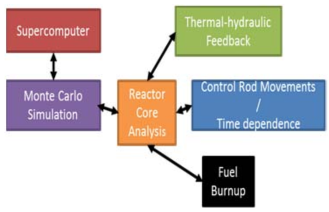
EU FP7 Project: HPMC-High Performance Monte Carlo (HPMC) Rector Core Analysis (Proof of Concepts)

Victor Sánchez-Espinoza (KIT), J. E. Hoogenboom (DNC), J. Dufek (KTH), J. Leppanen (VTT)

Project Goals: develop and demonstrate (proof-of-concept) the application of full Monte Carlo core calculations

- Depletion with thermal hydraulic feedbacks
- Stable burn-up calculations
- Explore time-dependent Monte Carlo methods
- Validate MC-tools using experimental data
- Make use of High Performance Computing
- Provide reference solutions for low-order static solvers

HPMC Structure & Partners



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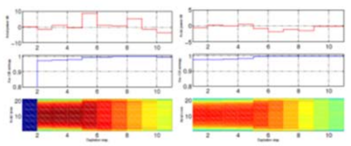
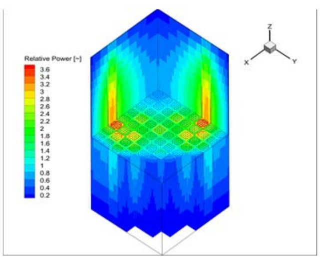
Stable Depletion Method: SIE



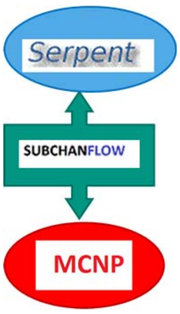
(a) (b)

Axial power tilt (top), Shannon entropy (middle) and spatial distribution of Xe-135:
- a) Iteration with no equilibrium Xe-135
- b) Stochastic Implicit Euler (SIE) iteration with equilibrium Xe-135



MCNP5/SubChanFlow: Full core pin-by-pin simulation (PWR)

HPMC Codes and Methods



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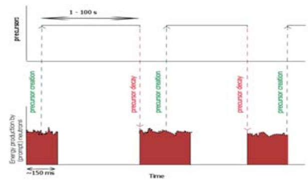
- First of the kind coupling of MC-codes with subchannel thermal hydraulics
  - Internal coupling
  - External coupling

Dynamic MCNP5-Developments: Approach

- Use cycle methodology for time interval
- Use of concept of storing precursors for next time interval
- Add prompt neutrons that reach the time interval boundary
- Distinguish precursors by negative weight
- forced decay of precursors in each time interval (to reduce variance)
- branchless collision method: allows always a single neutron continuing after a collision (either from scattering or fission)
- Novel and accurate technique to describe the movement of control rods or control rod banks

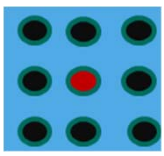


MCNP5: concept of time intervals

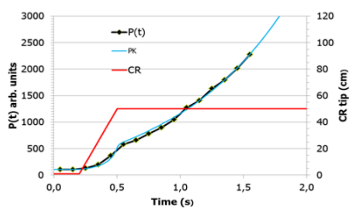
OUTLOOK

- Move from academic to industry-like applications
- Optimization of depletion taking into account TH-feedbacks
- Optimal parallelization and scalability
- Develop dynamic MC-codes for transient analysis

MCNP5/SubChanFlow: Analysis of a REA in Minicore



PWR 3x3 pins mini fuel assembly



MCNP5/SCF: Ejection of the central pin

- Visit our Website: www.fp7-hpmc.eu

Any additional information needed:
- contact victor.sanchez@kit.edu