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XP 1017_ext: RF heating at divertor/SOL regions

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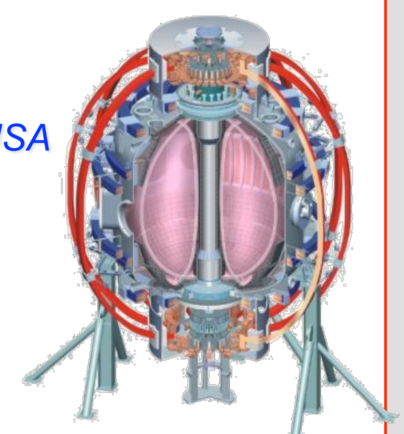

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XP Review
March, 2011

XP 1017: RF heating at divertor/SOL regions

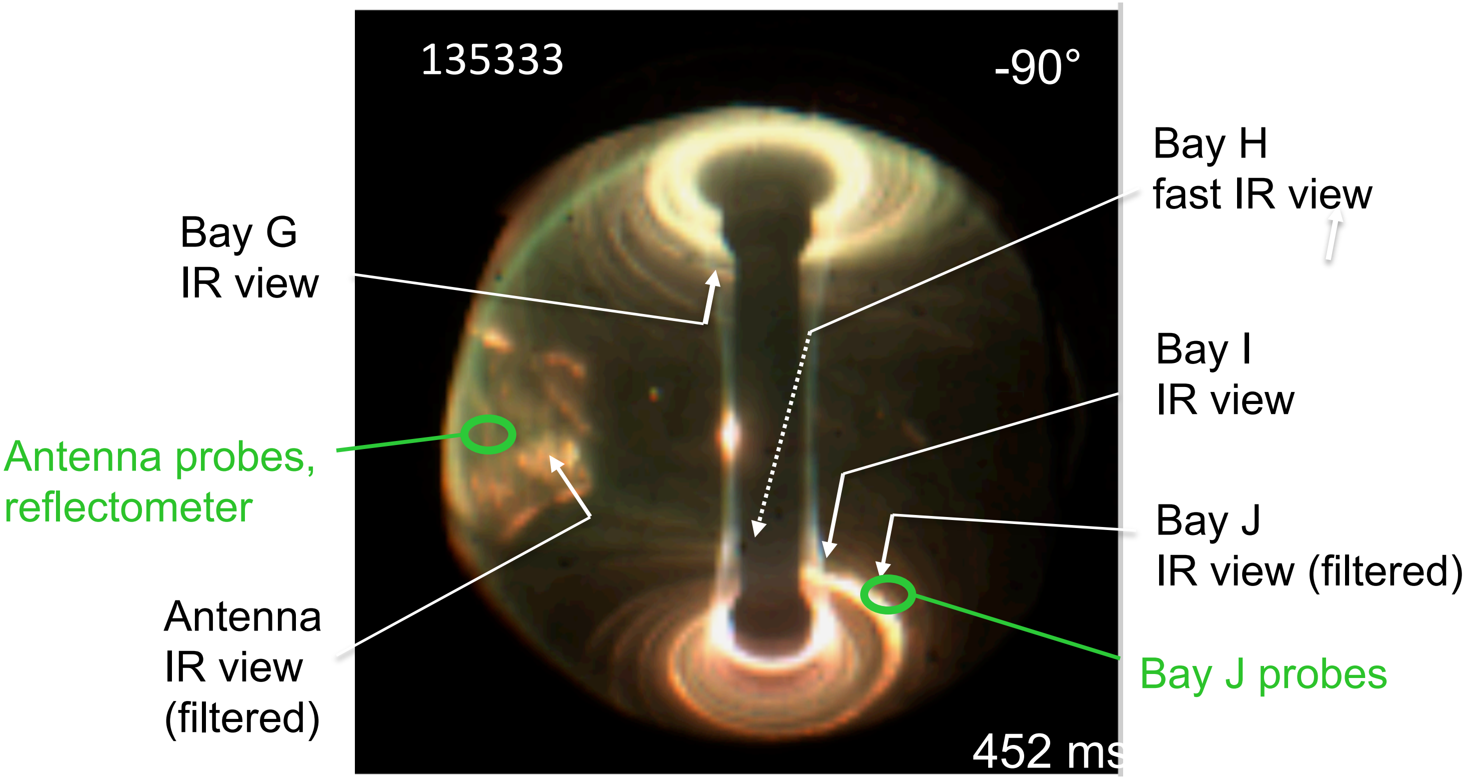
Goals:

- Understand the characteristics of the HHFW edge heating that has been observed in "hot" zones on the outer divertor plates
- Help benchmark edge heating effects in advanced RF heating codes

Objectives:

- Probe divertor and antenna hot zones and investigate heating characteristics and processes
  - ➢ Divertor hot zones
  - – Characterize divertor hot zones with visible and IR cameras, as well as with probes
  - – Enhance exploration of hot zone with scans in magnetic field pitch, gapout, and antenna phase
  - ➢ Antenna hot zones
  - – Characterize antenna hot zones with visible and IR cameras, as well as with probes, reflectometer
- Many additional diagnostics needed to investigate edge heating properties
  - – ERD, TS, CHERS, etc.

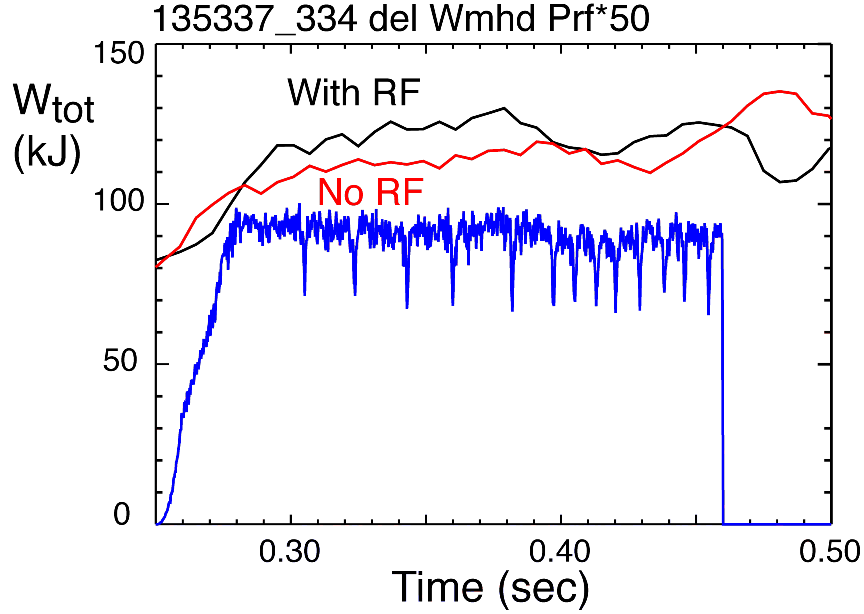
IR cameras and probes are critical for documenting edge heating



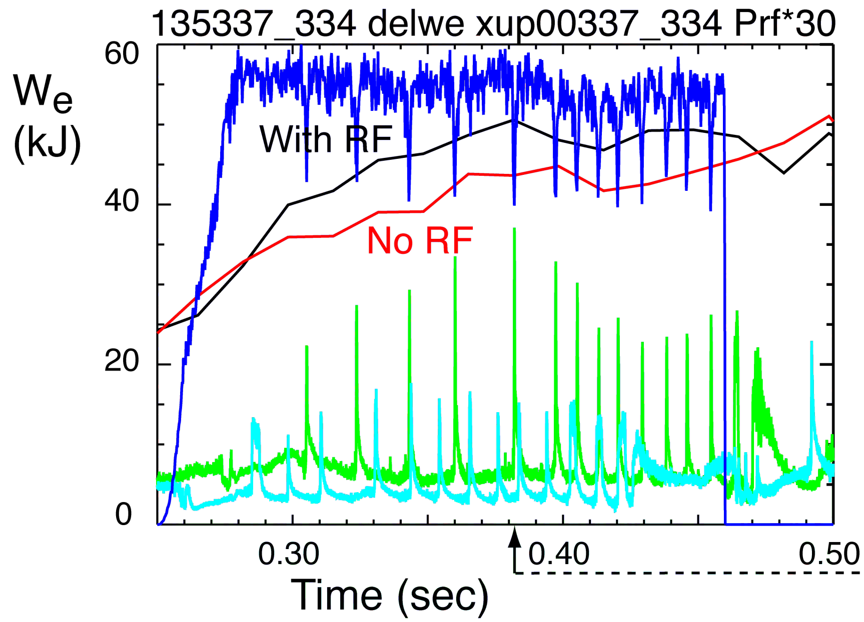
B_ϕ = 4.5 kG, I_P = 0.8 MA

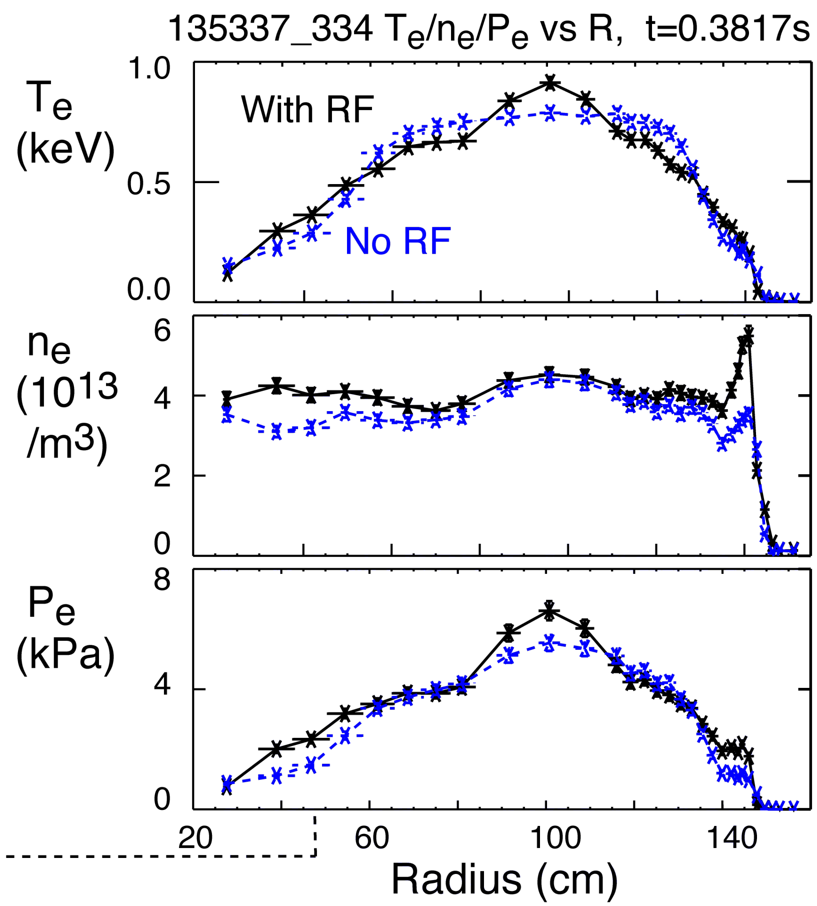
- New IR views of Bay J bottom and of antenna are needed for power deposition measurements
- Field pitch can be varied to pass hot zone over probe at Bay J bottom
- Higher field pitch will permit view of hot zone by fast IR at Bay H

Power coupled to core is affected by ELMs and/or by higher edge density/steeper density gradient

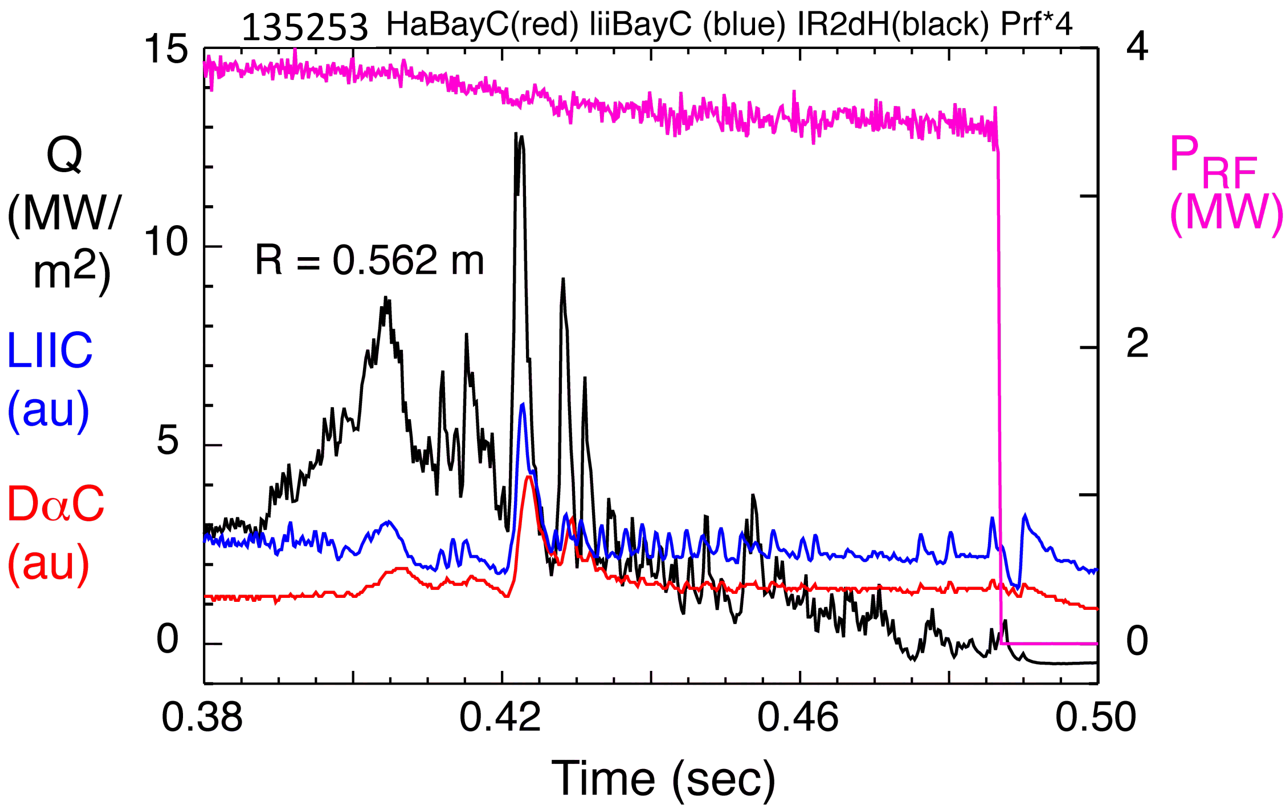


ΔW_{tot} and ΔW_e for shot 135337 with ELMs are reduced by ~ 50% relative to shot 130608 ELM free case





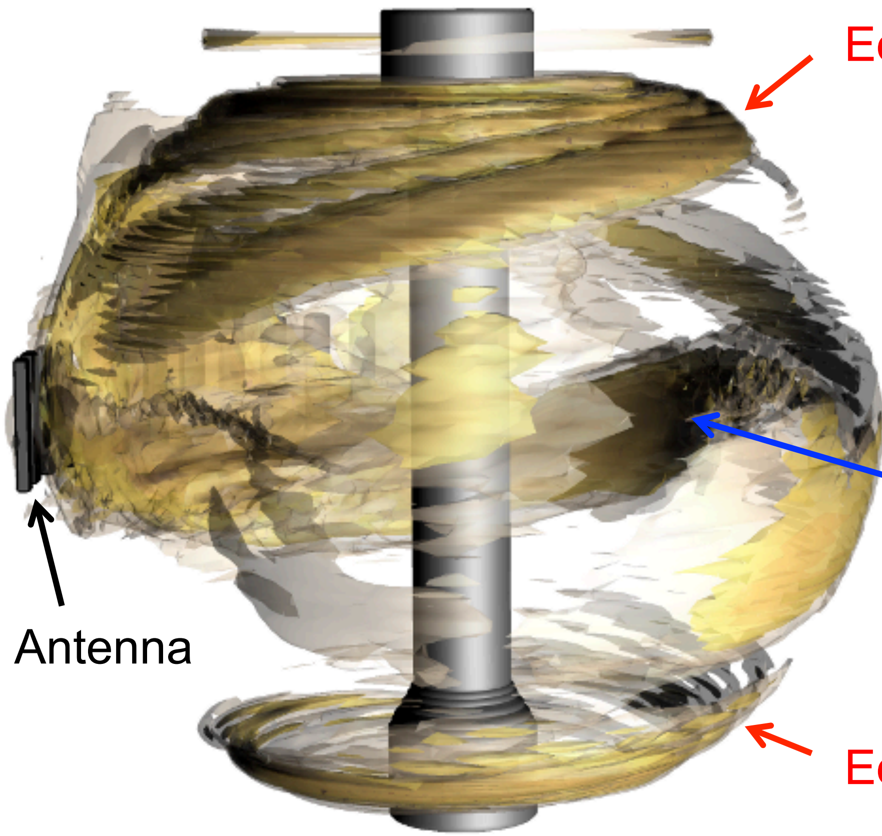
ELM heat deposition at the outer strike radius is very large but effect on density in plasma edge is small



- The Bay H fast IR heat deposition measurement, Q, clearly shows the ELM heat deposition on the lower divertor plate at R = 0.562 m (divertor strike radius)
- Small effect of largest ELM is barely evident on the net RF power
  - ELMs are located away from the antenna
  - Gives opportunity to evaluate RF edge loss without edge density increase during ELMs

AORSA extended to open field lines in the SOL gives edge RF fields – can be benchmarked in HHFW H-mode case

Co-current drive,
-90° antenna phasing,
$k_\phi = -8 m^{-1}$



- Initial results suggest edge modes could be cause of RF hot zone.
- Direct link is not yet established and AORSA edge modeling by D. Green et al. is continuing
- Higher current HHFW H-mode case will place RF hot zone in Fast IR camera view