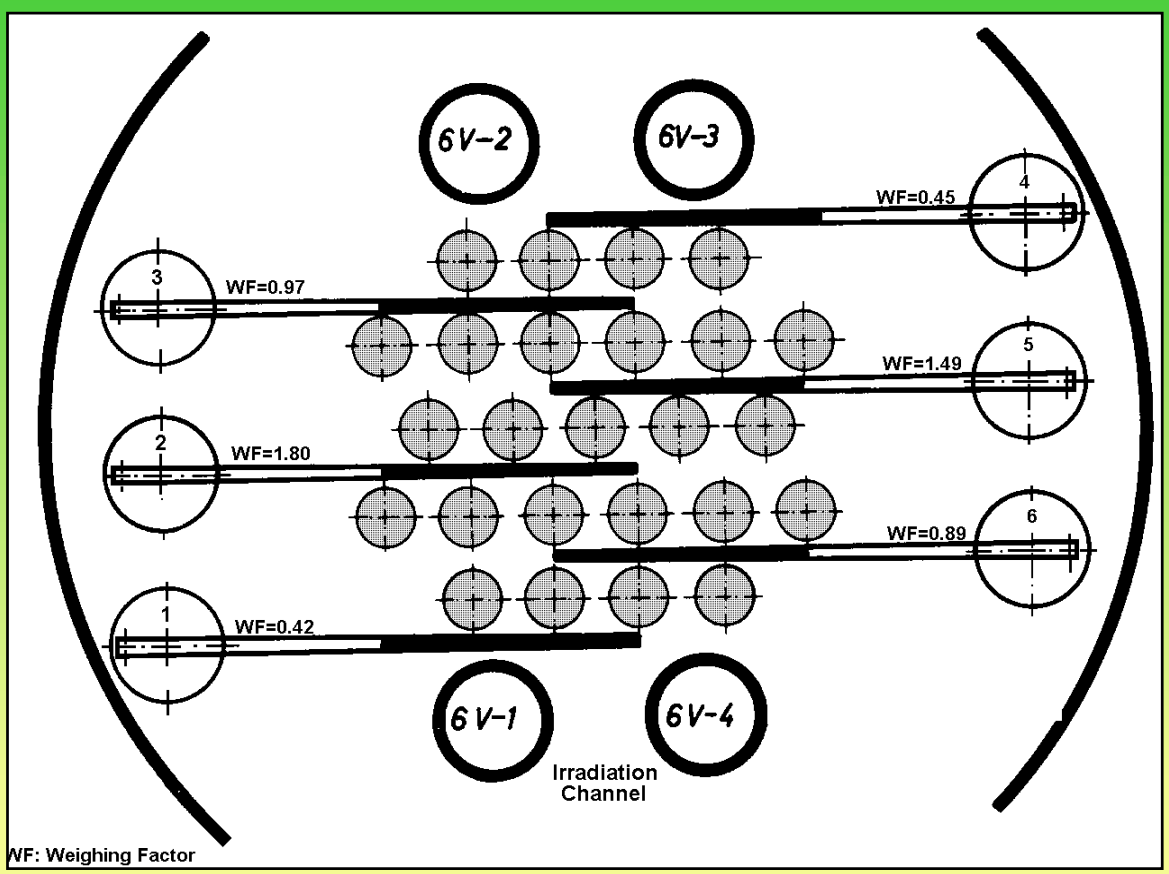
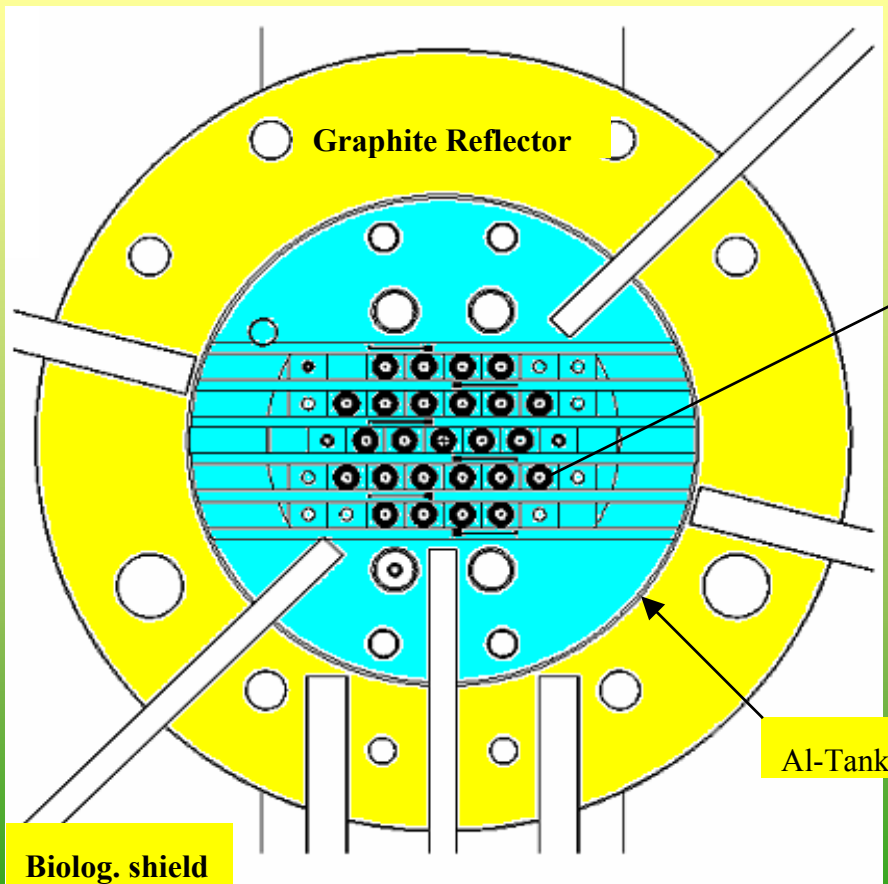
A Sophisticated Monte-Carlo-Code System for Safety and Core Physics Analysis of FRJ-2

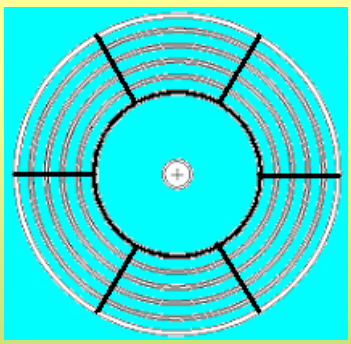
- The High Power FRJ-2 Research Reactor
- A Precise Method for Reactor Analysis
  - The MCNP Monte-Carlo code
  - The BURN Depletion Code
- Verification and Application
  - Global Behavior: Reactivity & M-Factor
  - Flux Profile and Local neutron flux
- Conclusions

Arrangement of the fuel elements in the reactor core



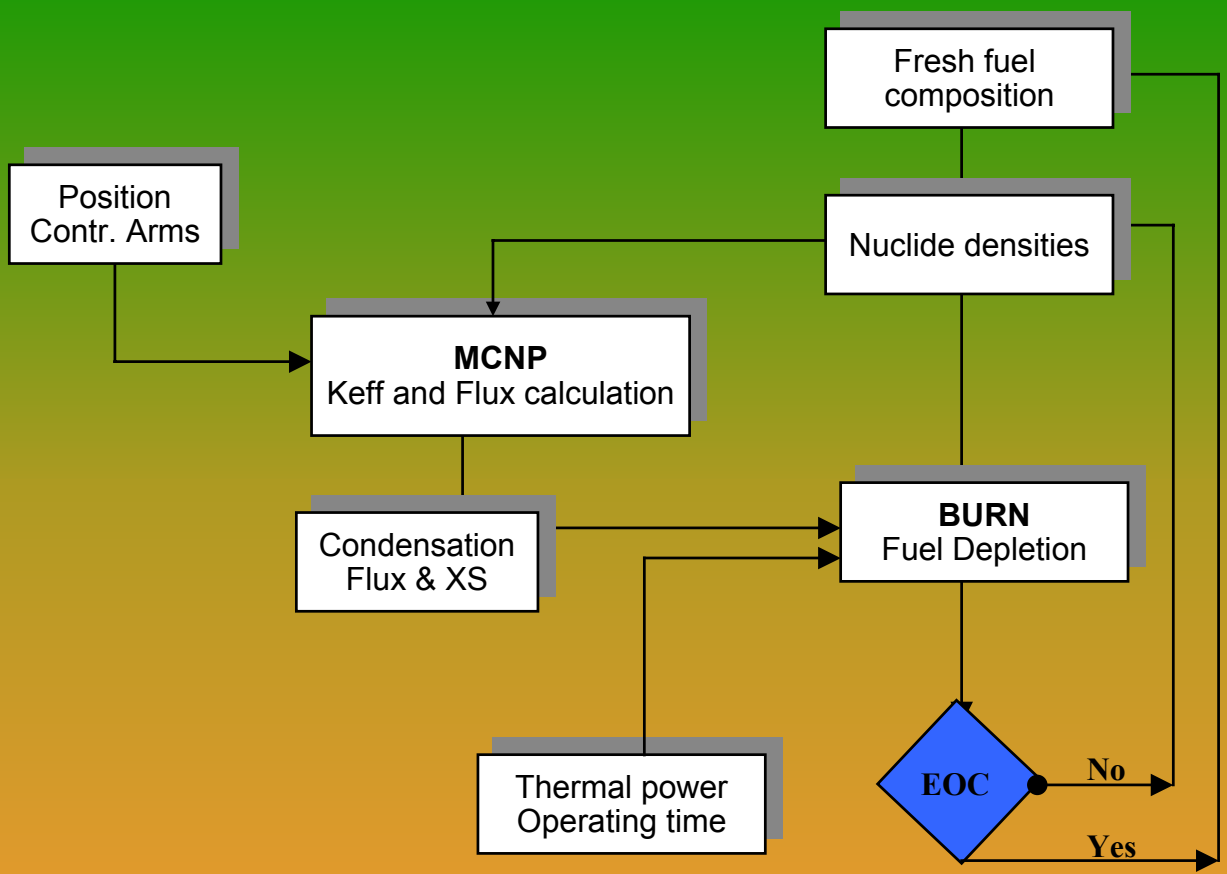
Horizontal cut view of the MCNP model of the fuel element, core and surrounding



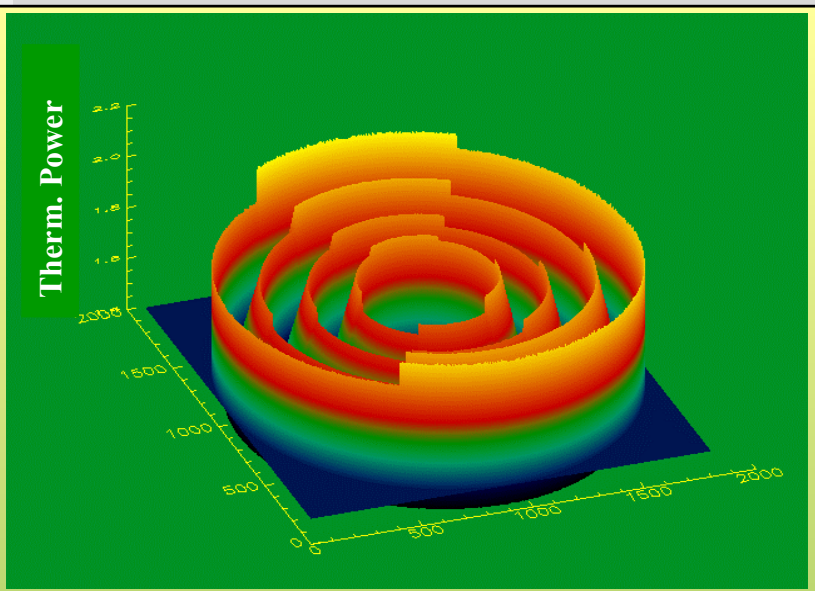


Fuel element model

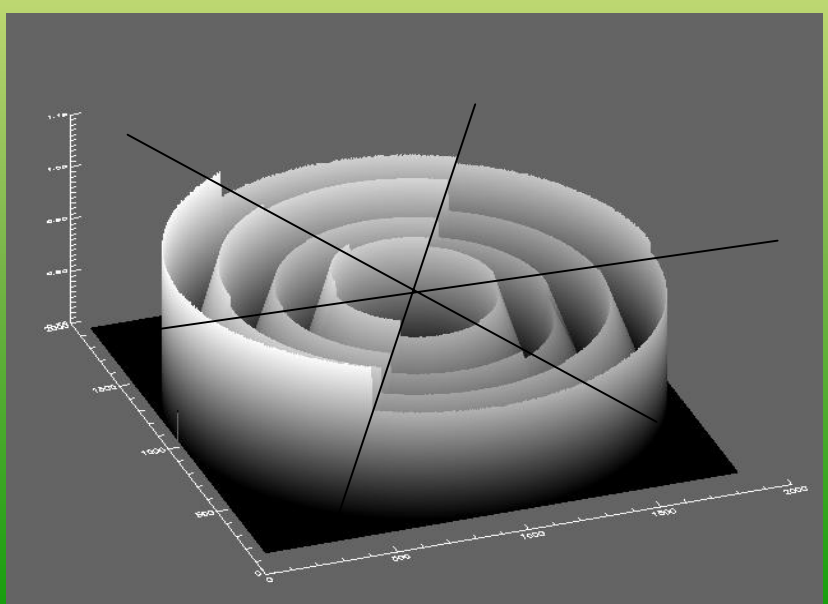
Coupling MCNP & BURN with Burnp and Flux Recycling (modeling operation cycle)



Radial und azimuthal power distribution in a fuel element in the midplane

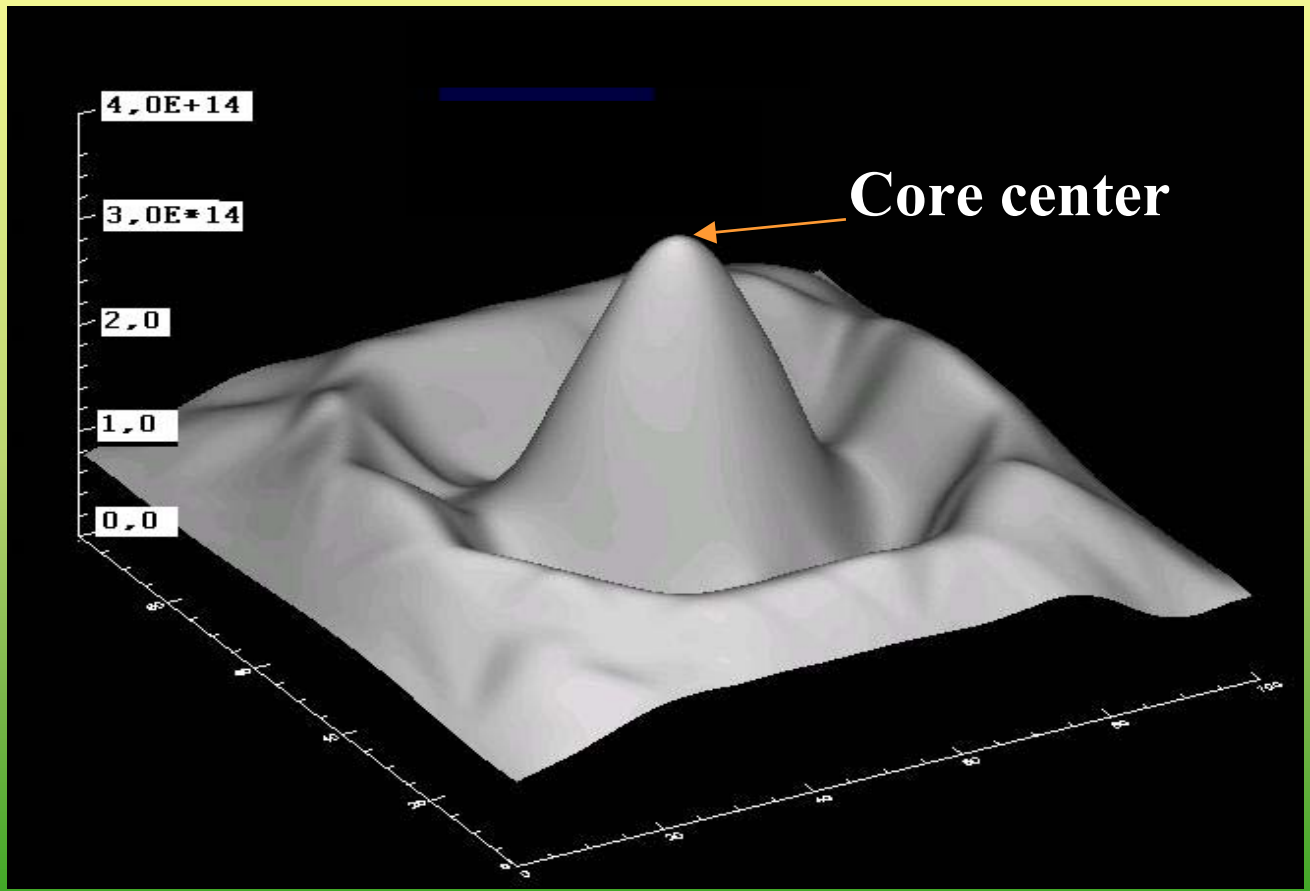


Central FE

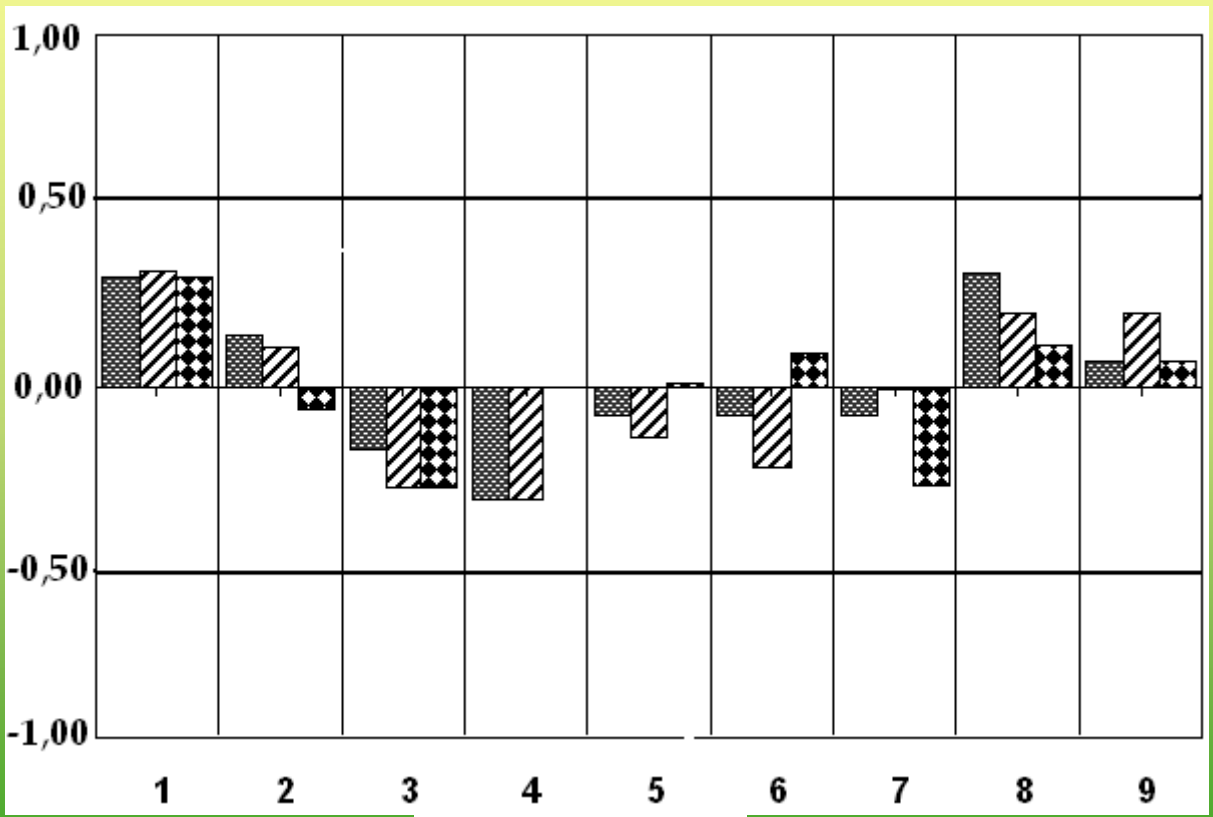


FE facing core center line from left

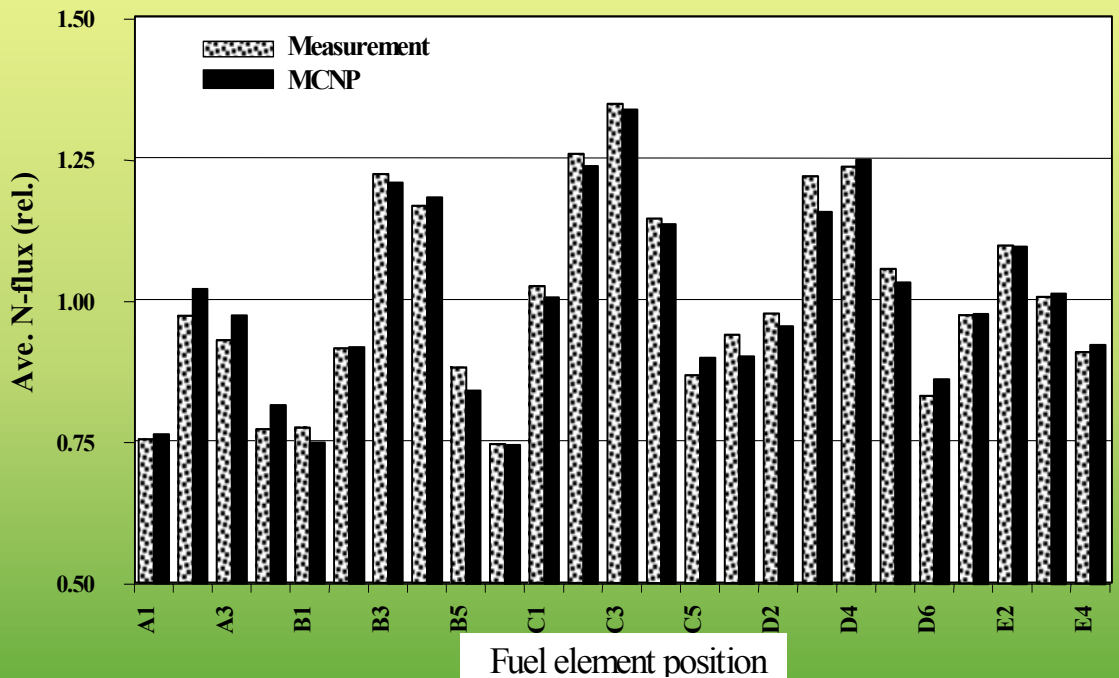
3-d Distribution of the n-flux in the reactor core midplane (MCNP-BURN)



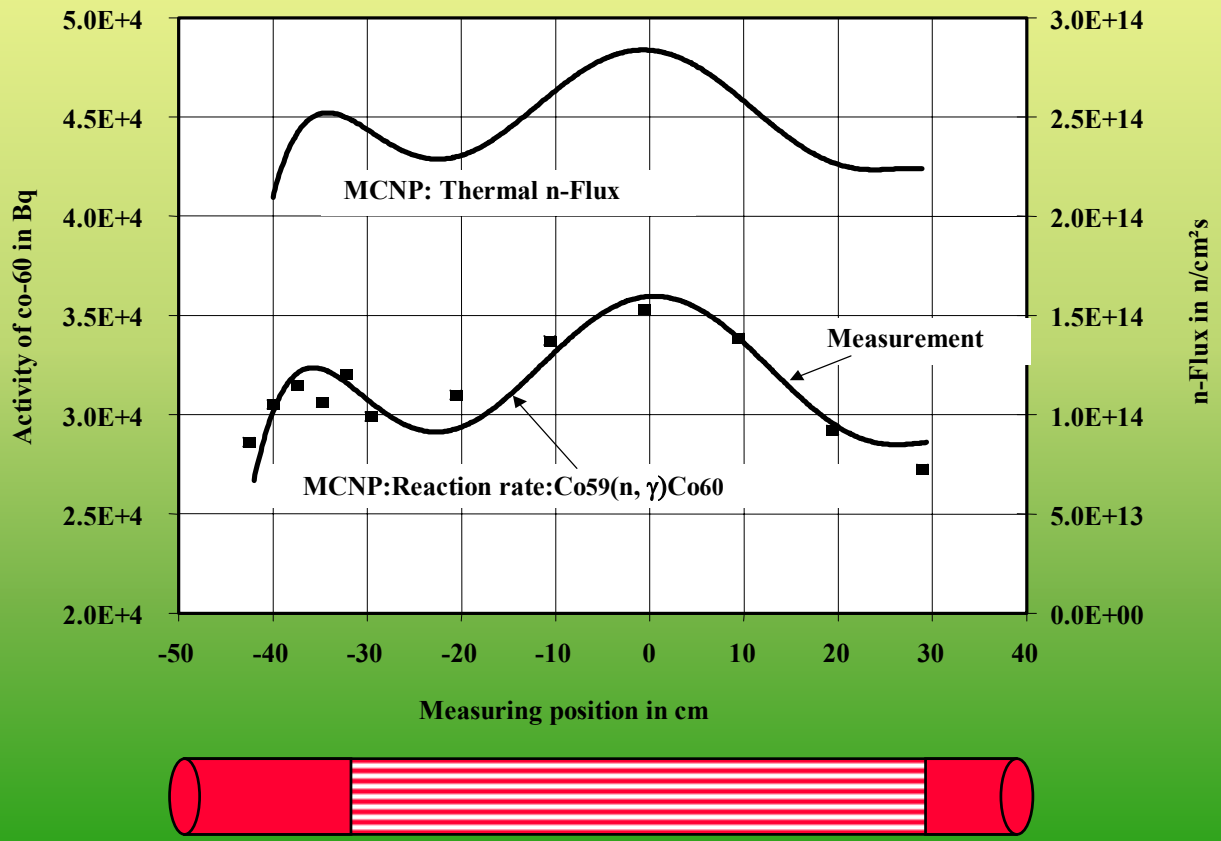
Exp. Verification: Multiplication factor as a function of operating time and burnup step respectively



Comparison of the calculated (MCNP-BURN) and measured thermal n-flux in 25 fuel elements



Comparison of the calculated (MCNP-BURN) and measured reaction rate in the central FE



Summary and conclusions

- **Using MCNP and BURN a precise method was developed for reactor analysis**
- **The whole model was verified by comprehensive measurements and experiments**
- **Due to its precision the state licensing authority approved the code system for the routine fuel management and safety analysis**
- **The tools are capable of predicting the neutronic state of every individual fuel element and any core configuration (HEU, mixed and LEU core)**

Arrangement of the fuel elements and absorber arms in the reactor core