Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: **Effect of Rotation on the L-H Threshold**

OP-XP-841	Revision: **0**	Effective Date: **6/19/08** Expiration Date: *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Responsible Author: Stanley Kaye	Date 6/22/08
ATI – ET Group Leader: Stanley Kaye	Date
RLM - Run Coordinator: Michael Bell	Date
Responsible Division: Experimental Research Operations	

Chit Review Board (designated by Run Coordinator)

MINOR MODIFICATIONS (Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL

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AUTHORS: **S. Kaye** DATE: **June 19, 2008**

1. Overview of planned experiment

The goal of this experiment is to study the effect of rotation on the L-H threshold power. n=3 braking will be used to vary the rotation.

2. Theoretical/ empirical justification

This XP is an element of the study of the 2008 Joule milestone, and it is to study the effect of rotation, and by extension rotational shear at the edge, on the L-H threshold. This has direct bearing on developing an understanding of the effect of this edge rotational shear and how it might impact thresholds in future devices at both low rotation (ITER) and at higher rotation (NHTX, ST-CTF).

3. Experimental run plan

- Establish L-H threshold power in low-κ, δ discharge (129019 baseline) using one source (use B initially); vary voltage in source to achieve threshold. If necessary modulate source to lower power even farther
  - Use optimal n=3 error field correction (-300 A in SPA1) and n=1 mode control
  - Source C will allow lower power (voltage) if necessary
- Vary n=3 SPA coil current to 0 A, 400 A, 800 A
  - Establish threshold in same manner at each level.
- Use 10-15 mg/min Li evaporation.
- No HeGDC between shots.
- Shorten shot to 500-600 ms to reduce shot cycle to 10 minutes.

TABULAR SHOT LIST

Condition	I_p (MA)	B_T (T)	SPA 1 Current (steady)
1	0.9	0.45	-300 A (optimum)
2	0.9	0.45	0 A
3	0.9	0.45	400 A
4	0.9	0.45	800 A

Total: 18 shots

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

Discharge reproducibility, ability to achieve H-mode with one source.

Important feature is to use NBI pre-heat (source A only) from 80-140 ms, then turn source back on after I_p flattop, at 220 ms.

5. Planned analysis

EFIT, TRANSP, specialized codes

6. Planned publication of results

Joule milestone, TTF, ITPA, IAEA

PHYSICS OPERATIONS REQUEST

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Machine conditions (specify ranges as appropriate)

I_{TF} (kA): **52 (4.5 kG)** Flattop start/stop (s):

I_P (MA): **0.9** Flattop start/stop (s):

Configuration: **LSN**

Outer gap (m): Inner gap (m):

Elongation κ: ~**1.8** Upper/lower triangularity δ: ~ **0.45**

Z position (m): **0**

Gas Species: **D** Injector(s):

NBI Species: **D** Sources: **3** Voltage (kV): **55-80 (B, C), 90 (A)** Duration (s): **<0.6 s**

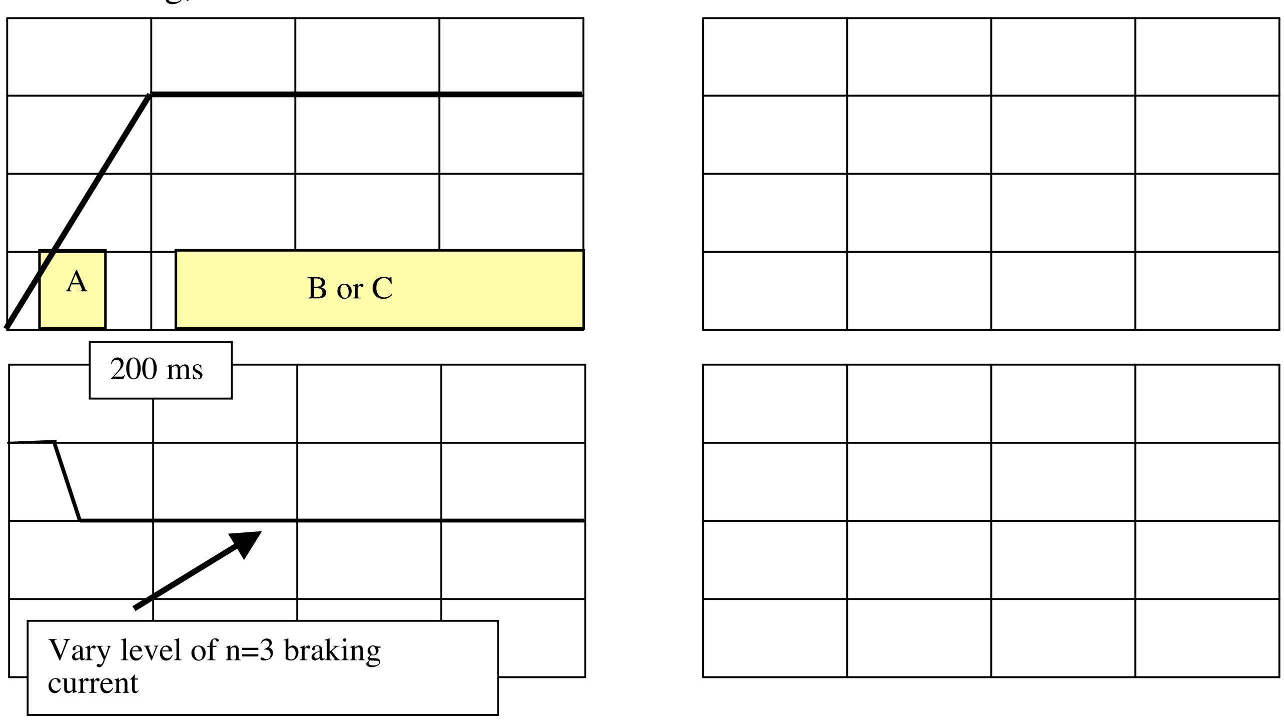
ICRF Power (MW): **0** Phasing: Duration (s):

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

LITER: Off (during initial attempt at XP)

Either: List previous shot numbers for setup: **129019**

Or: Sketch the desired time profiles, including inner and outer gaps, κ, δ, heating, fuelling, etc.



DIAGNOSTIC CHECKLIST

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Note special diagnostic requirements in Sec. 4

Diagnostic	**Need**	**Want**
Bolometer – tangential array	√	
Bolometer – divertor		
CHERS – toroidal	√	
CHERS – poloidal	√	
Divertor fast camera		
Dust detector		
EBW radiometers		
Edge deposition monitors		
Edge neutral density diag.		√
Edge pressure gauges		√
Edge rotation diagnostic	√	
Fast ion D_alpha - FIDA	√	
Fast lost ion probes - IFLIP		
Fast lost ion probes - SFLIP		√
Filterscopes	√	
FIReTIP		√
Gas puff imaging		√
Hα camera - 1D		√
High-k scattering		√
Infrared cameras		
Interferometer - 1 mm		
Langmuir probes – divertor		√
Langmuir probes – BEaP		
Langmuir probes – RF ant.	√	
Magnetics – Diamagnetism	√	
Magnetics – Flux loops	√	
Magnetics – Locked modes	√	
Magnetics – Pickup coils	√	
Magnetics – Rogowski coils	√	
Magnetics – Halo currents	√	
Magnetics – RWM sensors	√	
Mirnov coils – high f.	√	
Mirnov coils – poloidal array	√	
Mirnov coils – toroidal array	√	
Mirnov coils – 3-axis proto.		

Note special diagnostic requirements in Sec. 4

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