

Progress Toward Design Goals and Process

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Liquid Lithium Divertor Meeting
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Proposed Liquid Lithium Divertor Design Goals



• Proposed Physics Design Goals for the LLD

1) Achieve NSTX inductionless current drive density control capability in the range

- Option 1

$$n_e = 3 \times 10^{19} \text{ m}^{-3} \text{ at } I_p = 700 \text{ kA } (n_e/n_{GW}) \sim 0.4-0.5$$

[from Previous 5 Yr plan, ISD scenario]

- Option 2

$$n_e \sim 5 \times 10^{19} \text{ m}^{-3} \text{ at } I_p = 700 \text{ kA } (n_e/n_{GW}) \sim 0.65-0.8$$

[from more recent estimates (~15-25% decrease in n_e from recent exps)]

2) Allow for n_e scan capability in H-mode (e.g., ~ x2)

3) Exhaust 7.5 MW NBI incident power for 2 sec (15 MJ of energy)

• Proposed Geometry Design Goals for LLD

For SNL by April 15, 2007 need to specify the following LLD parameters:

1) Width

2) Major Radius R

3) Number of segments, gaps between segments, and clocking of segments ($\phi_{\min} - \phi_{\max}$)

4) Orientation (horizontal or sloped) and nesting (on tile or on copper PP)

Ideal Process for Arriving at the April 15 Decision



- 1) Identify technical constraints on the various candidate locations and geometries. (in progress)
- 2) Simulate particle balance and recycling physics. (refer to following talk on particle balance and recycling physics considerations, R. Maingi)
- 3) Analysis of available data (refer to presentation at next meeting, V. Soukhnovskii)
- 4) Update Decision Matrix (refer to next Slide)

Preliminary Decision Matrix



RADIUS & WIDTH	GENERAL MERITS	GENERAL DEMERITS	PARTICLE BALANCE & RECYCLING	EROSION & DEPOSITION	DIAGNOSTIC ISSUES re Radius & Width
Inner-half, Lower Inner Divertor	<ul style="list-style-type: none"> + Lowest R/a + Allows high performance NSTX plasmas + Graphite outboard for other XPs + Smallest circumference (7') 	<ul style="list-style-type: none"> - Biggest impact if malfunction during run. - Difficult to reach Inner Vessel feedthrus. - Lower Inner Divertor gas ports. - ~137cm Li feed stroke from HorizDiv Port. - Possible CHI issues 	Modeling in progress	<ul style="list-style-type: none"> -Shortest CS sputtering trajectory - highest Li_2C_2 formation? 	<ul style="list-style-type: none"> - Loss of 1 or 2 Bz coils - Loss of 2 TC - Loss of 2 LP
Outer-half, Lower Inner Divertor	<ul style="list-style-type: none"> + Graphite on inboard side for other XPs 	<ul style="list-style-type: none"> - Difficult access to Inner Vessel feedthrus. - Lower Divertor gas ports. - ~117cm Li feed stroke. - Possible CHI issues 	Modeling in progress		<ul style="list-style-type: none"> -Loss of 1 or 2 Bz coil - Loss of 2 TC - Loss of 2 LP spaces
Inner-half, Lower Outer Divertor	<ul style="list-style-type: none"> + Minimal impact if malfunctions during run + Allows majority of XPs to use Inner Divertor + Nearby large ports + Minimal feedthru issues + No apparent CHI issues + Higher R/a, NHTX-like XPs + Allows characterization of heat flux footprint for higher-aspect-ratio NHTX plasmas 	<ul style="list-style-type: none"> - Largest circumference (15.5') - Sloping installation on conical section more difficult. - Flat installation on conical section - Unusable for present smaller R/a high performance plasmas. - ~102 cm Li feed stroke from HorizDiv Port 	Modeling in progress		<ul style="list-style-type: none"> -Loss of 2 Bz coils - Loss of 2 TC - Loss of 1 LP - FL response changes?