Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Magnetic shear effects on transport

OP-XP-829	Revision: **2008**	Effective Date: *(Approval date unless otherwise stipulated)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Responsible Author: H. Yuh	Date 4/8/2008
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

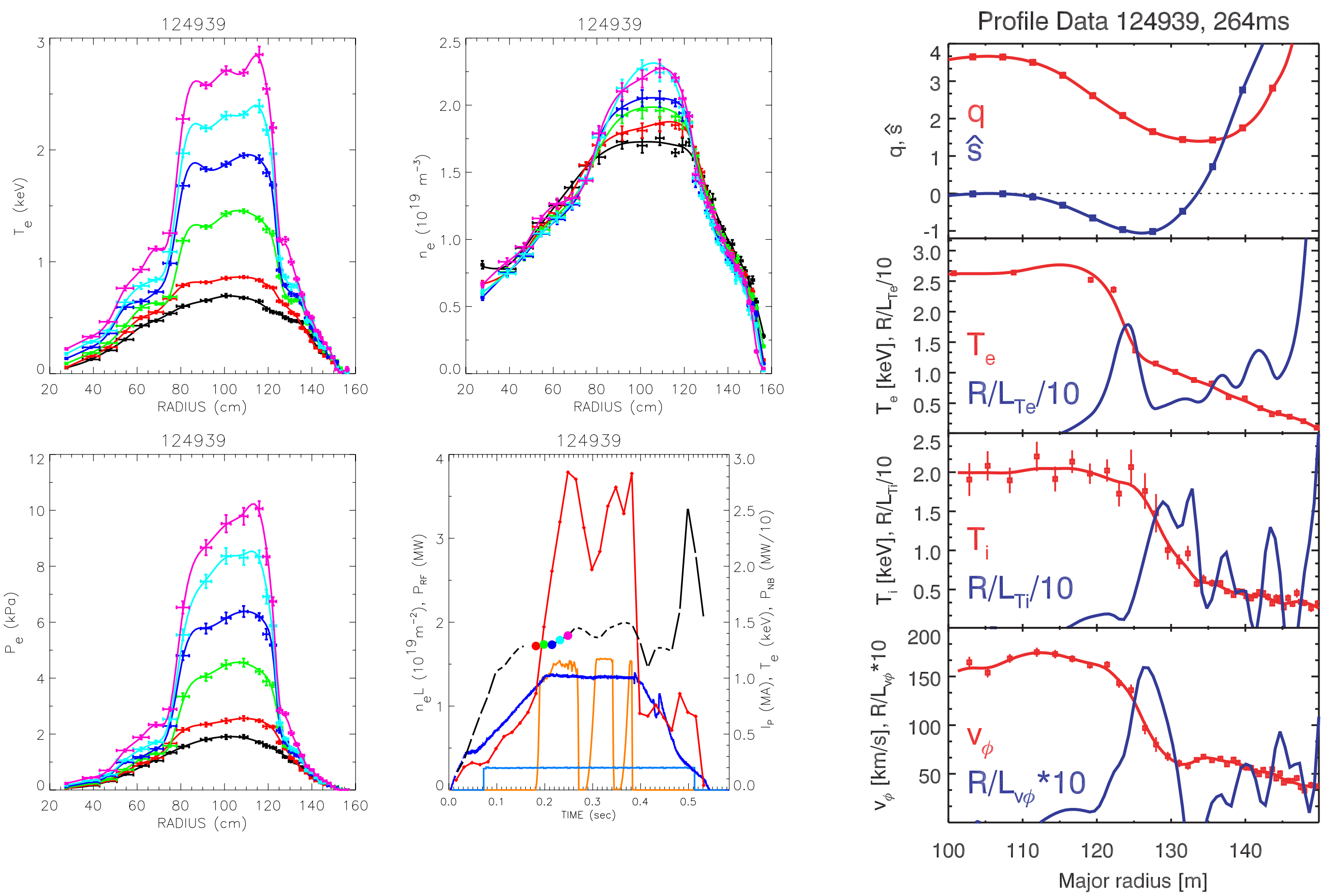
TITLE: Magnetic shear effects on transport | No. **OP-XP-829**

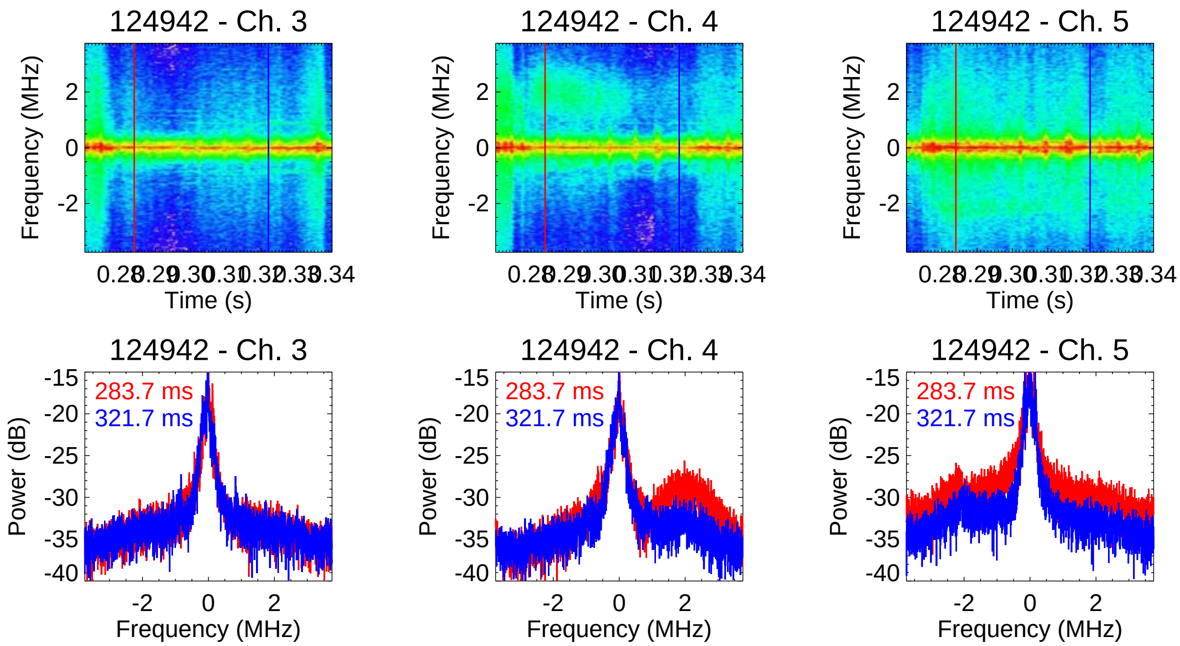
AUTHORS: **H. Yuh** | DATE: **4/3/2008**

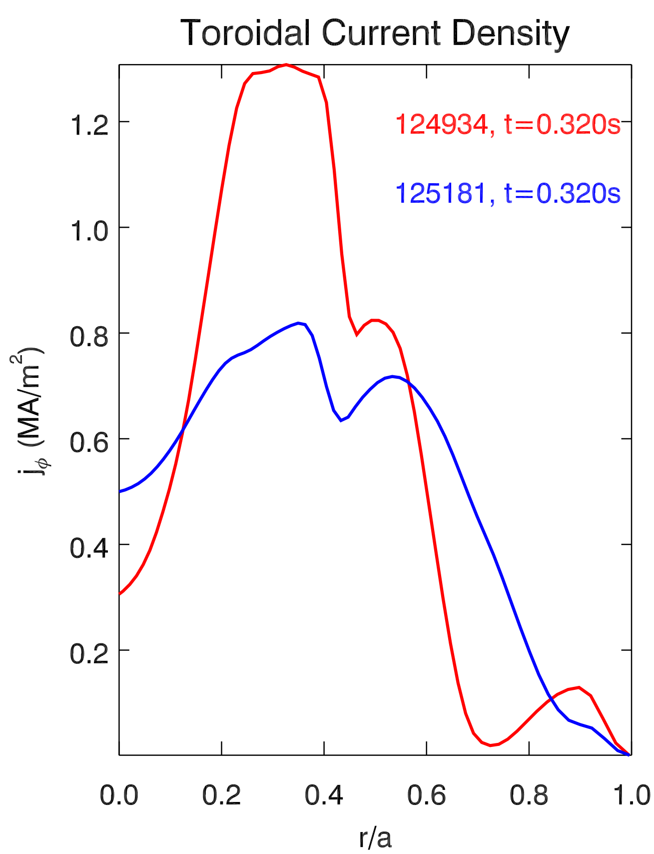
1. Overview of planned experiment

Continuing on the success of having created dramatic ITB transport profiles in 2007, we seek to extend the understanding and control of internal transport barriers in the electron, ion, and momentum channels. Specifically, the major goals for the XP in 2008 are:

1. Diagnose better using high-k the fluctuations within the ITB region. This calls for measurement of high-k fluctuations at 123-125cm.
2. Manipulate the foot of the ITB using beam timing and Ip ramp rates.







3. Try to sustain the ITB for a current diffusion time by reducing heating after establishing ITB.
4. H-mode (day 2)

2. Theoretical/ empirical justification

Prior work done in past years have produced steep R/L_{Te} that appears to exceed the critical gradients for the growth of ETG turbulence. The suppression of transport despite unstable linear growth is predicted through nonlinear simulation results by Jenko and Dorland [PRL, 2002]. This was found to be mostly consistent with experimental observations of the

3. Experimental run plan

1. Recreate 124939 and measure high-k fluctuations at 124cm (4 shots)
   A. If high-k Ch5 feature on ion side observed again, reduce high-k data sampling rate by 1MS/s. If data is aliased (f_{obs}=f - Nf_{samp}), the feature on Ch5 will change frequency but not Ch4.
2. Modification of the ITB foot via Ip ramp rate and beam timing (6 shots)
   A. Modify Ip ramp after 50ms (330kA) which nominally ends at 200ms (1MA) to 170 and 230ms.
   B. Change beam timing from 40ms and 100ms for successful current ramps.
3. Allowing ITB to persist by decreasing heating, changing momentum input (10 shots)
   A. Turn off A shortly after flattop (~210-200ms). Sustain with
      a. Sustain with RF only (1, 2 MW),
      b. Src B at 60keV, Src C at 60keV.
      c. Turn A back on prior to ITB collapse to take MSE measurements.

5. Try to duplicate ITB shots in deuterium (10 shots)
   A. Attempt to create most successful shot from He. Gas fueling changes expected

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

NBI A @ 90 keV, B @ 60 keV, RF at varying powers. He and D discharges possible.

5. Planned analysis

Linear GS2 (ongoing), exquisite LRDFITs with MSE, high-k, TRANSP (hopefully with TORIC RF deposition profiles).

6. Planned publication of results

This work is necessary to complete work for a submitted 2008 IAEA paper, and possibly others.

PHYSICS OPERATIONS REQUEST

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Machine conditions (specify ranges as appropriate)

I_{TF} (kA): 5.5kG Flattop start/stop (s):

I_P (MA): 1MA Flattop start/stop (s):

Configuration: **Repeat 124939, modified per shot plan**

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

Elongation κ: Upper/lower triangularity δ:

Z position (m):

Gas Species: Injector(s):

NBI Species: **D** Sources: A/B Voltage (kV): 90/60 Duration (s):

ICRF Power (MW): 0-2MW Phasing: Heating/CD Duration (s):

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

LITER: Off

Either: List previous shot numbers for setup:

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

TITLE: No. **OP-XP-**

AUTHORS: DATE:

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		