HHFW absorption in Neutral-Beam heated NSTX plasmas

XP -1012

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Allotted run time:
1 day

Large fraction of HHFW power can be absorbed by fast ions during NB injection

- May represent an issue for combined RF+NB heating/CD
- Little/no information available so far on *how much* RF power goes into fast ion channel compared to other loss channels
  - Dependence on RF phase, edge conditions, fast ion energy, …
- **New tFIDA diagnostic available, good progress in developing RF codes**

Goals:

> Characterize RF absorption as a function of RF phasing, L vs. H-mode plasmas, outer gap, magnetic field

> Provide consistent set of data to benchmark RF codes (CQL3D, AORSA, ORBIT-RF), synthetic diagnostics (FIDASIM) & compare with experiments

Target discharge includes both L and H-mode phases

- **L-mode** until ~350 ms, optimized for FIDA measurements
  - Similar to 2008 FIDA experiment on RF absorption by fast ions
  - NB sources: A@90kV for MSE, C@75kV modulated 10/20ms ON/OFF
- **H-mode** after ~350 ms, NB power ~3MW
  - Two RF pulses, $P_{RF} \sim 3MW$; timing: 400–550ms and 600–660ms
  - NB sources A @ 90kV, add B @ 65–90kV if needed
  - Adjust source B to minimize MHD but maintain good signal on CHERs
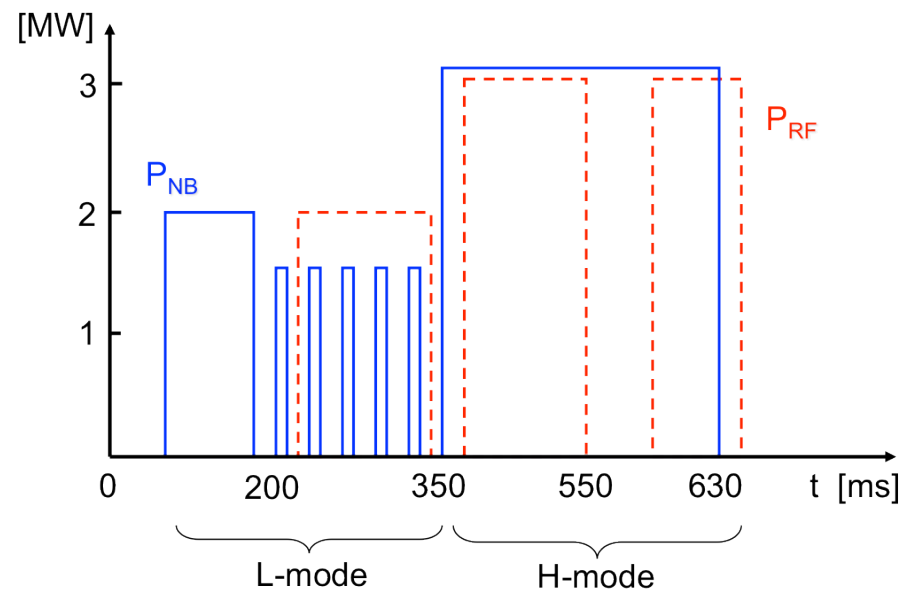
Run plan for 1 day XP, ~24 *good* shots

- Establish baseline scenario:
  - Modify sh#130608, B_{tor}=5.5kG, I_{pl}=900kA, gapout 4cm, n_0~$4 \times 10^{19} m^{-3}$ @ 400ms, no RF
    - Check for reliable L–H transition at ~350ms
  - Introduce RF; phasing $13m^{-1}$
- Start scans:
  - Scan RF phase: $13m{-}1$, $8m{-}1$, $3m{-}1$ (max 3 shots)
  - Scan outer gap: 4cm, 6cm, 8cm
  - For each value of outer gap, take a *NO RF* reference shot
- Identify "best case" and scan B_{tor}: 4.5kG, 3.5kG
- Identify "best case" @ B_{tor}=5.5kG

  - Scan NB injection voltage (source C during L–mode)

- Need 3MW of HHFW during H–mode phase
- Need all fast–ion diagnostics, moderate Lithium evaporation, small/no ELMs