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Low I_p HHFW Heating & Current Drive Experiments

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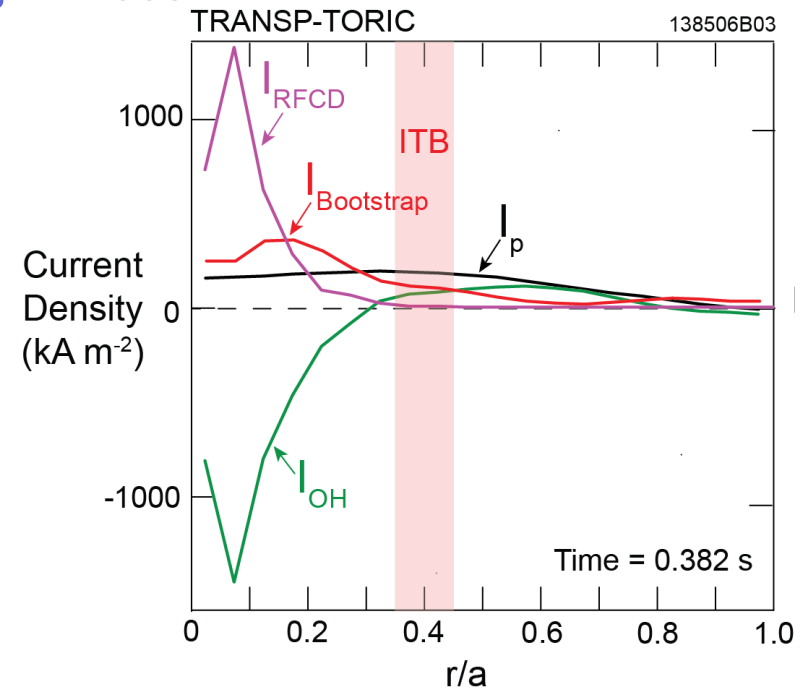
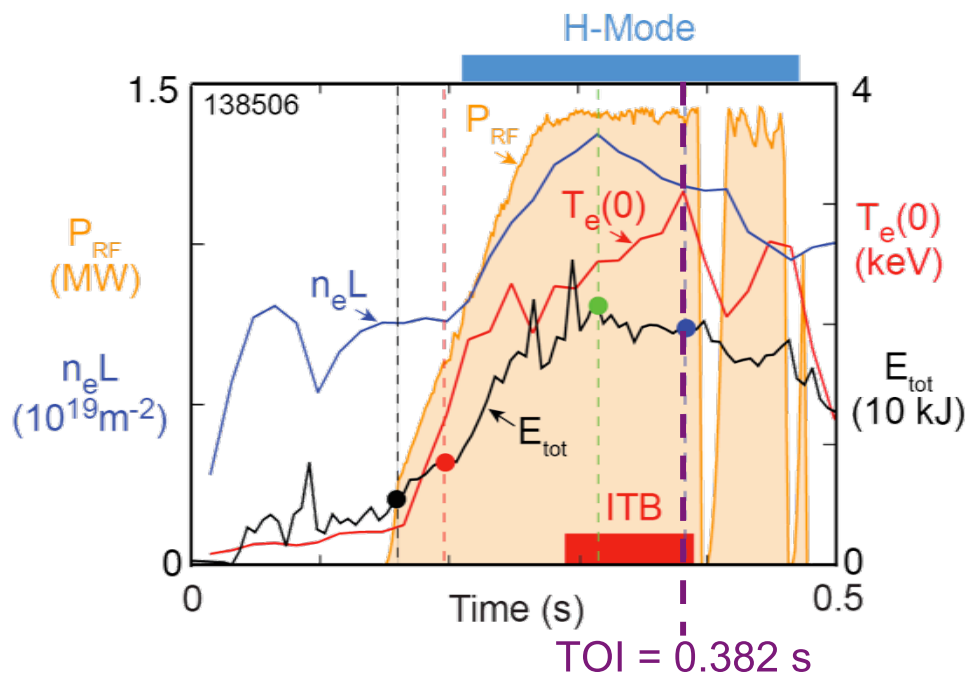
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Three low I_p HHFW XPs in support of research milestone R(12-2)

**WPI TSG Meeting
B252
March 3, 2011**

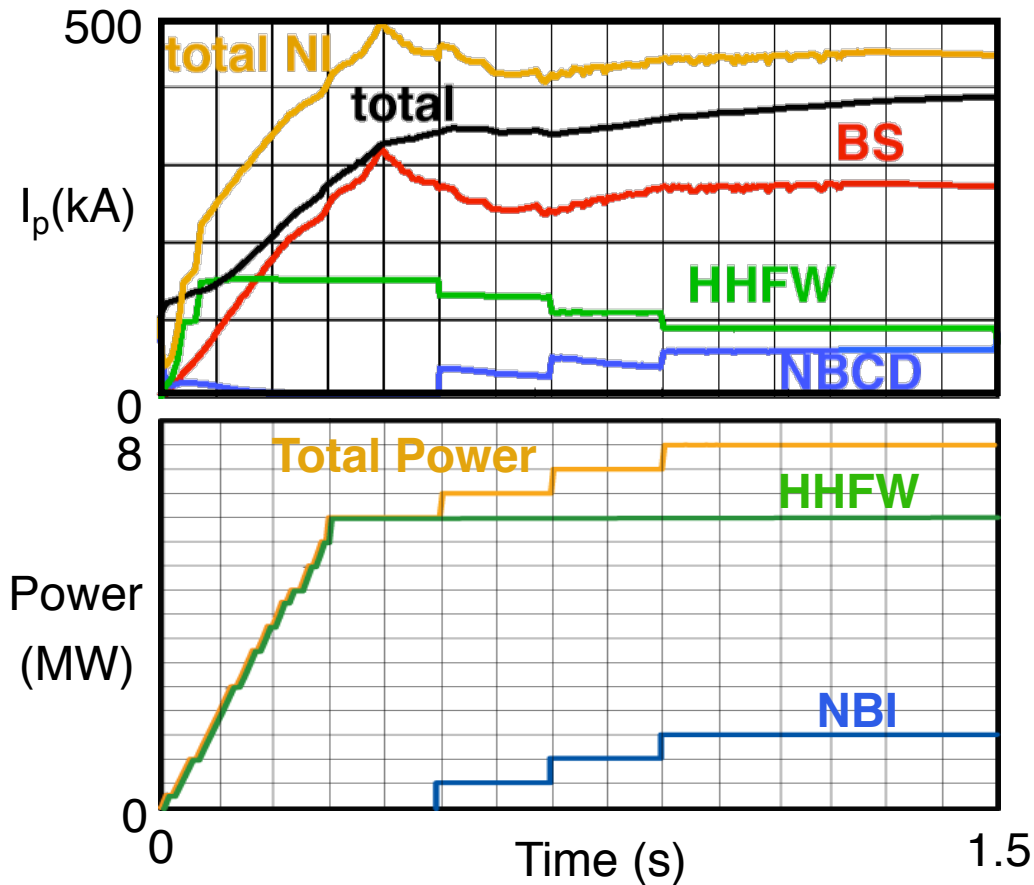
XP1009: $I_p \sim 300$ kA HHFW H-mode with $f_{NI} \sim 100\%$

- $I_p = 300$ kA HHFW H-mode in 2010 achieved $f_{NI} \sim 65\%$ with $P_{RF} = 1.4$ MW:
 - ITB formed during H-mode
 - Positive feedback between ITB, high $T_e(0)$ and RF CD
 - Result obtained after 3-4 hours of running XP1009



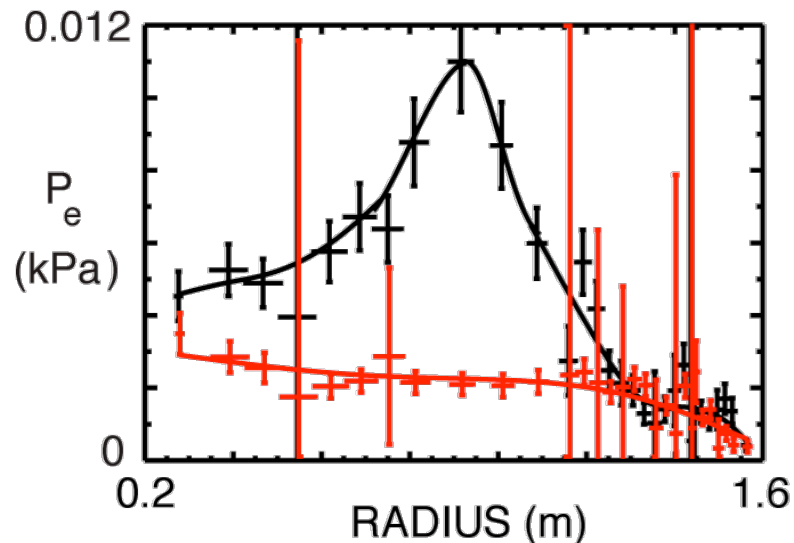
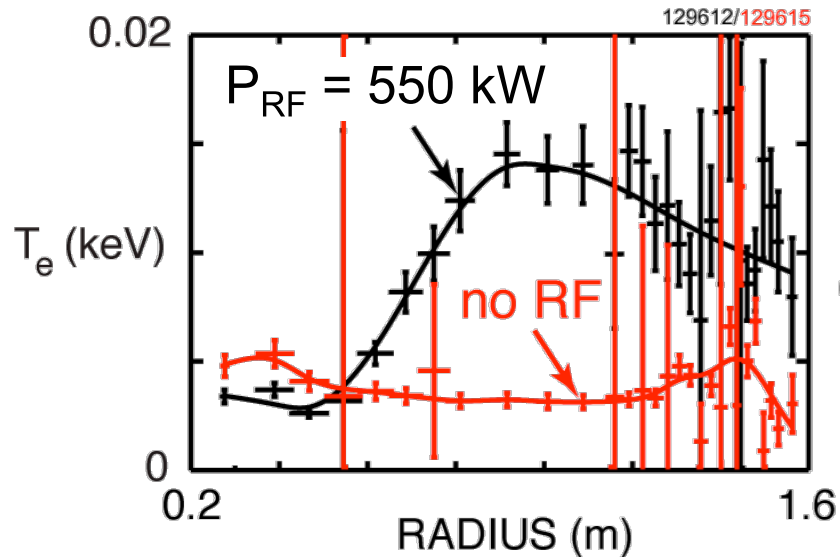
- Propose to continuing XP1009 with $P_{RF} \sim 3-4$ MW to achieve $f_{NI} \sim 100\%$
 - Some work may needed to further improve plasma position control
 - Repeat at $I_p = 250$ kA

HHFW ramp-up of inductively-initiated $I_p = 250$ kA plasma to $I_p = 400$ kA



- TSC simulation predicts 5-6 MW of $k_\phi = -8 \text{ m}^{-1}$ HHFW can ramp I_p to ≥ 400 kA
- Propose applying $P_{\text{RF}} \geq 5$ MW to an $I_p = 250$ kA flat top inductive plasma and ramping I_p to 400 kA with bootstrap and RF CD
- Begin with $I_p = 250$ kA HHFW H-mode developed in XP1009
- If I_p reaches ≥ 400 kA add NBI source A

HHFW heating of CHI-initiated plasma



- Initial attempts to heat CHI startup plasmas with HHFW in 2008 showed good electron heating but could not maintain coupling:
 - $P_{RF} = 550 \text{ kW}$ coupled from 10 to 20 ms into $I_p \sim 100 \text{ kA}$ CHI plasma increased $T_e(0)$ from 3 to 14 eV
- Propose revisiting HHFW-heated CHI plasmas, but probably not until the FY12 run:
 - Start HHFW pulse at $\sim 100\text{ms}$ when $I_p \sim 200 \text{ kA}$ and move HHFW pulse progressively earlier