Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: Shear profile effects on core high-k fluctuations

OP-XP-620	**Revision:** ***2006***	Effective Date: 7 June 06 *(Ref. OP-AD-97)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

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ATI – ET Group Leader: M. Bell and K. Tritz	Date
RLM - Run Coordinator: R. Raman	Date

Responsible Division: Experimental Research Operations

Chit Review Board (designated by Run Coordinator)

MINOR MODIFICATIONS (Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL

Shear profile effects on core high-k fluctuations **OP-XP-620**

1. Overview of planned experiment

Utilize the high-k scattering system to measure ρ_e-scale fluctuations in reverse shear (RS) and conventional shear (CS) discharges. Measure fluctuations both inside and outside the location of the "Te knee".

2. Theoretical/ empirical justification

Recent publications (Stutman, to be published in PoP; LeBlanc, NF 2004; and Bourdelle, PoP 2003) have explored the connection between ETG turbulence, electron thermal transport, and reverse shear profiles on NSTX. Reverse shear discharges exhibit improved core electron confinement and more peaked Te profiles compared to conventional shear discharges. The improved electron confinement may be related to reduced electron gyroscale fluctuations and ETG turbulence suppression.

The high-k scattering system can measure electron gyroscale fluctuations ($k_\perp \rho_e \leq 1$) with spatial and k-space resolution at several discrete values of $k_\perp$. With steerable optics, the scattering volume can be positioned throughout the plasma minor radius.

A prerequisite of this XP is the development of reproducible RS and CS discharges at the same plasma current, similar density profiles, and quiescent MHD. This is the objective of XP-610 (F. Levinton).

Scattering system alignment in real-space and k-space should take into account the results of XMP-44.

3. Experimental run plan

The plan is to position the scattering region at three tangency radii (107, 115, and 122 cm) and take two shots each for three discharge scenarios (CS, mild RS, and RS) for **18 shots total.** Controlled accesses will be required to reposition the scattering system.

	CS	mild RS	RS
R_{tan} = 107 cm	×2	×2	×2
R_{tan} = 115 cm	×2	×2	×2
R_{tan} = 122 cm	×2	×2	×2

The target plasmas are **121034 (CS), 121030 (mild RS), and 121040 (RS)**

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

Thomson, CHERS, NBI, reflectometer, FIRETIP, all x-ray diagnostics, all magnetics, XP610, XMP44

5. Planned analysis

TRANSP, LRDFIT, GS2

6. Planned publication of results

PoP or maybe even PRL

PHYSICS OPERATIONS REQUEST

Machine conditions (specify ranges as appropriate)

I_{TF} (kA): _____ Flattop start/stop (s): _____/_____

I_P (MA): **900** Flattop start/stop (s): _____/_____

Configuration:

Outer gap (m): _____, Inner gap (m): _____

Elongation κ: _____, Triangularity δ: _____

Z position (m):

Gas Species: **D**, Injector:

NBI - Species: **D**, Sources: **A**, Voltage (kV): **90**, Duration (s): _____

ICRF – Power (MW): ____, Phasing: , Duration (s): _____

CHI: **Off**

Either: List previous shot numbers for setup: **121040, 121034, 121030**

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

Error! Reference source not found. **OP-XP-620**

Diagnostic	Need	Desire	Instructions
Bolometer - tangential array	✓		
Bolometer array - divertor	✓		
CHERS	✓		
Divertor fast camera			
Dust detector			
EBW radiometers			
Edge deposition monitor			
Edge pressure gauges			
Edge rotation spectroscopy			
Fast lost ion probes – IFLIP			
Fast lost ion probes – SFLIP			
Filtered 1D cameras			
Filterscopes	✓		
FIReTIP	✓		
Gas puff imaging			
High-k scattering	✓		
Infrared cameras			
Interferometer – 1 mm		✓	
Langmuir probes - PFC tiles			
Langmuir probes - RF antenna			
Magnetics – Diamagnetism	✓		
Magnetics – Flux loops	✓		
Magnetics – Locked modes	✓		
Magnetics – Pickup coils	✓		
Magnetics - Rogowski coils	✓		
Magnetics - RWM sensors	✓		
Mirnov coils – high frequency	✓		
Mirnov coils – poloidal array	✓		
Mirnov coils – toroidal array	✓		
MSE	✓		
Neutral particle analyzer	✓		
Neutron Rate (2 fission, 4 scint)			
Neutron collimator			
Plasma TV			
Reciprocating probe			
Reflectometer - FM/CW		✓	
Reflectometer - fixed frequency homodyne		✓	
Reflectometer - homodyne correlation		✓	
Reflectometer - HHFW/SOL		✓	
RF antenna camera			
RF antenna probe			
Solid State NPA	✓		
SPRED	✓		
Thomson scattering - 20 channel	✓		
Thomson scattering - 30 channel	✓		
Ultrasoft X-ray arrays	✓		
Ultrasoft X-ray arrays - 2 color	✓		
Visible bremsstrahlung det.		✓	
Visible spectrometers (VIPS)		✓	
X-ray crystal spectrometer - H		✓	
X-ray crystal spectrometer - V		✓	
X-ray PIXCS (GEM) camera		✓	
X-ray pinhole camera		✓	
X-ray TG spectrometer		✓	