# Lithium FY11/12 Research Milestone (R11-3) Discussion

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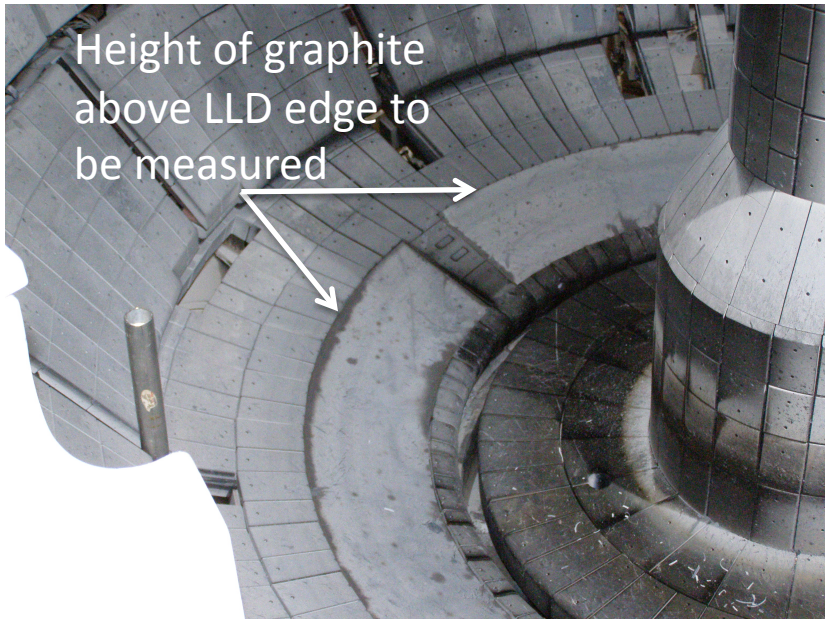
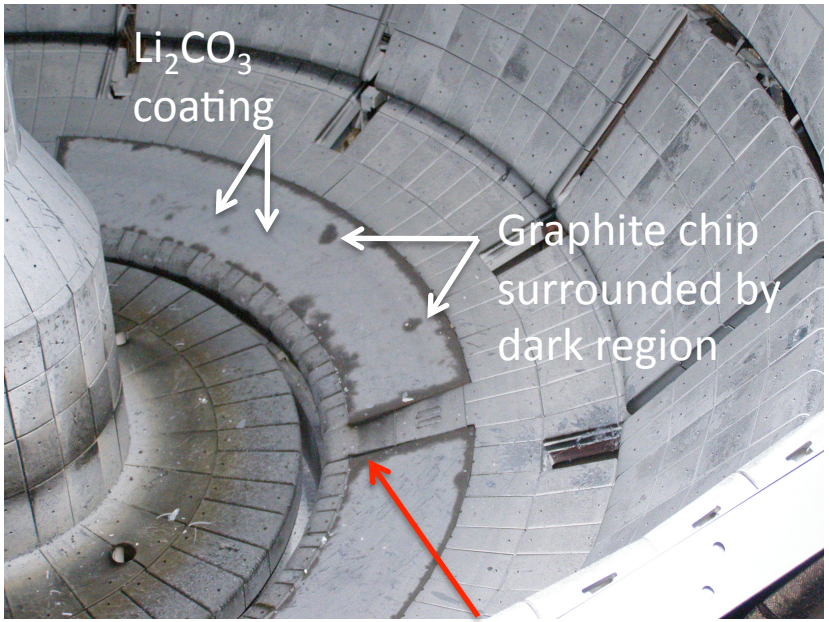
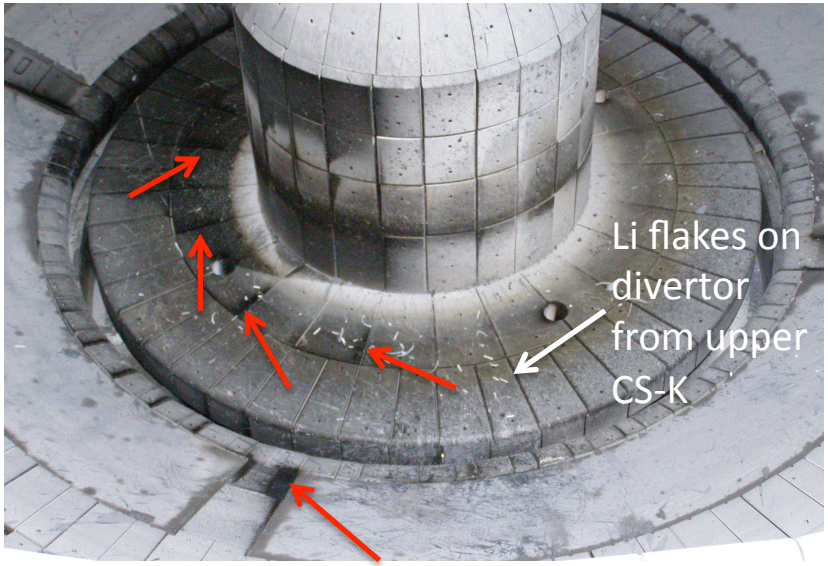
**LRTSG, Nov. 29, 2010**

# LLD Awaiting Cleanup and Maintenance Assessment




Dark features along most edges awaiting testing:

Water Test: (if fizzing)
- -LiOH, or $Li_2C_2$

Water Test: (if no fizzing)
- sputtered graphite, or
- Li-copper eutectic oxidzied into CuO (black); do copper test

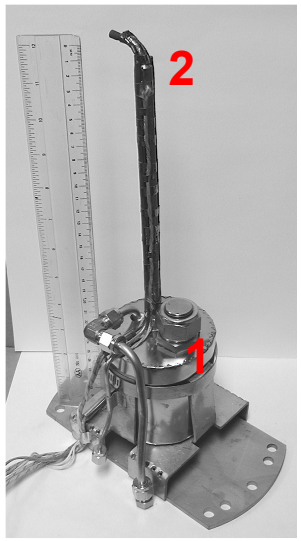
# LLD Maintenance Plans

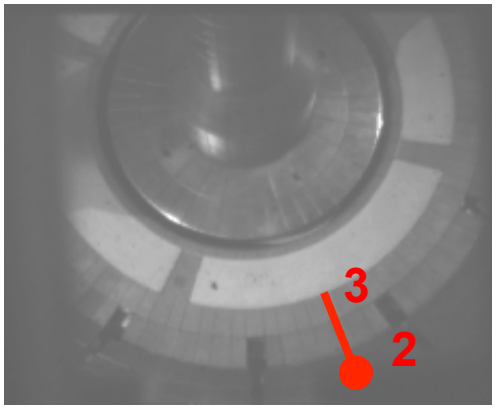
- **Assessment and Cleanup**
  - Deformation measurements and testing prior to cleanup
  - Procedure D-NSTX-IP-3226 LLD Cleanup under review; do cleanup
  - Leak check HE-plate bellows/ceramic break (assess cause of leak)

- **Upgrades**
  - Upgrade all ceramic breaks
  - Replace deflective heater leads (if feasible)

# Testing of More Efficient LLD Loading with Liquid Lithium Fill System in Progress

- **Proposed concept adopts LITER Liquid Lithium Fill system (LIFTER) technology being used to refill LITERS**
- **Concept**
  - **1 station per plate (one per 90°)**
  - **3 components per fill station:**
    1. External LIFTER-like unit (similar to LITER liquid Li fill system)
    2. Heated vertical pipe from port to distribution pipe near outer wall
    3. Moly or ATJ clad 316-SS pipe (spoke) from distribution pipe to plate




*J. Timberlake*

**Proposed** Research Milestone R(11-3): Assess the relationship between lithiated surface conditions and edge and core plasma conditions. The plasma facing components (PFC) of fusion devices play a key role in determining the performance of the fusion plasma edge and core by providing particle pumping and fueling and acting as a source of impurities. On NSTX, coating the divertor carbon PFCs with evaporated lithium has resulted in transient particle pumping, increased energy confinement, and suppression of edge localized modes (ELMs). To extend the duration of particle pumping, and to investigate the impact of liquid lithium on plasma performance, a liquid lithium divertor (LLD) ~~will be~~ was installed in FY2010, and the characterization now in progress of the relationship between these lithiated surface conditions and edge and core plasma conditions will be ~~determined~~ completed. Deuterium pumping will be studied as a function of LLD temperature and divertor electron density and temperature, strike-point location, and flux expansion~~. The deuterium recycling will be measured with a Lyman-α AXUV diode array.~~ The relationship between divertor deuterium luminosity induced by local recycling at the strike-points and that induced by fuel gas flowing across the divertor exit plumes and will be measured with a Lyman-α AXUV diode array. An in-situ materials analysis particle probe situated near the LLD will provide data on surface composition in the outer divertor region. The measurements will be compared to retention models. The temperature evolution of the LLD surface will be measured to determine its heat transfer properties and allowable peak flux, and to relate the LLD surface temperature to the influx of lithium and hydrogenic species. Finally, lithium transport from the plasma edge to the core will be measured. This research will provide the scientific understanding of LLD operation necessary to begin to evaluate liquid lithium as a possible PFC solution for NSTX and next-step facilities.