

XP1023: Optimized RWM control for high $\langle \beta_N \rangle_{\text{pulse}}$ at low collisionality and I_i

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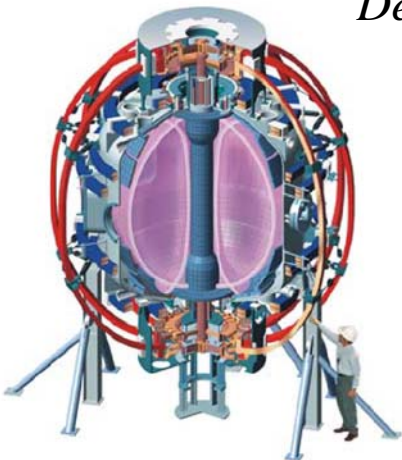
Princeton Plasma Physics Laboratory

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XP1023: Optimized RWM feedback control for high $\langle \beta_N \rangle_{\text{pulse}}$ at low collisionality and I_i

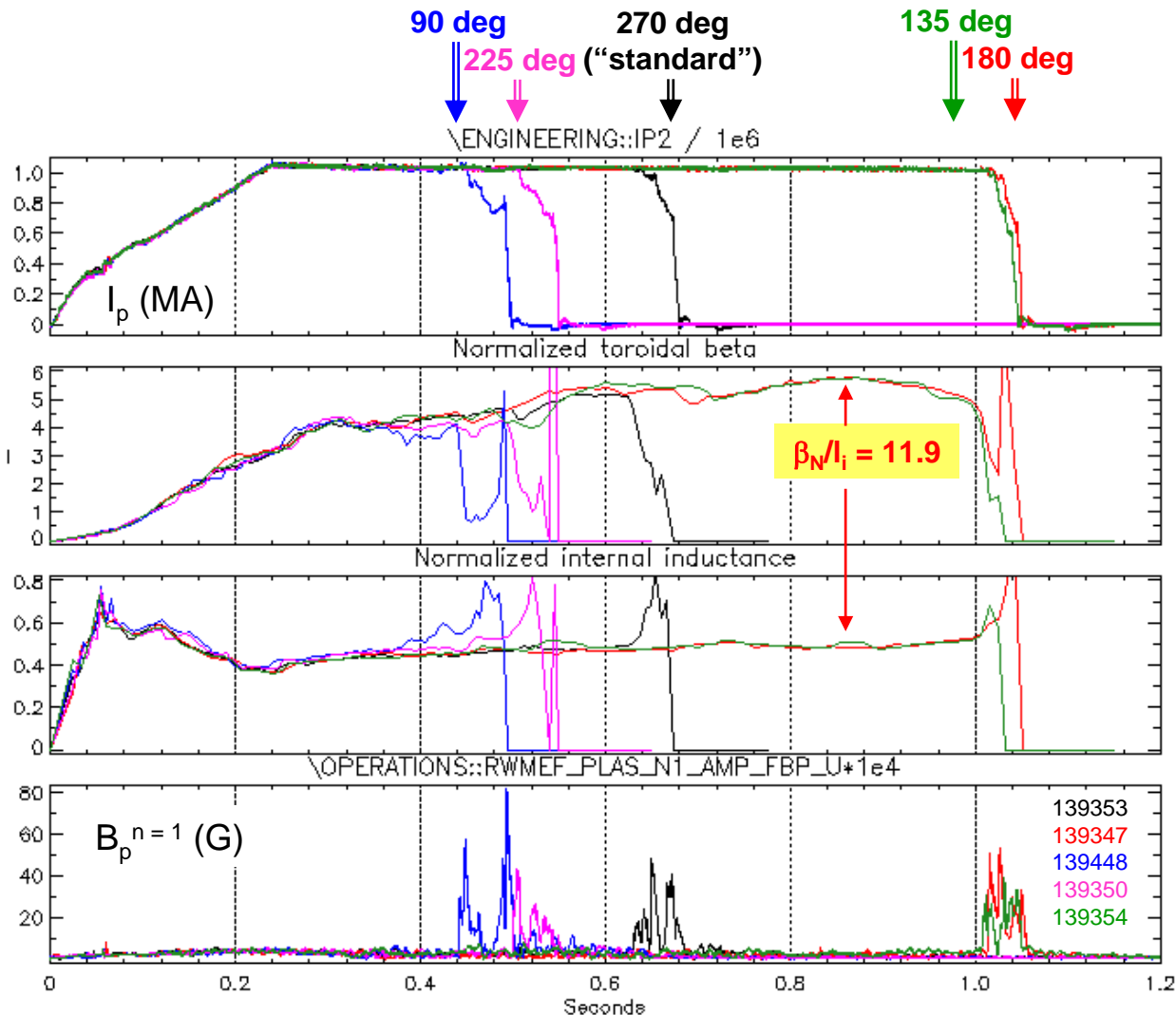
● Summary (8/3/10 run)

- Total of 8 shot (1.5 hours) – all useful
- Generated long-pulse, reduced I_i target plasmas, filling out $n = 1$ RWM feedback parameter scans before the LLD fill

● Progress

- Addressed several key outstanding question froms last run of Xp1023
 - Optimal $n = 1$ RWM control settings have apparently changed significantly
 - Changed settings apparently not due to new RWM sensor compensations afforded by new “MIU” algorithm
 - Best plasmas run with combination of $n = 1$ B_p and B_r RWM sensor feedback
 - Important to perform RWM control parameter scan in similar target plasmas when running low I_i
 - B_r sensor gain scan from last run is invalid
- Loss of RWM control sensitive to increase from I_i away from low I_i “bifurcated” state

(LAST RUN) XP1023: B_p sensor feedback phase scan yields new superior settings



- General thought that present FB settings were not stabilizing modes well enough

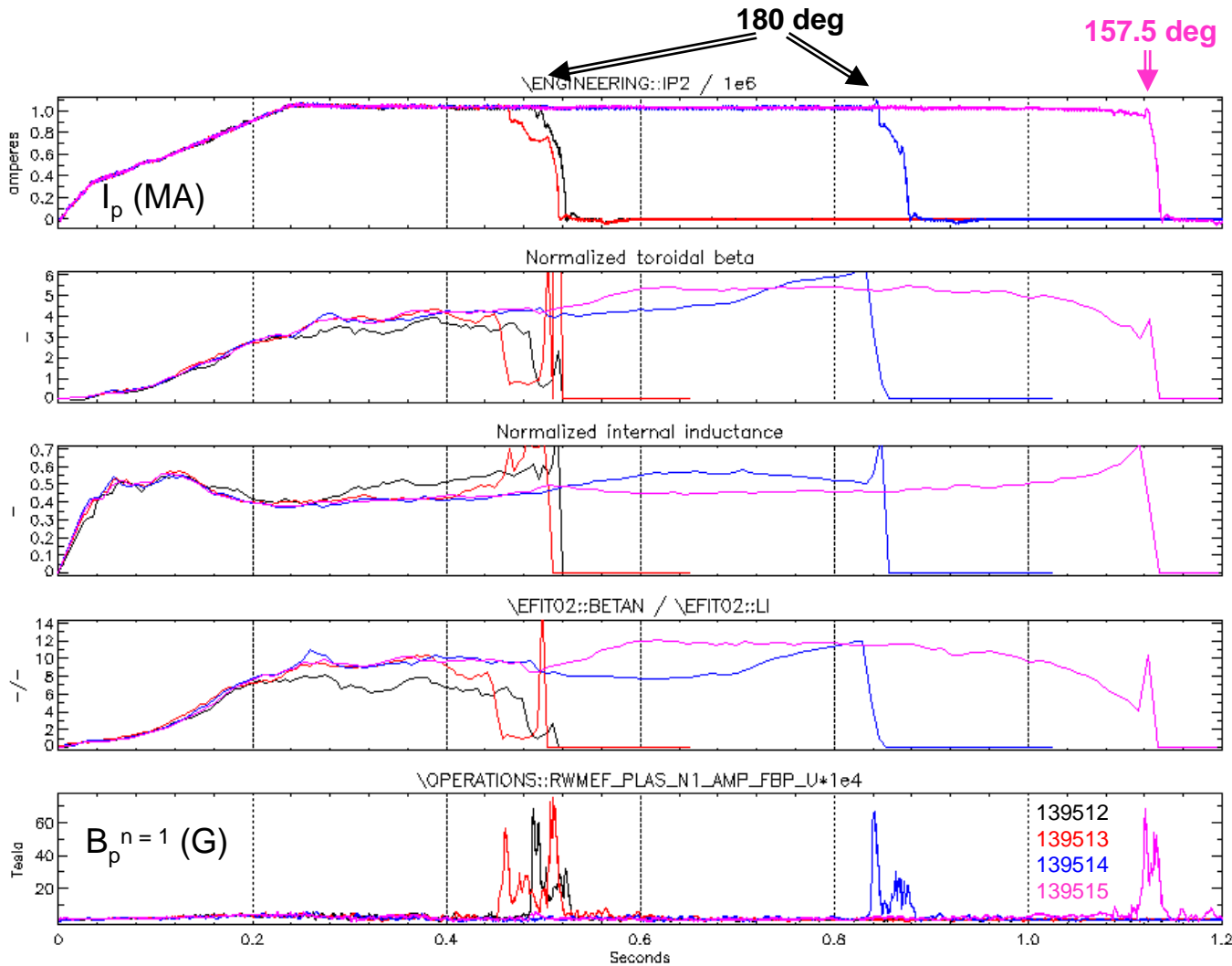
- Change from past runs?
- Could be due to
 - New mode ID upgrade ("miu") compensations
 - Low li plasma
 - Both, other reasons

- Superior settings

- Present value of 270 deg mediocre
- 180 and 135 deg settings are best
- Gain scan not attempted (yet)

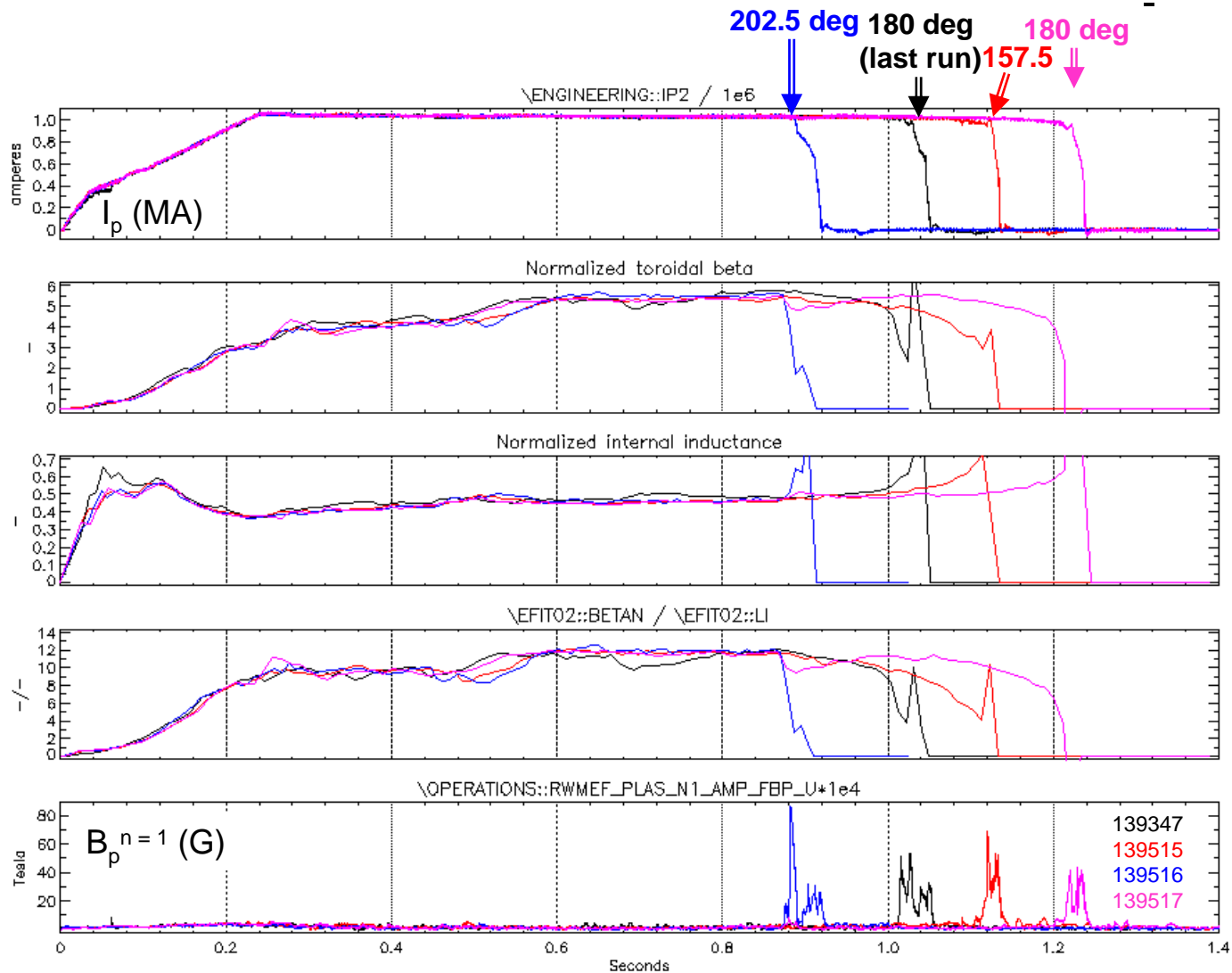


A few shots required to reach low I_i target plasma



- Increased lithium deposition
 - From 150 mg/shot to 300 mg/shot
- Tweaked B_p sensor feedback parameters near optimal setting
 - 180 and 157.5 deg settings are best
 - Gain scan not attempted (yet)

Tweaking B_p sensor feedback phase around 180 degrees led to long-pulse, low I_i , high β_N/I_i

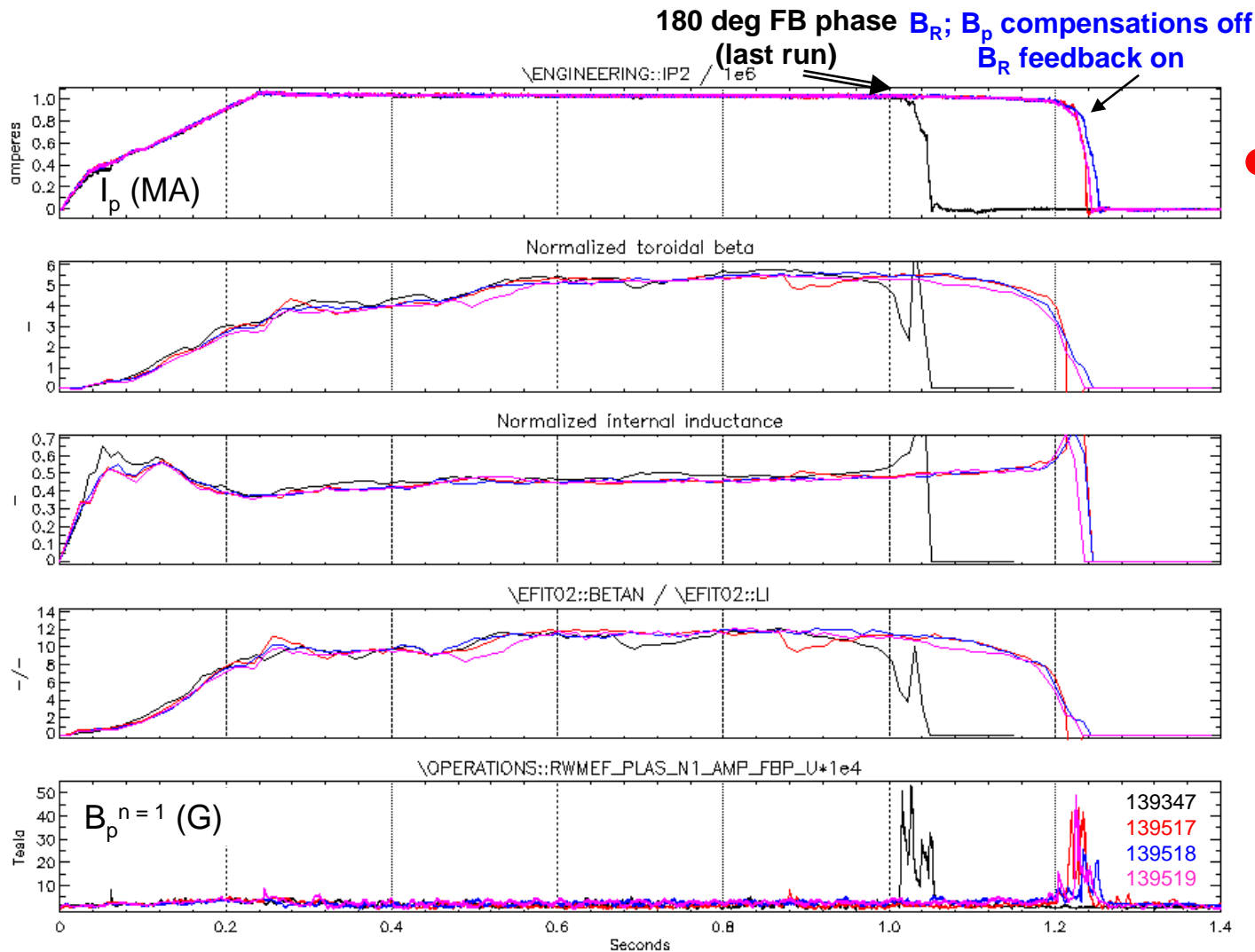


- Steady, high β_N/I_i

- Between 12 – 12.5

- Low I_i retained

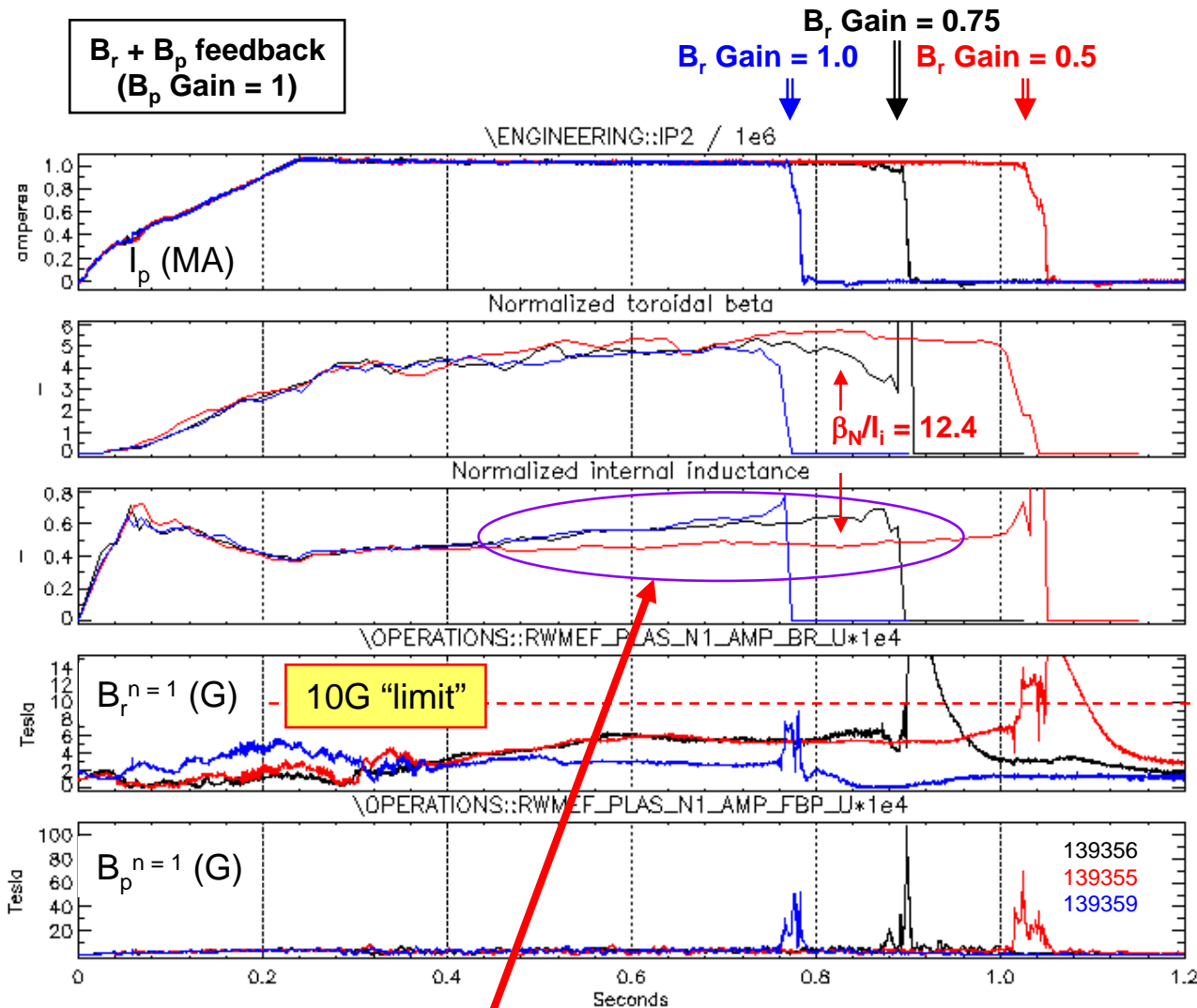
B_R sensors added, MIU compensations off: longest pulse plasmas, high performance



● Not enough time to complete full B_R sensor gain scan

□ To be completed during next XP1023 run

XP1023: Three point B_r sensor feedback gain scan taken



- Highest β_N/I_i of the day, long pulse length
 - $\beta_N/I_i = 12.4$ reached
 - NSTX highest value = 13
- Increased B_r sensor FB gain showed shorter pulse
 - B_r feedback spatial phase may be optimized with B_p sensor FB
 - Further analysis needed
 - Results not yet optimized
 - Need to complete scans