

XP: Sweep Deposition of Boron on Divertor Strike Regions Using TMB Fueling

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Overview of Planned Experiment



- **TMB fueling experiments were initiated to explore the potential for real-time maintenance of boron films, high performance regimes, and the effects of cladding the plasma in a low-Z mantle.**

- **NSTX TMB fuelling experiments have shown interesting promise. Summarized below are the previous and planned experiments.**

NSTX TMB fueling experiments have shown interesting promise



Discharge & TMB	Results	Results
FY01 Ohmic 90% He +10%TMB	<ul style="list-style-type: none"> • Yelded x2 decrease in central radiation after TMB. • The subsequent post-TMB, LSN, 900 kA, 1.5 MW, NBI fiducial discharge transitioned into the H-mode. • Edge fueling with TMB did not increase B V and C VI. 	<ul style="list-style-type: none"> • Film thickness • Spatial distribution • Performance Longevity
FY02 NBI 100% TMB	<ul style="list-style-type: none"> • Yielded Te~1.6 keV 	<ul style="list-style-type: none"> • Film thickness • Spatial distribution • Performance Longevity
FY03 NBI 95%D₂ + 5%TMB	<p>Sweep deposition of strike region followed by high performance discharge</p>	<ul style="list-style-type: none"> • Most efficient technique • Film thickness • Spatial distribution • Performance Longevity
FY03 CHI 95%D₂ + 5%TMB	<p>Inject TMB into CHI from lower divertor. Compare with midplane injection. Measure post CHI performance</p>	<ul style="list-style-type: none"> • Impurity behavior • Film thickness • Spatial distribution • Performance Longevity

NSTX TMB fueling experiments have shown interesting promise



- TFTR Lithium limiter painting experiments were very effective for accessing high performance regimes.
- In this XP, the effectiveness of painting or sweep deposition of NSTX divertor strike regions will be determined by characterizing a high performance discharge following various deposition sequences.

Estimated Depositions per Torr liter

Total Torr-Liter	Torr-Liter of TMB (5% of Total Torr-L)	mgm	BC ₃ units	BC ₃ /cm ² on Center Col*	Mono Layers on Center Col*	BC ₃ /cm ² on Lower Div*	Mono Layers on Lower Div*
20	1	2.6	3.3E19	1.3E15	0.6	6.5E14	0.3
200	10	26	3.3E20	1.3E16	6	6.5E15	3
2000	100	260	3.3E21	1.3E17	60	6.5E16	30

Prerequisites



- **Required diagnostic capabilities**
 1. **Sufficient Helium Discharge Conditioning to put the walls into pumping state.**
 2. **Quartz Crystal Deposition Monitor.**
 3. **Filtered, Wide Angle, Fast Camera for 2D impurity profiles.**
 4. **Filtered 1-D CCD divertor camera**
 5. **Filterscopes.**

Experimental run plan for LSN & DN Discharges



Discharge No.	Discharge Type	Example Fiducial	TMB Fuelling (Torr-liters)	Comments
1			0	Shutters Open
2			1	Closed
3			1	Closed
4			1	Closed
5			0	Shutters Open
6			6	Closed
7			6	Closed
8			6	Closed
9			0	Shutters Open
10			12	Closed
11			12	Closed
12			12	Closed
13			0	Shutters Open
14			0	Shutters Open

Analysis and Publication Plan



- **Planned analysis**

Simulation of impurity profiles, sputtering distributions, and fueling efficiency.

- **Planned publication of results.**

Proceedings of PSI.