
Plans for testing the module A concept in CDX-U

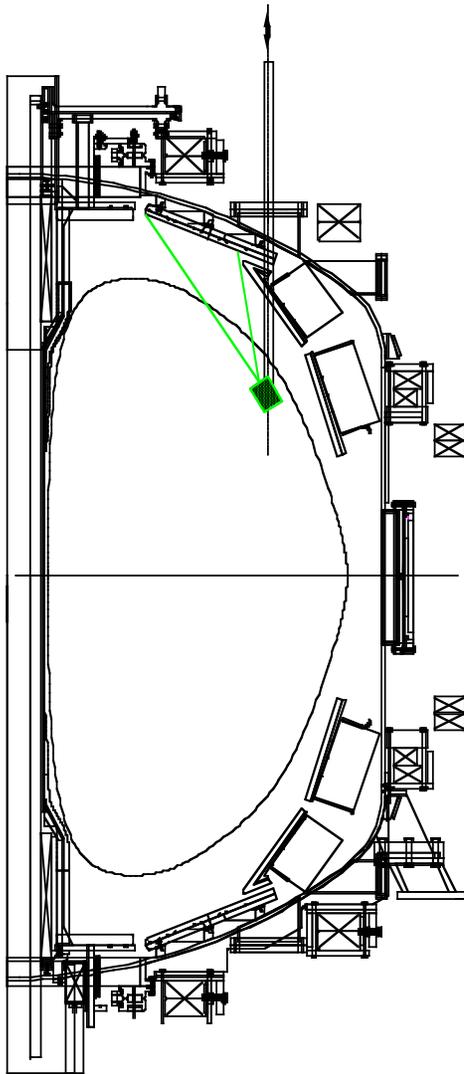
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Overview

- ◆ CDX-U will remove the present tray and install a coated limiter system in early spring 2004.
 - Duration of coated limiter tests is restricted to FY04.
 - In FY05 CDX will be disassembled and modified into LTX.
- ◆ Two substrates will be tested:
 - Carbon tiles (use ATJ carbon identical to present NSTX limiter tile material.
 - Engineered metallic tile. Surface/substrate TBD.
 - » Fallback is tungsten on chromium-plated copper.
- ◆ *Many of the detailed aspects of the lithium-on-carbon system are better examined in offline facilities.*
- ◆ *The main role of the CDX experiments is to compare recycling on the two systems.*
 - Comparison with the bulk liquid lithium system will be facilitated by roughly conserving area. *But differences are unavoidable.*

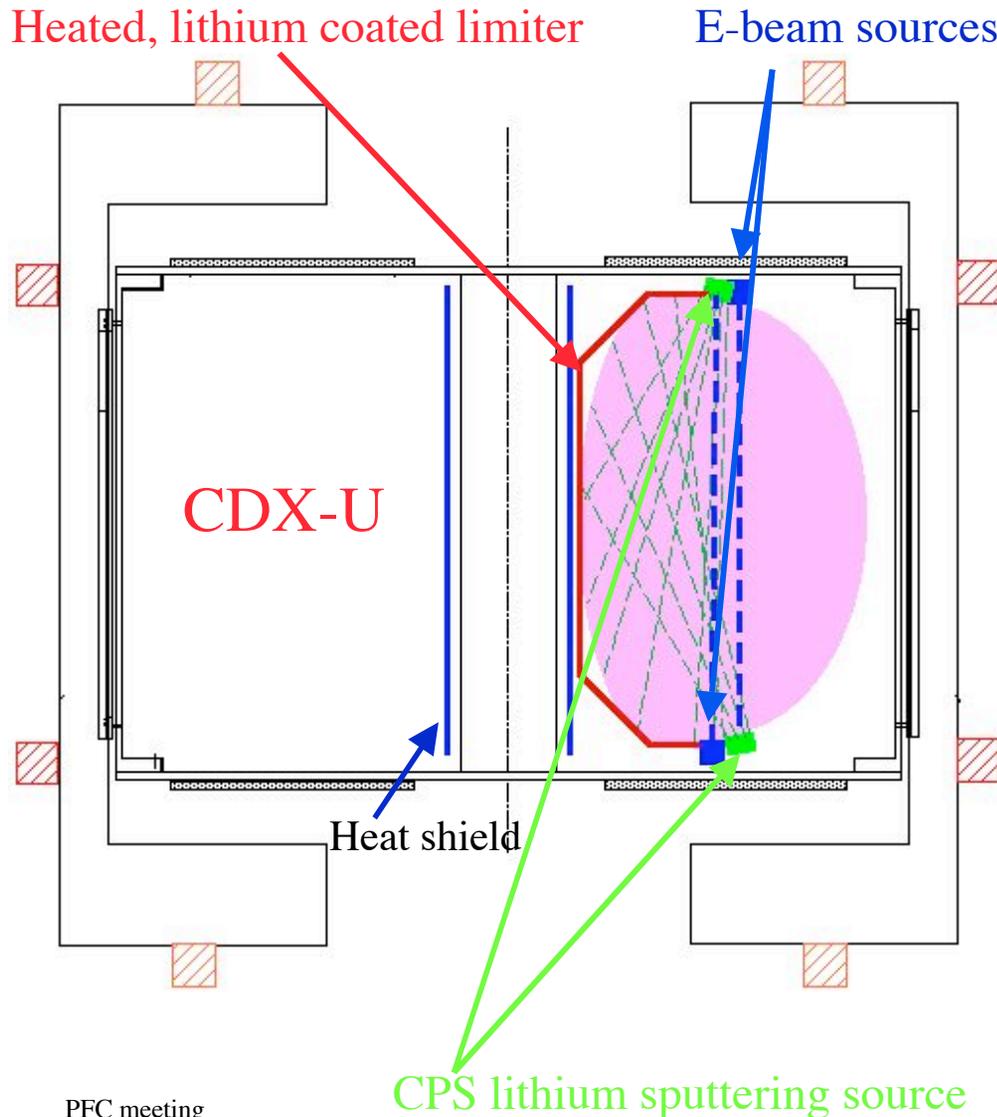
NSTX lithium divertor coatings

Slide from NSTX forum presentation 12 November



- ◆ Goal: Control divertor recycling using between-shots application of lithium coatings to the outer divertor tiles
 - Is lithium-on-graphite acceptable? Or is metallic lithium on an impenetrable substrate needed?
- ◆ Install an insertable e-beam (or resistively heated) deposition system (upper port as shown)
- ◆ Deposit few 1000\AA of lithium. Withdraw deposition system.
 - Reminiscent of the insertable getters used in PLT, PBX
 - But time scale is different
 - » Few 10's of seconds for 1000\AA coating
 - » Cycle time is dominated by insertion/removal of deposition source.
- ◆ Coat before *every shot*
 - 1000 shots \square 0.1 mm accumulation
 - » Accumulation may be limited by evaporation

Module A test limiter in CDX-U

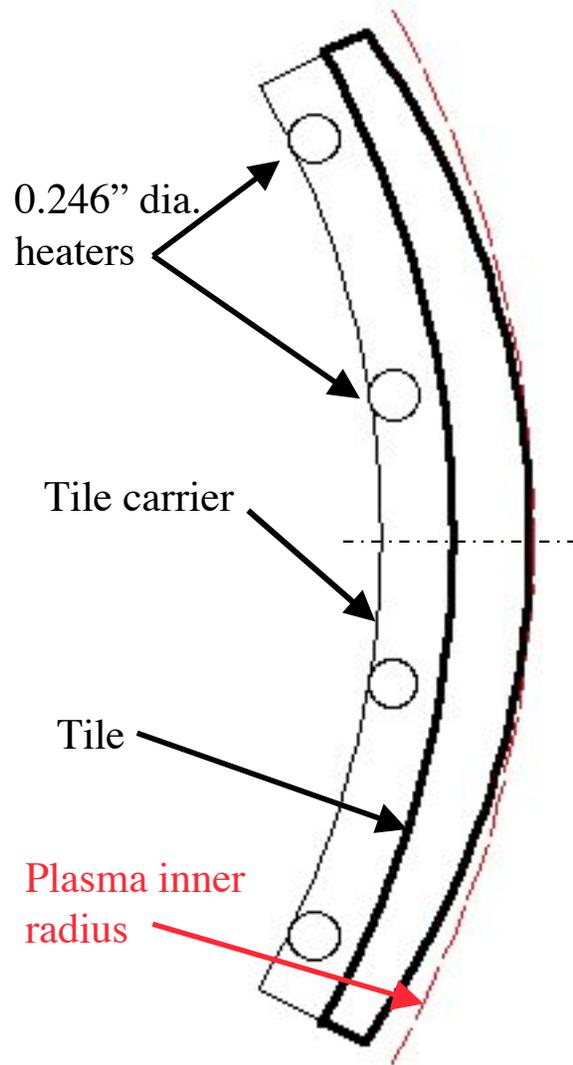


- ◆ Single toroidal location
- ◆ Limiter will utilize 11 rectangular tiles
 - Curved on P-F side
 - Approx. 10 x 15 cm ea.
 - 1,650 cm² total area
 - Comparable to tray area
 - 60° coverage of C-S
 - Heated
- ◆ Two e-beam sources.
 - Try electrostatic focussing; allow magnetic guide field (using PF coils).
 - One up, one down.
 - Fixed, above/below plasma LCFS.
- ◆ Two lithium sources.
 - One upward facing, one downward facing.
 - Russians interested in supplying sources (CPS)
 - Sources will be fixed during operation

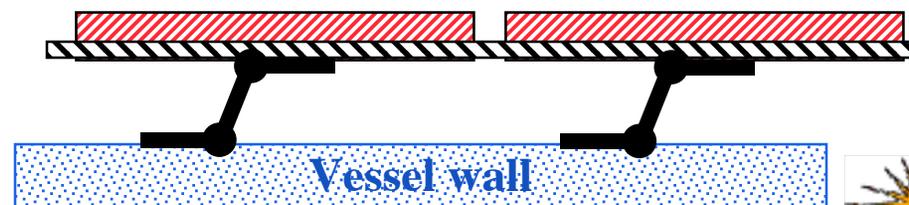
Module A test limiter

- ◆ Lithium coatings will be deposited on a partial poloidal limiter
 - Inner, upper, lower plasma limiting surface.
- ◆ Limiter will consist of 11 tiles, 10 x 15 cm each.
 - Mounted on tubular resistance heaters.
 - Fixed at centerstack midplane; flexible restraints at upper/lower ends
- ◆ Centerstack tile outside radius: 14 cm
 - Reduces plasma minor radius by 1 cm; R_0 to 35 cm.
 - Upper-lower limiter distance 67 cm.
- ◆ Utilize commercial tubular heaters with custom cold sections
 - Stainless steel sheaths
 - Fed through swageloks; all electrical connections in air
 - 5 kW

Tile cross section



- ◆ Tile carriers will be mounted on heaters
- ◆ Tiles will be mounted on carriers along centerline only
- ◆ Limiter assembly will only be fixed at midplane
 - Allows for thermal expansion
- ◆ Grafoil between carrier and tile for thermal transfer
- ◆ Upper/lower limiter assembly will be restrained with hinged assemblies
 - Allows for thermal expansion with minimal vertical displacement
 - Produces small bending moment on C-S tile assembly



E-beam and lithium reservoir

- ◆ E-beam sources will be fixed
 - One above upper limiter near major radius
 - One below lower limiter near major radius
- ◆ Beams will be few hundred mA, 4 kV
 - Use same filament as in existing commercial source.
 - Same power supply (purchase second unit for additional source).
- ◆ NSTX has a preference for electrostatic focussing vs. magnetic mapping.
 - May not be easy to achieve at desired current densities.
 - CDX can use simple gun geometry, magnetic mapping from gun to lithium target
- ◆ Lithium CPS target will be obtained from Russians
 - Strongly desire a collaboration in this area

Critical measurements and results

- ◆ Recycling! Direct comparison of Li on carbon and a metallic substrate.
 - Fueling observations and D_{\square} measurements
 - Will also compare with tray results.
- ◆ Further investigation of effects on current channel width, T_e profile
 - Improved magnetics available
 - Modeling with ESC and/or EFIT (if there's a volunteer)
- ◆ Will again attempt to get manpower for Thomson scattering diagnostic
- ◆ Better control of loop voltage evolution may be available
- ◆ Post mortem of carbon tile important
 - Are there any added effects due to tokamak plasma exposure?
- ◆ Long term behavior of metallic system important for NSTX, LTX