Princeton Plasma Physics Laboratory

NSTX-U Machine Proposal

Title: **Increase the CD-4 Plasma Current**

OP-XMP-131	Revision: **0**	Effective Date: **8/11/2015** Expiration Date: *(2 yrs. unless otherwise stipulated)*

Proposal Approvals

Responsible author: **Devon Battaglia**	Date
ATI (NSTX-U Physics Ops): **Stefan Gerhardt** — Stefan Gerhardt — Digitally signed by Stefan Gerhardt DN: cn=Stefan Gerhardt, o=Physics, ou=PPPL, email=sgerhard@pppl.gov, c=US Date: 2015.08.11 09:03:24 -04'00'	Date
RLM (NSTX-U Expt. Research Ops): **Stefan Gerhardt** — Stefan Gerhardt — Digitally signed by Stefan Gerhardt DN: cn=Stefan Gerhardt, o=Physics, ou=PPPL, email=sgerhard@pppl.gov, c=US Date: 2015.08.11 09:04:18 -04'00'	Date

Responsible Division: **Experimental Research Operations**

Procedure Requirements

designated by RLM

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

RESTRICTIONS AND MINOR MODIFICATIONS

Approved by RLM

REVIEWERS (designated by RLM)		
Organization/Position	Name	Signature
ATI	S. Gerhardt	Stefan Gerhardt Digitally signed by Stefan Gerhardt DN: cn=Stefan Gerhardt, o=Physics, ou=PPPL, email=sgerhardt@pppl.gov, c=US Date: 2015.08.11 09:03:00 -04'00'
Test Director		
Independent Reviewer		
NB system		
RF systems		
FCPC systems		
Diagnostics		

TRAINING (designated by RLM)

Training required: No ■ Yes ☐ Instructor _____

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

RLM _____

NSTX-U MACHINE PROPOSAL

TITLE: **Increase the CD-4 Plasma Current** No. **OP-XMP-131**
AUTHORS: **D. Battaglia** DATE: **8/11/2015**

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1. Overview:

The intention of this XMP is to increase the plasma current from 100 kA to 200-300kA. This will still be all feed-forward control.

2. Justification:

The 100 kA plasma produced on 8/10/2015 satisfies the CD-4 deliverable. However, it is desirable to further increase the plasma current and improve the centering of the plasma:

- To provide efit reconstructions with less vessel current (or higher fraction of plasma current to vessel current).
- To get higher current data for rtEFIT testing.
- To better understand, and correct, the source of the vertical asymmetry in the plasma.
- To get scattered light for MPTS testing.

3. Plan:

A sequence of shots will be taken attempting to increase the plasma current beyond the 100 kA demonstration. Coil-only shots may be interspersed with these to ensure that the plasma current is properly calculated.

Logging will be kept via the NSTX-U electronic logbook.

The following variables are envisioned to be scanned, potentially individually but maybe in an interspersed way.

3.1 Up-down balance and outer gap:

- Increase imbalance in PF3U/L shot to shot until plasma goes vertically unstable up.
- Modify PF5 if necessary to maintain a proper outer gap.
- Modify the PF-3/PF-5 ratio to provide the correct vertical field index.
- Potentially use the PF-1cL to adjust the field at the machine bottom during breakdown to avoid the early diverting action.

3.2 Prefill scan:

As noted in XMP, the pre-fill pressure may be scanned to establish connection to Ip ramp or limits to breakdown.

3.3 Optimization of the post-breakdown plasma:

Scan gas injection and loop voltage after 30ms to achieve target I_p ramp (similar to NSTX) at different gas fueling levels.

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

Need pre-programmed control of the PF-5, PF-3U/L, PF-1cL, OH and TF coils.

Need pre-fill control, LFS gas fuelling capability, and between-shot He glow capability.

5. Sign off at run time:

5.1 Permission to Proceed:

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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