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MCNP4 Exercise for the Salt Tub Reactor

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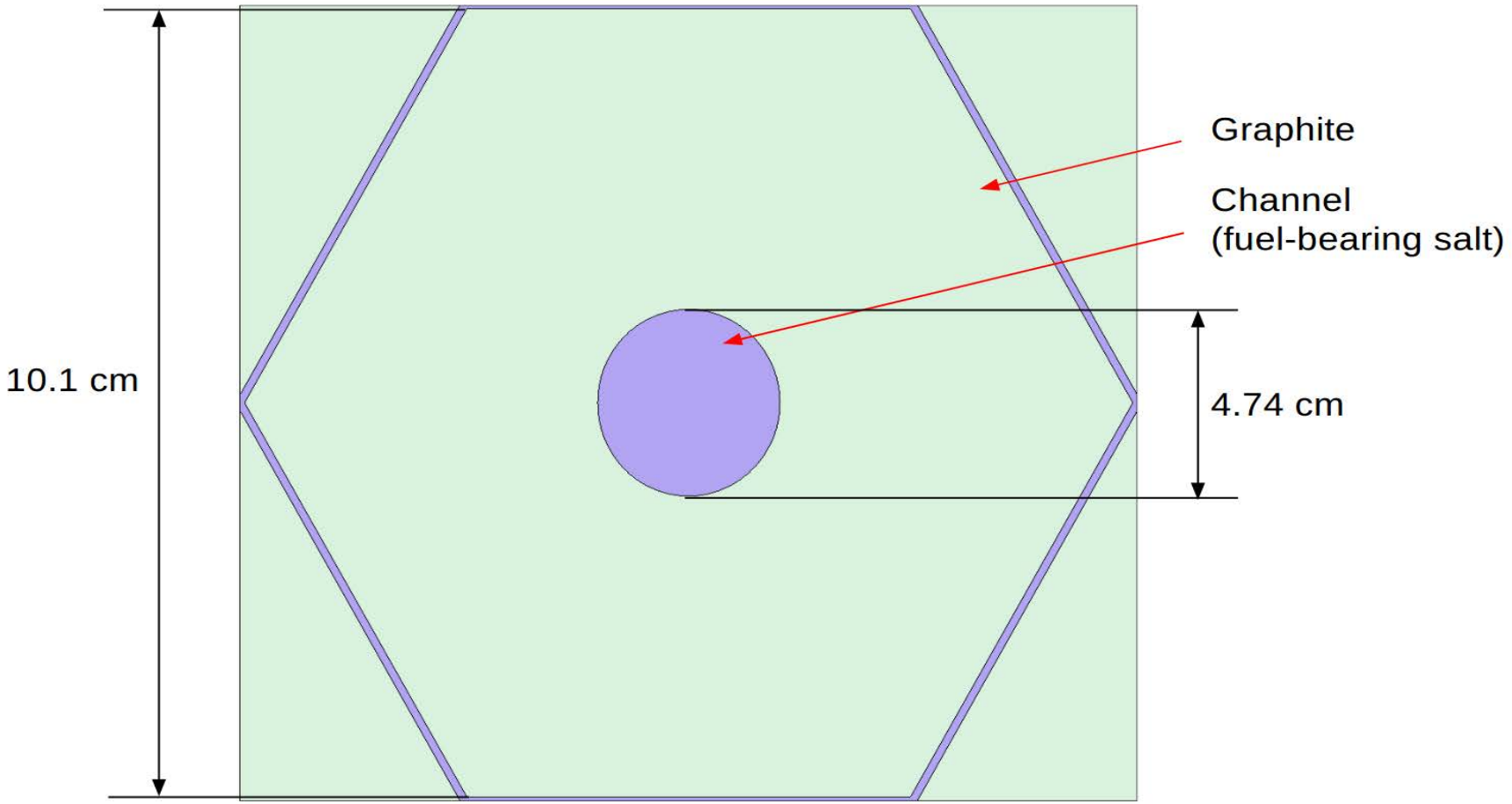
Monte Carlo

- City in France (Famous for gambling)
- Stochastic solver of transport equation.
- Version: MCNP4C
  - No need for licence
  - Old code (current version is MCNP6)
  - Don't use it for designing an actual reactor at home!
- Very simple input file: one cell of graphite with a salt channel.

STR layout



Limitations

- No burn-up (would need to use Origen)
- No transport of delayed neutrons.
- No thermalhydraulics.
- No fission products.
- Probably more...

Exercise

- The executable provided runs under windows on a PC.
- You may ignore pop-up messages informing you of obscure errors. They relate to the running of MCNP on Windows, not to the actual running of MCNP itself.
- MCNP writes its own output files.
- The manuals of MCNP are provided as pdf files

Task 1

- 1. Examine input file str01:
  - Understand the geometry
  - Determine the material composition, in particular the salt composition
  - Establish the temperatures of the various components
  - Understand control cards

Task 2

- 2. Run mcnp:
  - Open a CMD window on the PC.
  - Navigate to the mncp directory.
  - Type mcnp.exe inp=str01 out=str01o xsdir=xsdir (xsdir is a file that points to the nuclear data, have a look at it)
  - Note that you need to remove all output files if you want to run the same command again, mcnp does not overwrite files.

Task 3 and 4

- 3. Examine the output file:
  - Use the manual to understand some of the output;
  - Understand why there are inactive and active cycles.
  - Make a note of k-eff
  - Look at the development of k-eff.
- 4. Examine the file str02 and look at the difference with str01
  - Run it and compare the results with str01

Input file str01

```
Salt Tub Reactor
100  1  -4.34  -10    12 -13  IMP:N=1 TMP=7.76E-08
101  2  -1.75  -11 10 12 -13  IMP:N=1 TMP=6.89E-08
102  0       #(-11    12 -13) IMP:N=0

10  rcc  0 0 -1  0 0 302     2.37
*11 rhp  0 0 -2  0 0 304  0 10.1 0
12  pz                0
13  pz              300

mode n
totnu
kcode 10000 1.0 20 60
ksrc 0.0 0.0 150.0
print 40
m1       3007.60c  7.40E-02
         4009.60c  1.65E-02
         9019.60c  1.45E-01
        92235.60c  4.81E-05
        94239.60c  1.92E-05
        92238.60c  9.43E-03
m2       6000.60c  8.77414E-02
         5010.60c  9.64977E-09
         5011.60c  3.90864E-08
mt2  grph.05t
```