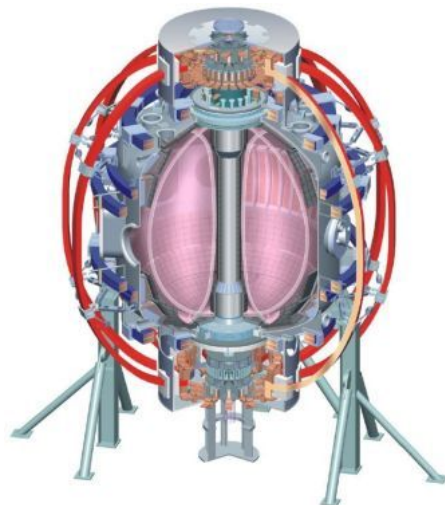


XP-823: Robustness of improved error field suppression in long-pulse discharges

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For the NSTX Research Team

**NSTX Results Review
LSB B318 - PPPL
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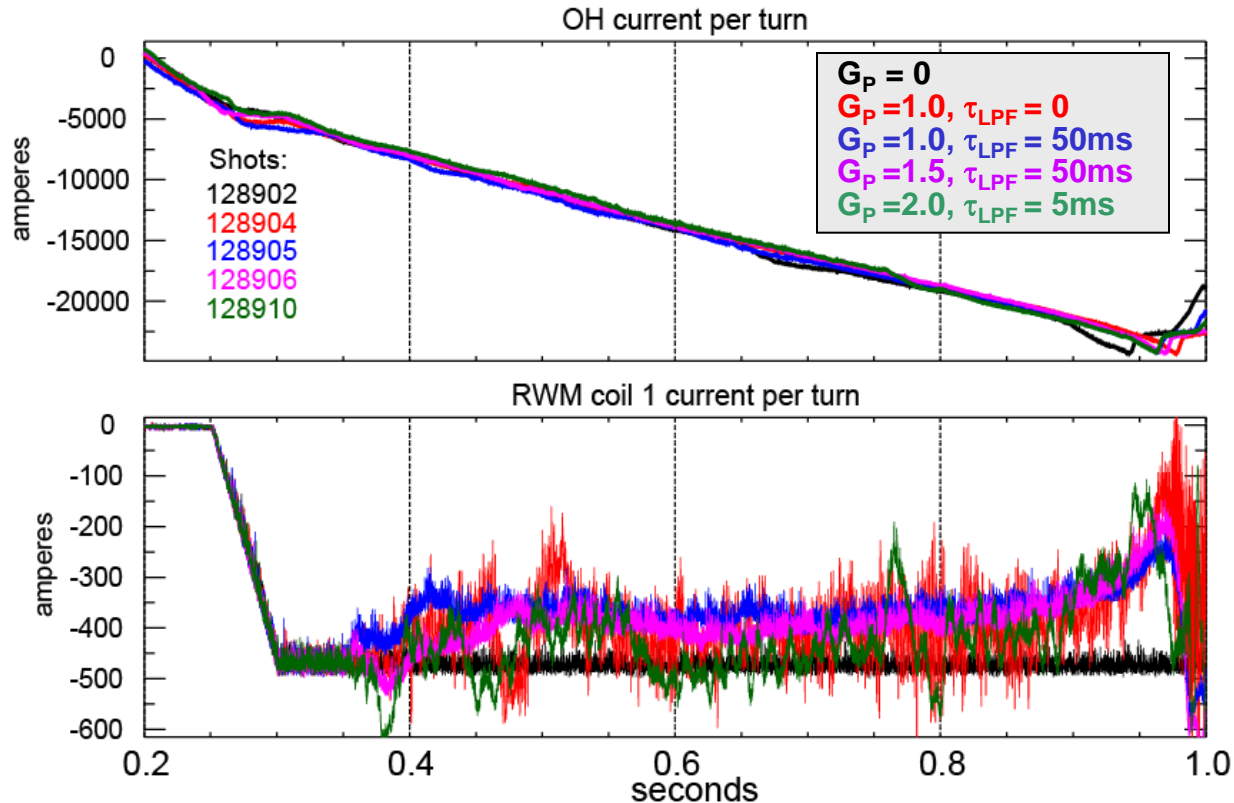
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n=1 feedback gain, LP filter optimized for $I_p = 1.1\text{MA}$

Expands 2007 data set at 900kA

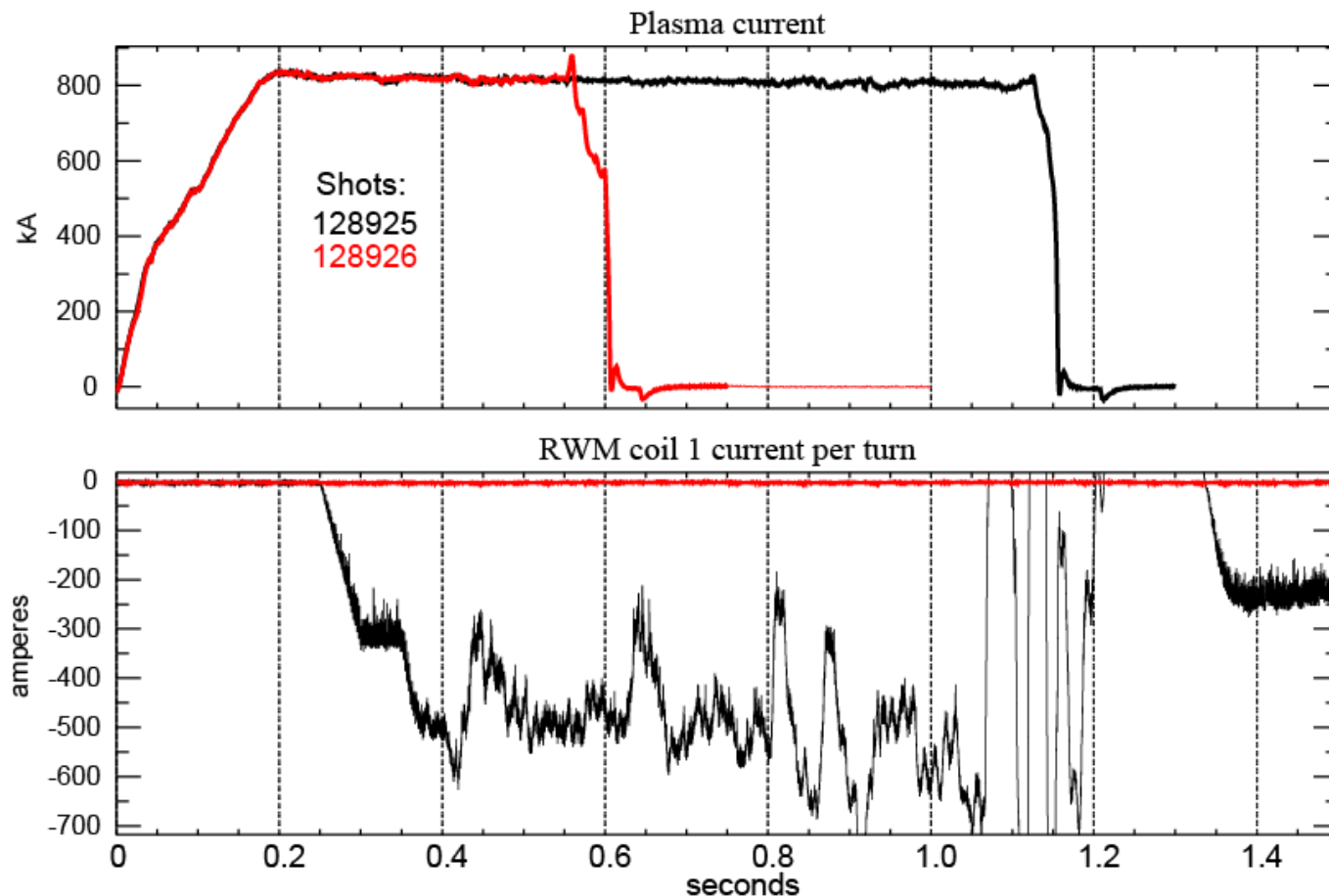
- Instead of applying known n=1 EF, used OHxTF EF (1.1MA uses full OH swing)
- Used B_p U/L averaging from 2007, included n=3 EFC (new for 2008)
- Increased gain scan by factor of 3: 0.7 in 2007 \rightarrow up to 2 in 2008
 - Response to n=1 RFA from OHxTF error field changes little for $G_p > 1$
 - System marginally stable at $G_p = 2$ for τ_{LPF} as low as 1-2ms

\rightarrow Optimal control parameters: $G_p = 1-1.5$, $\tau_{LPF} = 2-5\text{ms}$



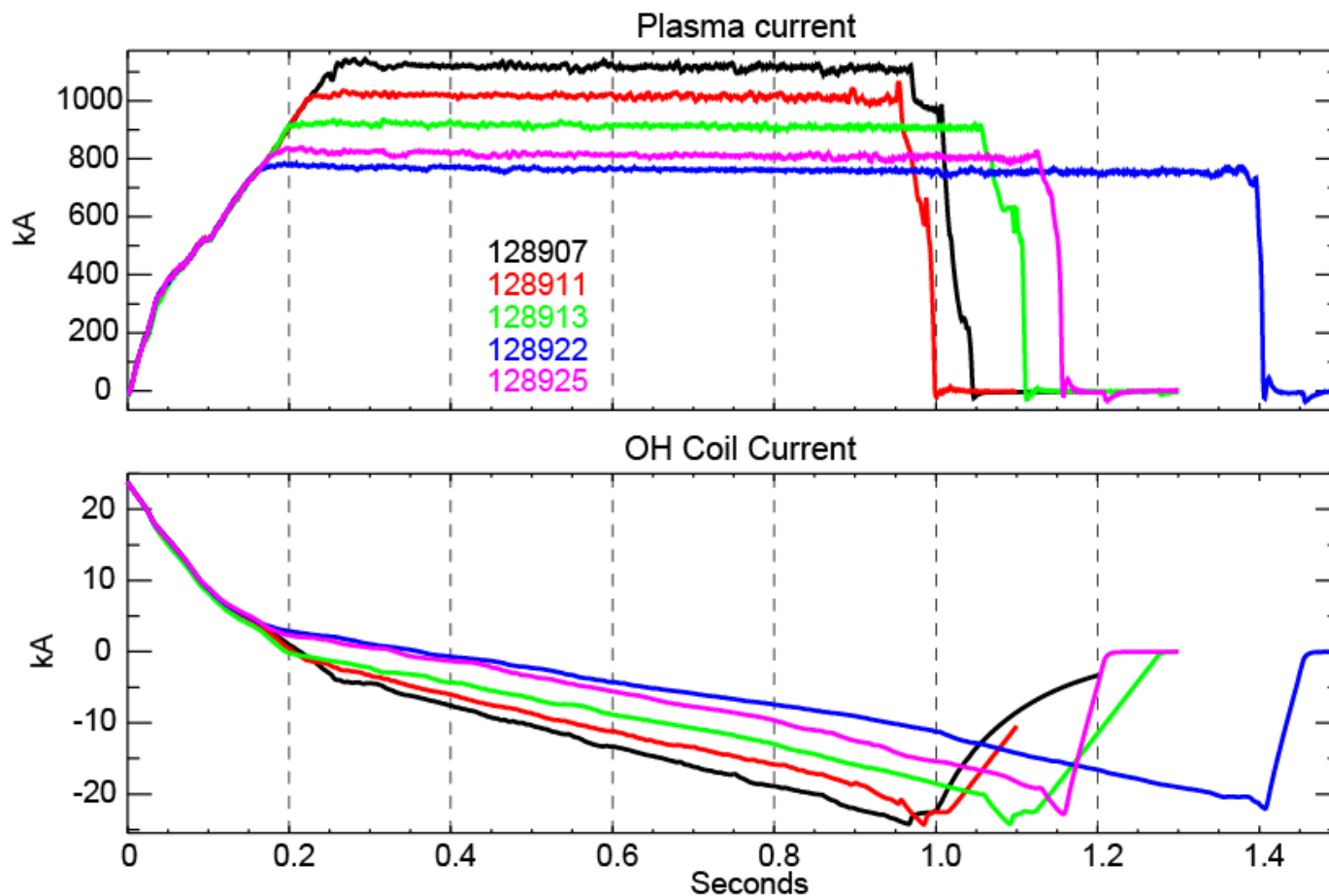
$n=3$ EFC + $n=1$ feedback important at lower current ($< 900\text{kA}$) for extending pulse lengths

- Pulses commonly disrupt near $\sim 0.6\text{s}$ w/o mode control
 - At high beam power (high $\beta_N = 5.5 \rightarrow 6$), mode control insufficient to avoid disruption (not shown)



$n=3$ EFC + $n=1$ feedback was successfully applied to wide range of plasma current = 0.75-1.1MA

- Pulses run reliably until nearly all OH flux is consumed



Optimized mode control + Lithium → record NSTX pulse-lengths

- Flux consumption reduced following LITER experiments
 - Lower V_{LOOP} at lower P_{NBI}

- Li + optimized EFC →
 - Avoid late n=1 rotating mode
 - rotation sustained
 - $\beta_N \geq 5$ sustained 3-4 τ_{CR}
 - record pulse-length = 1.8s

