Princeton Plasma Physics Laboratory

NSTX Experimental Proposal

Title: **Controlled lithium introduction with Mo tiles**

OP-XP-1133	Revision:	Effective Date: *(Approval date unless otherwise stipulated)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

PROPOSAL APPROVALS

Responsible Author: R. Maingi	Date
ATI – ET Group Leader: C. Skinner	Date
RLM - Run Coordinator: S. Sabbagh	Date

Responsible Division: Experimental Research Operations

RESTRICTIONS or MINOR MODIFICATIONS

(Approved by Experimental Research Operations)

NSTX EXPERIMENTAL PROPOSAL

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AUTHORS: R. Maingi, the LRTSG group members DATE: **June 9, 2011**

1. Overview of planned experiment

The goal of this experiment is to introduce lithium in a controlled manner for the 2011-2012 run, as done in the 2008 and 2009 runs. The dependence of discharges on amount of lithium evaporation will be thoroughly documented. This experiment will mesh with the discharge development XMP as much as practical.

2. Theoretical/ empirical justification

The controlled introduction of lithium in 2008 provided substantial insight into lithium effects, as well as a number of refereed journal articles. To the extent possible, we will add lithium to discharges methodically to document the effects of the new Mo tiles. Comparison will be made with the 2009 data at high triangularity, and also to the 2008 data at lower triangularity.

3. Experimental run plan

1. Start with a high triangularity 4 MW fiducial with no lithium, or 50 mg at most. If the pre-requisite XMP did not achieve pre-lithium discharges with 100-200 ms flat-top, try again at this point for the no-lithium reference points with 6.5 minutes of HeGDC between. Repeat ~ 4 times, making adjustments to LFS and HFS gas if needed. Do at least 2 identical discharges before moving to next step. If the first set of discharges had 0 lithium, then repeat this step with 50mg between discharges for ~ 5 discharges.
2. Increase inter-discharge lithium evaporation to 100 mg, and repeat as above, for 4-5 discharges.
3. Increase inter-discharge lithium evaporation to 150-200 mg, and repeat as above, for 4-5 discharges. The amount to use will be a control room decision, based on discharge characteristics.
4. Increase inter-discharge lithium evaporation to 250-300 mg, and repeat as above, for 4-5 discharges. The amount to use will be a control room decision, based on discharge characteristics.
5. Time permitting, repeat with an even higher evaporation of ~ 500mg, and repeat ~ 5 discharges.

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

Up to 6 MW NBI, no rf, no CHI. Nominally plan for 4-5 MW NBI.

5. Planned analysis

EFIT, TRANSP, and pedestal/stability analysis.

6. Planned publication of results

Results allowing, this will be published at the next PSI meeting.

PHYSICS OPERATIONS REQUEST

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Brief description of the most important operational plasma conditions required:

High delta fiducial with 4 MW NBI. Option to use 5 MW if better for pre-lithium discharge performance.

Previous shot(s) which can be repeated:

Previous shot(s) which can be modified:

Machine conditions *(specify ranges as appropriate, strike out inapplicable cases)*

I_{TF} (kA): **4.5 kG** Flattop start/stop (s):

I_P (MA): **0.9 MA** Flattop start/stop (s):

Configuration: Limiter / DN / LSN / USN: **LSN drsep=-5mm**

Equilibrium Control: Outer gap / **Isoflux (rtEFIT)** / Strike-point control (rtEFIT)

Outer gap (m): **8-10cm** Inner gap (m): Z position (m):

Elongation: **2.4** Triangularity (U/L): **0.8** OSP radius (m):

Gas Species: **D** Injector(s):

NBI Species: **D** Voltage (kV) **A: 90** **B: 90** **C:** 70-90 Duration (s):

ICRF Power (MW): Phase between straps (°): Duration (s):

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

LITERs: Off / On Total deposition rate (mg/min):

LLD: Temperature (°C):

EFC coils: Off/On Configuration: **Odd / Even / Other**

DIAGNOSTIC CHECKLIST

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Note special diagnostic requirements in Sec. 4

Diagnostic	Need	Want
Beam Emission Spectroscopy		
Bolometer – divertor		
Bolometer – midplane array		√
CHERS – poloidal		√
CHERS – toroidal	√	
Divertor L-alpha array		√
Divertor visible camera		√
Dust detector		
Edge deposition monitors		√
Edge neutral density diag.		
Edge pressure gauges		√
Edge rotation diagnostic		
Fast cameras – divertor/LLD		√
Fast ion D_alpha - poloidal		
Fast ion D_alpha - toroidal		
Fast lost ion probes - IFLIP		
Fast lost ion probes - SFLIP		
Filterscopes	√	
FIReTIP		√
Gas puff imaging – divertor		
Gas puff imaging – midplane		√
Hα camera - 1D		√
High-k scattering		
Infrared camera – standard		
Infrared camera – 2-color		√
Infrared camera – wide-angle		√
Interferometer - 1 mm		
Langmuir probes – divertor		√
Langmuir probes – LLD		√
Langmuir probes – bias tile		
Langmuir probes – RF ant.		
Magnetics – B coils	√	
Magnetics – Diamagnetism	√	
Magnetics – Flux loops	√	
Magnetics – Locked modes		√
Magnetics – Rogowski coils	√	
Magnetics – Halo currents		
Magnetics – RWM sensors		√

Note special diagnostic requirements in Sec. 4

Diagnostic	Need	Want
MAPP		
Mirnov coils – high f.		√
Mirnov coils – poloidal array		√
Mirnov coils – toroidal array		√
Mirnov coils – 3-axis proto.		
MSE-CIF		√
MSE-LIF		
NPA – E||B scanning		
NPA – solid state		
Neutron detectors		
Plasma TV		√
Reflectometer – 65GHz		
Reflectometer – correlation		
Reflectometer – FM/CW		
Reflectometer – fixed f		
Reflectometer – SOL		
RF edge probes		
Spectrometer – divertor		
Spectrometer – SPRED		√
Spectrometer – VIPS		
Spectrometer – LOWEUS		
Spectrometer – XEUS		
SWIFT – 2D flow		
TAE Antenna		
Thomson scattering	√	
USXR – pol. arrays		√
USXR – multi-energy		
USXR – TG spectr.		
Visible bremsstrahlung det.		√
X-ray crystal spectrom. - H		
X-ray crystal spectrom. - V		
X-ray tang. pinhole camera		