

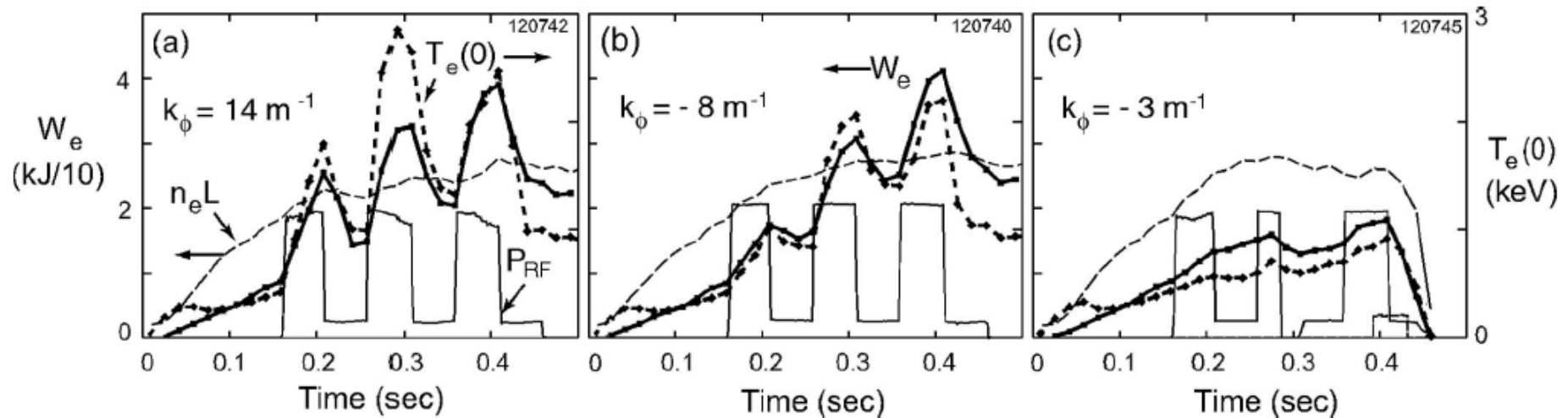
Characterizing the SOL Losses of HHFW Power in H-Mode Plasmas

R. J. Perkins

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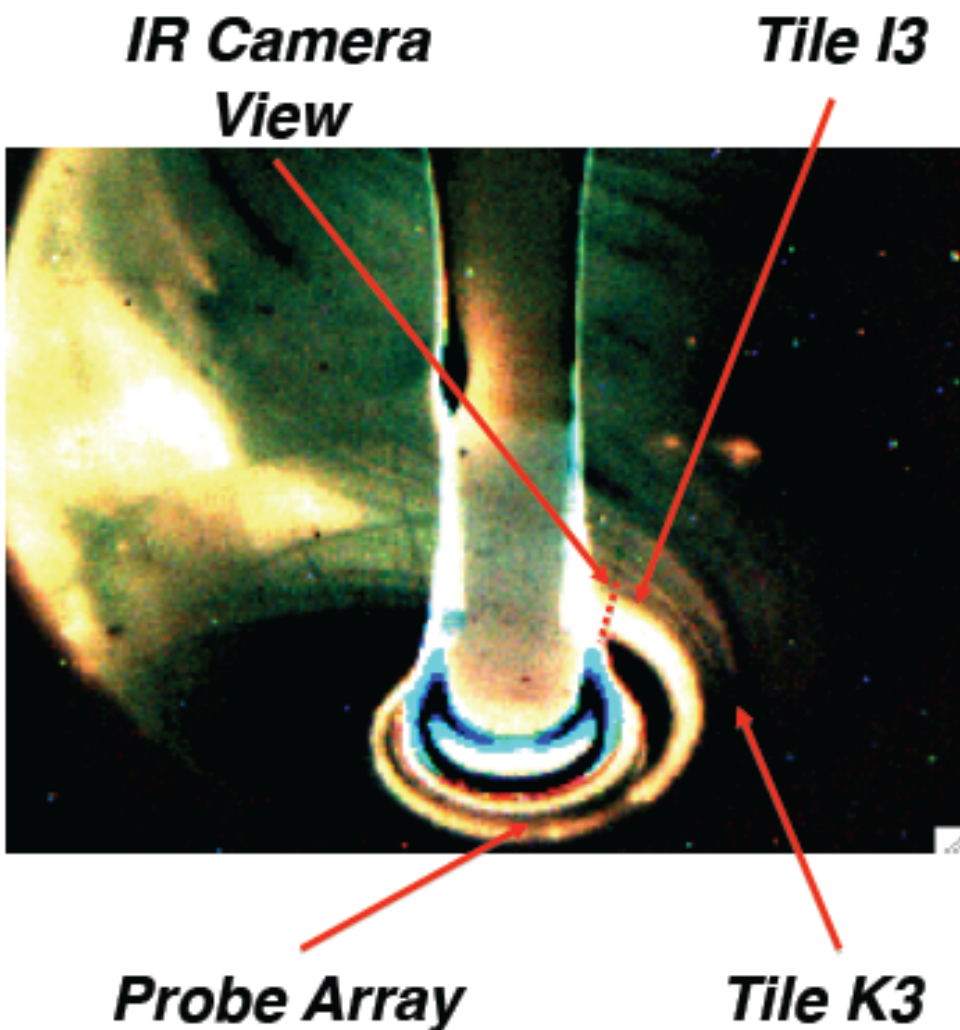
HHFW Heating Efficiency a Strong Function of Edge Density, B_T , and Antenna Phase

- Increasing antenna phasing has been shown to improve both central T_e and stored electron energy
 - He discharges, $B_T = 5.5$ kG, $I_p = 0.72$ MA, $P_{RF} = 2$ MW



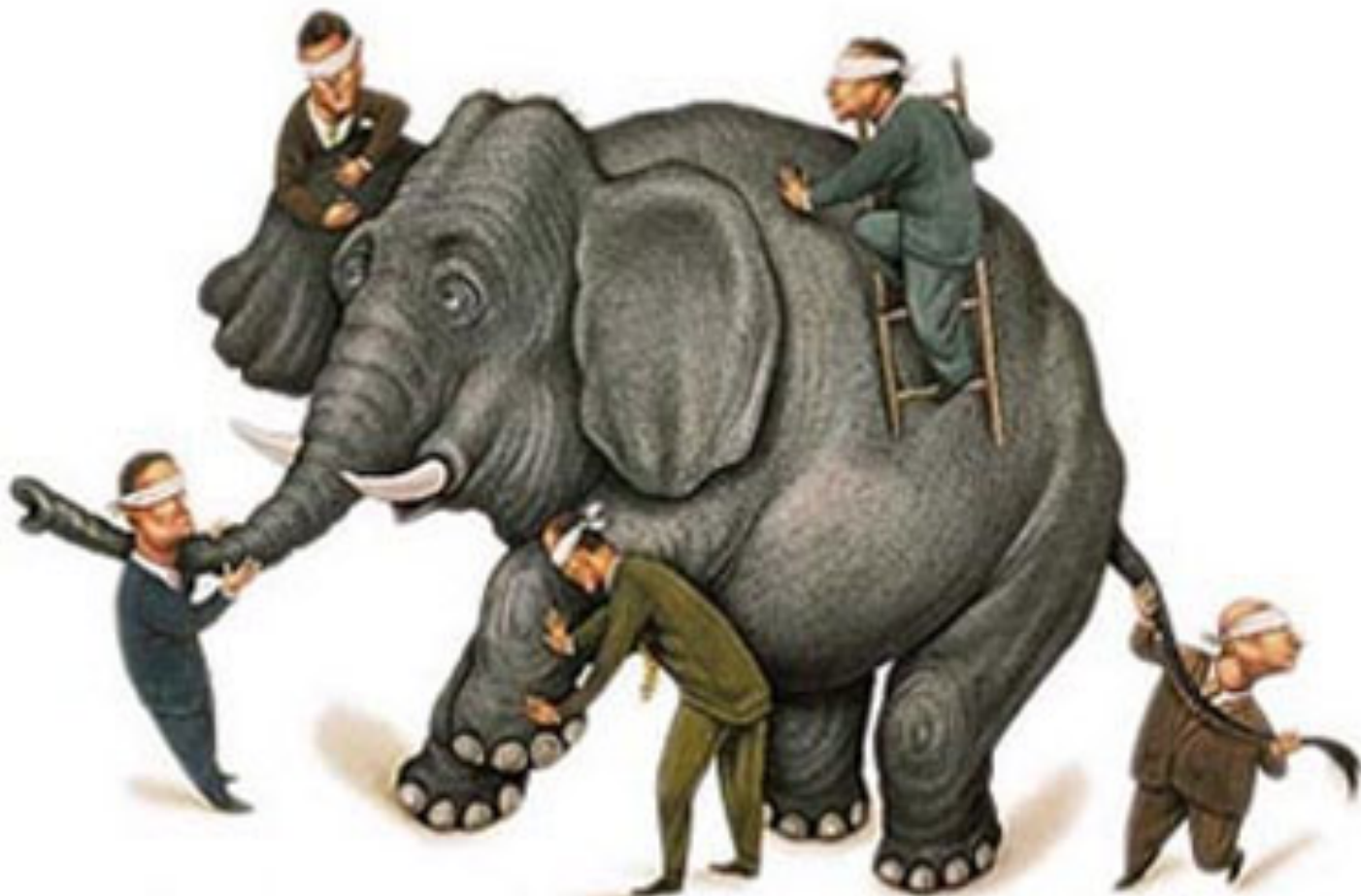
- Heating typically improves with increased B_T and decreased SOL n_e
- Suggests that poor heating efficiency results when fast-wave cutoff is too close to antenna

RF-Induced Spirals Observed in Divertor Regions



- Bright and hot spirals form on upper & lower divertor during RF
 - Heat flux up to 2 MW/m^2 (for 1.8 MW coupled P_{RF})
- Studied with a variety of divertor diagnostics
- Studies complicated by spatial extent of spiral and strong variation of intensity along length of spiral

The different diagnostics have been invaluable... but several 'big picture' issues remain unanswered



Three new/upgraded diagnostics will answer many of these questions

- RF Langmuir probes
 - Radial arrays of six probes in outer upper & lower divertor regions
 - Located at most intense portion of spiral (Bay J)
 - Equipped for RF measurements: will measure RF rectification at divertor
 - *Does V_{RF} correlate with edge conditions & poor heating efficiency?*
- IR camera with wide-angle view of lower divertor
 - Measure total heat flux under spiral
 - Measure heat flux intensity as a function of length along spiral
 - *Does heat flux under spiral account for HHFW power missing from core?*
 - *Does heat flux measured at probe location match with RF sheath theory?*
- Upgraded ORNL SOL reflectometer
 - Locate the radial location of the righthand cutoff in front of antenna
 - *Confirm whether trends in RF probes and IR camera data follow movement of cutoff layer*

Rough shot plan over 1 – 1.5 days:

- Operate in both RF-only and RF+NBI H-modes
- RF-only H-modes were He discharges in past
 - Lower recycling -> better RF coupling
 - Good option for pre-lithium operation
- RF + NBI discharges may be feasible w/o Li conditioning
 - However, if XP is execute after LI conditioning, we may use it to lower edge density
- Scan antenna phase (six values)
- Perform a power scan at one or two phases
- Scan magnetic field to highest value allowed at time
- Time permitting: attempt to put divertor in radiative configuration
 - Should uncover presence of volumetric parasitic SOL heating, if any