Princeton Plasma Physics Laboratory

NSTX Machine Proposal

Title: **Neon (gas-puff) injection within the lithium deposition framework**

OP-XMP-	Revision**: 0**	Effective Date: *(Ref. OP-AD-97)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

Procedure Approvals

Responsible author: Luis F. Delgado-Aparicio	Date 04/29/2009
ATI (NSTX Physics Ops):	Date
RLM (NSTX Expt. Research Ops):	Date

Responsible Division: **Experimental Research Operations**

Procedure Requirements

designated by RLM

	NSTX Work Permit		T-MOD (OP-AD-03)
	Independent Review		ES&H Review

MINOR MODIFICATIONS

Approved by RLM

REVIEWERS (designated by RLM)		
Organization/Position	Name	Signature
ATI	D. Mueller	
Test Director		
Independent Reviewer		
NB		
RF		
Diagnostics		

TRAINING (designated by RLM)

Training required: No ■ Yes ☐ Instructor ______________________

Personnel (group, job title or individual name)	Read Only	Instruction	Hands-On

Training Rep. ________________________________

RLM _____________________________________

NSTX MACHINE PROPOSAL

TITLE: **Neon (gas-puff) injection within the lithium deposition framework**	No. **OP-XMP-**
AUTHORS: **L. Delgado-Aparicio, K. Tritz, B. Blanchard, M. Cropper, R. Bell, M. Finkenthal, B. LeBlanc, S. Kaye, S. Sabbagh, W. Solomon and D. Stutman.**	DATE: **04/29/2009**

1. Overview:

Before the application of Lithium to the PFCs, a brief neon puff (~10-50 ms) has been used as a perturbative transport tool in NSTX in order to asses impurity diffusivity as well convective (pinch) velocity. However, the application of Lithium deposition may have lowered the neutral density at the edge resulting in an increased neon mean free path (much stronger penetration as previously experienced), thus the standard H-modes collapsed rapidly. Now we have the expertise and the tools needed to control the gas puffs (e.g. operational knobs such as $t_{injection}$, $\Delta t_{injection}$, P_{Plenum} and Neon gas flow rates) in order to avoid the plasma collapse allowing the use of this perturbative tool in both MHD and T&T experimental proposals.

2. Justification:

Three experimental proposals have indicated the use of Neon injection to asses particle transport and the effect of RWM in the background plasma: a) XP931 on the Effect of the active stabilization of RWMs on the background plasma (Macroscopic Stability TSG), b) XP-921 on the Characterization of GAE modes & their effect on electron thermal transport (Transport and Turbulence & Wave and Particles TSGs) and c) XP 908 on the Dependence of momentum and particle pinch on collisionality (Transport and Turbulence TSG). The development of this perturbative tool is necessary for the success of these three experimental proposals mentioned above, since Lithium deposition is required in between plasma shots.

3. Plan:

Add 121162 NBI prescriptions to the morning fiducial shot. Lithium deposition will be added in subsequent shots (at rates of 15 and 30 mg/min for 10 minutes) with neon injection timed at t~350-400 ms for a time window of 10 ms; the flow rate chosen will be of 1.5 Torr·*l*/sec for different plenum pressures in the range of 100-600 T. Two shots for dialing the background conditions and four shots per Lithium deposition rate make a total of ten (10) plasma shots.

__121162 and/or morning fiducial__

Total shot number: 10 (including contingency)

4. Required machine, beam, ICRF and diagnostic capabilities:

Normal operations (e.g. as for fiducial morning shots). The neon bottle will be arranged by vacuum techs as described in the schematic drawing shown below.

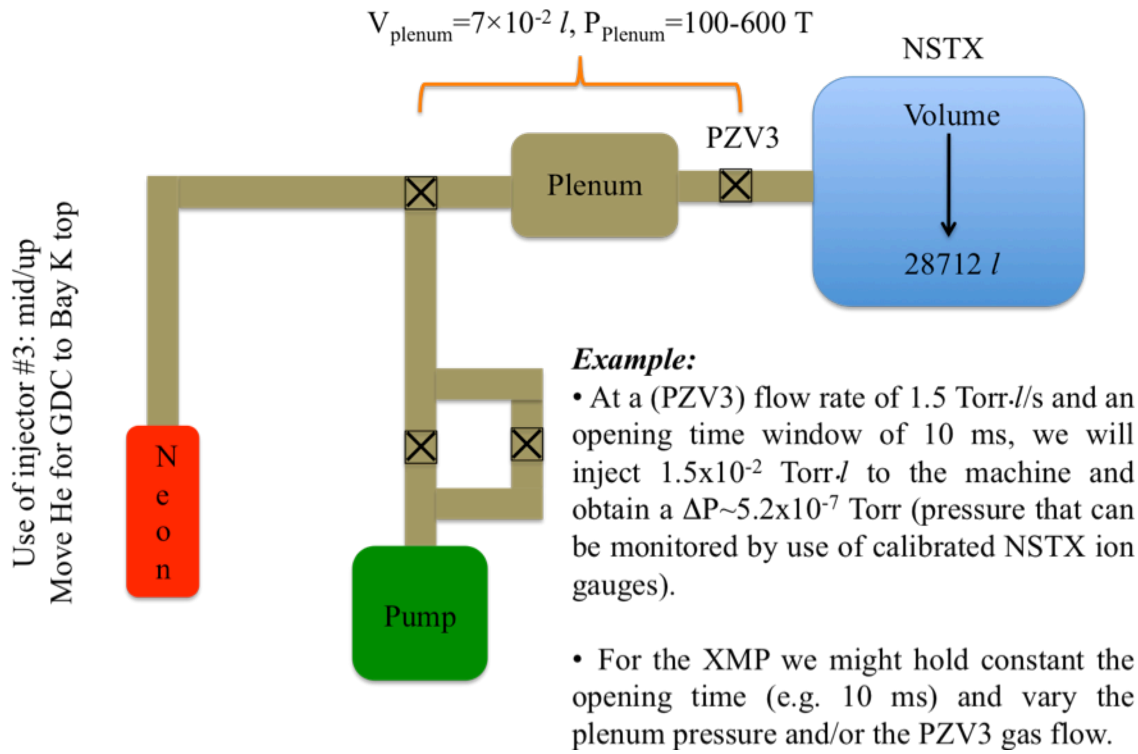

Fig 1.- Basic gas/pump diagram for neon tests during XMP

5. Sign off at run time:

5.1 Permission to Proceed: ____________________________

Physics Operations Head

5.2 Documentation of results:

Documentation of the results completed, attached to proposal and sent to Ops. Center with copies to Cognizant Physicist and Head of Physics Operations.

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Cognizant Physicist/Test Director

PHYSICS OPERATIONS REQUEST

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

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

I_P (MA): 1.0 MA Flattop start/stop (s):

Configuration: **Limiter / DN / LSN / USN** *(strike out inapplicable cases)*

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

Elongation κ: Upper/lower triangularity δ:

Gas Species: Injector(s):

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

ICRF Power (MW): Phasing: Duration (s):

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

LITERs: Off and On Total deposition rate (mg/min): **Between 10 and 40 mg/min**

EFC coils: Off and On Configuration: **Odd (n=1)**

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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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 – E‖B 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		