NSTX-U

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NSTX-U Commissioning Phase

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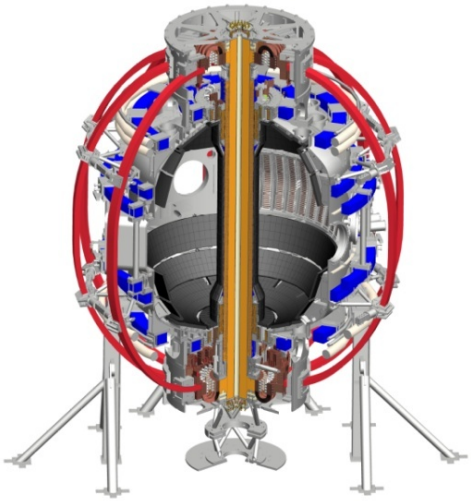

CD-4 Will Establish Plasma Breakdown

- Requirement is I_p > 50 kA at 0.5 T (transiently)
  - Pre-programmed OH and EF coils
  - CS bake and He GDC for wall conditioning
  - Ohmic heating (no beams)
  - Establish pre-fill pressure range for breakdown, ECH pre-ionization timing and optimize PF current evolution up to 20ms
  - Requires plasma TV, magnetics, neutrons, filterscopes

- If time permits, try gap and I_p control starting at 20 ms
  - EFIT development would benefit from ~450 kA

Coordinating the NSTX-U Commissioning Activities is the Responsibility of the Physics Operations Group

- Commissioning will produce a scenario useful for XPs, calibrate diagnostics, check systems
  - B_T ~ 0.5 T, I_p ~ 1.0 MA, beam heated, > 1s flattop
  - Reliable H-mode timing
  - PFC conditioning recipe
    - Boronization (1 – 1.5 weeks) + He GDC
  - Most likely near DN (small d_{rsep})
    - Diverting with feed forward PF1/2
  - Initial understanding of DCPS impact on plasma operation

- Upcoming slides outline plans and goals for four weeks
  - We will try to make commissioning period as short as possible
  - Please contact Mueller and Battaglia via email to add commissioning activities, XMPs, give comments, etc.

First 2 weeks: Magnetics, Breakdown Scenarios (1)

- Magnetics calibration (*Myers*) [1 day]
  - Single and multiple PF, OH and TF waveforms
- Breakdown scenario development (*Battaglia*) [1 day]
  - Design front-end of discharges for 0, 12, 24 kA precharge
    - Compatible with DCPS (OH/TF heating ΔT)
    - Establish PF3/5 programming vs. OH precharge level
    - Optimize prefill, ECH timing, shot cycle activities (GDC, OH/TF cooling)
  - Document impact of bake on impurity, breakdown (compare to CD4)
  - Check I_p, vessel current in real time inputs

First two weeks: I_p & Gap Control, Vertical Stability (2)

- I_p and R control on NSTX-U (*Mueller*) [3 days]
  - Tune R feedback gains at 20 ms
  - Develop early fueling scenario for MHD avoidance
  - Optimize shape evolution to minimize l_i
  - Demonstrate I_p control up to ~500kA flattop, low-κ cross section
  - Optimize outer gap feedback at highest I_p
  - Initial checkout of vertical stability feedback
  - PF1/2 feed forward to bring X-points in vessel (probably still oval)
  - MPTS checkout, EFIT checkout

- Neutral beam checkout (*Mueller*) [1 day]
  - Fire each beam individually
    - Check beam signals, including real-time signals
  - Beam diagnostic checkout (dedicated calibration XMPs later)

Next two weeks: L-mode I_p Ramp-up, H-mode Access (1)

- L-mode development (*Mueller*) [2 days]
  - Develop beam heating scenario for I_p ramp up to 1 MA
  - Ramp κ to establish vertical stability limits in L-mode flattop
    - Might have to be lower than 1 MA for long (1s) L-mode flattop
  - Optimize feedback, V_{loop}, shape evolution to expand κ range
  - Divert using PF1/2 feed forward
  - Possibly do boronization in middle of XMP to evaluate impact on wall
  - Evaluate L-mode density control with LFS flow rate control

- H-mode entry at SOF (*Battaglia*) [1 day]
  - Beam heating, CS gas fueling, GDC parameters for reliable H-mode entry at start of flattop

Next two weeks: H-mode Fiducial Development

- Increase H-mode flattop (*Mueller*) [3 days]
  - Develop fiducial with steady, ELMing H-mode
  - Investigate H-mode entry during I_p ramp
  - Achieve diverting plasma with an inner gap for entire flattop
- Commission rtEFIT, ISOFLUX (*Boyer*) [1 day]
- XMPs to commission diagnostics and systems outside of control aspects (Phys Ops and RC must coordinate)
  - Dud-detector (Gerhardt)
  - He GDC, gas flow rate optimization (Battaglia)
  - RWM coil commissioning
  - RF commissioning
  - CHERs, MSE
  - ……