

XP proposal: study effects of toroidal rotation on dynamics of TAEs

M. Podestà *et al.*

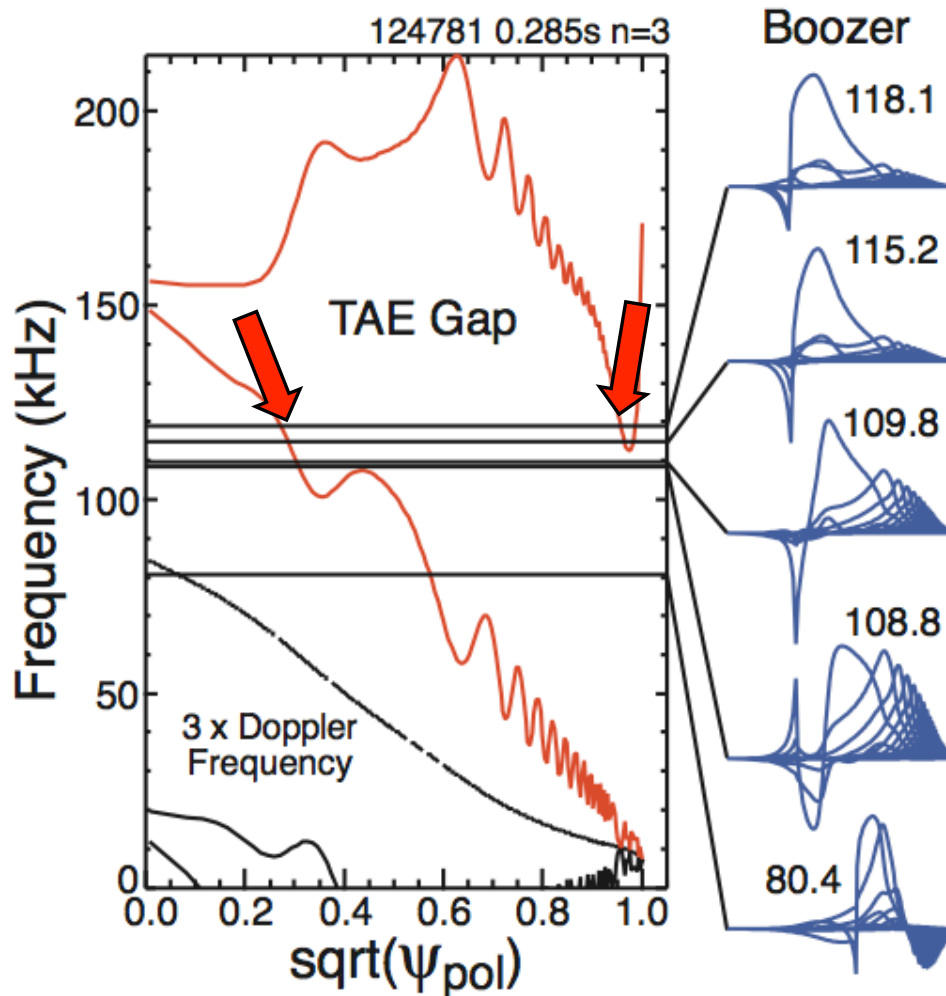
WPI-TSG meeting, October 2010

- Study of TAEs in L-mode continue in 2010
 - Collecting data for detailed comparison theory/experiments
 - “Rotation” is an important element
- NSTX (low aspect ratio) has large rotation frequency
 - Rotation comparable with TAE frequency (plasma frame)
 - Stability and structure of TAE modes may change as TAE gap varies for different rotation profiles
- Goal: explore dependence of TAE dynamic on rotation profile; compare results with predictions from codes such as NOVA-K, M3D-K

Example: *continuum damping* is sensitive to gap structure; large contribution to total damping on NSTX

NOVA calculations, Lab frame

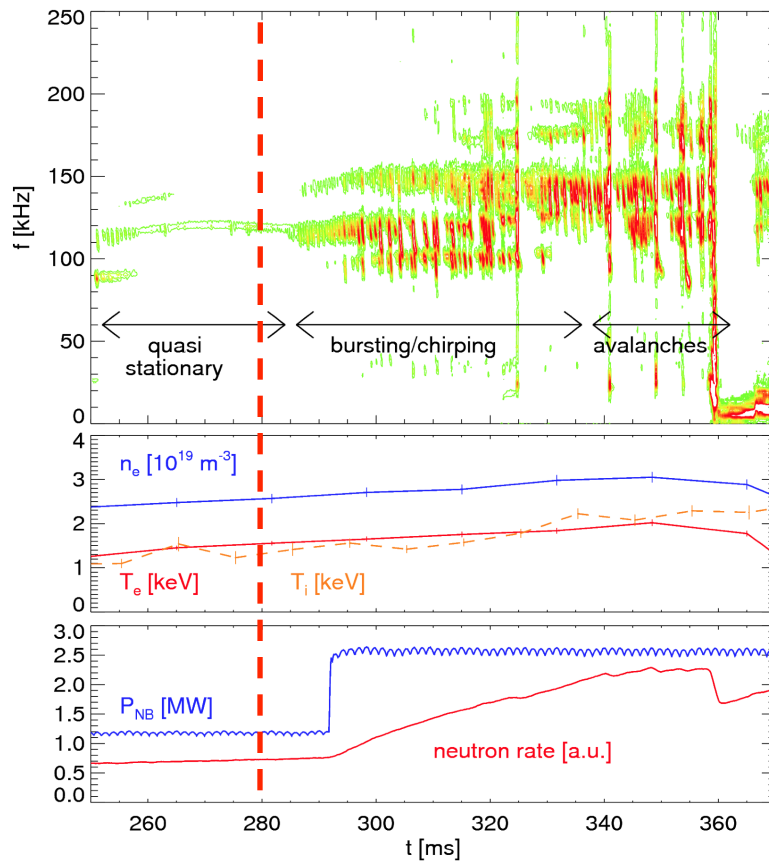
[E. Fredrickson et al., PoP 16 (2009)]



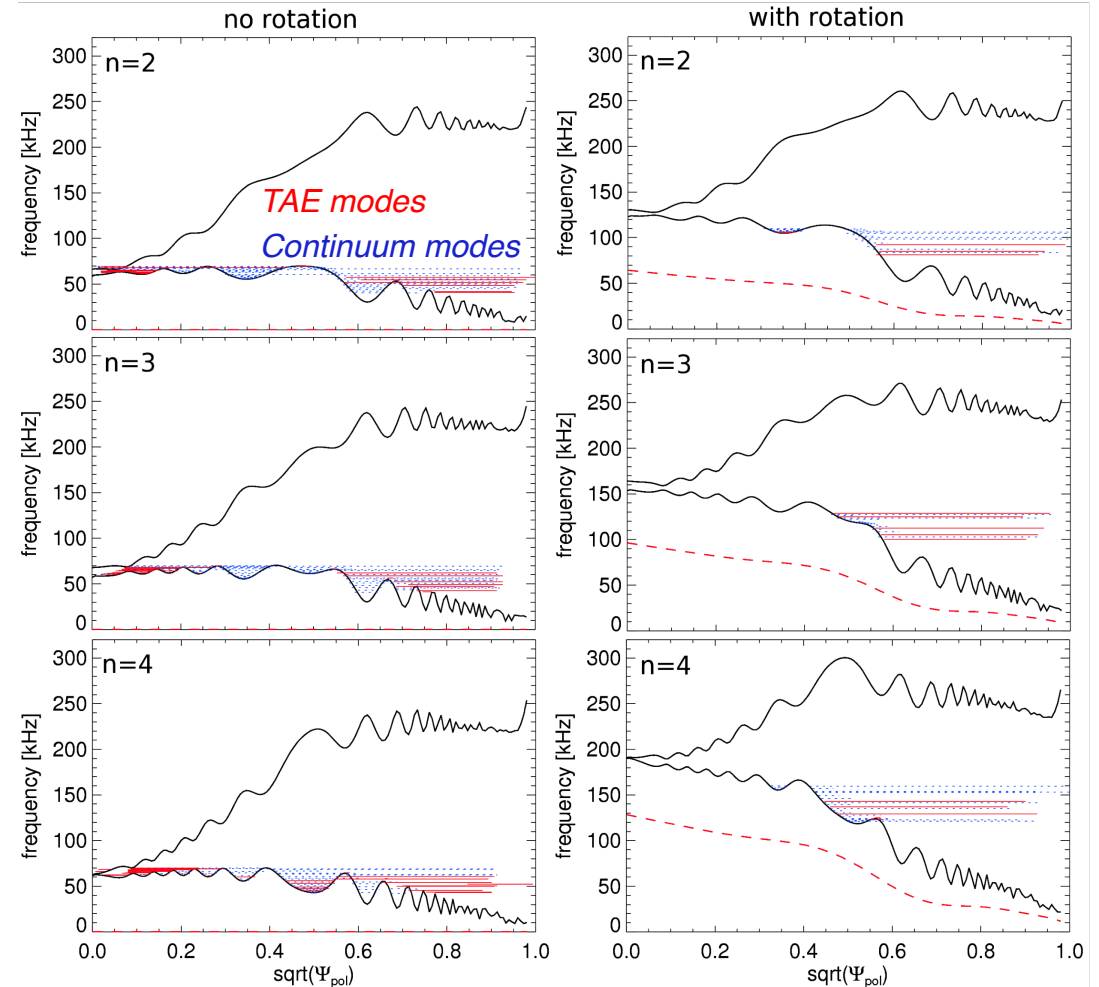
- As *rotation* and *q-profile* evolve, modes can experience strong interaction with continuum
- Can we separate the different effects experimentally?

Effects of rotation can be different for different (toroidal) mode numbers

shot#135388



TAE gap structure (NOVA), $t=280$ ms



Important for understanding overall “multi-mode” dynamic (e.g. TAE avalanches)

Run plan – ½ day experiment

- Target: “best shot” from 2009: shot no 135388 **2 shots**
 - Target $B_{\text{tor}}=5.5\text{kG}$, $I_p=900\text{kA}$, center-stack limited plasma
 - Backup: shot from XP-1015 (2010)
- Optimize scenario for reduced TAE bursts/chirps **6 shots**
 - Density is a crucial parameter... but, in practice, it is a difficult knob to use
 - Modifying NB power and timing is the way to go
 - Try other parameters (shape) as backup option?
- Introduce $n=3$ braking as early as possible
 - Start ramp as early as ~ 200 ms, flat-top at 250–280 ms
- Scan of $n=3$ braking **6 shots**
 - Start with 200 A; increase shot-by-shot up to $\sim 1.2\text{kA}$ (or whenever bad things happen: plasma locks, ...)
- If time permits: revisit scenario with strong bursts **6 shots**
 - Repeat $n=3$ braking scan
- If time permits even more: back to *H-mode* scenario **>4 shots**
 - Chose best case from XP-1011, perform $n=3$ braking scan

Required machine and diagnostic capabilities

- Run after XP-1015
- Usual profile diagnostics
 - MPTS, CHERS, (pCHERS)
- Need MSE (NB source A) for q-profile data
- Need all fast ion diagnostics
 - FIDA, NPA, ssNPA, sFLIP, neutrons
- Mode structure measurements are crucial:
 - Reflectometers (L-mode part)
 - BES w/ maximum radial coverage, both views (130cm,140cm)
 - Soft-X rays
- Plan to use one/two NB sources at de-rated voltage
- Open issue: compatibility of BES views with Liter (& availability of Liter...)