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**ENERGY**

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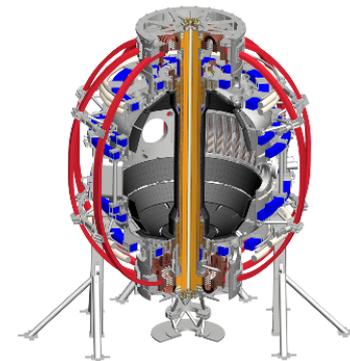


# XP-140: PF5 Proportional Error Field Correction

## Preliminary results from February 25, 2016

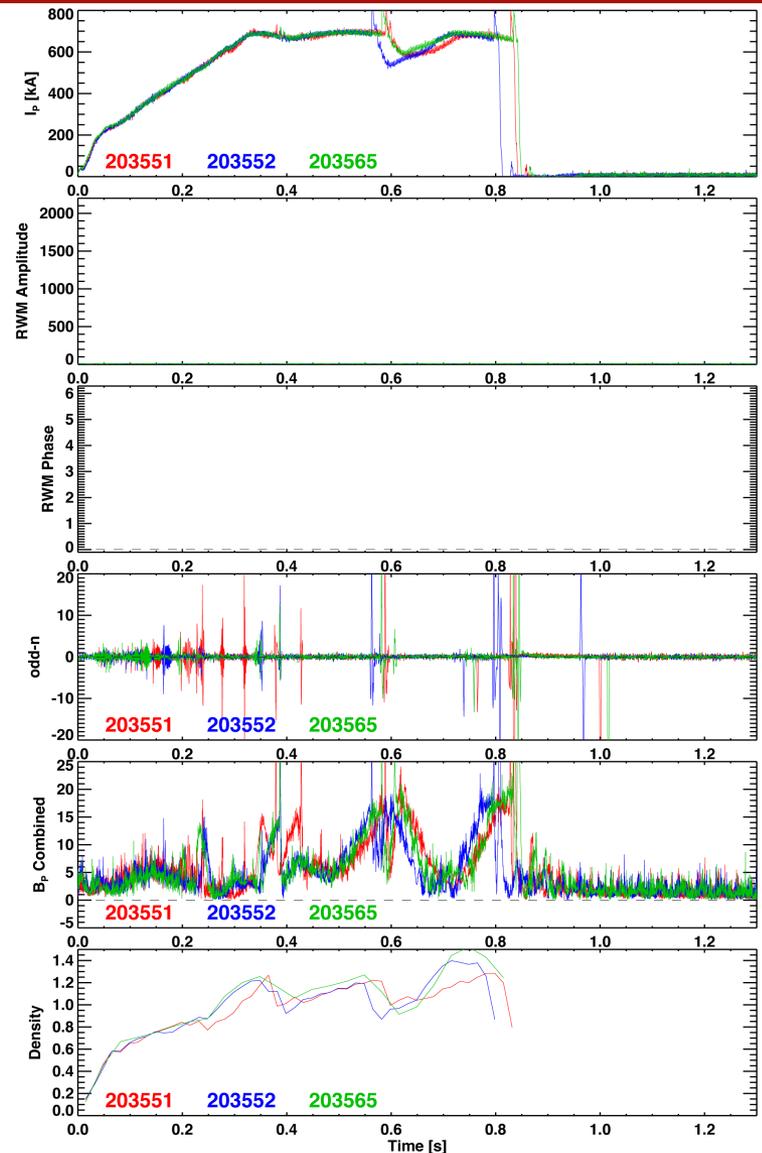
S. P. Gerhardt, C. E. Myers, J. E. Menard, etc.

NSTX-U Monday Physics Meeting  
February 29, 2016



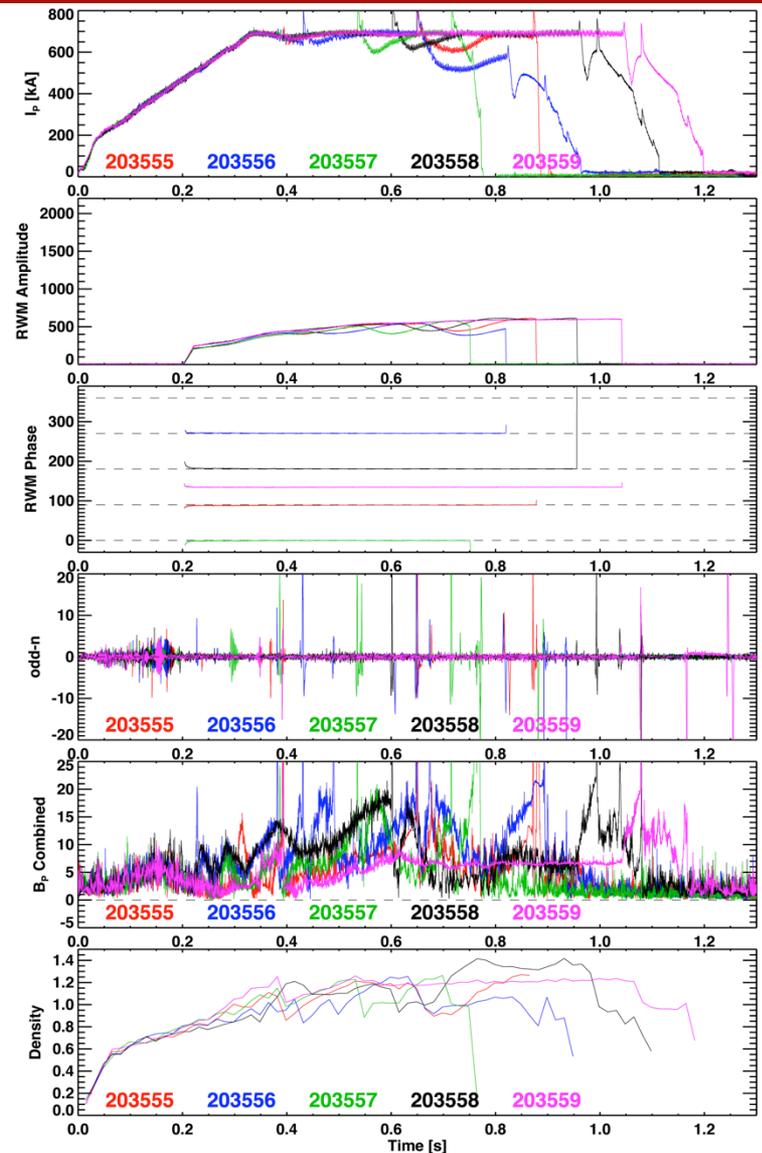
# Motivation and plan for XMP-140

- Motivation
  - Larger  $n=1$  error fields are expected from the PF5 coil in NSTX-U
  - This has been preliminarily confirmed by physical measurements of the coils
  - Prohibitive MHD mode activity observed when trying to raise the current above 600 kA
- Run plan
  - Apply  $n=1$  correction fields proportional to PF5 using the RWM coils
  - Use the new FEC (Field Error Correction) subset of the TMF (Third Mode Feedback) algorithm in PCS
  - Perform a phase scan of the  $n=1$  proportionality at fixed amplitude
  - Perform an amplitude scan at the best observed phase



# Phase scan at fixed amplitude

- Amplitude selection
  - Choose a proportional amplitude (in RWM amps per PF5 amps) that makes things change
  - After a few shots, settled on 0.086 A/A
  - This gives peak RWM currents of  $\sim 500$  A in a 700 kA discharge (86 RWM A/PF5 kA)
- Phase scan
  - 203255 =  $90^\circ$
  - 203256 =  $270^\circ$
  - 203557 =  $0^\circ$
  - 203558 =  $180^\circ$
  - 203559 =  $135^\circ$
- Results
  - Clear improvement or degradation observed
  - Phase =  $135^\circ$  gives the best performance



# Amplitude scan at phase = 135°

- Amplitude scan
  - 203262 = 0.086 A/A
  - 203263 = 0.129 A/A
  - 203564 = 0.200 A/A
  - 203565 = 0.000 A/A (Reference)
  - 203566 = 0.043 A/A
- Takeaways:
  - 0.086 A/A gives the best performance
  - Maybe a flat spot going up in amplitude
  - Outcome = ohmic L-mode with 700 ms flattop
  - This EFC algorithm was used to achieve the following with one beam:
    - NSTX-U's longest shot = 203577 (1.8 sec)
    - NSTX-U's highest current = 203583 (1 MA)

