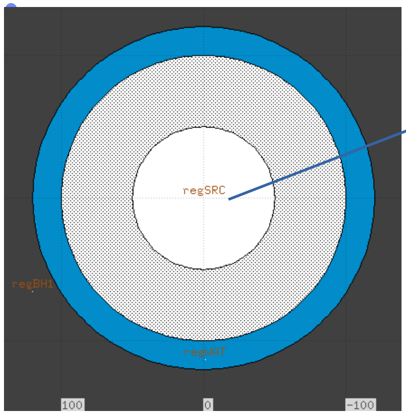
Exercise: Source

Advanced FLUKA Course 2019

Goal and setup

- Goal: learn to code a custom source routine
- Plus: see the moderating effect of water and the importance of albedo
- Setup: neutron source, distributed inside a cylindrical volume, with “complex” energy distribution, ==> cannot use CYLI-VOL
- Neutron energy distribution from the results of the bias exercise
- Very simple geo :

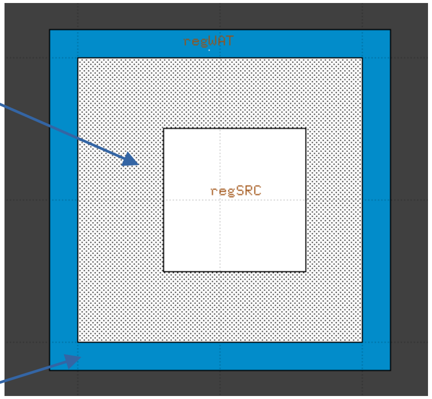


Front

Source region
Cylinder
R=50
H=100
Center: (0,0,10)
Vacuum

Void region
Cylinder
R=100
H=200
Center: (0,0,0)
Vacuum

Water region
Cylinder
R=120
H=240
Center: (0,0,0)
Water



Sid
e

Source.f

- Provided: source_spc.f
- It reads the energy spectrum, divided in energy intervals, from external file (formatted as the xxx_tab_.lis from scoring)
- Name of the file given in the SDUM field of the SOURCE card, plus extension *".dat"*
- It samples the energy bin:
  - build the cumulative distribution of the spectrum c_i=Sum(f_j), j<=i where f_j is particles/GeV * energy_j interval
  - Throw a random number, *R (0-1),* normalize it to the total of the spectrum->R_c
  - Energy bin: k such as $c_{k-1} < R_c < c_k$
- It samples the energy uniformly within the bin, throwing a second random number

Source.f: you

- Add sampling of the event position, within the source region:
- Take the center of the region from the BEAM card, stored in BEAMCM as XBEAM,YBEAM,ZBEAM
- Assume that the radius and height of cylinder are passed by the SOURCE card in the WHASOU common
- Sample z,r,phi
- Hint: Uniform distributions: use the same algorithm as per sampling inside the energy bin
- Hint: beware to radius. Which is the good variable to sample?
- Transform to x,y,z and Fill the stack

- Direction: leave the standard (along z)

Input file

- Two options: build it (the geometry it is simple), or take the skeleton ex_source_skeleton.inp
- Add a SOURCE card
  - passing the geo parameters in the first two WHAT's
  - and the name of the file in the SDUM, stripping "*.dat*".
  - The provided spectrum name is *biasmat.dat*
- We want to check our source: add scoring: see next slide

Input file: scoring

- For the energy spectrum: USRTRACK in the source region, scoring BEAMPART from thermal neutrons (1.E-14) to 100 MeV, logE, 130 bins
- For the Volume sampling: two ways (do both)
- A) do not have a “source” generalized particle..but: fluence of primary neutrons in the source region should be uniform in the r-phi coordinates, and grow linearly along z :
- Add USRBIN scoring BEAMPART fluence on a cylindrical grid that covers the target, bin size 1cm, 6 phi bins
- B) add USERDUMP to dump source only and visualize in Flair:

USERDUMP what(1)=100. , what(3)=1., SDUM=dump (see next lecture…)

- To see the effect of the water layer: add similar USRBIN and USRTRACK scoring NEUTRON. Only one phi-bin in this usrbin

Run

- Run..
- Hint: first run with only the provided source, to check that the input and scoring are correct
- Run with your source
- Plot the USRTRACK results for primary particles in lethargy (E*Y), log in x and y
- Plot the input spectrum (in flair, enter its name as if it was the result of an estimator) with the same settings.
- Check that they are the same
- Plot the USRBIN for primary. Check that it's uniform in the transverse plane.
- The same with 1-D projection: check that it grows linearly
- Plot together the two USRTRACK : note the explosion of the thermal part of the spectrum