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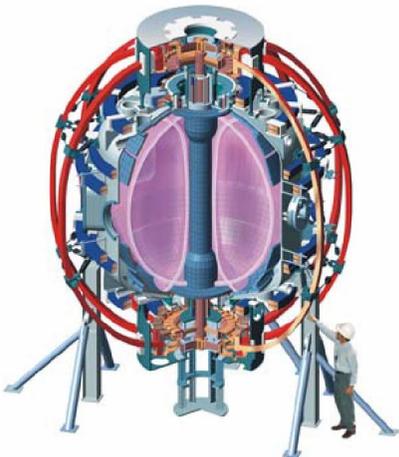


# MHD ETG Breakout Session Summary

S.A. Sabbagh / D.A. Gates  
(Columbia U. / PPPL)

**NSTX Research Forum**  
September 22 - 24, 2004  
Princeton Plasma Physics Laboratory

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ENEA, Frascati  
CEA, Cadarache  
IPP, Jülich  
IPP, Garching  
U Quebec



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# MHD XP ideas focus on advanced NSTX capabilities

## ❑ Overall

- ❑ Presentations / ideas address exciting MHD research clearly targeting leading edge physics questions in the world community

## ❑ Talks

- ❑ Relaxation in MFE experiments: T. Jarboe
- ❑ Ellipticity criterion for flowing two-fluid high  $\beta$  equilibria: A. Ishida
- ❑ MHD activity induced toroidal flow damping: K. Shaing

## ❑ Proposals

- ❑ 15 experimental proposals requesting run time
  - Run time oversubscribed by a factor of 2
- ❑ Prioritization for 8 run days seriously sacrifices proper demonstration of the benefit/physics from key system upgrades
- ❑ Schedule for 12 run days plus some contingency was thought to at least have a reasonable chance of addressing key physics

# MHD XP Presentations: NSTX Forum 9/22/2004

- ❑ MHD XP Presentations requesting run time
  - ❑ Troyon Scaling at high  $I_N$ , high  $\delta$ , modified PF1A (Gates) 2-3 days
  - ❑ Error field/locked-mode studies using RWM coils (Menard) 2.0 days
  - ❑ Onset and saturation characteristics of the 1/1 mode (Menard) 1.5 days
  - ❑ MHD spectroscopy of wall stabilized high  $\beta$  plasmas (Sabbagh) 1.0 days
  - ❑ Suppression of resonant field amplification at high  $\beta_N$  (Sabbagh) 1.0 days
  - ❑ Active stabilization of the resistive wall mode (Sabbagh) 2.0 days
  - ❑ XP414: Aspect ratio effects near the high  $\beta_p$  equilibrium limit (Sabbagh) 1.5 days
  - ❑ XP428: Dissipation physics of the RWM (Sontag) 1.5 days
  - ❑ XP453: DIII-D/NSTX RWM similarity experiment (Sontag) 1.5 days
  - ❑ Active control of rotation damping in RWM plasmas (Zhu) 1.5 days
  - ❑ Fishbone mode and the beam ion distribution function (Heidbrink) 1.0 days
  - ❑ Neoclassical tearing modes (Fredrickson) 1.0 days
  - ❑ Kinetic Instabilities – TAE/central shear/q(0) – L-mode (Fredrickson) 0.5 days
  - ❑ DIII-D/NSTX CAE similarity experiment ( $B_t = 6$  kG) (Fredrickson) 0.5 days
  - ❑ External kink and control of RWM (Okabayashi) 1.0 days

**(guidance: 8 days for 14 week run, 12 days for longer run)**      Run days: 19.5-20.5

# MHD XP Prioritization: NSTX Forum 9/22/2004 (8 day)

- ❑ MHD XP Presentations requesting run time
  - ❑ Troyon Scaling at high  $I_N$ , high  $\delta$ , modified PF1A (Gates) 1.0 days
  - ❑ Error field/locked-mode studies using RWM coils (Menard) 1.0 days
  - ❑ MHD spectroscopy of wall stabilized high  $\beta$  plasmas (Sabbagh) 1.0 days
  - ❑ Suppression of resonant field amplification at high  $\beta_N$  (Sabbagh) 1.0 days
  - ❑ Active stabilization of the resistive wall mode (Sabbagh) 1.0 days
  - ❑ XP453: DIII-D/NSTX RWM similarity experiment (Sontag) 0.5 days
  - ❑ XP428: Dissipation physics of the RWM (Sontag) 0.5 days
  - ❑ Onset and saturation characteristics of the 1/1 mode (Menard) 0.5 days
  - ❑ Active control of rotation damping in RWM plasmas (Zhu) 1.0 days
    - External kink and control of RWM (Okabayashi)
  - ❑ XP414: Aspect ratio effects near the high  $\beta_p$  equilibrium limit (Sabbagh) 0.5 days
  - ❑ Fishbone mode and the beam ion distribution function (Heidbrink) 0.5 days
  - ❑ DIII-D/NSTX CAE similarity experiment ( $B_t = 6$  kG) (Fredrickson) 0.5 days
  - ❑ Neoclassical tearing modes (Fredrickson) (piggyback) 0.0 days
  - ❑ Kinetic Instabilities – TAE/central shear/q(0) – L-mode (Fredrickson) (pb) 0.0 days

(guidance: 8 days for 14 week run, 12 days for longer run)

Run days: 8.0



NSTX

MHD Task Group

# MHD XP Prioritization: NSTX Forum 9/22/2004 (12 day)

MHD XP Presentations requesting run time	MHD (contingency)
<input type="checkbox"/> Troyon Scaling at high $I_N$ , high $\delta$ , modified PF1A (Gates)	1.5 days (+1.5)
<input type="checkbox"/> Error field/locked-mode studies using RWM coils (Menard)	1.5 days (+0.5)
<input type="checkbox"/> MHD spectroscopy of wall stabilized high $\beta$ plasmas (Sabbagh)	1.0 days
<input type="checkbox"/> Suppression of resonant field amplification at high $\beta_N$ (Sabbagh)	1.5 days
<input type="checkbox"/> Active stabilization of the resistive wall mode (Sabbagh)	1.5 days (+0.5)
<input type="checkbox"/> XP453: DIII-D/NSTX RWM similarity experiment (Sontag)	1.0 days
<input type="checkbox"/> XP428: Dissipation physics of the RWM (Sontag)	0.5 days (+0.5)
<input type="checkbox"/> Onset and saturation characteristics of the 1/1 mode (Menard)	0.5 days
<input type="checkbox"/> Active control of rotation damping in RWM plasmas (Zhu)	1.0 days
<ul style="list-style-type: none"><li>• External kink and control of RWM (Okabayashi)</li></ul>	
<input type="checkbox"/> XP414: Aspect ratio effects near the high $\beta_p$ equilibrium limit (Sabbagh)	0.5 days
<input type="checkbox"/> Fishbone mode and the beam ion distribution function (Heidbrink)	0.5 days
<input type="checkbox"/> DIII-D/NSTX CAE similarity experiment ( $B_t = 6$ kG) (Fredrickson)	0.5 days (+0.5)
<input type="checkbox"/> Neoclassical tearing modes (Fredrickson)	0.5 days
<input type="checkbox"/> Kinetic Instabilities – TAE/central shear/q(0) – L-mode (Fredrickson) (pb)	0.0 days

(guidance: 8 days for 14 week run, 12 days for longer run) Run days: 12.0 (+ 3.5 contingency)

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# MHD XP priority naturally suited to new capabilities

## ❑ Prioritization process

- ❑ Although run time guidance is very tight, group handled the task smoothly and efficiently
- ❑ With proper run time and manpower support, MHD ETG XPs can yield results/physics understanding on advanced issues

## ❑ Advancement leverages system/diagnostic upgrades

- ❑ PF1A upgrade for greater  $\kappa$ , shape control
- ❑ Full RWM coil capability / feedback control development
- ❑ MSE diagnostic (between-shots highly desired)
- ❑ Between-shots CHERS
  - Required to support between-shots equilibrium fits with rotation
  - Issue with insufficient signal in many high performance plasmas

## ❑ Early preparation required to make plan work

- ❑ Set up meetings where necessary ...*start your XPs!*