

**Princeton Plasma Physics Laboratory
NSTX Experimental Proposal**

Title: **High-k turbulent fluctuations in NSTX**

OP-XP-821

Revision:

Effective Date: 02/20/08

Expiration Date:
(2 yrs. unless otherwise stipulated)

PROPOSAL APPROVALS

Responsible Author: E. Mazzucato

Date 02/20/08

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: **High-k turbulent fluctuations in NSTX**
AUTHOR: **E. Mazzucato**

No. **OP-XP-821**
DATE: **2/20/08**

1. Overview of planned experiment

Previous measurements of high-k fluctuations in Helium plasmas with HHFW heating (XP-735) have revealed the existence of a turbulence with large values of $k_{\perp}\rho_s$.

The goal of this experiment is to study the plasma response to changes in the critical gradient for excitation of this type of turbulence.

2. Theoretical/ empirical justification

In XP-735, plasmas were found near marginal stability, as defined by Jenko's empirical formula for the critical gradient of the electron temperature gradient mode. Since the latter is very sensitive to Z_{eff} and the temperature ratio T_e/T_i , the goal of this experiment is to measure high-k fluctuations in plasmas with different values of these two parameters. This could be done by employing both Helium and Deuterium plasmas (Z_{eff}) using a variable RF power and plasma densities (variable T_e/T_i).

3. Experimental run plan

First ½ day-run: repeat measurements of XP-735 in D-plasmas with a variable HHFW power (1÷2.5 MW) and a longer (> 0.35 s) RF pulse (~ 12 shots).

Second ½ day-run: same in He-plasma (~ 12 shots).

See shotlist on p. 3

Remaining of run plan (1 day) to be decided after first day operation (outboard measurements, density scan, RF+NBI)

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

XP should be scheduled after completion of XP-HHFW in D-plasmas.

Shot development needed to attain MHD quiescent conditions in D plasmas

5. Planned analysis

LRDFIT, TRANSP, Turbulence Codes

6. Planned publication of results

IAEA, PRL

Shot list for XP-821 [E. Mazzucato]				
Ref. Shot 124901: $B_T = 5.5$ kG, $I_p = 700$ kA, $n_e = 1.5 \times 10^{19}$ m ⁻³ $\Delta t_{RF} = 0.15 - 0.45$ s, $k_{ } = -7$ m ⁻¹ , $E_{NB} = 90$ kV,				
#	Filling Gas	P_{RF} [MW]	Δt_{NB} [s]	R_{scat} [m]
1	He	0.0	0-0	1.20
2	He	0.0	0.40-0.45	1.20
3	He	2.0	0-0	1.20
4	He	2.0	0-0	1.20
5	He	2.0	0.40-0.45	1.20
6	He	2.0	0.40-0.45	1.20
7	He	2.0	0.20-0.25	1.20
8	He	2.0	0.20-0.25	1.20
9	He	1.0	0.40-0.45	1.20
10	He	1.0	0.40-0.45	1.20
11	He	0.5	0.40-0.45	1.20
12	He	0.5	0.40-0.45	1.20
1	D	0.0	0-0	1.20
2	D	0.0	0.40-0.45	1.20
3	D	2.0	0-0	1.20
4	D	2.0	0-0	1.20
5	D	2.0	0.40-0.45	1.20
6	D	2.0	0.40-0.45	1.20
7	D	2.0	0.20-0.25	1.20
8	D	2.0	0.20-0.25	1.20
9	D	1.0	0.40-0.45	1.20
10	D	1.0	0.40-0.45	1.20
11	D	0.5	0.40-0.45	1.20
12	D	0.5	0.40-0.45	1.20

PHYSICS OPERATIONS REQUEST

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Machine conditions (specify ranges as appropriate)

B_{TF} (kG): 5.5 Flattop start/stop (s): 0.15 /0.6

I_P (MA): 0.7 Flattop start/stop (s): 0.15 /0.6

Configuration: As for 124901

Outer gap (m):

Inner gap (m):

Elongation κ :

Triangularity δ :

Z position (m):

Gas Species: He / D Injector:

NBI - Species: D Sources: 2 sources Voltage (kV): 90/70 Duration (s): 0.05 s blips

ICRF – Power (MW): ≤ 2 MW Duration (s): 0.15-0.55

CHI: Off

LITER: Off

List previous shot numbers for setup: 124901 with 0.15-0.60 flattop

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		
Fast lost ion probes - IFLIP		
Fast lost ion probes - SFLIP		
Filterscopes	x	
FIReTIP	x	
Gas puff imaging		
H α 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		
Neutron measurements		
Plasma TV		
Reciprocating probe		
Reflectometer – 65GHz		
Reflectometer – correlation		
Reflectometer – FM/CW		
Reflectometer – fixed f		
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		