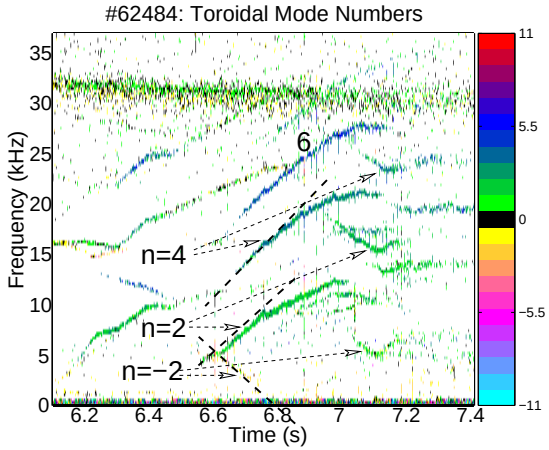
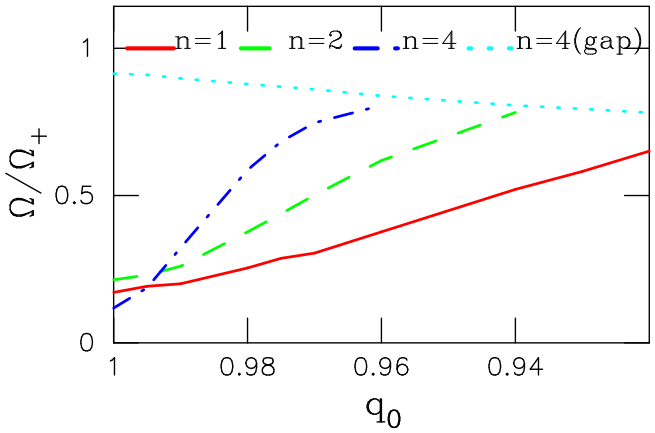
Some thoughts about future directions of EP research

1. EP transport physics is not understood (embarrasing for our area):
   - need to confirm d3d results: similarity?, persistent instabilities?, can we achieve this and avoid avalanches?
2. Low frequency instabilities should be of high priority:
   - new physics,
   - potential for solving transport problem.
3. High frequency instabilities:
   - energy, α channeling,
   - wave particle phase space enginiring.

BAAEs were observed on JET and NSTX



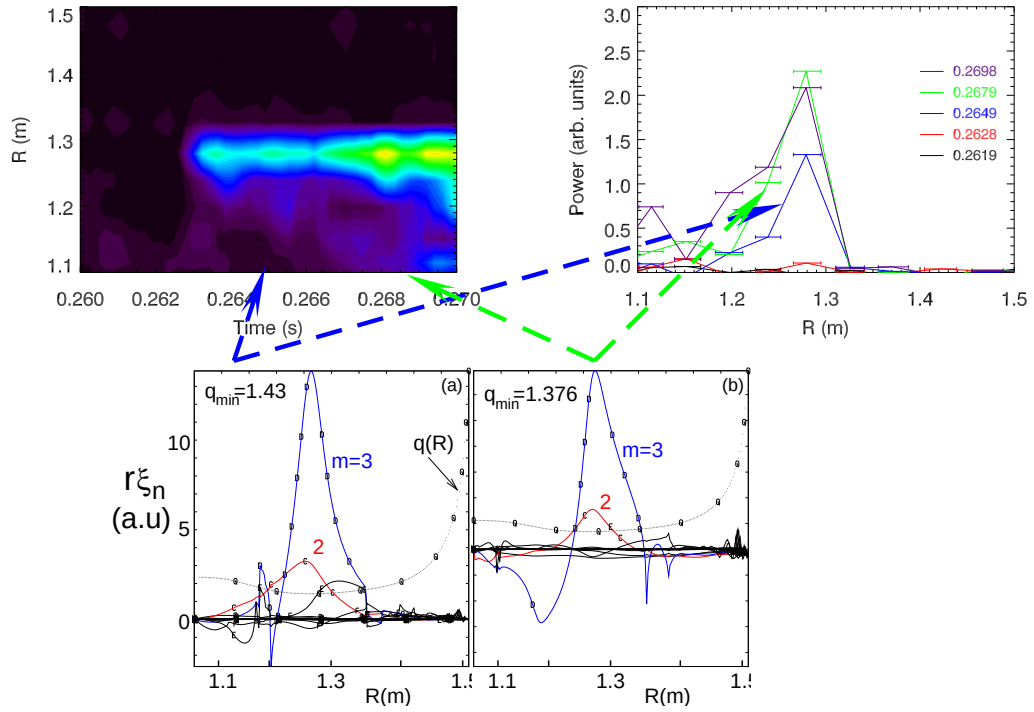


- So far, BAAE observations qualitatively agree with theory and NOVA:
  - Frequencies sweep up from $f_{pl} = 0 - 20kHz$
  - Only even n's were observed $\Rightarrow q = 3/2$? MSE was not available
  - Frequency is much lower than RSAE/TAE frequency, v_A/qR and $\omega_* < 1kHz$
- Problem in JET-theory comparison is frequency mismatch at saturation, at least 50%.

Potential BAAEs effects on fast ions and applications:

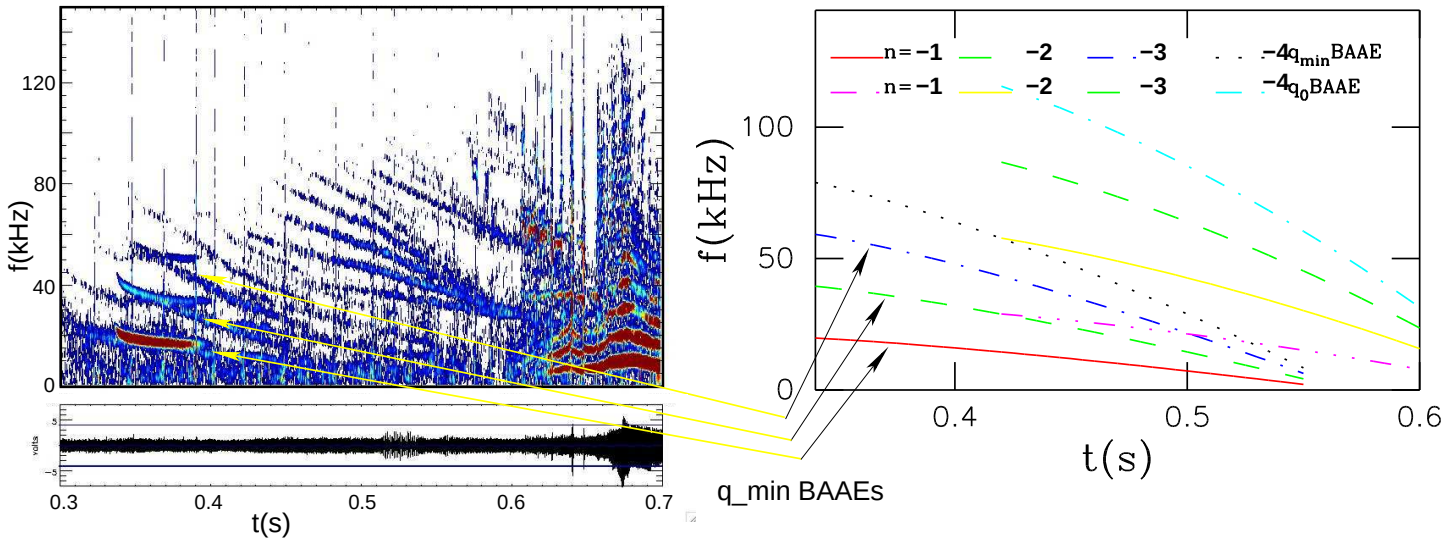
r - redistribution, MHD-spectroscopy, can study acoustic waves

NSTX further confirms BAAE identification via USXR signal to NOVA comparison



- Why BAAEs are unstable??? acoustic wave $\Rightarrow$ strong damping.
- DIIID with ECH and NBI, maybe low density is the target to lower thermal ion damping.
  - Initial evidence of BAAEs like modes in 128926, 122116 DIIID plasmas

BAAE are observed at high $\beta \sim 30\%$ NSTX H-mod plasmas



Applied modified Alfvénic dispersion with rotation $f_{rot}(q_{min}) = 19 - 23kHz,\ f_{rot}(q_0) = 26 - 30kHz,$ $q_{o,min}$ is from MSE: $f = f_{BAAE} + n f_{rot}, n < 0$

Modified Alfvénic wave dispersion is essential: $f_{BAAE} = v_A k_{\|} / \sqrt{1 + 2q_{0,min}^2}$

In addition to BAAE several other activities has to be identified.

Possible other instabilities are TFAEs - toroidal Flow induced AEs (van der Holst,2000, TMA?).