Princeton Plasma Physics Laboratory

NSTX Machine Proposal

Title: **FIDA checkout**		
OP-XMP-54	Revision**: 0**	Effective Date: **Feb 18, 2008** Expiration Date: *(2 yrs. unless otherwise stipulated)*

Procedure Approvals

Responsible author: **W. Heidbrink**	Date
ATI (NSTX Physics Ops): **D. Mueller**	Date
RLM (NSTX Exp. Research Ops): **M.G. Bell**	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		
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: **FIDA checkout** No. **OP-XMP-54**
AUTHORS: **W. Heidbrink, M. Podesta** DATE: **Feb 18, 2008**

1. Overview:

Use different neutral-beam injection patterns to confirm and optimize FIDA spatial, temporal, and energy resolution.

2. Justification:

FIDA is a new diagnostic. We need quiet plasmas (where the fast-ion distribution function is reasonably well known) with unusual neutral beam injection to test our system.

3. Plan:

Baseline condition: 0.8 MA, 3-4e13 cm-3, helium gas (~124764 –exact conditions not crucial). All sources at 60 keV (except step #5).

1) **One equivalent steady source** (33% duty cycle each); A-B-C then A-C-B (2 shots). *Relative source contributions to signal.*
2) **50% duty cycle** First A for ~ 100 ms, then B, then C (1 shot). *Background subtraction (compare beam modulation with toroidally offset views).*
3) **Two equivalent steady sources** (67% duty cycle each) (1 shot). *Relative source contributions to signal.*
4) **Isolated blips** (10 ms on, 50 ms off) One source each shot (3 shots). *Quiet case with reliable theoretical time evolution & spatial profile to validate spatial profile.*
5) **Energy variation** Raise beam voltage on favorite case (1 shot). *Change Doppler shift to verify spectra.*
6) **Timing optimization** 5 ms time bins (was 10 ms) on favorite case (1 shot). *Assess signal vs. accuracy of background subtraction tradeoff.*
7) **Halo contribution/neutron corroboration** Switch to deuterium gas. Repeat shots from first four steps in order of best results (2-4 shots). *Measure effect of beam halo on spatial resolution.*

Total: 11 – 13 shots

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

Machine: nothing special besides helium gas.

Beam: Lower voltage operation than usual, plus many beam modulation patterns. (See Fig. 1)

Diagnostic: Magnetics to verify quiet plasma; fast-ion (neutrons, NPA, SSNPA, sFLIP) to corroborate FIDA; plasma (Thomson scattering, CHERS) for theoretical fast-ion distribution function.

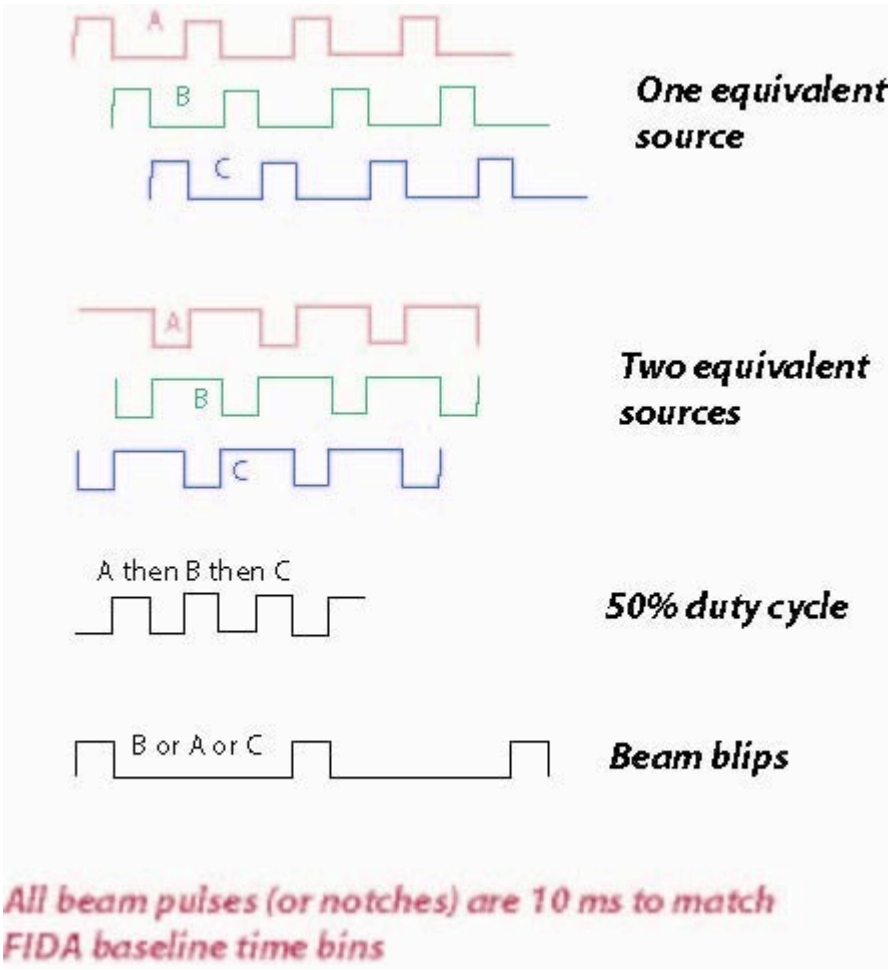

Fig. 1 Waveforms for NBI pulses

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.

_____

Cognizant Physicist/Test Director

PHYSICS OPERATIONS REQUEST

TITLE: **FIDA Checkout** No. **OP-XMP-54**
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Machine conditions (specify ranges as appropriate)

I_{TF} (kA): 41-53 Flattop start/stop (s): 0/0.75

I_P (MA): 0.8 Flattop start/stop (s): 0.25/0.5

Configuration: **Inner Wall Limiter** (shape not crucial)

Outer gap (m): 0.04 Inner gap (m): 0

Elongation κ: 1.9 Triangularity δ: 0.4

Z position (m): 0

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

NBI Species: **D** Sources: A/B/C Voltage (kV): 60 → 90 Duration (s): 0.4

ICRF Power (MW): 0 Phasing: Duration (s):

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

LITER: Off

Either: List previous shot numbers for setup: **124764**

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

TITLE: **FIDA Checkout** No. **OP-XMP-54**

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Diagnostic	Need	Want	Conditions
Bolometer – tangential array			
Bolometer – divertor			
CHERS – toroidal	x		
CHERS – poloidal		x	
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	x		
Fast lost ion probes - IFLIP		x	
Fast lost ion probes - SFLIP	x		
Filterscopes	x		
FIReTIP		x	
Gas puff imaging			
Hα camera - 1D		x	
High-k scattering			
Infrared cameras			
Interferometer - 1 mm			
Langmuir probes - divertor			
Langmuir probes - BEaP			
Langmuir probes – RF ant.			
Magnetics – Diamagnetism		x	
Magnetics – Flux loops		x	
Magnetics - Locked modes		x	
Magnetics - Pickup coils			
Magnetics - Rogowski coils		x	
Magnetics – Halo currents			

Diagnostic	Need	Want	Conditions
Magnetics - RWM sensors			
Mirnov coils – high f.	x		
Mirnov coils – poloidal array	x		
Mirnov coils – toroidal array	x		
Mirnov coils – 3-axis proto.		x	
MSE		x	
NPA – ExB scanning	x		
NPA – solid state	x		
Neutron measurements	x		
Plasma TV			
Reciprocating probe			
Reflectometer – 65GHz		x	
Reflectometer – correlation			
Reflectometer – FM/CW			
Reflectometer – fixed f		x	
Reflectometer – SOL			
RF edge probes			
Spectrometer – SPRED			
Spectrometer – VIPS		x	
SWIFT – 2D flow			
Thomson scattering	x		
Ultrasoft X-ray arrays		x	
Ultrasoft X-rays – bicolor			
Ultrasoft X-rays – TG spectr.			
Visible bremsstrahlung det.		x	
X-ray crystal spectrom'r - H			
X-ray crystal spectrom'r - V			
X-ray fast pinhole camera			
X-ray spectrometer - XEUS			