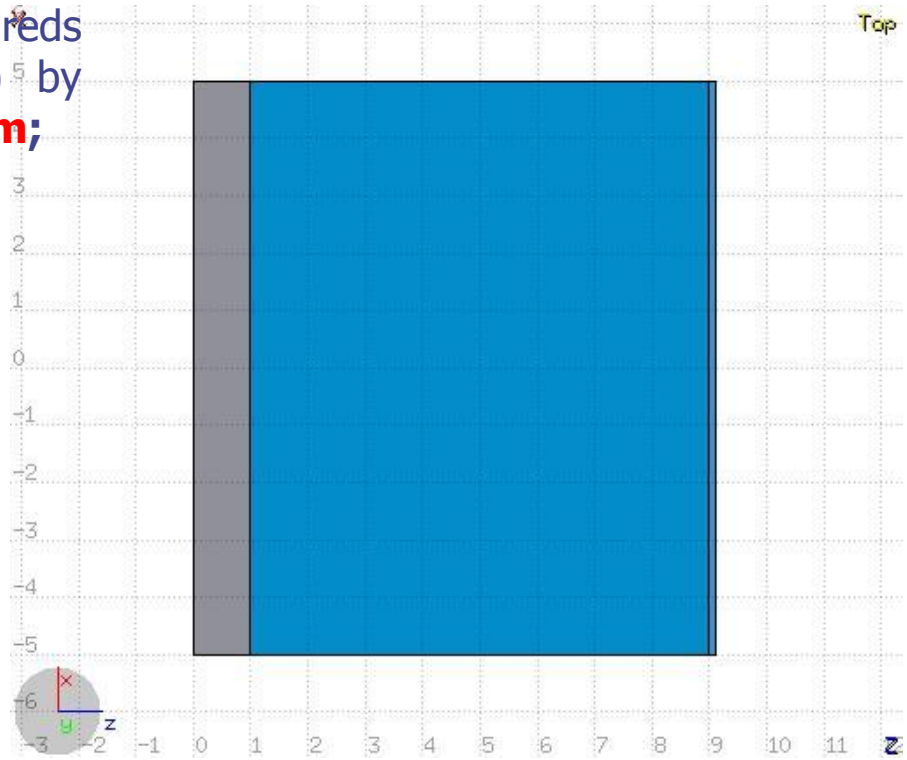
Exercise 7: Low Energy Neutrons

Beginners' FLUKA Course

Exercise: Low Energy Neutrons

GOAL: Simulate the effect of the thermal neutron cutoff of a thin Cd foil.

- Create a folder called **ex7** and start there a new flair project based on the **course** template (as before)
- Save the input as **ex7.inp**
- Modify the geometry:
  - Increase the **TARGS2** dimensions by moving the **T2seg** plane to **z=9 cm**
  - Thin out the **TARGS3** to few hundreds of microns (start with 100 um) by moving plane **ZThigh** to **z=9.01 cm;**



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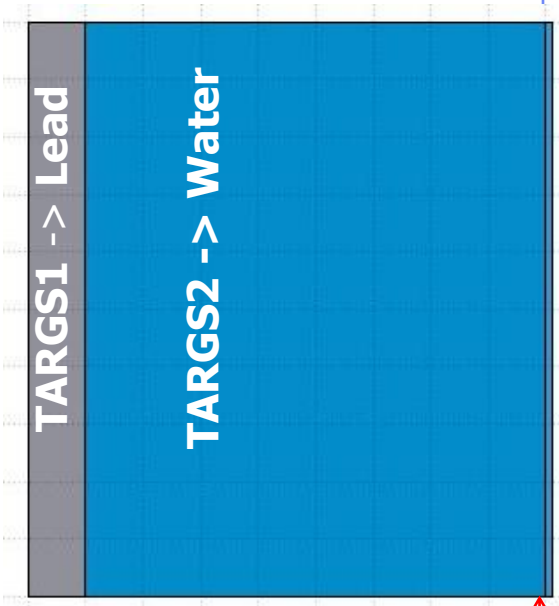
- Change the materials as follows:
  - **TARGS1** -> **Lead**
  - **TARGS2** -> **Water**
  - **TARGS3** -> **Iron/Cadmium** (between **#if ... #else ... #endif** statement)
- **Note: Cadmium** is not a FLUKA default element so you must define the material card first (you can try to use flair to add it)




```
END
GEOEND
Materials definition
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 define Cadmium
MATERIAL                Name: CADMIUM            #              ρ: 8.65
      Z: 48.              Am:                    A:           dE/dx:

 define a flag
#define flagIRON              :

 if "flagIRON" flag is set assign "iron" to the TARGS3 region
 if not assign Cadmium instead
#if     flagIRON
  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: BLCKHOLE      Reg: BLKHOLE       to Reg:
```

Exercise: Low Energy Neutrons

- Add a boundary crossing estimator to score the neutron *fluence* from the thin foil region **TARGS3** to the region **INAIR**:
  - Use logarithmic energy binning down to the group of lowest energy
  - Write the output unformatted to unit 56
- Run for Iron and Cadmium 5 cycles of 20000 primaries and plot the results as a lethargy spectrum (x-axis: GeoMean, y-axis: Y*<Xgeo>, both axis logarithmically)
- For the **Iron** case: Identify the peak in thermal part of spectrum (note the automatic matching of neutron group structure)
- Compare the results with the **Cadmium** case

Note: not to overwrite the results when running the second time you can create two runs in flair and run them independently