Update on Modeling of Power and Particle Control for ARIES-Compact Stellarator

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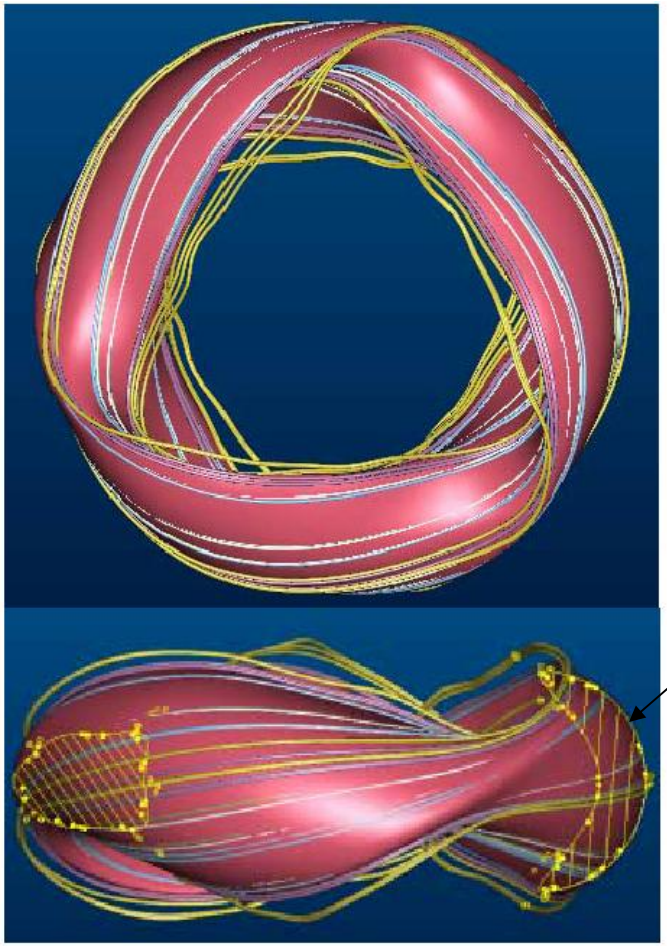
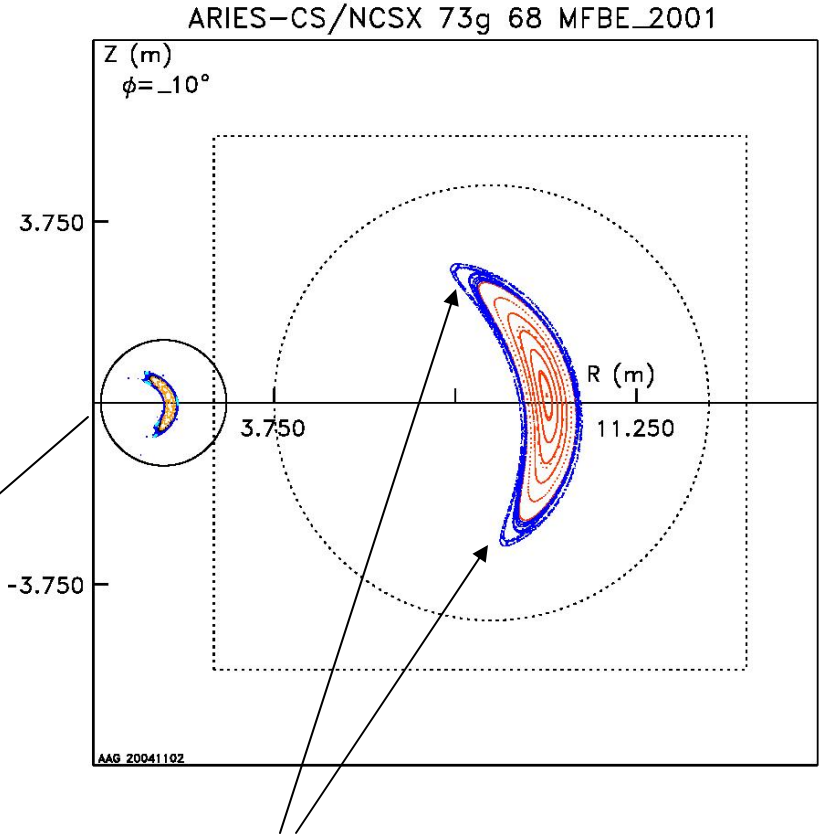
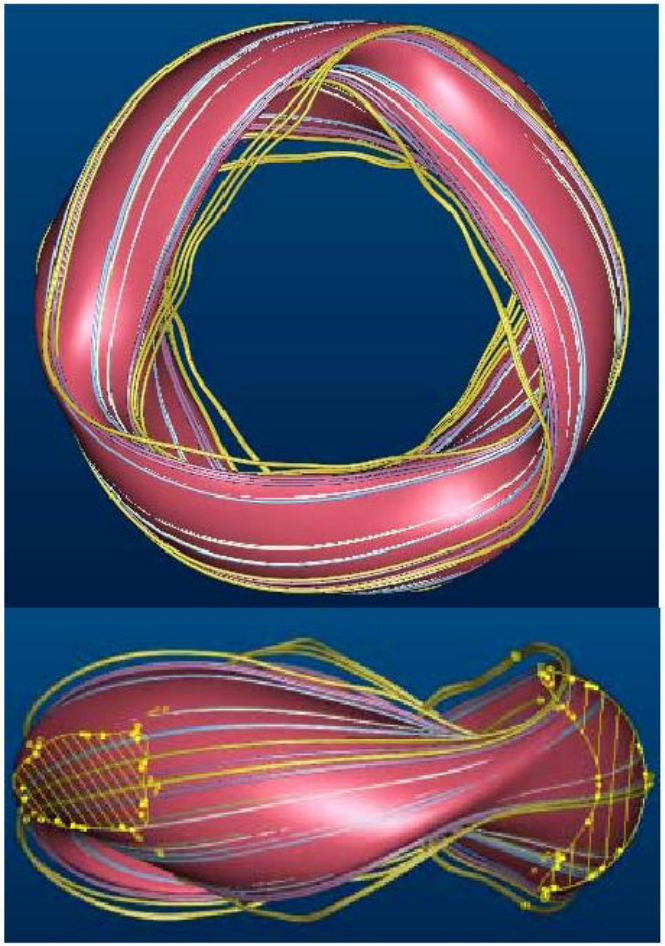
10° NCSX vs. ARIES-CS

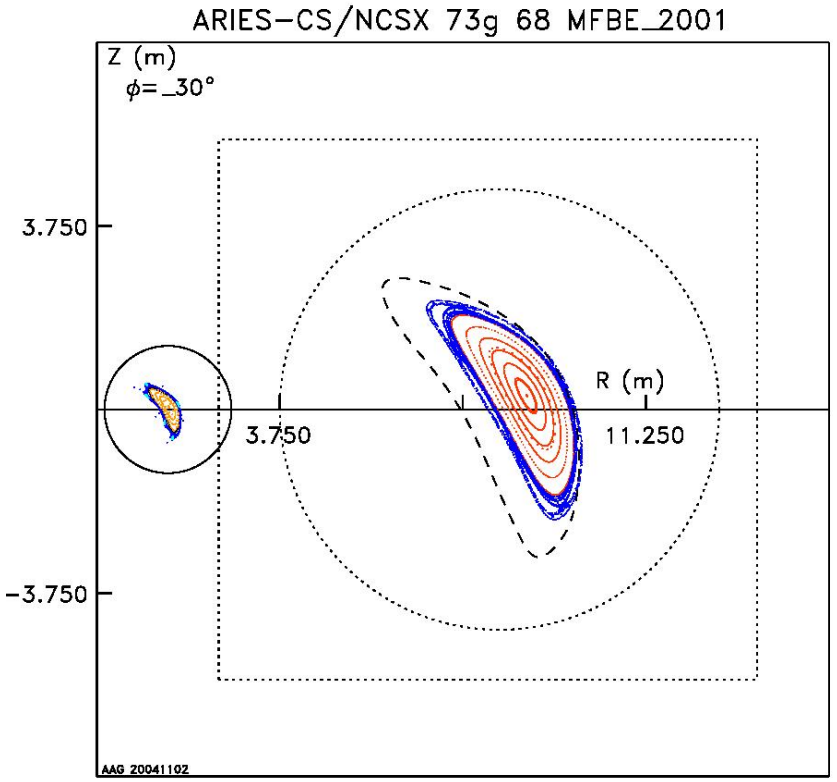




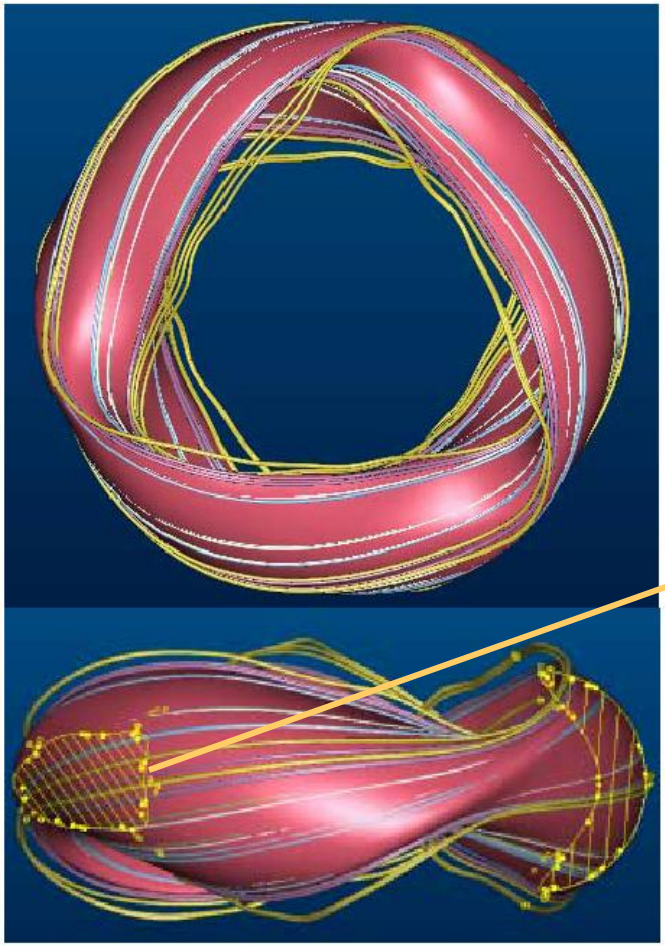
Islands at Helical Edge

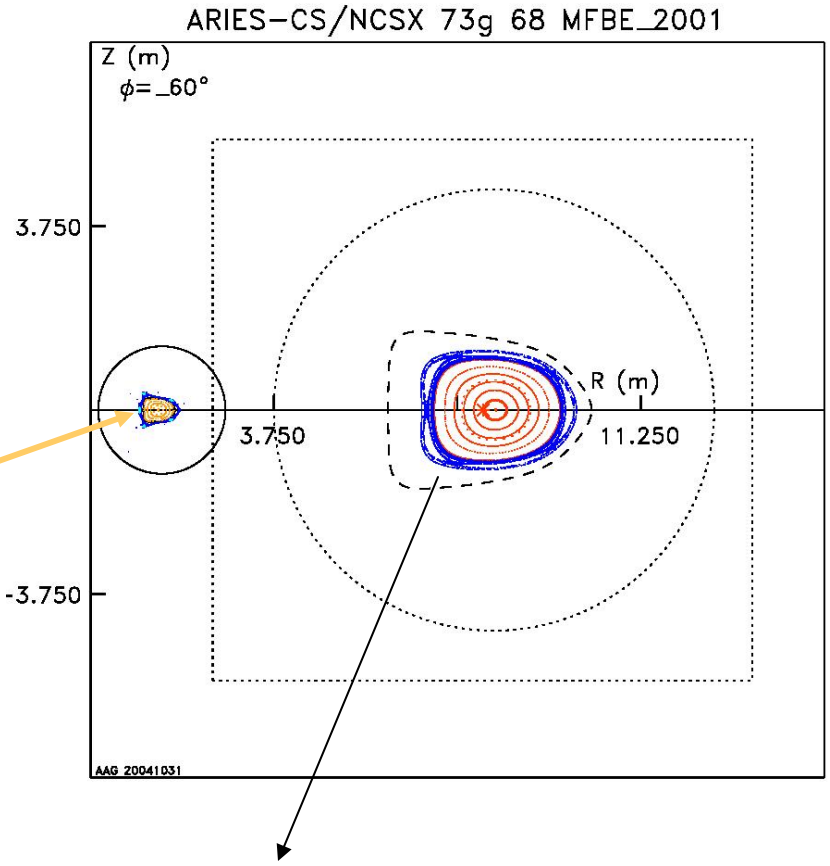
30° NCSX vs. ARIES-CS





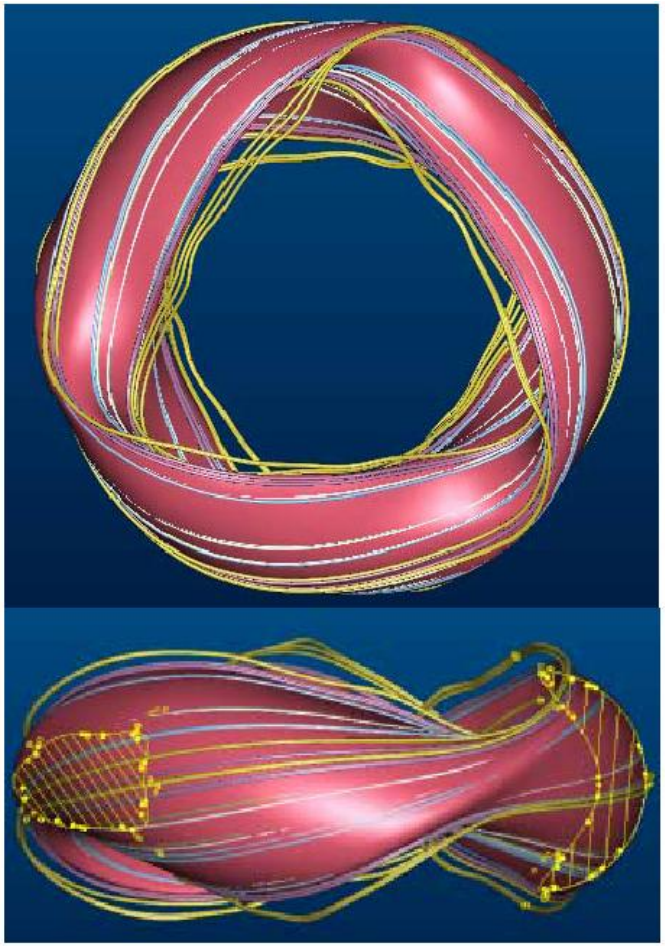
60° NCSX vs ARIES_CS

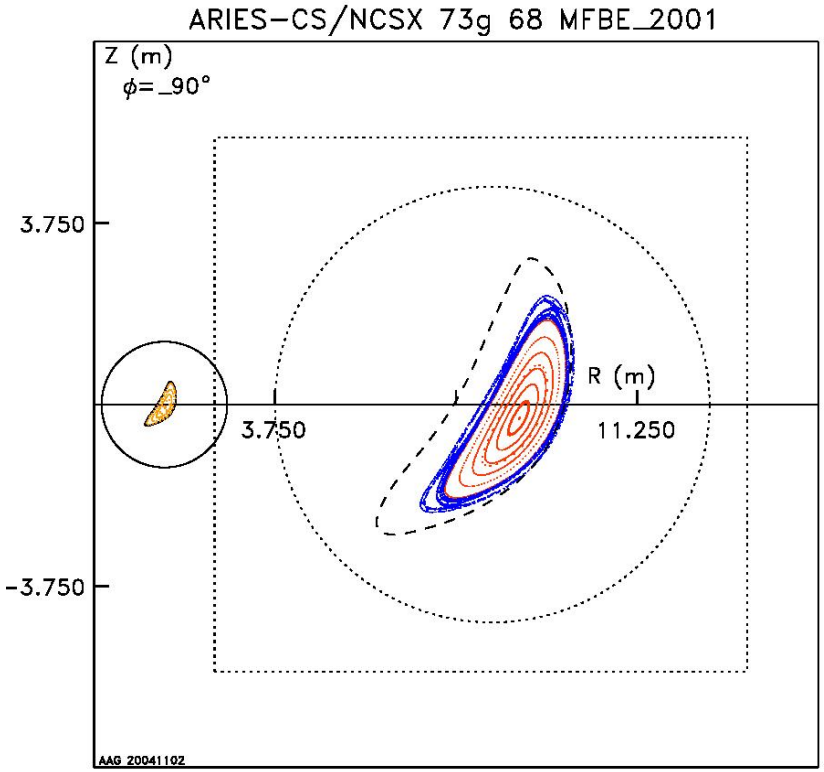




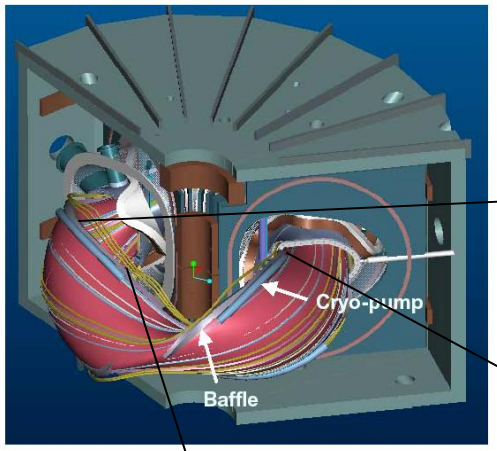
5 Islands Resolved at iota=0.6 (3/5 Island Chain)

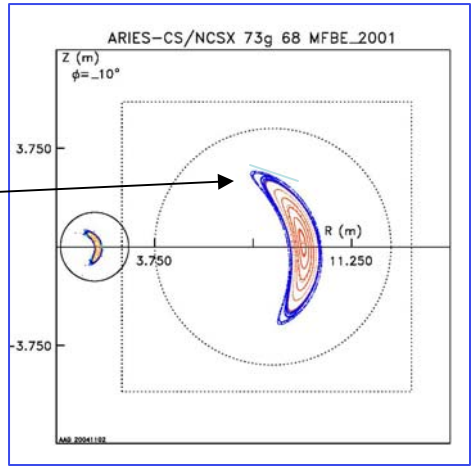
90° NCSX vs. ARIES-CS

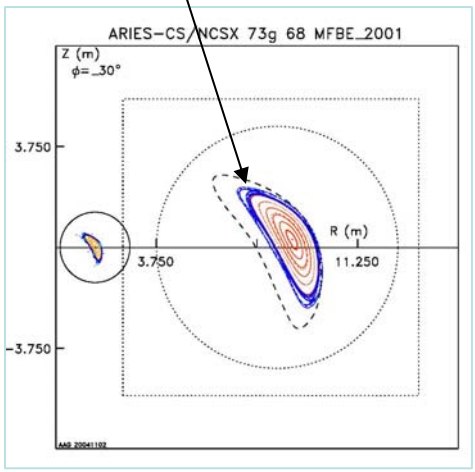


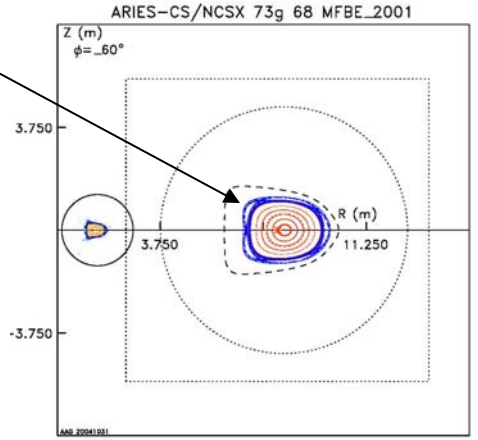


Plasma Column with Divertor and Baffle Plates At Island Helical Edge

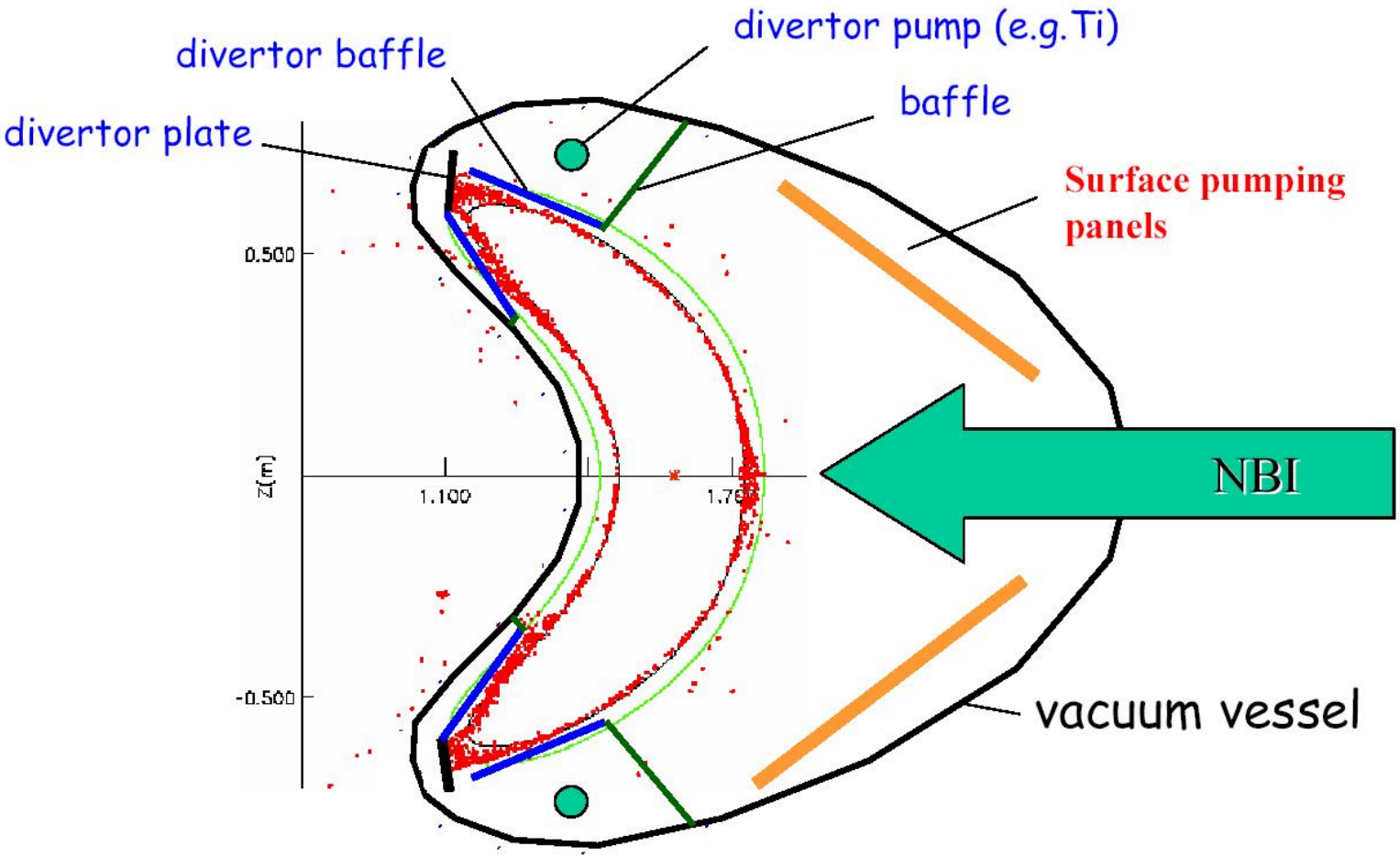




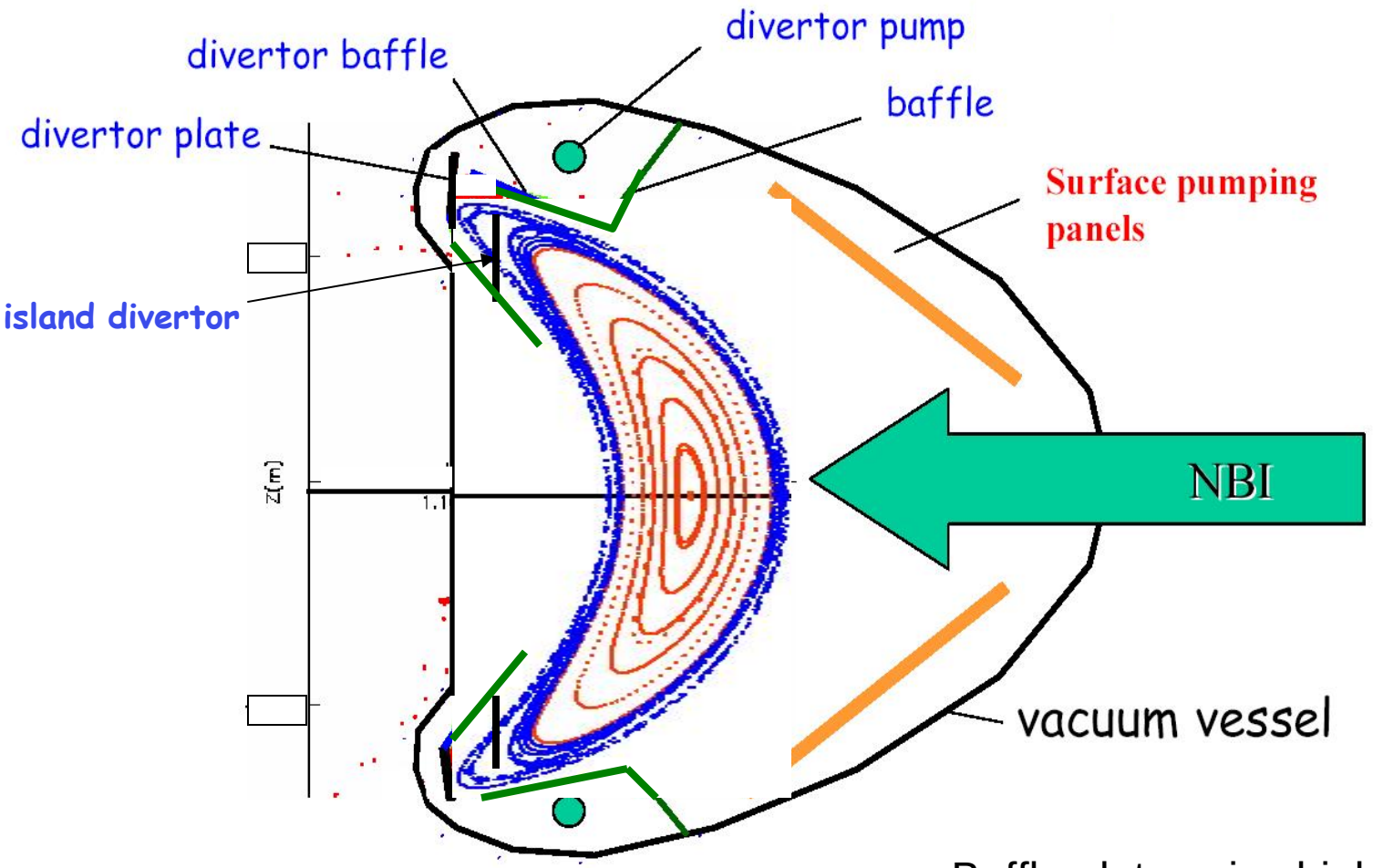




NCSX Divertor Concept

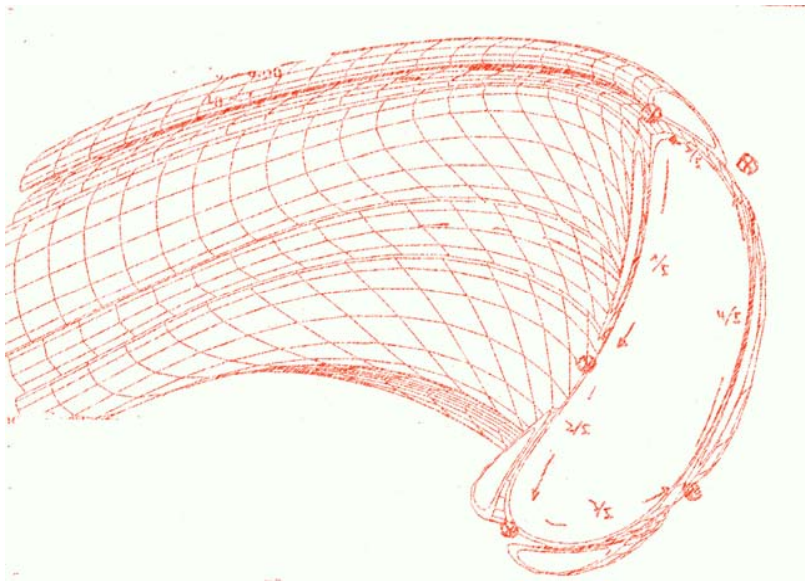


Aries-CS Divertor Concepts



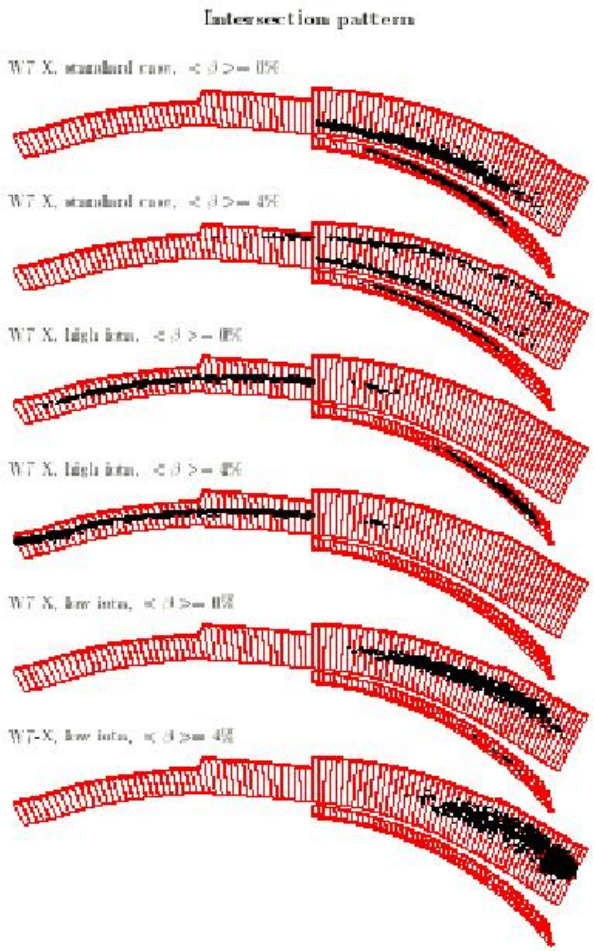
Baffle plates give higher neutral densities for improved pumping

Island divertor is like tokamak divertor



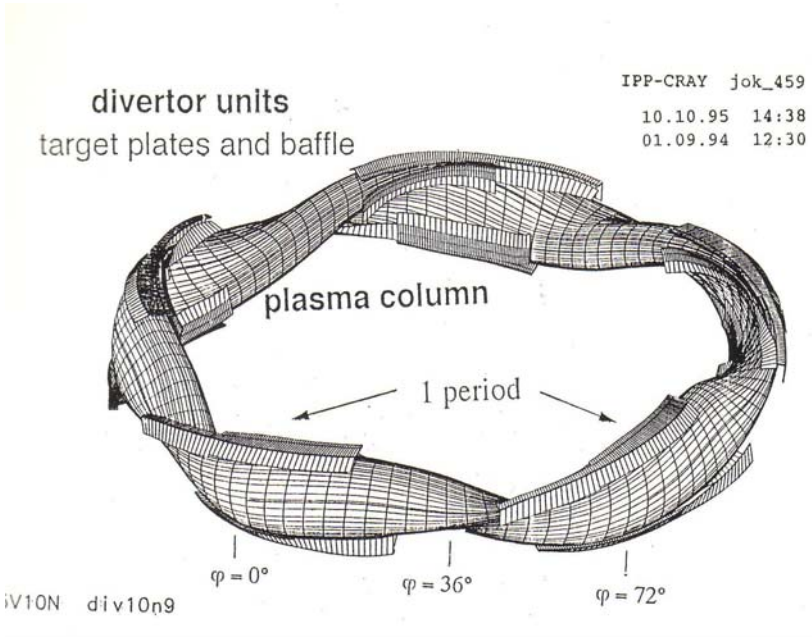
- Each island has the same basic topology as SN tokamak divertor, except x-lines helical.
- Smaller radial scale length requires higher densities than tokamak divertor. Achieved by confinement of recycled particles in closed islands.

Island divertor highly optimizable via GOURDON



- Island size and position provide flexible way to optimize geometry.
- Lc -target/sep distance control via iota, Bz, and control coils.
- Lc directly impacts the perp/parallel transport. Comprehensive map of Lc via GOURDON is 1st step.

3D Effects Important



- Toroidal variation of island shape – higher loads at islands cross-sections that are small radially.
- Segmented targets- Field lines periodically cross neutral clouds- these are high recycling zones in W7-AS (flux amp >10).
- Must tilt targets to avoid leading edges.

Conclusion

- The magnetic field structures are somewhat different in ARIES-CS and NCSX.
- A non-stochastic 3/5 island chain (NCSX had stochastic island remnants of small radial extent) at iota=0.6 has been observed outside the Aries-CS LCMS.
- Larger island width at the helical edge may allow the W7 island divertor concepts to work in ARIES-CS.
- An open divertor like NCSX cases without robust islands may also apply ARIES-CS.