



U.S. DEPARTMENT OF  
**ENERGY**

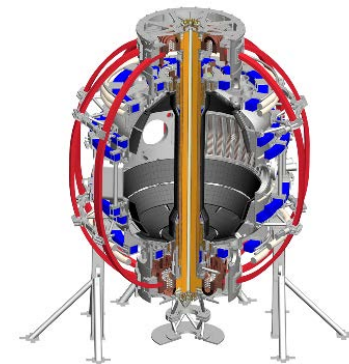
Office of  
Science



# Program update

J. Menard  
for the NSTX-U Team

NSTX-U Team Meeting  
MBG auditorium  
September 15, 2016



# Outline

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- Program status and plans
- Collaboration opportunities
- Engineering reviews

# Very scientifically productive year

- Thank you for contributions to FY16 year-end report
  - Many capabilities brought online and provided new data
  - Substantial new physics results + continued analysis of NSTX data
    - ~200+ pages of research content
  - Shared with FES for their assessment of our performance
  - Highly useful for IAEA, APS, FWP
- Link on NSTX-U homepage:

[http://nstx.pppl.gov/DragNDrop/Reports/Quarterly\\_Reports/2016/Q4/](http://nstx.pppl.gov/DragNDrop/Reports/Quarterly_Reports/2016/Q4/)



## NSTX-U FY2016 Year End Report

J. Menard, M. Ono, and the NSTX-U Team  
September 14, 2016 – Version 13

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FY2016 Research Milestones:	
o R(16-1): Assess H-mode energy confinement, pedestal, and SOL characteristics with higher BT, Ip and NBI heating power	45
o R(16-2): Assess the effects of NBI parameters on the fast ion distribution function and neutral beam driven current profile	51
o R(16-3): Develop the physics and operational tools for obtaining high-performance discharges in NSTX-U	55
Additional Research Highlights:	
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• NSTX-U FY2016 Publications, Invited talks, Seminars, Major awards, Hosted Meetings, and External Leadership (PPPL employees only)	217

# Near and long-term NSTX-U schedule

- Results Review – Wed-Thu, Sept 21-22 in B318
  - Draft agenda circulated by Stan
- Run Assessment – Wed, Sept 28 also in B318
- Q1 FY2017: Data analysis and preparation for major fusion meetings including IAEA FEC, APS, and ITPA.
- Q3 - PAC-38 - date TBD
- Q4 - Diagnostic and operations preparations and experimental planning (aka Research Forum)
- **Opportune time for collaborations on other facilities: Dec 2016 to Aug/Sept of 2017**

# Outline

- Program status and plans
- **Collaboration opportunities**
- Engineering reviews

# Recently solicited PPPL NSTX-U researchers regarding collaboration interests

- Collaboration ideas should ideally complement / extend NSTX-U research results and plans
- Initial feedback - total of ~3 FTE years of collaboration ideas proposed (in addition to existing collaborations)
  - DIII-D: Core transport and MHD/EP, pedestal physics, support FY2017 joint research target on dissipative divertors
  - EAST: Edge physics, plasma material interactions (high-Z, Li)
  - JET: Energetic particle studies and plasma ramp-down scenario development and modelling
  - KSTAR: Core MHD and rotation physics, plasma control
  - MAST-U: Control, scenario modelling supporting 1<sup>st</sup> plasma
- **Similar interests? want to join forces? let us know!**

# Off-site facility operations schedules (1)

(Questions? Ask R. Hawryluk, R. Maingi, D. Gates, J. Menard)

- ASDEX-U: Start Feb 2017, run thru year except Aug/Sep (RH)
- DIII-D: Start Jan 23 and run thru July (RH)
  - 6 run weeks, perhaps additional week for “Frontier Science” and another for “National Campaign”
- EAST: not finalized - normally operate April-June, Nov-Dec (RM)
- JET: Next campaign: Oct. 10- Nov. 11 (RH)
  - Pre-DT Shutdown: Nov. - August 2017
  - Restart: September – Dec 2017, physics experiments: Dec. 2017
- KSTAR: start ops in April 2017, end August 2017 (RH, JK Park, S. Sabbagh)

# Off-site facility operations schedules (2)

(Questions? Ask R. Hawryluk, R. Maingi, D. Gates, J. Menard)

- LHD: H-ops Feb 8, D expts starting Mar 7 (DG)
- MAST-U goal: 1<sup>st</sup> plasma in ~1 year, research by end of CY17 (JM)
- TCV: Nearly continuous operation (RH)
  - Except 4-5 weeks in January-February and 4-5 weeks between August and September
  - Probably avoid the EUROfusion campaign in June and July
- W7-X: Start July 2017 with 20 week run (DG)
  - Taking proposals now, run planning workshop Feb/Mar 2017



# ITER Science Fellows Program (1)

(more info on the [web...](#))

- **ITER goal for program:**

- “Create a network of scientists and physicists working on simulation and theory within the research laboratories and institutes of the ITER Members, with strongly reinforced ties to ITER Project and team.”



# ITER Science Fellows Program (2)

(more info on the [web](#)... or talk to Rich H / Jim Van Dam)

- **ITER Scientist Fellows will:**

- Be drawn from the leading researchers in the Members' fusion communities who have achieved international recognition for their contributions to fusion research.
- Be chosen by the Director-General, supported by the Executive Project Board, based on nominations from the heads of institutions.
- Remain in the employ of their home institutions
- Interact closely with the ITER Science & Operations Department in the definition of a research program and with other Fellows in its implementation.
- Spend average of 25-30% of time on ITER-related issues
  - 4 priority research areas: ELM control, disruption mitigation, edge plasma modelling, and integrated modelling (focus areas which may expand as the program evolves).

# Outline

- Program status and plans
- Collaboration opportunities
- **Engineering reviews**

# FY17 FES “Notable Outcomes” emphasize getting NSTX-U to full performance, improving processes

- **Thorough assessment of coils and in-vessel components**
  - “Complete an extent-of-condition review of NSTX-U, chaired by an independent subject matter expert, to identify possible design and construction deficiencies in the experimental device that might affect NSTX-U operation at full parameters....”
- **Reviews of new coils, tubes + any extent of condition items**
  - “Complete a final engineering design review, chaired by an independent subject matter expert, certifying that all engineering analysis tasks identified in the preceding notable outcome have been successfully executed....”
- **Improve engineering review and design change procedures**
  - “Conduct a review of policies and procedures for engineering changes made during construction, installation, and operational startup of NSTX-U and develop corrective actions to ensure that they effectively and efficiently identify, consider, and avoid or mitigate technical and operational risks.”

# Additional comments from JEM

- Research and engineering need to continue to work as a team to make the best long-term decisions about facility modifications
  - When replacing/upgrading components, should revisit design requirements as needed, based on FY16 ops experience
- Need to be open to suggestions about how to improve engineering processes, procedures, organization
  - We will get help from external committees, but our own personnel know and experience the issues first-hand
  - Insufficient analysis of electromagnetic effects on nominally “mechanical” objects is a persistent issue – need to remedy
    - “Critical systems” need to be identified, trigger higher/highest level of design review scrutiny – magnet systems are a prime candidate

# Summary

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- Thanks for all your contributions during FY16!
- In FY17, we will work together to move NSTX-U toward full capability safely, diligently, and ASAP
- FES, PSO, PU, PPPL remain highly supportive of NSTX-U, we thank them for their support
- **Questions?**

# Backup

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# Comments on milestones / research goals

- H-mode confinement, pedestal, SOL vs. current and field research incomplete (not really started)
  - This milestone will be carried forward in FY18
- Similarly, fast-ion confinement & AE vs. tangency radius needs MSE + run-time (and supports JRT-18)
  - Milestone will also be carried forward in FY18
- **Need sufficient time for scenario development**
- Will support 2017 JRT on dissipative divertors
  - Participate more in DIII-D since no NSTX-U ops in FY17
- Still assessing high-Z tile installation...
  - Rajesh led first Boundary SG discussions on high-Z
  - Issues: Diagnostic coverage and scientific utility if on upper OBD, installation and alignment procedure, **schedule impact**