**Introduction**

- In ITER, Blanket Modules (BMs) are arranged around the plasma to provide thermal and nuclear shielding for the vacuum vessel (VV), magnets, and other external components.
- Nuclear heating, radiation damage (dpa), and He production are important parameters needed in the design process of the BMs.
- BMs are geometrically complex making a CAD based approach to neutronics analysis ideal.
- Goal is to analyze the most critical BMs and regions using a 3-D CAD approach (subject to CAD model availability and cleanliness).
- These results will support the ITER BM Final Design Review (FDR) and other design processes.

**Blanket Lite (BL-Lite) Model and Approach**

- Creating and running a 40° global CAD model of ITER using detailed CAD models of individual components would require too much computer memory.
- Instead, create a 40°, simplified CAD model for BM nuclear analysis (BL-Lite).
- BL-Lite created from ITER's Catia based CAD models.
- This BL-Lite model provides the proper nuclear “boundary” environment.

**Approach:**

1. Insert the detailed components into BL-Lite in the region of interest.
2. Generate conformal tetrahedral mesh for mesh tallies of interest.
3. Perform neutronics analysis with DAG-MCNP.
4. Pass mesh based nuclear results to finite element engineering codes (e.g., ANSYS).

**Example: BM01**

- Combining detailed BM01 and BL-Lite Model.
- 993 volumes, 20360 surfaces.

**NB Nuclear Heating Results**

- A simplified model of the NB port region was integrated into BL-Lite.
- Purpose to investigate port liner and VV heating.
- 797 volumes, 13059 surfaces.

**Port Liner Nuclear Heating:**

- Location of liner.
- Nuclear heating profile provided to engineers for thermal analysis.

**Port Extension/VV Nuclear Heating:**

- Plasma view.
- Meshed region.
- Original design.
- Possible solution: Thicker floor.
- SB15 shown for reference.
- Threshold filter applied to results at 0.6 W/cm².
- Still some region with excess heating.

**BM04 Nuclear Heating Results**

- Cartesian mesh tally on BM01 (0.5 x 0.5 x 0.5 cm voxels): 362 volumes, 7001 surfaces.

**Conformal tetrahedral mesh tally on the VV:**

- Meshed region.
- SB shown for reference.
- Manifold water shown for reference.

**Upper Port Results**

- A simplified model of the upper port region was integrated into a 20° version of the BL-Lite model.
- 362 volumes, 7001 surfaces.

**VH Nuclear Heating:**

- Still some regions with excess heating.

**Conclusions and Future Work**

- Detailed 3-D nuclear analysis is important in the design process for the ITER Blanket Modules and nearby components.
- A 40° global model of ITER is the basis of this CAD based approach.
- The results of this work are being actively used to refine the design in regions where limits are exceeded.
- Future Work: Detailed upper port region, BM11-13 region with ELM coils, He production in FW/SW water connectors for OB BMs.

Support for this work has been provided by Sandia National Laboratory. Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000. The views and opinions expressed herein do not necessarily reflect those of the ITER Organization. Part of this work was carried out using a portion of the Blaze MCNP model which was developed as a collaborative effort between the FDS team of ASIPP China, University of Wisconsin-Madison, ENEA Frascati, CCFE UK, JAEA Naka, and the ITER Organization.