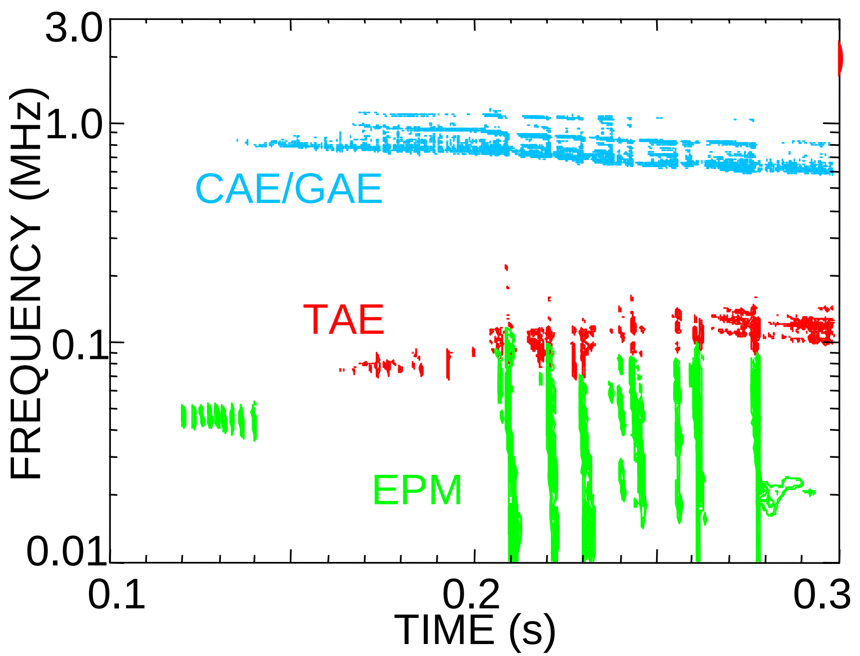
Recent Chirping Analysis



- **2004 Experiment**
- **"Effect of ion cyclotron acceleration on rapidly chirping beam-driven instabilities in NSTX" in press in *Plasma Phys. Cont. Fusion*.**
- **CQL3D calculation of fast-ion acceleration by Bob Harvey.**
- **Quantitative comparison with Berk-Breizman model by Herb Berk.**

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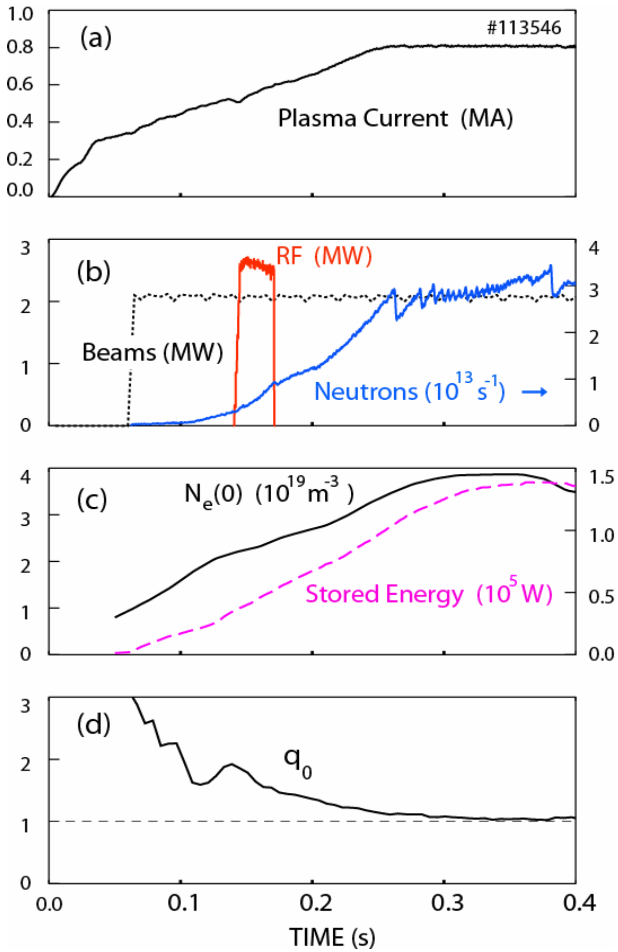
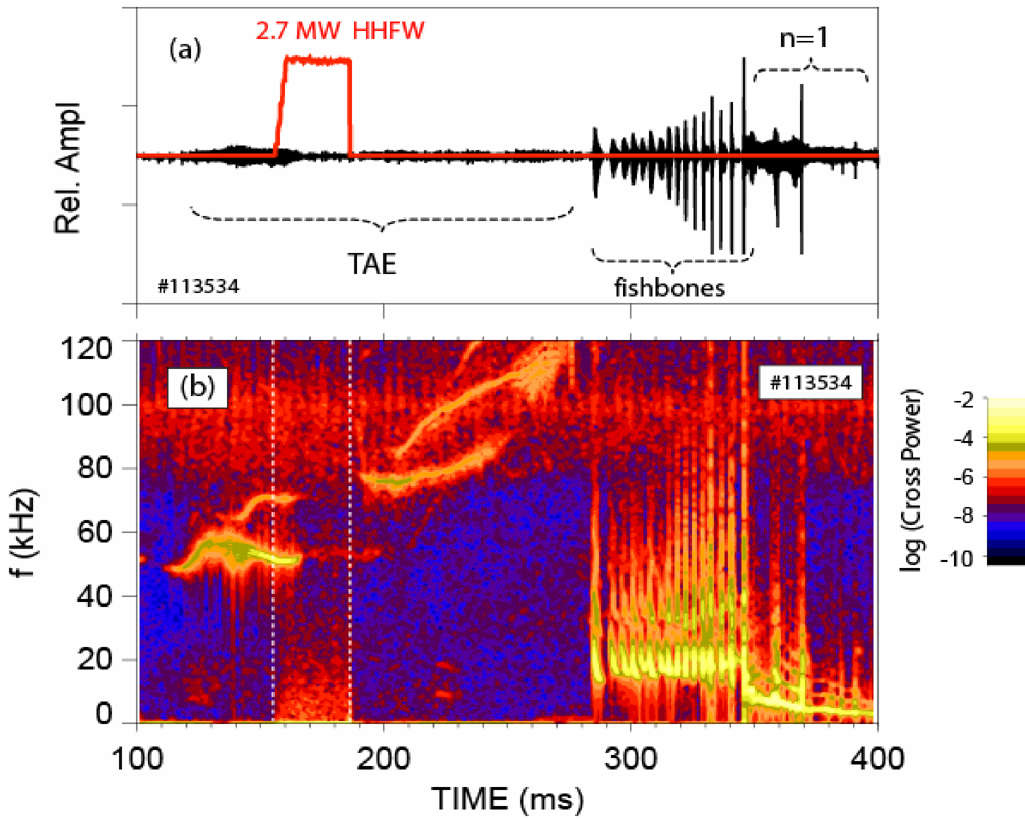
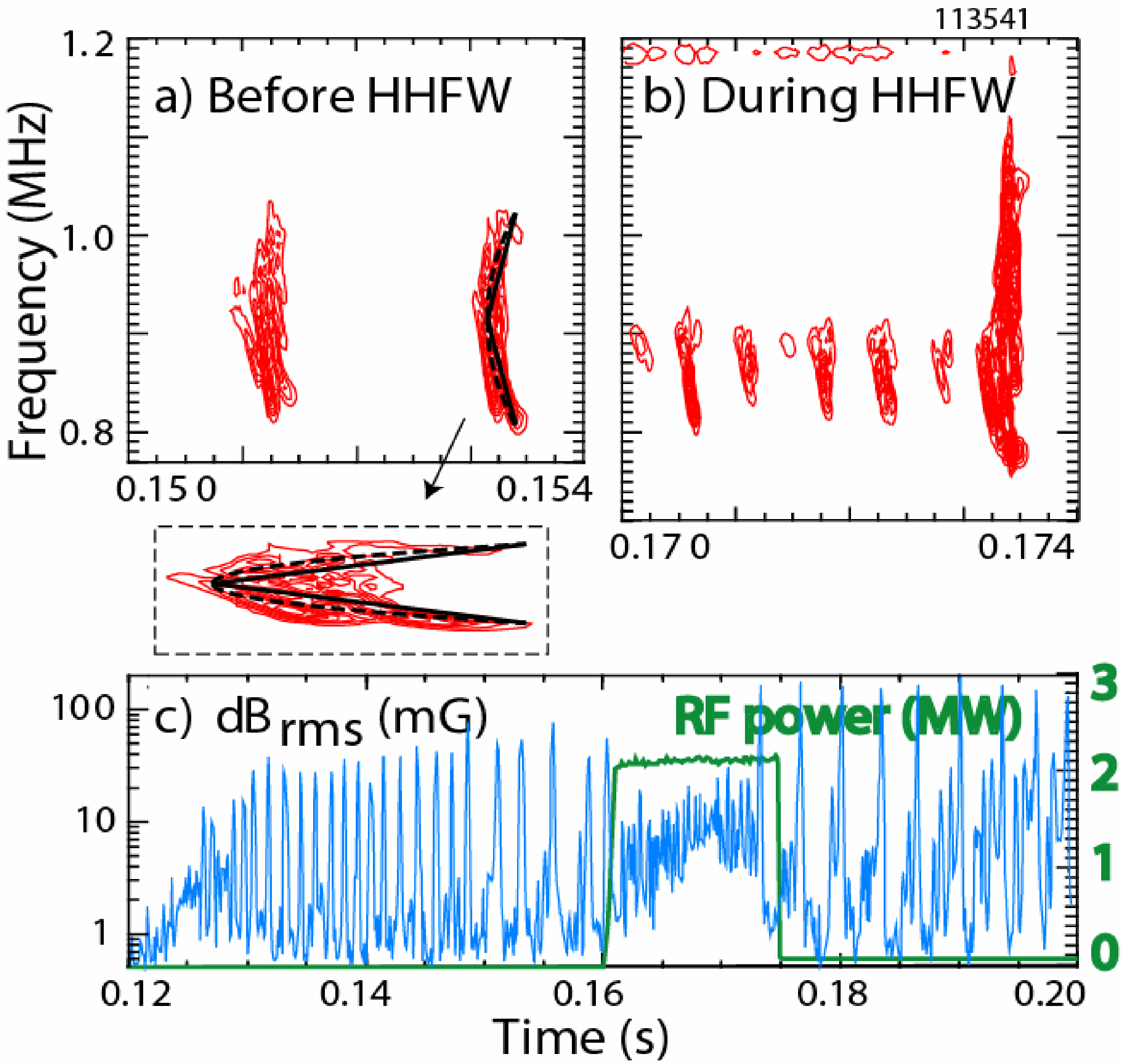
Plasma Conditions for 2004 Experiment: Early TAES and Late Fishbones



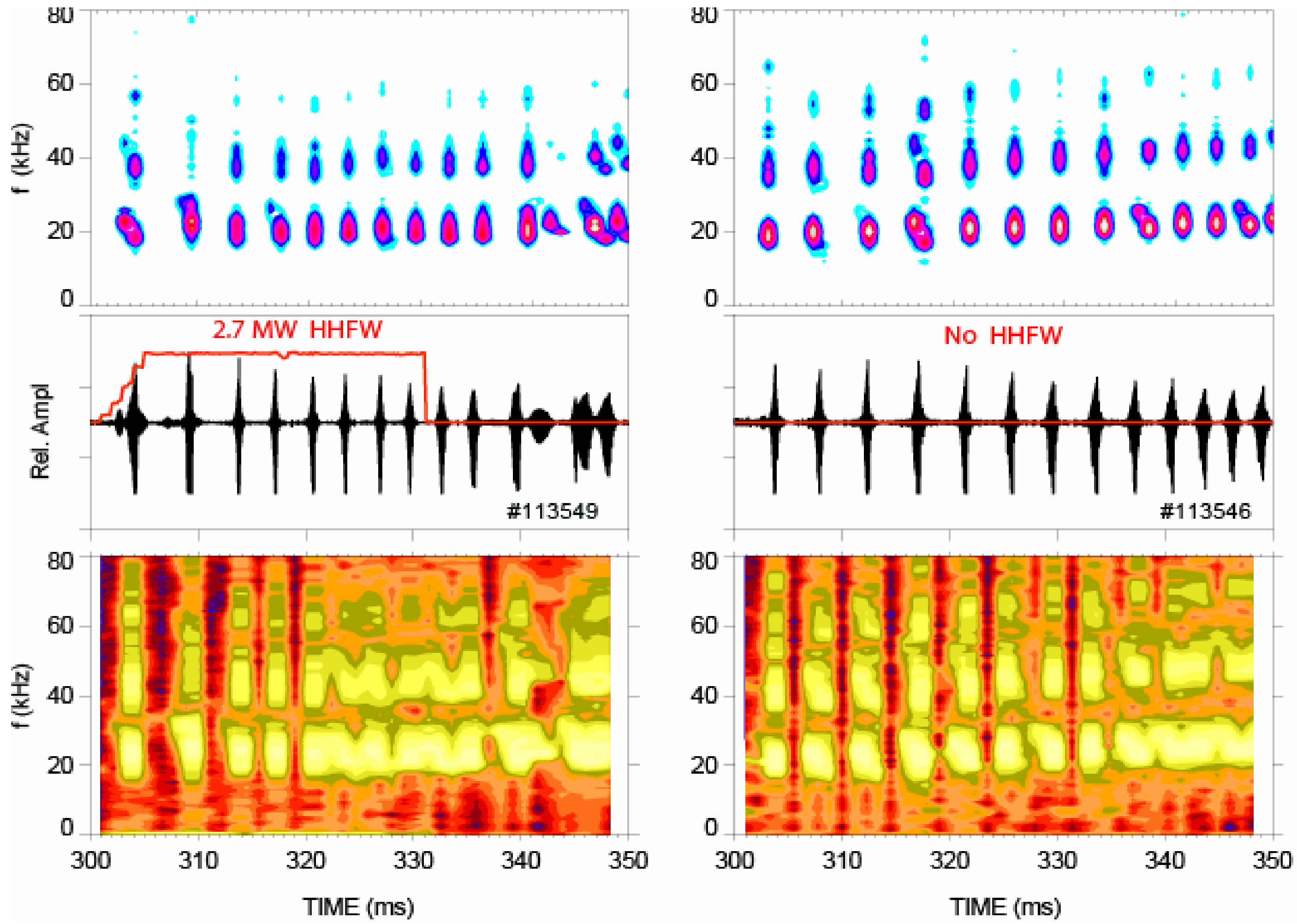


- **Helium L-Mode Plasma**

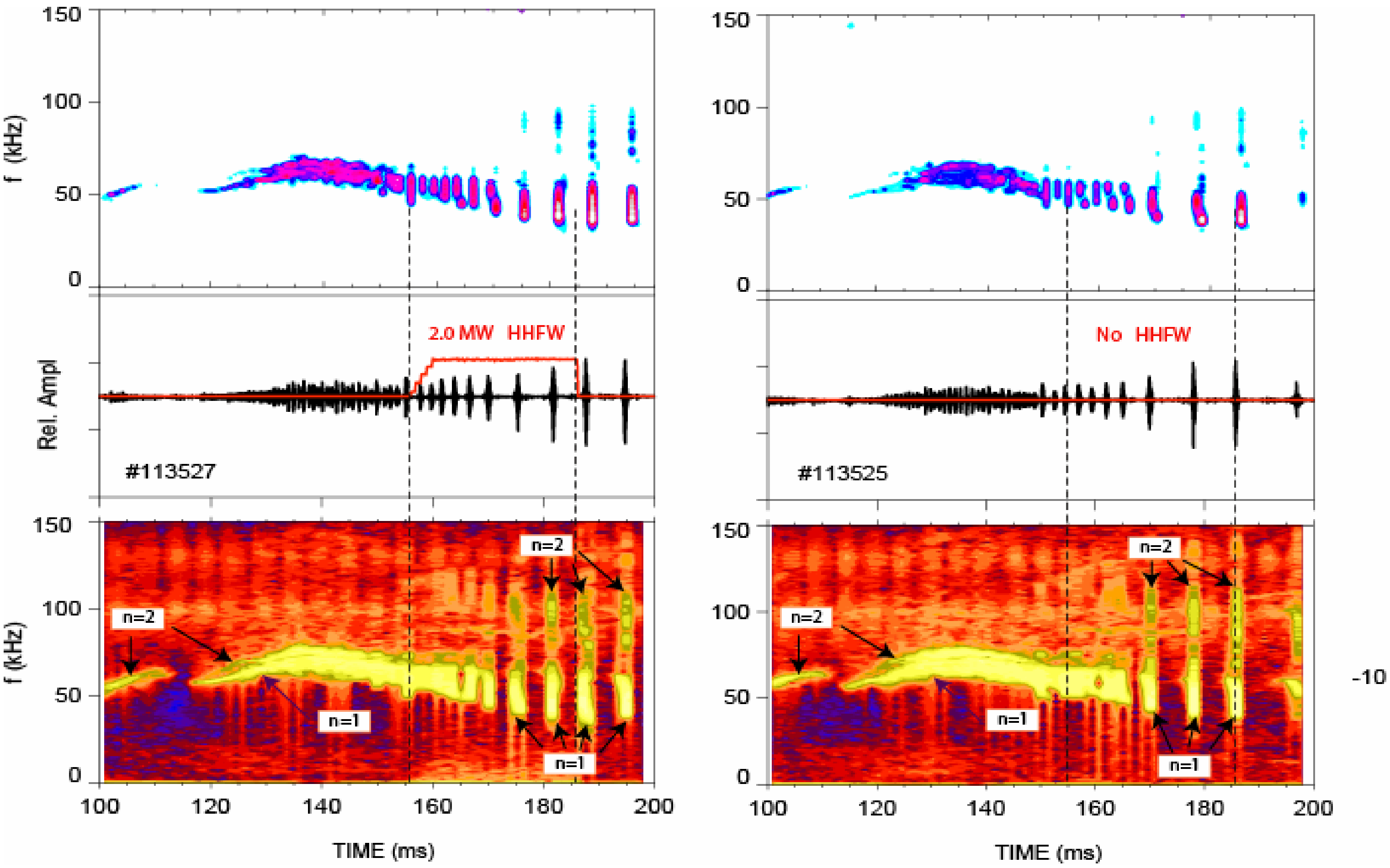
Possible effect on MHz-band chirping



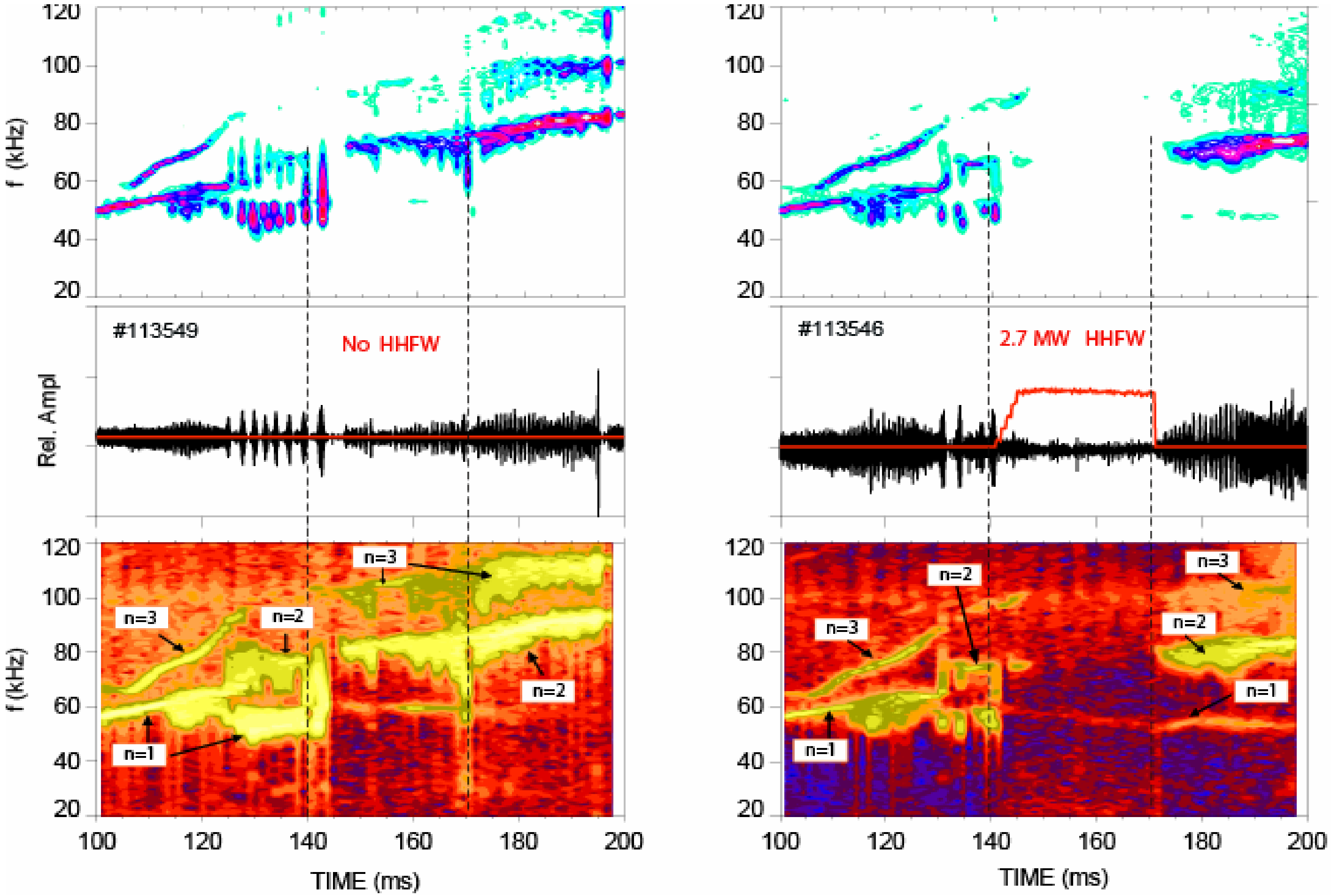
HHFW has no effect on Fishbones



HHFW has no effect on TAE-band chirping

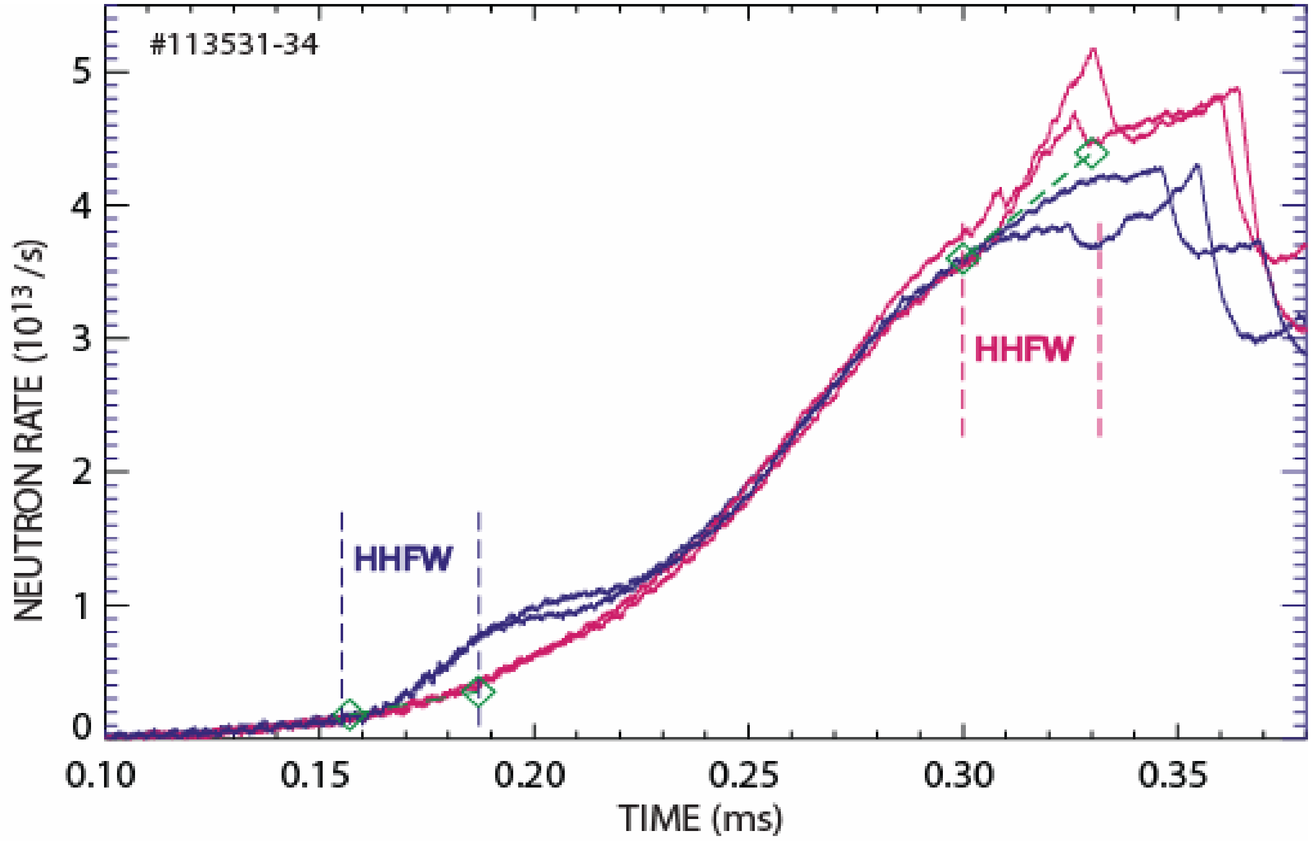


HHFW alters steady-frequency TAEs



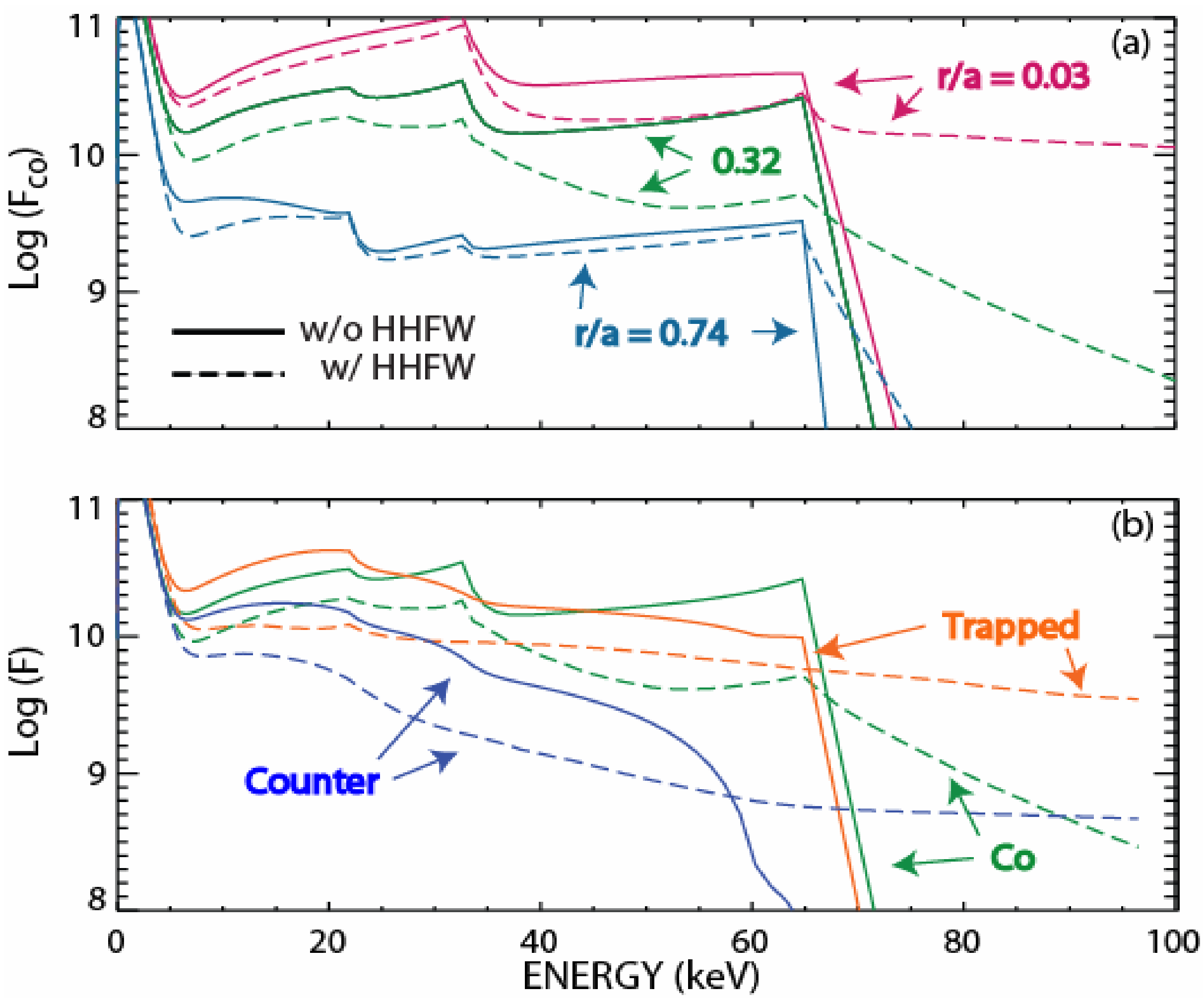
- **Change occurs in ~ 5 ms**

Rise in Neutron Rate → HHFW Accelerated Fast Ions



- $k_{||}$ = 14 m^{-1}
- **2-3 MW**

CQL3D Predicts Fast-ion Acceleration throughout Phase Space



- Expected for large normalized gyroradius and many resonances
- Simulation predicts neutrons increase x2.5 (experiment = 2.0)
- Substantial tail above injection energy (observed by NPA)
- Tail largest in core but apparent at all radii
- f decreases below injection energy (NPA not apparent)
- Large trapped tail
- Big reduction in co

CQL3D Simulation Guides Interpretation of the Results

- **HHFW accelerates trapped fast ions at all radii → can alter CAE chirping**
- **Large trapped tail → The number of trapped fast ions inside q=1 increases slightly, so fishbone stability should not be affected.**
- **f decreases below injection energy (particularly for co population) → decrease in co-circulating fast ions with v ~ v_A explains TAE stabilization**
- **Power distributed throughout phase space → Lack of effect on TAEs and fishbones not inconsistent with Berk-Breizman theory ("used a blunderbuss rather than a scalpel")**