CDX-U Liquid Lithium Results and Plans for Future Research

Presented by Dick Majeski

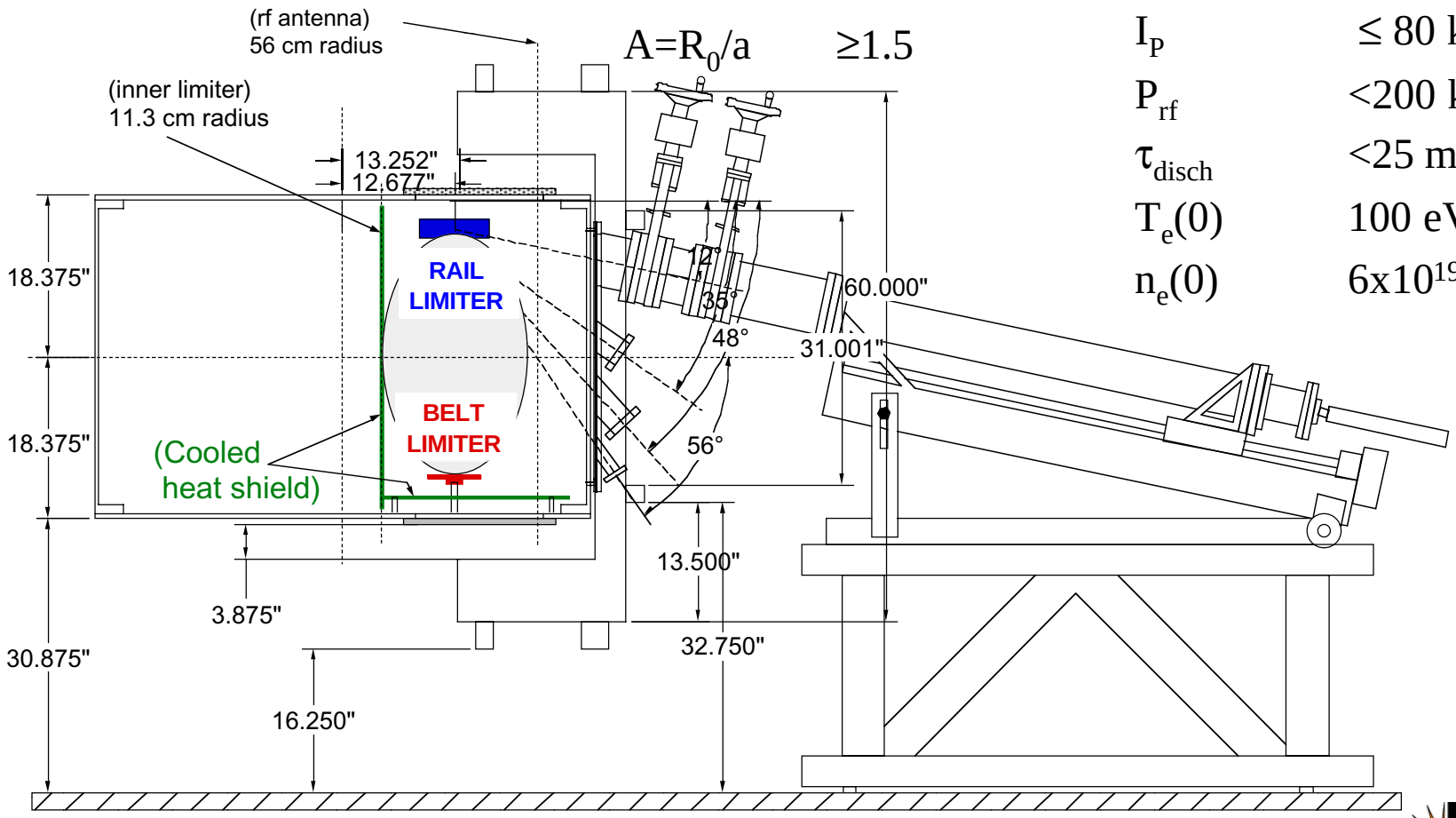
R. Kaita, M. Boaz, P. Efthimion, D. Hoffman, B. Jones, H. Kugel, J. Menard, T. Munsat, S. Raftopoulos, V. Soukhanovskii, J. Spaleta, G. Taylor, J. Timberlake, R. Woolley, L. Zakharov, *PPPL*, M. Finkenthal, D. Stutman, *Johns Hopkins University*, S. Luckhardt, R. Doerner, G. Antar, *UCSD*, R. Maingi, *ORNL*, S. Molesa, *Hope College*, M. Maiorano, *Rutgers University*

PPPL PRINCETON PLASMA PHYSICS LABORATORY

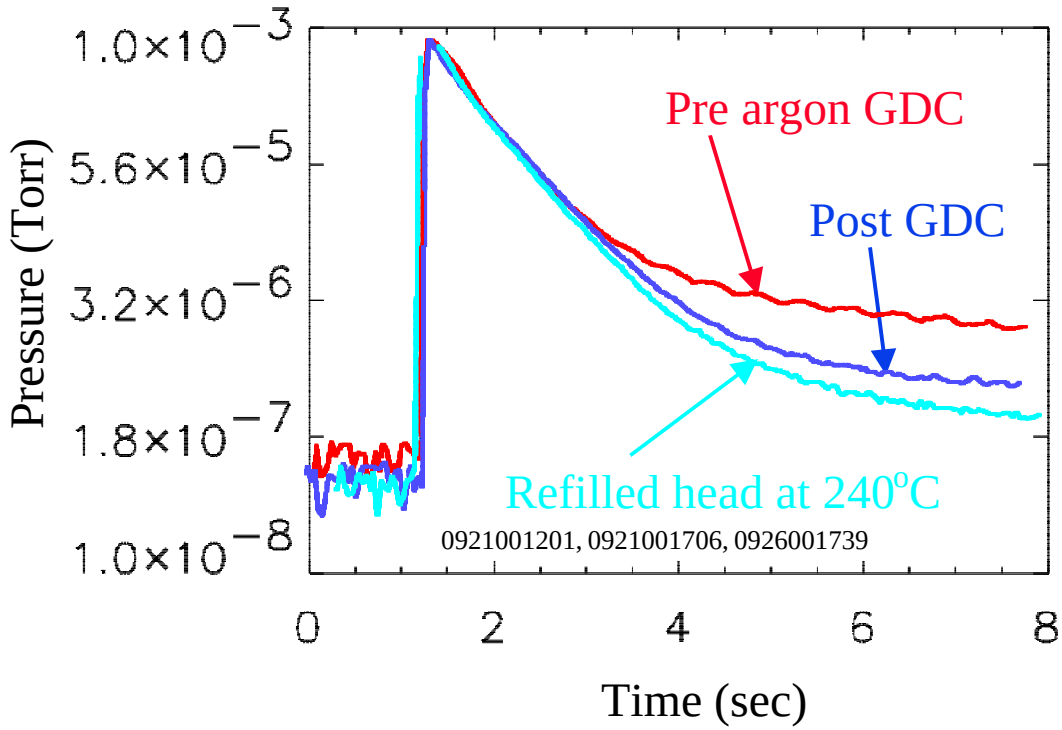
Typical CDX-U parameters

R_0	34 cm
a	22 cm
$A=R_0/a$	≥1.5

κ	≤1.6
$B_T(0)$	2.2 kG
I_P	≤ 80 kA
P_{rf}	<200 kW
τ_{disch}	<25 msec
$T_e(0)$	100 eV
$n_e(0)$	6×10^{19} m^{-3}



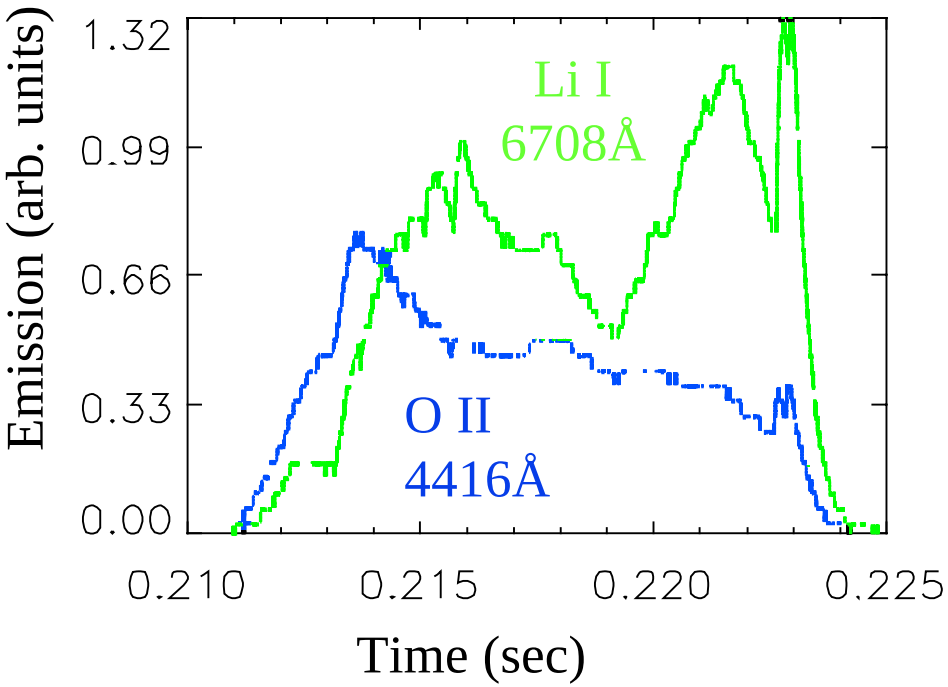
Clean, liquid lithium pumps deuterium

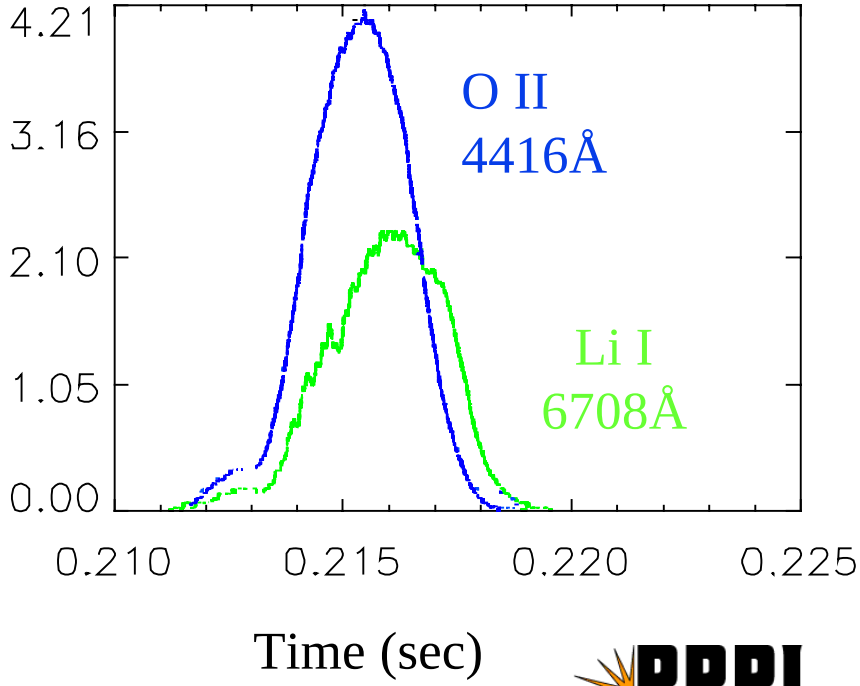


- Pumpout rate for deuterated lithium is similar to pre-lithium rates
- Enhanced pumpout rate following argon GDC provides evidence of deuterium removal by argon ion bombardment
- Pumpout rate for fresh liquid lithium is higher still

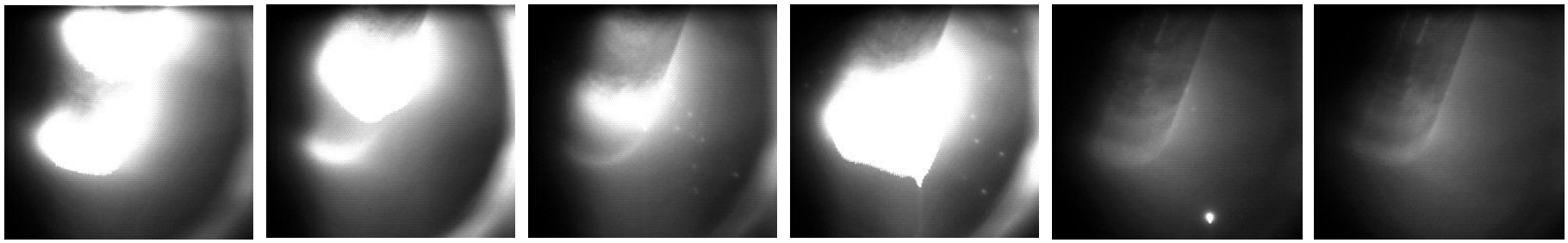
Clean, liquid lithium limiter reduces oxygen

- With a discharge-cleaned liquid limiter lithium emission is brighter than oxygen
  - OII *drops* during the discharge
- With a “dirty”, solid lithium limiter oxygen emission from surface coatings dominates

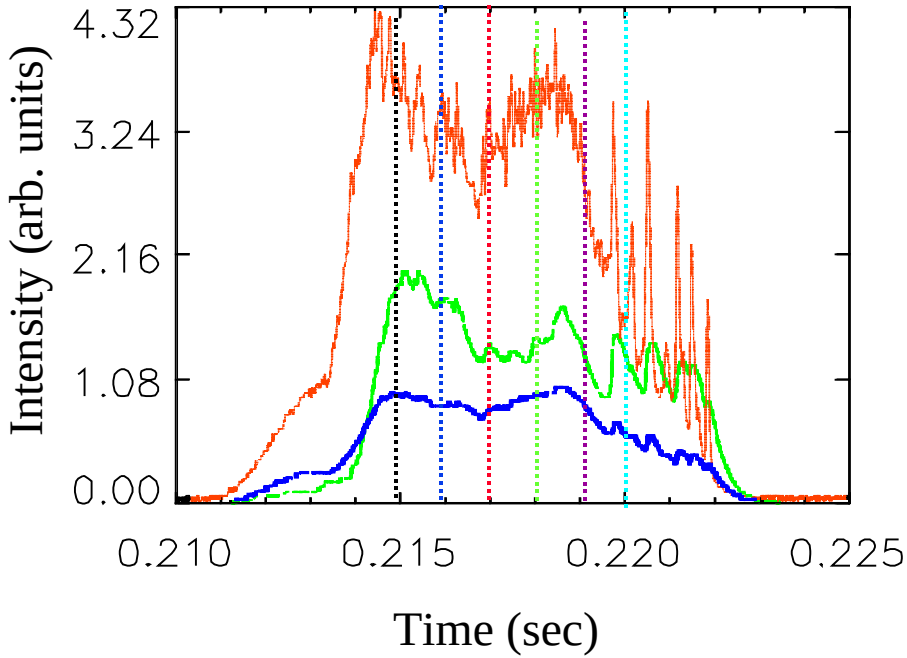


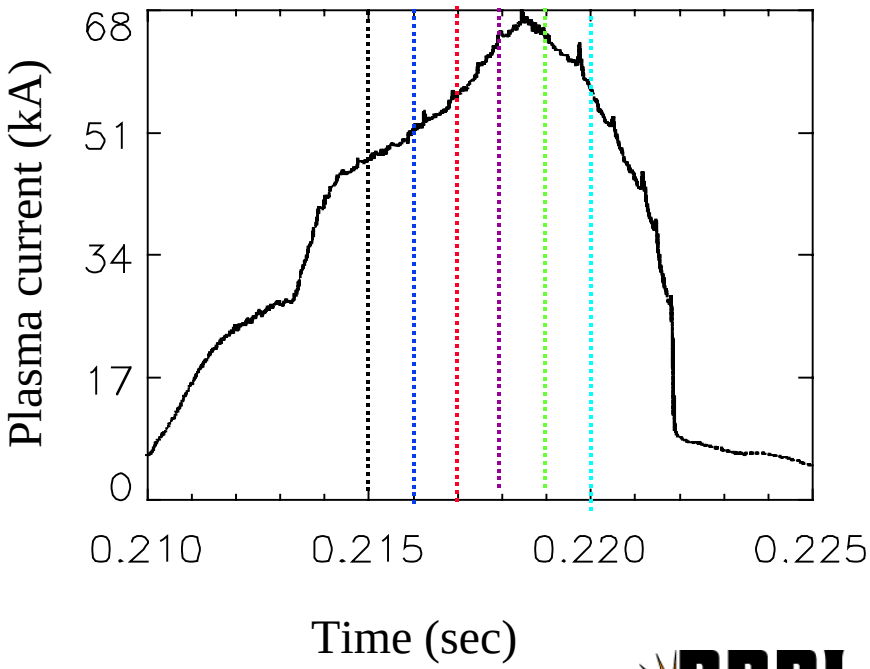


Large lithium influx (drip) does not disrupt discharge

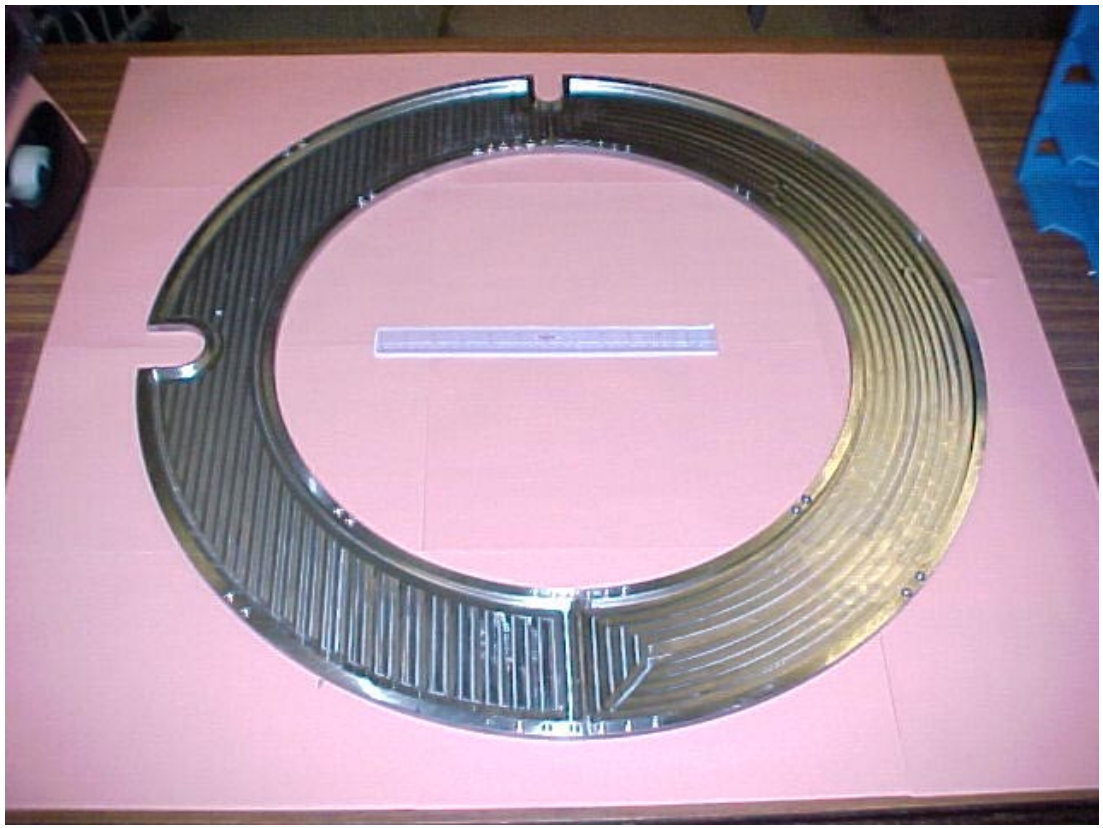


0.215s 0.216s 0.217s 0.218s 0.219s 0.220s





Stainless steel tray to provide liquid lithium belt limiter has been fabricated



- 49.46” (125.63 cm) diameter
- 0.25” (1.27 cm) deep to contain liquid lithium
- Fabricated in two halves that can be electrically isolated
- Heaters beneath for temperature control
- Now assembled and undergoing heater bakeout

Summary and plans

- CDX-U initial experience with lithium as a limiter is benign
  - Reduction, not elimination, of recycling (liquid or solid)
  - Edge influx, not much in the core
  - Lithium “droplet injection” does not disrupt the plasma
  - No significant window coating seen
  - Lithium splatters largely limited to area beneath the rail limiter
  - Easy cleanup “with a damp sponge.” Machine is now vented for belt limiter installation.
- CDX-U will undergo upgrades to extend the pulse length, increase auxiliary heating power.
- Test of a flowing lithium wall module for NSTX may be feasible.
  - Install in 20 cm wide x 66 cm high access port.
  - Install new head design on UCSD probe drive to test module ideas.