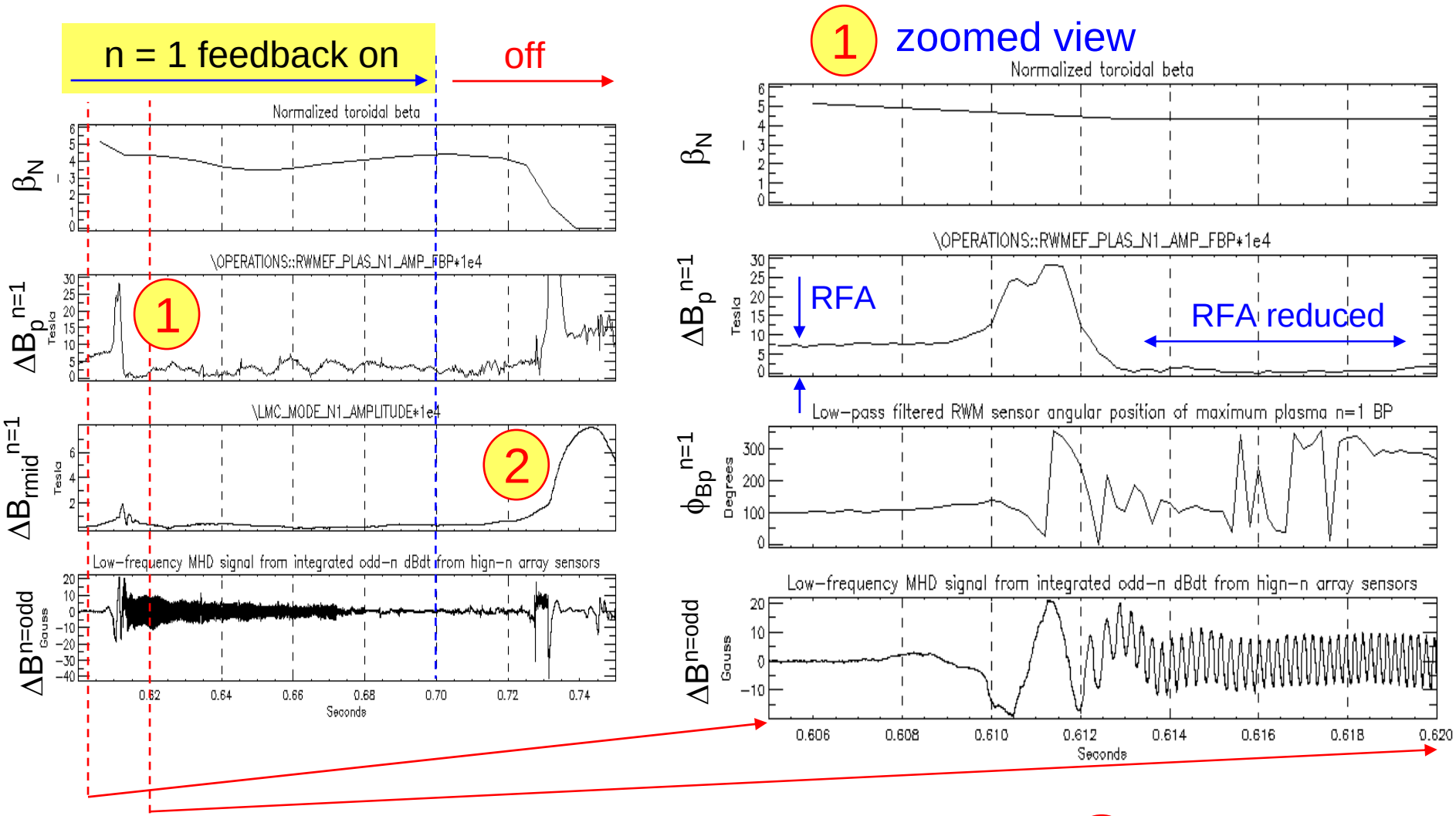
XP802: Active RWM stabilization system optimization and ITER support

Progress 4/11/08

- Goals
  - Alter active control configuration to achieve highly reliable RWM stabilization at various plasma rotation, ω_ϕ
    - Upper/lower RWM B_r, B_p sensors, follow from best CY2007 feedback settings
    - B_r sensor feedback provides RFA correction, B_p provide RWM stabilization
    - Determine if stable, low $\omega_\phi < \omega_{*i}$ operation exists with feedback turned off
    - If achieved, control system open as a tool for all NSTX XPs as desired
  - Specific ITER support requests
    - Study effect of applied time delay on feedback (requires control system time delay capability)
    - Determine impact of a large toroidal gap on active RWM stabilization to simulate ITER port plug coil geometry (take out one of six control coils)
- Addresses
  - Joule milestone, ITER Organization (IO) request, NSTX PAC request
  - ITPA experiment MDC-2

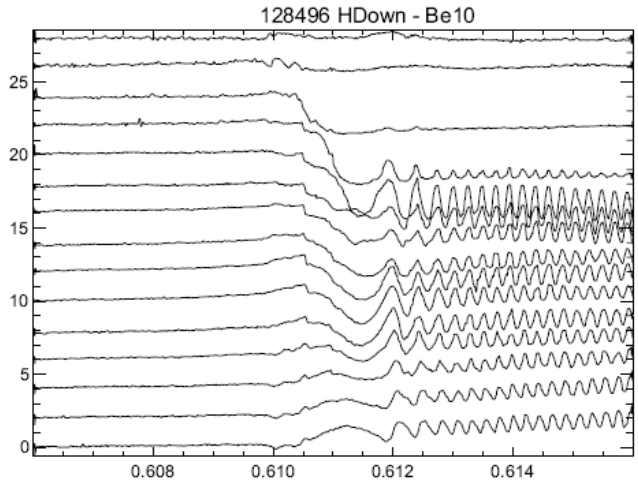
Initial RWM signature leads to rotating global kink



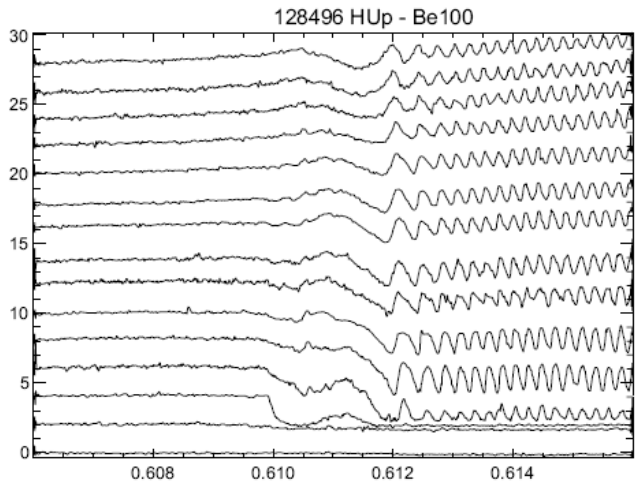
- Transition to global kink indicates that mode 1 is an RWM

1 USXR shows transition from RWM to global kink

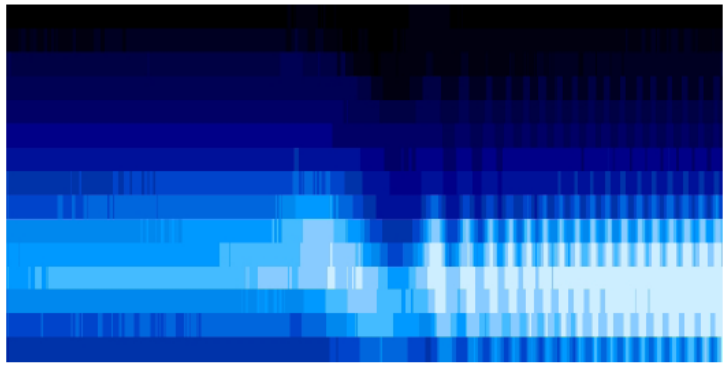
edge

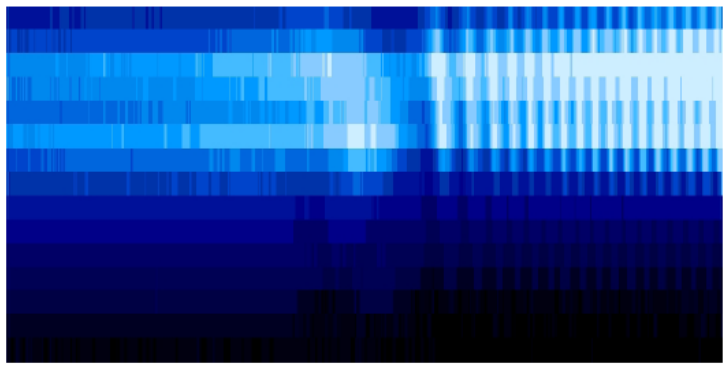


core



edge

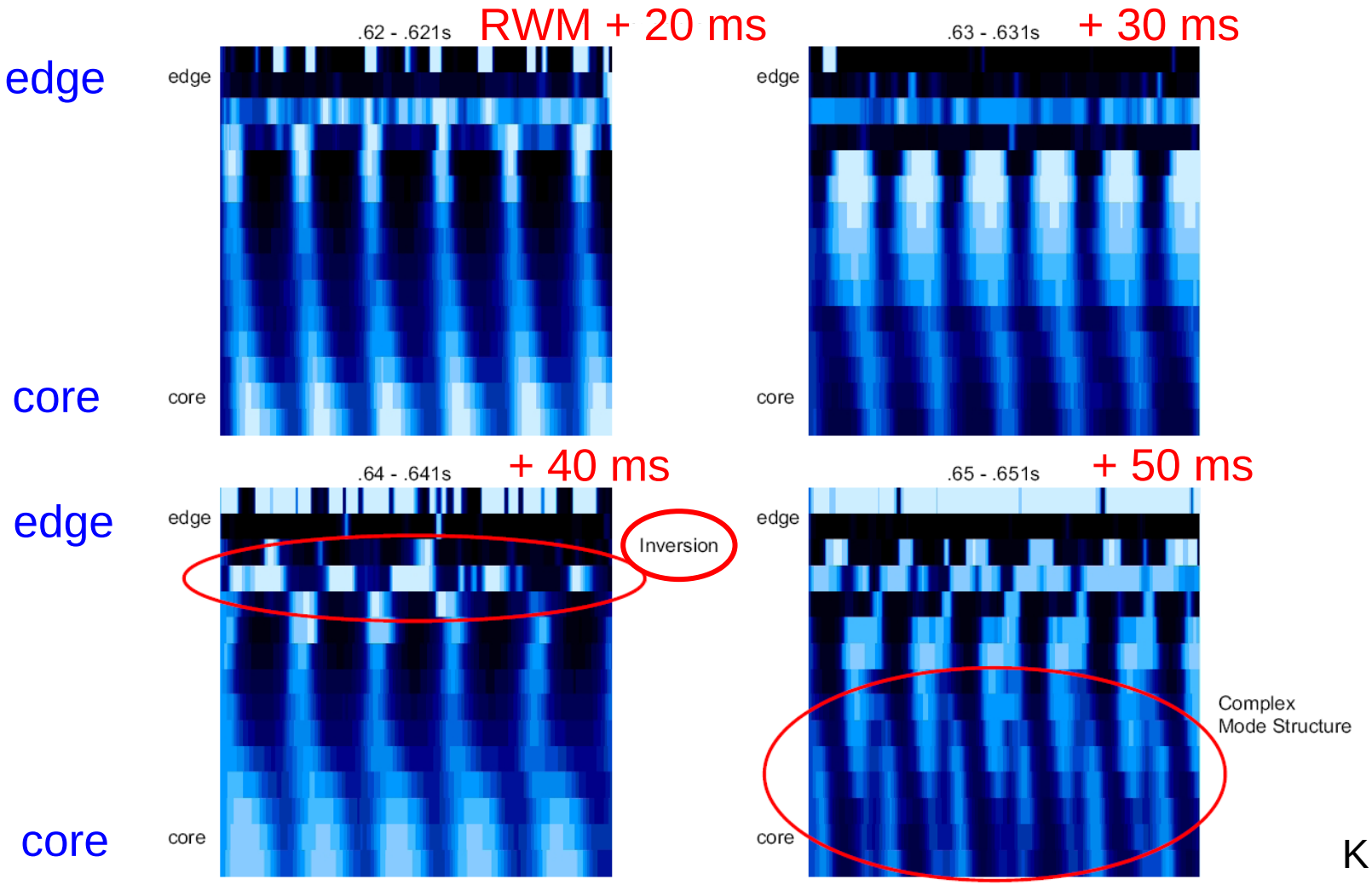




K. Tritz

- Initial RWM locked signature spins up, amplitude dies away

Tearing mode appears significantly after global kink



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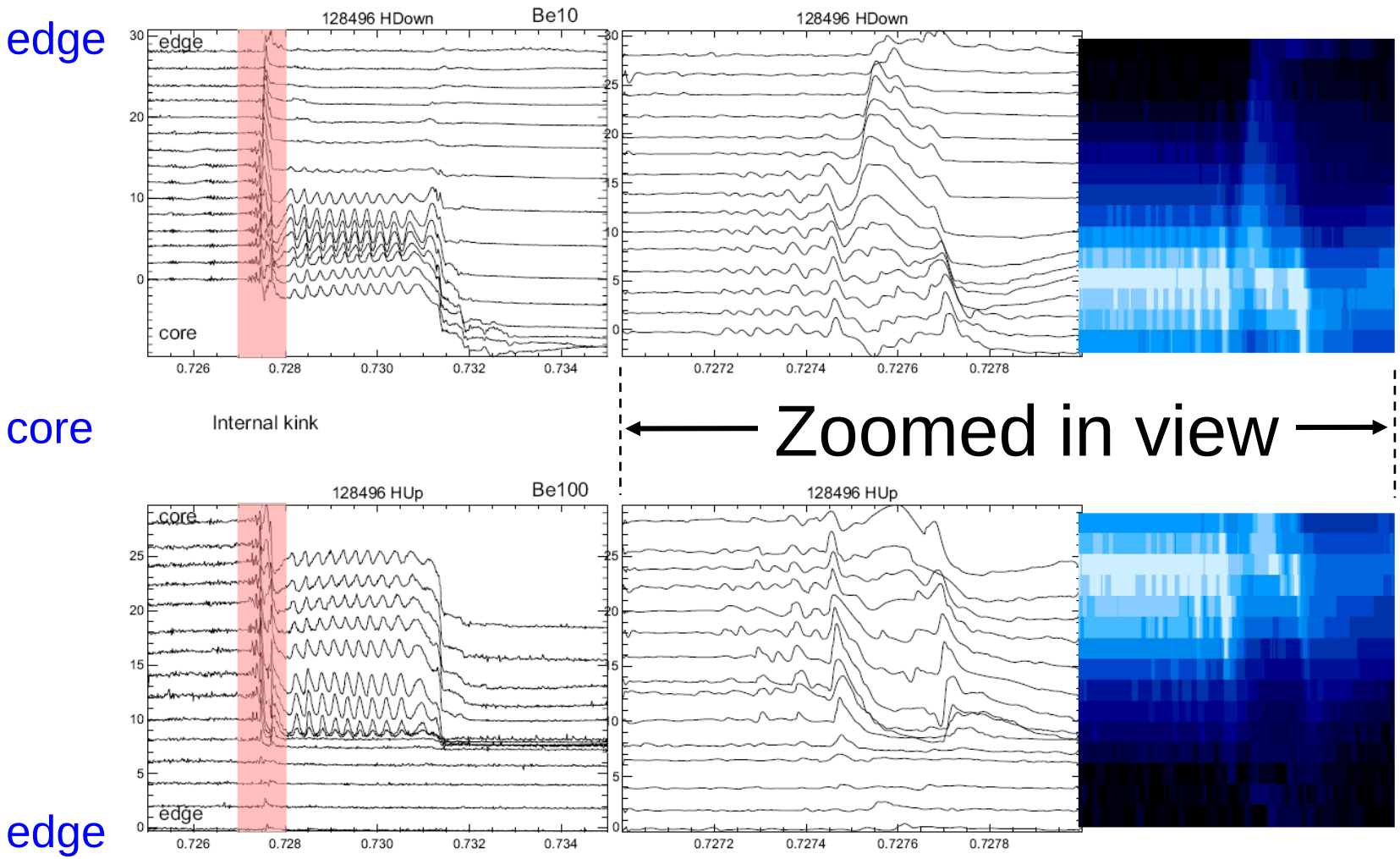
- Significantly different than DIII-D results (H. Reimerdes)

2 Terminating event appears to be an internal kink



K. Tritz

- n = 1 LMD shows mode lock (RWM?) preceding/concurrent w/kink
- Internal kink precedes H-L back-transition

n = 1 feedback / RWM results show stabilization detail

- General conclusions (so far)
  - n = 1 feedback system has produced far greater reliability of discharge avoiding RWM
    - Statistics being compiled
  - n = 1 feedback system does not insure stability against RWM
    - Reasons for failure being analyzed (e.g. fast mode growth)
  - Mode characteristics appear to be RWM, not tearing
    - Unlike present observation/conclusion by DIII-D
    - Mode spin up, converts to global kink mode initially, tearing appears later
    - Feedback system might be easing transition to rotating kink by altering boundary condition
  - Results to date question the validity of a “critical rotation” for RWM
- Next Steps
  - Analysis of XP830 RWM Stabilization Physics (Berkery), and related analysis to test kinetic stabilization model producing “bands” of stability/instability in rotation, beta