NSTX

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XP-1019: Disruptivity Reduction with β_N-Control Status Report

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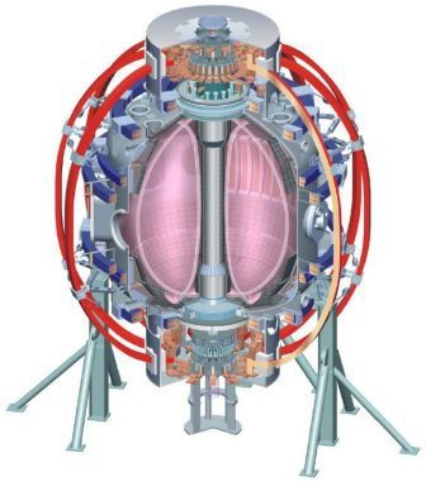
Monday Physics Meeting



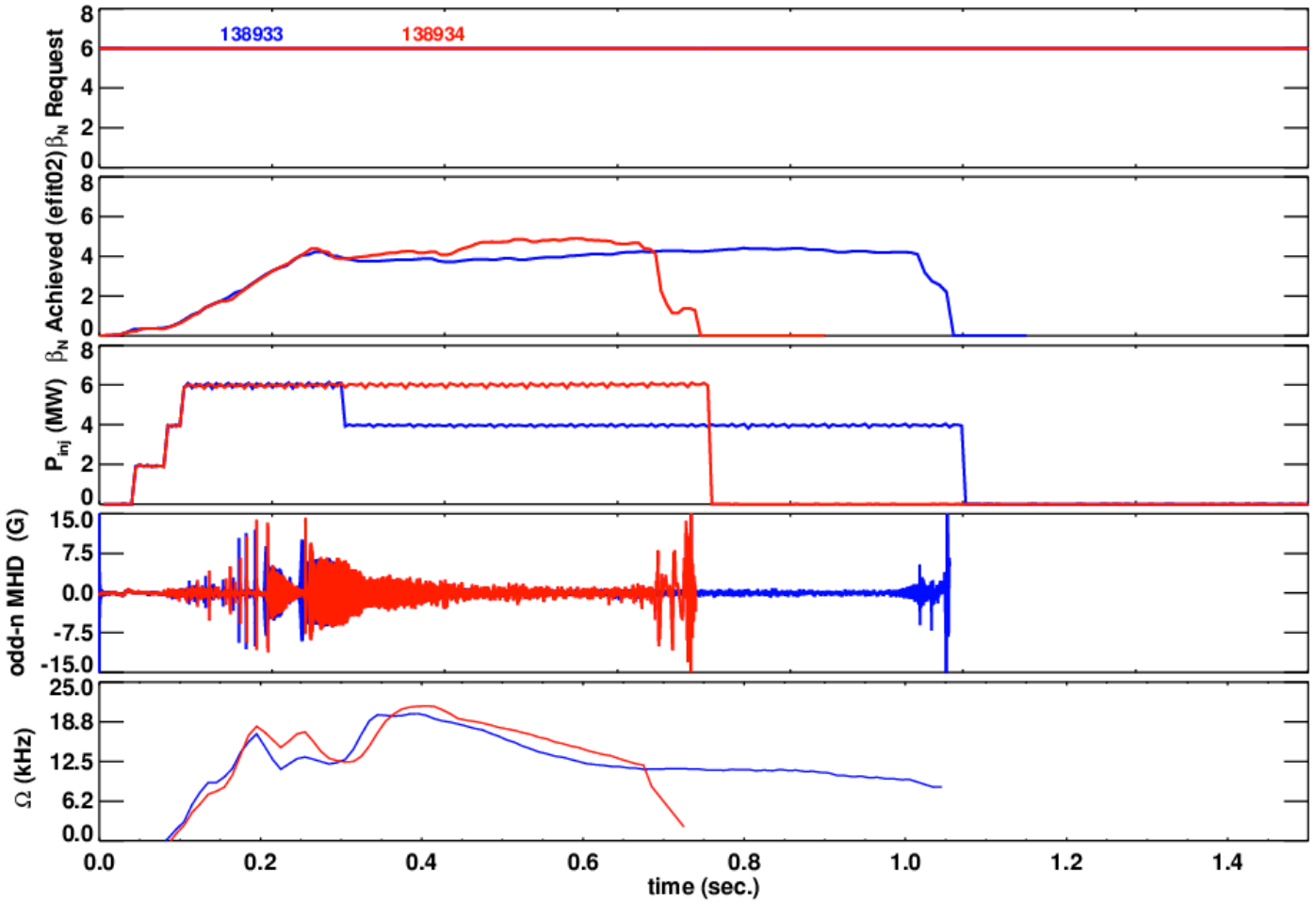
Overview

- XP Goal: Demonstrate (or not) that feedback control of β_N, using rtEFIT and NB modulations, allows operation at a higher value of β_N than feedforward programming.

- XMPs in 2009 and 2010 brought the system on-line.
  - 2009: First demonstration of capability.
  - 2010: Recommissioned after a change of the PID operator, determined useful values of the proportional and integral gains.
    - Further fix implemented upon suggestion by M. Bell and E. Kolemen.
  - β_N control is ready for use in XPs!

- XP took ~3 hours on Monday, June 28th.
  - 2 & 4 days separated from argon vents.
  - Did achieved a reasonable target condition.
  - Was not able to show that β_N control is particularly advantageous.
  - However, NB reliability issues severely impacted the experiment.
    - Source B often failed to run on, possibly due to machine contaminants impacting source performance.

Target Condition Achieved



Plasma 138933 with 4 MW runs through, with some late core mhd.

Plasma 138934 with 6 MW has an large mhd event and disruption.

Can the β_N control system find the power that maximizes pulse length w/o mhd.

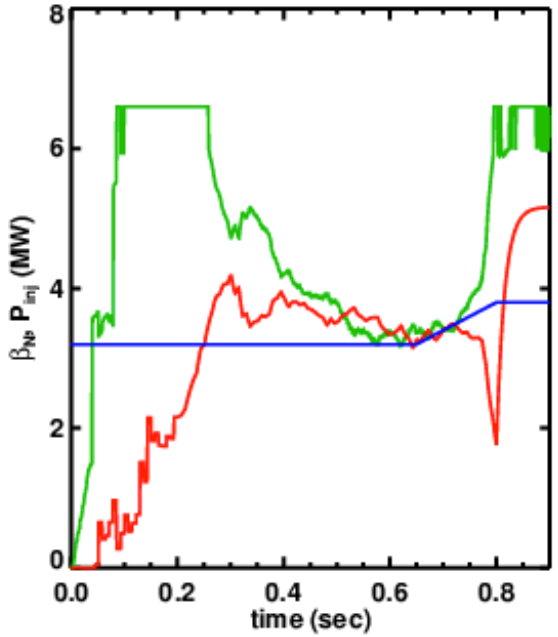
(Extra power slows the J evolution and delays core MHD, unless an RWM/Ideal mode grows.)

Turn-On Failures Compromised the Control Test

Requested Power

Requested β_N

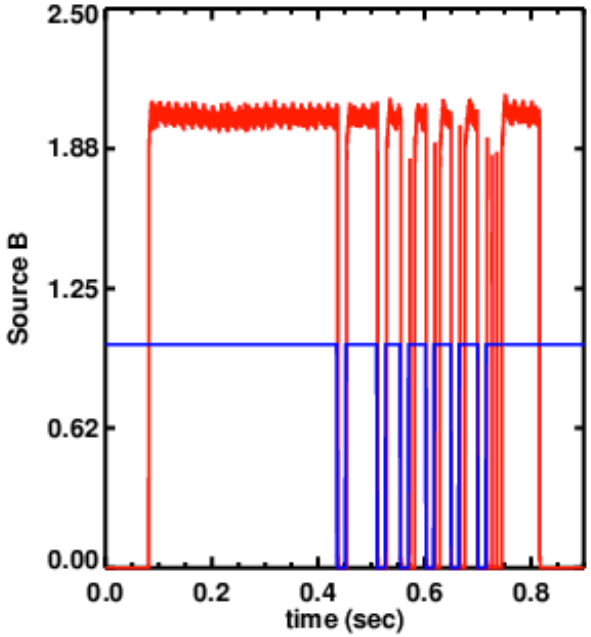
Achieved β_N (rtEFIT)



Source B

Modulation Command

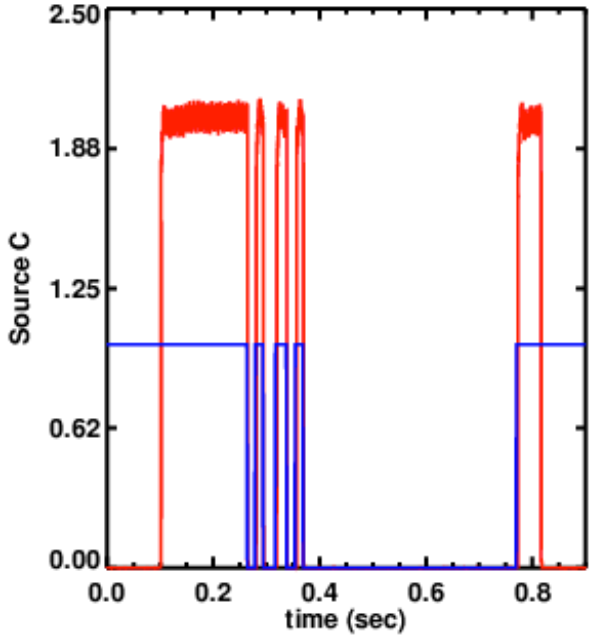
Source Power



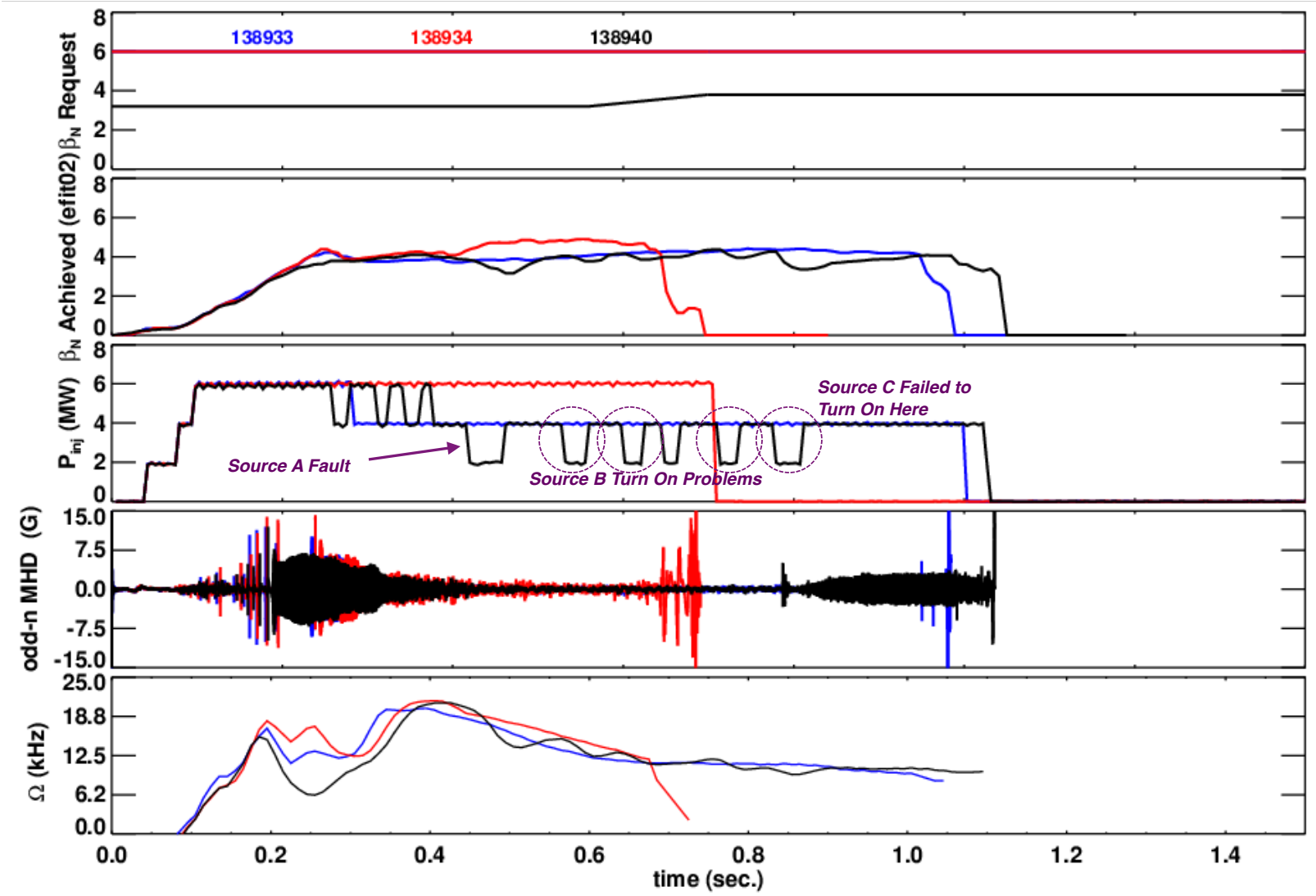
Source C

Modulation Command

Source Power



Best Show With Feedback Was a Longer Pulse Than 4 MW Reference, but May Source Issues



Status and Plan

- Good high-κ, long-pulse target has been achieved.
- β_N control is showing signs of doing its job.
- Need 3-4 hour block of time to finish the XP.
  - ***Desire*** improved machine conditions.
    - Get the "Z_{eff} anomaly" down so that TRANSP is more reliable.
  - ***Need*** reliable NB turn-ons.