Generating and Characterizing an Edge Harmonic Oscillation Via Counter-Ip Torque Injection

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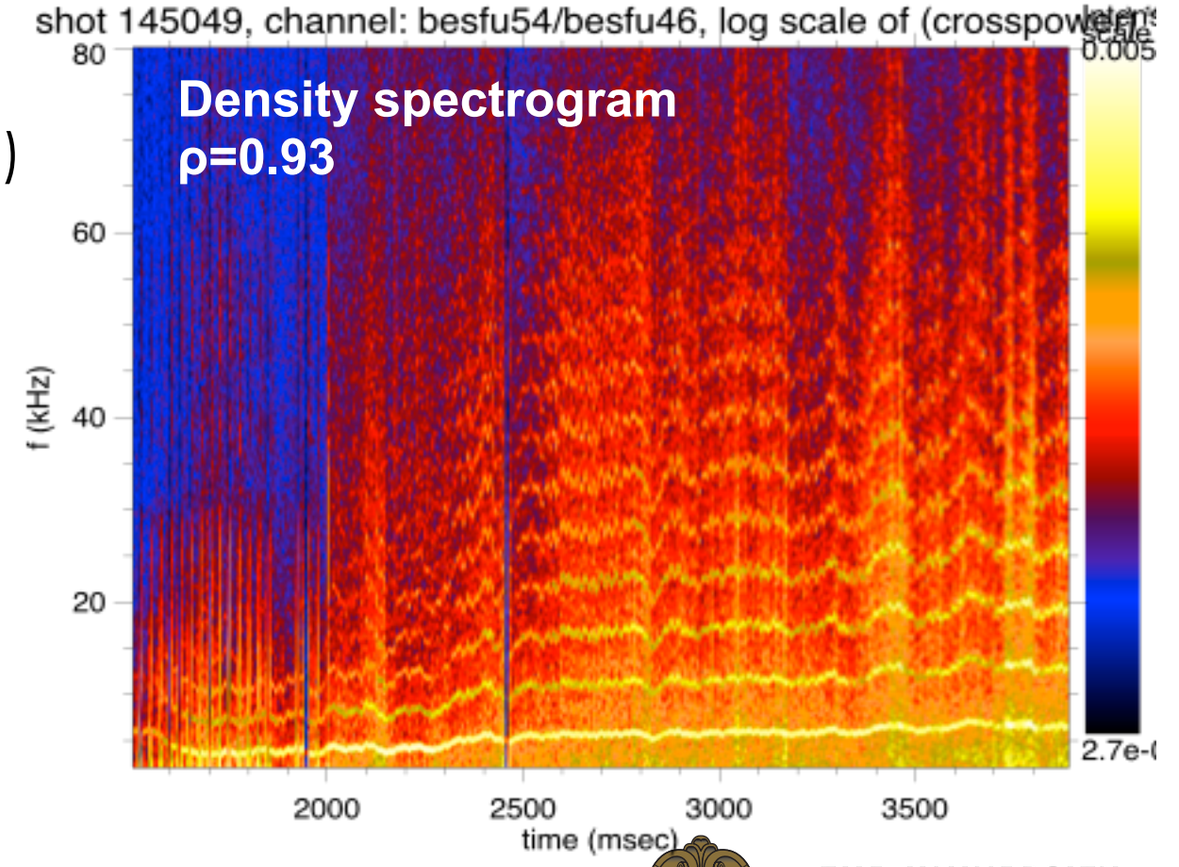
- **Motivation: Quiescent H-Mode Plasmas Offer the Potential for High-Confinement ELM-Free Operation in the ST**
  - ELM-free operation for many τ_E
  - Edge Harmonic Oscillation in pedestal, drives particle flux (replacing ELMs)
    - *Lives on P-B stability boundary; Low-n saturated Kink-Peeling mode?*
  - Demonstrated over wide parameter range on DIII-D
- **EHO Features:**
  - Multiple harmonics observable (~10 or more)
    - *Magnetic; fundamental, n=1, 2 or 3 typically*
  - "Global" mode across core/pedestal/SOL
    - *Peaks near steep gradient region of pedestal*
  - Clear 2D spatial structure
    - *Radial phase shift; <u>not</u> island like*
  - Outward skewness of ñ-fluctuation
    - *Can transport particles radially outward*



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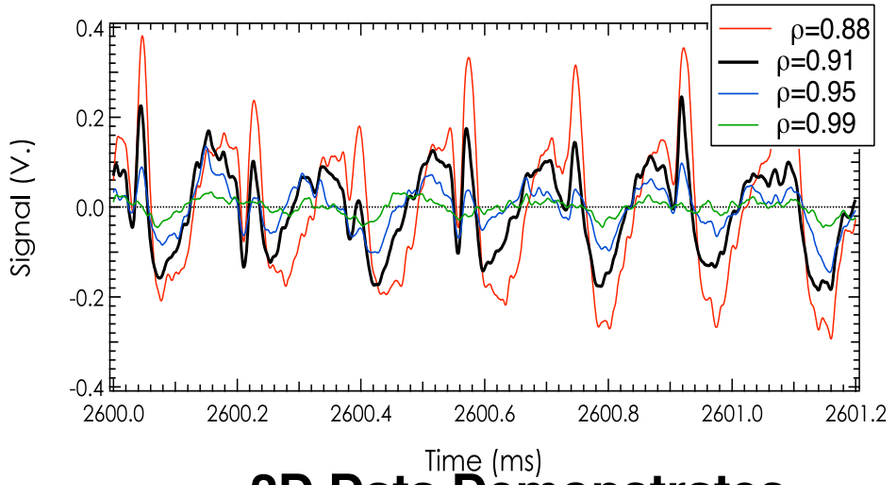
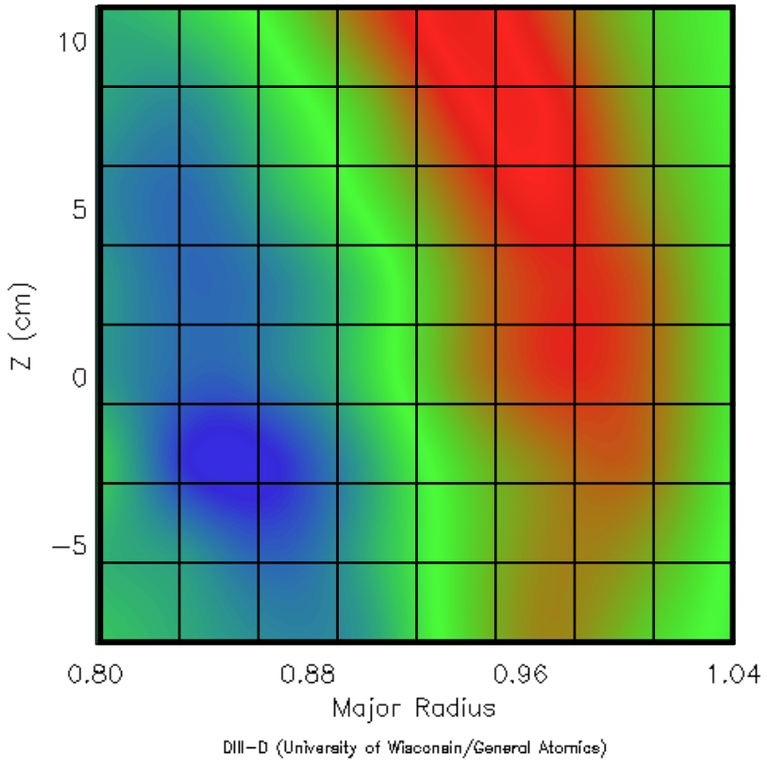
- **Generating the EHO**
  - Exceptionally deep E_R well near pedestal facilitates formation of EHO: may drive and saturate instability via shear flow
- **Experiment plan**
  - Counter-I_P NBI
    - *Toroidal rotation and diamagnetic terms superimpose to generate very deep E_r well*
  - Low-density/ν^*
  - Additional tangential NBI on NSTX-U
    - *Will need to assess fast-ion losses*
  - If counter-Ip is not feasible, Co-Ip may allow
    - *More difficult to achieve in DIII-D w/Co-Ip*
  - Utilize 2D BES, GPI, other diagnostics to measure spatial and temporal characteristics of EHO
- **Goal:**
  - Determine feasibility and applicability of QH-Mode in STs; identify physics of EHO drive & saturation

Time Series shows EHO Skewness



2D Data Demonstrates Radial-Poloidal Structure



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