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NSTX

Impact of density reduction on long-pulse discharges

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Jon Menard, PPPL

Advanced Scenarios and Control TSG Final Review

Princeton Plasma Physics Laboratory

June 27, 2008

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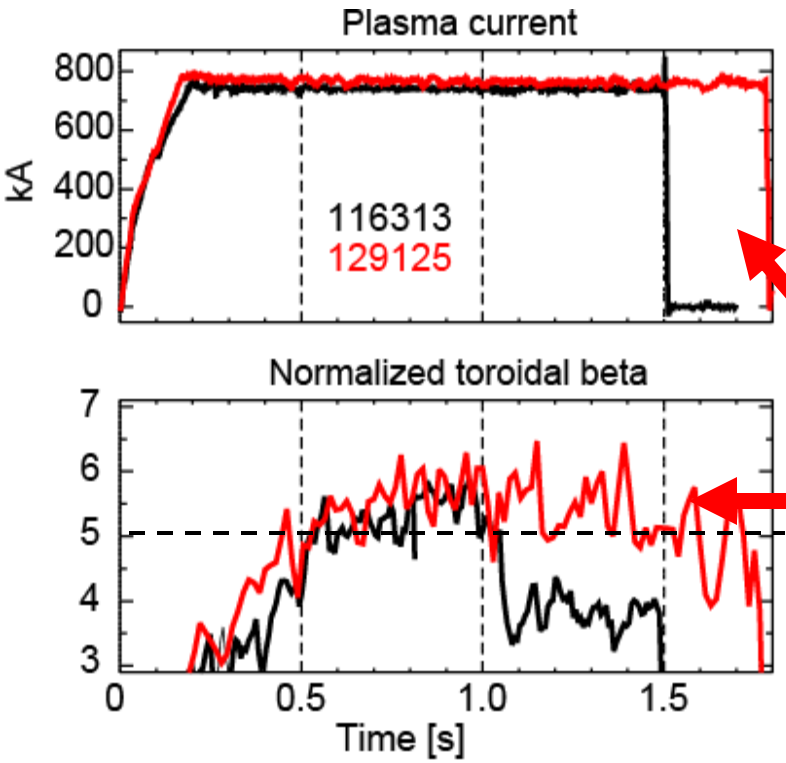
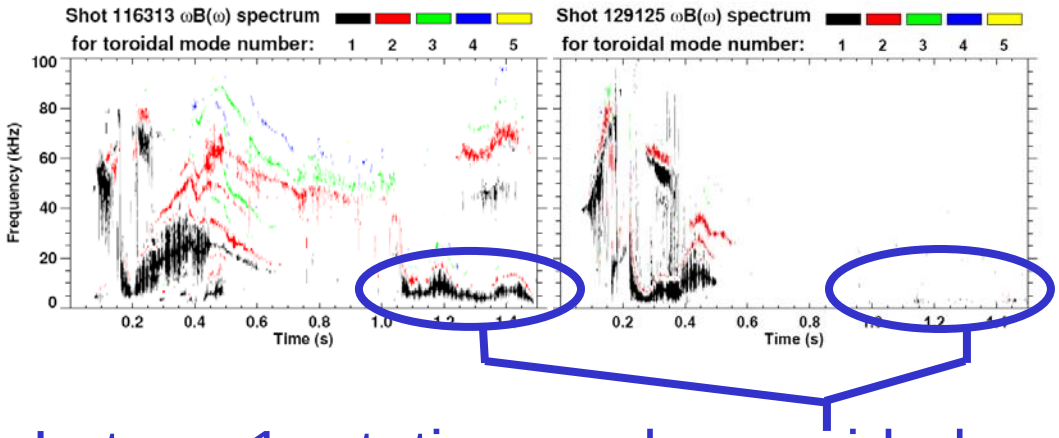
n=3 EF correction combined with n=1 RFA/RWM feedback and Li wall conditioning extends NSTX sustained high-β_N

116313 – no mode control or Li
129125 – with mode control + Li





Late n=1 rotating modes avoided

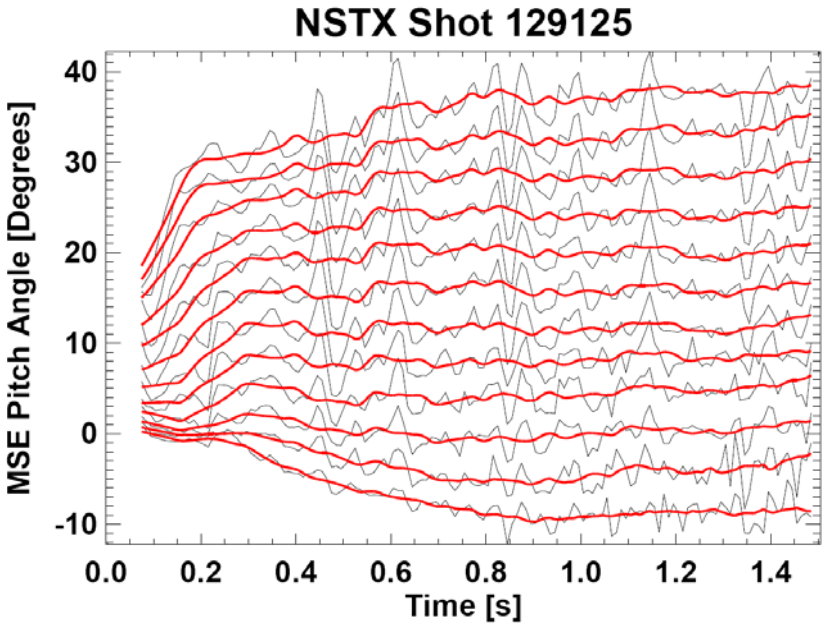
NSTX record pulse-length = 1.8s

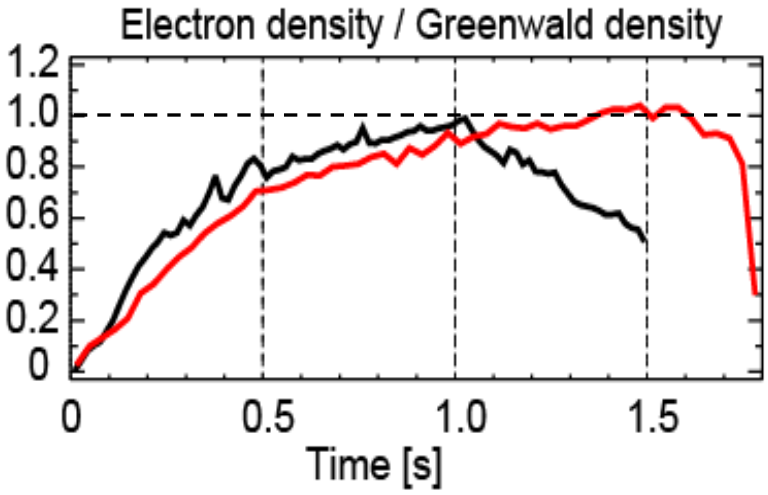
$\beta_N \geq 5$ sustained for 3-4 τ_{CR}

- EF/RWM control helps sustain rotation, high β

NOTE: these results were obtained after LITER ran out of Li – need to assess long-pulse characteristics during active Lithiumization

Record pulse-length discharges achieve stationary current profile, but do not reach stationary density





- Reconstructions indicated constant q_{min} = 1.2 after t=0.8s
  - Implies partially inductively-driven equilibrium with constant $V_{LOOP}(\rho,t)$
- High n_e / $n_{Greenwald}$ fraction at end of discharge may be triggering the large ELMs and loss of confinement that interrupts high β_N phase

- **GOAL: Try to reduce density further and/or reduce rate of rise**

GOAL: Assess non-inductive CD (flux consumption) at reduced density and/or density rate-of-rise

- Reproduce and extend long-pulse discharges **(8 shots)**
  1. Constant evaporation rate = 20mg/min
  2. Start from 129125 - scan I_P = 750kA, 700kA at B_T = 0.41 and 0.375T

- For longest duration discharge, perform density scan
  1. Reduce HFS fueling rate in 100T increments
  2. As plasma density becomes too low and destabilizes locked modes, try:
     - Replace early fueling with SGI fueling to increase density **(8 shots)**
     - Optimize beam power and timing to avoid early disruption **(4 shots)**
     - Attempt earlier EFC and assess impact on early mode locking **(4 shots)**

  GOAL: Attempt to completely replace HFS with SGI fueling

- At lowest stable operating density, try increased toroidal field and elongation to attempt to increase non-inductive fraction **(8 shots)**
  – Start from 129986 (record β_P) – scan density with HFS and/or SGI
  – Scan toroidal field from 4.4 kG to 5.2kG in 0.2kG increments