Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: **L-H Threshold Power: D vs He**

OP-XP-941	Revision: **0**	Effective Date: **7/22/09** *(Approval date unless otherwise stipulated)* Expiration Date: **7/22/11** *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Responsible Author: Stanley Kaye	Date 7/22/09
ATI – ET Group Leader: Kevin Tritz	Date 7/22/09
RLM - Run Coordinator: Roger Raman	Date 7/22/09

Responsible Division: Experimental Research Operations

Chit Review Board (designated by Run Coordinator)

MINOR MODIFICATIONS (Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL

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AUTHORS: **S. Kaye** DATE: **7/21/09**

1. Overview of planned experiment

The goal of this experiment is to study the species dependence of the L-H transition using HHFW in D vs He plasmas.

2. Theoretical/ empirical justification

This study is related to a high priority ITPA issue, as the first operation phase of ITER will be in non-Deuterium plasmas. The hope is to perform target scenario development in He plasmas, but L-H access in He needs to be demonstrated on present day devices. Asdex-Upgrade has shown the L-H threshold power for He to be the same as that for D, but that is the only experiment so far that has performed this study. Results from other devices are needed.

3. Experimental run plan

- Re-establish L-H transition in HHFW-heated only plasma, discharge=130632 (P_{LH}~0.85 MW)
  - Start in Helium (~ 2.0e15 cm^{-2}); inject 1.5 MW of HHFW to establish transition condition
  - Perform binary search for transition, increasing or decreasing power as necessary
    - Might need to increase or decrease outer gap and/or density
  - Redo in Deuterium
- Use optimal n=3 error field correction (-300 A in SPA1) and n=1 mode control
  - Source C will allow lower power (voltage) if necessary
- Use 15-20 mg/min Li evaporation
- Inject source A shortly after transition (after transition time is established) for CHERs, etc.

TABULAR SHOT LIST

Condition	Species	HHFW Power
1	He	Start at 1.5 MW
2	D	Start at PLH from above

Total: 12 good shots (anticipate 6 to 10 shots in each species)

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

Discharge reproducibility, including ability to achieve H-mode.

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5. Planned analysis

EFIT, TRANSP, specialized codes

6. Planned publication of results

TTF, ITPA, IAEA

NSTX PHYSICS OPERATIONS REQUEST

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Describe briefly the most important plasma conditions required for the XP:

Discharge reproducibility achieving the L-H transition.

List any pre-existing shots: 130632

Equilibrium Control: Gap Control / rtEFIT (isoflux control):

Machine conditions *(specify ranges as appropriate, use more than one sheet if necessary)*

I_{TF} (kA): **63 (5.5 kG) ?** Flattop start/stop (s):

I_P (MA): 0.8 MA Flattop start/stop (s):

Configuration: **LSN**

Outer gap (m): Inner gap (m): Z position (m): **0.00**

Elongation κ: **~2** lower triangularity δ: ~

Gas Species: **D, then He** Injector(s):

NBI Species: **D** Voltages (kV) **A: 90 B: var C:** var Duration (s):

ICRF Power (MW): <=3 MW Phasing: -150 deg Duration (s): 220 ms

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

LITERs: On Total deposition rate (mg/min): 15-20 mg/min (as in 130632?)

EFC coils: On Configuration: **optimum EF correction to start, n=1 f/b as in 130632**

DIAGNOSTIC CHECKLIST

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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		√