Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: **Core Momentum Confinement Studies**

OP-XP-820	Revision:	Effective Date: **2/15/08** 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: **Core momentum confinement studies** No. **OP-XP-820**
AUTHORS: **S. Kaye** DATE: **2/15/08**

1. Overview of planned experiment

The goal of this experiment is to study the momentum confinement in an H-mode plasma core by applying perturbative torques through the use of beam blips.

2. Theoretical/ empirical justification

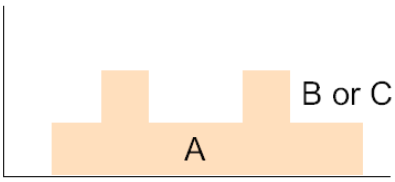
This XP is an element of the study of the momentum confinement characteristics in NSTX plasmas. This study directly addresses the 2008 Joule milestone. This is a companion XP to 813, which will be using perturbative application of n=3 braking fields to study the momentum confinement characteristics in the outer part of the plasma.

3. Experimental run plan

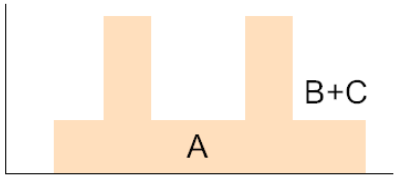
- Attempt to attain MHD quiescent H-mode condition with no Lithium, shot 123848 (2 shots); no n=3 braking (decrease I_p to 0.9 MA, increase B_T to 5.5 kG) to establish steady-state momentum confinement baseline
  - This presumably will have been done in conjunction with XPs 812 and 813
- Establish beam blip duration/separation (4 shots)
  - Want to see change with both on and off, but to minimize duration/separation times to avoid significant profile evolution
  - Considerations are density profile evolution, momentum confinement time, fast particle slowing down time
  - Start off with 40 ms on/100 ms off (370-410, 510-550 ms)
- One steady source (A), one blip source (B)
  - If cannot achieve H-mode, then either
    - A+B□A, then blip B, or
    - A+C, blip B
  - Fix I_p (0.7 MA), vary B_T (0.35, 0.45, 0.55 T) (6 shots)
  - Fix B_T (0.55 T), vary I_p (0.9, 1.1 MA) (4 shots)

- Fix I_p (0.9 MA), B_T (0.55 T) ; perform 3 blip scenarios :

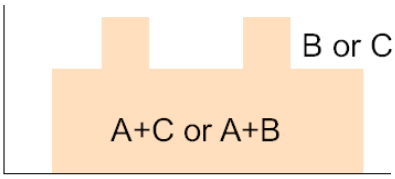
A) (4 shots, may be reduced to 2 shots, depending on blip scenario above and ability to achieve H-mode with one source)



B) (2 shots, again dependent on ability to achieve H-mode with one source)



C) (4 shots)



TABULAR SHOT LIST

Condition	I_p (MA)	B_T (T)	Steady Beam	Blip Beam
1	0.9	0.55	A	B
2	0.7	0.55	A	B
3	1.1	0.55	A	B
4	1.1	0.35	A	B
5	0.9	0.35	A	B
6	0.7	0.35	A	B
7	0.9	0.55	A	C
8	0.9	0.55	A	B+C
9	0.9	0.55	A+B	C
10	0.9	0.55	A+C	B

Total: 24 shots

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

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

5. Planned analysis

LRDFIT, TRANSP, 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 kA (5.5 kG) Flattop start/stop (s):

I_P (MA): 1.1 MA Flattop start/stop (s):

Configuration: **LSN**

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

Elongation κ: 2.3 Upper/lower triangularity δ: 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)

Shot numbers for setup: **123848, 121154; baseline condition from XP812**

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
Hα 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