NSTX-U

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NSTX-U Collaboration Status and Plans for: LLNL/CHI CHI Modeling on NSTX-U

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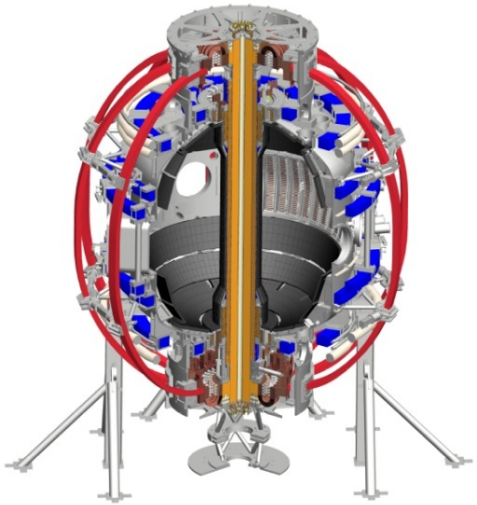
X Science LLC

Bick Hooper
Carl Sovinec
Roger Raman

NSTX-U Collaborator Research Plan Meetings
PPPL – LSB B318
April / May 2014



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Research plans and needs for this year (FY2014) in preparation for NSTX-U operations in FY2015

- CHI simulations extended to include density injection
  - In simulations with helicity injection only, the closed flux volume is less than deduced in experiments — density injection may be a cause
    - Experiments — Density injection is used rather than prefilled density
    - Simulation — Low density in the "Vacuum" region outside injected flux "bubble" is new — modeled using enhanced radiation
    - Preliminary results → Find sensitivity of density distribution, plasma temperature and other parameters — conclusions still "working"
    - Also ongoing — Effects of impurity radiation during density inject.
    - These new simulations use an upgraded NIMROD (Carl Sovinec)
- Plans for later this year
  - Modify boundary conditions for NSTX-U
    - Begin simulations to determine conditions for simulated injection (Voltage, Injection current, toroidal current)
    - Examine conditions for flux-surface closure — compare with NSTX
    - Begin comparison of other physics with NSTX results

Research Plans for FY2015

- Continue study of helicity injection in NSTX-U and compare with experiment (when available)
  - Example: The new operating conditions may allow higher electron temperatures and toroidal currents
    - Examine injection scaling with temperature
    - This work will extend the impurity radiation study
  - Support experimental planning including differences between NSTX and NSTX-U
  - Work with Roger Raman to obtain data needed to provide further, detailed comparison with the MHD model
  - Support experiments on the transfer to auxiliary current drive

Ideas to enhance participation in NSTX-U research/program by U.S. Universities, early-career researchers, and students

- Helicity injection startup studies in NSTX-U will include "localized" injection (Ray Fonck's group) → Suggestion:
  - Consider supporting a student for Carl Sovinec to extend localized-injection ("flux-rope") modeling to NSTX-U
    - Extend the recent simulations by O'Bryan and Sovinec*
    - Support the new experiments on NSTX-U
    - Allow comparing physics results (and current-drive opportunities) using simulations of TCHI and localized injection
  - I would be pleased to support Carl and a student in such a comparison of the modeling

*PPCF **56**, 064005 (2014)