Proposals for 2010 XPs

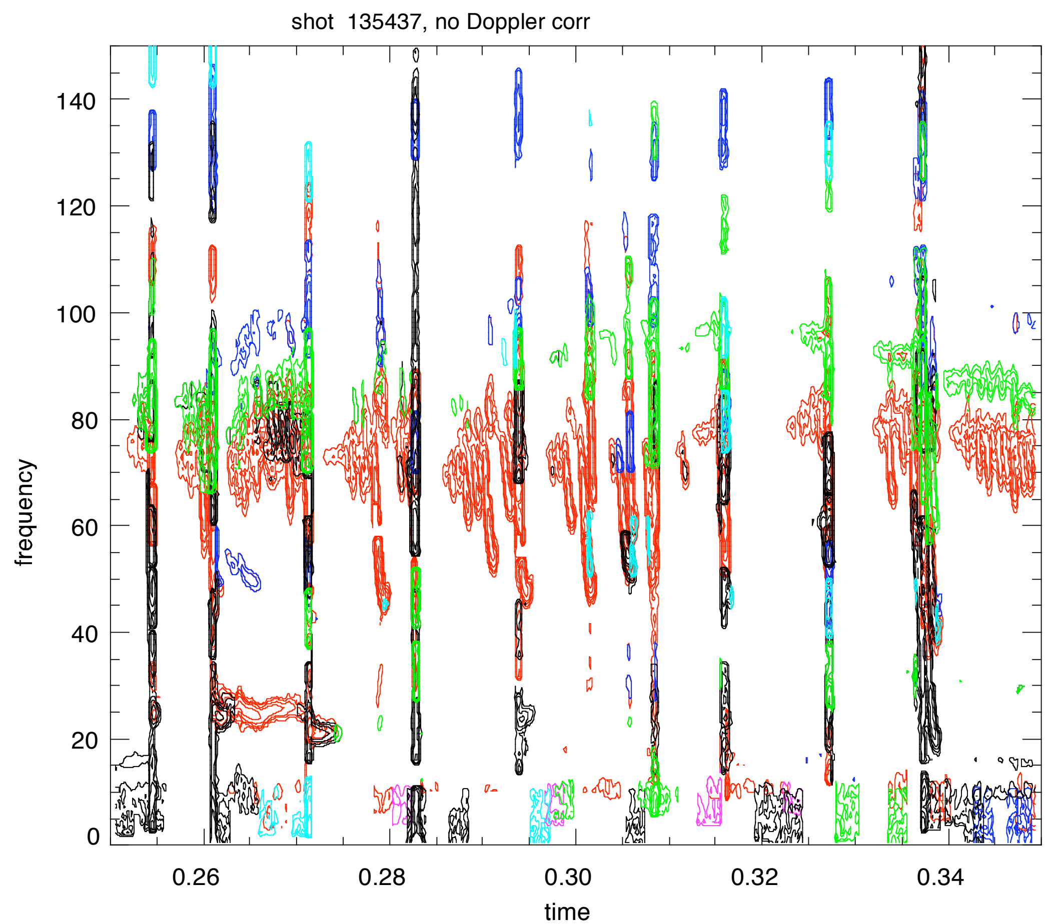
1. H-mode TAE (GAE) avalanches
2. Documentation of Angelfish
3. Document high frequency CAE
4. Revisit again n=3 braking and affect on TAE stability?

H-mode TAE Avalanches w/BES

- Need to extend L-mode TAE avalanche studies to H-mode.
- H-mode avalanches are seen with full voltage beams, no difficulty getting MSE data.
- Measure fast ion redistribution, mode amplitudes, equilibrium parameters (q-evolution).
- Maybe avalanche threshold

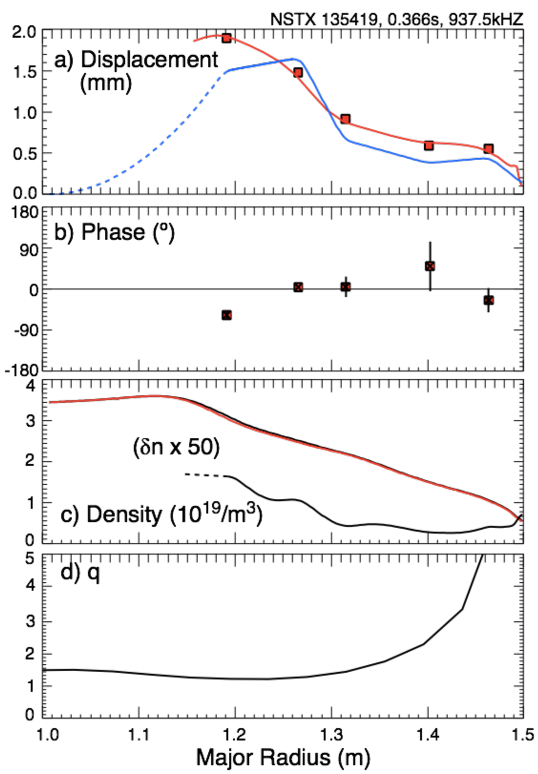
TAE avalanches similar in H-mode

- TAE avalanche-like behavior seen in many H-modes
- Often, neutron drops are weak.
- 'Sharper' bursts are GAE avalanche-like events.
- Reproduce target like this with beam voltage scan to find thresholds.

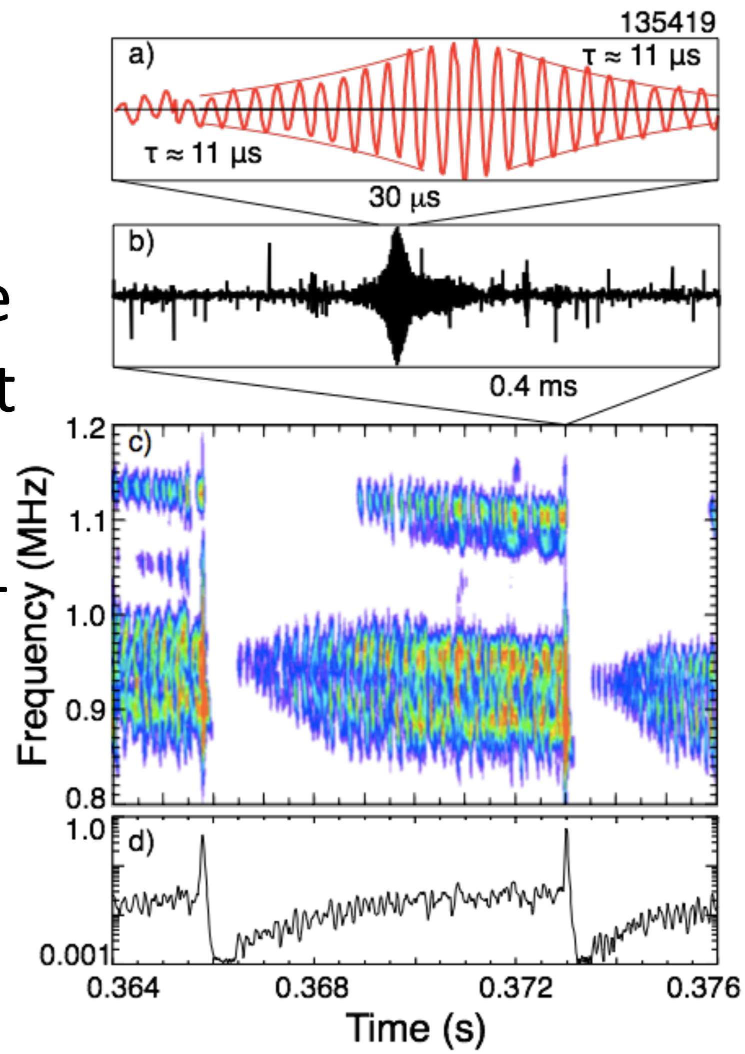


GAE avalanches in H/L-mode

- Use BES & new reflectometer diagnostics to measure mode structure and amplitude.

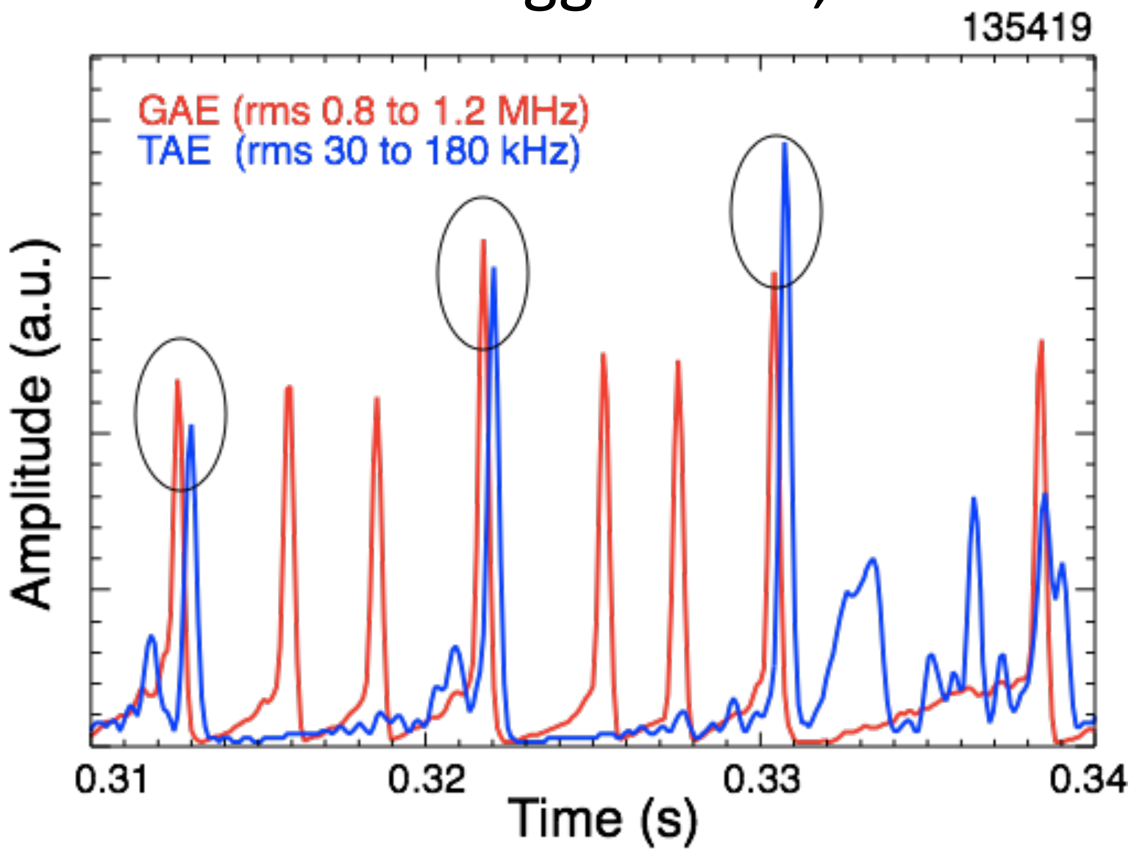


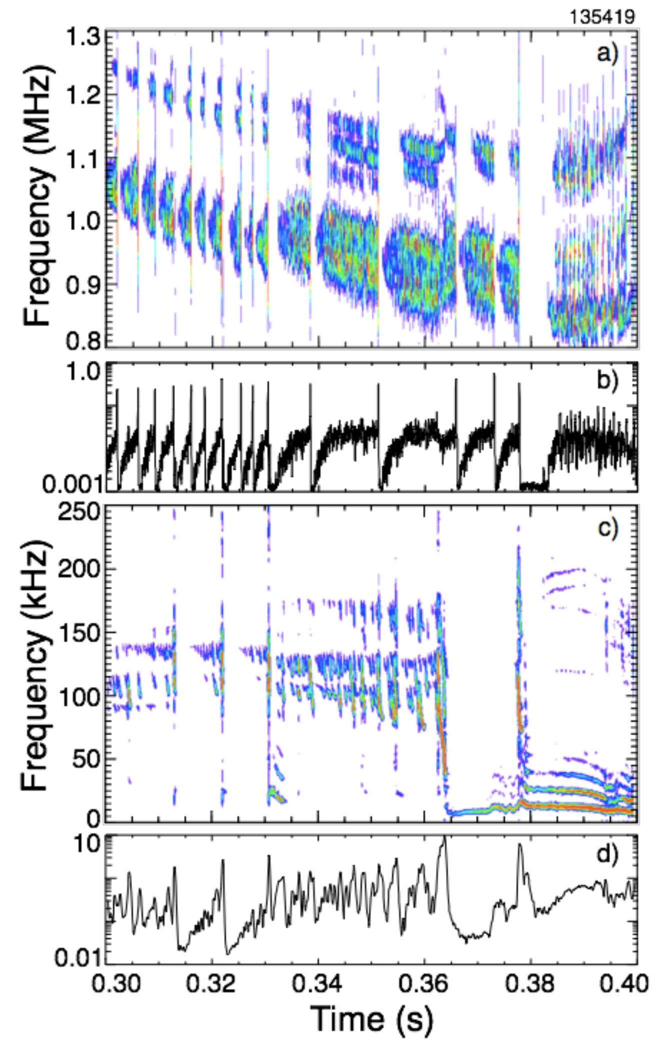
- Peak amplitude lasts ≈10 μs out of 5 ms period.
- Could be piggy-back on TAE avalanche XPs.



GAE avalanches in H/L-mode

- Bursts can trigger TAE avalanches; implies significant redistribution of fast ions
- Sometimes trigger EPM, too.



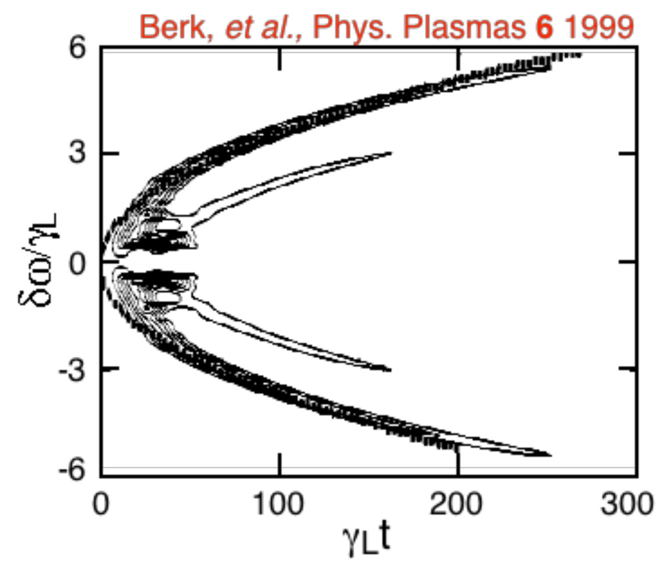


Measure radial structure of Angelfish

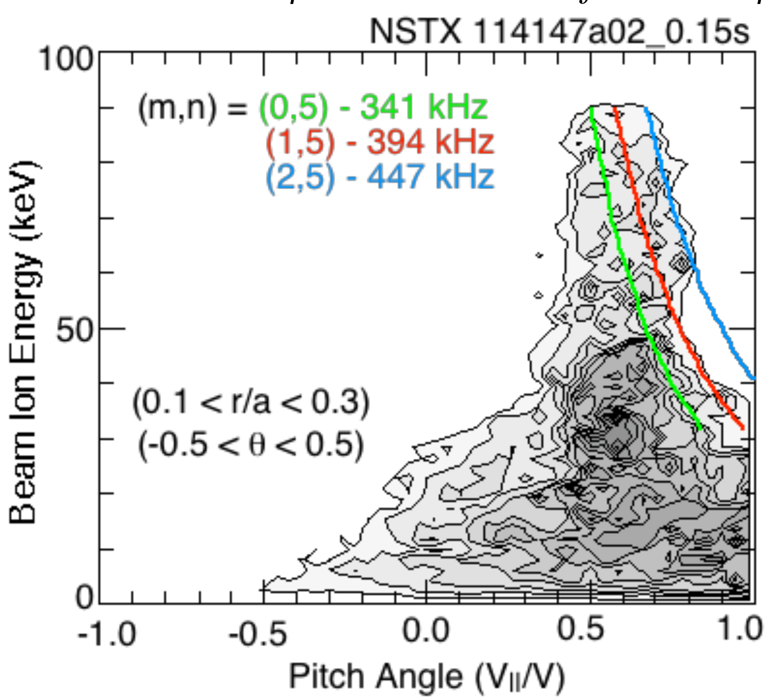
- Dedicated experiment; operation at 32 kA, 2.5 kG where best Angelfish were seen.
- Typically best Angelfish in bat-ear H-modes, so no reflectometer data.
- BES should be able to capture mode, good MSE data would be worth effort.
- Maybe FIDA might see something – if fast enough (0.5ms chirps every couple of ms)

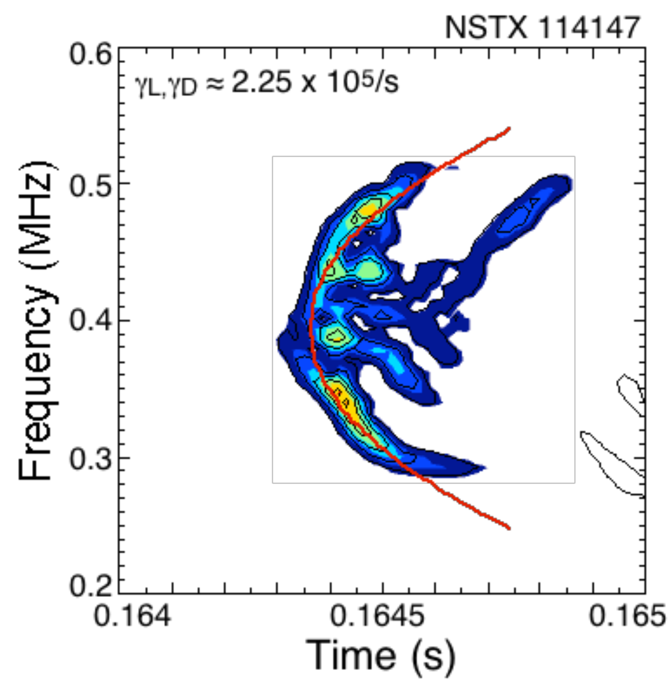
Angel fish GAE or CAE?

- Polarization measurements are not definitive.
- So far, most examples with up-down chirps were 3 kG.



$$\omega_{lab} = \omega_{GAE} - k_\phi V_{tor} = k_\parallel V_{Alfvén} - k_\phi V_{tor} \qquad \omega_{ci} - k_\parallel V_{b\parallel} + k_\phi V_{tor} = \omega_{GAE}$$



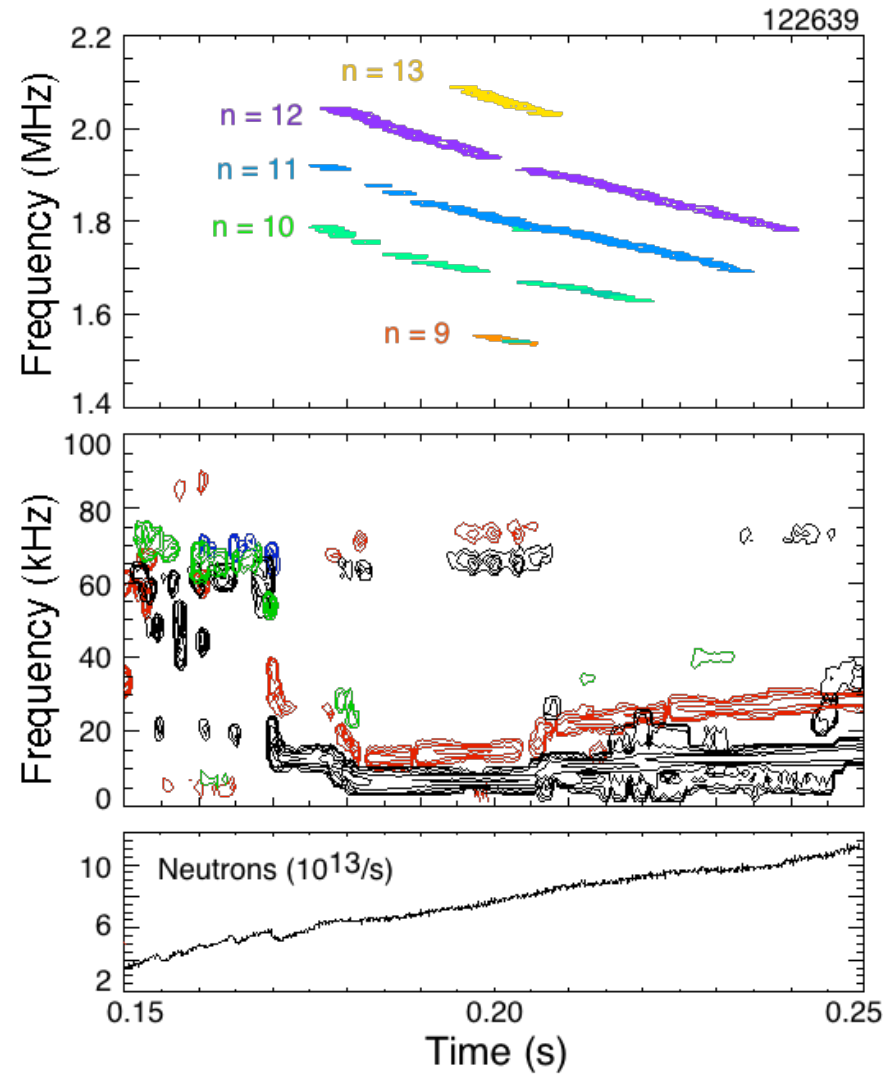


High-frequency CAE

- These modes typically appear with n=1 kink mode, possibly as a result of fast ion redistribution.
  - Frequency spacing, mode numbers consistent with CAE.
  - Propagate co-parallel to beams, $8 \leq n \leq 13$.
  - Few fast ions in unperturbed distribution meet resonance condition.
- Probably pick up in piggy-back, but might need dedicated run-day

Early modes present when kink present around 200 ms, Ip < 800 kA?

- Here, modes with n = 9 through n = 13 are identified.
- There is some delay, suggesting diffusion plays a role in fast ion redistribution responsible for mode drive.
- Alfvénic early modes don't seem to have similar effect.
- Fast ions originate from core region?

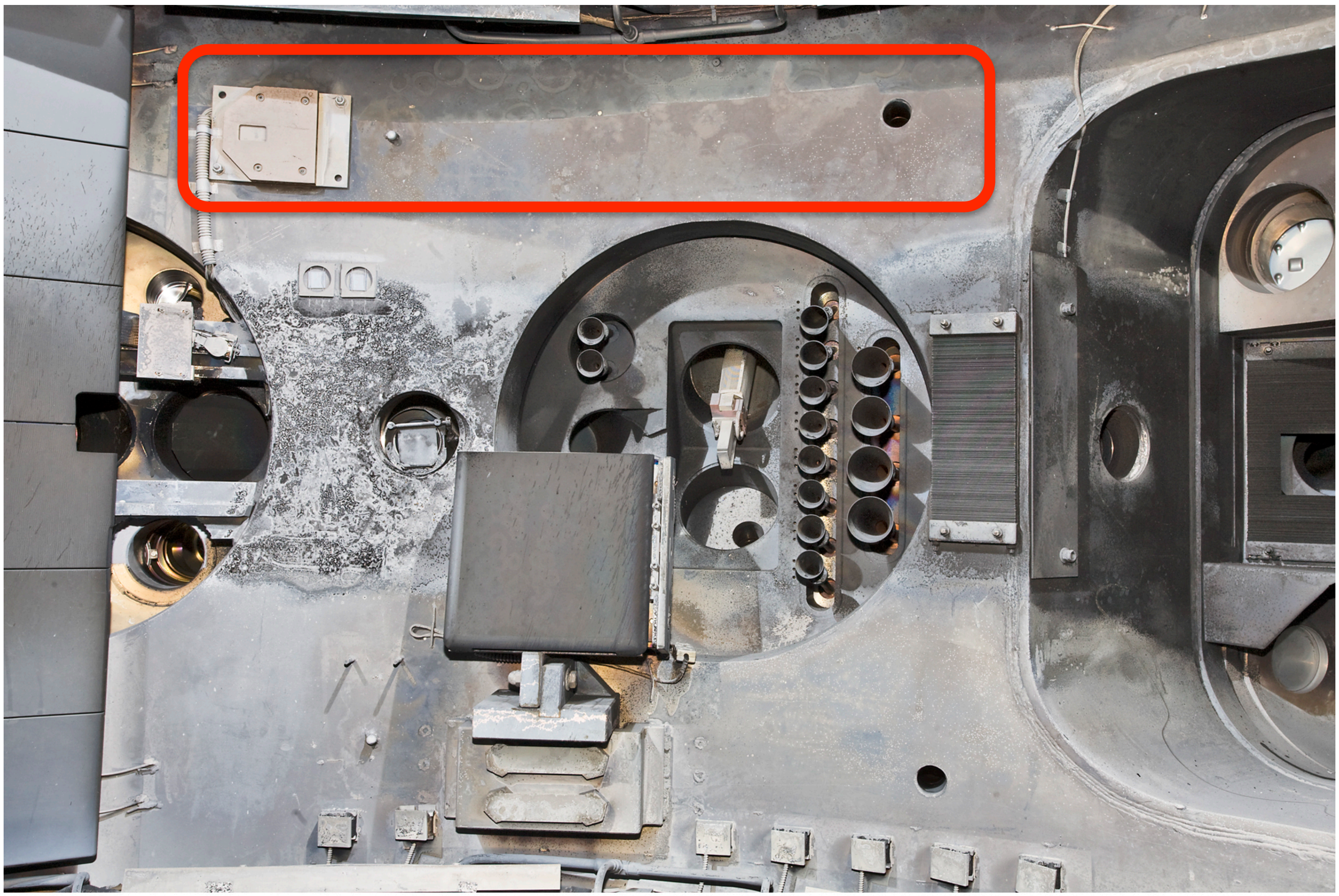


N=3 Braking

- Some data, *e.g.*, 132758 – 132769, but avalanches and TAE not that good.
- Spend a day developing good avalanche target, incl. small Ip and TF scan.
- Then add braking.
- This XP cannot be done in piggy-back, needs at least one full day.

Add Coil for TAE excitation?

- Add simple ≈5 turn coil as shown – ≈15 cm x 80 cm, # turns tbd
- Very similar to C-Mod coil (15cm x 25cm, 5 turns, 400 W amplifier)
- Possible to add this opening, if we think it's worth pursuing



Proposed XP's

1. 3-wave coupling with n=3 error field (NC)
2. Affect of TAE induced transport on rotation, NBCD (stability scaling)
3. 'High density' TAE in monotonic H-mode plasmas.
4. Search for KAWs
5. Reversed field FIDA validation XP
6. HHFW acceleration of fast ions
7. HHFW on chirping (Sharapov EP?) (see 6).
8. EPM(fishbone) fast ion transport
9. eGAM search (reversed Ip)
10. Code validation TAE experiment
11. EPMs (see 8)
12. Marginal stability conditions for TAE
13. Characterize low frequency modes
14. Effect of HHFW on plasma rotation
15. HHFW interaction with fast ions (see 6&7)
16. HEF

Additional XP's not covered

- Fast ion transport by turbulence
- Document amplitude/structure of high frequency *AE in electron transport studies.

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- 3-wave coupling with n=3 error field
- Affect of TAE induced transport on rotation, NBCD (stability scaling)
- 'High density' TAE in monotonic H-mode plasmas.