




Worms

Simple Monte Carlo code for
reactor physics applications

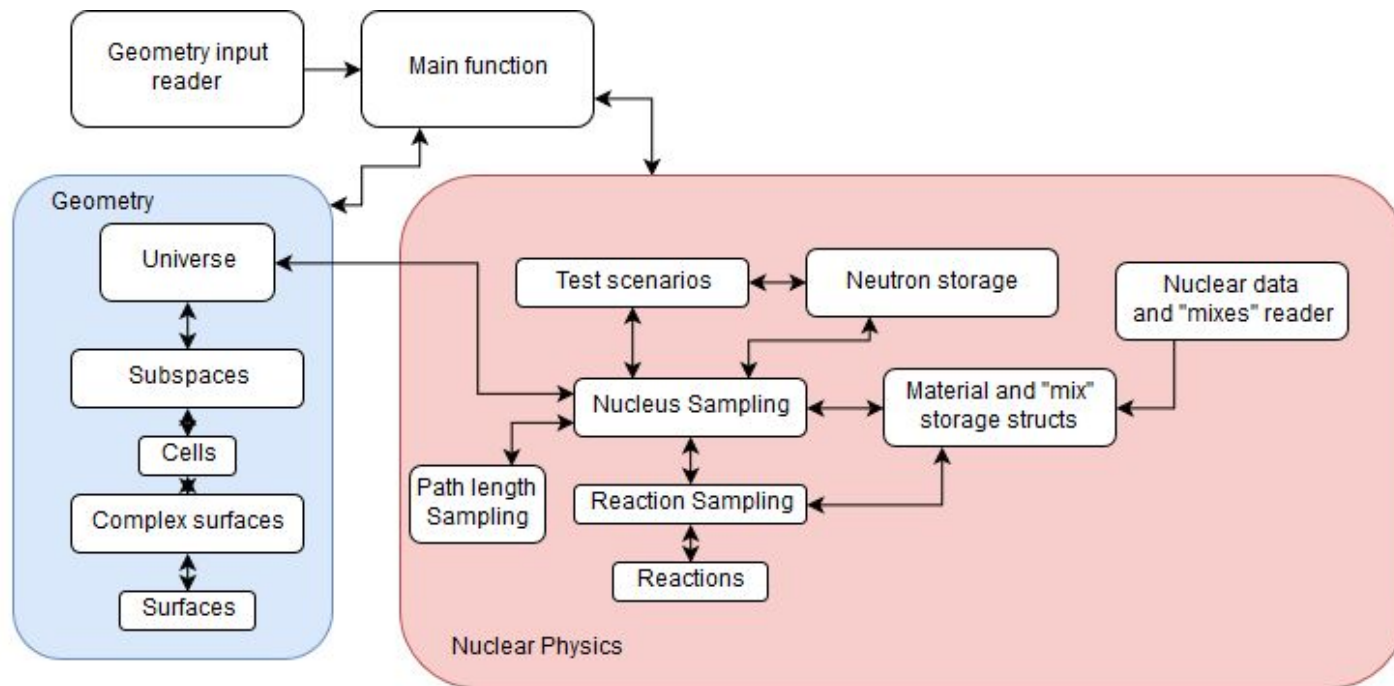




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Overall structure





Geometry - Input

- Simplified surface input by allowing for easy to comprehend parts
 - Cubes, cylinders instead of single surface components
- Cells constructed from Complex surface parts
 - Also lattice information
- Multiple subspaces
- Rotations and translocations handled separately



Geometry - Calculations

Calculations are called from the top most structure and moves down in complexity

Main functions are Point in Universe that is used to determine in which subspace and cell a point is located.

Length to cell that finds the distance along a direction to cell surface, if such exists.

Both functions works downwards in case of nested subspaces.



Nuclear Physics - Input and data structure

Data files for material cross sections are inputted in a list, to allow for pre allocation in the material bank, and parallelisation.

Materials(isotopes) struct contains all the material data and MT-data, in the form of a MT-struct, for simple access. Energy - Cross section pairs stored in map form for quick access.

For materials composed of multiple isotopes a mixes struct is used to store the nuclear density (and in the same time ratio) of the different isotopes.



Nuclear Physics - Choosing target nucleus, reaction

- Built using the provided lecture material.
- Added some safeguards as there were problems with about 1 neutron per 100 000.
- Tried to keep the functions short for readability and easy modification.
 - Grew with all the statistics collected.
- Neutron storage functions
 - Bank
 - Moneybags
 - Graveyard



Connecting the two

- Simplified by giving the Cells in the geometry names that match the Mix names from the nuclear data.
- Sampled path length checker to see if surface crossing.
- Modified data collection to match all needed statistics.



Mistakes

$$\delta = \frac{-\cancel{M} \pm \sqrt{L^2 - 4MK}}{2M}$$

The equation shows a red 'X' over the 'M' in the numerator, with a handwritten 'L' above it, indicating a correction from $-M$ to $-L$.

- In theory geometry input was good, reality turned out to be something else.
 - Hard to spot input errors meant hard to pinpoint if errors was due to input or code.
- Geometry functions might not be performing optimally.
 - Overall complexity too large.

“How i learned to love the debugger and stop worrying”



Final thoughts

- Very interesting course all in all
 - Learning to structure a larger project with many parts
 - Code optimization
 - Parallelization
- Heavy workload
 - However the flexibility of the course made it achievable