Charge to NSTX Working Groups

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NSTX Physics Meeting
B318, PPPL
January 20, 1997

NSTX Working Groups are the Centerpiece of the NSTX Research Forum

The Working Groups, guided by the NSTX scientific mission and goals, have graciously agreed to serve.

- Encourage and receive input synopses from participants on the scientific elements of NSTX research
- Organize open parallel WG Sessions during the Forum
- Hold the WG Sessions for all contributors
- Present summary of the WG Session results
- Produce WG reports on the scientific elements of NSTX research

Working Groups Discussion Should Emphasize Unique Features of ST Plasma

- Current Formation and Sustainment by Slow (DC) Mechanisms

  Electromagnetic mechanisms slower than plasma oscillations and resonances

- Heating, Current Formation and Sustainment by Fast Mechanisms

  Interactions with rf waves and energetic particles

- Magnetics and Stability Limits

  Magnetohydrodynamic (MHD) instabilities and limits

- Transport and Fluctuations

  Cross-field transport and small scale fluctuations

- Divertor, Scrape-Off Layer, Fueling

  Interaction with the non-plasma environment

Overall Agenda for NSTX Research Forum

- 2/5 am: Plenary I
  - Purpose and output of forum
  - NSTX scientific mission and performance goals
  - NSTX physics design considerations
  - NSTX baseline device, facility, diagnostics capabilities
- 2/5 pm, 2/6 am, 2/6 pm: WG Sessions I, II, III
  - 5 parallel WG Sessions for presentations, discussion, preparation of summary report
- 2/7 am: Plenary II
  - 5 WG summaries and comments (30 min each)
  - 1 summary of recommended measurements (30 min)
- 2/7 pm: One-hour tour of planned NSTX facilities
  - optional

WG Report: The Scientific Elements of NSTX Research in …

- Scientific goals for the research topic during the initial 2-3 years of NSTX experimentation, emphasizing the unique ST plasma properties
- Recommended research elements to achieve these goals
  - Anticipated scientific results
  - Necessary plasma operating conditions
  - Necessary measurements and accuracy
  - Diagnostics ideas
- Recommended priority or schedule for these elements of research
- Appendix: synopses

WG Schedule

- January 20: receive inputs (synopsis)
- January 27: organize and distribute WG session agendas
- February 5-7: NSTX Research Forum
- Mid-February: issue WG reports on web

Back-up and Updated Information to Follow

ST Features for WG1: Current Formation and Sustainment by Slow (DC) Mechanisms

- Physics Mechanisms
  - Magnetic flux induction
  - Helicity injection
  - Magnetic reconnection, etc.
- Unique ST Plasma Features
  - Smaller magnetic flux and helicity content than Tokamak
  - Similar poloidal flux to and larger helicity than Spheromak, FRC, Spherical RFP
  - Presence of applied toroidal field, etc.

ST Features for WG2: Heating, Current Formation and Sustainment by Fast Mechanisms

- Physics Mechanisms
  - Alfven waves
  - Ion cyclotron waves
  - Lower hybrid waves
  - Electron cyclotron waves
  - Suprathermal ions (E ~ 100 keV)
  - Sheared flow
- Unique ST Plasma Features
  - Large ratio of electron cyclotron to plasma frequencies
  - Large ratio of beam ion to Alfven speeds
  - Beam ion gyroradius comparable to “banana” width

ST Features for WG3: Magnetics and Stability Limits

- Physics Mechanisms
  - Ballooning modes
  - Kink modes
  - Tearing modes
  - Conducting shell effects
  - Kinetics effects
  - Non-ideal effects, etc.
- Unique ST Plasma Features
  - Large pressure (temperature and/or density) gradients
  - Large current density gradients
  - Large bootstrap, Phirsch-Schlutter, diamagnetic currents
  - Large magnetic shear near edge, etc.

ST Features for WG4: Transport and Fluctuations

- Physics Mechanisms
  - Corrections to neoclassical model
  - Electrostatic fluctuations
  - Electromagnetic fluctuations
  - Suppression by sheared flow, etc.
- Unique ST Plasma Features
  - Large magnetic well in plasma core (central local beta ~ 1)
  - Large magnetic shear near edge
  - Large field line curvature near edge relative to plasma cross section
  - Large ratio of gyroradius to minor radius, relative to tokamak
  - Large guiding center orbit near magnetic axis
  - Compressed guiding center orbit away from magnetic axis, etc.

ST Features for WG5: Interaction with Non-Plasma Environment

- Physics Mechanisms
  - Open flux tube (SOL) instabilities
  - Parallel and cross field transport in SOL
  - Interactions with neutrals
  - Interactions with impurities
  - Interactions with solid surfaces
  - Interactions with injected pellets
  - Interactions with injected compact tori, etc.
- Unique ST Plasma Features
  - Inboard limited plasmas with naturally diverted SOL (natural divertor)
  - Large variations in magnetic field strength (mirror ratio)
  - Large field line curvature relative to plasma cross section
  - Possibly strong interchange instability with tied ends, etc.

Purpose of NSTX Research Forum (2/5 7/97)

- Provide an efficient opportunity to
  - Outreach to the broad expertise of the U.S. magnetic fusion community for input
  - Develop the scientific elements of

  the National NSTX Research Program

Researchers Interested in Participating in NSTX Research are Encouraged to Send Inputs to WGs

Send one-page synopsis to all Coordinators, Assistant and Members of WGs of appropriate topics, containing

- Scientific issue(s) being addressed
- Relevance to ST Fusion and/or Plasma Science, identifying uniqueness to ST plasmas
- Measurements needed and/or recommended
- Plasma parameters and operating conditions required

WG1: Current Formation and Sustainment by Slow (DC) Mechanisms

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WG3: Magnetics and Stability Limits

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WG5: Divertor, Scrape-Off Layer, and Fueling

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