

Determination of the Radiation Field in an Interim Storage Facility

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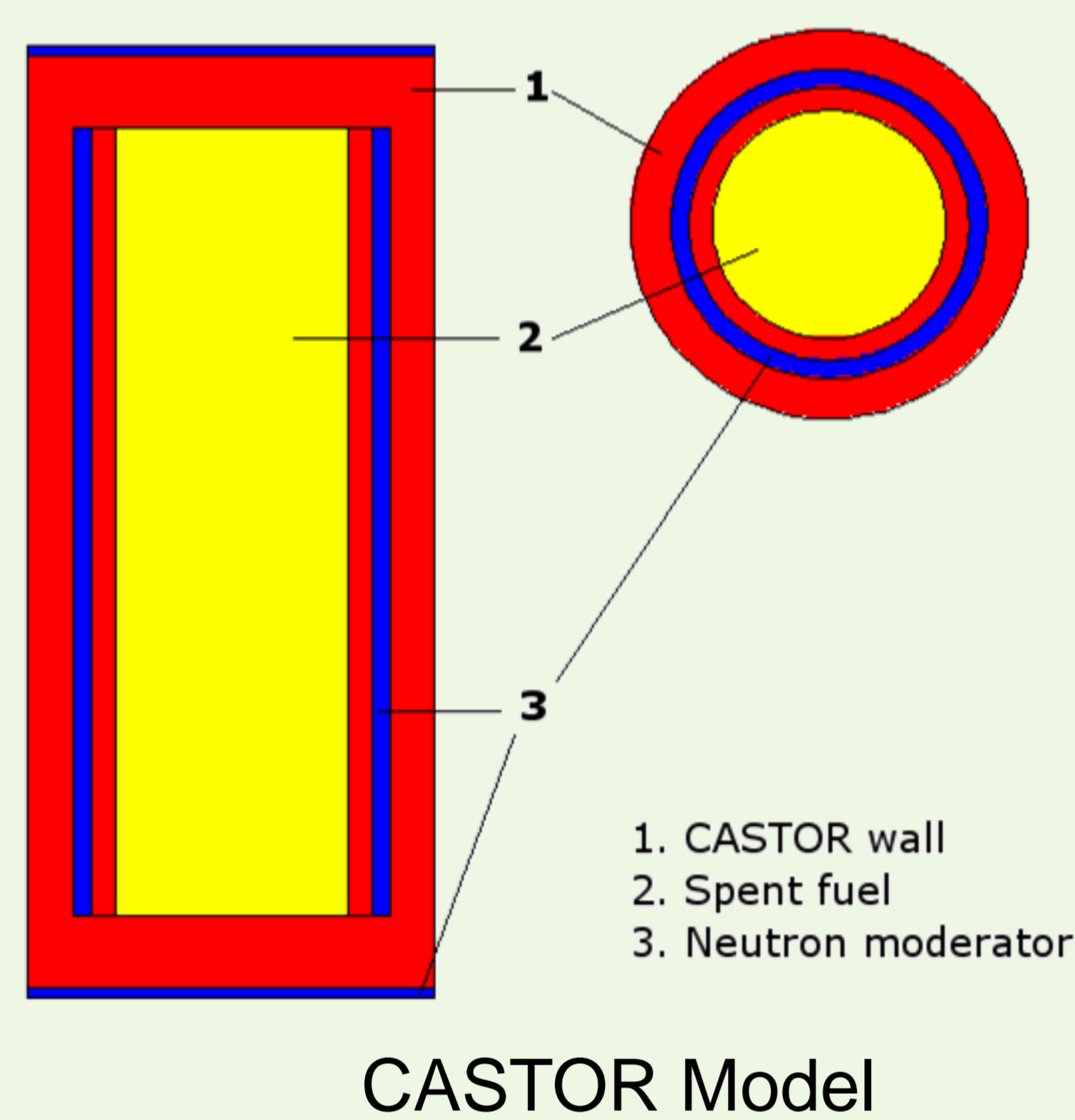
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1 Introduction

Since currently there are no final disposal places available, casks for storage and transport of radioactive material (CASTORs) are used to store spent nuclear fuel in interim storage facilities in Germany. For radiation protection purpose, we have performed simulations for CASTORs V/19 with MCNP5. Variance reduction techniques and parallel computing has been applied to improve the calculation efficiency for the complicated geometry and large number of CASTORs. Besides, surface source has been used to avoid unnecessary duplicated calculations.

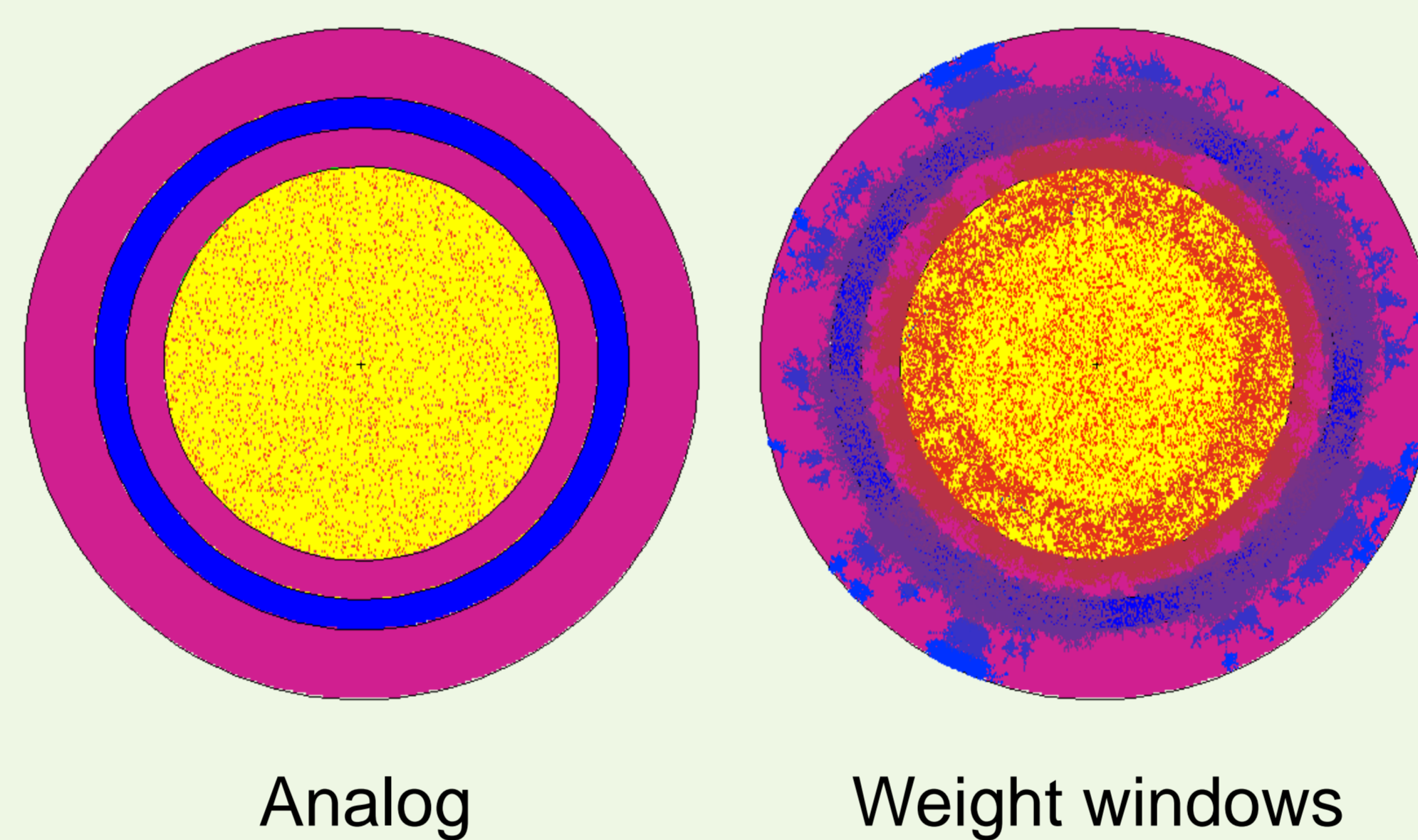
2 MCNP5 Model

- Simplified structure [1]
- Single moderator layer
- Uniform source distribution



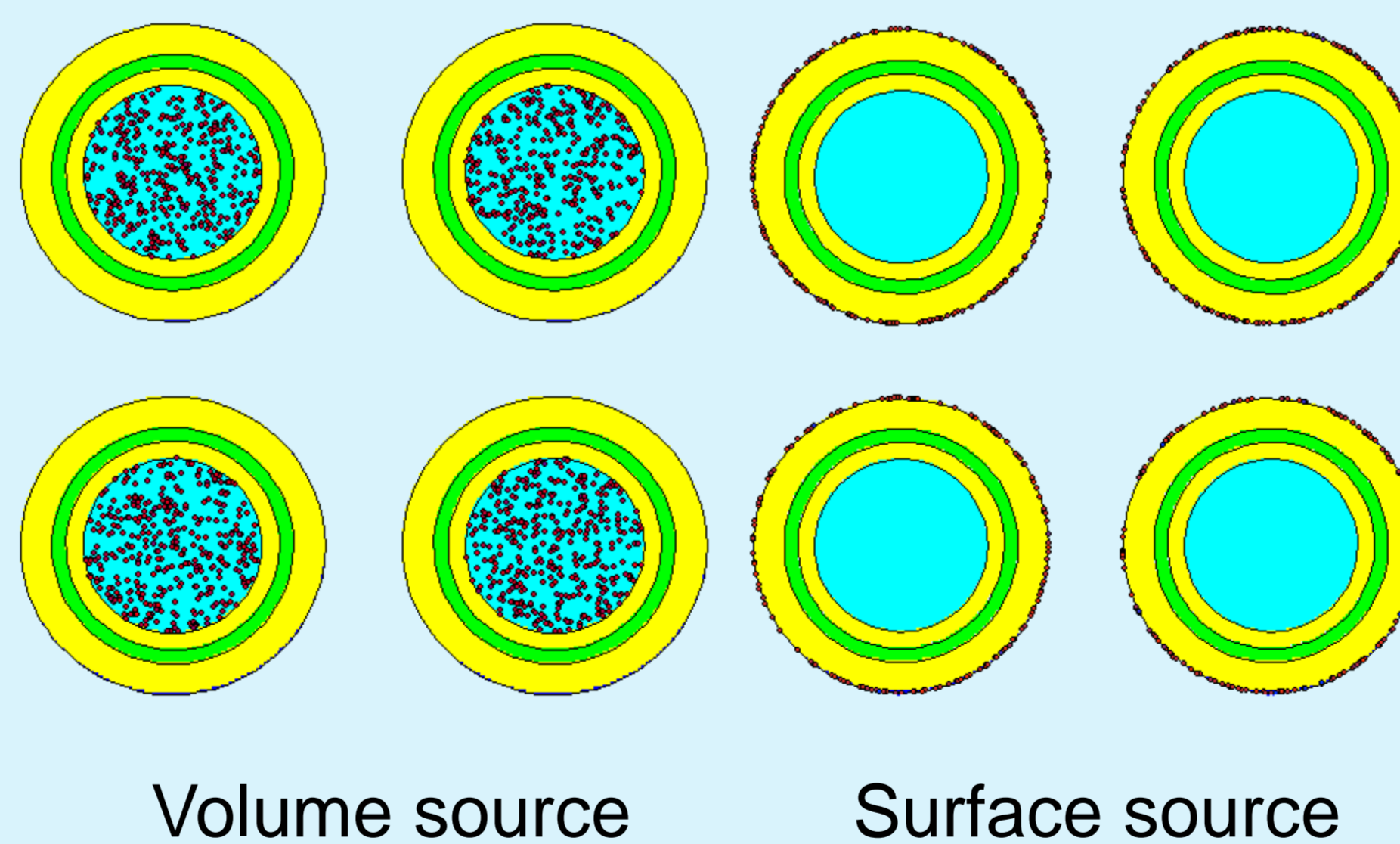
3 Weight Windows

- Parallel geometry
- Based on energies, weights, directions of particles, etc.
- Improved calculation efficiency



4 Surface Source

- SSW, SSR card of MCNP5
- Copy and translation of the source [2]
- Avoiding recalculations
- Save calculation time

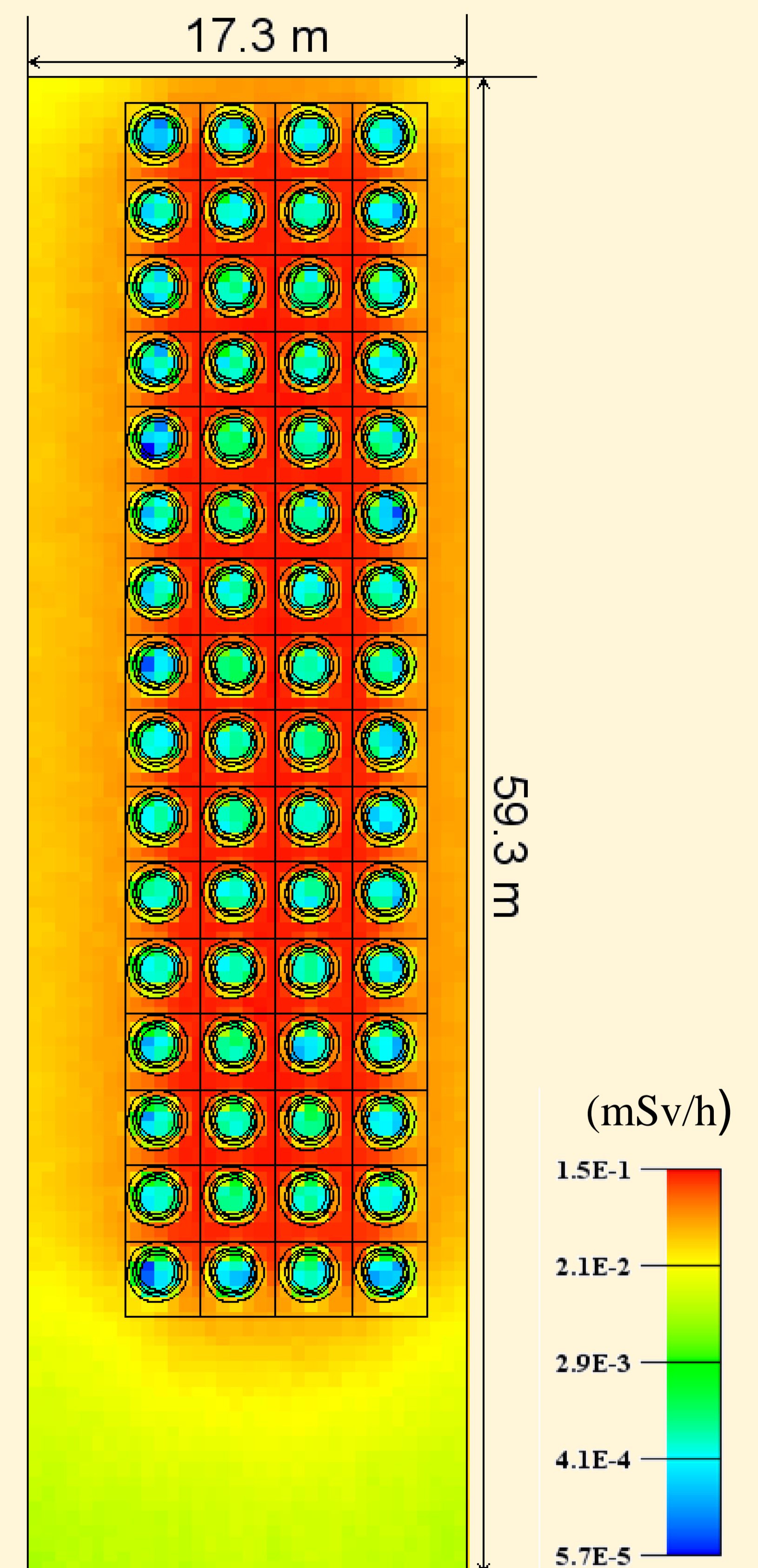


5 Parallel Computing

- SCC Linux cluster system
- Several tens of processors
- MCNP5 compilation with MPI
- Speeds up calculations with a large number of CASTORs

6 Simulated Neutron Field

- 64 CASTORs



7 Summary

The use of a computer cluster allowed simulating geometries with 64 CASTOR-casks in acceptable times. The simulations yield new insights into dose rate distributions and notably into the composition of the mixed radiation field, taking into account that spectra of the field are difficult to measure.

References

- [1] G. Zhang, Monte Carlo Simulation of Mixed Neutron-Gamma Radiation Fields and Dosimetry Devices, PhD Thesis, Karlsruhe Institute of Technology, 2011
[2] G. Zhang, R. Fritschek, F. Becker, M. Urban, S. Prys, Shielding Calculations of a CASTOR with MCNP5, in Proceedings of Annual Meeting on Nuclear Technology, Berlin, Germany, May 4-6, 2010

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