Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: Recycling Control Using Lithium Pellet Injection

OP-XP-515	**Revision:**	Effective Date: 02/24/05 *(Ref. OP-AD-97)* Expiration Date: 02/24/07 *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Author: H. Kugel et al	Date
ATI – ET Group Leader: R. Kaita	Date
RLM - Run Coordinator: J. Menard	Date

Responsible Division: Experimental Research Operations

Chit Review Board (designated by Run Coordinator)

MINOR MODIFICATIONS (Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL OP-XP-515

1. Overview of planned experiment

• Following special conditioning procedures, TFTR demonstrated that thin lithium films deposited on the graphite tiles of the inner toroidal limiter using lithium pellet injection could reduce recycling and impurity influxes significantly.

• NSTX will be to make contact with the TFTR database by conditioning the inner graphite Center Column limiter region with Center Column limited helium ohmic discharges. The relative change in the ratio of plasma D-alpha luminosity from recycled deuterium from previous operations to that of the edge carbon luminosity will provide a measure of the state and effectiveness of the conditioning procedure. Filtered TV cameras will be used to measure the lithium distribution on plasma facing surfaces.

• After a state of low deuterium recycling is reached, lithium will be applied by lithium pellet injection. After repeated lithium pellet injection, the density rise and fueling efficiency of Center Column limited Deuterium fiducial discharges will be measured to characterize the effectiveness of graphite tile lithium coating in controlling recycling.

2. Theoretical/ empirical justification

TFTR found that lithium deposition reduced recycling and impurities.

3. Experimental run plan

[1] Condition: using toroidally limited Helium Ohmic Disharges. [6 -30 shots]

• Condition until the ratio of the CS region Dα to CII becomes asymptotic and indicative of a well-conditioned wall.

• Note: Fewer Helium conditioning discharges may be needed if this XP is preceded by 2 days of RF Helium discharges.

[2] Measure Recycling: Limited D Ohmic Fiducial Discharge.[2 shots]

[3] Recover conditions: Helium conditioning discharge [2 shots]

[4] Apply Lithium: Using the above Helium discharge with constant mass (2 mg), vary velocity (50, 100, 200, 300 m/s). [8 shots]

[5] Apply Lithium: Using the above discharge For constant velocity (100 m/s), vary mass (1, 2, 5 mg). [6 shots]

[6] Measure Recycling and Duration: Apply D Ohmic Fiducial Discharge; [6 shots]

[7] Maintenance: If recycling starts to increase [6], select from above optimum LPI parameters and inject into ramp-up of D Ohmic Fiducial Discharges one or more LPI until performance is recovered.

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

- It is desirable for this XP to follow 2 days of RF heated helium discharges.
- 800 KA, 0.45T, DND Helium and Deuterium ohmic discharges.
- Diagnostic Checklist as requested.

5. Planned analysis

The analysis of the data shall include: EFIT, TRANSP, UEDGE, etc.

6. Planned publication of results

The results will be published in J. Nucl. Mater. and/or Nucl Fus.

PHYSICS OPERATIONS REQUEST OP-XP-515

Machine conditions: Example discharge: Ohmic phase of 111522

I_{TF} (kA): **53** Flattop start/stop (s): _____/_____

I_P (MA): **800** Flattop start/stop (s): **125ms/500ms**

Configuration: **Inner Wall / Lower Single Null / Upper SN / Double Null**

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

Elongation κ: _____, Triangularity δ: **1.9**

Z position (m): **0.00**

Gas Species: **He& D**, Injector: **Midplane / Inner wall / Lower Dome**

NBI - Species: **0**, Sources: **A/B/C**, Voltage (kV): **0**, Duration (s): **0**

ICRF – Power (MW): **0**, Phasing: **Heating / CD**, Duration (s): **0**

CHI: **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

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Diagnostic	Need	Desire	Instructions
Bolometer – tangential array	X		
Bolometer array - divertor	X		
CHERS	X		
Divertor fast camera	X		
Dust detector			
EBW radiometers			
Edge deposition monitor	X		
Edge pressure gauges	X		
Edge rotation spectroscopy		X	
Fast lost ion probes - IFLIP		X	
Fast lost ion probes - SFLIP		X	
Fast X-ray pinhole camera		X	
Filtered 1D cameras	X		
Filterscopes	X		
FIReTIP	X		
Gas puff imaging	X		
Infrared cameras	X		
Interferometer - 1 mm	X		
Langmuir probe array	X		
Magnetics - Diamagnetism	X		
Magnetics - Flux loops	X		
Magnetics - Locked modes	X		
Magnetics - Pickup coils	X		
Magnetics - Rogowski coils	X		
Magnetics - RWM sensors		X	
Mirnov coils – high frequency	X		
Mirnov coils – poloidal array	X		
Mirnov coils – toroidal array	X		
MSE			
Neutral particle analyzer	X		
Neutron measurements	X		
Optical X-ray	X		
Plasma TV	X		
Reciprocating probe		X	
Reflectometer – core		X	
Reflectometer - SOL		X	
RF antenna camera			
RF antenna probe			
SPRED	X		
Thomson scattering	X		
Ultrasoft X-ray arrays	X		
Visible bremsstrahlung det.	X		
Visible spectrometer (VIPS)	X		
X-ray crystal spectrometer - H	X		
X-ray crystal spectrometer - V	X		
X-ray PIXCS (GEM) camera		X	