

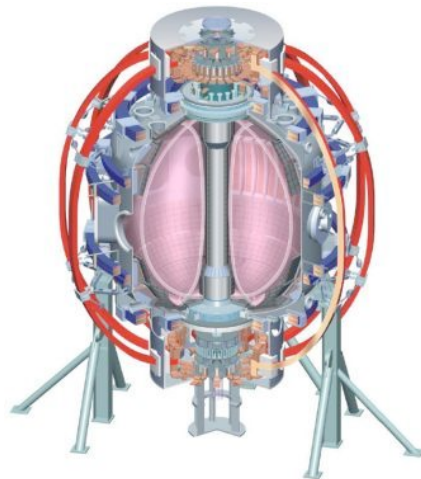
XP1000 (1059): LLD Characterization Part-2 and Part-3

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NSTX LRTFG

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XP1000 with Cold Lithium Coating + Liquid Lithium LLD Exhibited Lithium Related Pumping

- Initial XP1000 results are consistent with pumping by *active solid lithium coatings plus active liquid lithium LLD* yielding comparable edge-pumping conditions to all-solid coatings
 - Saturation of the solid coating not tested
- Core Pumping was indicated by
 - Required increase in integrated gas puffing ~x2
 - Required front-end startup adjustments in fueling and heating power
 - Reduction in flux consumption early in the discharge
 - HeGDC not required to remove fuel gas from previous discharge
- Edge pumping was indicated by
 - Edge plasma density and T_e profiles very similar to extensive operation with solid lithium coatings
 - Characteristic improvements in confinement relative to no Li
 - *Absence of ELMS*

XP1000 Tested LLD Under Thin Film Conditions

- During XP1000, LLD fill was only ~2-3%. For this low initial fill, analysis is complicated by several interleaved issues.
- Filling LLD to >50% Li capacity decreases the physical to geometric area ratio and by passes or minimizes 6 issues:
 - desorption of deuterium exacerbated by the high surface area of the porous Mo
 - mass-limited diffusion into the Li
 - mass-limited retention
 - effective range uncertainty
 - Impurity strata due to repeated hot-cold-hot cycles
 - Li to impurity ratio higher

Part 2, Day-1: Filling LLD to 50-100% of Lithium Capacity Gives Highest Probability of Observing Maximum Pumping Duration of Liquid Lithium

Day-1:

- Fill 50% @220°C
- Keep LLD at 220°C with LITER 20-40mg/min
- Take R=35cm fiducial [2]
- Take R=50cm, R=63cm, R=70cm reference discharges [2]
- When ELM-free, and characteristic Li-edge conditions are confirmed at R=70cm, turn off LITER and allow cold Li coating to saturate [3]
- If R=70cm Li-edge conditions persist due to LLD pumping, measure the number of shots until Li-edge conditions cease (e.g, ELMy, non-Li profiles) [6]
- If R=70cm Li-edge conditions persist, vary HFS and SGI fueling to minimize central density [6]
- Let LLD cool from liquid (220°C) to below solidification (<180°C) and characterize rate at which LLD Li saturates and Li-edge conditions cease

Part 2, Day-2: Starting with LLD at Room Temperature Raise LLD Temp to 220°C and Attempt to Recover Active Li-edge Conditions of Day-1

Day-2:

- Start with LLD at room temperature and LITER 20-40mg/min
- With LLD cold, take R=35cm fiducial [2]
- With LLD cold, take R=50cm, R=63cm, R=70cm reference discharges [2]
- Start heating LLD from cold to 220°C [6]
- If at 220°C, ELM-free, characteristic Li-edge conditions are confirmed at R=70cm, turn off LITER and allow cold Li coating to saturate [3]
- Restart LITER and restore Li-edge conditions. [3]
- If Li-edge conditions restored, start XP1001.
- If Li-edge conditions not restored, increase LITER to 50-60mg/min and raise LLD temp 20°C per shot from 220°-320°C [5]
- If Li-edge conditions not restored cease Part 2, Day-2 and await start of Part 3

Part-3: Test Loading LLD Using Li Powder Dropper

- Lithium Dropper Status
 - 1 dropper to be installed on EAST (D.Mansfield has arrived at EAST; equipment to arrive Fri)
 - Bay-I dropper is half-loaded and under argon
 - Bay-E dropper under vacuum and proceeding with its 1 month pumpout
 - On 6/1/10, the droppers will be within ~ 2-3 wks installation on VV with ~50g each
 - The available rate between discharges 120mg/s or 50g ea in <10 min
 - The resultant injection with LLD 220°C will land partially on LLD
- After completion of the 0.75 day, FY10 Forum Dropper XP “Investigate ELM Pacing and Impurity Input Suppression” use remaining 0.25 day to test loading LLD with Li powder dropper
- With LITER on, and LLD 220°C, take R=70cm reference discharge
- Then, between discharges, drop 50g (some fraction will stick to LLD, some will coat InrDiv)
- Measure the effect on Li-edge conditions of solid coating +powder + liquid LLD
- Turn-off LITER, allow solid coating +powder to saturate, measure effect on Li-edge conditions due to liquefied + powder on LLD