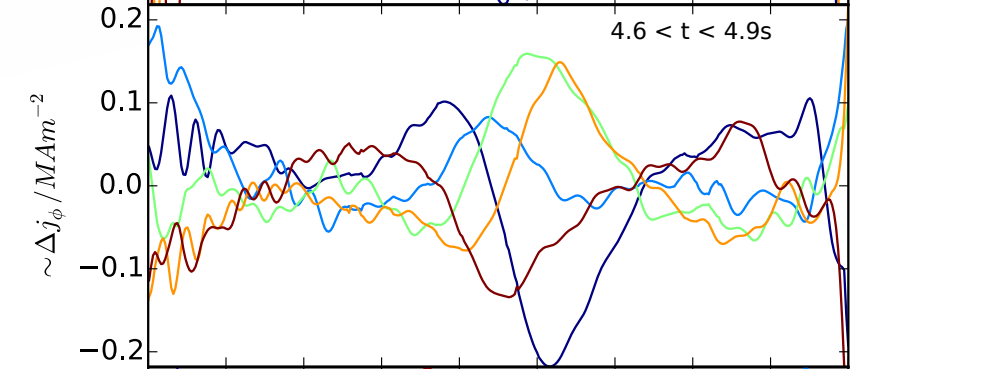
34671:

- Dropped to L-mode during scan, sawteeth move.
- Scanned small range of  $\kappa_0$  ( $\sim 0.08$ ).
- Some changes in sawteeth, but need to examine everything else that is changing.

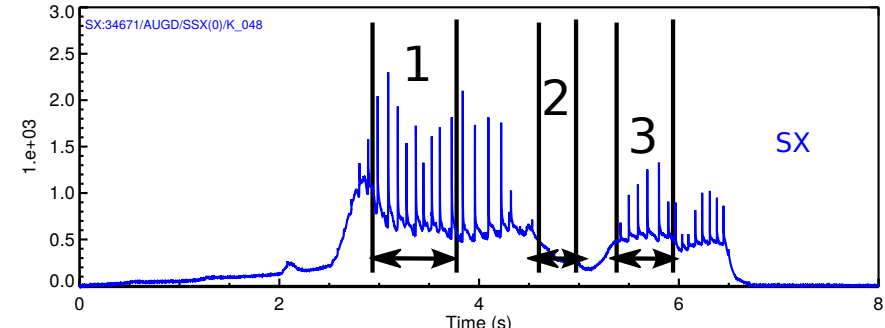
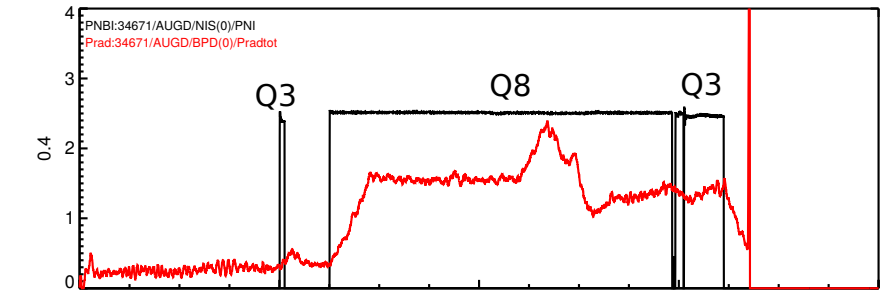
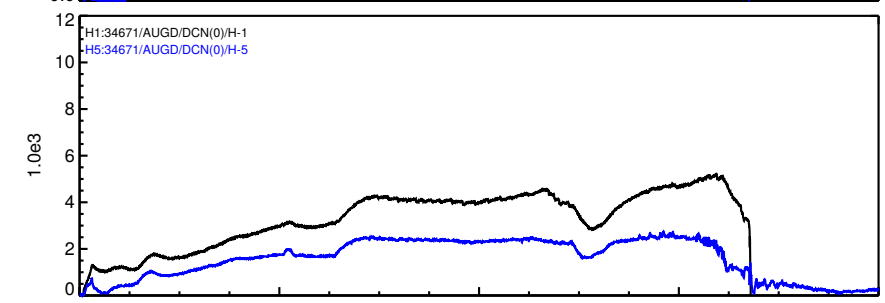
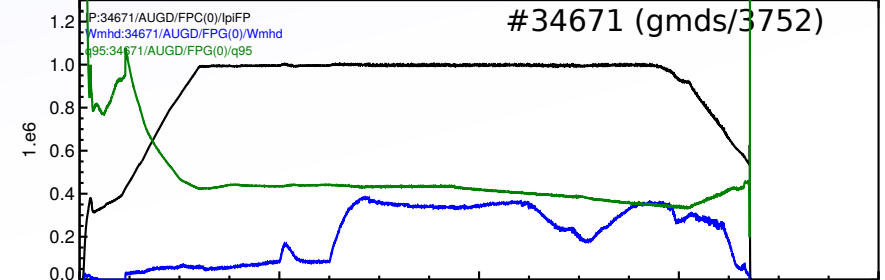
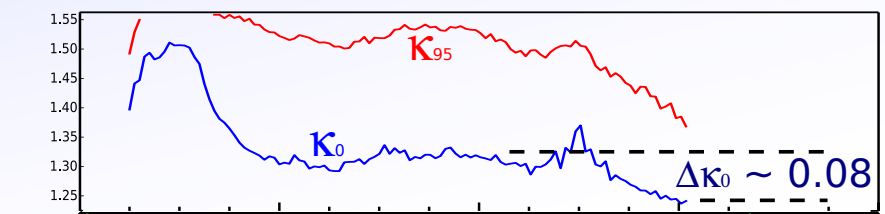
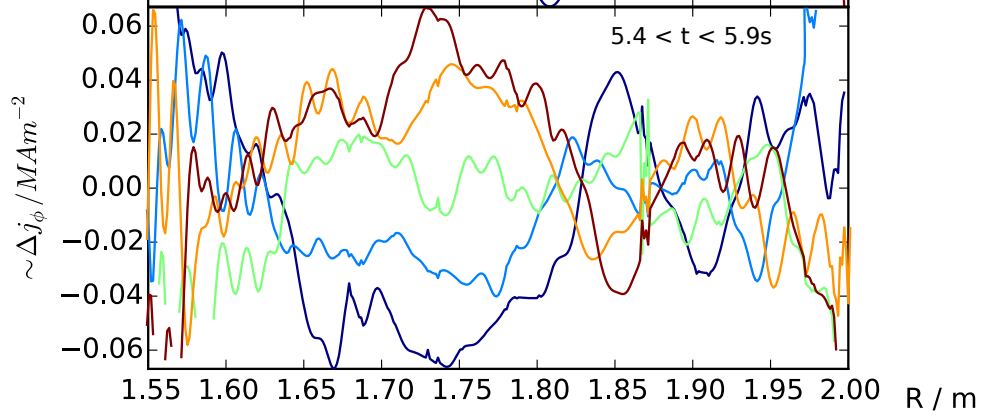
1:

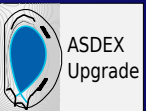


2:



3:





# IMSE + Sawteeth: Future

To be done...

- 1) Analysis using IDE with calibration shots and to derive absolute  $q$  profiles.
- 2) Determine if  $j_0/q_0$  really are not changing.
  
- 3) Further development of elongation scan.
  - Need  $I_p$  ramp to compensate any  $q_0$  change?
  - What else changes? Can it be avoided?  
(Suggestions welcome)
  
- 4) ECRH Behaviour
  - It would be good identify exactly when/how ECRH helps and when it hinders the sawteeth.
  - Scan ECRH across  $q_0$  surface from outside.
  - Stepped scan so that we can the ECRH effect on the current profile with the IMSE.