Princeton Plasma Physics Laboratory

NSTX Machine Proposal

Title: **Characterization of Neutral Beam fractions**

OP-XMP-59	Revision**:**	Effective Date: *(Ref. OP-AD-97)* Expiration Date: *(2 yrs. unless otherwise stipulated)*

Procedure Approvals

Responsible author:	Date
ATI (NSTX Physics Ops):	Date
RLM (NSTX Experimental Research Ops):	Date

Responsible Division: **Experimental Research Operations**

Procedure Requirements

designated by RLM

MINOR MODIFICATIONS

REVIEWERS (designated by RLM)		
Organization/Position	Name	Signature
ATI	D. Mueller	
Test Director	M. Podestà	
Independent Reviewer		
NB	M. Cropper	
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: **Characterization of Neutral Beam fractions**	No. **OP-XMP-59**
AUTHORS: **M. Podestà**	DATE: **July 8, 2008**

1. Overview:

Use beam-into-gas discharges to characterize the Neutral Beam species (full, one-half, one-third energy components) as a function of the injection voltage. Measurements of the beam-ion energy distribution are taken with NPA, ssNPA and FIDA diagnostics.

2. Justification:

Information on the NB species fraction is needed for the analysis of charge-exchange diagnostics' data, eg. from CHERS and FIDA. Data from TFTR operation is available only for injection voltage > 80kV, but not for injection voltage < 80kV. The goal of the proposed XMP is to obtain up-to-date data for the range 60kV → 90kV of beam acceleration voltage.

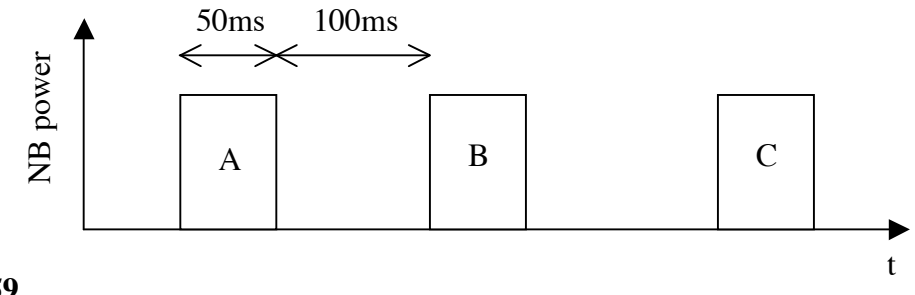
3. Plan:

- Optimize NPA tangency radius during MSE calibration shots in order to maximize the signal from all the three sources. If this does not interfere with MSE calibration, insert a short (40ms) blip with source C at the end of MSE shots. The C pulse should start ~50ms after the main (source A) pulse.
- Assuming this XMP is run after MSE calibration shots, source A will already be operating at full voltage (90kV). Pre-condition sources B, C at 60kV. Then, ramp-up B and C voltage and ramp-down A voltage on a shot-to-shot basis, with steps of 5kV. Fire three sources in sequence : A, then B, then C. Pulse duration : 50ms. OFF time between pulses : 100ms (if necessary, can be increased to avoid over-heating of – and to lower sputtering from – beam armor), see Table and sketch here below.

Shot list:

Sh#, V [kV]	60	65	70	75	80	85	90
1	B, C						A
2		B, C				A	
3			B, C		A		
4				A, B, C			
5			A		B, C		
6		A				B, C	
7	A						B, C

Discharge timing:



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

Machine: B_{tor} = 4.5 or 5.5 kG if higher field is needed for NPA signal; B_{pol} = 0.

Preferably perform the XMP directly following MSE calibration (XMP-33)

Filling gas pressure: same as for MSE calibration shots.

Beam: Scan of beam voltage, from 60kV up to 90kV (steps of 5kV).

ICRF: not needed.

Diagnostics: NPA, ssNPA, FIDA

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)

I_{TF} (kA): **-53 – -65** Flattop start/stop (s): **0/0.5**

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

Configuration: **---**

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

Elongation κ: --- Triangularity δ: ---

Z position (m): ---

Gas Species: **D** Injector(s): Midplane/Inner wall/ Lower dome

NBI Species: **D** Sources: A/B/C Voltage (kV): **60 → 90** Duration (s): **0.05 each**

ICRF Power (MW): none Phasing: Duration (s):

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

LITER: Off

Previous shot numbers for setup: **126773 (53kA TF) or 126797 (65kA) or equivalent from preceding XMP-33**

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		