MCNP Lab Exercises 4

Aims:

- Sources,
- Tallies
- Tally modifiers
- Criticality

4A Waste drum extension:

Using a working waste drum file, either your own or from canvas.

- Create a cylindrical volume neutron source in the magnox material with U235 thermal fission watt spectrum (see appendix d of the manual), you do not need to change the material to include U235.
- Note: you will need to change the material definitions to isotope specific depending on the available cross section libraries, if you get fatal error "cross section not found".
- Calculate the average neutron heating (energy deposition) in the concrete layer (in Watts / cm^3) assuming a source strength of 1×10^6 n/s.
- Calculate the reaction rate of Fe55 production in the steel layer via the (n,2n) reaction on Fe56 using appropriate fm card and determine the saturation activity assuming a source strength of 1×10^6 n/s.

4B Waste drum criticality

- Change the magnox material to include 10% U235, 40% U238 and increase the density to 5.1 g/cm^3.
- Add a kcode card skipping 20 cycles out of a total of 100 cycles, with 1000 particles per cycle and an initial Keff guess of 0.3 to the data block and calculate k effective.
- Change your initial estimate of K eff and examine the effect on the behaviour of Keff.
- Change the increase the total number of cycles and examine how it effects the Keff value and the standard deviation.
- Change the number of skipped cycles so that the value of keff is not oscillating once the skipped cycles have finished.
- Calculate the neutron energy spectrum in the concrete layer.