2 ISLA Session II-B 27 April 2011

Lithium in Magnetic Confinement Topical Experiments
(Chair : S.Mirnov)

Effect of Lithium Coatings on Edge Plasma Profiles, Transport, and ELM Stability in NSTX

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J. Canik, T. Osborne, P. Snyder, D. Boyle, J. Manickam, R. Bell, A. Diallo, S. Kubota, B. LeBlanc, M. Podesta, Y. Ren, D. Smith, V. Soukhanovskii, and the NSTX Team

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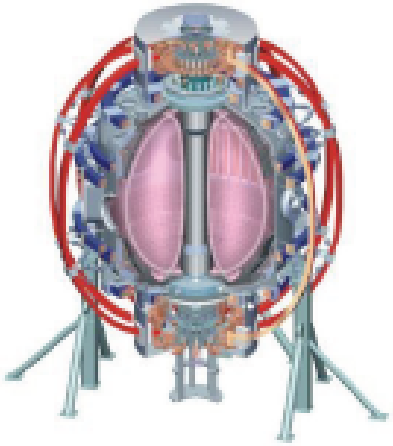
2nd International Symposium on Lithium Applications
Princeton, NJ
April 27-29, 2011



Evaporated Li coatings provide edge plasma profile and stability control in NSTX

- This talk describes a pre-LLD experiment with systematic and slow increase in lithium wall coating between discharges
  - "Medium" coatings level used to study Edge Localized Modes (ELM) stability physics
    - "Larger" coatings reproducibly suppress ELMs on ~ every discharge
  - Global energy confinement improved and ELMs stabilized
  - Operating regime achieved in which global stability limits observed before edge stability limits
- Region of reduced edge particle and electron thermal transport (aka H-mode transport barrier) broadened
  - Depends ~*continuously* on amount of pre-discharge Li deposition
- ELM frequency also depends nearly continuously on amount of pre-discharge Li deposition
  - n_e profile broadening critical component

Characterization of transient particle loads during lithium experiments on the National Spherical Torus Experiment

V. Surla[1]

M.A.Jaworski[2], T. K. Gray[3], R.Kaita[2], H.Kugel[2], J.Kallman[2], A. McLean[3], F.Scotti[2], V. Soukhanovskii[4], D.N. Ruzic[1] and the NSTX Research Team

[1] University of Illinois at Urbana-Champaign
[2] Princeton Plasma Physics Laboratory
[3] Oakridge National Laboratory
[4] Lawrence Livermore National Laboratory

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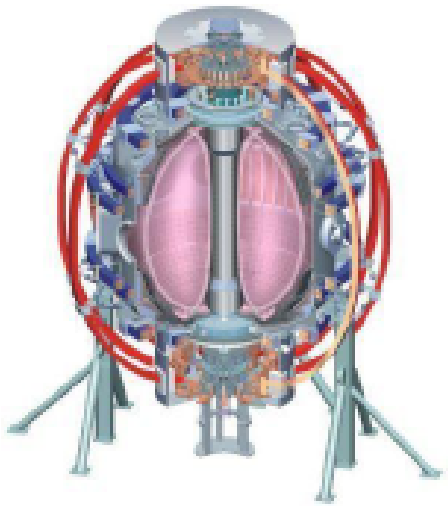

Conclusions

- Demonstrated the use of HDLP Array for characterizing ELMs
  - HDLP array provides particle flux measurements with a time resolution of 4 μs to allow studies within one ELM
  - A methodology was developed to characterize ELMs and ELM statistics are presented
  - An average of 1.5 MW/m^2 strikes the probe surface during an ELM
- A correlation was found between particle flux from the probes with D-alpha signal during the ELMs
- Comparison of heat flux profiles from IR diagnostic with the probe offers interesting analysis
  - The q_{IR} profiles are longer in duration than I_{sat} profiles
  - A correlation between τ_{IR} and fraction (f_{peak}) was seen – only 15 ± 8% of the ELM energy deposited leads to an increase in target temperature

High Density and Pellet Injection Experiments with Lithium Coated Wall on FTU

D Frigione

ENEA, Frascati , FTU Team
Frascati, Rome, Italy

Major Contributors: M.L. Apicella1, R. Cesario, L. Garzotti, E. Giovannozzi, M. Marinucci, G. Mazzitelli, C. Mazzotta, G. Pucella, O. Tudisco and FTU Team

- The use of Lithium produces many beneficial effects on FTU operation
- Impurity content and wall recycling are substantially reduced
- The density operation range is extended well above the Greenwald limit in association with the peaking of the density profiles
- Improved Ohmic confinement is observed at high density
- Pellet injection is well received by the target plasma showing the presence of an enhanced particle pinch.
- The low recycling regime, together with pellet injection has been used for studying LH penetration at high density opening the path towards the use of LHCD at ITER relevant densities.

STATUS AND PROSPECT FOR THE DEVELOPMENT of LIQUID LITHIUM LIMITERS FOR STELLARATOR TJ-II

A.V.Vertkov, I.E.Lyublinski, F.Tabares, E.Ascasibar

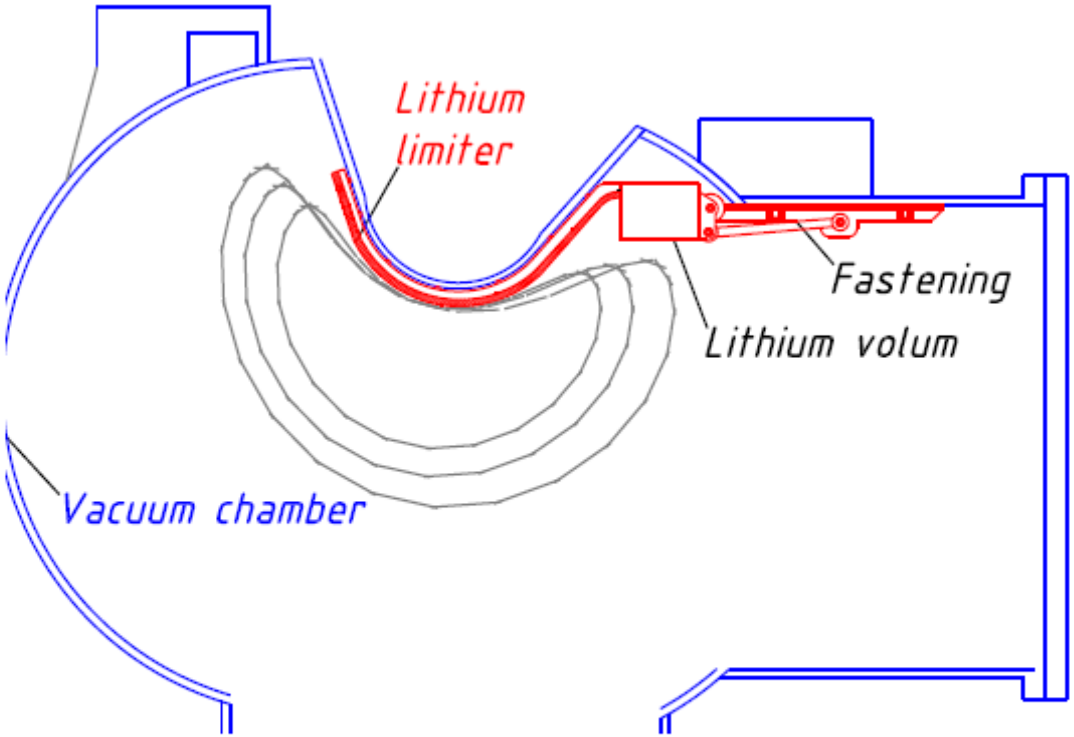

FIG. 8. Scheme of lithium limiter arrangement in TJ-II

Effect of Lithium Wall Conditioning on Impurities in LTX

Erik M. Granstedt, R. Kaita, R. Majeski, (PPPL)
T. Gray, R. Maingi, A. McLean (ORNL)
and the LTX team

Princeton Plasma Physics Laboratory, Princeton, NJ

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- fresh Li plasma-facing surfaces may contribute to improved plasma performance by reducing impurity wall sources (oxygen, metals?) lowering overall plasma impurity content
- neutral Li flux into plasma is $\sim 10\times$ higher when operating with hot shells, and substantially higher than the estimate from the known Li evaporation rate
- the reason for increased carbon emission following Li conditioning remains unknown

Fueling of LTX Plasmas with Lithium Plasma Facing Components

D.P. Lundberg, R. Kaita, R. Majeski
and the LTX team

Princeton Plasma Physics Laboratory, Princeton, NJ

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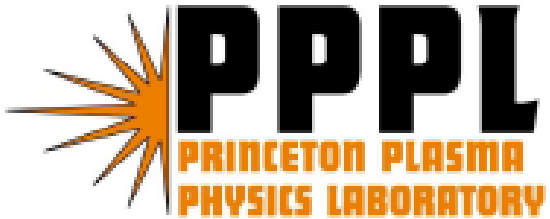

Supported by US DOE contract # DE-AC02-09CH11466

Future Plans

- Optimize performance of cluster injector on LTX
  - Maximize fueling efficiency / percentage of core fueling
    - Does this depend on cluster size or just molecular density in the jet?
  - If successful, this fueling system should be of interest to the broader fusion community
    - Cheaper and less complicated than pellet injection
    - High fueling rates available
- Use the cluster injector as a tool to study plasma density profiles with low-recycling walls
  - How does the density profile evolve differently with:
    - Edge fueling?
    - Core fueling?
    - The absence of external fueling?
  - Can we strongly affect the electron density profile via fueling?