



# Exercise 9: Low Energy Neutrons

FLUKA Beginner's Course

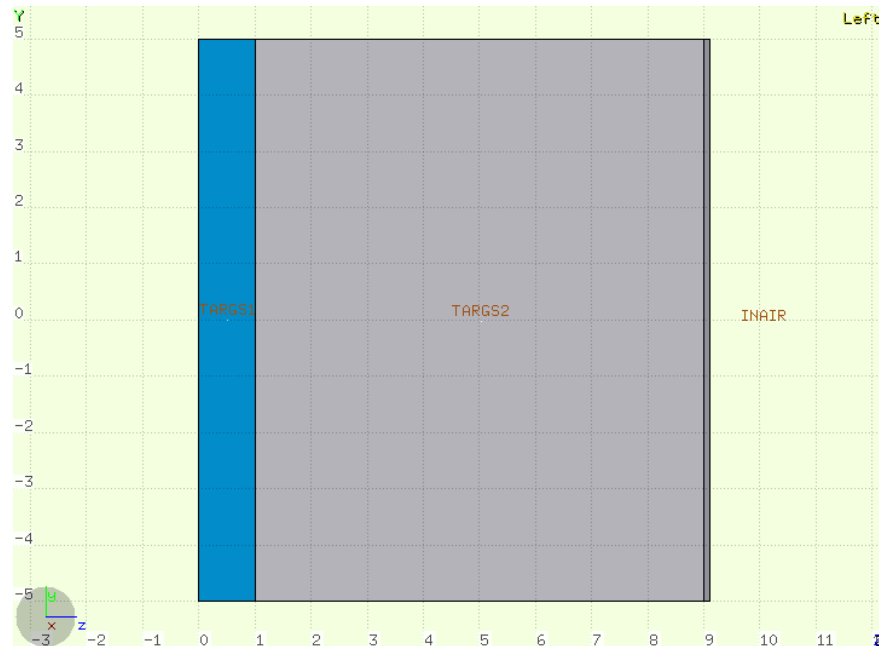
# Exercise 9: Low Energy Neutrons

## **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

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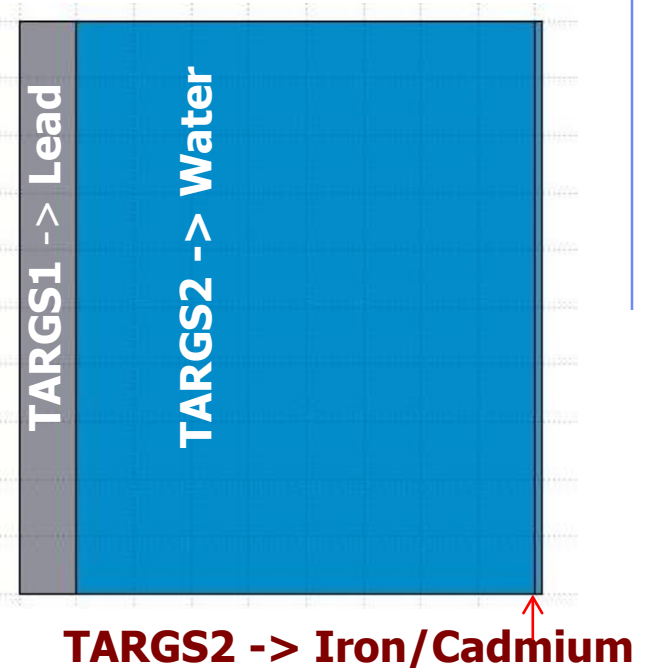
- ❑ Start from the solution of ex5 (copy both inp and flair files):  
`mkdir ex9 ; cp ex5/ex5.inp ex9/ ; cp ex5/ex5.flair ex9/ex9.flair ; cd ex9`
- ❑ Geometry modifications:
  - Increase **TARGS2** size moving **T2seg** plane to **z=9 cm**
  - Squeeze **TARGS3** to 100 microns moving **ZThigh** to **z=9.01 cm**



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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: ▼
```

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- 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 top toolbar is circled in red. Below it, the 'Run' configuration window is open, with several annotations:

- Set primaries**: An arrow points to the 'Primaries' field, which is set to 5000.
- Set random seed**: An arrow points to the 'Rnd' field, which is set to 1765575965.
- Set the flag(s)**: An arrow points to the 'Flag\_IRON' checkbox, which is checked.

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

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- Plot the results as a lethargy spectrum  
( x-axis:  $E$  [GeV],  
y-axis:  $dN/d(\log E)$  [cm<sup>-2</sup> 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