Neutron Wall Loading Distribution

L. El-Guebaly, M. Wang, D. Henderson,
T. Tautges, and the ARIES Team

Fusion Technology Institute
University of Wisconsin - Madison

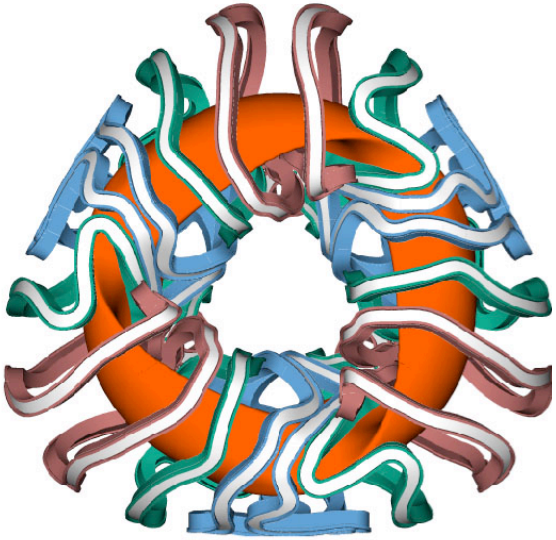
November 11, 2004

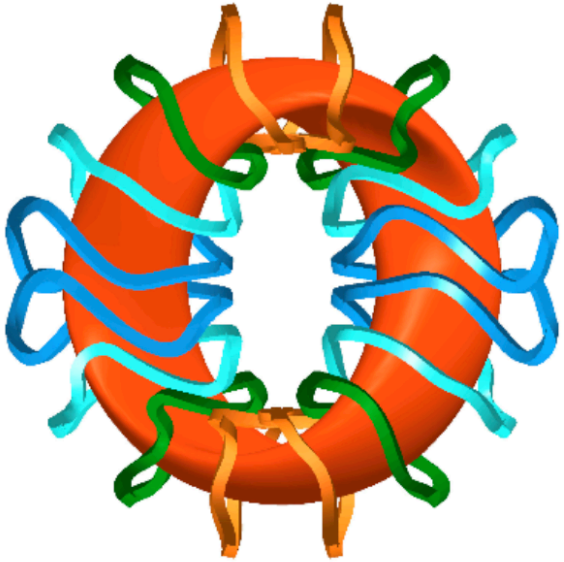
Contents

- CAD/MCNP model.

- Main results:
  - Poloidal distribution of neutron wall loading (NWL)
  - Location of peak
  - Peak to average ratio.

ARIES-CS Plasma and Coils





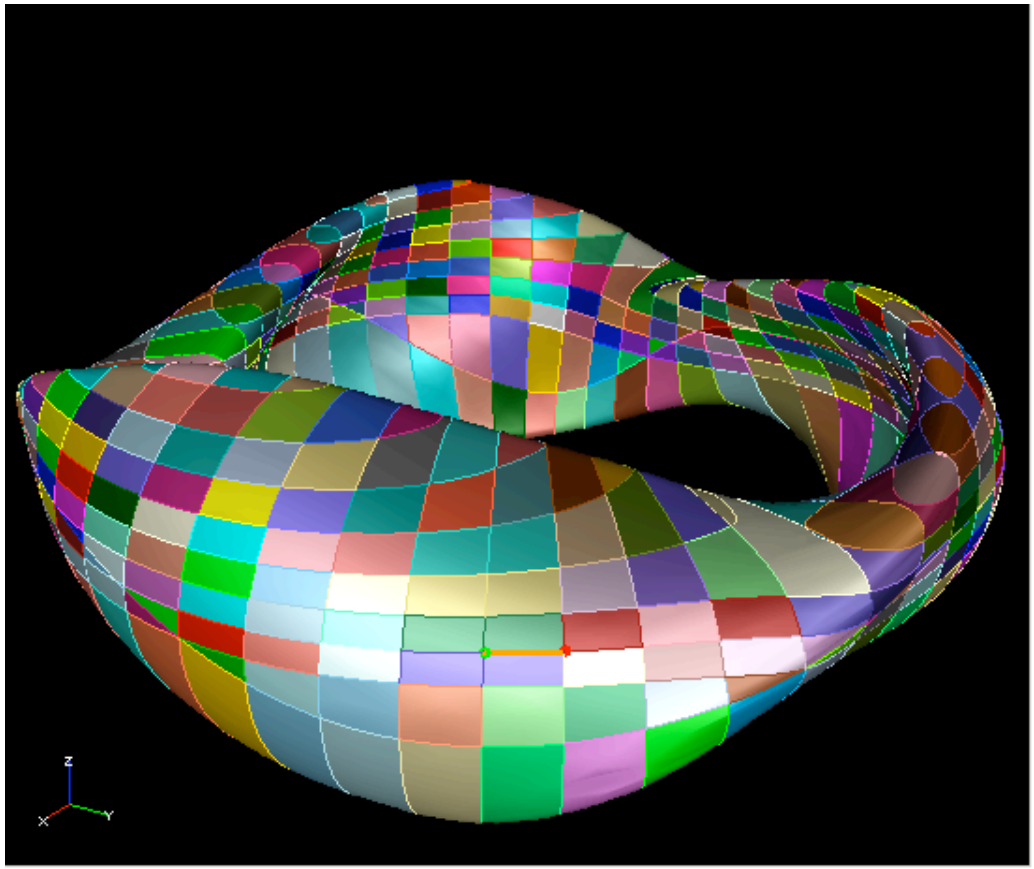
3 FP Configuration
R = 8.25 m
a = 1.85 m

2 FP Configuration
R = 7.5 m
a = 2 m

Selected configuration for NWL analysis

CAD / MCNP Model

- Neutrons tallied in discrete bins.
- Toroidal angle divided every 7.5°.
- Vertical height divided into 0.5 m segments



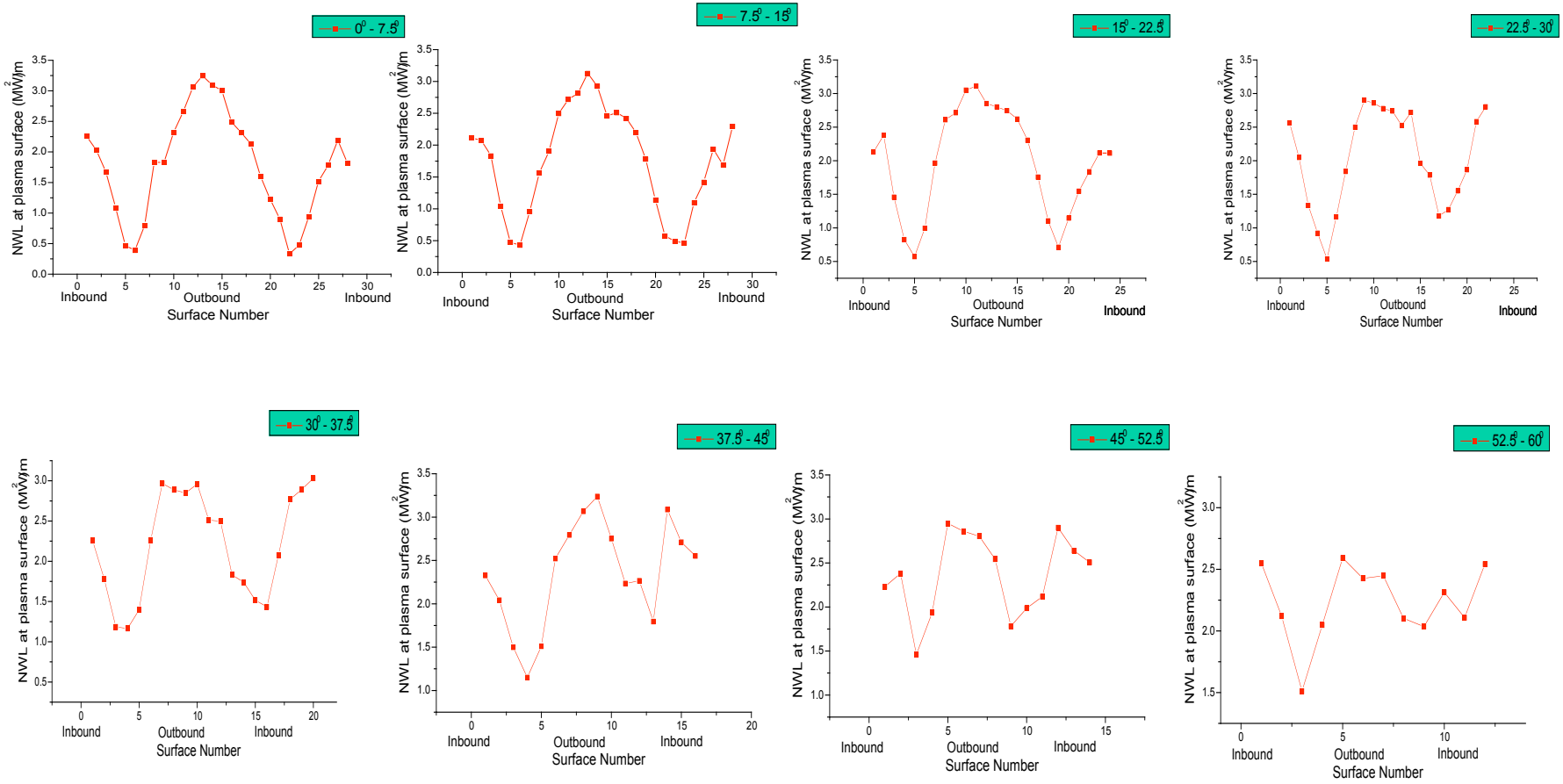
NWL @ Plasma Surface

(3-FP Configuration, P_f= 2,000 MW, P_n= 1,600 MW)

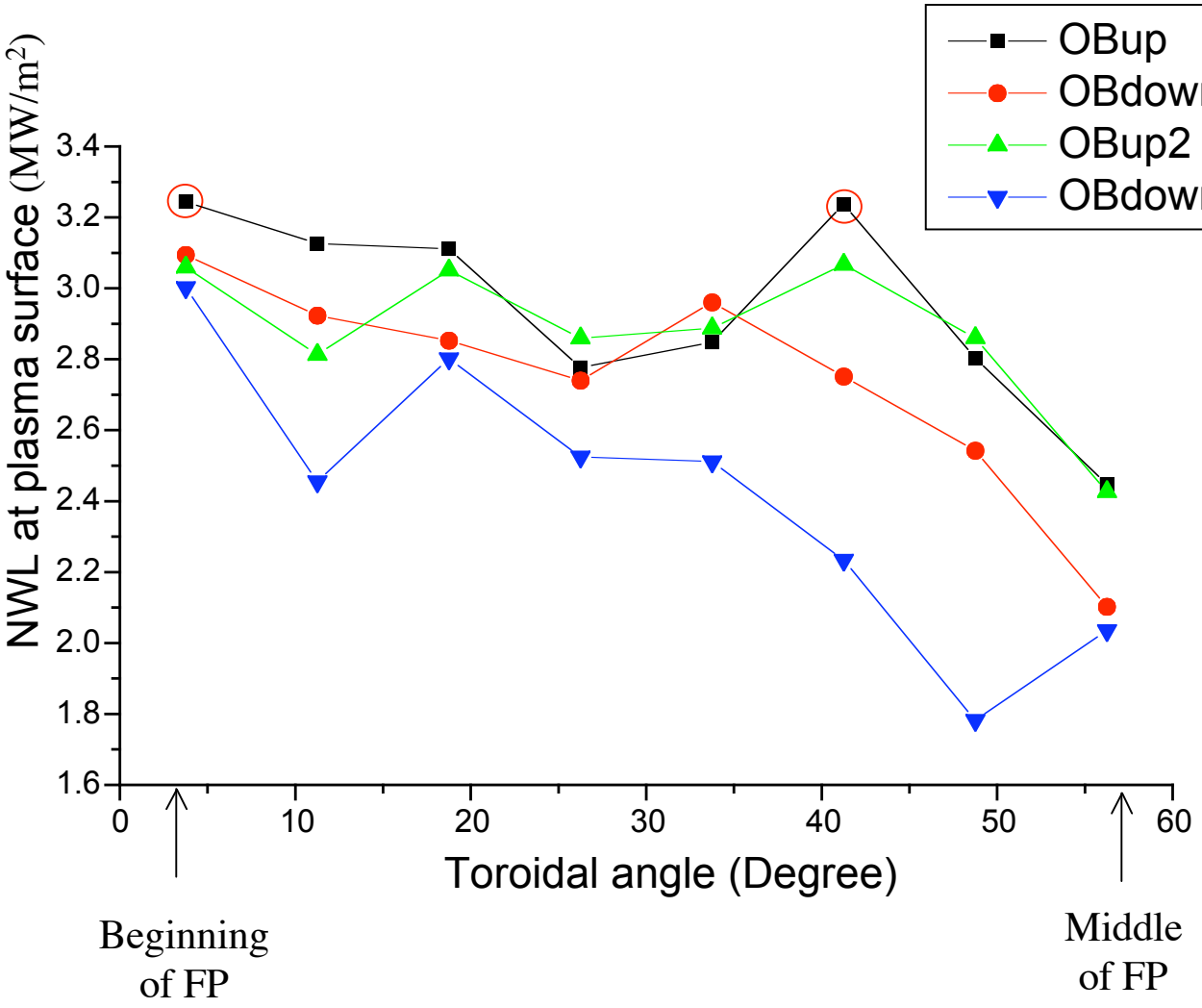
	Plasma Surface	First Wall (5 cm SOL)
Surface Area (m^2)	800.6	825
Average □ (MW/m^2)	2.0	1.94
Peak □ (MW/m^2)	3.24	? (~ 3.1)
Peak/Ave Ratio	1.62	? (~1.62)

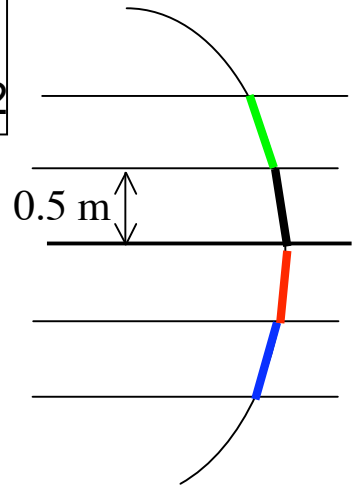
Multiply □ at plasma surface by ~0.97 to get NWL @ FW

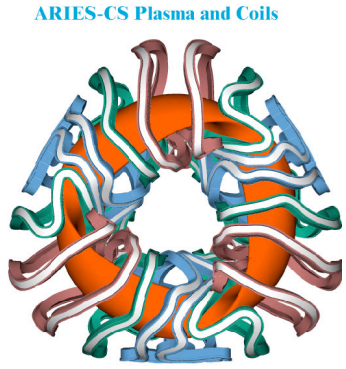
Poloidal Distribution of NWL



□ Peaks Above/Below OB Midplane within ±1 m

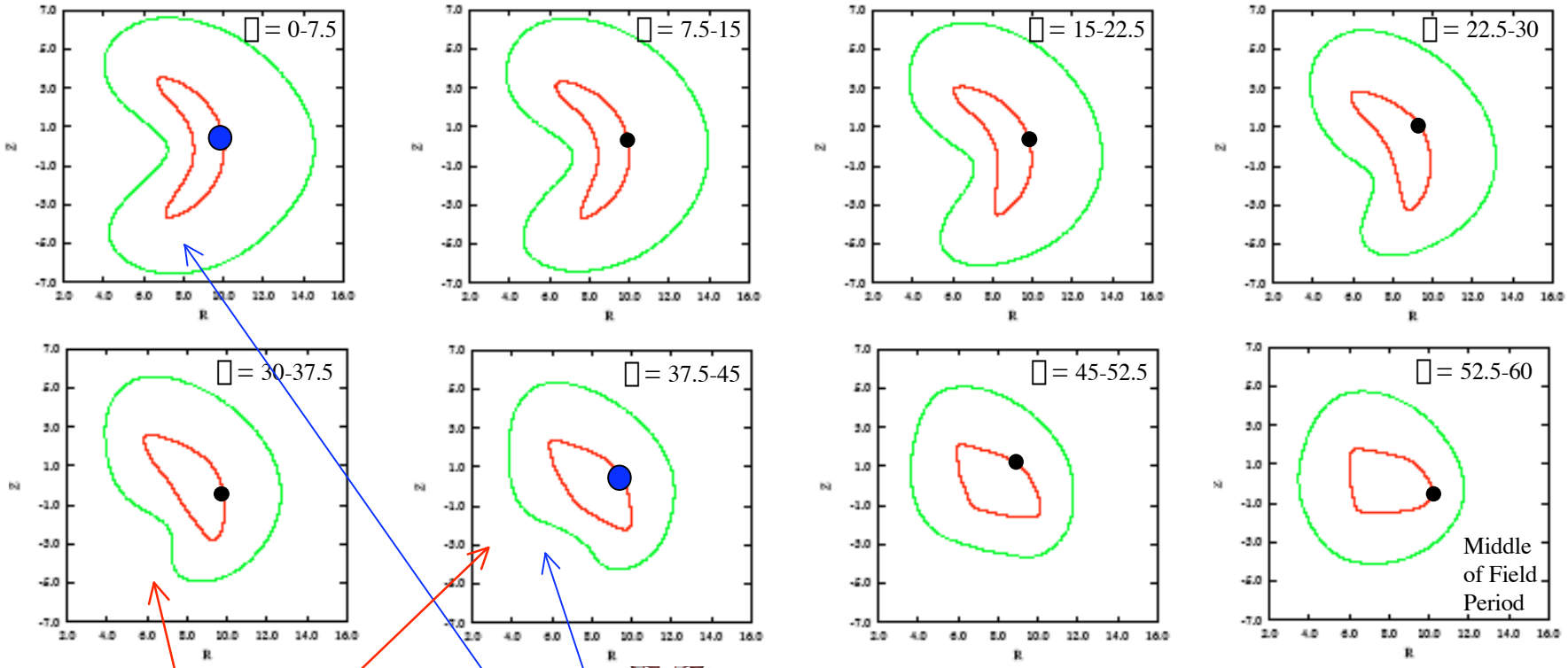


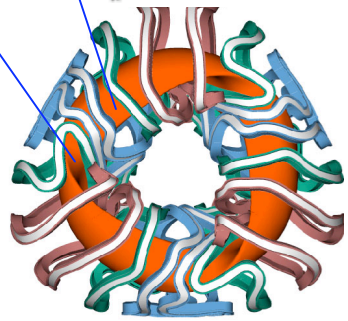




□ Peaks near OB Midplane
(Marked with Dot at 8 Xns Covering 1/2 Field Period)

Beginni
of Field
Period





Critical Xns for FP maintenance scheme

□ peaks @ ~3.24 MW/m^2 at □ = 0-7.5° **and** □ = 37.5-45°

Peak to Average □ Ratio vs A

Tokamaks:

- ARIES-AT
- ARIES-ST

Stellarators:

- ARIES-CS - 3 FP
- HSR - 4 FP
- SPPS - 4 FP