NSTX-U

Supported by

U.S. DEPARTMENT OF ENERGY | Office of Science

Scoping study for core impurity reduction using HHFW*

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or/plus anyone interested from RF, PC, or ASC groups

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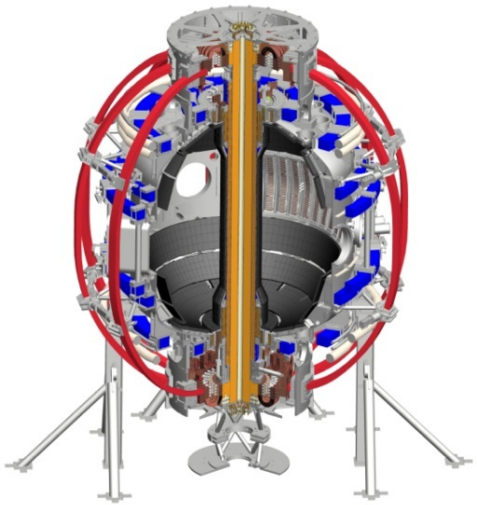
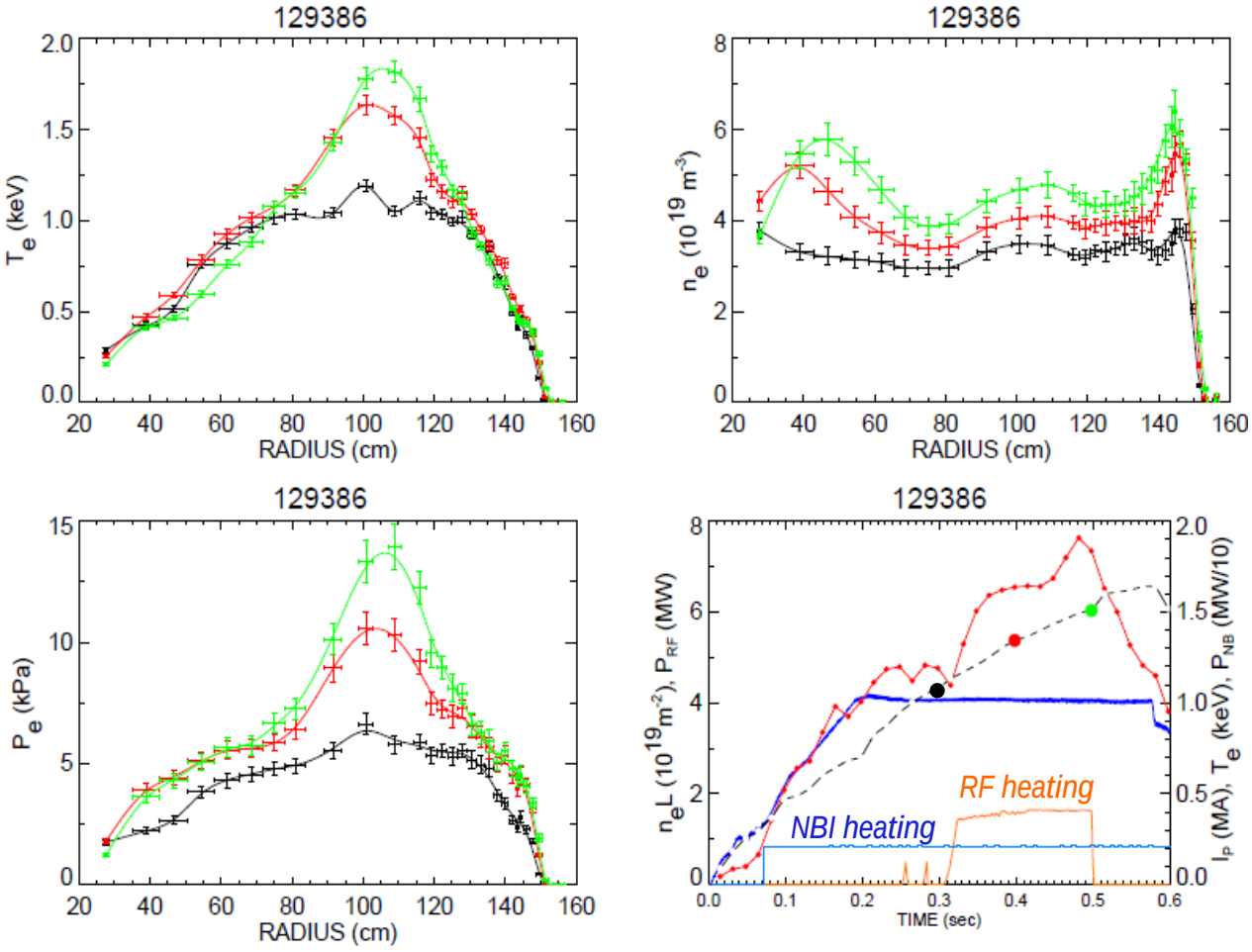
NSTX-U Research Forum 2015
PPPL
February 24-27, 2015

*This work supported by US DoE contract DE-AC02-09CH11466



2008-09: High toroidal field (0.55T) observed to improve RF coupling in beam heated H-mode plasmas

- Able to almost double central T_e with 2MW of RF heating
  - But, good RF heating in NBI H-mode was difficult to reproduce…

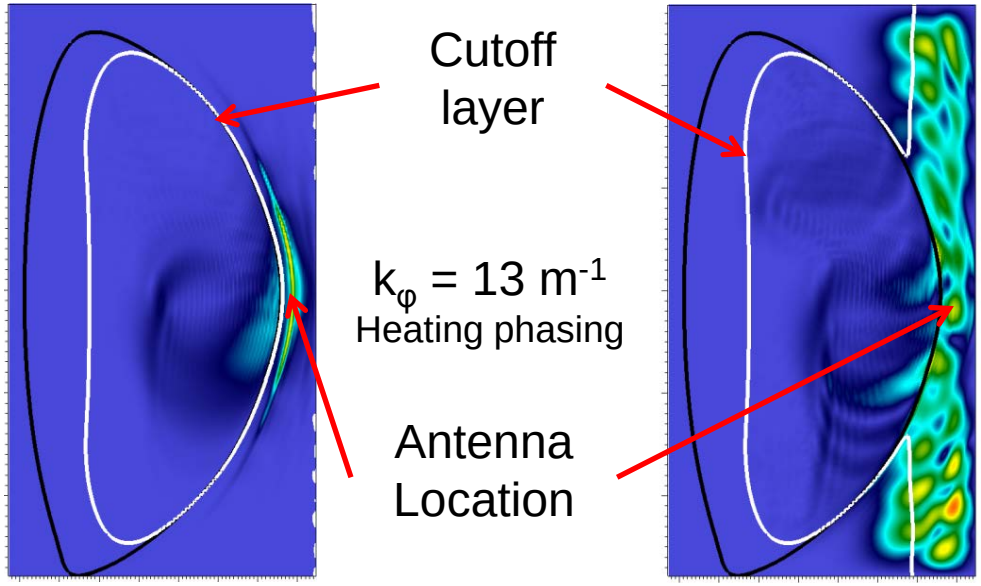


Now understand higher B likely moves cut-off away from antenna, reduces surface waves, improves coupling/heating

$$n_{e,FW cut-off} \propto \frac{k_{\parallel}^2 B}{\omega}$$

Lower SOL density
(n_{ant} = 1x10^{12} cm^{-3})

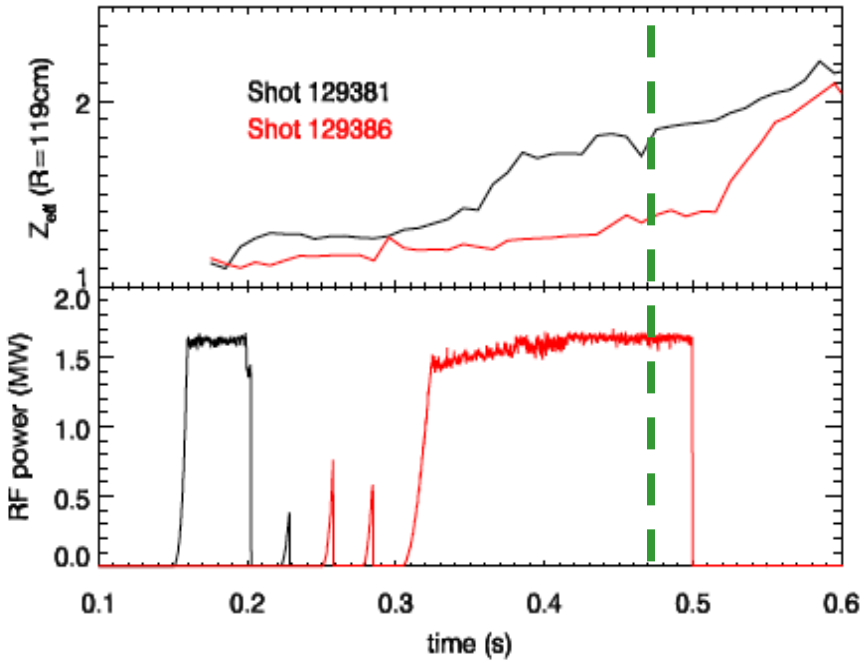
Higher SOL density
(n_{ant} = 2x10^{12} cm^{-3})

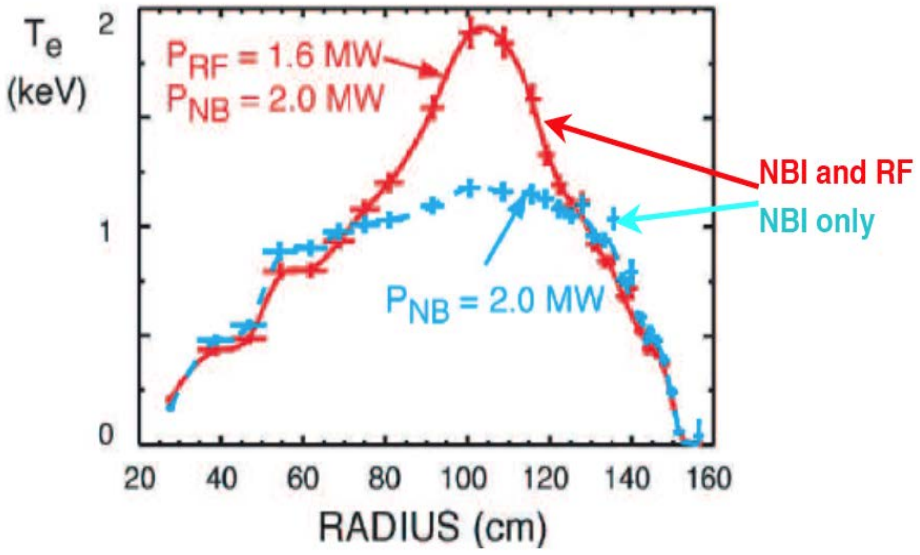


[N. Bertelli et al., Nucl. Fusion 54 (2014) 083004]

Core electron heating sometimes correlated with core carbon Z_{eff} reduction

- Impurity reduction (lower C Z_{eff}) observed with HHFW + NBI
- Significant T_e peaking – drive for increased turbulent particle x-port?





- Higher field of NSTX-U should be conducive to more routine core heating and maybe impurity expulsion(?)

Shot requirements and plan (request 1 run day)

- RF requirements: Antenna conditioning must be sufficiently mature that the antenna is not a major source of impurities (since the goal is to reduce impurities)
- Use beam-heated H-mode plasma with low/no ELM frequency and evidence of C or high-Z impurity accumulation
  - Such as for lithium ELM-free H-mode plasmas
  - And/or plasmas with high-Z accumulation (noble gas, W, Mo, etc)
  - Shots should show some signs of RF central electron heating (!)
- RF scans:
  - Heating power 1-3MW (2MW or more is better)
  - Two phasings: Compare heating - 180 degree vs. CD - 90 degree
  - Gap scan: vary from 3-10cm
  - Scan time of RF power application in flat-top – does it matter?
- Pass to particle control TF (or do jointly) if successful (?)