

NSTX-U HHFW Studies

J. Hosea WEP SFG meeting 1/26/2012

HHFW heating and current drive physics:

Increase in B_T is important:

n_{onset} increased to $\sim 1 \times 10^{18} \text{ m}^{-3}$ for -90° antenna phasing

- HHFW performance enhancement:
 - ✧ More RF power to core plasma at -90° antenna phasing and less to edge SOL
 - ✧ Can revisit current drive at higher efficiency

Magnetic field pitch can be lowered to DIII-D (ITER?) value at reasonable plasma parameters ($I_p \sim 0.6 \text{ MA}$, $B_T \sim 1 \text{ T}$):

- Can directly compare FW results between NSTX and DIII-D
 - ✧ NSTX: 0.6 MA, 1 T DIII-D: 1.2 MA, 2 T
 - ✧ Same harmonic for 30 MHz/60 MHz
 - ✧ Higher single pass absorption on NSTX
 - ✧ Can extend magnetic pitch studies to lower pitch to see effect on core heating/edge losses

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NSTX-U HHFW system and diagnostic improvements:

Enhance voltage standoff of antenna prior to startup:

- Test RF antenna elements on the RF test stand

Determine effect of B_T increase on antenna voltage standoff

Install RF and Langmuir probes in path of edge losses

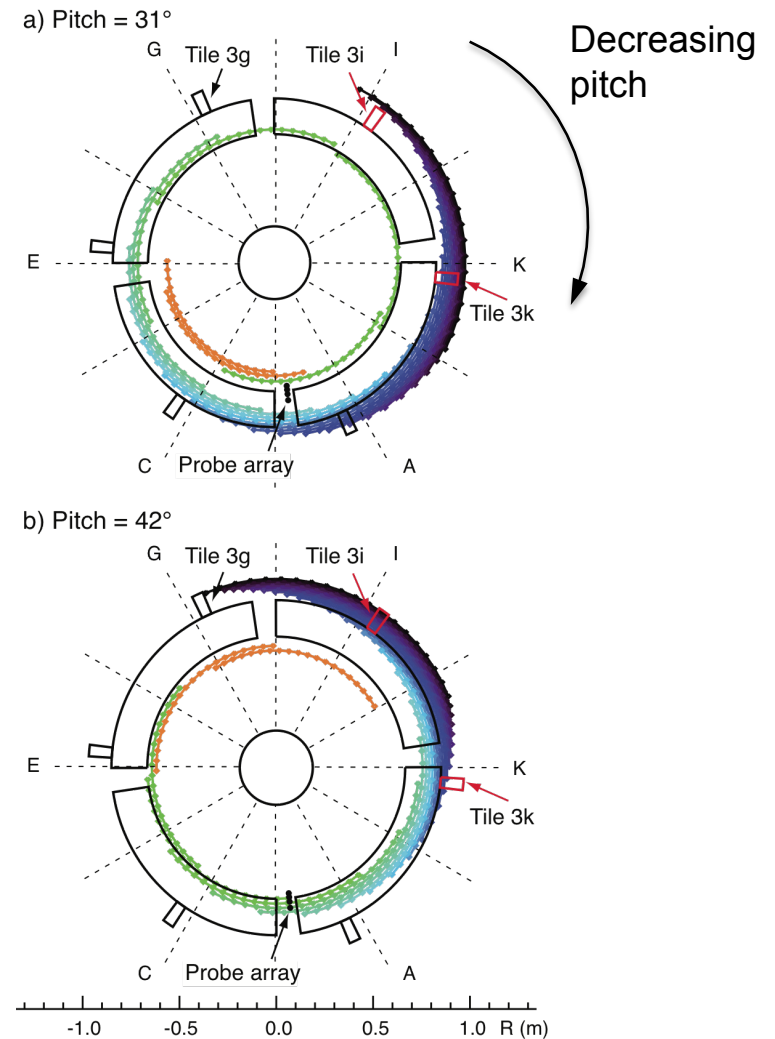
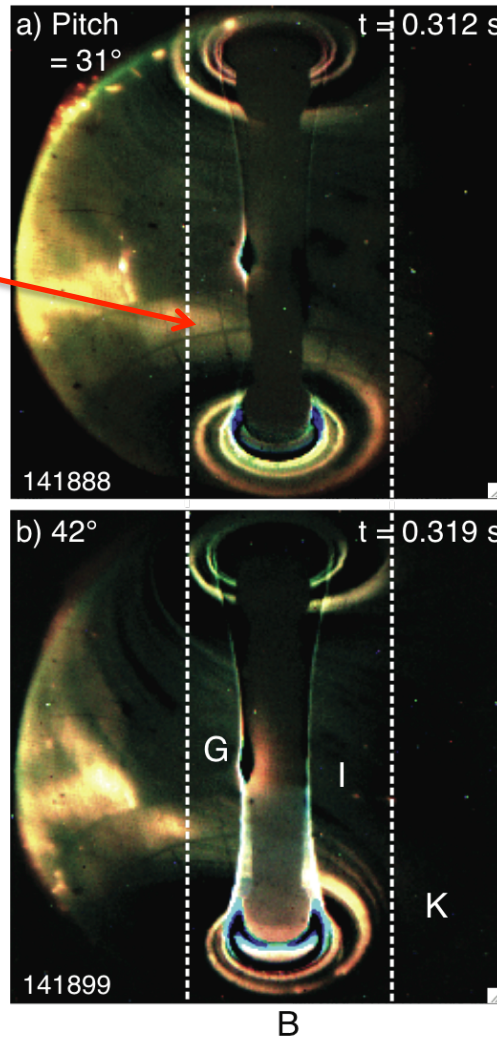
- Place in protective tiles along the open field lines passing in front of the antenna and on outer divertor floor and ceiling

Position IR cameras to study divertor region heating (bottom and top) around torus and to study antenna heating

- Bay H and Bay G IR positions probably OK at low pitch – Bay I good for second pass
- More IR cameras needed

Reducing pitch moves RF hot zone clockwise on bottom divertor region

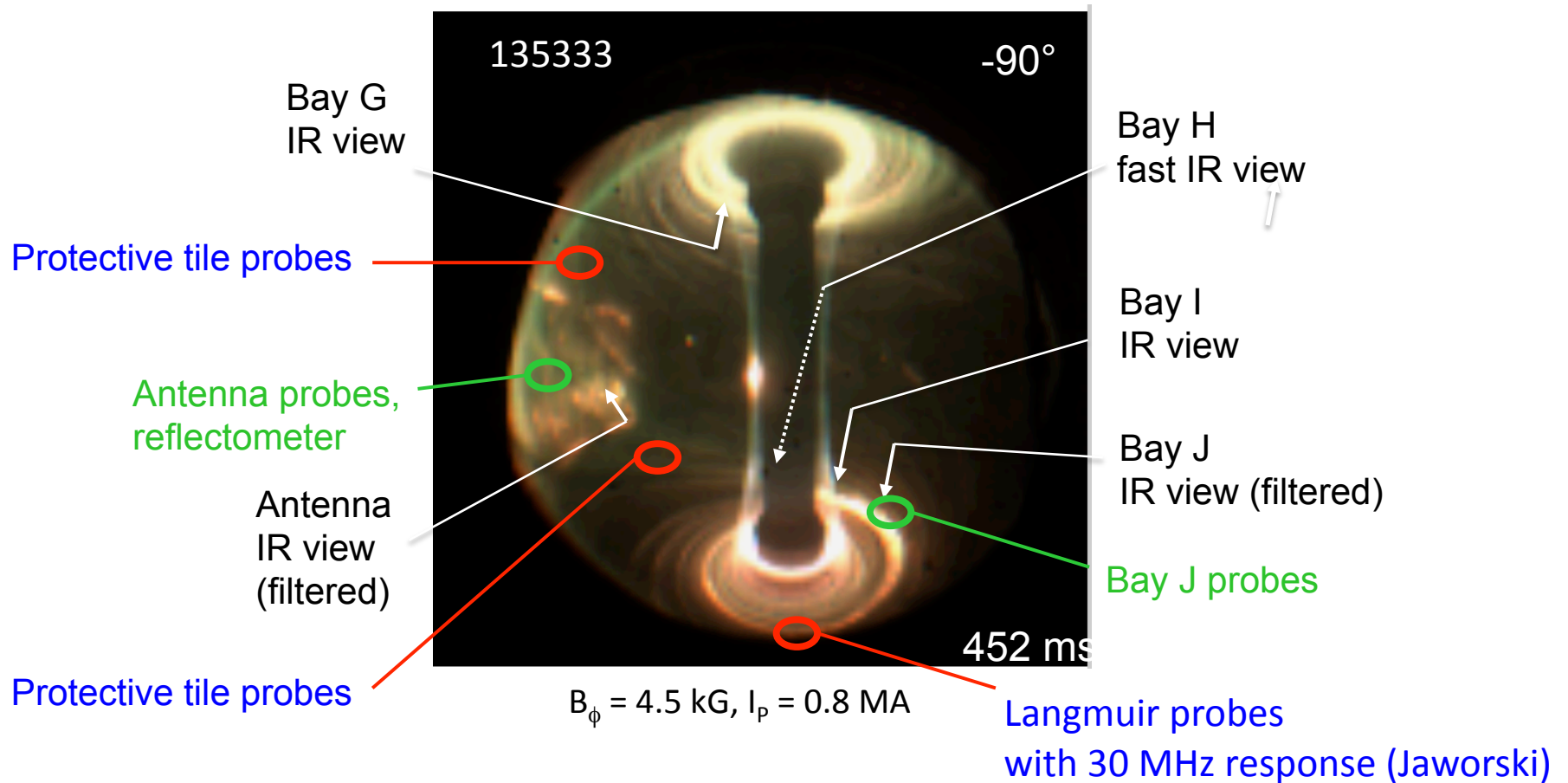
RF/Langmuir probes needed in tiles to measure RF fields leading to hot zones



Reduced magnetic pitch will allow direct comparison between fast wave results on NSTX and DIII-D

- same harmonic number for 30 MHz/60 MHz and same pitch

IR cameras and probes are critical for documenting properties of RF edge heating to compare to advanced RF codes for SOL



- Need probes in protective tiles under and above antenna and in same vertical locations away from field lines that pass in front of the antenna