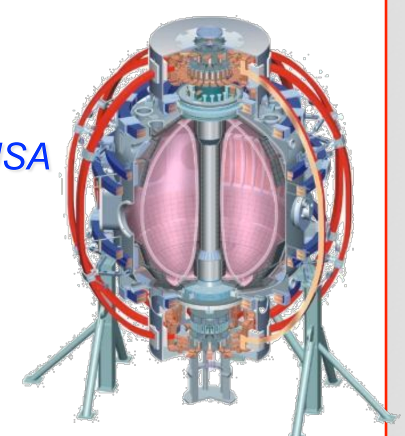
XP 1016_ext: HHFW power coupling vs ELMs

J.C. Hosea, PPPL

J-W Ahn[2], R. E. Bell[1], E. Feibush[1], E. Fredrickson[1], D. L. Green[2], R. W. Harvey[3], E. F. Jaeger[2], B. P. LeBlanc[1], R. Maingi[2], C. K. Phillips[1], L. Roquemore[1], P. M. Ryan[2], G. Taylor[1], K. Tritz[4] , E. J. Valeo[1], J. Wilgen[2], J. R. Wilson[1], et al.

and the NSTX Team

[1]Princeton Plasma Physics Laboratory, Princeton, NJ, USA
[3]Oak Ridge National Laboratory, Oak Ridge, TN, USA
[2]CompX, Del Mar, CA USA
[4]Johns Hopkins University, Baltimore, MD, USA



XP Review
March, 2011

XP 1016: HHFW power coupling vs ELMs

Goals:

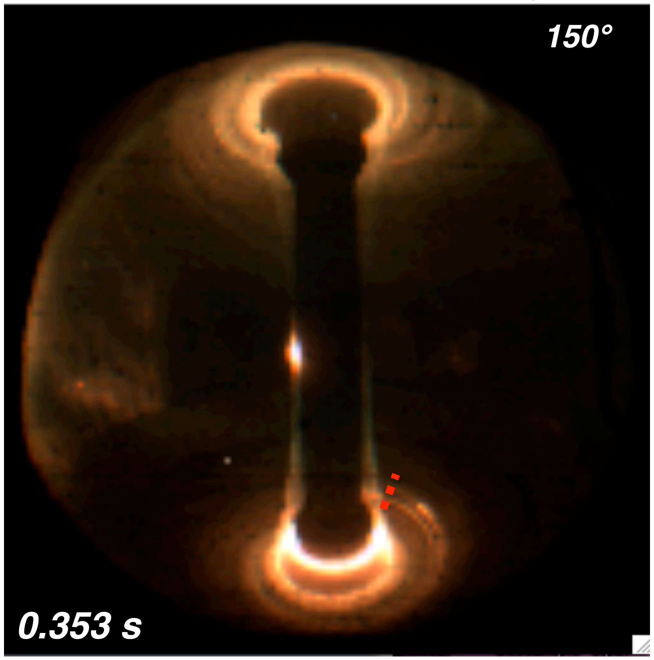
- Understand the effect of ELMs on HHFW heating efficiency and edge losses
- Determine if it is acceptable to power through the ELMs with the HHFW system without blanking or diverting the power during the ELM.

Objectives:

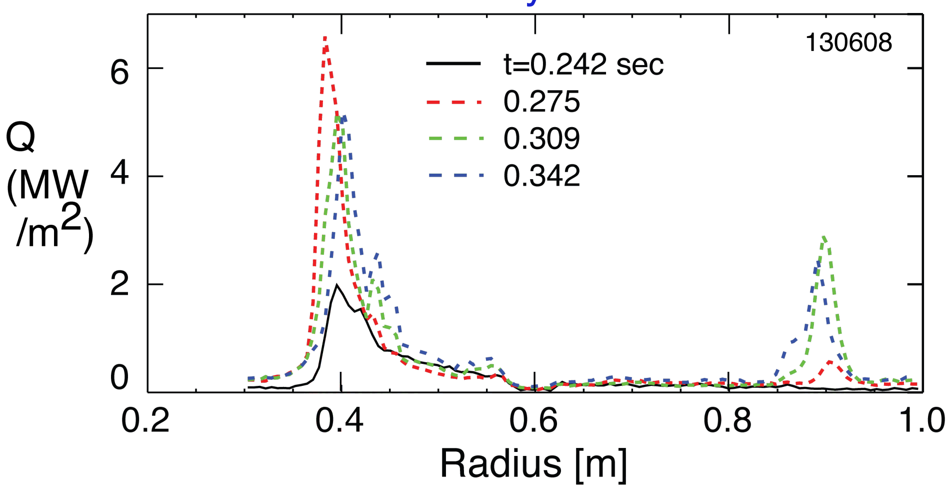
- Compare the ELMy H-mode case to the ELM-free H-mode case in deuterium
  - ➢ Quantify the effect of ELMs on the HHFW core energy confinement that is dominated by electron confinement
    - Modulate P_{RF} to determine τ_E
  - ➢ Determine the effect of ELMs on edge power deposition
    - For edge power deposited in the divertor and on the antenna and for the estimated power loss due to the PDI effect
    - Characterize antenna hot zones with visible and IR cameras, as well as with probes, reflectometer, etc. as for XP 1017
      - ** Of particular importance will be the fast IR data

Heating on outer divertor plate is more intense with ELMs with same field pitch (P_{RF} = 1.9 MW)

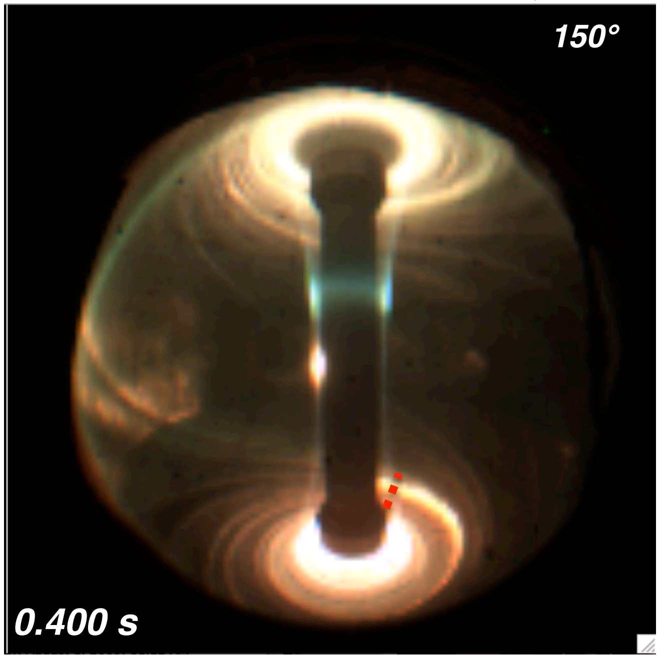
130608 ELM free – 5.5 kG, 1 MA



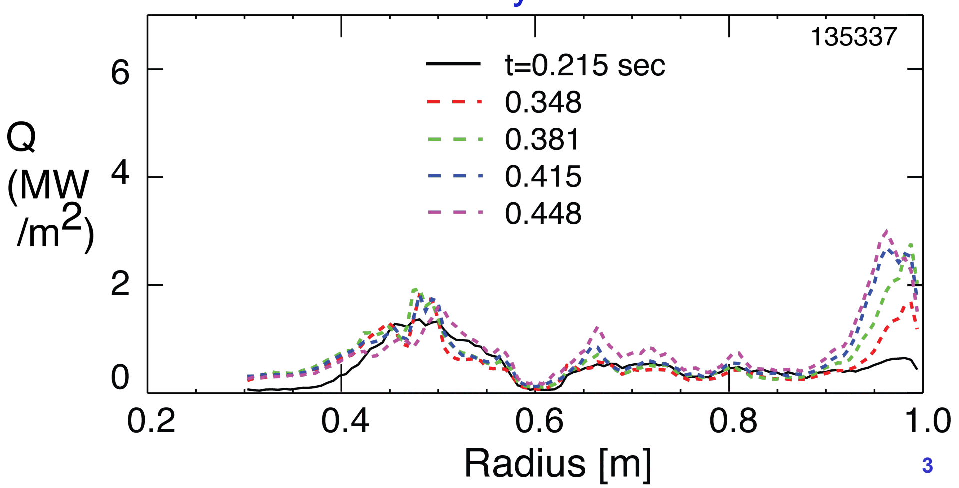
IR Bay I



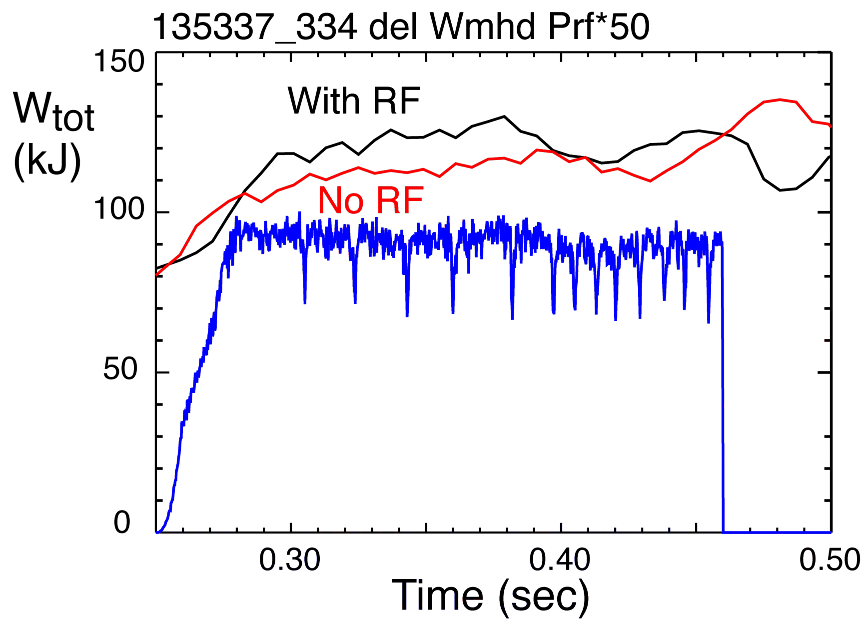
135337 with ELMs – 4.5 kG, 0.8 MA



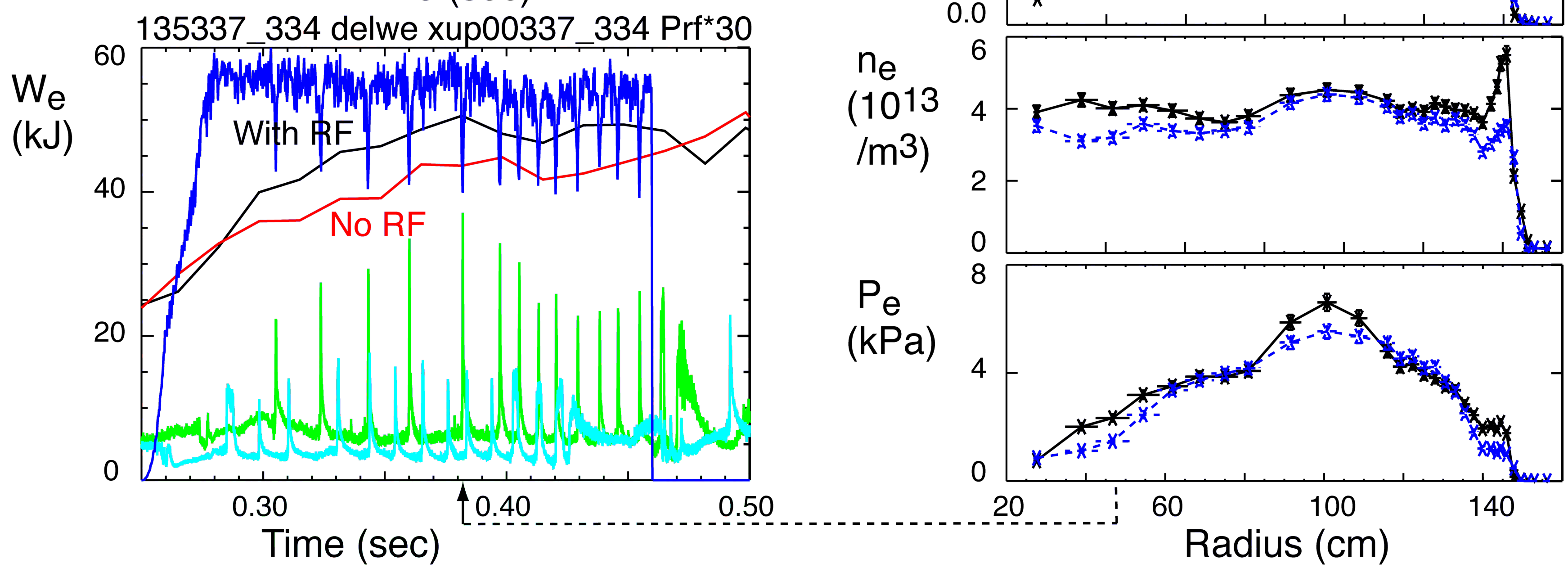
IR Bay I



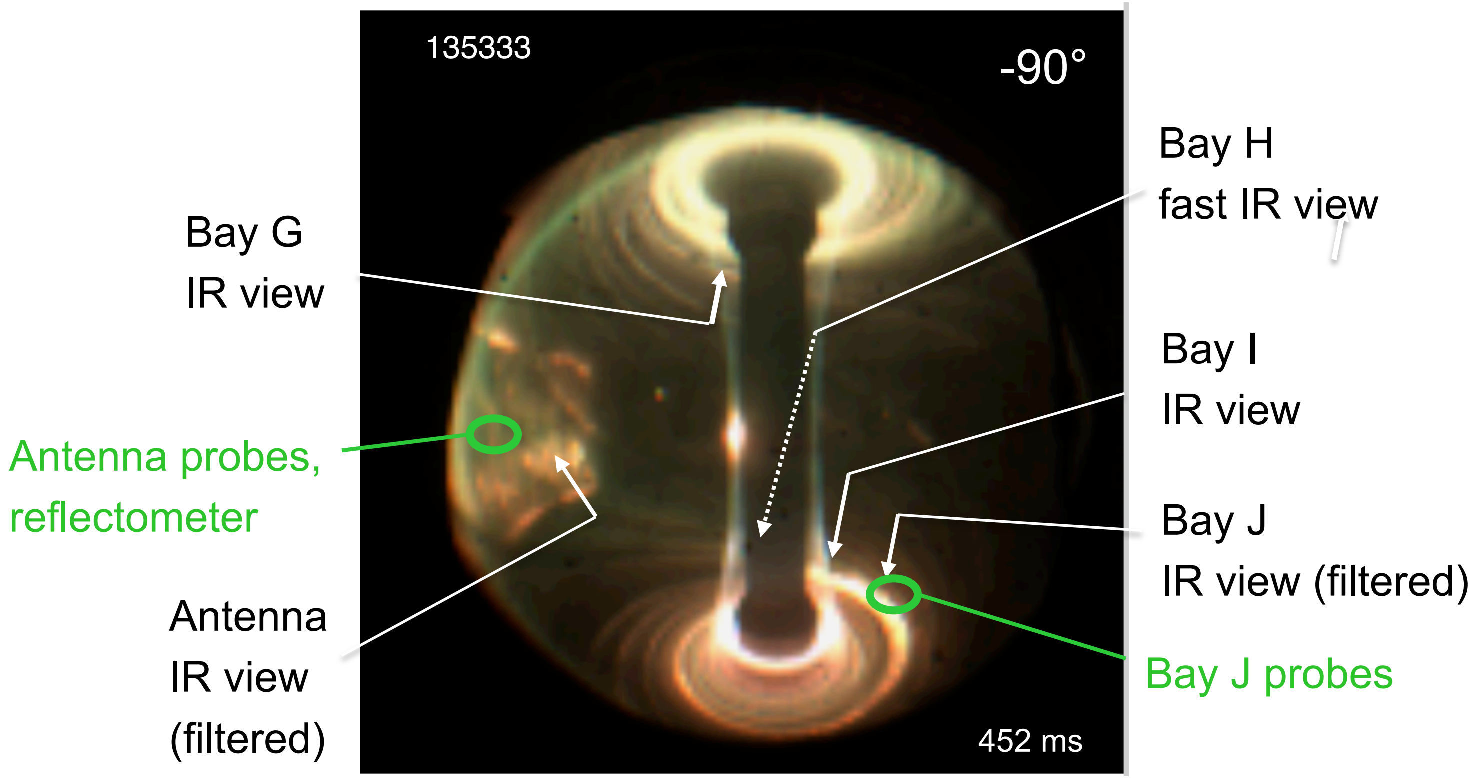
Power coupled to core is affected by ELMs and/or by higher edge density/steeper density gradient



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



IR cameras and probes are critical for documenting effect of ELMs on 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 ELM effect on hot zone by fast IR at Bay H