Exercise: materials

Exercise objectives

- Declaring & assigning materials
- Defining compound materials
- Running, plotting and interpreting results

Making gruyère (as a COMPOUND material in FLUKA)

- Swiss gruyère cheese, 100 g (simplified composition):
  - 34.5 g water
  - 28.5 g proteins: $C_3H_7NO_2$
  - 33.4 g lipids: $CH_3(CH_2)_{14}COOH$
  - 1 g Ca
  - 600 mg P
  - 360 mg Na
  - 74 mg K
  - 40 mg Mg

What is the most convenient way in which to describe these materials?

- Density ρ = 915.35 kg/m^3
- **Note:** Authentic Swiss gruyère does not have holes; it can therefore be considered a homogeneous medium…☺

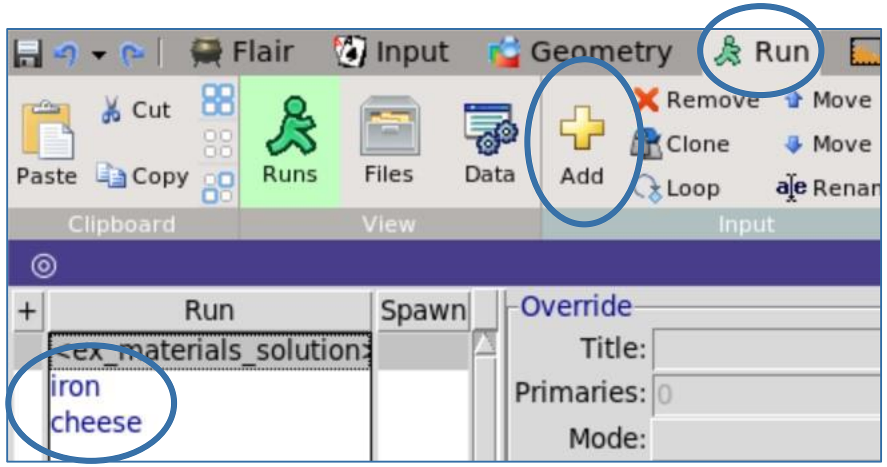
Geometry, beam parameters and scoring

- Start from the provided input
- Define **GRUYERE** as a compound material
  - **Hint:** first define proteins and lipids as compound materials, then use them to define the gruyère

- A non-divergent 200 MeV proton beam along the z-axis starting from (0,0,-5) is already defined
  - You can confirm this by looking at the **BEAM** and **BEAMPOS** cards
- A scoring card (**USRBIN**) is already included:
  - Proton fluence in an X-Y-Z 3D-mesh encompassing the target

Run

- Assign the new material **GRUYERE** to region **TARGET**
- Add a new run (“cheese”) and run 5 cycles with 10^4 primaries each
  - **Note:** check to see that the number of primaries per cycle is set in the **START** card

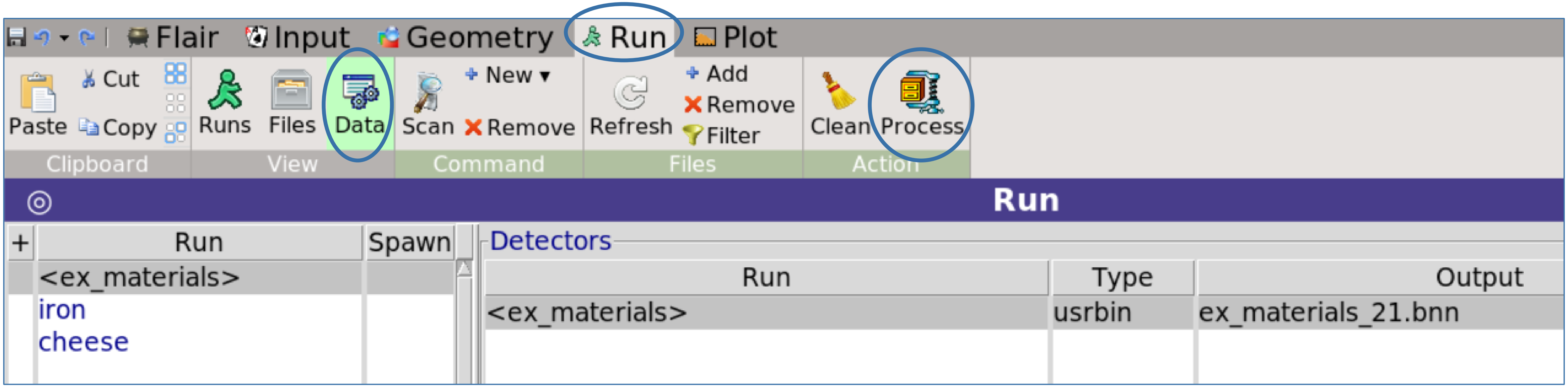


- Then, assign material **IRON** to region **TARGET**, add a new run (“iron”) and run again

- Did you notice a difference in the CPU time per primary for the two cases?

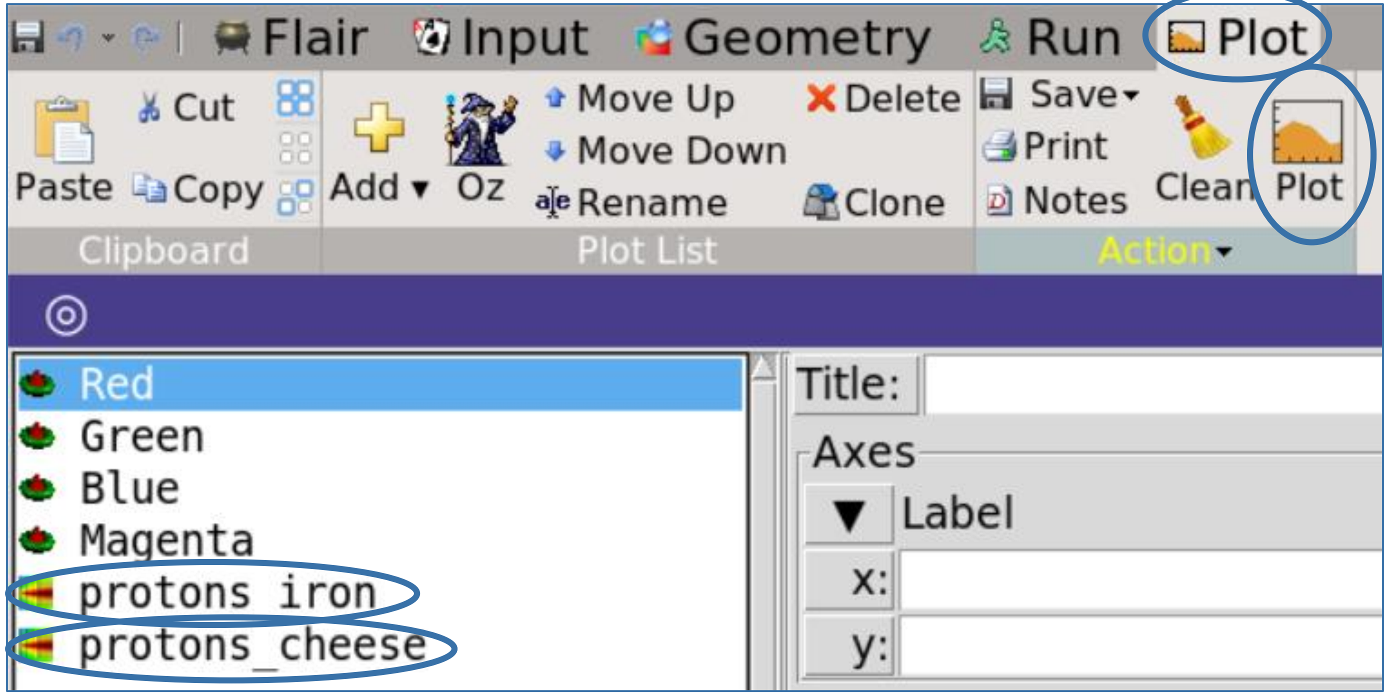
Process the results

- After running, process the results (in the Run tab, go to Data, select both runs and click Process)



Plot the results

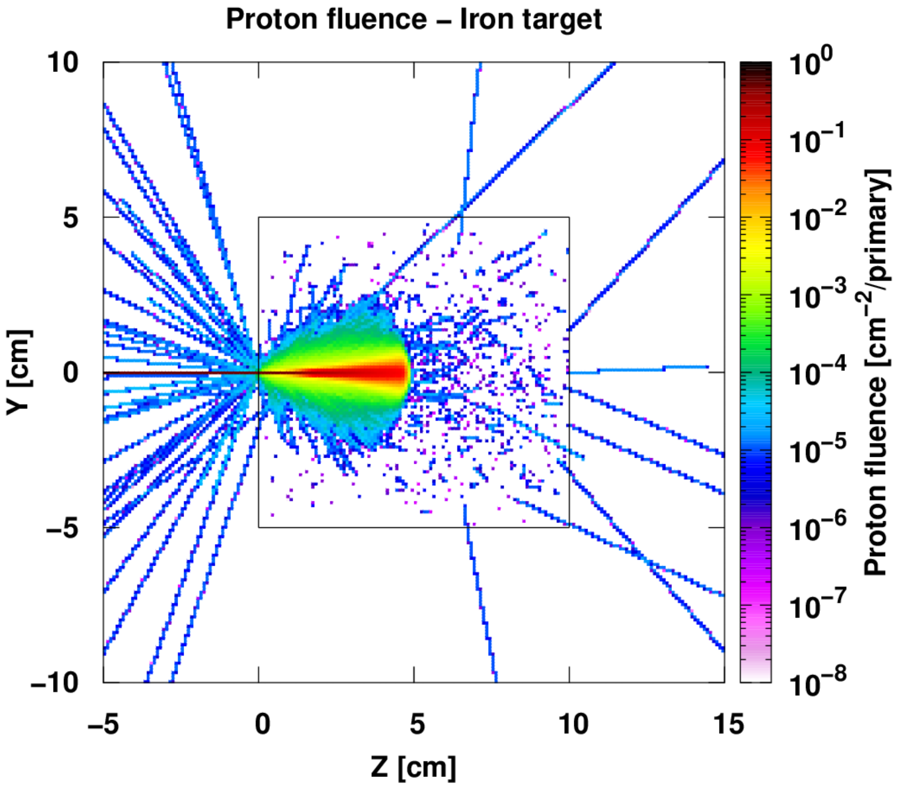
- After processing the results, go to the Plot tab and plot each result in turn by selecting the corresponding scoring (shown in the lower left) and clicking Plot

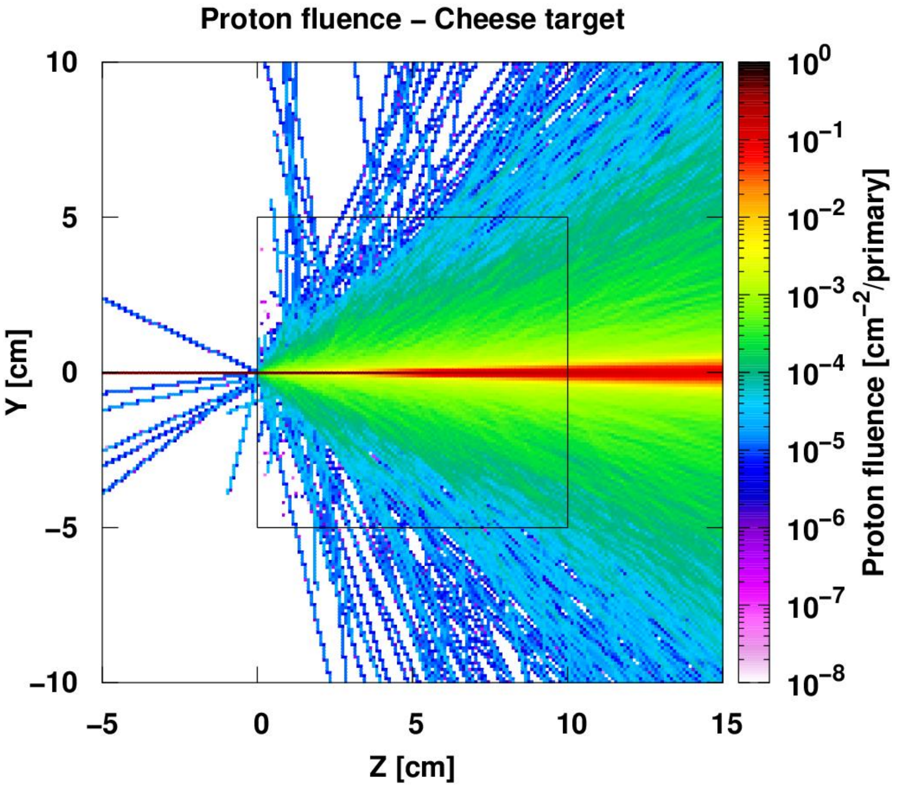


- **Note:** if you did not name the runs “iron” and “cheese”, then you will need to change the Binning Detector file in order to produce the plots

Interpreting the results and getting additional information

- Observe the plotted results for the two cases. Which material would be a better beam dump? Can you explain the difference in CPU time between the two cases?





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