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SSP CMS5 & SC 20-06
EPRI B-TAC *FEB 24TH, 2021*

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AGENDA

- **Summary SC 20-06**
- **Discussion of CMS5 CRB Depletion**
- **Representative Results**
- **Summary / Questions**

SUMMARY SC 20-06

- SSP has only seen the Non-Proprietary version (key points).
  - The top node reactivity worth can impact SDM regardless of the depletion of the rest of the rod.
  - Significantly reduced worth of the top node of the control rod could potentially lead to not satisfying the SDM requirement.
- SC 20-06 Recommended Actions
  1. Control rods in the core that have hafnium tips are not impacted, no actions are recommended.
  2. Non-hafnium tip control rods present in the core, recommendation is to account for the depletion for the top node of withdrawn control rods.

SUMMARY SC 20-06 (CONT)

3. If after accounting for the depletion of the top node while the control rod is withdrawn, the depletion in the top node is not in excess of the depletion lifetime limit, then there is no impact on the minimum SDM.

4. If the top node is in excess of the depletion lifetime limit, then determine the impact on the minimum SDM due to the reduced worth of the control rod(s).

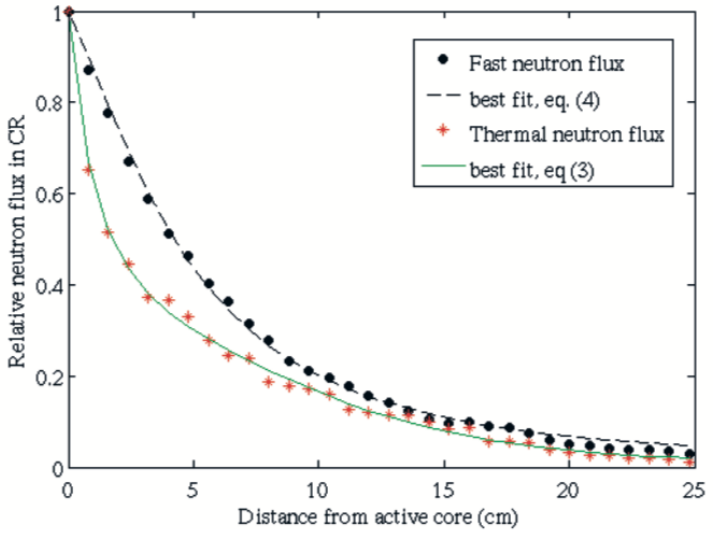
5. Ensure adequate SDM is available by explicitly accounting for the reduced control rod(s) worth.

6. Alternate vendor control rods should also be evaluated.

CMS5 can easily address all these recommendations.
(CASMO-4/SIMULATE-3 can not)

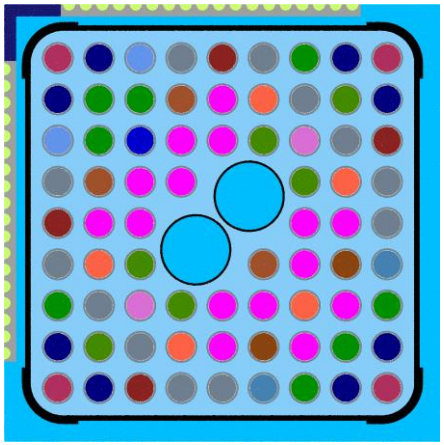
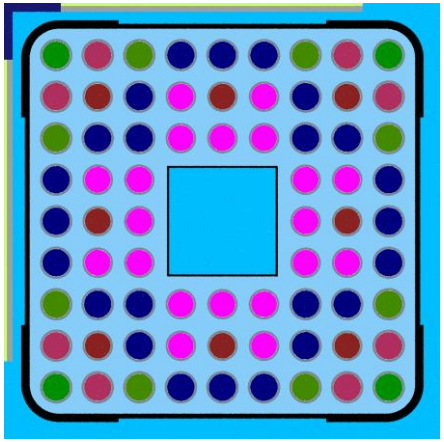
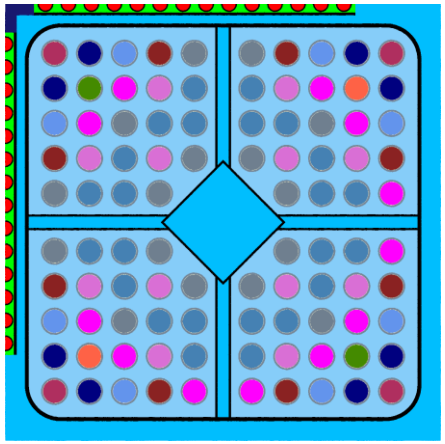
DISCUSSION OF CMS5 CRB DEPLETION

- CASMO5/SIMULATE5 (CMS5) has an explicit control rod depletion module.
  - CMS5 can model and track up to 20 independent segments per wing.
  - S5 tracks the absorber depletion by reconstructing the flux at control blades absorber rod locations.
  - For parts of the blade in the reflector, the flux is evaluated using the coefficients computed from higher order Monte Carlo calculations



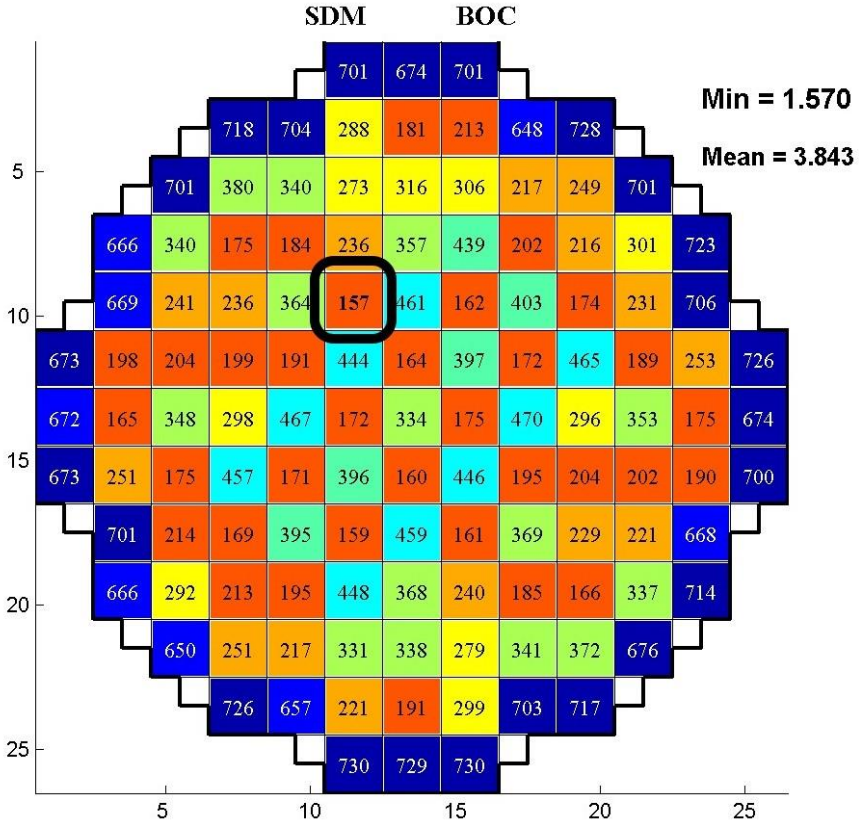
DISCUSSION OF CMS5 CRB DEPLETION (CONT.)

- Any section of the control blade that is in the bottom reflector continues to be depleted when the blade section is in the reflector including the tip of the blade.
- A simple switch (BCR) on the S5C card will automatically generate the required CASMO5 branch cases for the reactivity feedback.
- Reactivity feedback due to the depletion of the control blade in SIMULATE5 is as simple as running core follow.
- CMS5 can model all blade and fuel vendors products and combinations.

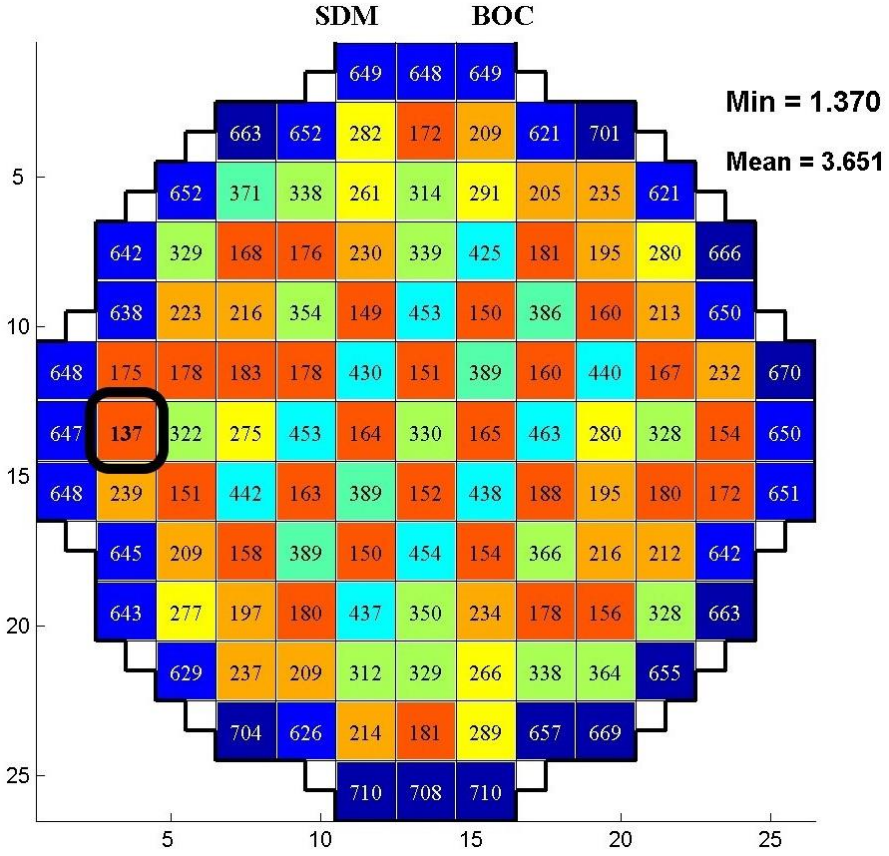
REPRESENTATIVE CMS5 SDM RESULTS

Without Neutronic Feedback



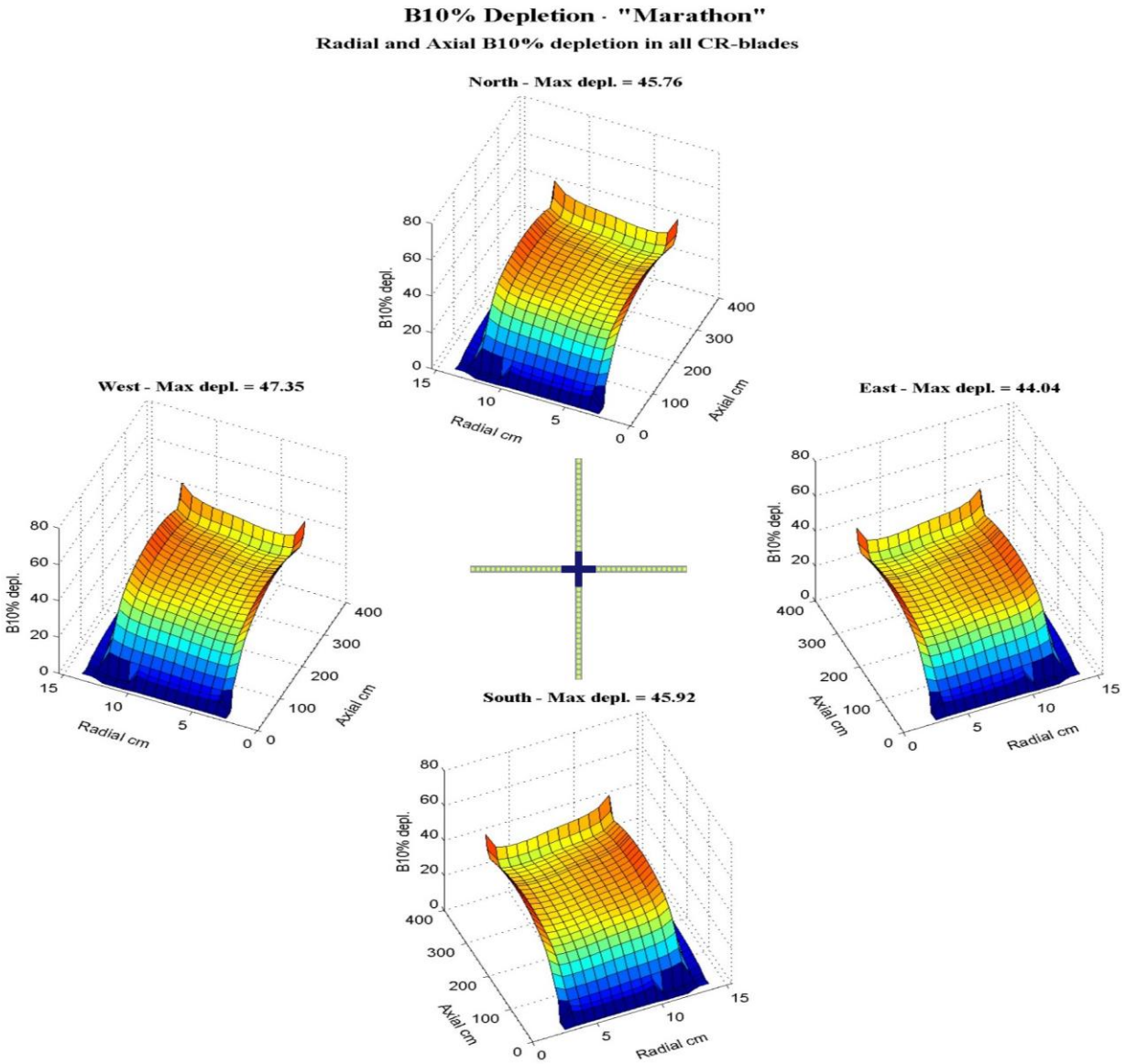
Limiting Location has cluster of fresh blades.

With Neutronic Feedback



Limiting Location has cluster of depleted blades.

REPRESENTATIVE CMS5 %B10 RESULTS



SUMMARY

- CMS5 calculates the depletion of the control blades in the reflector, including the tips of withdrawn blades.
- CMS5 can provide reactivity feedback of the control blades to calculate SDM.
- It is as simple as doing core follow with CMS5.
- Much more rigorous and integrated approach than using a bounding tip-adder approach.

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