

**Princeton Plasma Physics Laboratory  
NSTX Experimental Proposal**

**Title: Effect of Rotation on Energy and Impurity Confinement**

**OP-XP-812**

Revision:

Effective Date: **2/25/2008**

Expiration Date:  
*(2 yrs. unless otherwise stipulated)*

**PROPOSAL APPROVALS**

**Responsible Author: S. Kaye**

Date

**ATI – ET Group Leader: S. Kaye**

Date

**RLM - Run Coordinator: M. Bell**

Date

**Responsible Division: Experimental Research Operations**

**Chit Review Board** (designated by Run Coordinator)

**MINOR MODIFICATIONS** (Approved by Experimental Research Operations)

# NSTX EXPERIMENTAL PROPOSAL

TITLE: **Effect of rotation on energy and impurity confinement**

No. **OP-XP-812**

AUTHORS: **S. Kaye, L. Delgado-Aparicio**

DATE: **Feb 12, 2008**

## 1. Overview of planned experiment

The goal of this experiment is to study the effect of varying rotation on energy and impurity confinement and transport in steady H-modes. Steady  $n=3$  braking fields will be used to vary the plasma rotation.

## 2. Theoretical/ empirical justification

ExB shear could have profound effect on local turbulence and transport, and rotation and shear can be varied using the  $n=3$  braking. There were attempts to do this last year in dedicated scans, but MHD activity led to plasma distress, and the changes in transport properties could not be assessed properly. A subsequent NTM experiment used the  $n=3$  braking fields without destabilizing MHD immediately, and these discharges will be used as a basis for this year's experiment. This XP addresses one of the elements of the 2008 Joule milestone.

## 3. Experimental run plan

- Attempt to attain MHD quiescent H-mode condition with no Lithium, shot 123848 (2-4 shots); no  $n=3$  braking (decrease  $I_p$  to 0.9 MA, increase  $B_T$  to 5.5 kG)
- If this fails, attempt MHD quiescent condition with 121154 (2-4 shots); no  $n=3$  braking
- If failure in  $\frac{1}{2}$  day: Cut losses and move on
  - Return later in no-Li portion of run, or with Li
- If successful in either condition
  - Increase  $n=3$  fields in 4 to 5 steps
    - 400 A, 600 A, 650 A, 700 A, .... until MHD shortens discharge
      - » Ensure no large islands at any  $n=3$  current (SXR, profiles)
    - 3 shots/condition: no impurity injection, impurity injection @ 400 ms, no impurity injection
- Total: 15-21 shots

## 4. Required machine, NBI, RF, CHI and diagnostic capabilities

Shot development needed to attain MHD quiescent H-mode condition

## 5. Planned analysis

LRDFIT, TRANSP, NTV analysis (IPEC), specialized codes

## 6. Planned publication of results

Joule milestone, TTF, IAEA, PRL (?)

# PHYSICS OPERATIONS REQUEST

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Machine conditions (specify ranges as appropriate)

$I_{TF}$  (kA): **64** (5.5 kG)      Flattop start/stop (s):

$I_p$  (MA): **0.9**      Flattop start/stop (s):

Configuration: **LSN**

Outer gap (m):      Inner gap (m):

Elongation  $\kappa$ : **2.3**      Upper/lower triangularity  $\delta$ : **0.8**

Z position (m): **0**

Gas Species: **D**      Injector(s):

**NBI** Species: **D** Sources: **3**      Voltage (kV): **80, 90**      Duration (s): **full shot**

**ICRF** Power (MW): **0**      Phasing:      Duration (s):

**CHI**: **Off**      Bank capacitance (mF):

**LITER**: **Off (during initial attempt at XP)**

Previous shot numbers for setup: **123848, 121154**

## DIAGNOSTIC CHECKLIST

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Diagnostic	Need	Want
Bolometer – tangential array	x	
Bolometer – divertor		
CHERS – toroidal	x	
CHERS – poloidal	x	
Divertor fast camera		
Dust detector		
EBW radiometers		
Edge deposition monitors		
Edge neutral density diag.		
Edge pressure gauges		
Edge rotation diagnostic		x
Fast ion D_alpha - FIDA	x	
Fast lost ion probes - IFLIP		
Fast lost ion probes - SFLIP		x
Filterscopes	x	
FIRETIP		x
Gas puff imaging		x
H $\alpha$ camera - 1D		
High-k scattering		x
Infrared cameras		
Interferometer - 1 mm		
Langmuir probes - divertor		
Langmuir probes – RF ant.		
Magnetics – Diamagnetism	x	
Magnetics - Flux loops	x	
Magnetics - Locked modes	x	
Magnetics - Pickup coils	x	
Magnetics - Rogowski coils	x	
Magnetics - RWM sensors	x	

Diagnostic	Need	Want
Mirnov coils – high f.	x	
Mirnov coils – poloidal array	x	
Mirnov coils – toroidal array	x	
MSE	x	
NPA – ExB scanning		
NPA – solid state		x
Neutron measurements	x	
Plasma TV		
Reciprocating probe		
Reflectometer – 65GHz		
Reflectometer – correlation		
Reflectometer – FM/CW		
Reflectometer – fixed f		x
Reflectometer – SOL		
RF edge probes		
Spectrometer – SPRED	x	
Spectrometer – VIPS		
SWIFT – 2D flow		
Thomson scattering	x	
Ultrasoft X-ray arrays	x	
Ultrasoft X-rays – bicolor	x	
Ultrasoft X-rays – TG spectr.		
Visible bremsstrahlung det.		x
X-ray crystal spectrom'r - H		
X-ray crystal spectrom'r - V		
X-ray fast pinhole camera		
X-ray spectrometer - XEUS		x