
Status of Power and Particle Control Modeling in NCSX

NCSX

Peter Mioduszewski
for
NCSX Plasma Boundary Group

NCSX Project Meeting
June 11-12, 2001



Main Power- and Particle Control Tasks

NCSX

- 1 Define vacuum vessel contour, i.e. the envelope of the field line excursions of the boundary plasma.
 - 1 for day-1 plasma configuration
 - 1 for future upgrades including divertor baffles and pumping

- 1 Define location and shape of the plasma-facing components
 - 1 peaking factors of power handling
 - 1 optimized for neutrals control

- 1 Set up 3-D neutrals calculations
 - 1 to estimate atomic effects in the bean-shaped cross-section and
 - 1 to provide guidance for the design of the plasma-facing components



The Vacuum Vessel Shape Should Allow Sufficient Connection Lengths

NCSX

Background:

- 1 Good H-mode performance requires sufficiently high pedestal temperatures;
- 1 Satisfactory divertor operation requires low target temperatures;

To satisfy both conditions, sufficient connections lengths between separatrix and divertor target are necessary.

Plan:

1. follow a sufficient number of field lines for a connection length of $L_c=120$ m,
2. generate Poincaré plots to map out poloidal envelopes;
3. generate the toroidal envelope with Poincaré plots every 5 toroidal degrees for half a field period



Plasma-Facing Components Should Handle Power Flux and Provide Some Neutrals Control

NCSX

- 1 The main tool for designing the PFCs are the foot prints generated with field-line-following codes intercepting the outermost boundary plasma surface.
- 1 We are collaborating with the W7-AS group to obtain versions of the field-line-following codes that generate foot prints on the wall.
- 1 Initially, we will generate the foot prints in the areas of the inner limiters and baffles at the top and bottom of the bean-shaped cross-section.
- 1 The foot prints, generated with the diffusion-added version of the field line code, should give us some indication for the peaking factors needed for the design of the PFCs.
- 1 This work is in progress.



Present Status and Activities

NCSX

- 1 Have started field line following for connection lengths to map out complete envelope.
- 1 Presently benchmarking several versions of the MFBE and Gourdon codes against each other (with and without field line diffusion).
- 1 Our development plasma configuration is Li383 with 1017 coil configuration.
- 1 Need input from project: free boundary calculation for 1.4 m case, VMEC with higher toroidal resolution, other (will define!).

