Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: **Parametric Study of Highly elongated plasmas**

OP-XP-836	Revision:	Effective Date: *(Approval date unless otherwise stipulated)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Responsible Author:	Date
ATI – ET Group Leader:	Date
RLM - Run Coordinator:	Date

Responsible Division: Experimental Research Operations

Chit Review Board (designated by Run Coordinator)

MINOR MODIFICATIONS (Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL

TITLE: **Parametric Study of Highly elongated plasmas** No. **OP-XP-836**
AUTHORS: **D. Gates** DATE: **5/15/08**

1. Overview of planned experiment

The goal of this experiment is expand on work done last year aimed at developing high non-inductive current fraction plasmas at high plasma elongation. This involves a plasma current scan, a toroidal field scan, the use of lithium, and the use of the error field correction/feedback capabilities.

2. Theoretical/ empirical justification

It is well known that the bootstrap fraction depends on β_p, and that higher elongation raises β_p for fixed plasma current and β_N. The purpose of this experiment is to optimize the bootstrap fraction by finding the optimum elongation.

3. Experimental run plan

1. Use Liter at 40mg/min, (use no glow scenario if this is effective). Start with shot 129125. (1 shot)

2. Increase plasma elongation in increments of 0.1 (3 -5 shots)

3. Using elongation with optimum non-inductive current, increase toroidal field in 0.25kGauss increments up to 5.5 kGauss. Adjust pulse to avoid trips. (12 shots)

4. Do current scan at select toroidal fields. Use optimum toroidal field, .25kGauss higher and .25 kGauss lower. Current scan from 700-900kA in 50kA steps. (12 shots)

5. Repeat 3 and 4 with lithium recently applied, but with evaporator off. Intersperse LITER-off shots if this is time efficient. (20 shots)

6. Repeat successful shots without feedback. (3 shots)

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

LITER is required. All shots require 3 NBI sources. Request Camera view of electron side if RF antenna to observe any deleterious effects of lost beam ions on the RF limiter.

5. Planned analysis

EFIT on every shot.

LRFIT and TRANSP on select shots.

6. Planned publication of results

Results are aimed at the primar mission of NSTX – demonstration of steady state operating scenarios for the ST. Successful results to be presented IAEA meeting in October of 2008 and corresponding NF paper.

PHYSICS OPERATIONS REQUEST

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Machine conditions (specify ranges as appropriate)

I_{TF} (kA): 48 -66kA Flattop start/stop (s): 0s - till max available

I_P (MA): 700-900kA Flattop start/stop (s): 0.2s – end before end of TF

Configuration: **Limiter / DN / LSN / USN**

Outer gap (m): **12cm** Inner gap (m): **8cm**

Elongation κ: **2.4-2.8** Upper/lower triangularity δ: 0.4/0.8

Z position (m): **0cm**

Gas Species: **D** Injector(s): As configured for D

NBI Species: **D** Sources: Voltage (kV): 90kV/90kV/70kV Duration (s): 2s

ICRF Power (MW): N/A Phasing: N/A Duration (s): N/A

CHI: **Off** Bank capacitance (mF): **N/A**

LITER: On and Off

Either: List previous shot numbers for setup: **129125**

Or: Sketch the desired time profiles, including inner and outer gaps, κ, δ, heating, fuelling, etc. as appropriate. Accurately label the sketch with times and values.

DIAGNOSTIC CHECKLIST

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Note special diagnostic requirements in Sec. 4

Diagnostic	Need	Want
Bolometer – tangential array		X
Bolometer – divertor		X
CHERS – toroidal	X	
CHERS – poloidal		X
Divertor fast camera		X
Dust detector		X
EBW radiometers		X
Edge deposition monitors		X
Edge neutral density diag.		X
Edge pressure gauges		X
Edge rotation diagnostic		X
Fast ion D_alpha - FIDA		X
Fast lost ion probes - IFLIP		X
Fast lost ion probes - SFLIP		X
Filterscopes		X
FIReTIP		X
Gas puff imaging		X
Hα camera - 1D		X
High-k scattering		X
Infrared cameras		X
Interferometer - 1 mm		X
Langmuir probes – divertor		X
Langmuir probes – BEaP		X
Langmuir probes – RF ant.		X
Magnetics – Diamagnetism	X	
Magnetics – Flux loops	√	
Magnetics – Locked modes	X	
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	X	
NPA – ExB scanning		X
NPA – solid state		X
Neutron measurements		X
Plasma TV		X
Reciprocating probe		X
Reflectometer – 65GHz		X
Reflectometer – correlation		X
Reflectometer – FM/CW		X
Reflectometer – fixed f		X
Reflectometer – SOL		X
RF edge probes		X
Spectrometer – SPRED		X
Spectrometer – VIPS		X
SWIFT – 2D flow		X
Thomson scattering	X	
Ultrasoft X-ray arrays	X	
Ultrasoft X-rays – bicolor		X
Ultrasoft X-rays – TG spectr.		X
Visible bremsstrahlung det.		X
X-ray crystal spectrom. – H		X
X-ray crystal spectrom. – V		X
X-ray fast pinhole camera		X
X-ray spectrometer – XEUS		X