

Multicycle analysis of BEAVRS benchmark based on deterministic one-step code CRANE

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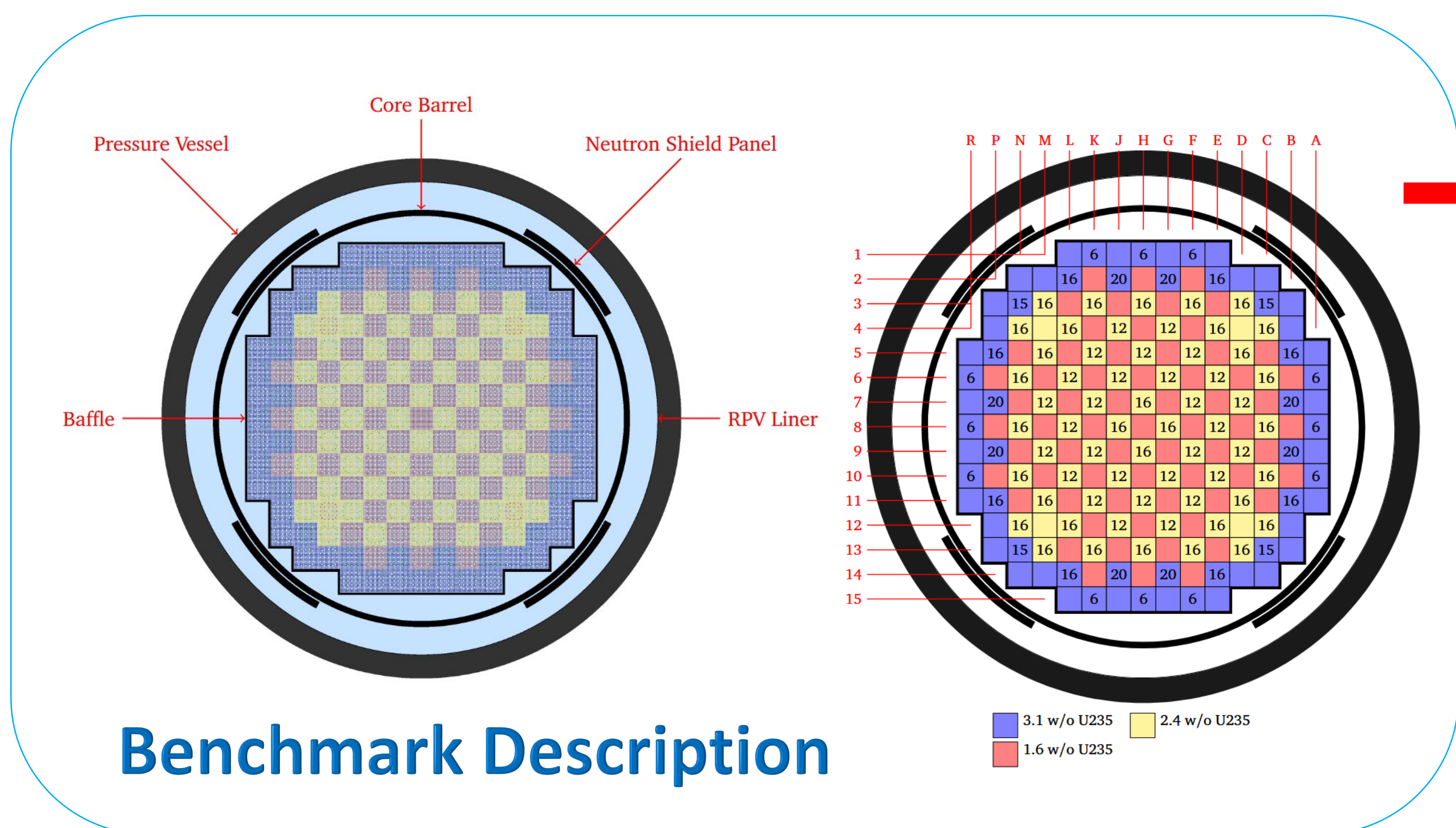


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Introduction

The **BEAVRS** benchmark issued by **MIT** is widely used in the validation of the **new generation of high-fidelity** core analysis code for LWR in the world.

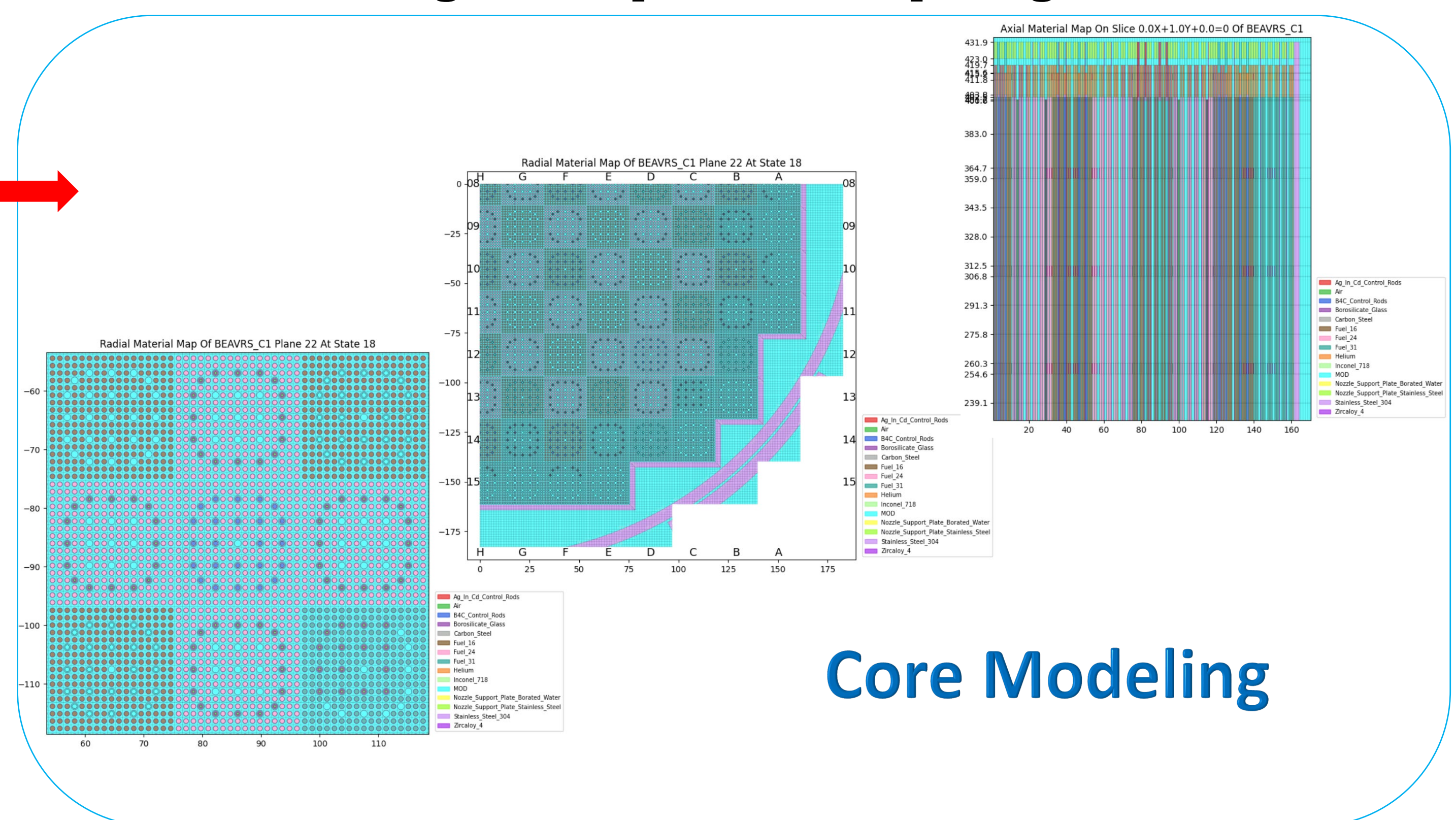
This benchmark enables analysts to develop an extremely detailed reactor model, and carry out code verification and validation under the conditions of **multi physics coupling**.



Method

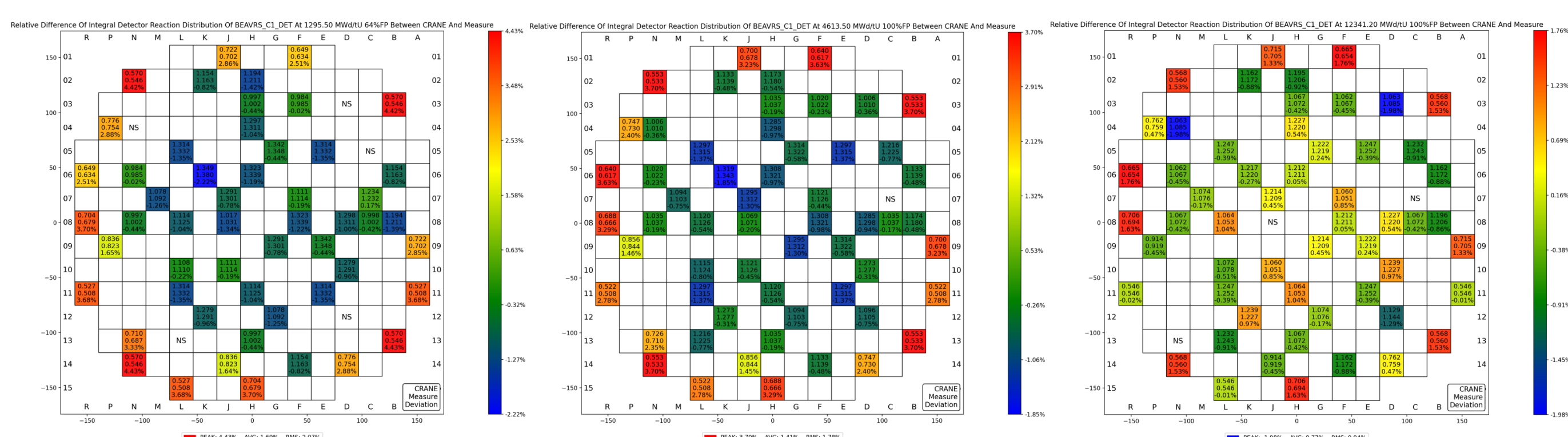
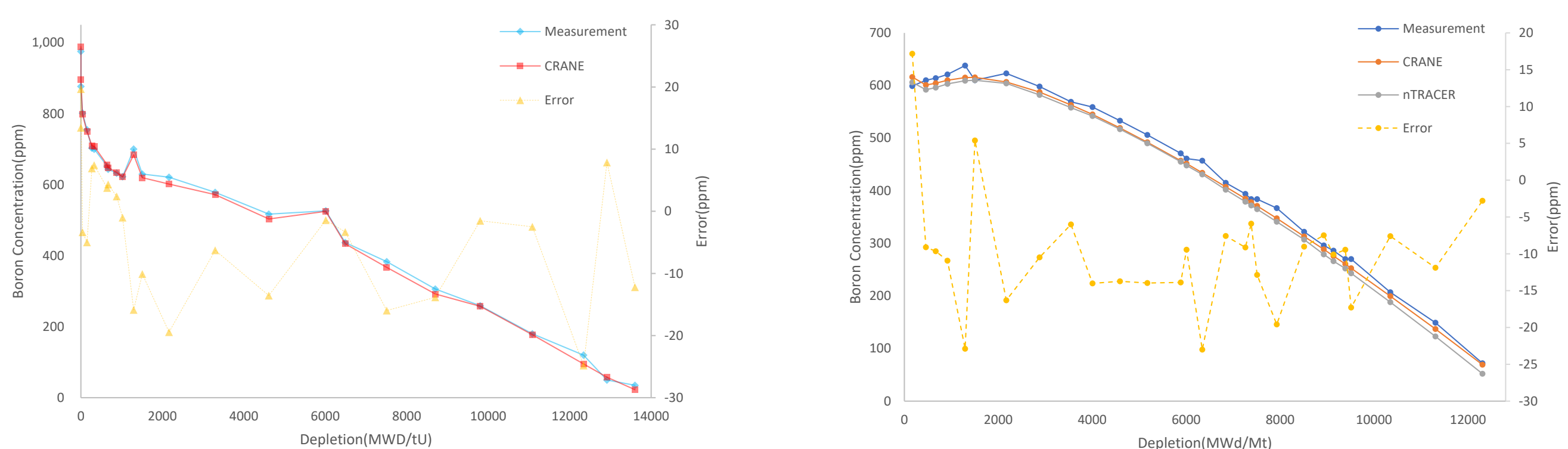
CRANE is a **deterministic one-step** PWR neutronics and thermal hydraulics coupled core analysis code developed by Shanghai NuStar Nuclear Power Technology Co., Ltd.

- **Neutronic calculation: Linear source approximation 2D-MOC + 1D-MOC**
- **Thermal hydraulic calculation: Transient model of two fluid and three flow field reactor core channel**
- **CPU-GPU heterogeneous parallel computing**



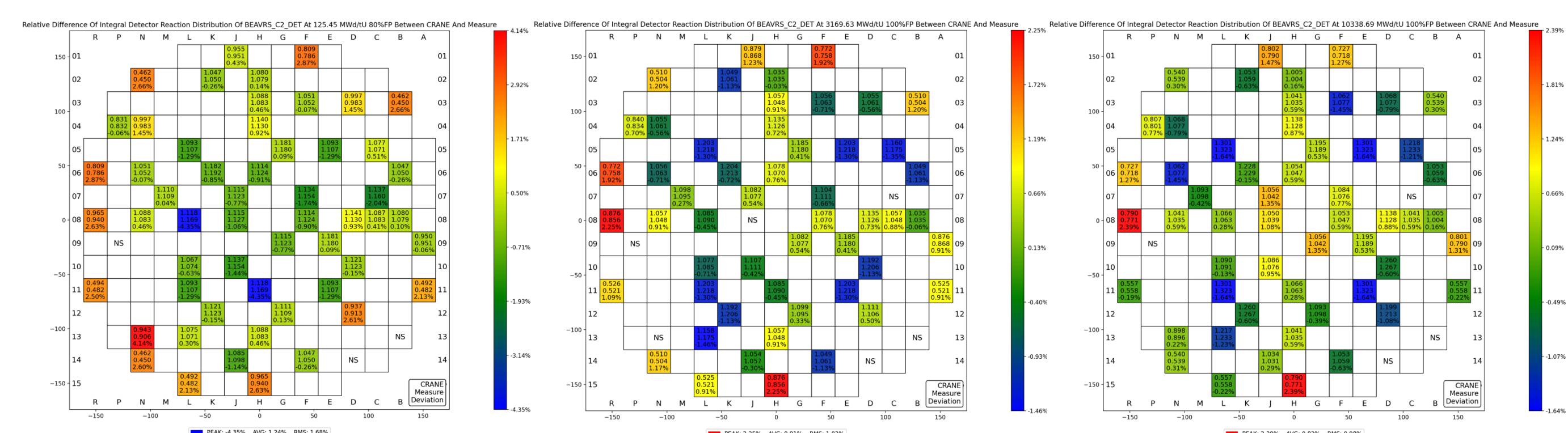
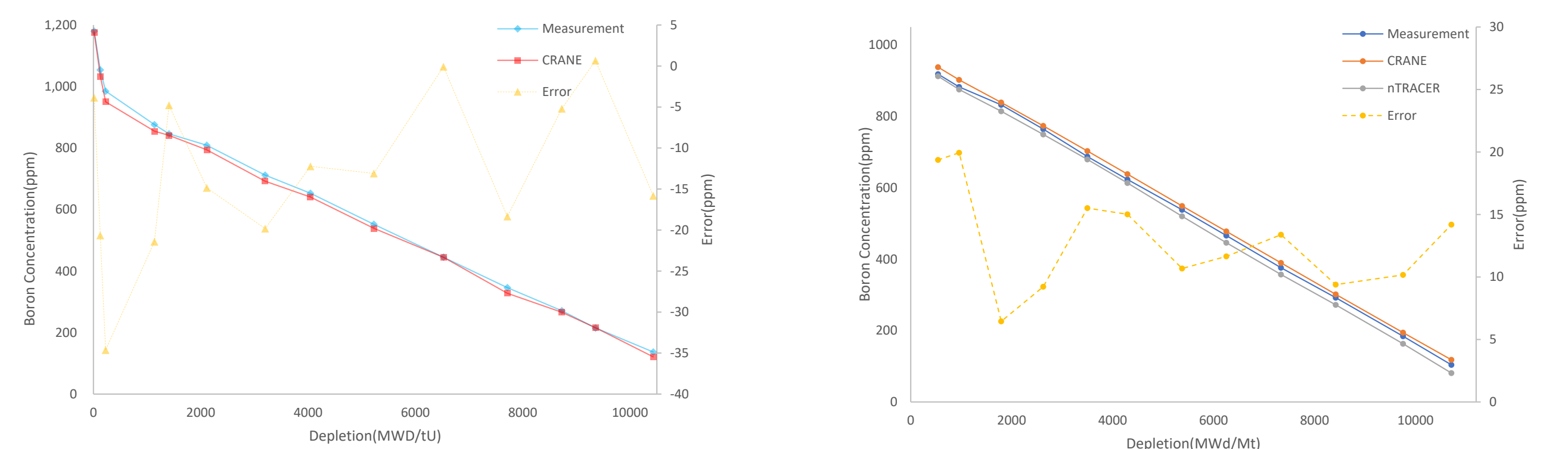
Results

Cycle 1 Boron letdown curve



Cycle Average RMS error: 1.64%

Cycle 2 Boron letdown curve



Cycle Average RMS error: 1.32%

Conclusion

The comparison between the obtained results and the measurements shows that CRANE is able to perform very detailed core analysis for **large commercial PWRs**. Its **excellent accuracy** is fully comparable with those high-fidelity codes newly developed in the world.

Moreover, due to the code can fully exploit the fast-developing **GPU computing power**, it's **running speed** outperforms most of the current high-fidelity codes.

Acknowledgement

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