Whole Device 3D Full-Wave Modeling of HHFW on NSTX

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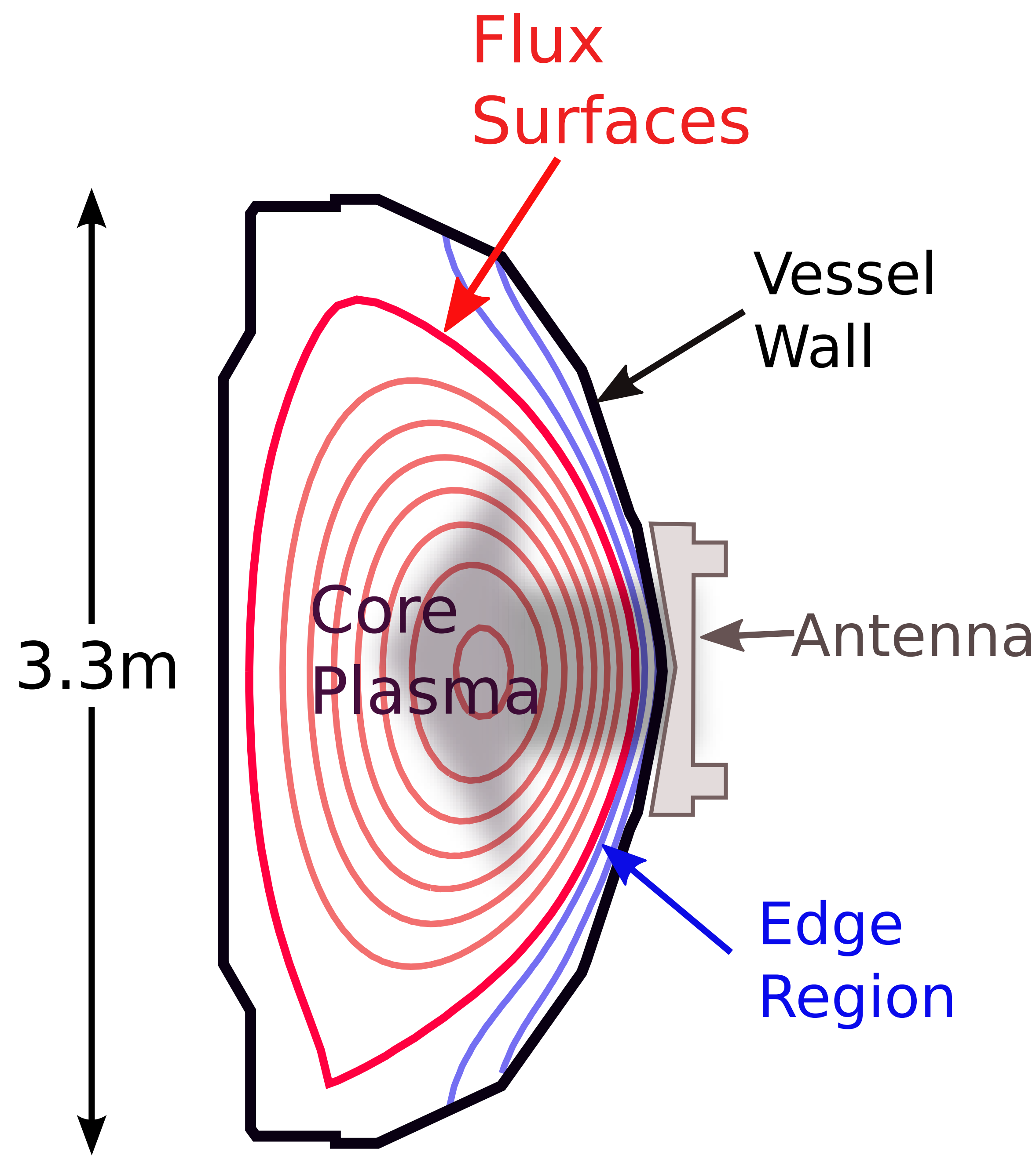
Extend AORSA to solve in the edge region

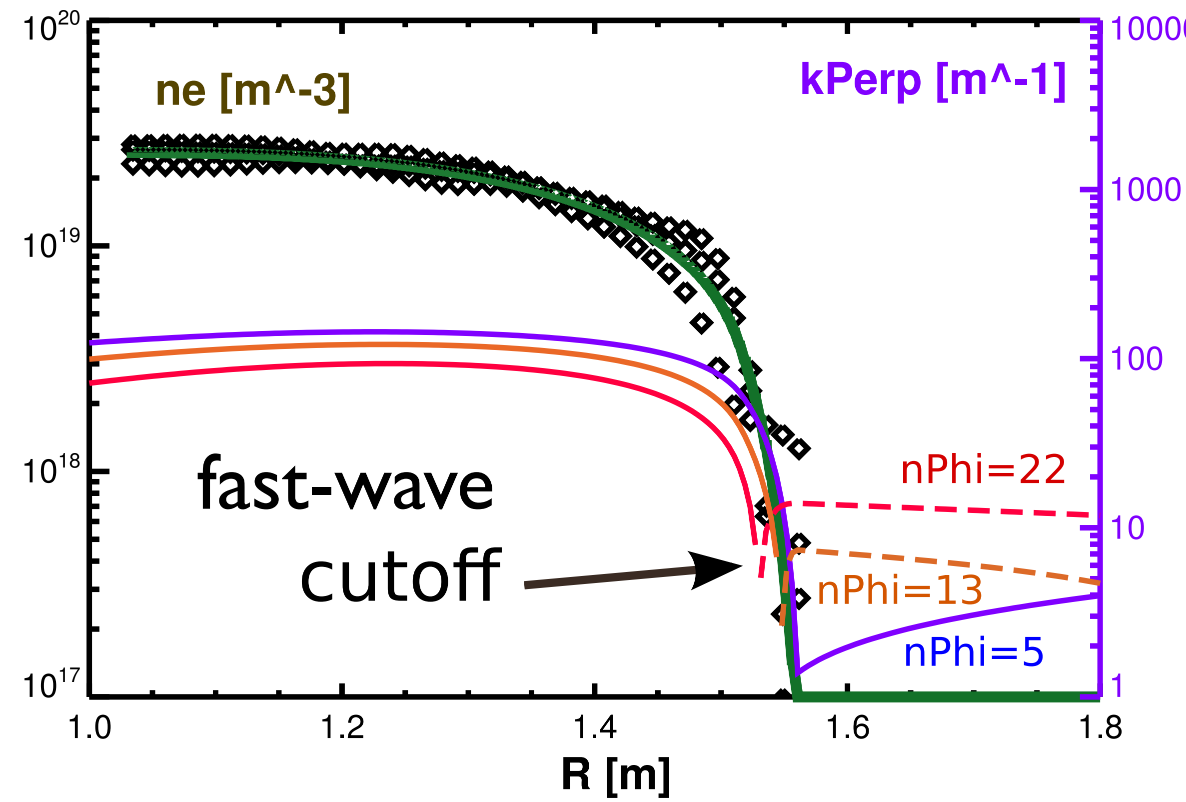
- Most hot plasma full-wave codes are spectral in the parallel direction to capture the non-local parallel response.
- To capture an all-orders high harmonic perpendicular plasma response AORSA is also spectral in the perpendicular direction.
- AORSA does not see open or closed field lines.
- We can now solve for an arbitrary 2D boundary and profiles. In general some modification to rlim/zlim from g-eqdsk.



2D profiles are created from fits to data

- Inside the last closed flux surface (LFCS) profiles are 1D flux functions.
- 2D numerical profiles are generated using
  - Fits to Multi-Point Thomson Scattering (MPTS) data with exponential decay with distance from LCFS
  - SOLPS transport modeling helps with estimating the 2D scrape-off profiles [Thanks to John Canik]
- Edge collisional damping factor is somewhat arbitrary and used to control coaxial mode amplitude.

Density profile



Fast-wave onset location varies with launched toroidal mode number

2D NSTX Results

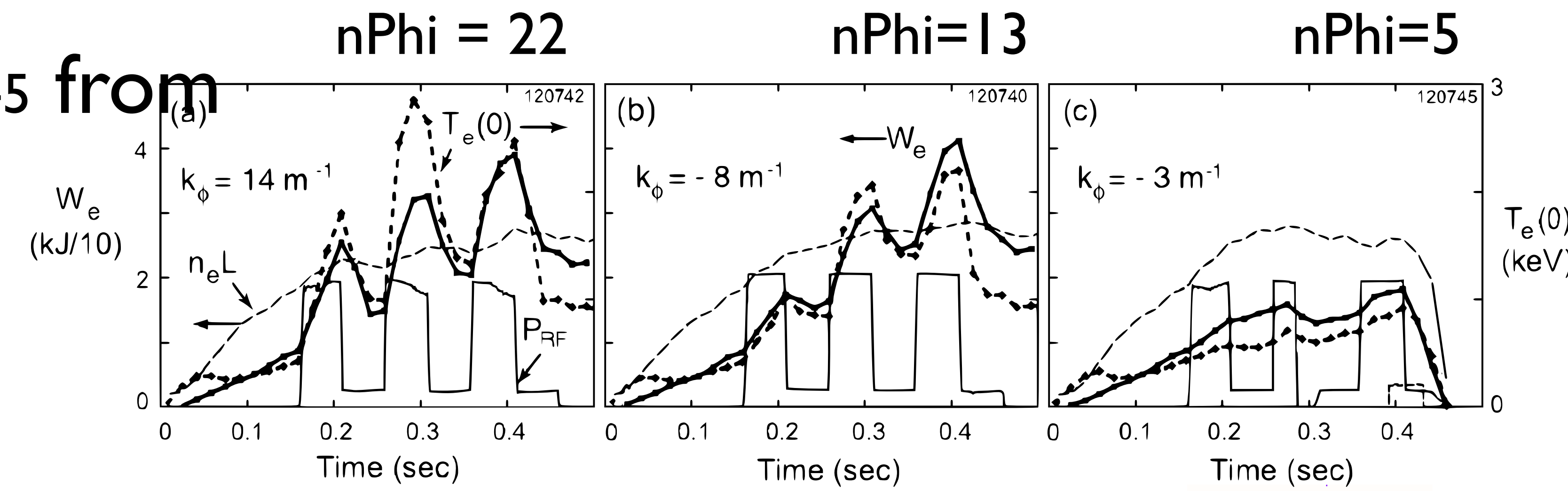
- Shot #120742, 120740 & 120745 from Hosea et al.,

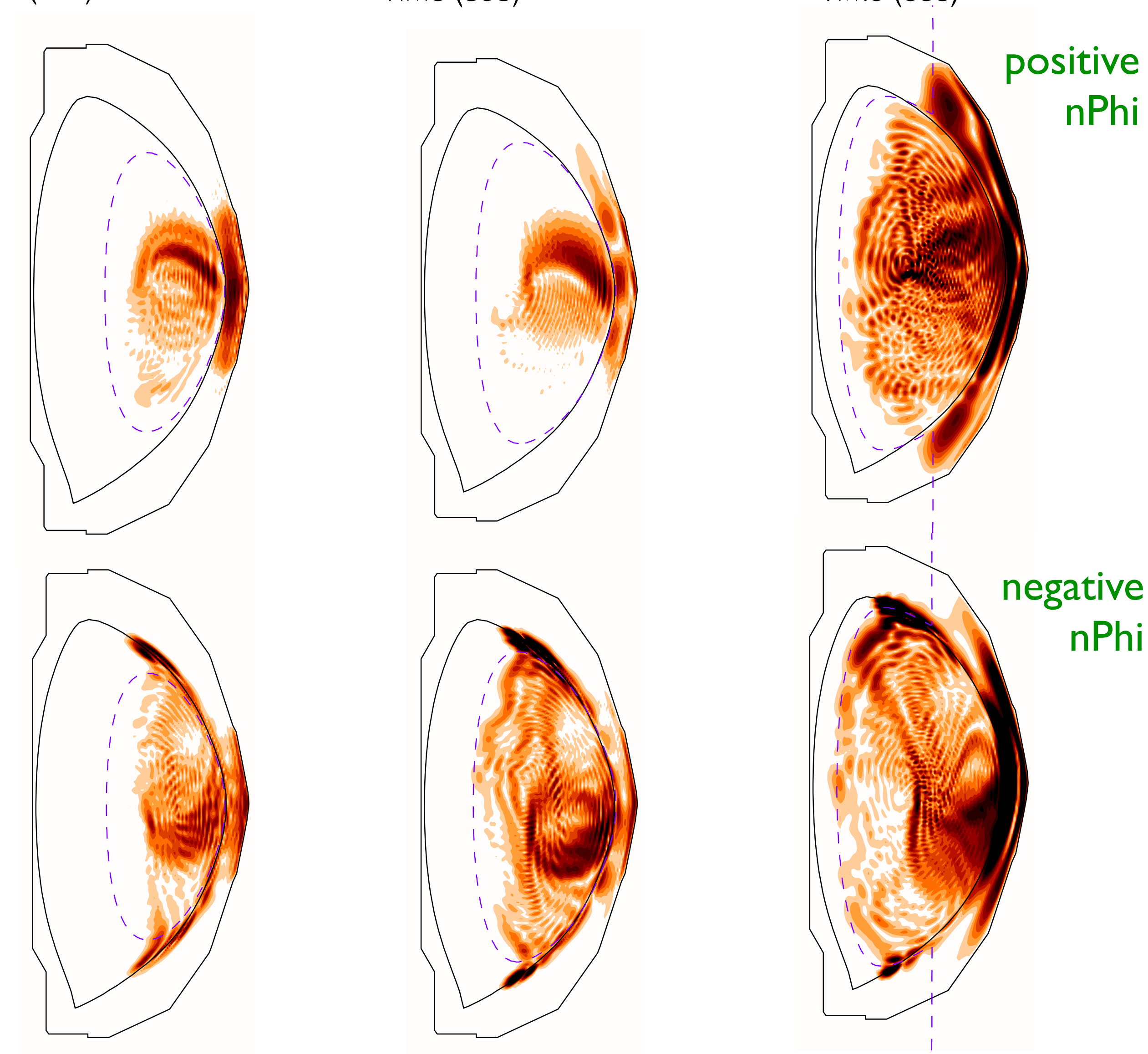
  PoP 15, 056104 (2008)

- He, 30MHz

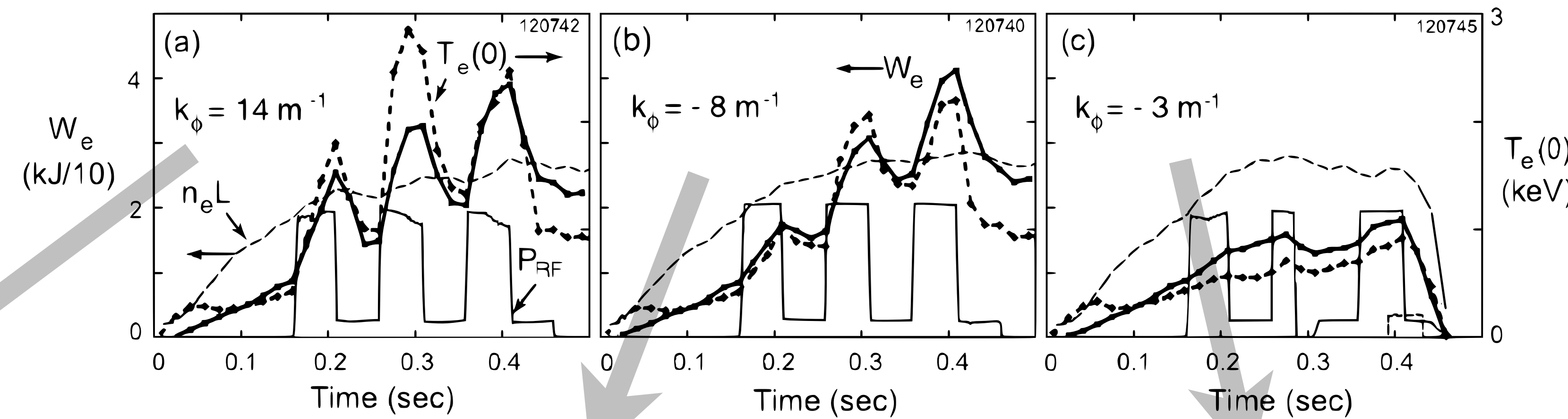
- Cavity modes between the wall and plasma for small nPhi where the fast wave is propagative.

- Edge localized, field-aligned traveling eigenmodes for negative toroidal modes caused by tangential reflection of the fast-wave inside the density gradient and fast-wave cutoff.

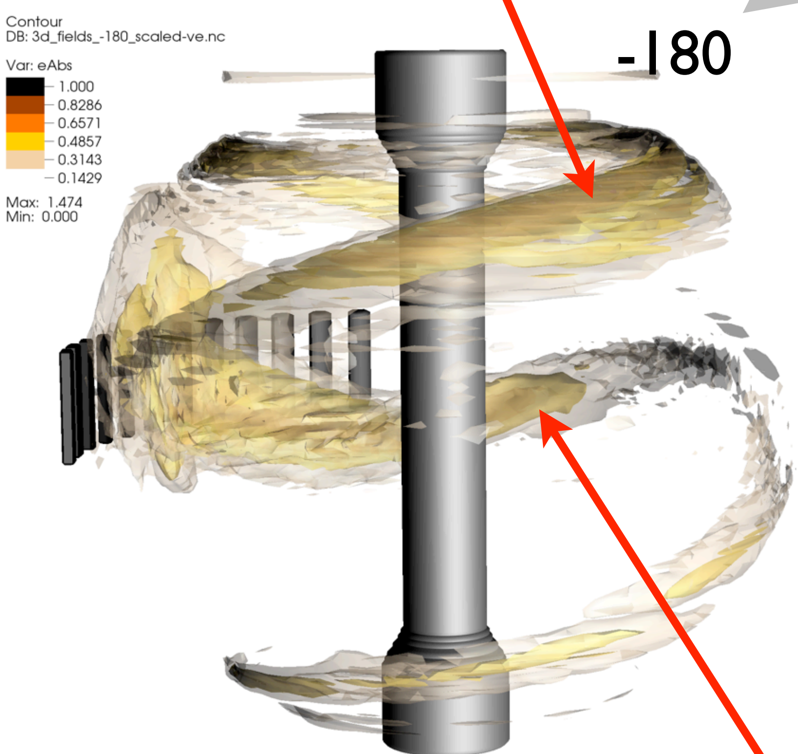


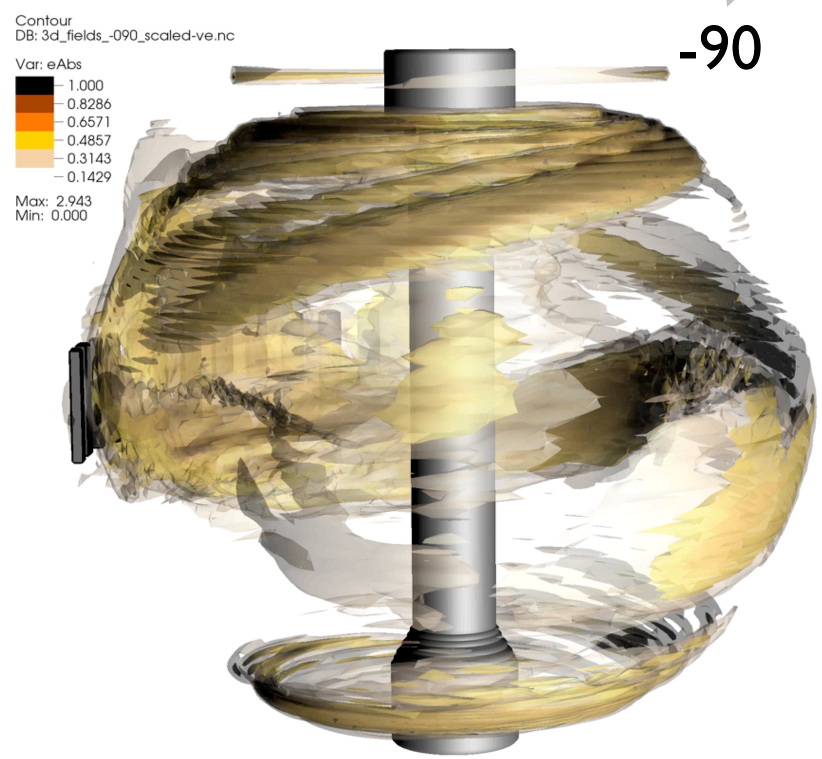


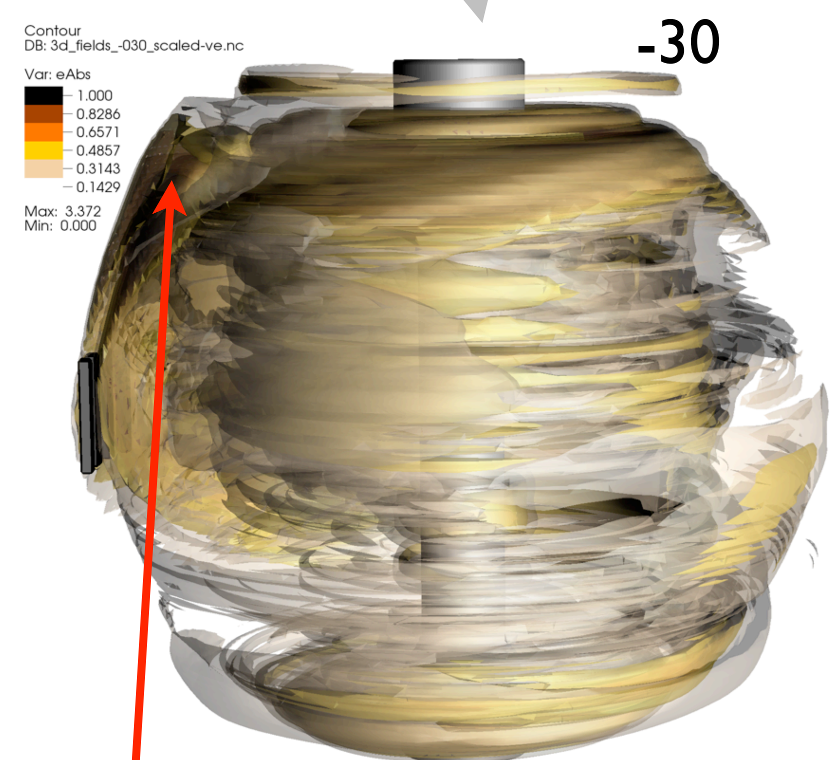
3D NSTX Results



Edge eigenmode





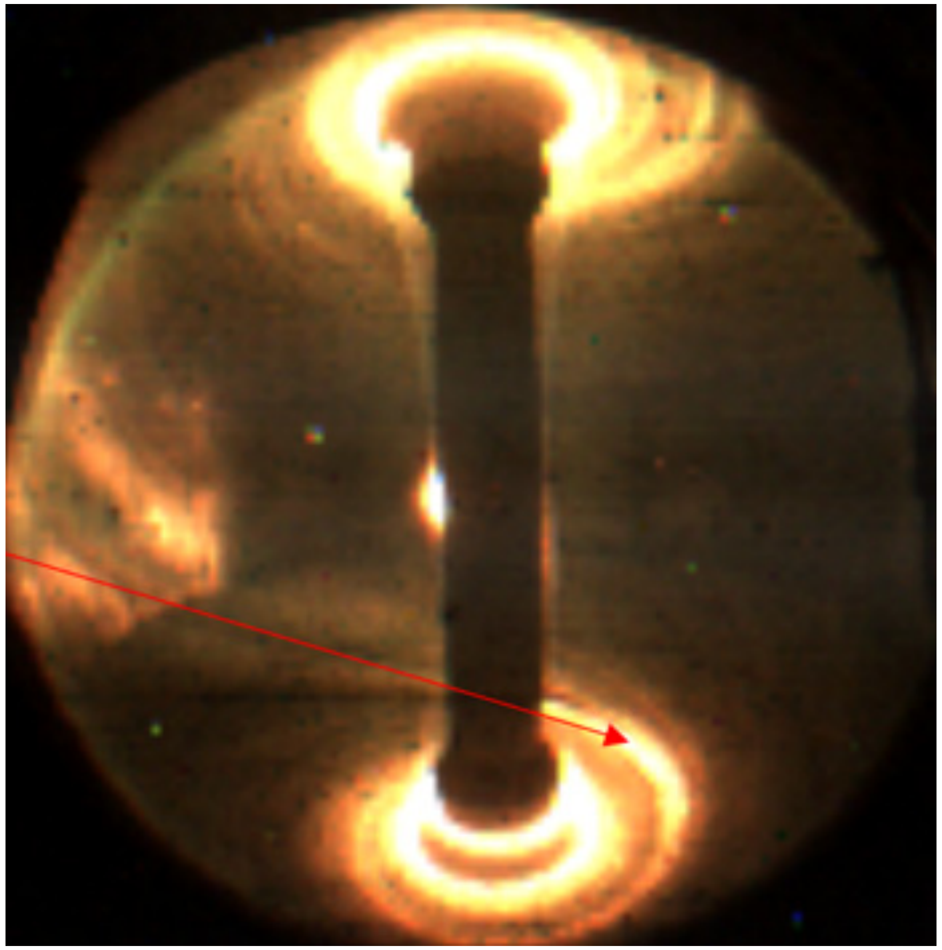


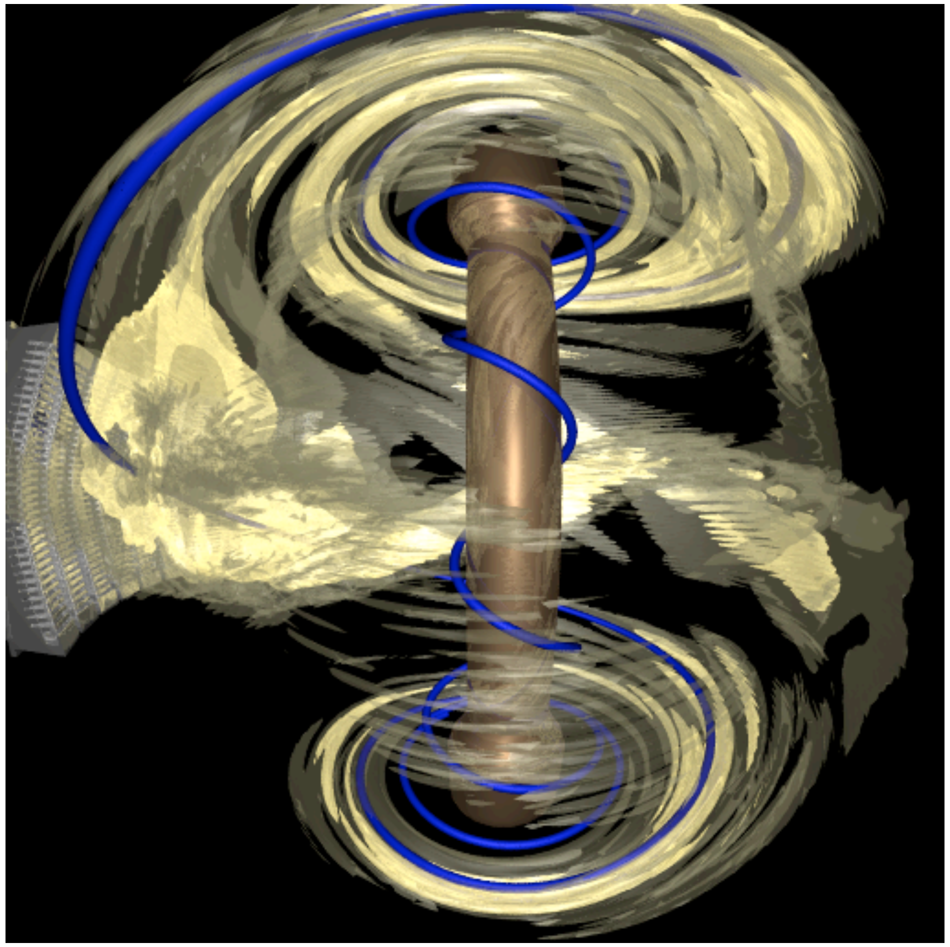
Core fast-wave

Coaxial edge mode

3D NSTX Results II

-90 degree phasing, Phillips et al., Nuclear Fusion 49, 075015 (2009)





Correlation (if any) between this images is unclear.