



Exercise 7: Low Energy Neutrons

FLUKA Beginner's Course

Exercise: Low Energy Neutrons

Aim of the exercise:

- 1- More geometry practice
- 2- Use of Conditional Directives
- 3- Run parallel cases
- 4- See FLUKA capabilities on low energy neutrons

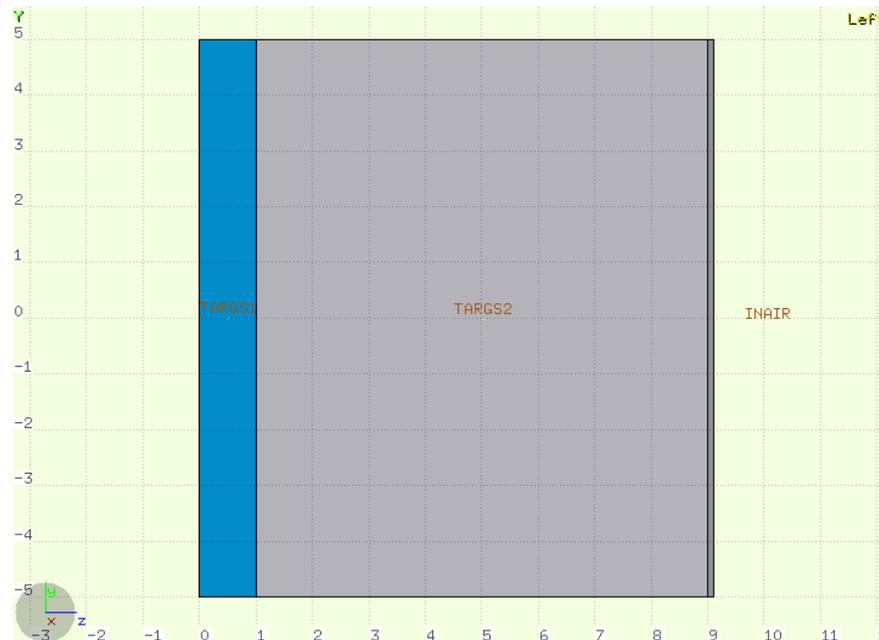
Exercise: Low Energy Neutrons

- Start from the solution of **ex4** (Copy both .inp and .flair files):

```
mkdir ex7 ; cp ex4/ex.* ex7 ; cd ex7
```

- Geometry modifications:

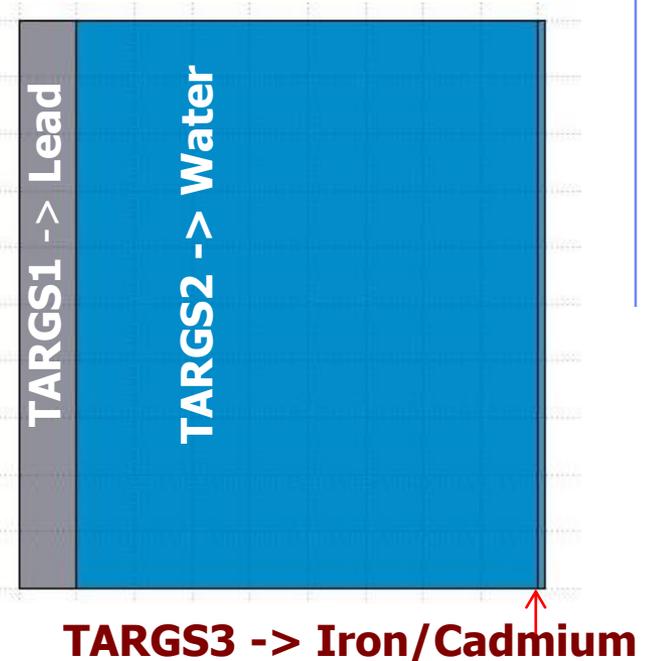
- Increase **TARGS2** size moving **T2seg** plane to **z=9 cm**
- Squeeze **TARGS3** to 100 microns moving **ZThigh** to **z=9.01 cm**



Exercise: Low Energy Neutrons

Material modifications:

- ❑ TARGS1 -> Lead
- ❑ TARGS2 -> Water
- ❑ TARGS3 -> Iron/Cadmium
(use `#if ... #else ... #endif`)
- ❑ NB: Cd is not a FLUKA predefined material
MATERIAL card must be defined
(you can try to use Flair to add it)



```
# #define Flag_IRON :
If Flag_IRON is defined, then Iron is assigned to the TARGS3 region otherwise Cadmium is assigned
# if Flag_IRON
  ASSIGNMA Mat: IRON Reg: TARGS3 to Reg:
  Mat(Decay): Step: Field:
# else
  ASSIGNMA Mat: CADMIUM Reg: TARGS3 to Reg:
  Mat(Decay): Step: Field:
# endif
ASSIGNMA Mat: CO2 Reg: INAIR to Reg:
Mat(Decay): Step: Field:
```

Exercise: Low Energy Neutrons

- Add **boundary crossing scoring** from TARGS3 to INAIR
 - Estimate neutron fluence (unformatted output on unit 53)
 - Use log energy binning down to the lowest energy group
- For **both Fe and Cd**: run 5 cycles, 5000 primaries each
- **WARNING**: do not overwrite results when running the 2nd case, create two runs in Flair and run them independently

Add new a run

The screenshot shows the Flair software interface. The 'Add' button in the 'Input' menu is circled in red. Below it, the 'Run' configuration window is open, showing a table with columns 'Name' and 'Value'. The 'Flag_IRON' flag is checked. Red arrows point to the 'Add' button, the 'Run' button, and the 'Flag_IRON' checkbox. The 'Run' configuration window also shows 'Primaries' set to 5000 and 'Rnd' set to 1765575965.

Set primaries

Set random seed

Name	Value
<input checked="" type="checkbox"/> Flag_IRON	

Set the flag(s)

Exercise: Low Energy Neutrons

- Plot the results as a lethargy spectrum
(x-axis: E [GeV],
y-axis: $dN/d(\log E)$ [cm⁻² per proton] (Value: $\langle X \rangle * Y$),
both log axis)
- For the **Iron** case:
 - Identify the peak in thermal part of the spectrum
 - Note the automatic matching of neutron group structure
- Compare with the results obtained in the **Cadmium** case