NSTX-U

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Effect of B conditioning

Charles Skinner

B Koel, J. Roszell

J.P. Allain, F. Bedoya

and the NSTX Research Team

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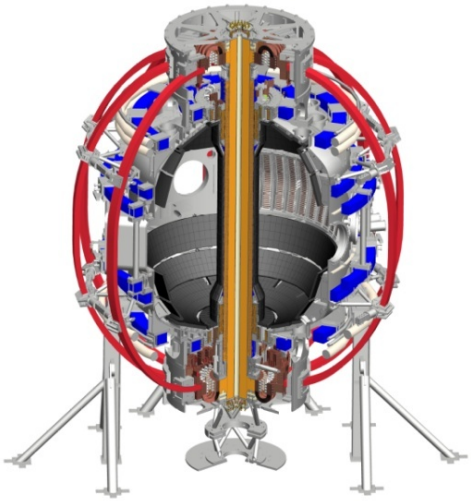
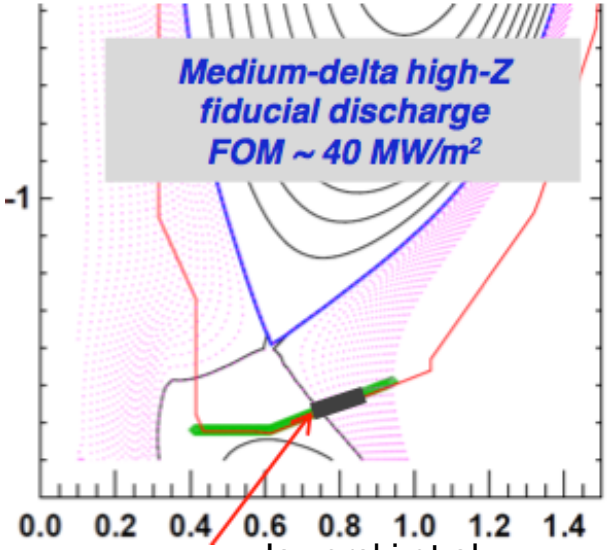


Motivation

- Effects of boronization and lithiumization on NSTX has been well documented
  [Skinner: Ohmic Boronization 2002, Kugel: Li, 4 + papers, Mangi: Edge profiles with Li, 4+ papers ….]
- This XP/XMP proposes to:
  - Establish optimal application conditions for B on NSTX-U
  - Relate changes in plasma performance to surface composition using MAPP.
    - Do beneficial B effects correlate with B surface density ?
  - Study transition from Li back to B.

- Assumes MAPP XPS has been commissioned,
  - Initially MAPP probe drive will be manual, precluding intershot analysis without break for controlled access.
  - Can correlate with individual discharge conditions when probe drive is automated.
- Assumes significant particle flux onto MAPP from low triangularity plasma (to be developed).
- Assumes standard diagnostics for Zeff, Prad, USXR impurity densities, influx, Ip flattop time, stored ion/ electron energy, confinement time, D-alpha, ELMs, QMBs



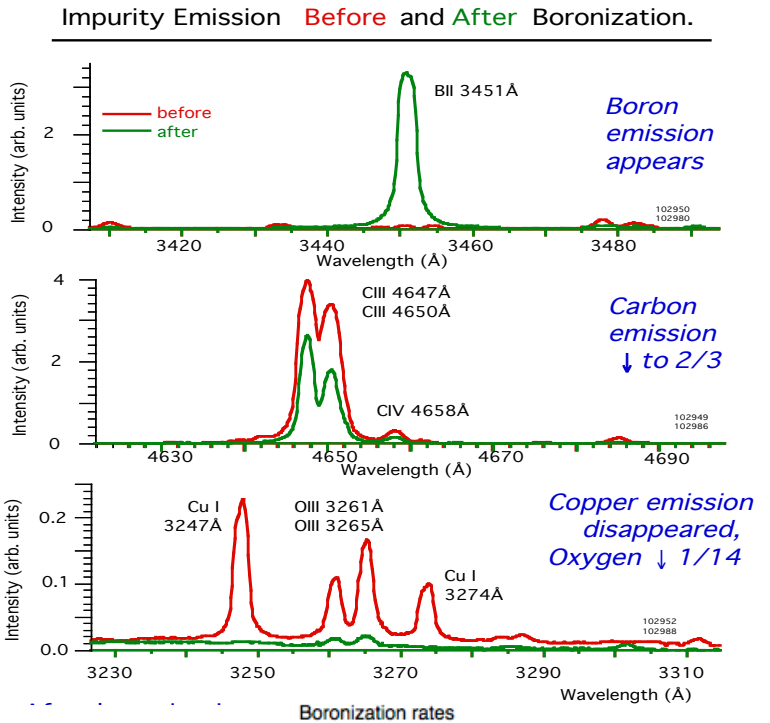
Jaworski et al.,

2002 Boronization

Boronization in Ohmic plasmas [NF 42 (2002) 329]

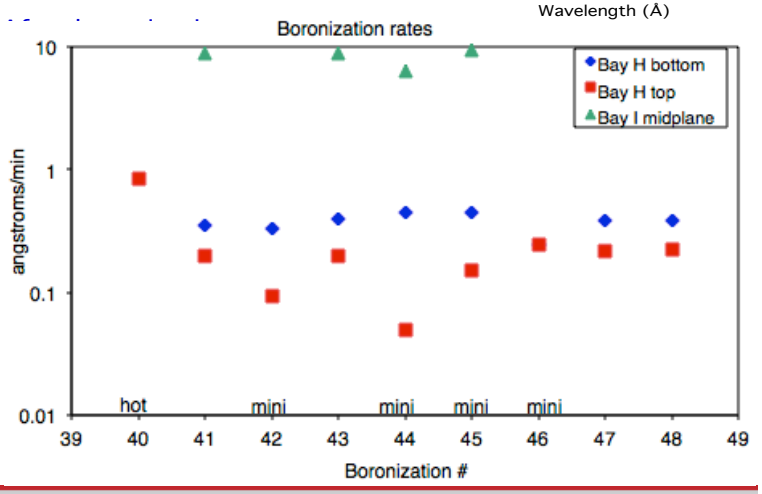
After boronization:

- D-alpha increased x2
- VB emission decreased to 1/3
- Energy confinement time increased by 30% - 70% (lower loop voltage).
- Ip flattop increased by 50-70%
- Access to H-mode plasmas after 3rd boronization.



BUT QMB data shows boron deposition highly non-uniform (TMB mfp). Average:

- Bay I midplane: 9 Å/min
- Bay H bottom: 0.36 Å/min (down x25)
- Bay H top: 0.19 Å/min (down x47)



2015 Boronization XMP

New TMB system has 3 gas inlets:

- Bay I mid-plane centerstack
- outboard midplane Bay F/G
- Bay C lower divertor.

Do we still need full 10 g-TMB (1 gas bottle) ?

XMP proposal:

1. Initial boronization: use 1 g, then 2 g, then 6 g TMB.
   - Before and in between run ohmic plasmas and record spectroscopic & V loop changes.
2. Boronize until H-mode achieved. Then wait for boron effect to diminish.
   - Then boronization with 1 g, then 2 g, then 6 g TMB

In between run H-mode plasmas and record spectroscopic & V loop changes.

Correlate plasma performance with MAPP measurement of B and B-oxide, (may need test cell access to insert and withdraw/change probe).