Review of XP 515

NSTX

Recycling Measurements Following Repeated Lithium Pellet Injection

H. W. Kugel, et al.

Proposed Goal: Make Contact With the TFTR Lithium Database by Measuring with TFTR Wall Conditions, Recycling in Toroidally Limited, Ohmic Discharges Following Repeated Lithium Pellet Injection

The Effectiveness of Lithium Thin Films on TFTR Has Not Been Reproduced on Large Diverted Machines

NSTX

- **TFTR found deposition of thin lithium films very effective for reducing recycling and improving edge conditions. This involved:**
  - *Large area toroidal limiter*
  - *40 Helium conditioning discharges to remove deposited deuterium*

- **Since TFTR-97, large diverted machines (TdeV, C-Mod, D-IIID, NSTX) have observed smaller effects.**
  - *The origin of these differences is still under investigation*
  - *Three hypotheses have been suggested to understand the previous measurements*

3 Hypotheses Have Been suggested to Understand the Previous Measurements

• Hypothesis: "More Substrate Conditioning Required"

TFTR demonstrated the need for extensive Helium Conditioning Discharges to reduce lithium interactions with absorbed fuel gas in toroidally limited discharges.

- *Lock mode issues at low density discouraged this on diverted machines*

• Hypothesis: "More Diffusion into Graphite and Erosion in Diverted Discharges"

The tendency for lithium to diffuse (intercalate) deep into graphite may be enhanced in diverted machines where power deposition is focused on narrow strike regions, and where high erosion rates would also reduce lithium availability to absorb ions and neutrals.

- *Sugai et al found 200 nm Li film on graphite readily absorbed*

• Hypothesis: "Main Chamber Recycling is Important in Diverted Discharges"

Both divertor and main chamber lithium deposition may be required in diverted machines due to possible fueling from divertor and main chamber regions.

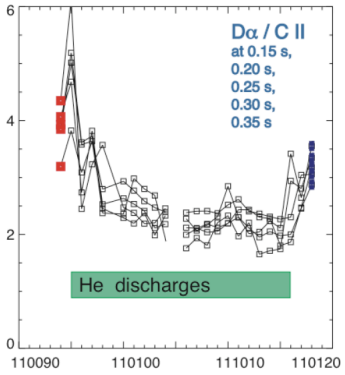
- *Increasing interest in the significance of main chamber fueling*

Proposed XP: Make Contact with the TFTR Li Database by Measuring, with TFTR Wall Conditions, Recycling in Toroidally Limited, Ohmic Discharges Following Repeated Lithium Pellet Injection

NSTX

[1] Condition: using toroidally limited Helium Ohmic Disharges. [6 - 30 shots]

NSTX

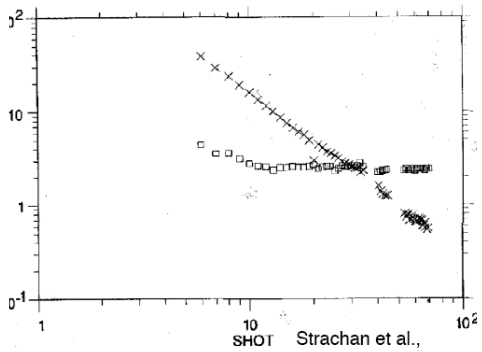


C.H.Skinner, NSTX XP304, 2/03.

- **Evaluation of D-alpha/CII**

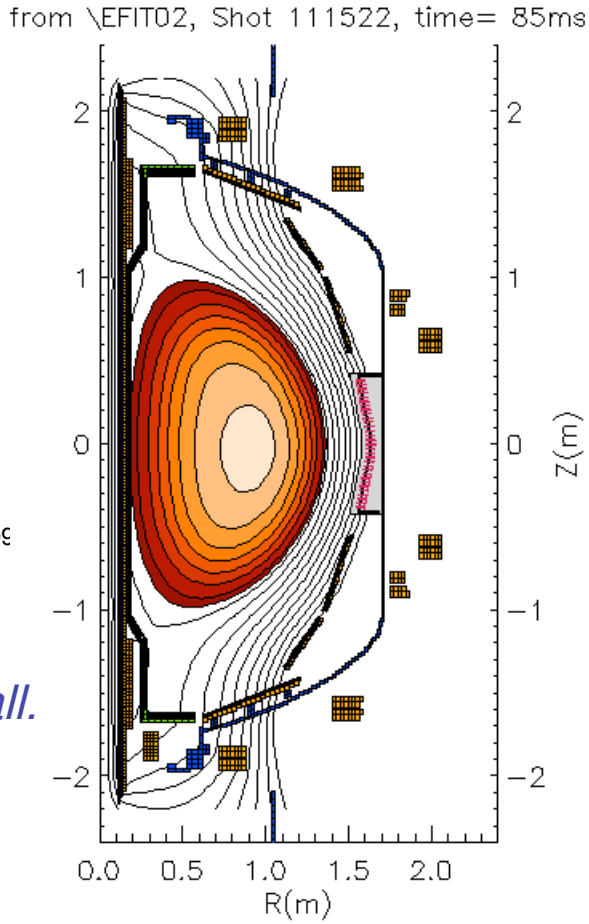
17 conditioning discharges gave modest change in D-alpha intensity, D-a decreased by 40% cf x10 TFTR plot.

TFTR



11. Hydrogen (×) and carbon (□) influx in helium
harge cleaning pulses following a 1 MA ohmic disruptior
ear the end of a disruptive discharge cleaning campaign.

J.D.Strachan, et al, J.Nucl. Mater., 196-198 (199



111522, Ip 800 KA, 0.45KG

- *Condition until the ratio of the CS region Dα to CII becomes asymptotic and indicative of a well-conditioned wall.*
- *Note: Fewer Helium conditioning discharges may be needed if this XP is preceded by 2 days of RF Helium discharges.*

Proposed XP: Make Contact with the TFTR Li Database by Measuring, with TFTR Wall Conditions, Recycling in Toroidally Limited, Ohmic Discharges Following Repeated Lithium Pellet Injection

NSTX

[2] Measure Recycling: Limited D Ohmic Fiducial Discharge [2 shots]

[3] Recover conditions: Helium conditioning discharge [2 shots]

[4] Apply Lithium: Using the above Helium discharge with constant mass (2 mg), vary velocity (50, 100, 200, 300 m/s). [8 shots]

[5] Apply Lithium: Using the above discharge for constant velocity (100 m/s), vary mass (1, 2, 5 mg). [6 shots]

[6] Measure Recycling and Duration: Apply D Ohmic Fiducial Discharge; [6 shots]

[7] Maintenance: If recycling starts to increase [6], select from above optimum LPI parameters and inject into ramp-up of the D Ohmic Fiducial Discharges one or more lithium pellets until performance is recovered.

Future Work

- Move limited low recycling discharges from the CS wall to give low recycling semi-limited discharges.

- While maintaining low recycling conditions, gradually increase discharge elongation and decrease limiting.

- Apply the above to characterize low recycling conditions for other discharges of interest.