NSTX

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Jog experiments to measure *AE radial eigenfunctions (and other modes)

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FY 2010 NSTX Research Forum
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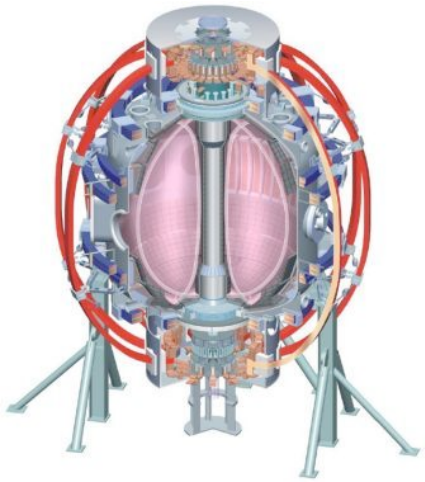
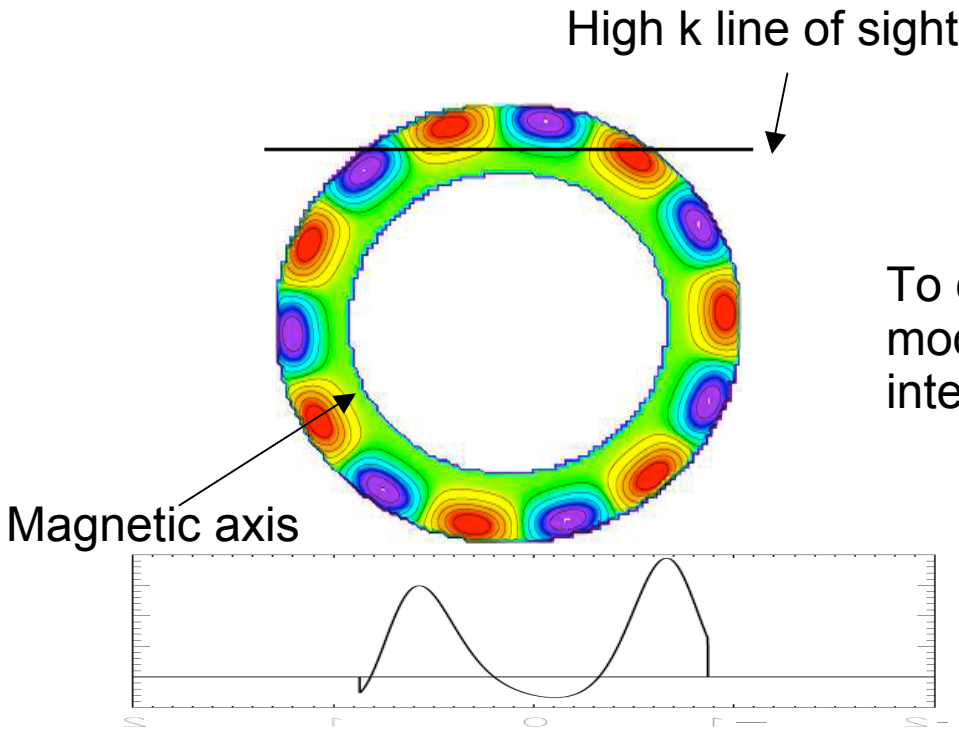


Jog technique successfully used on numerous experiments to improve spatial resolution of measurements

- Particularly important on NSTX with few localized measurements of radial eigenfunctions
- Not utilized much to date because of required development time
- Fairly straight forward to add jogs to rtEFIT based control
- Need only optimize settling time for control
- Technique can be used to good effect for any steady mode, not just *AE modes
  - Cross-cutting development?

Mode identification key to analysis of fast-ion effects

Using the CAE mode profile above, a line integral was performed to determine the amplitude of the CAE. The mode is assumed to vary toroidally as cos(nθ).



Integrating an MHD mode with amplitude "A", and n=8 gives

$$\int \tilde{n}_{norm}\, dl = 0.33A$$

To calculate the amplitude of the MHD mode in the plasma, we divide the integrated density by this integration factor

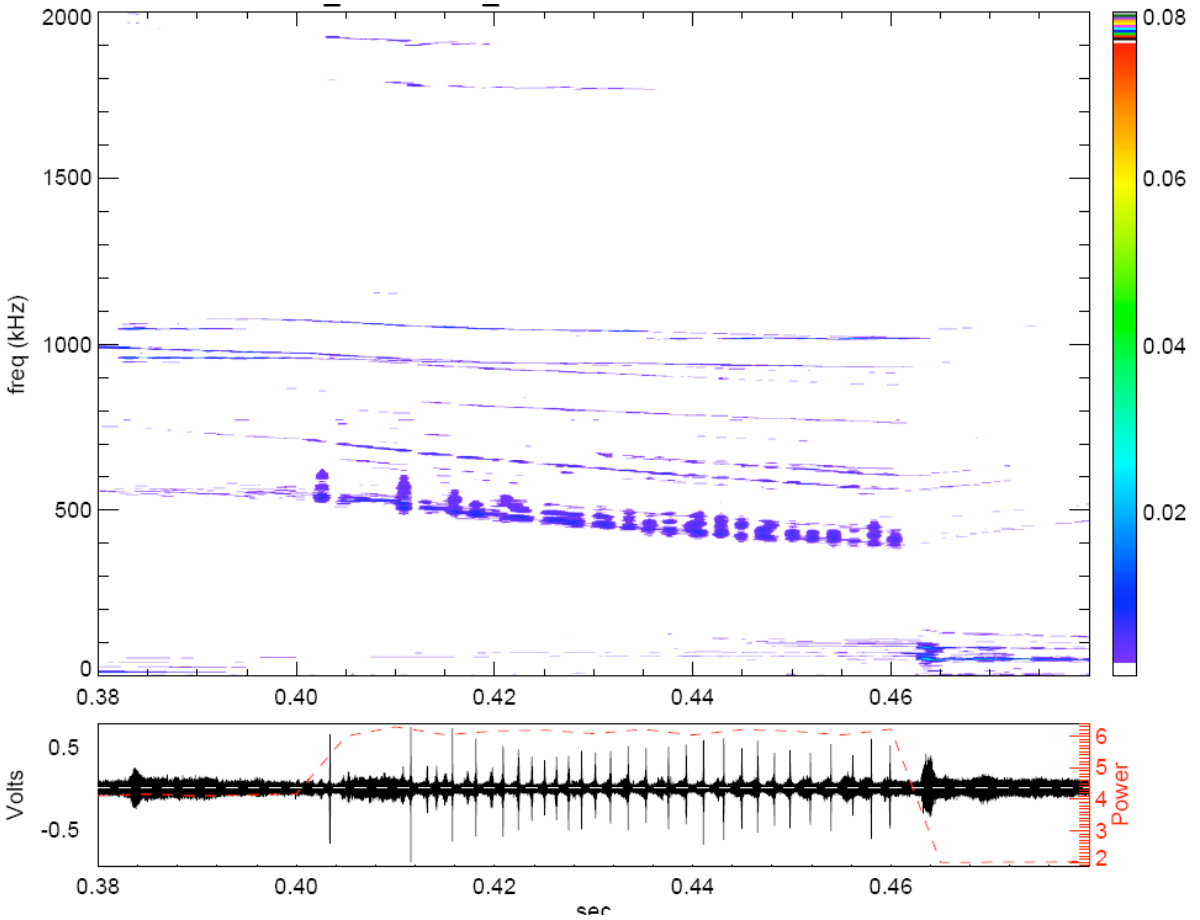
$$\frac{\int \tilde{n}_{measured}}{\int \tilde{n}_{calculated}} = \frac{0.0026}{0.33} = \frac{\tilde{B}_{\|}}{B} = 0.0079$$

This gives

$$\frac{\tilde{B}_{\|}}{B} = \frac{\tilde{n}_e}{n_e} = 0.0079$$

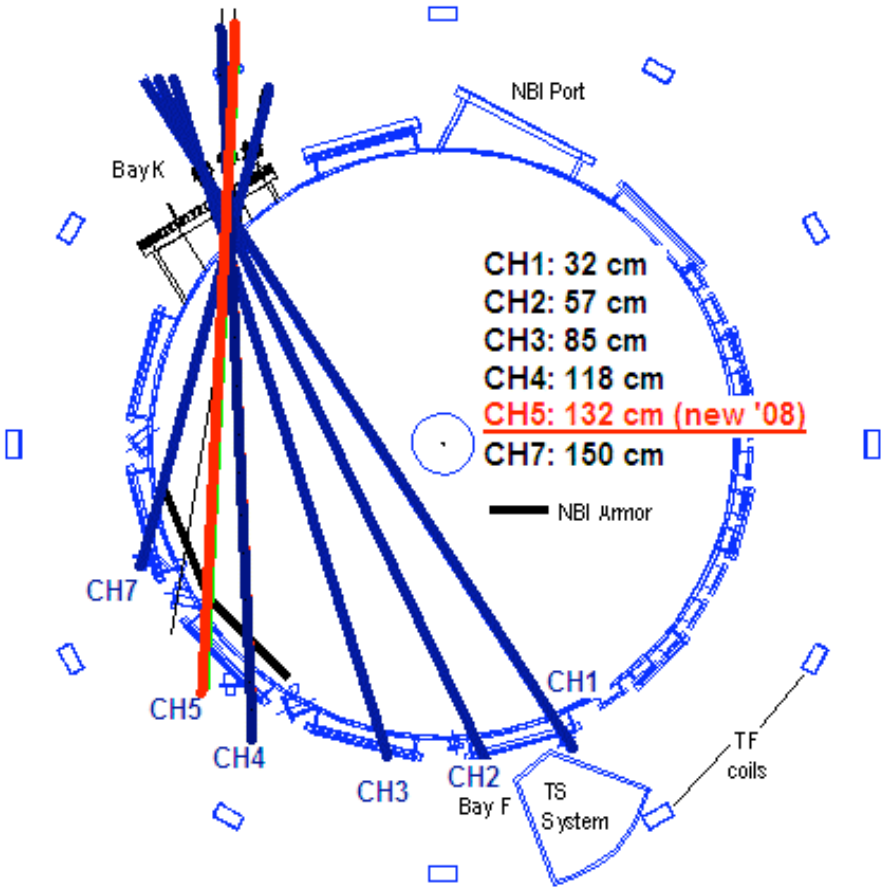
*AE mode frequency stable over 100ms time period

- Allows mode tracking over relevant time for jogs
- Bursting modes may also be trackable, but not easily automated



FIReTIP provides coarse δn_e data over entire plasma cross-section

- FIR measures permutation of k_r and k_ϕ
- Should easily distinguish core localized modes (GAE) from edge localized (CAE)
- Jogs will allow determination of k_r if k_ϕ is known
- Will be even more useful for reflectometer array



Initial experimental proposal

- Requires ~1 day of operation
- Develop jog scenarios
  - Optimize settling time (optimize radial position gain?)
  - Define viable range of variation
  - Create scenarios for different modes (EPMs, CAEs, GAEs, TAEs, MHD modes?) H-mode, L-mode, post-ear H-mode
- Obtain data for H-mode CAE/GAEs
- Make available to others as desired…