Task A: Plasma/Liquid-Surface Interactions

Status of Edge-Plasma Modeling for APEX

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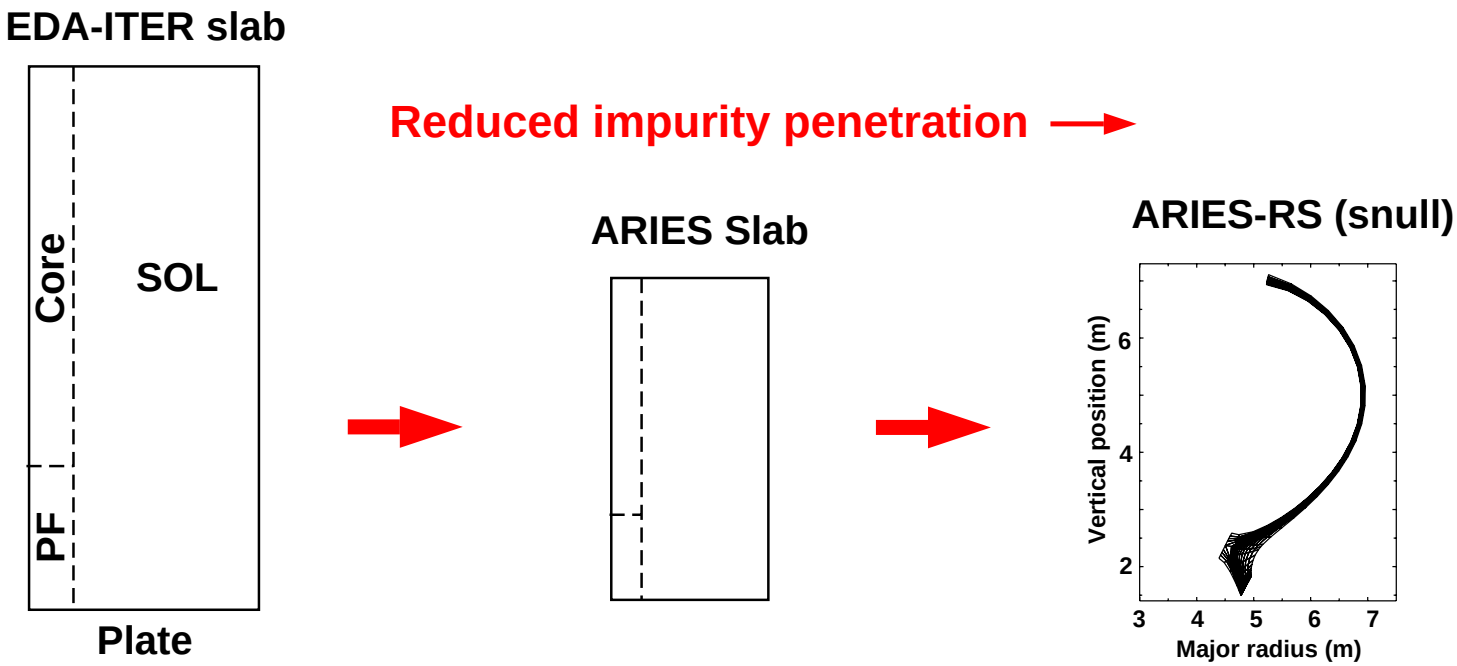
Geometrical shape and size significantly impacts impurity screening capability for tokamaks with liquid walls



Summary of wall surface temperature for high-recycling tokamak

Material	lithium	tin-lithium	flibe/flinable	tin
Old Teff(C)	> 300	> 500	390	
New Teff (C)	390	600	450	810
New Tout (C)	420	630	480	840

Divertor surface temperature depend strongly on material conductivity

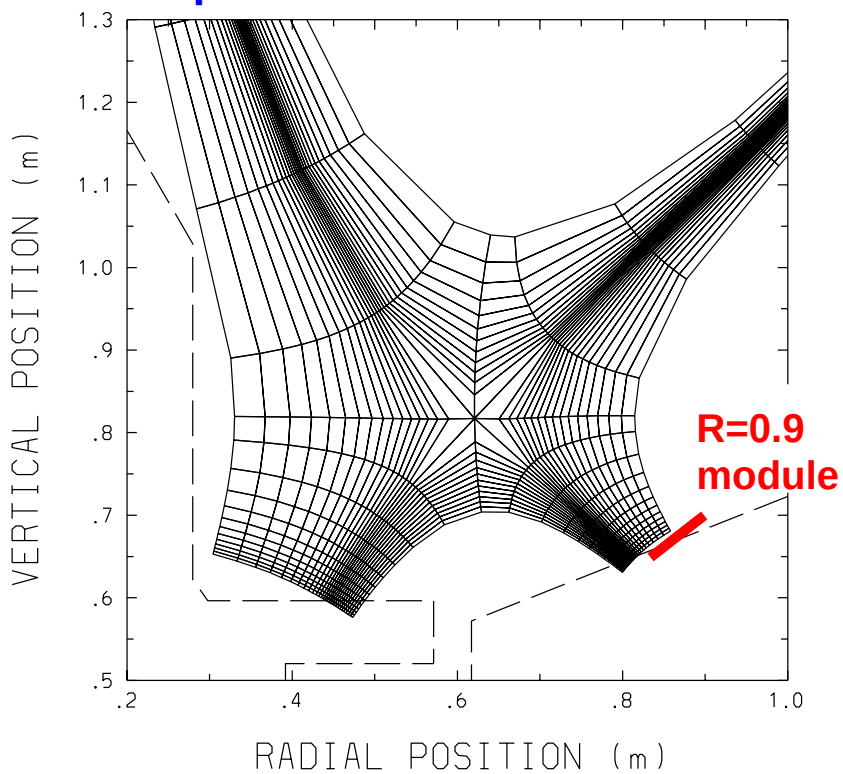
- For Sn, the temperature rise should be acceptable

- For flinabe, the question hinges critically on the assume enhancement of the conductivity from turbulence

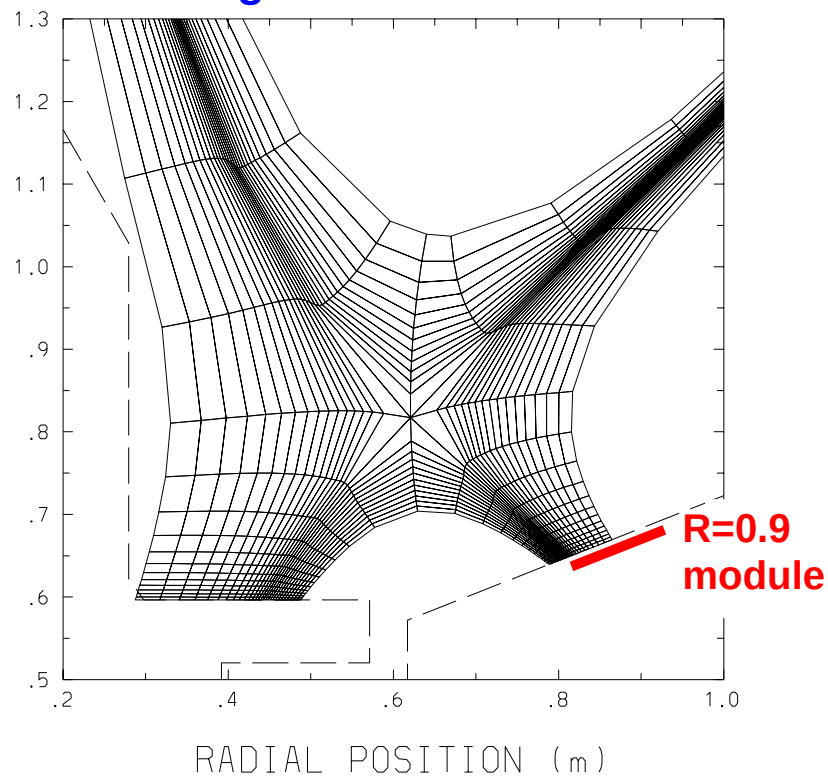
- Sputtering appears not to be a problem unless the experimentally measured temperature enhancement is too large - still being characterized and will be assessed

UEDGE meshes used for NSTX module modeling differ in the shape of the divertor surface

Mesh & module perpendicular to poloidal flux surfaces

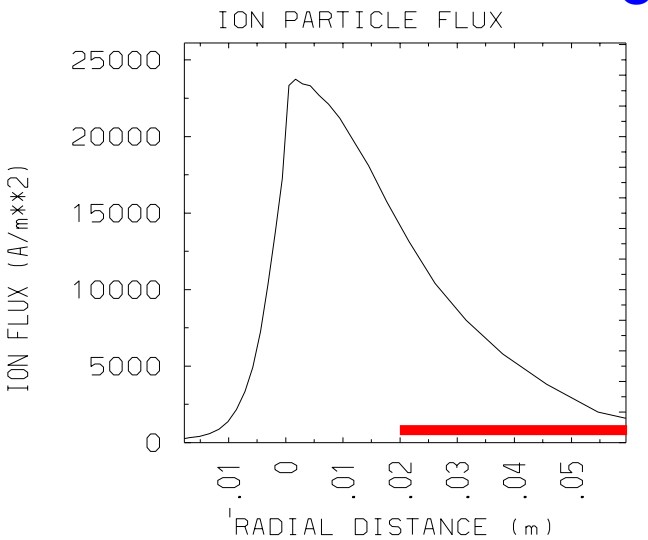


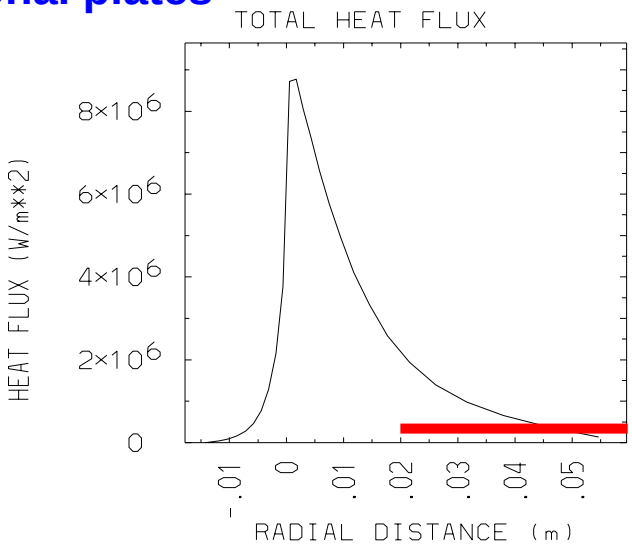
Mesh & module conform to existing divertor surfaces



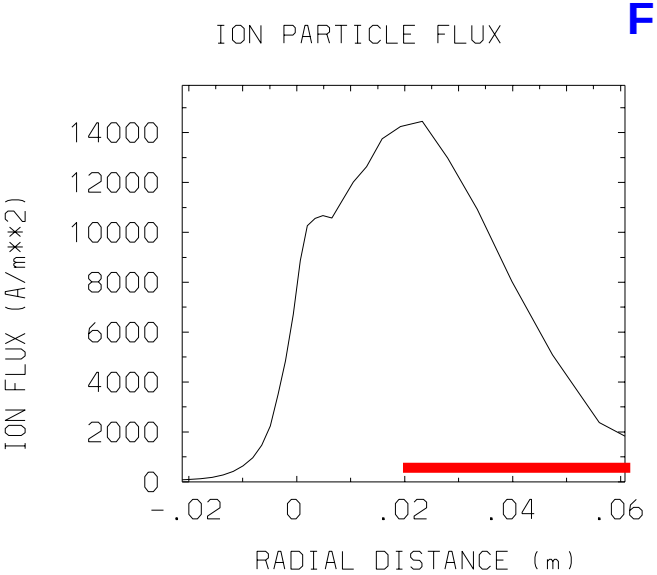
Particle and energy fluxes to plate depend on details of plate orientation

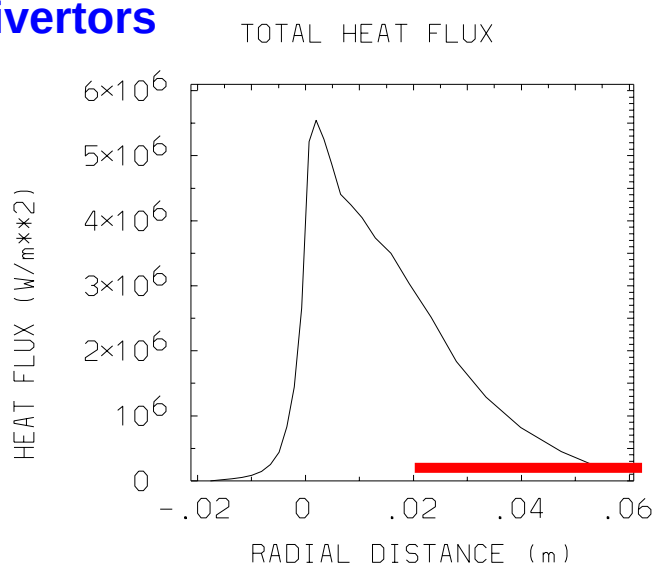
Orthogonal plates





Fit to divertors

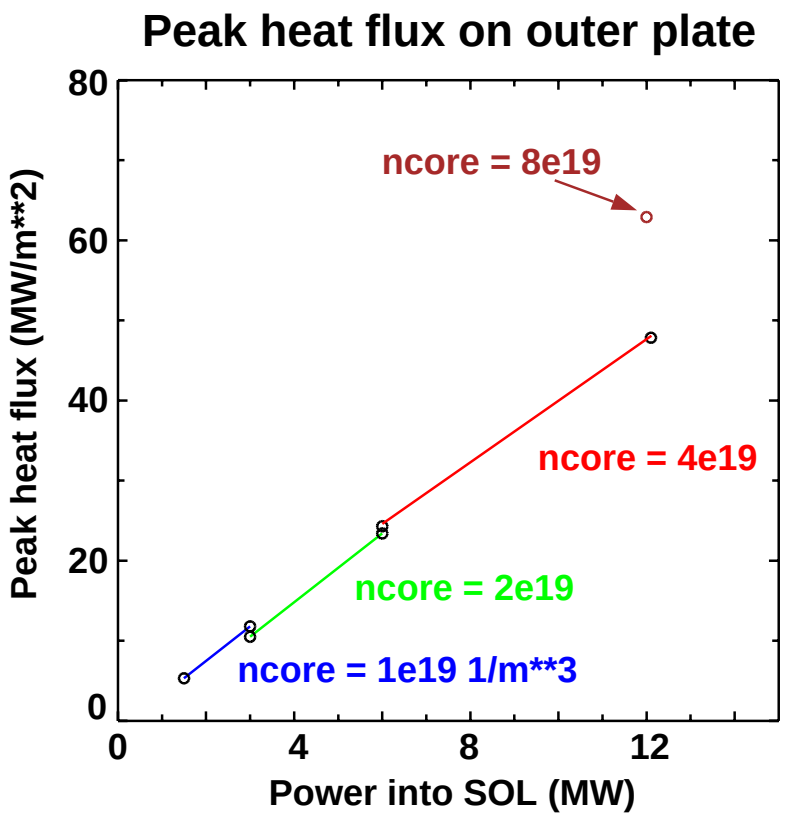


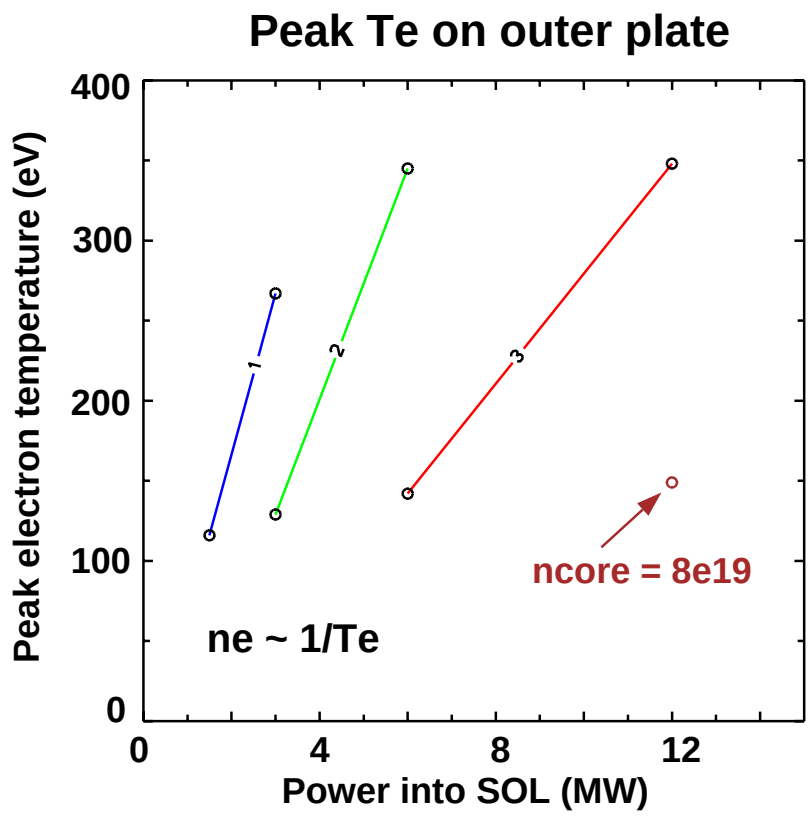


UEDGE simulations of NSTX single null with pumping module 2 cm beyond separatrix on outer plate

Various core-edge densities used as boundary conditions; n_sep ~ 0.6 ncore

Impurity radiation is neglected; module aligned to divertor plate





Plans for remaining FY02

- Calculate helium plasma distribution for CLIFF design

- Refine flinable calculations as thermal conduction data is available; also use data to calculate flinabe divertor temperature rise & evaporative flux

- Assess impurity shielding from auxiliary heating in front of liquid wall

- Determine kinetic plasma transport corrections by comparing UEDGE & MCI

- Complete spheromak liquid wall writeup

- Continue NSTX and Alcator-Mod module calculations for heating and sputtering

Plans beyond FY02 - an overview

- Provide edge-plasma properties for full CLIFF-like designs and modules, integrating wall and divertor

- Expand auxiliary impurity shielding analysis if FY02 study is positive

- Couple SOL and core transport to evaluate impact of materials on core

- Include assessment of improved edge stability from varying edge conditions - e.g., high temperature edges from low recycling