
XP414: Rotation and Aspect Ratio Effects near the High β_p Equilibrium Limit – First run 2/6/04

□ 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 (I_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

Initial results of first run day are promising

- ❑ High β_p target conditions established at 0.8 MA
 - ❑ High rotation targets, $f_\phi \sim 30$ kHz in plasma core
- ❑ High β_p and β_N reached
 - ❑ $I_p = 0.8 \rightarrow 0.6$ MA, current profile modified to $I_i \sim 1.0$
 - ❑ plasma $\beta_p = 1.5$, world record $\beta_N = 7$, $W_{\text{tot}} = 200$ kJ
 - ❑ Plasma slightly diamagnetic
 - ❑ Partial kinetic EFIT and rotation analysis pending TS and CHERS
- ❑ Initial investigation of plasma behavior and limiting modes
 - ❑ Rapid, global rotation collapse correlates with drop from max β_N
- ❑ Only the most conservative waveforms tested
 - ❑ Late start ($\sim 10:45$ AM)
 - ❑ Difficultly with DND target, rtEFIT in LSN, and eliminating early MHD

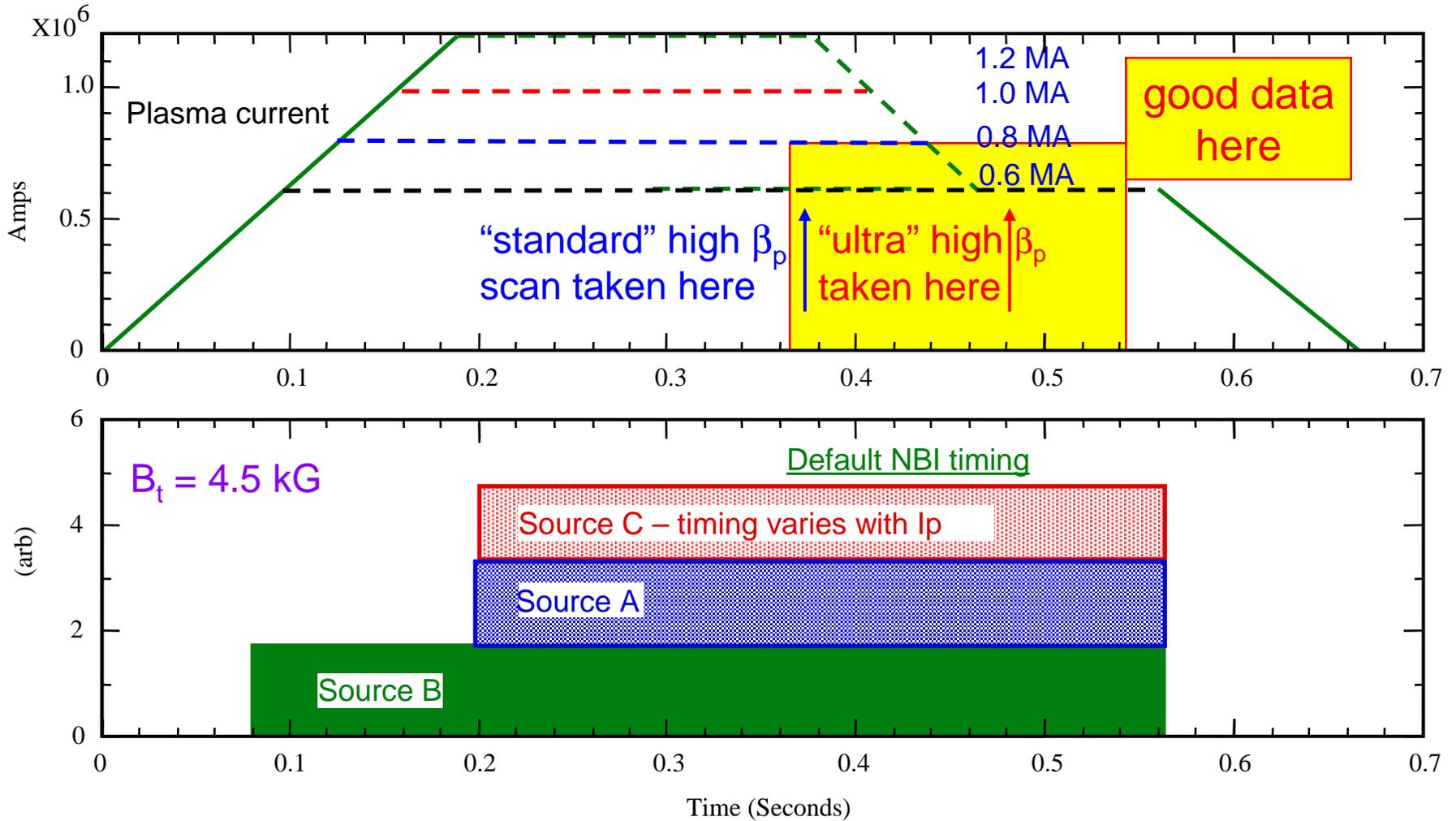
XP414: Aspect Ratio Effects at High β_p - Run plan

□ Scan aspect ratio and poloidal beta (36 shots)

Task	Number of Shots
A) Use shot 110184 as template, $B_t = 4.5$ kG, maintain fixed, lowest aspect ratio ~ 1.27 ; late I_p ramp-down to 0.6 MA, full NBI power	
(i) Set up initial $I_p = 0.8$ MA; attain H-mode (at $\beta_N > 6$)	4
(ii) Initial $I_p = 0.6$ MA;	2
(iii) Initial $I_p = 1.0$ MA	2
(iv) Attempt initial $I_p = 1.2$ MA	4
B) Repeat with A increasing to 1.6 by increasing inner gap	8
C) Repeat with A increasing to maximum by increasing inner gap	8
D) <u>Get one more aspect ratio or vary Mach number</u>	8
Total shots:	36

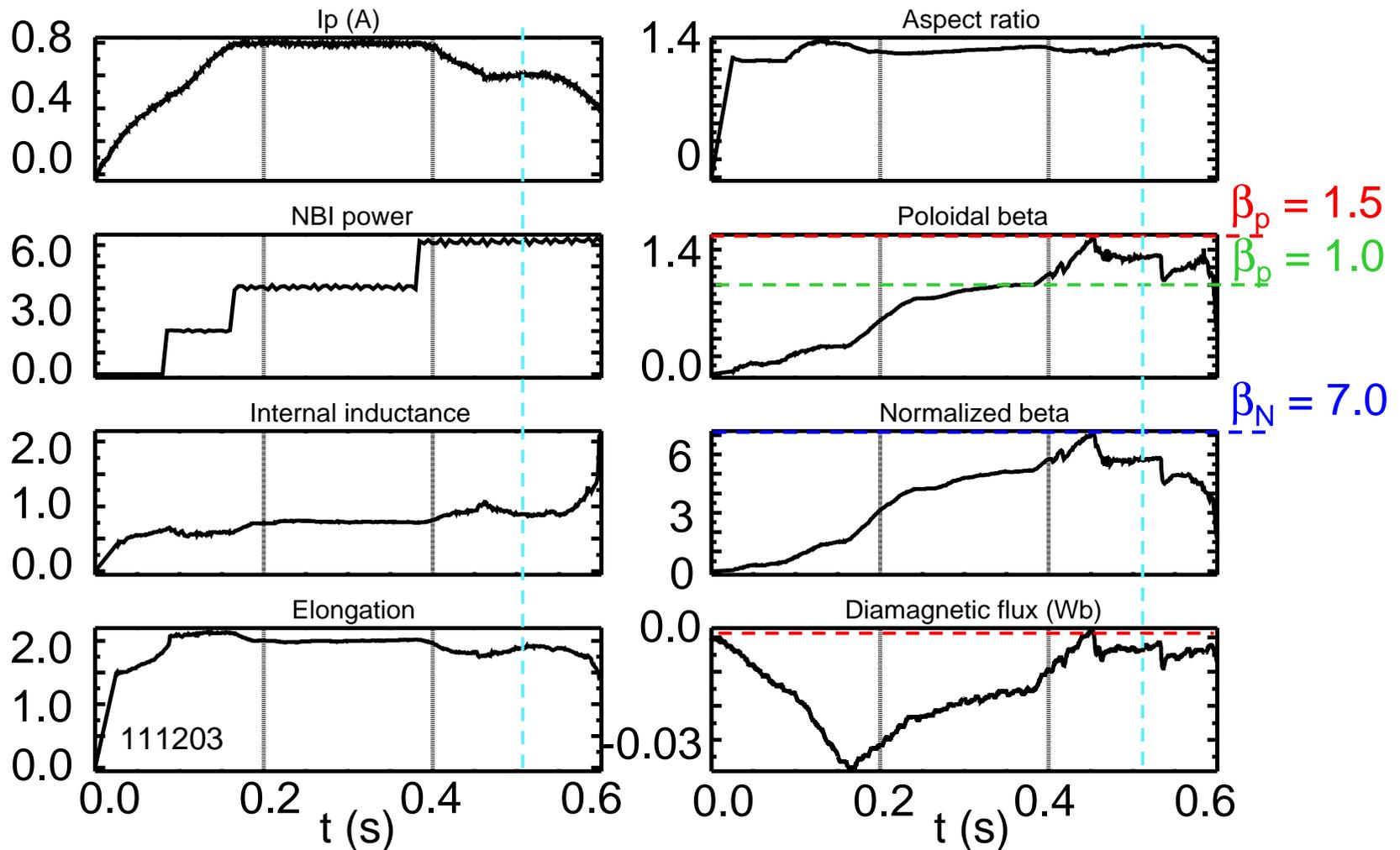
We are here

High β_p equilibria can be investigated at several points



□ Aspect ratio in 110184 increased in time – vary A in similar way

High β_N plasma still not near equilibrium limit $\beta_p \sim 2.5$



□ Highest β_p plasma is slightly diamagnetic

Duration and Required / Desired Diagnostics

