

Plasma Fuelling with TMB

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Trimethylboron (TMB) Injected into Plasma Edge Reboronizes Plasma-Wetted Surfaces



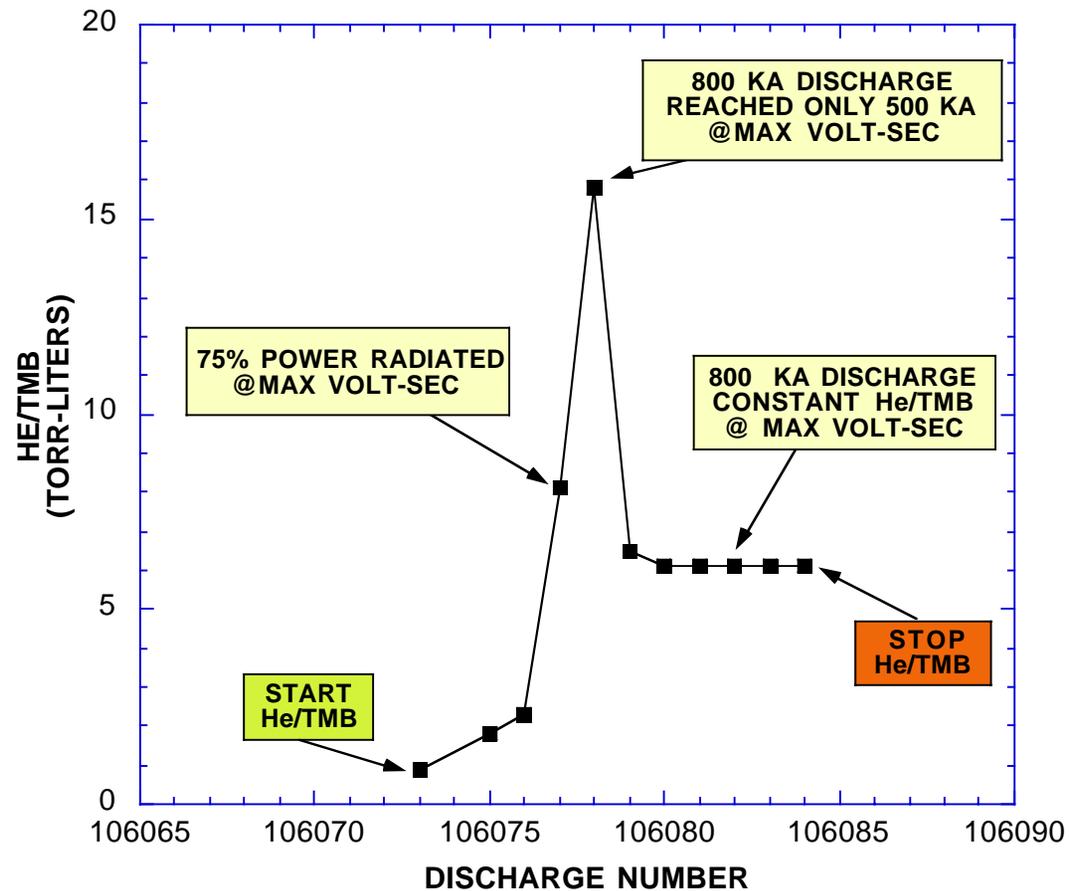
- HeGDC is used to deposit boron film over the vessel interior (100 nm)
- Subsequent erosion of this deposited film occurs preferentially on plasma wetted surfaces, e.g., Center Column and Divertor strike points.
- On TEXTOR (Esser et al.) and TdeV (Boucher, et al.) tested plasma fueling with boron gases, and obtained interesting results and improved performance.
- On PISCES, the injection of carborane into the plasma resulted in very high boron film deposition rates (~1000 nm/min) on the target samples. This was attributed to good transport of the injected carborane to the plasma wetted surface.
- NSTX has performed preliminary tests of plasma boronization (XMP-12).

Test of Direct Injection of TMB [B(CD₃)₃] Yields x2 Decrease in Central Radiation & H-mode



- TMB fueling to 15.8 Torr-liters reached operational limits: 800 kA discharge only reached 500 kA due to high radiative power losses and He recycling.
- TMB fueling was then reduced to 6 Torr-liters for next 6 TMB fueled discharges (12 discharges total) : *yielded x2 decrease in central radiation after TMB.*
- The subsequent post-TMB, LSN, 900 kA, 1.5 MW, NBI fiducial discharge exhibited a *transition into the H-mode.*
- The edge O and C luminosities were comparable within the limited statistics due to initially clean conditions. Edge fueling with TMB did not increase B V and C VI.
- Density profile for the post-TMB CSL discharge exhibited an *outboard shoulder.*

Sequence for Direct Injection of 90% Helium and 10% TMB [B(CD₃)₃] Into 800 KA, D₂ Discharge

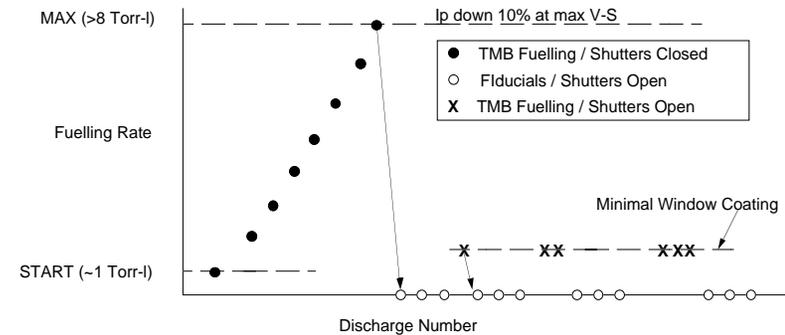


The Scientific Questions Investigated By This Experimental Proposal

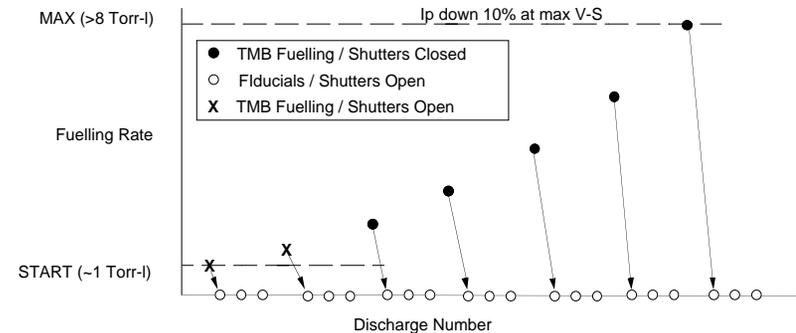


- What is the minimal fuelling rate producing an observable performance enhancement?
- What is the erosion rate per discharge and how does this depend on fuelling rate?
- At what fuelling rate can the Shutters be safely opened for MPTS measurements?
- What is the ratio of Plasma Wetted Surface to Outer Wall depositions vs fuelling rate?
- What is the maximum fuelling rate before the available volt-sec are consumed?
- How does the absence of Helium effect this limit and overall performance?
- What is the edge distribution of B (and C) as observed by a Filtered Camera?.
- How is core performance, transport, energy balance effected by fuelling rate?

SCENARIO-1



SCENARIO-2



Scenario-1: Similar to XMP-12

Scenario-2: Preferred for this XP