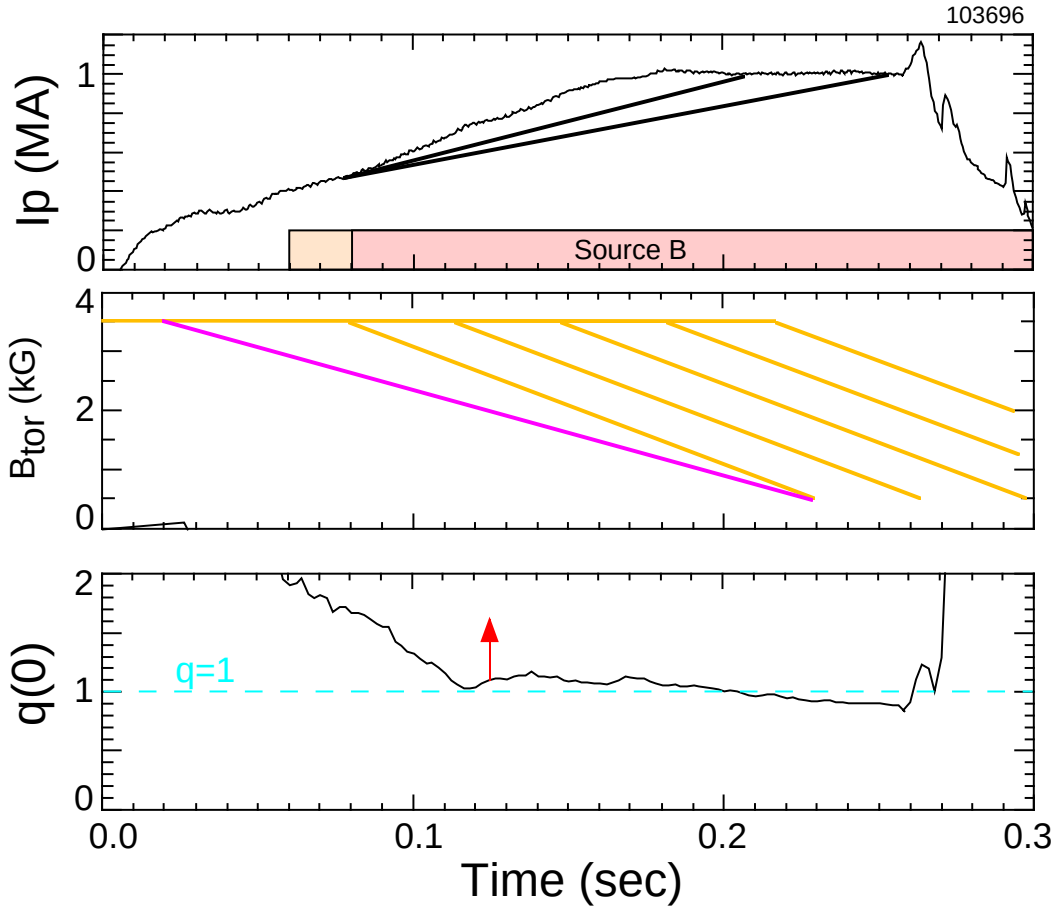
# Review of XP-28
# Current driven external kinks

J. Manickam, E. Fredrickson,
M.Okabayashi and the NSTX team

# Overview of XP-28




- Ramp current to maintain finite edge current density and drive the external kink
- Ramp down B-tor to reduce q_95
- Early beam heating to keep q_min > 1

# Signature of ideal kink

- Large perturbation at plasma edge
  - Small or no perturbation in core
  - Low frequency non-axisymmetric mode
- Correlation with q_95
- No island structure on SXR contours
- Mode frequency not locked to plasma
- Parametric dependence

# XP-28 shots of interest

105980 - 105992,105996,105997,105999,106011-15

105998,106001,106000,106010

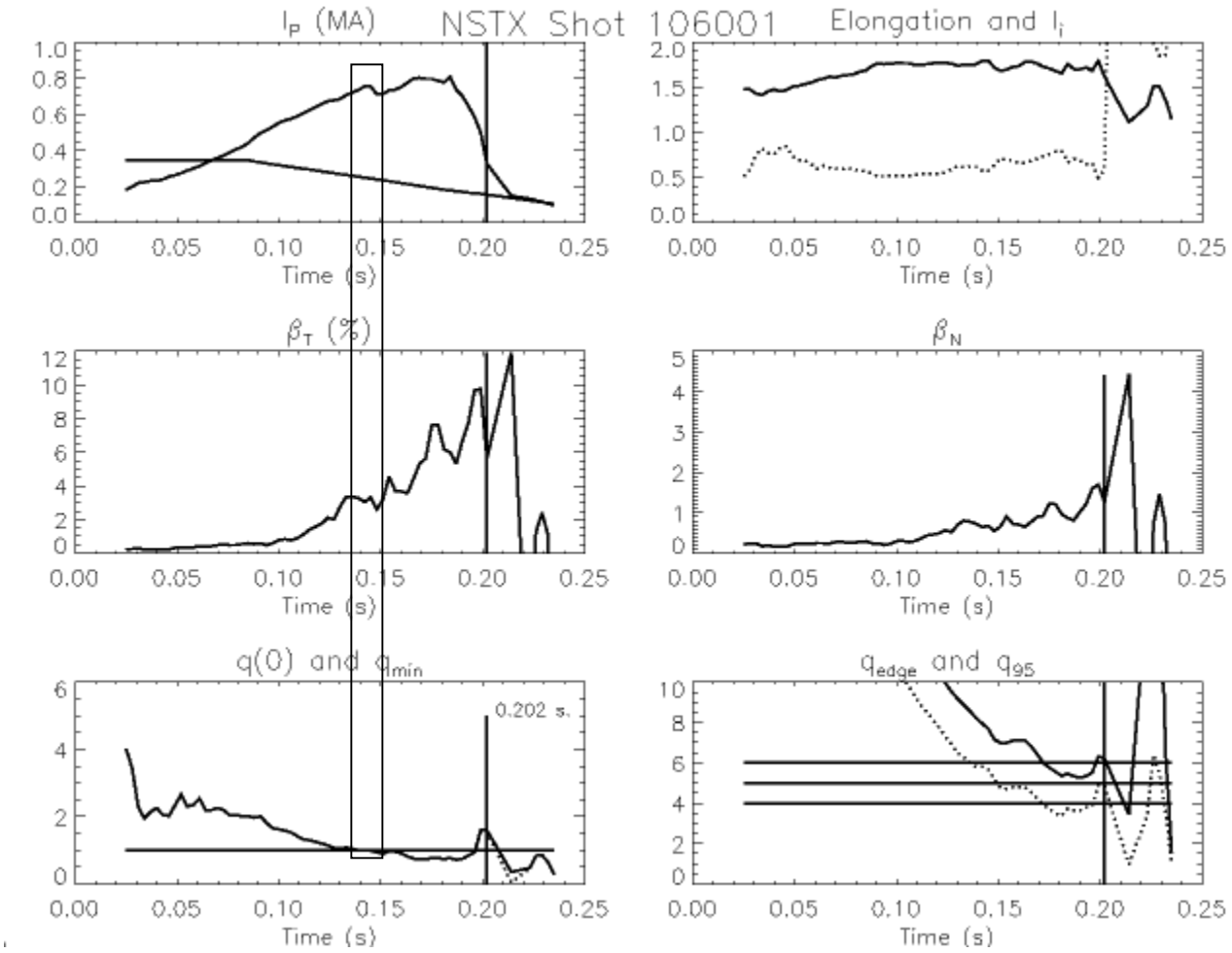
105993,105994,105995,106008,106009

106002,106003,106006,106007

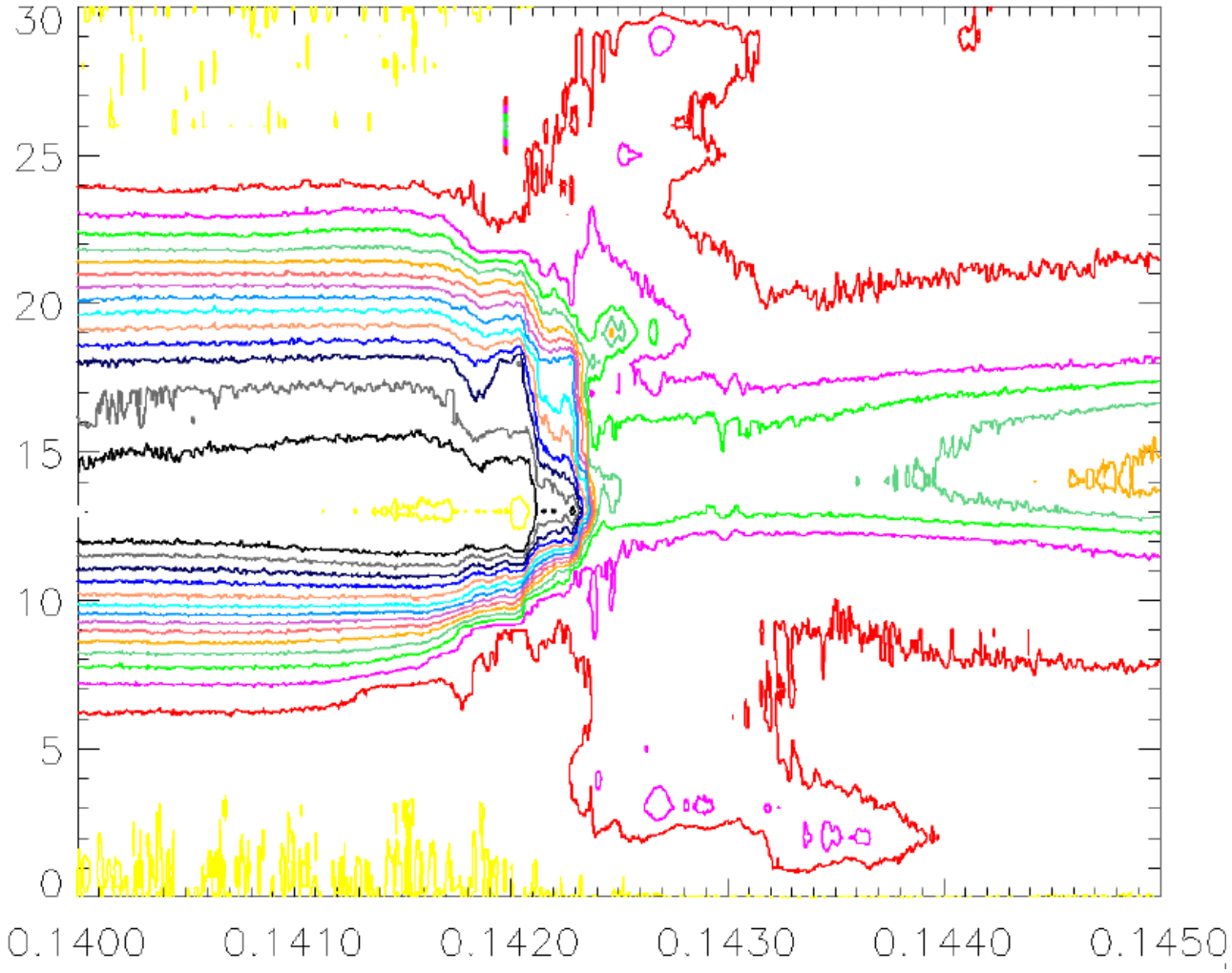
106004,106005

- Other problem with discharge or no clear signature
- Possible ext. kink few oscillations – locked ?
- Possible ext. kink many oscillations
- Internal kink + Possible ext kink
- Clear external kink

# Time traces for 106001



# 106001 - Possible ext. kink-few oscill. - locked ?



# Zero frequency mode amplitude signals

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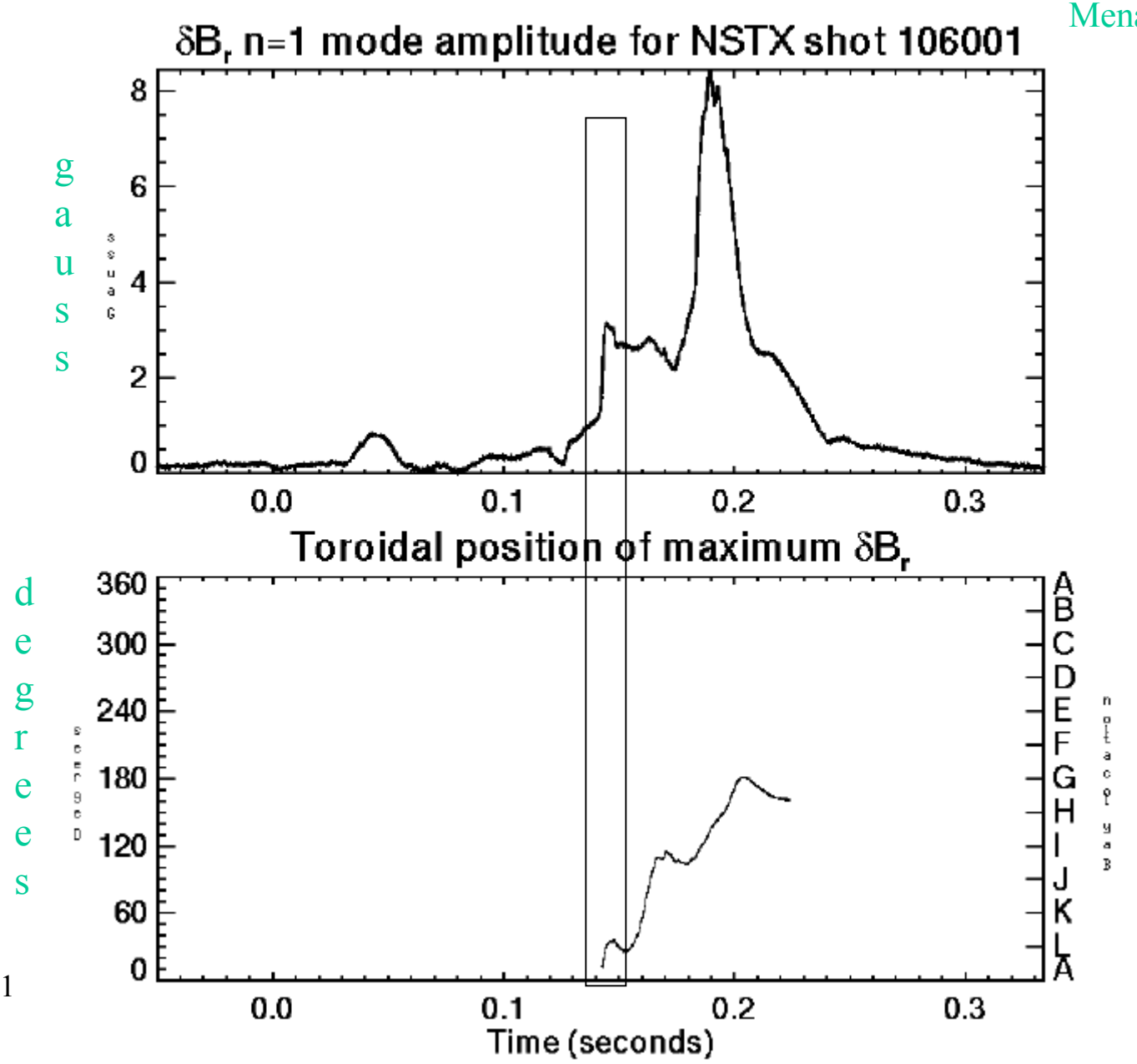
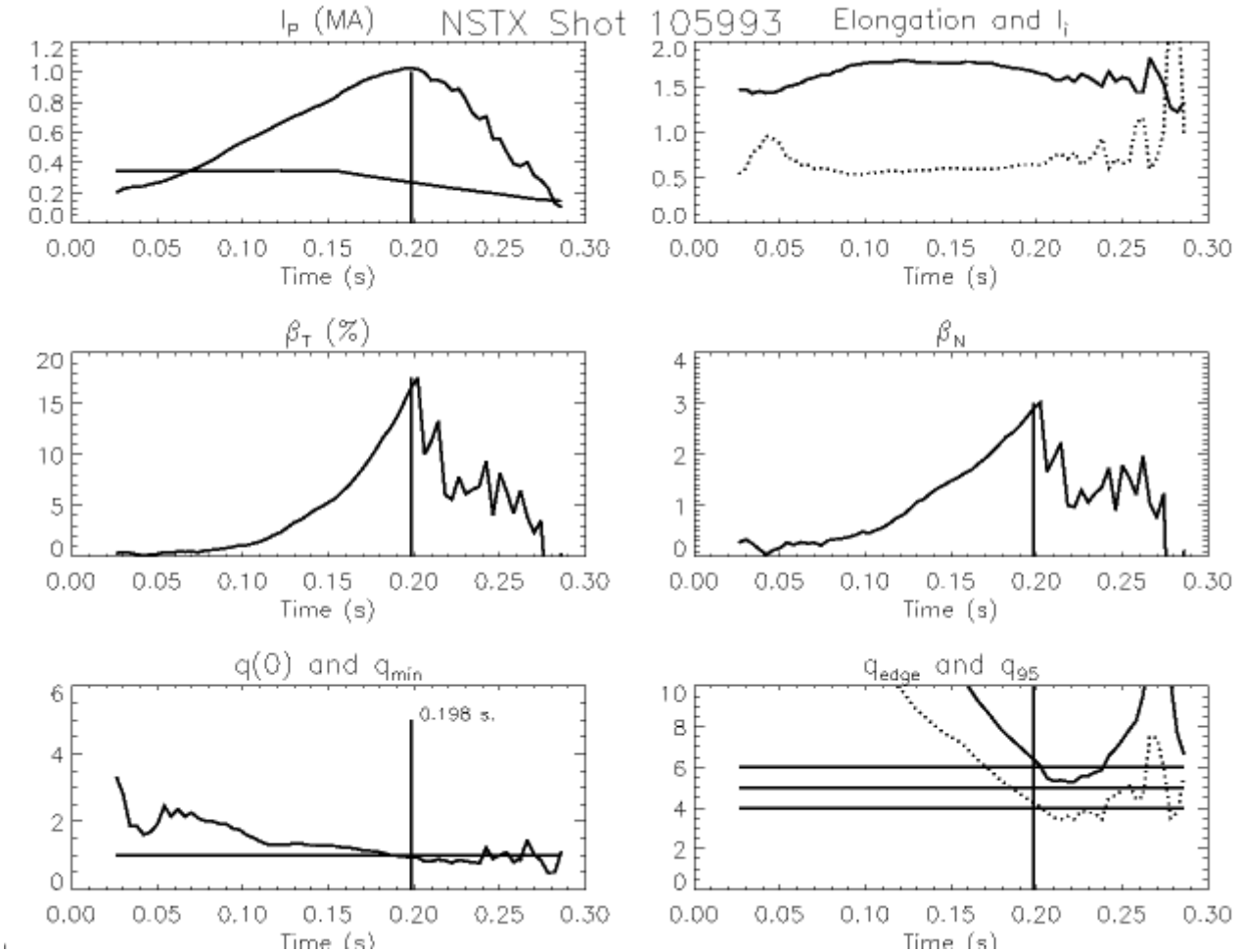
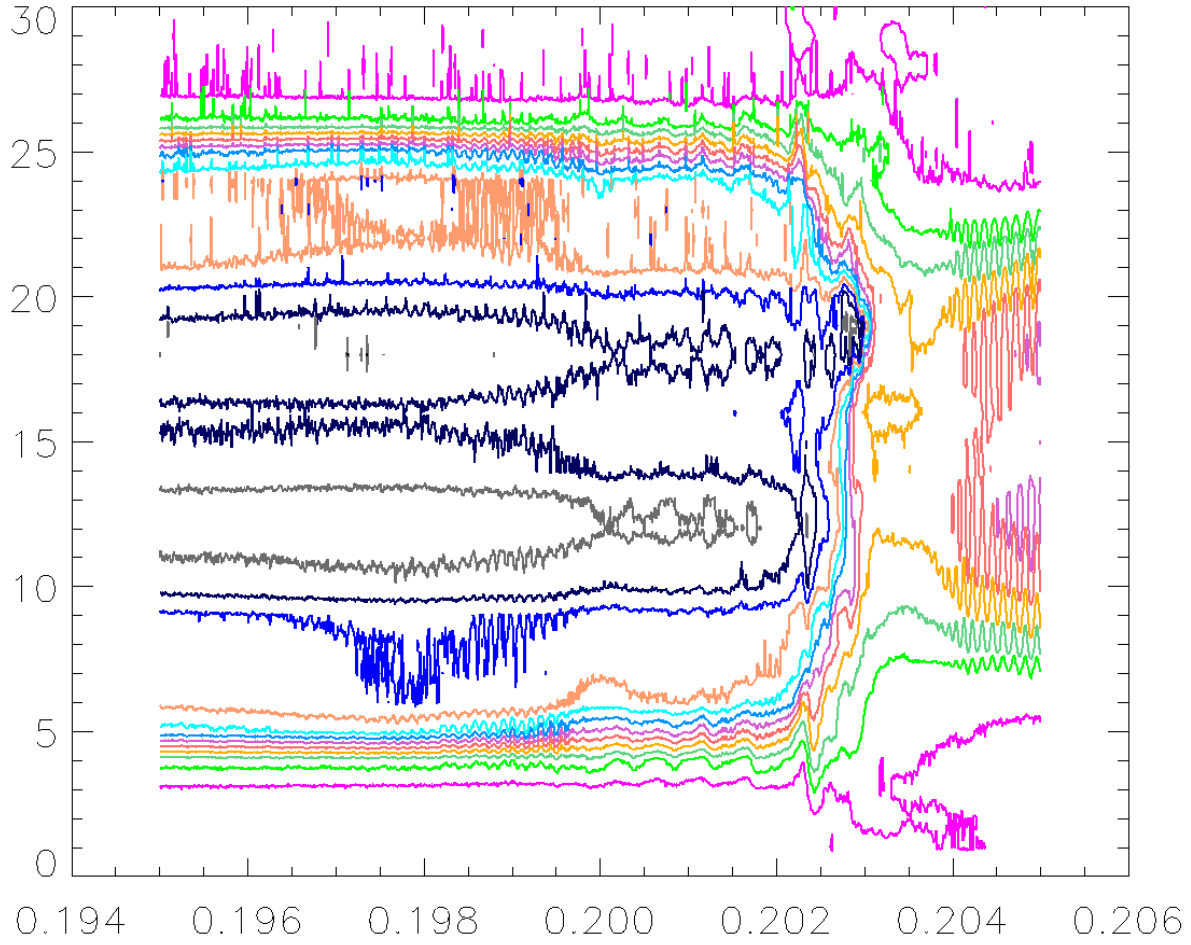


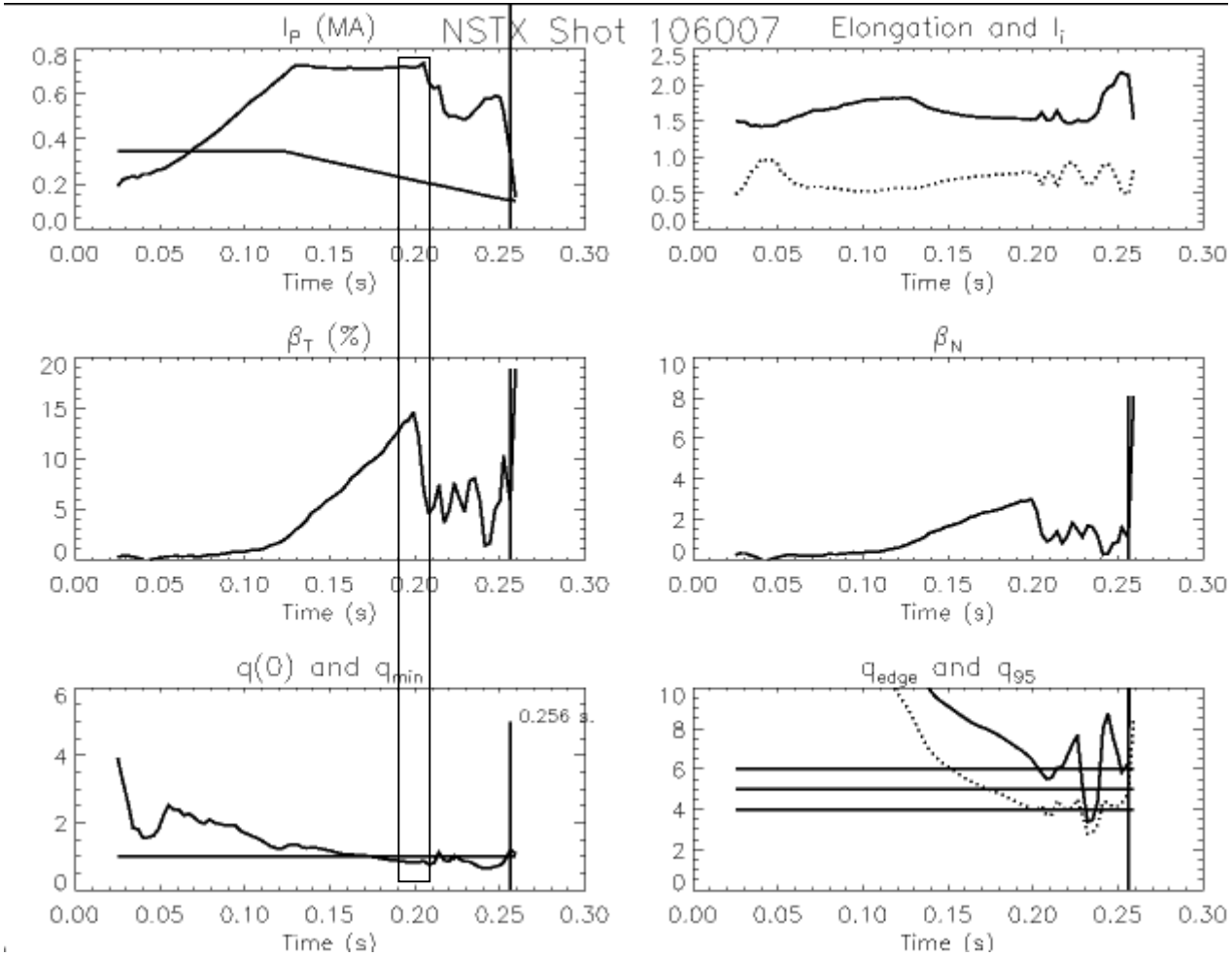
# Time traces for 105993



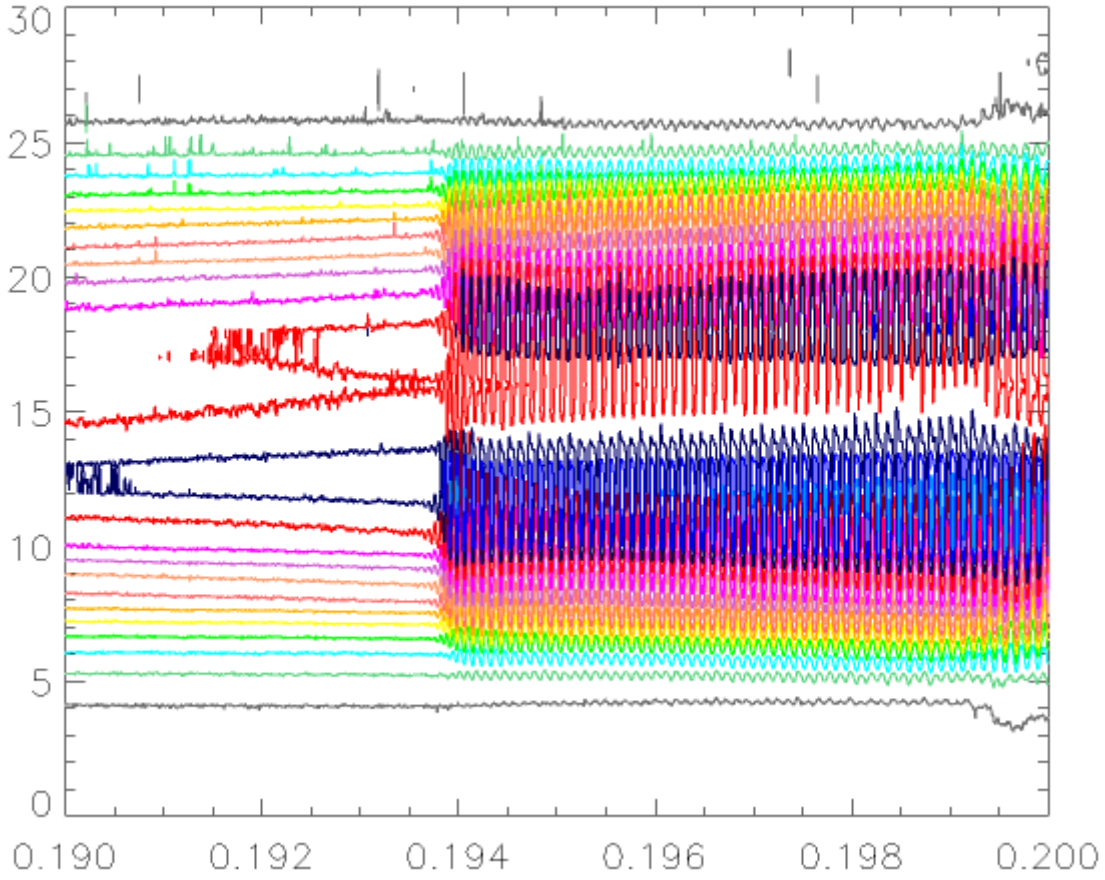
# 105993 - Possible ext. kink many oscillations



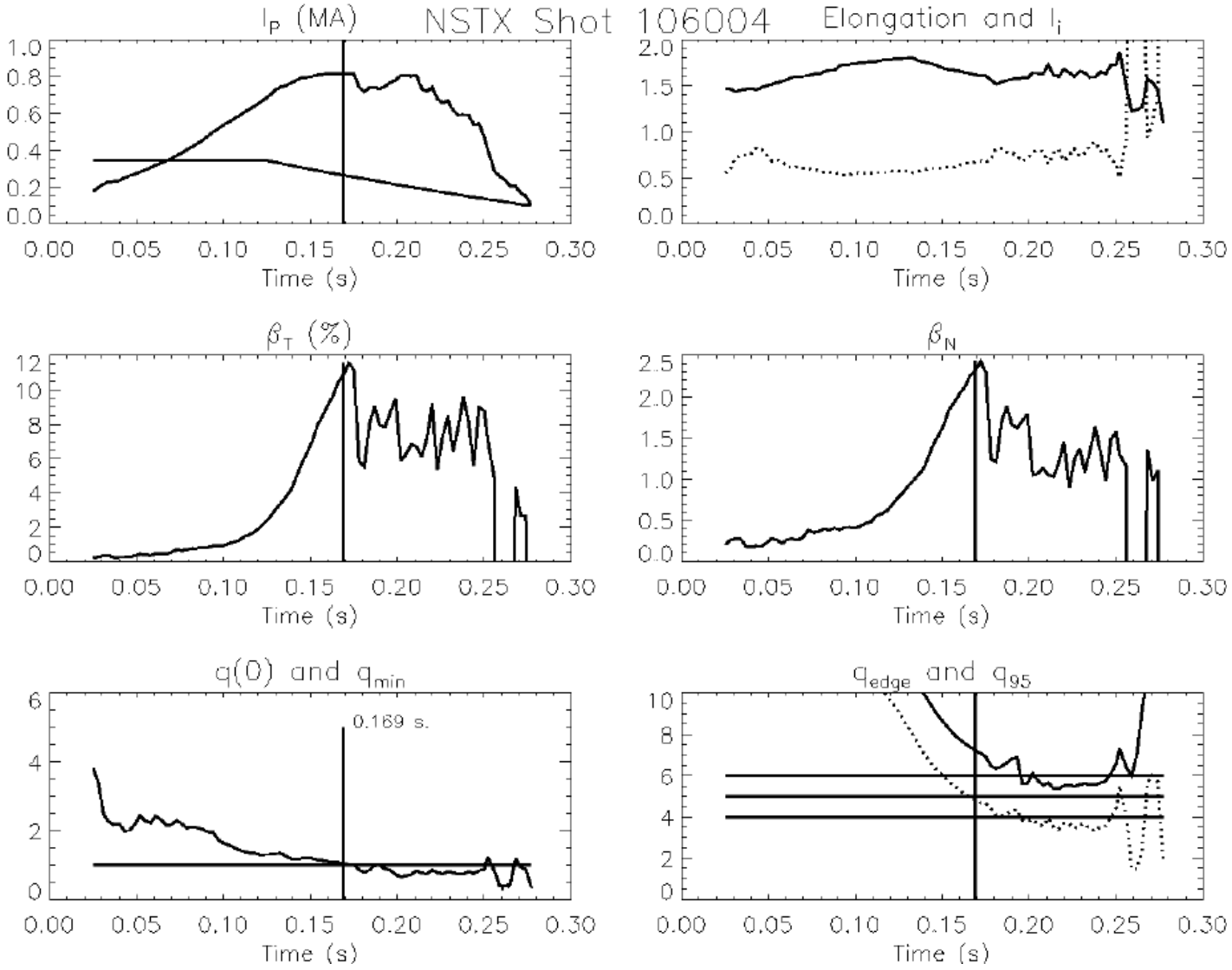
# Time traces for 106007



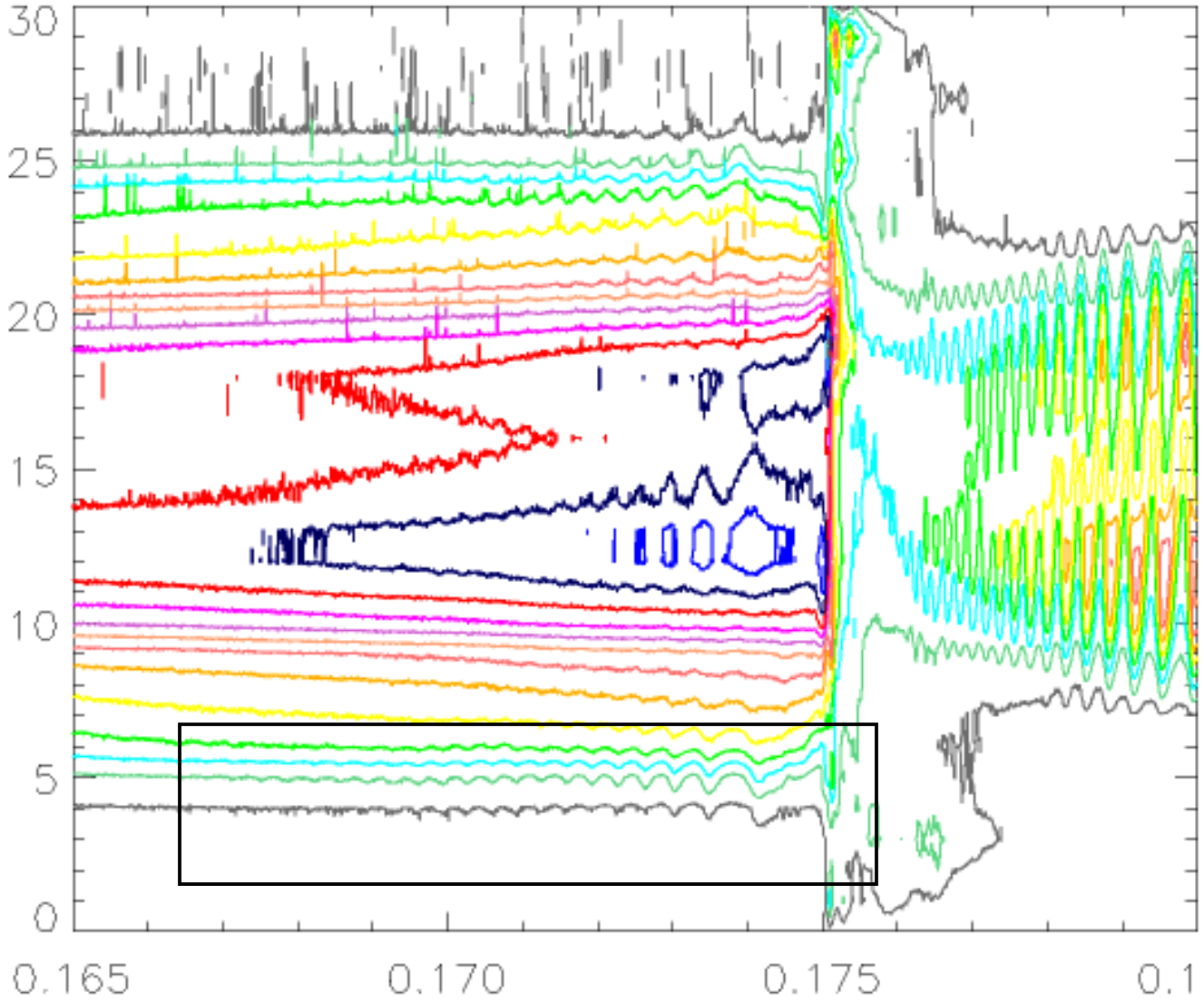
# 106007 - int kink + possible ext kink



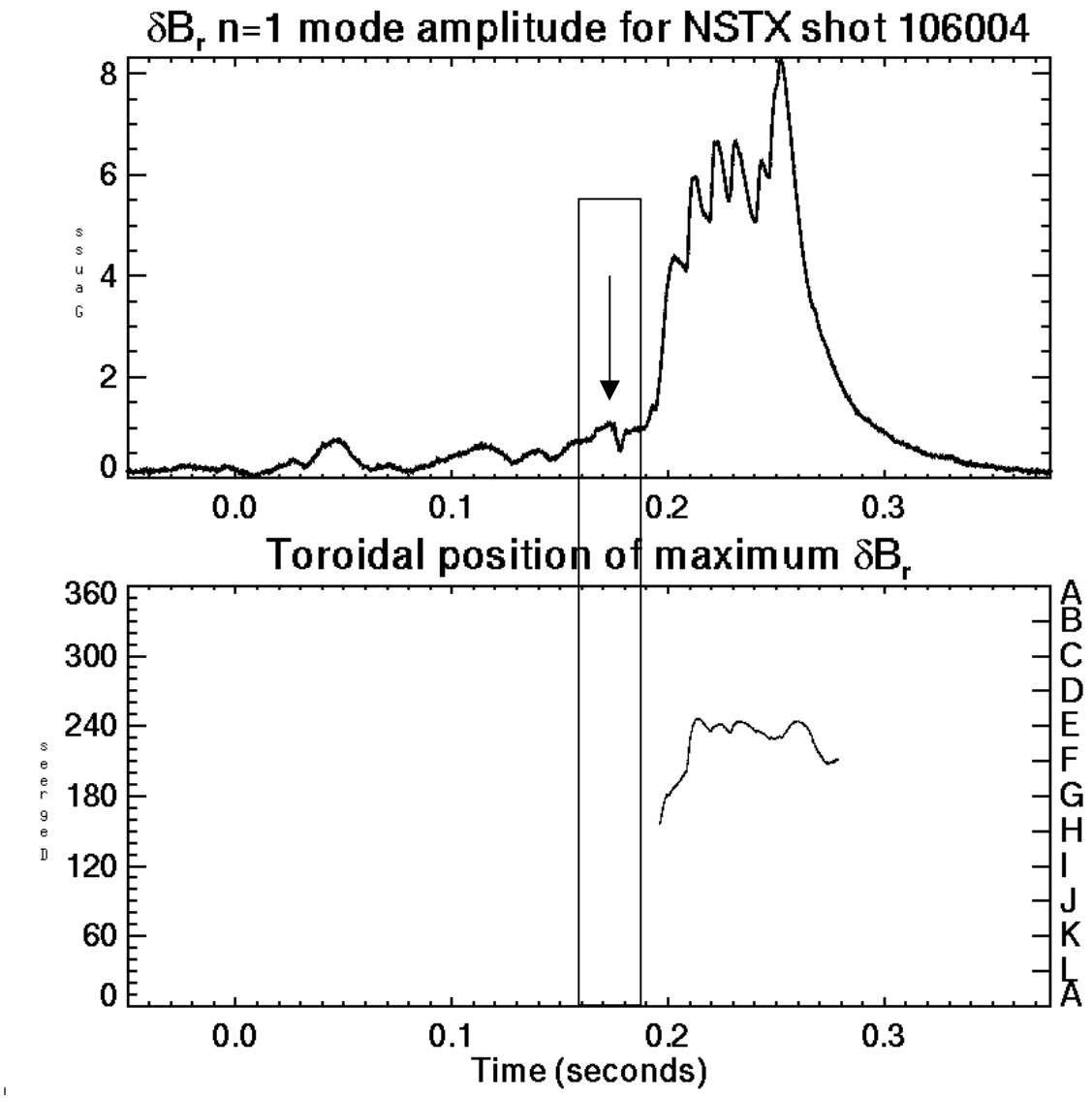
# Time traces for 106004



# 106004 - Clear external kink



# Zero frequency n=1 mode signal

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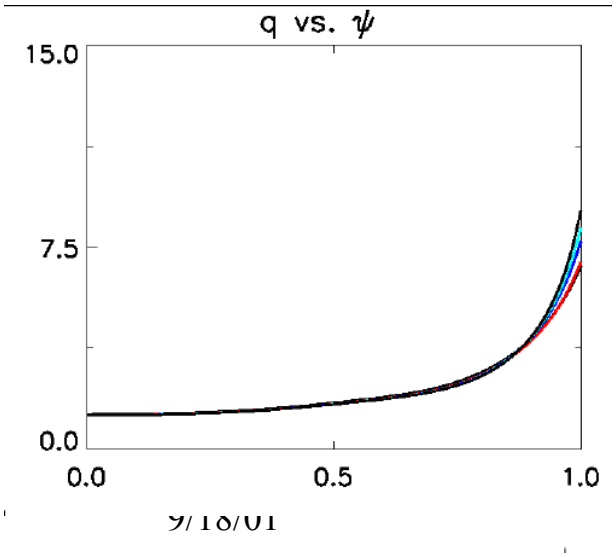
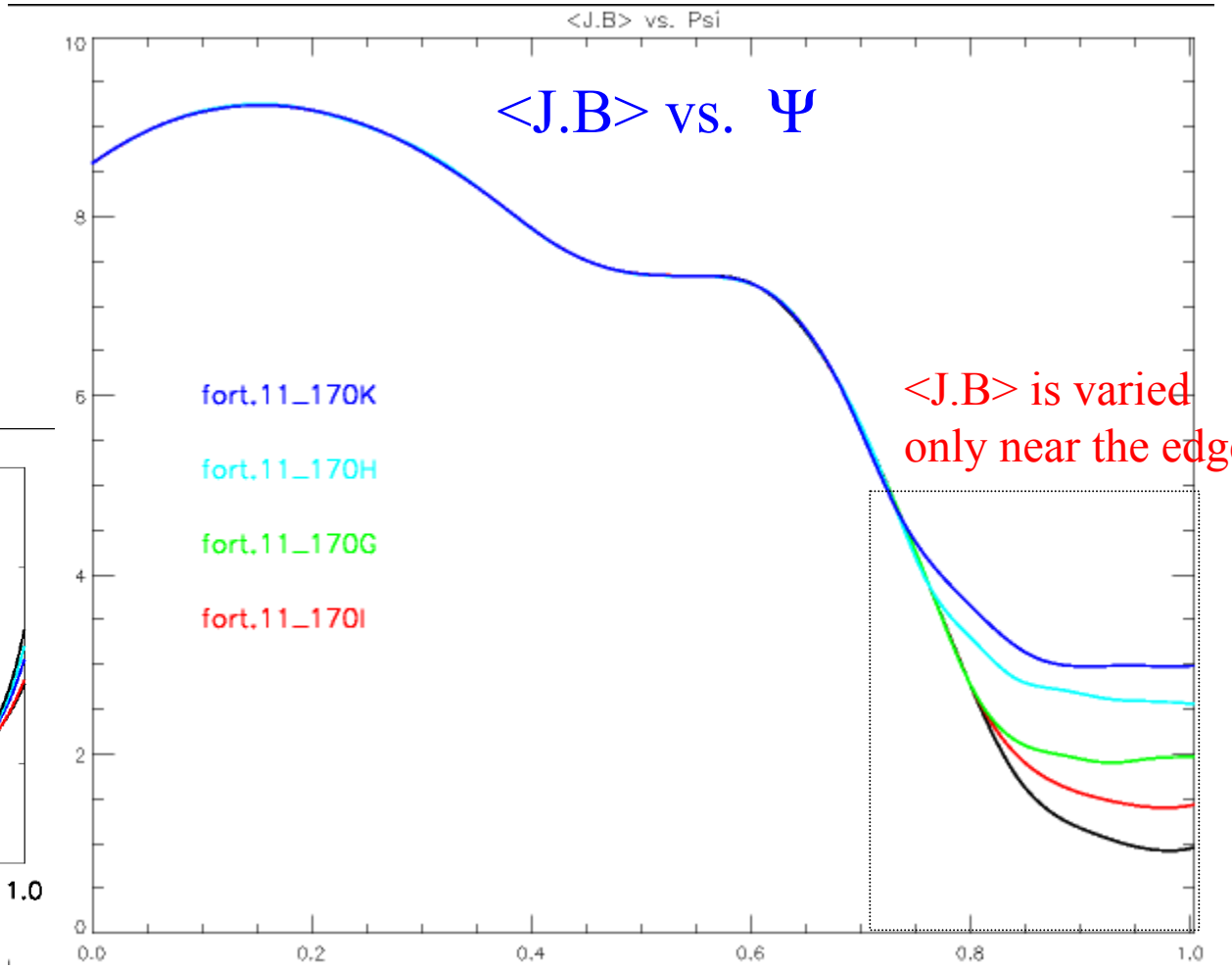
# Theoretical modeling

- EFIT
  - model pressure profile
  - current profile, ff', adjusted to match magnetics
  - shape determined self-consistently
- TRANSP
  - uses EFIT shape and q-profile
  - kinetic pressure
- No MSE data to guide q-profile constraint

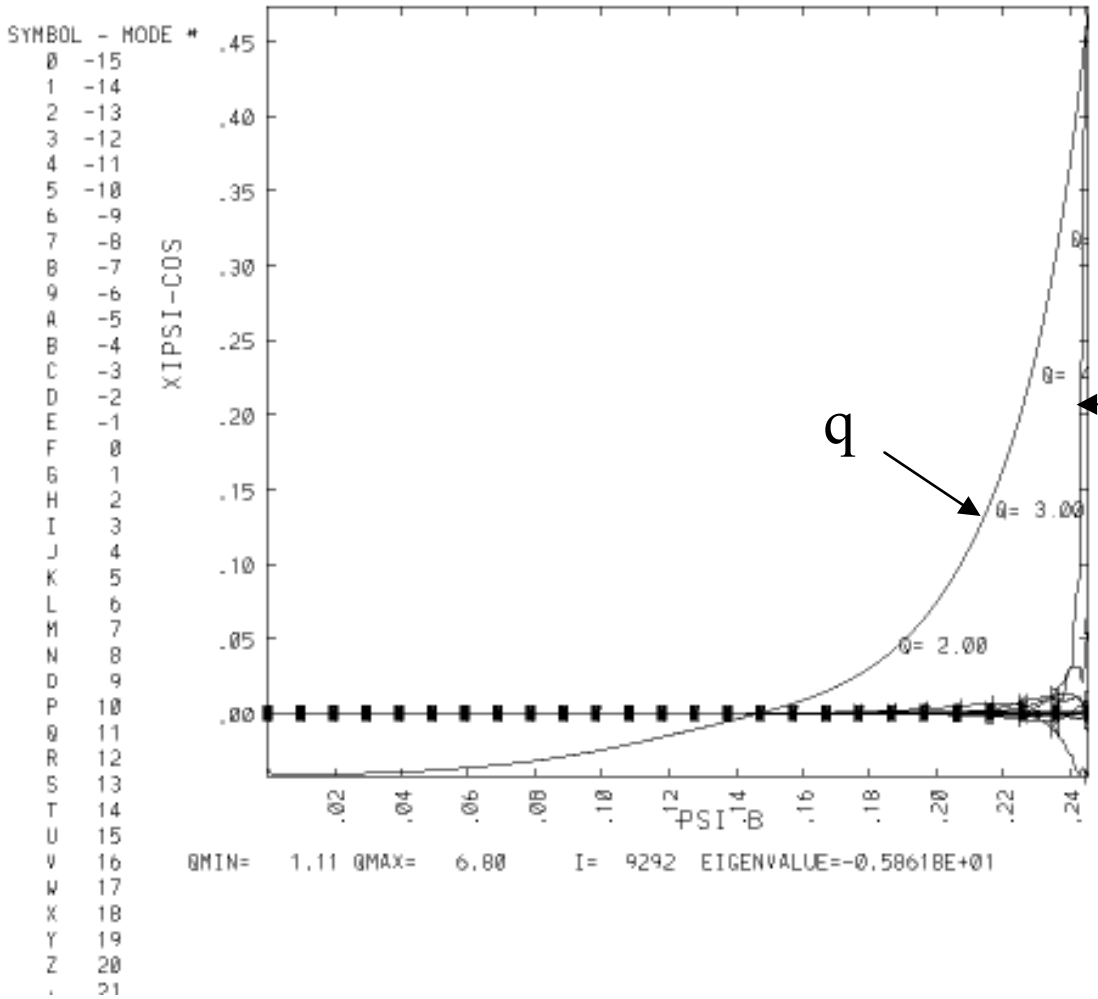
# Model current profiles based on 106004




<J.B> is varied only near the edge

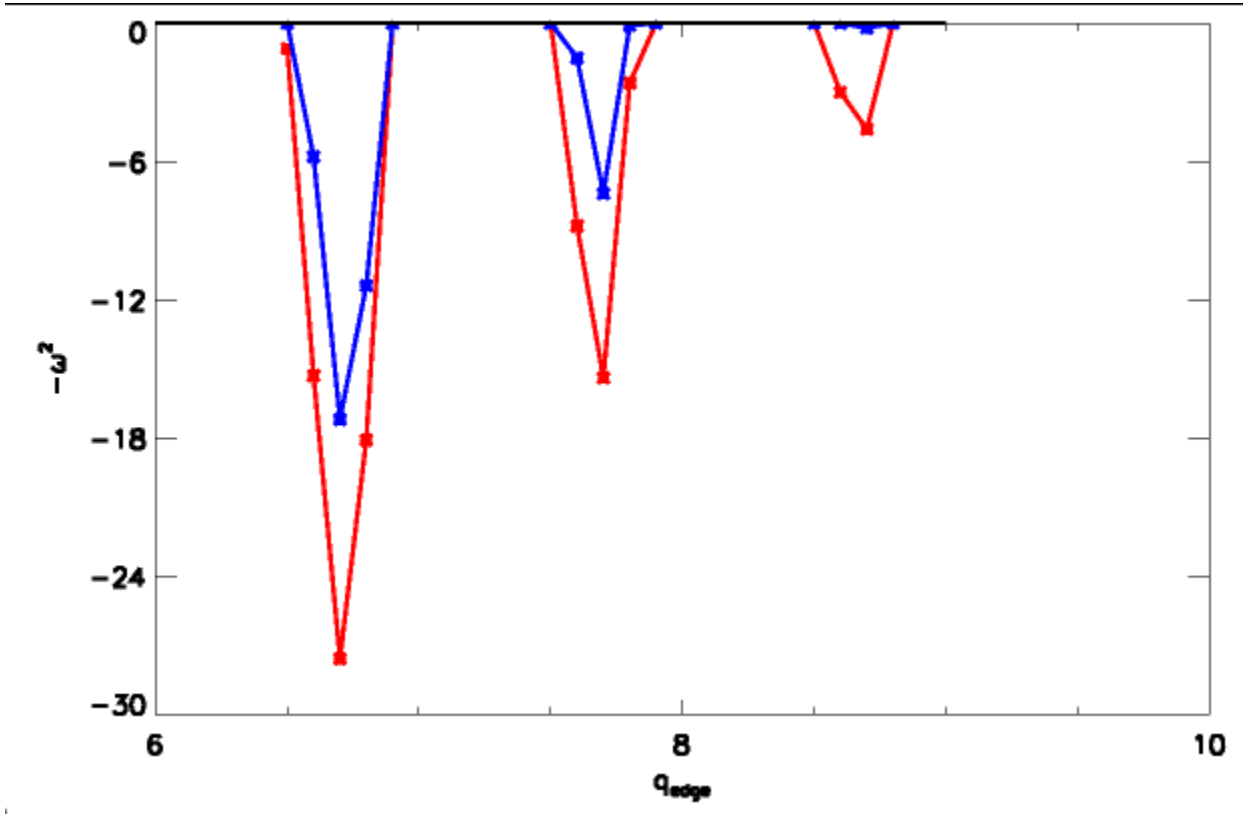
# External kink mode structure




q

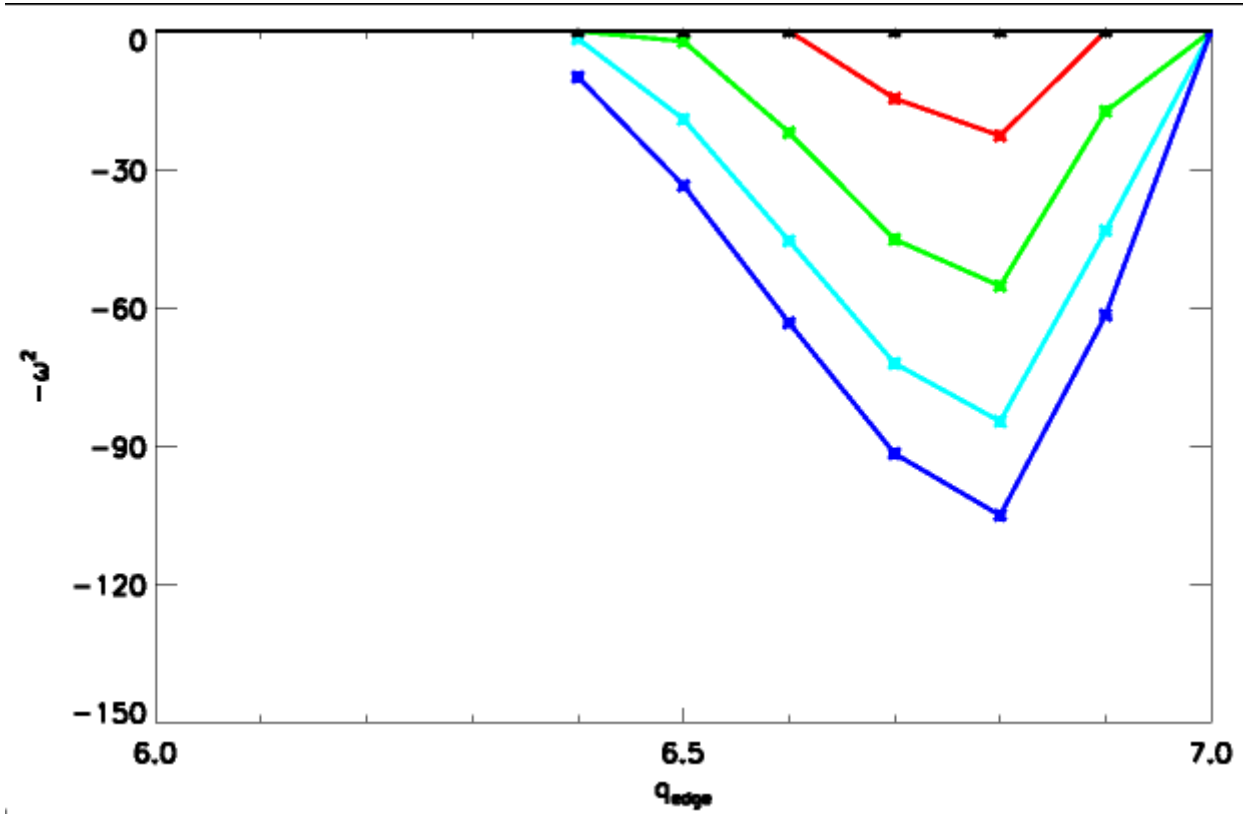
Highly localized mode structure typical of a current driven kink

# Growth-rate shows the classic dependence on $q_{edge}$ for the external kink



# n=1 kink mode growth-rate depends on the current pedestal near the edge

The toroidal field is scaled to get the same $q_{edge}$



# Observations

- We have successfully identified the conditions to observe a current pedestal driven external kink instability in NSTX
- There is a lot of interesting physics in the data set and is the subject of future analysis
- Need improved modeling and diagnostics