



U.S. DEPARTMENT OF
ENERGY

Office of
Science



NSTX-U Commissioning Update

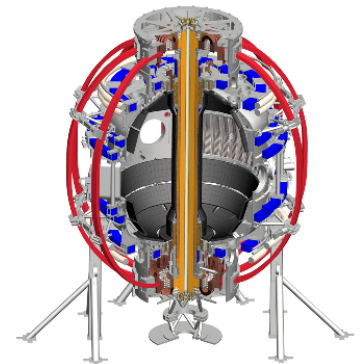
Devon Battaglia

On behalf of the NSTX-U team

NSTX-U Monday Science Meeting

PPPL

January 4, 2016

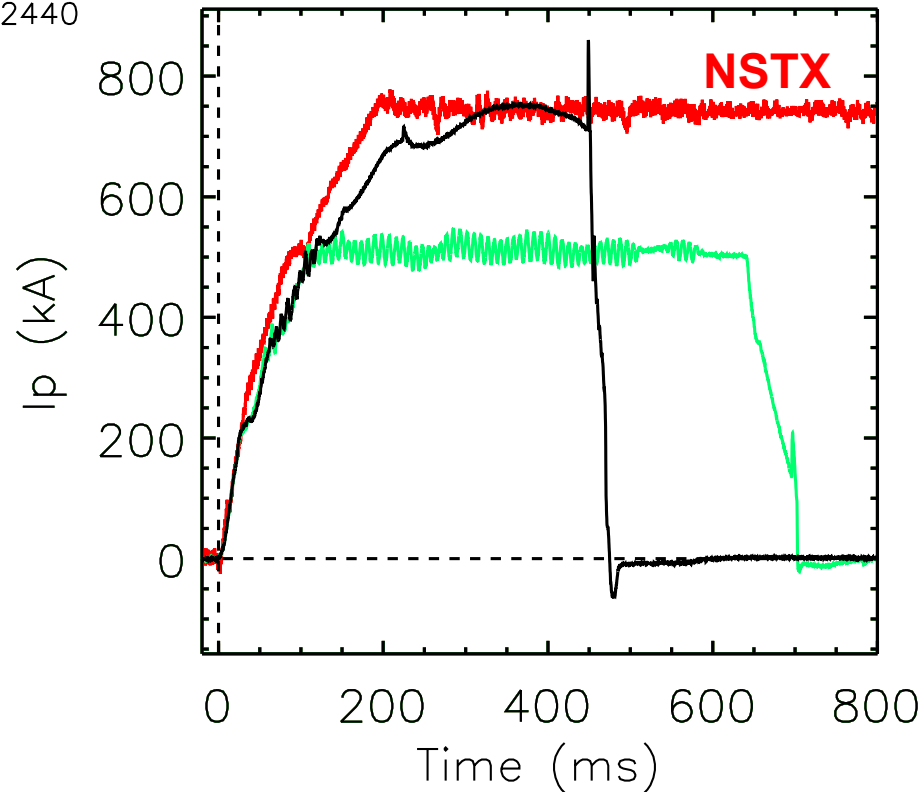


Completed “pre-boronization” period

- CD4 (August, 2015): Produce plasma with $I_p > 100\text{kA}$
 - Short bake of CS, no vessel bake, no boronization
 - Gas prefill feedback, feed-forward PF5, PF3U/L, OH
 - About 30 shots. TF = 60 kA (0.5T)
- Pre-boronization operations (December, 2015)
 - Three run days to acquire baseline data before boronization
 - I_p , outer gap, Z_p feedback; oval inner-wall limited L-mode
 - About 50 shots. TF = 80 kA (0.65T)
- Boronized commissioning period (January, 2016)
 - Develop research plasma (diverted, H-mode)

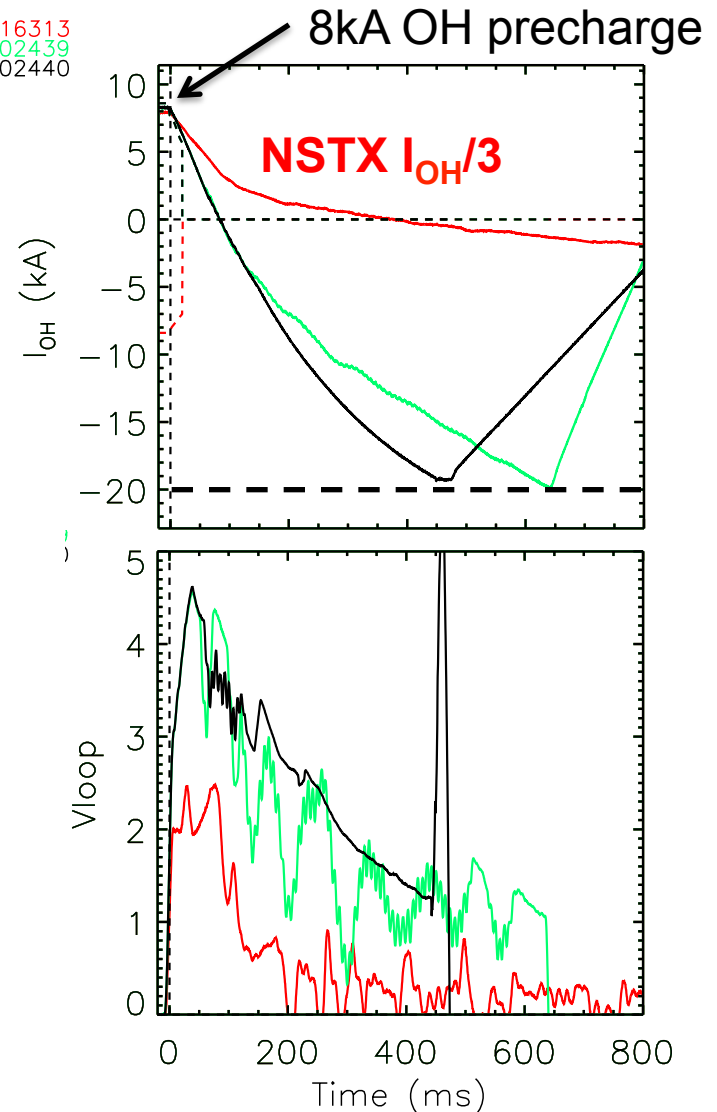
Controlled I_p flattop ≥ 0.5 MA achieved

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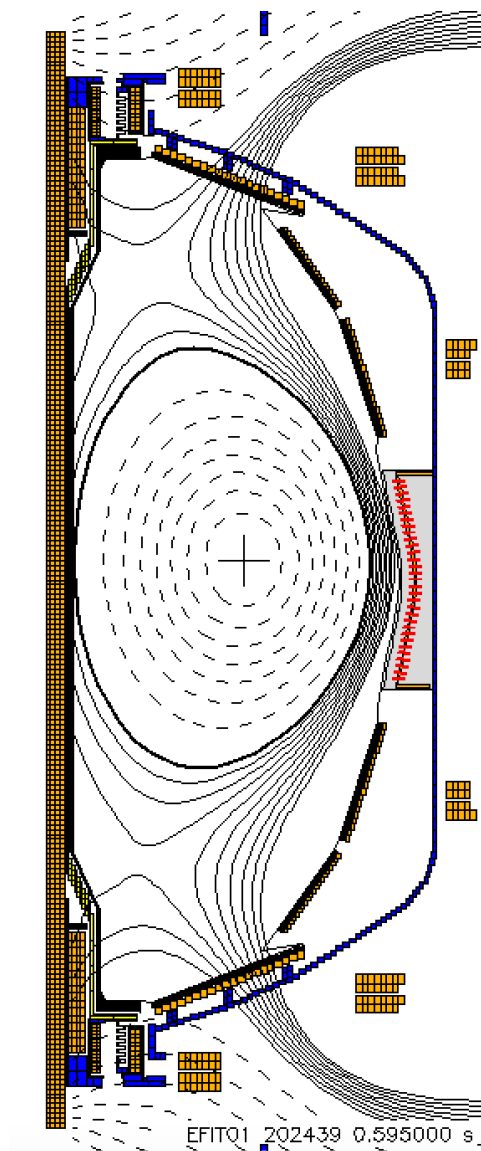
NSTX-U discharges are L-mode, inner wall limited, with deuterium prefill and helium fueling
 $I_{TF} = 80$ kA (0.65 T)

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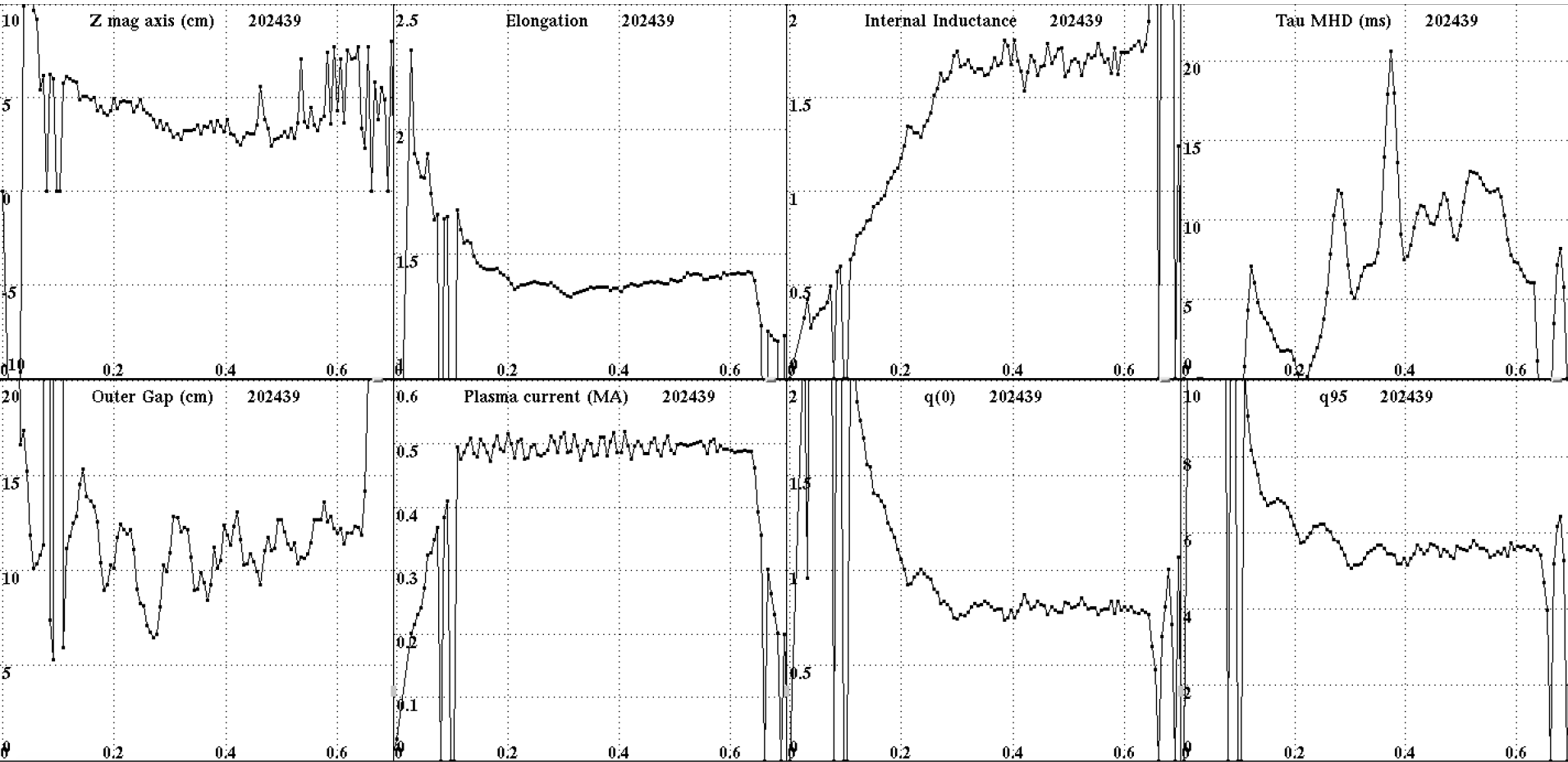


Enabled by successful commissioning of PCS feedback in XMP-126, XMP-105

- Active feedback of I_p , outer gap and Z_{pos} implemented
 - Optimization and expansion of these control capabilities still remains
- Magnetics, equilibrium fits, cameras, Thomson scattering, spectroscopy contributing to progress
- “Insufficient I_p ” and “Loss of control at $I_{OH\ max}$ ” shutdown successfully implemented
 - Prevented coils and gas running longer than needed, shortening OH cooling time



IWL discharges are well-controlled in flattop



“Pre-boronization” phase successfully completed

- Breakdown optimization, active feedback tools resulted in achieving 0.5 MA I_p flat top for 0.5s, 0.7MA for 0.1s
 - V_{loop} 1 to 2 volts larger than expected for clean plasmas
 - Anticipate that boronization will reduce V_{loop} requirement
 - Spectroscopy data will help quantify impact of boronization
- CD4 plasmas were dusty and bright
 - Long plasmas showed considerably less dust and dimmer
 - Removing dust before boronization was one goal of running
- Coming up in the near future:
 - Use larger OH precharge, tune feedback parameters, add NBI
 - Establish diverted L-mode, optimize vertical stability control
 - Neutron calibration, controlled shutdown development