XP414: Rotation and Aspect Ratio Effects near the High β_p Equilibrium Limit – Results 2/25/04

❑ **Goals**

    ❑ Examine aspect ratio dependence of rotation effects at high β_p

    ❑ Produce maximum β_p and β_N in NSTX

- Approach (reach?) the equilibrium limit ($\beta_p \sim 2.5$ based on 110184)
- Examine bootstrap current
  - potential for hysteresis in (l_i, β_N) space toward conceptual design target
- Reach $\beta_N = 8$ (conceptual design milestone)
  - potential for $\beta_N = 10$ in best case scenario
- Test equilibrium reconstruction in diamagnetic plasma, maximum β_p

    ❑ Determine global stability / confinement in new equilibrium regime

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More progress toward equilibrium limit at high rotation

❑ High β_p target conditions established

  ❑ High rotation targets, $f_\phi \sim 30$ kHz in plasma core

❑ High β_p and β_N reached

  ❑ $I_p = 0.8 \to 0.6$ MA, current profile modified to $l_i \sim 1.2$

  ❑ plasma $\beta_p = 1.8$, several shots $\beta_N \sim 6.5$, $W_{tot} \sim 180$ kJ

  ❑ Plasma slightly diamagnetic (2 mWb)

  ❑ Partial kinetic EFIT run; key rotation analysis pending CHERS

❑ Recent shots show smaller, external reconnections limit β

  ❑ Neutron collapse in $\beta_N = 7$ plasma indicates internal/global mode

  ❑ Recently beta collapses need not correlate with neutron collapses

  ❑ CHERS: carbon accumulation near edge, spreads inward

    • perhaps due to edge island; rapid rotation slow down

❑ Difficulty with $I_p = 1.0 \Rightarrow 0.6$ MA waveform

  ❑ Used ~ 10 shots for development, but returned to $I_p = 0.8 \Rightarrow 0.5$ MA

NSTX

High β_N plasma reaches $\beta_p = 1.8$; $\beta_p = 2$ late
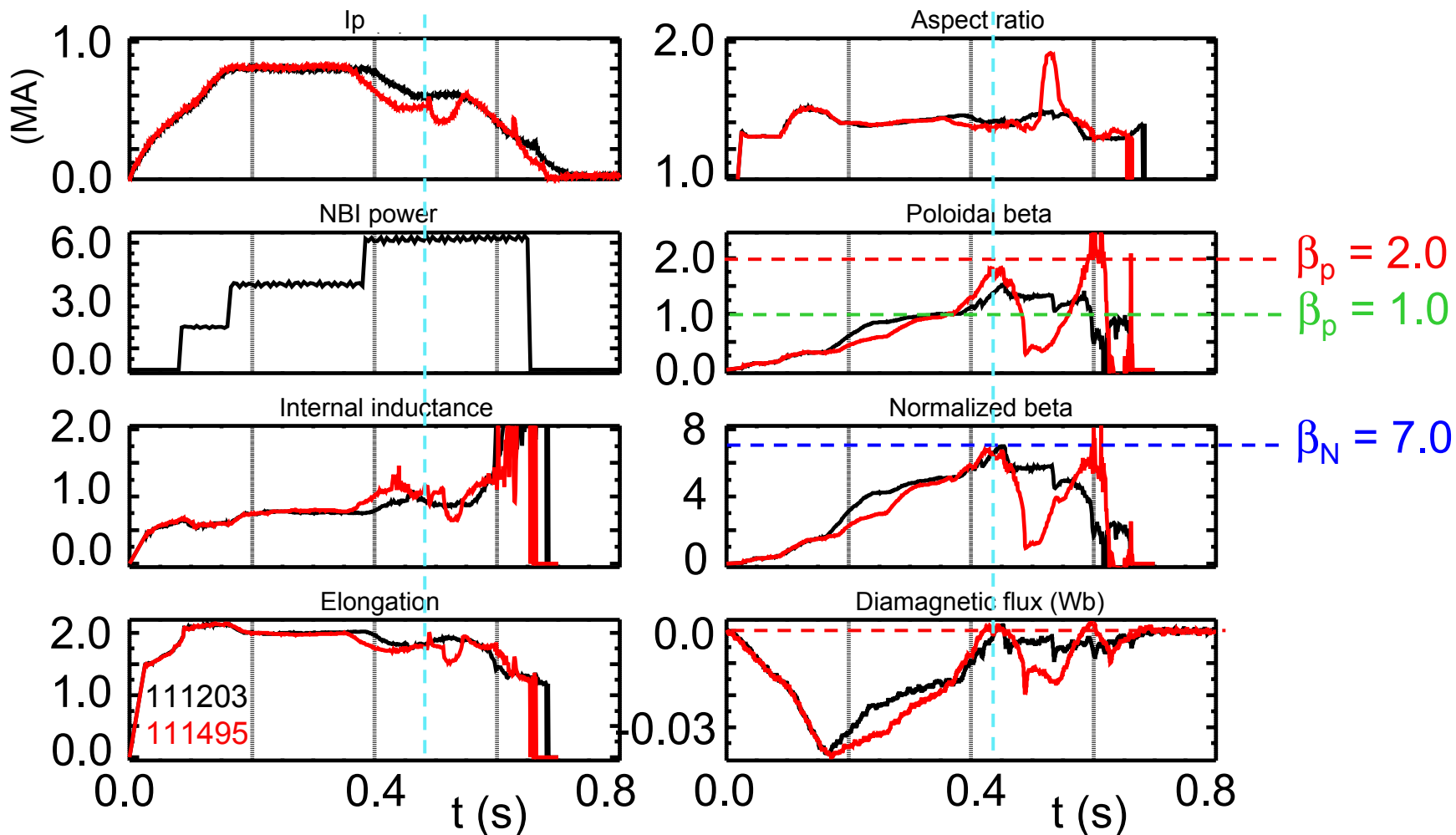
- ❑ Highest β_p plasma is slightly diamagnetic (2 mWb)

- ❑ Recent shots closer to equilibrium limit ~ 2.5

NSTX

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Operating space (l_i, β_N) has been expanded