NSTX-U

Supported by U.S. DEPARTMENT OF ENERGY Office of Science

XP-1521: Validation of Gyrokinetic Codes in NSTX-U NBI-heated L-mode Plasmas

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T&T TSG group review, June 17th, 2015

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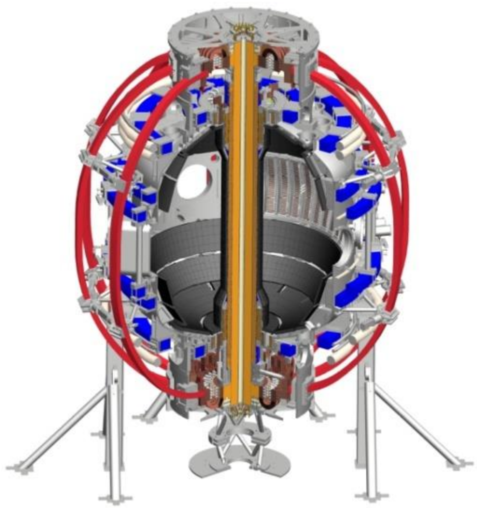

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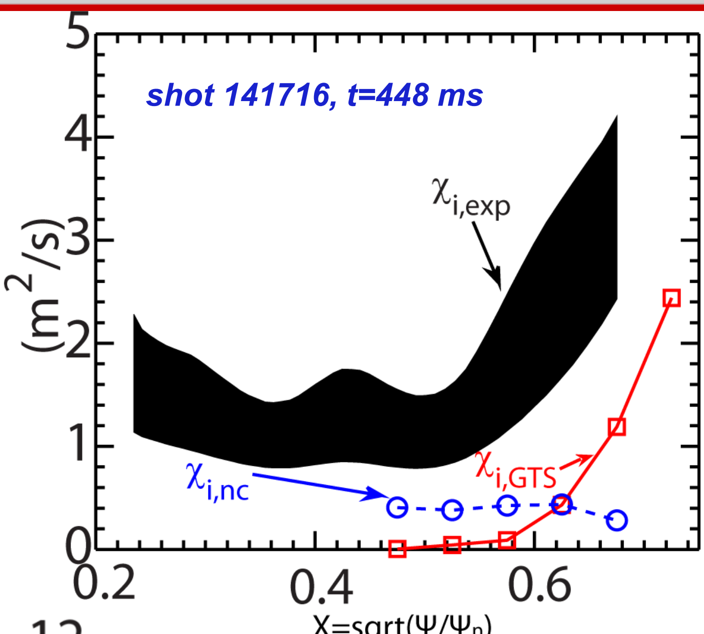
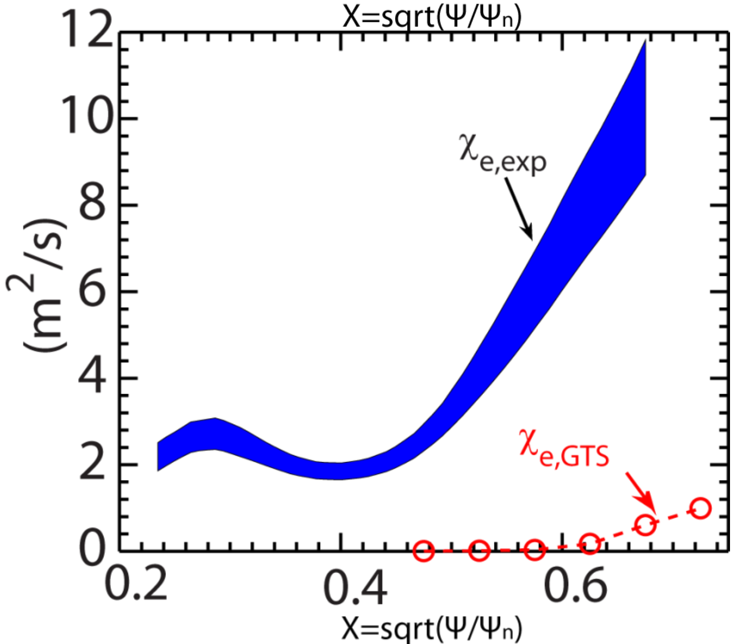
Background and Motivations

- Validating gyrokinetic codes is important
  - To find limitations and improve codes
  - Compare transport level between experiments and nonlinear gyrokinetic simulations
  - Compare fluctuations through synthetic diagnostics
- L-mode plasmas offer some favorable properties to code validation
  - Easier to obtain stationary profiles, e.g. no impurity accumulation
  - No complications from edge transport barrier
- Will provide a data base for developing reduced transport models, e.g. TGLF, for NSTX-U parameter regimes.





XP-1521 Experimental Plan

- Establish quasi-stationary MHD quiescent NBI-heated L-mode plasma, hopefully from a dedicated XMP for L-mode scenario development
  - Use NBI source 1A at 90 kV for MSE and CHERS measurement
- Depending on the results from L-mode scenario development, two plans of B_T and I_p scan are under consideration.
- If (0.5 T, 0.55 MA) case is successfully developed, we will use plan A.
  - If not, we will use plan B
- Plan A:

  [Bt (T), Ip (MA)]
  - (0.5, 0.55) 2 shots+1 contingency
  - (0.65, 0.55) 2 shots+1 contingency
  - (0.65, 0.70) 2 shots+1 contingency

  total: 6 shots+3 contingency

XP-1521 Experimental Plan (cont.)

- Plan B:

  [Bt (T), Ip (MA)]

  – (0.65, 0.55) 2 shots+1 contingency

  – (0.65, 0.70) 2 shots+1 contingency

  – (0.75, 0.70) 2 shots+1 contingency

  – (0.75, 0.55) 2 shots+1 contingency

  total: 8 shots+4 contingency

- If plan B is used, experiment can be run as two half days with the higher B_T shots run when 0.75 T capability becomes available.
- If long quasi-steady-state MHD quiescent L-mode is achieved (current flattop >2.5 s), then we can incorporate SGI density perturbation in shots in the B_T and I_P scan
  – First second of current flattop for the validation study
  – The SGI density perturbation induced for the rest 1.5 second

XP-1521 Experimental Plan (cont.)

- If long quasi-steady-state MHD quiescent L-mode is achieved (current flattop ~2 s), Walter Guttenfelder's perturbative momentum transport XP can also be run on the same day as this XP
  - Apply 2-3 short RMP pulses (~10-50 ms duration, every ~200 ms) that could be used for the perturbative momentum transport XP

- The least total number of good shots required for the experiment is 6

Diagnostic Needs and Analysis

- Must-have diagnostics:
  - BES, reflectometer
  - CHERS, MPTS, MSE
  - Magnetics
  - other diagnostics required for conducting TRANSP analysis

- Planned analysis
  - LRDFIT, TRANSP, GS2, GYRO, GTS, XGC1