

HHFW absorption in Neutral-Beam heated NSTX plasmas

XP -1012

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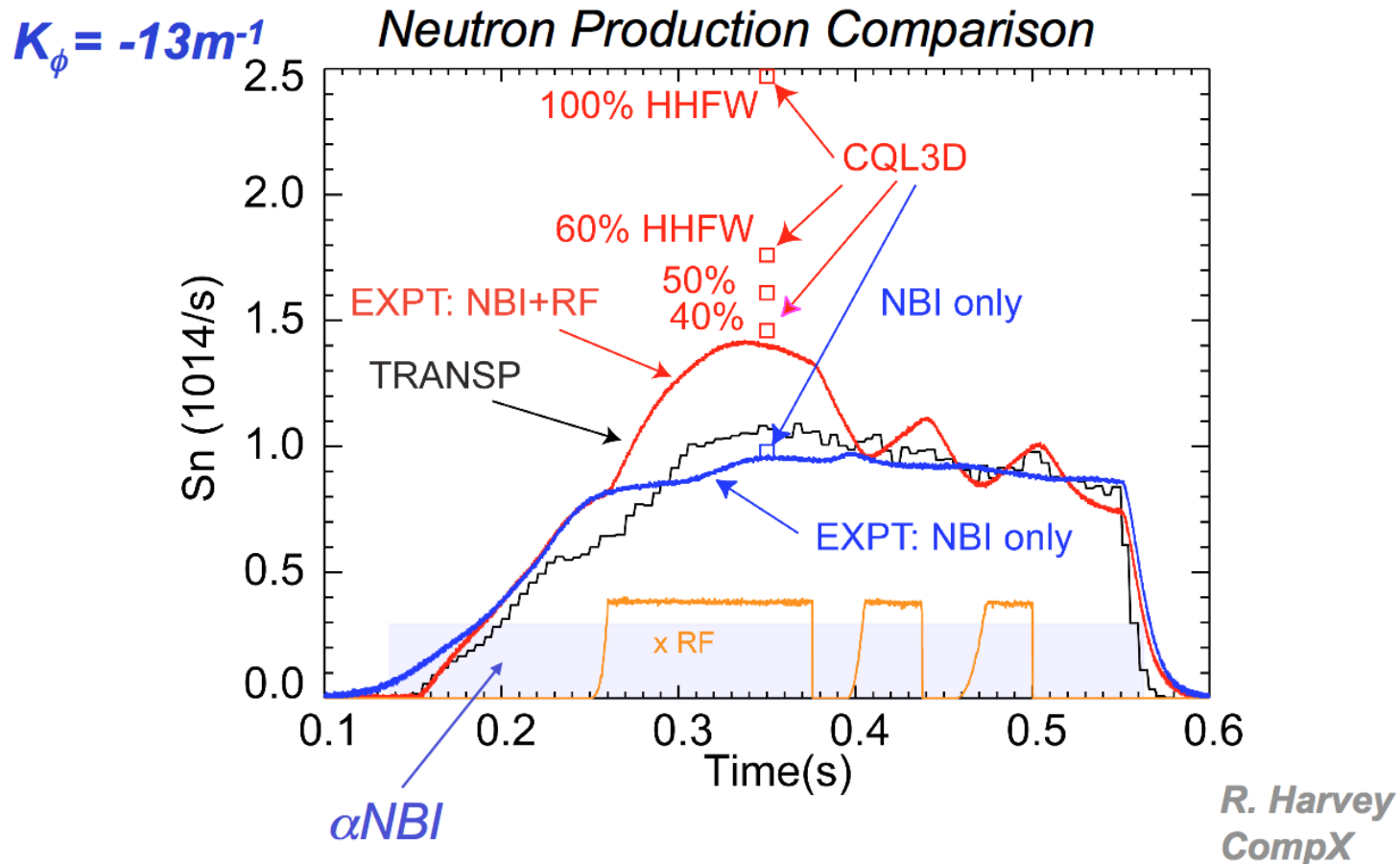
Goal: characterize the fraction of HHFW power that is absorbed in the core of NB-heated plasmas.

Contribute to NSTX Milestone R10-2

Allotted run time:

1 day

HHFW power coupled to the core plasma during NB injection is mostly absorbed by fast ions

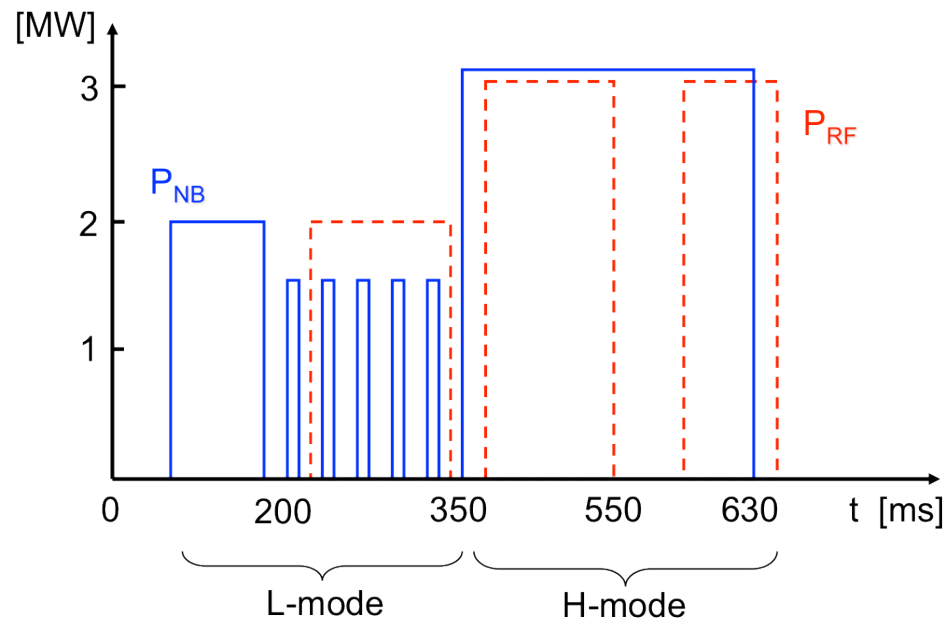


Need to characterize RF absorption as a function of RF phasing,
L vs. H-mode plasmas, outer gap, magnetic field

Look at fast ion profile, spectrum to infer absorbed fraction

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, low NB power ~3MW
 - Two RF pulses, $P_{RF} \sim 3\text{MW}$; timing: 400-550ms and 600-660ms
 - NB sources A @ 90kV + B @ 65-90kV
 - Adjust source B to minimize MHD but maintain good signal on CHERs



Run plan for 1 day XP, ~24 good shots

- Establish baseline scenario: **4 shots**
 - Modify sh#130608
 - Start with $B_{\text{tor}}=5.5\text{kG}$, $I_{\text{pl}}=900\text{kA}$, outer gap 4cm, $n_0\sim 4\times 10^{19}\text{m}^{-3}$ @ 400ms, no RF
 - Check for reliable L-H transition at ~350ms
 - Introduce RF; phasing 13m^{-1}
- Start scans: **12 shots**
 - Scan RF phase: 13m^{-1} , 8m^{-1} , 3m^{-1} (max 3 shots)
 - For each phase, scan outer gap: 4cm, 6cm, 8cm
 - For each value of outer gap, take a *NO RF* reference shot

} 9 shots
- Identify “best case” and scan B_{tor} : 4.5kG, 3.5kG **max 6 shots**
- Identify “best case” @ $B_{\text{tor}}=5.5\text{kG}$
 - Scan NB injection voltage (source C during L-mode) **as time permits**

Machine requirements / diagnostics

- Machine requirements/prerequisites:
 - Develop/try target discharge during RF conditioning ?
 - Make sure we can trigger L -> H transition at ~350ms
 - Liter: moderate deposition rate to ensure reproducibility (~15mg/min)
 - HHFW system conditioned, available $P_{rf} \sim 4\text{MW}$
 - Low impurity level (in particular, low oxygen) for FIDA
 - Small ELMs tolerable in H-mode if they do not cause RF trips
 - May increase Lithium deposition to minimize/suppress ELMs



- Required diagnostics:
 - All fast ion diagnostics (FIDA, NPA, ssNPA, sFLIP, neutrons)
 - Plasma profiles (MPTS, CHERS, MSE) & magnetics