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NSTX run plan for 2007

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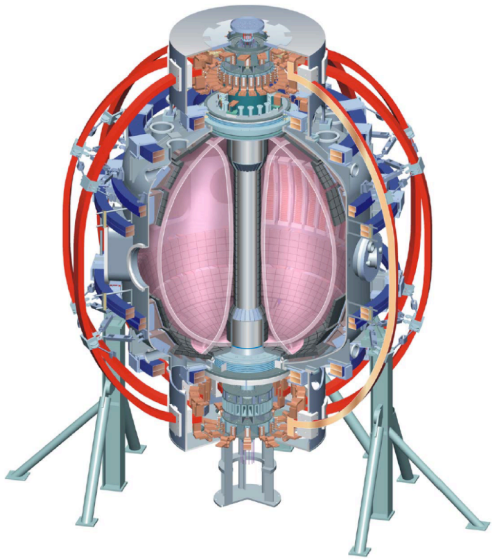
Presented at the

21st NSTX PAC meeting

January , 2007

PPPL



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Outline

- 2007 Research goals
- Research Program (by ET group)
  - MHD (S. Sabbagh, N. Gorelenkov)
  - Waves (G. Taylor, J. Hosea)
  - Transport and Turbulence (K. Tritz, S. Kaye)
  - Solenoid-free startup (R. Raman, D. Mueller)
  - Boundary Physics (V. Soukhanovskii, H. Kugel)
  - Integrated Scenario Development (R. Maingi, J. Menard)
- Research schedule

NSTX Program Planning

- NSTX Results Review (July 26-27, 2006)
- NSTX Research Forum (Dec. 5-7, 2006)
  - General guidelines (required):
    1. Is the experiment well posed? Can all the measurements be made using diagnostics that are available? Can the required plasma conditions be arranged on NSTX?
    2. Is the experiment scientifically interesting? Does successful completion of the XP answer an important question? Will the results warrant publication in a major journal?
  - Specific features (helpful):
    1. Contribution to the ST development path.
    2. Direct contribution to project milestones.
    3. Participation in ITPA sponsored joint experiments.
  - 122 proposals requesting 124 run days were presented from institutions located across the US, Europe
  - Each group was asked to prioritize experiments assuming 2 different run planning scenarios

Program Planning guidance

- Each ET was asked to prioritize according to 2 different planning scenarios one with a more run days one with less
- The run-time planning framework was:
  - MHD/Particles 8/14
  - TT 5/10
  - ISD 5/10
  - Edge 5/10
  - Startup 5/10
  - Waves 3/6

MHD/Particle ET priorities (8 days)

Milestone:

- Characterize effectiveness of closed loop RWM feedback control & dependence on rotation using ITER like control coils

ST Physics:

- High β_t with strong plasma shaping
- RWM physics at low aspect ratio

ITPA/ITER and general toroidal plasma science:

- Error field control and assessment (MDC-3)
- n=3 braking with n=1 error field correction (MDC-3)
- Neoclassical toroidal viscosity (MDC-12)
- NTM physics (MDC-3, MDC-4)
- Cross machine RWM experiments (MDC-2)
- Plasma response to 3D fields (thesis)

Color code:
Blue - Priority 1
Black - Priority 2
Light green - ITPA
Dark green - thesis

Milestones shown are from FY07 only

Run day assignments are based on 35 day initial allocation + 15 day contingency

MHD/Particle ET priorities (8 days) (cont.)

Milestone:

- Measure, identify, and characterize modes driven by super-Alfvénic ions (MDC-10)

ITPA/ITER and general toroidal plasma science:

- Fast-ion loss in the multi-mode *AE regime and in the presence of energetic particle modes (MDC-11)
- Document plasmas with Alfvén cascades
- Identification of Alfvén acoustic modes

Transport and turbulence (7 days)

Milestone:

- Study variation of local high-k turbulence with plasma conditions

ST Physics

- Ascertain the impact of very high β on the nature of turbulence (electromagnetic vs. electrostatic)
- Investigation of ion power balance on NSTX (thesis)

ITPA/ITER and general toroidal plasma science:

- β scaling of confinement (CDB-2)
- Understand scaling of confinement with aspect ratio (CDB-6)
- Understand effects of plasma rotation on confinement (braking)
- Effect q-profile on electron confinement (TP-8.2)
- Momentum confinement studies (TP-6.3)
- Z scaling of impurity transport (thesis)
- B_t scaling of high-k turbulence (thesis)

Boundary Physics priorities (6 days)

ST Physics:

- SOL width scaling at low aspect ratio

ITPA/ITER and general toroidal plasma science:

- Lithium experiments
- Pedestal scaling with aspect ratio (PEP-9)
- Cross-machine comparison of ELM regimes (PEP-16)
- Edge turbulence characterization (DSOL-15)
- ELM physics experiments
- Dust Injection
- Supersonic gas injection fuelling studies
- SOL/divertor power control experiments
- MARFE studies

Solenoid free plasma startup (4.5 days)

ST physics:

- Maximize CHI current
- Couple CHI current to OH
- HHFW heating of low current plasmas

Integrated Scenario Development priorities (4.5 days)

ST Physics

- High non-inductive fraction plasmas at high elongation
- Long pulse with reduced fuelling and higher q_{min}

ITPA/ITER and general toroidal plasma science:

- Suppression of ELMs with Resonant Magnetic Perturbations
- Improved breakdown/ramp-up scenarios
- Development of Enhanced Pedestal H-mode
- X-point limiter plasmas
- Early HHFW heating
- Radiative divertor scenarios
- MIMO control development

Waves priorities (3.5 days)

ST Physics:

- HHFW heating at higher TF (5.5kG)
- HHFW current drive at higher TF
- 13m^{-1} HHFW current drive phasing

ITPA/ITER and general toroidal plasma science:

- Understand EBW emission in both L- and H-mode plasmas (thesis)
- HHFW + NBI rotation physics (TP-6.1)

Cross-cutting and enabling (3 days)

- Allocated to tasks that benefit more than one group
  - First day physics ops (1 day machine proposal)
  - MSE calibration (1 day machine proposal)
  - RF conditioning (1 day machine proposal)

Run plan summary (50 days)

ET Group	Run days
MHD/Particles	8
Transport & Turbulence	7.5
Boundary Physics	6
Solenoid Free Startup	4.5
Integrated Scenarios	4.5
Waves	3.5
Cross-cutting & Enabling	3
Total:	37 (13 contingency to be assigned after mid-run assessment)

Unique capabilities allow NSTX to develop the ST concept and strengthen our understanding of the physics of toroidal confinement devices

- EF/RWM control unique among STs, and closely mimics ITER system
- Lithium research investigates an important option for future divertor concepts
- High-k scattering diagnostic holds promise of pinning down the causes of anomalous electron confinement
- Full complement of profile diagnostics leads to detailed physics understanding
- Solenoid free startup capability unique among all large toroidal devices
- High values of $v_{fast}/v_{Alfvén}$ provides important test of multi-mode physics for ITER
- We look forward to a productive 2007 run period