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HHFW+NBI High I_p H-Mode Plasmas at Maximum P_{nbi}

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HHFW+NBI High I_p H-Modes at Maximum P_{nbi}: Description/Background

Description:

- Experiment assesses HHFW+NBI H-mode operation with P_{RF}~ 5 MW and P_{NBI} ~ 6 MW in preparation for NSTX-U, it has four goals:
  - Understand the interaction of the rf wave field with the NBI the fast-ions
  - Study interaction of fast-ions with the HHFW antenna and antenna heating
  - Investigate surface wave behavior at maximum available P_{RF} and P_{NBI}
  - Study dependence of heating and CD efficiency on k_ϕ, outer gap, and n_{edge}

Background:

- HHFW+NBI H-modes have usually used P_{NBI} ~ 2 MW to minimize interaction between fast-ions and antenna:.
  - This interaction heats antenna, increasing density, injecting impurities and generally degrading RF heating efficiency and plasma performance
  - H-mode scenarios in NSTX-U will use P_{NBI} up to 12 MW so we need to assess HHFW heating in NSTX H-modes at the maximum P_{NBI} and P_{RF}

HHFW+NBI High I_p H-Modes at Maximum P_{nbi}: Experimental Approach/Plan

Plan:

- 1. Setup a previous HHFW+NBI H-mode that had good electron heating, for example shot 134909 (I_p = 0.9 MA, B_t = 0.55 T, outer gap = 5 cm, P_{NBI} = 2 MW, P_{RF} = 2 MW, -150 degree phasing) and increase P_{RF} to 5 MW. Use NBI source A. [5-10 shots]
- 2. Find maximum outer gap that still maintains good RF coupling:
  - Adjust Li, fuelling and outer gap to optimize coupling [5 shots]
- 3. Increase P_{NBI} to 6 MW. First add source B, then source C [5 shots]
- 4. Adjust fuelling, Li conditioning and outer gap to minimize antenna heating and maximize RF coupling [5-10 shots]
- 5. Repeat 1-4 with -90 degree antenna phasing [20 shots]

Machine Time: 2 days requested, 1 day minimum needed

Operational Requirements: P_{RF} = 5 MW, probably run in FY12

Key Diagnostics: MSE, MPTS, CHERS, rf probes, t-FIDA, v-FIDA, IR & visible cameras

Analysis/Modeling: TORIC-TRANSP, GENRAY-ADJ, ORBIT-RF, CQL3D, 3D-AORSA(ext. boundary)