Exercise: Simple sources and preprocessor

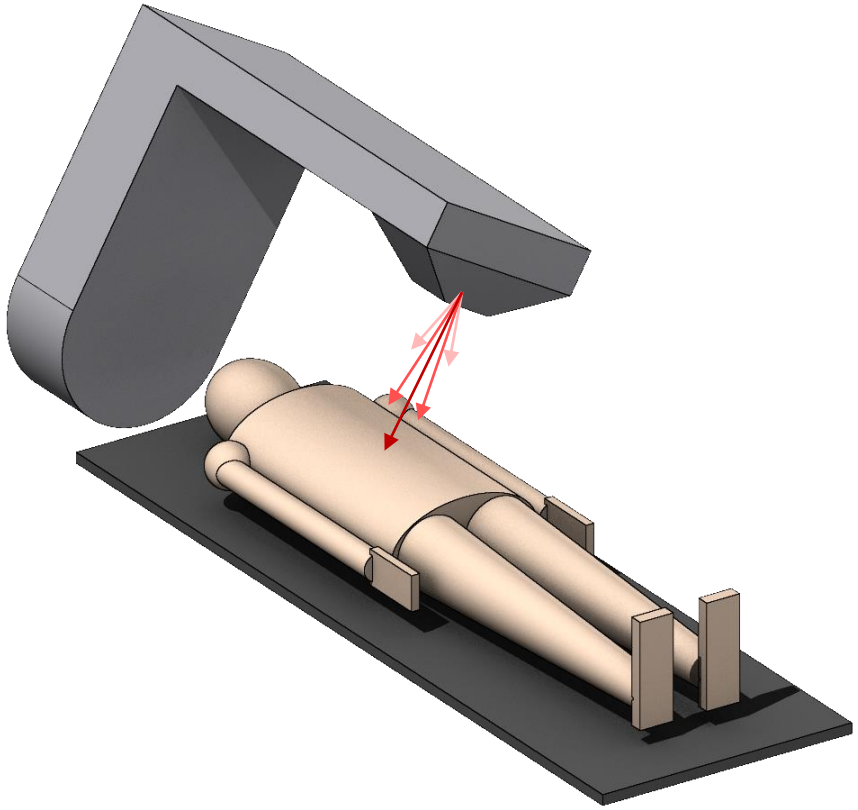
Exercise objectives

- Setting up different simple beams
  - Point source with **`BEAM`** and **`BEAMPOS`** card
- Using conditional preprocessor
- Using separate runs
- Visualising the beams
- Plotting the predefined scorings

Problem description

- Start from the provided input
- We want to run a simulation for radiation therapy (the geometry is provided)

- The beams should start in the gantry
  (x = 22.5, y = 38.97114317, z = 0.0)
  and be directed towards the origin (0,0,0)



- The following scorings are already included:
  - Side view of the beam
  - Shape of the beam close to the patient
  - Beam energy spectrum

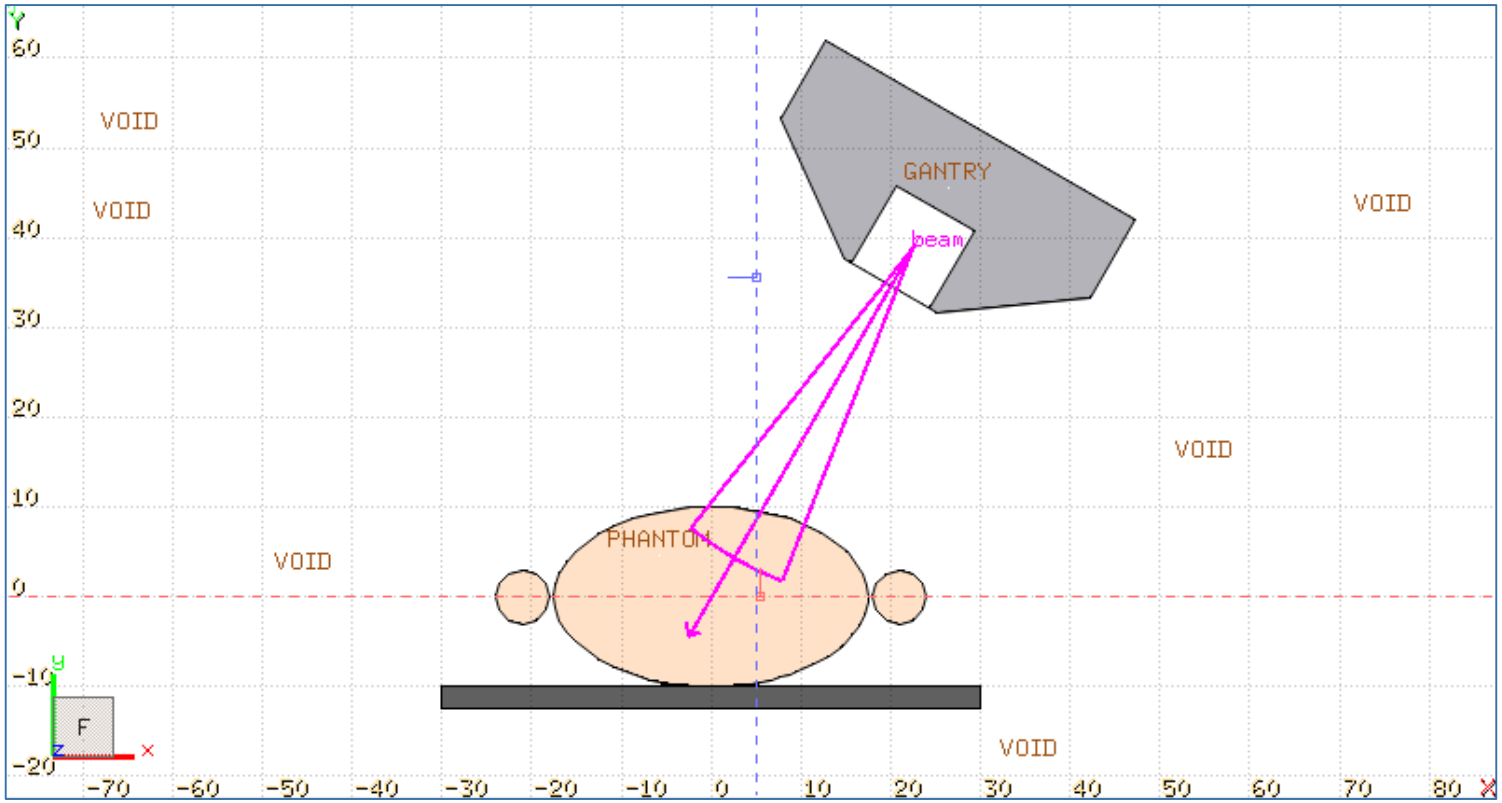
Defining and selecting a beam

- Set up two different photon beams with a flat 0.3 rad angular divergence but different momentum distributions:
  1. Flat momentum distribution between 5 and 10 MeV/c
  2. Gaussian momentum distribution: Mean energy = 10 MeV, FWHM = 1 MeV/c

- Define (`#define`) an identifier named "**Gaussian**"
- Make the two beams selectable using conditional preprocessor directives (`#if`, `#else` and `#endif`)
  - Make sure that if the "**Gaussian**" identifier is enabled, the corresponding Gaussian beam is used

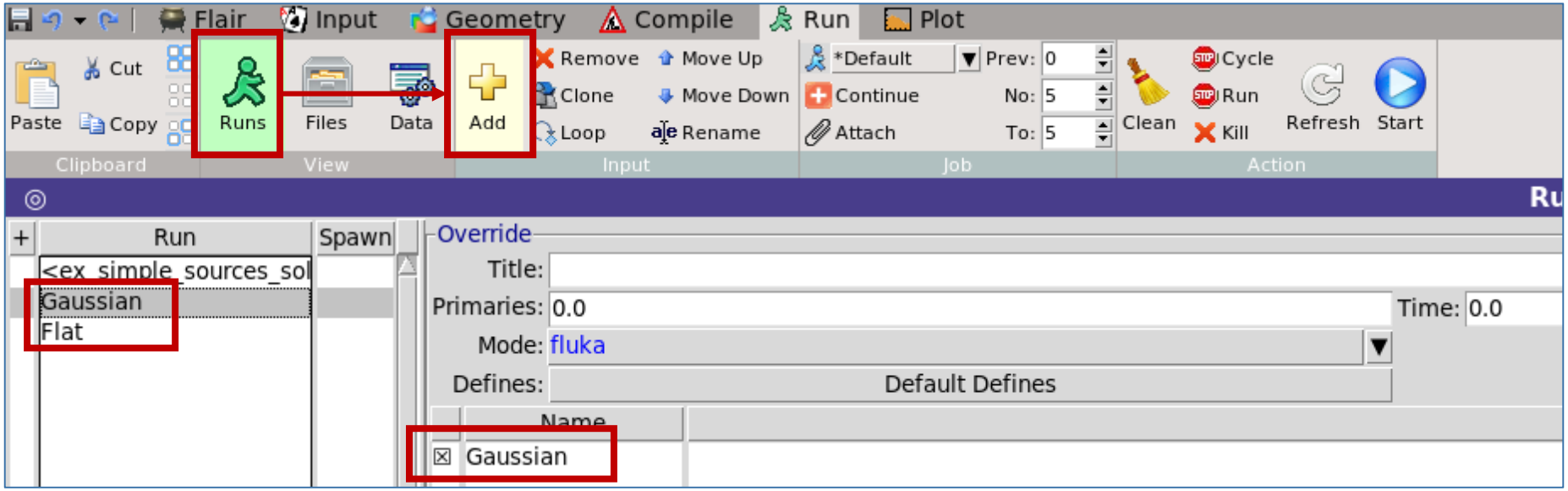
Visualising the beam

- Use the Geometry tab (Geoviewer) to see if the direction and angular divergence are correct
  - Set the scale property to 5000 to be able to see the beam



Creating separate runs (in the Run tab)

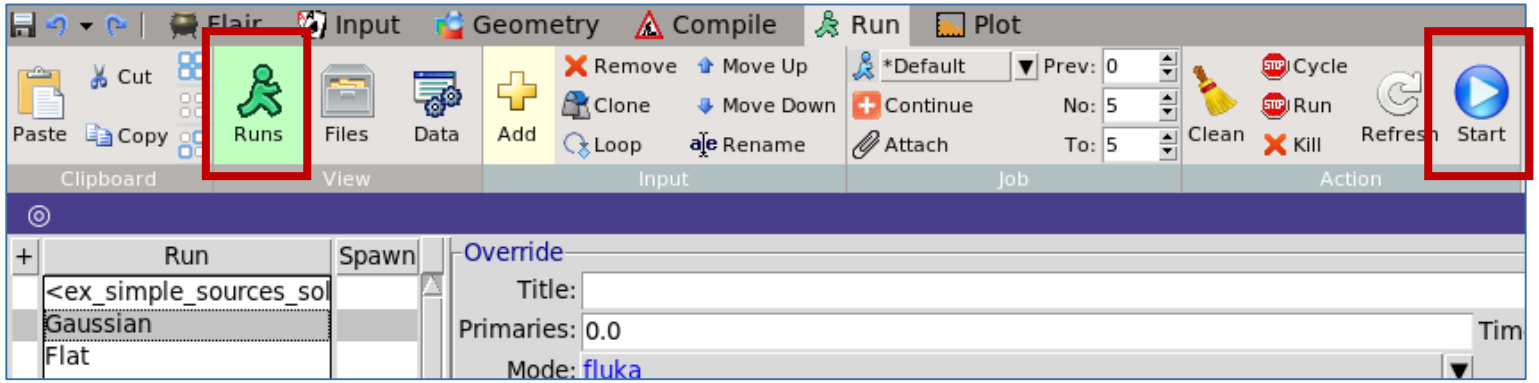
- Create two new runs called “**Gaussian**” and “**Flat**” in the Run tab



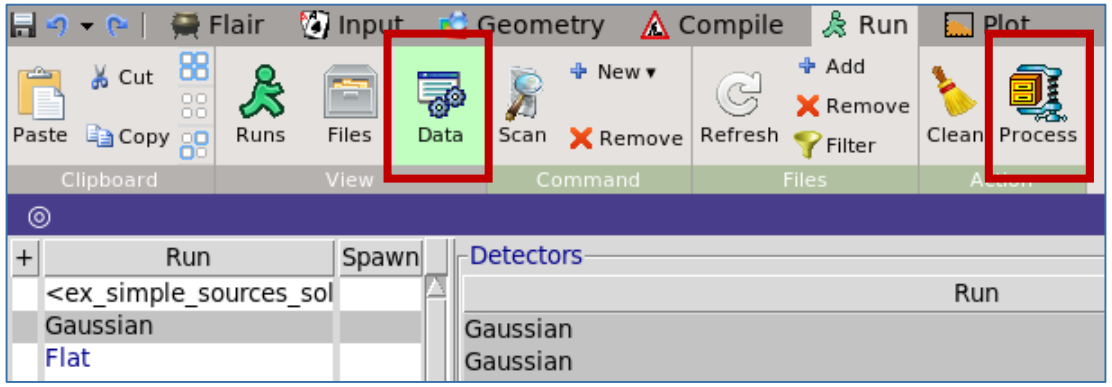
- You can enable or disable an identifier without changing it in the Input tab.
- If the box is checked then the identifier will be enabled, if it is unchecked the identifier will be disabled for the specific run
  - **Enable** the Gaussian identifier for the **Gaussian** run
  - **Disable** the Gaussian identifier for the **Flat** run

Run and process the simulations (in the Run tab)

- Run both simulations:
  - Select the name of the run and click **Start** on the Ribbon



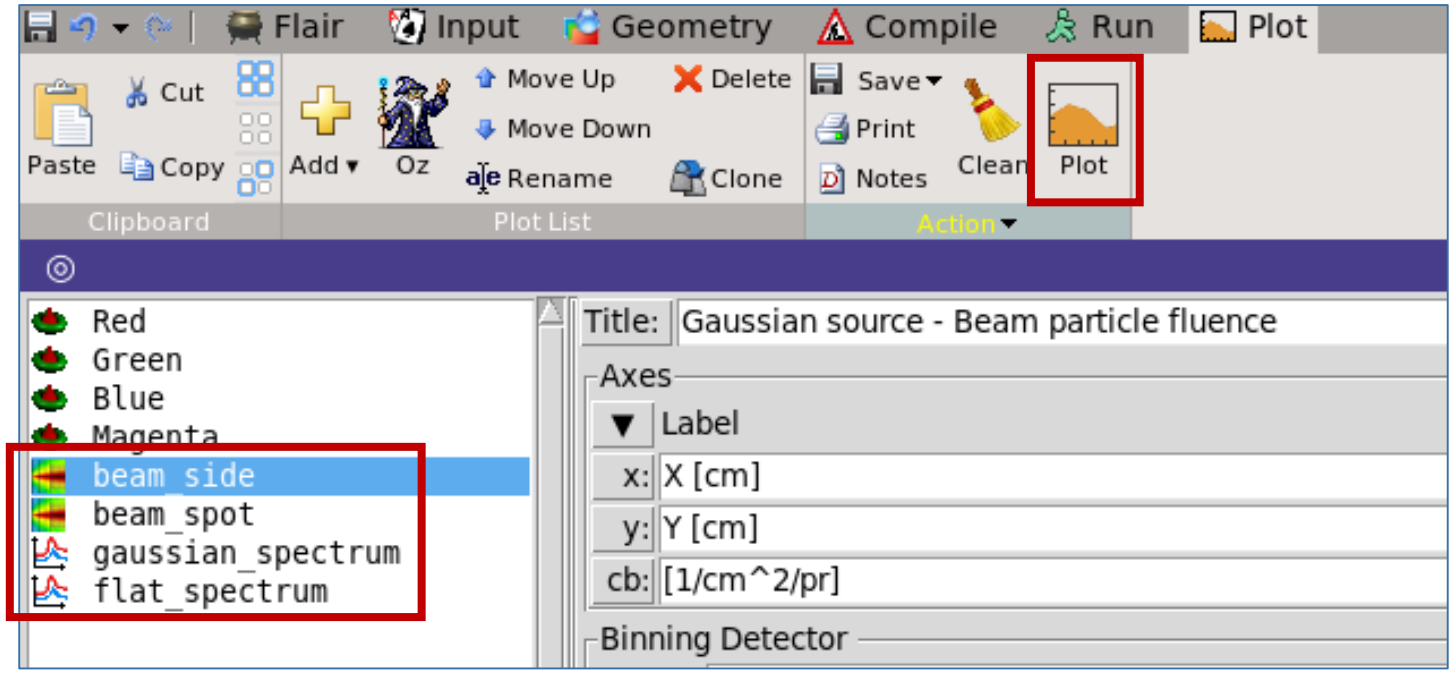
- Process both simulations after the runs are complete:
  - Click **Data** on the Ribbon, select the name of the run and click **Process** on the Ribbon



Plot the results

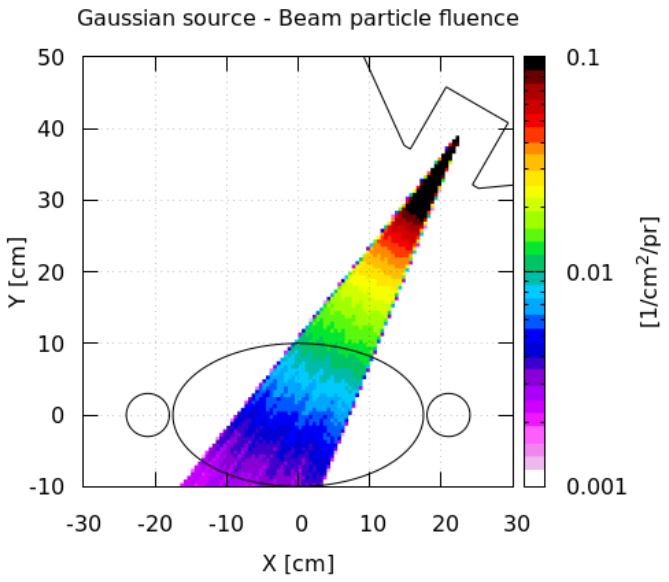
- 4 plots are already prepared:
  - Side profile of the beam
  - Spot shape of the beam
  - Energy spectrum of the Gaussian beam
  - Energy spectrum of the Flat beam

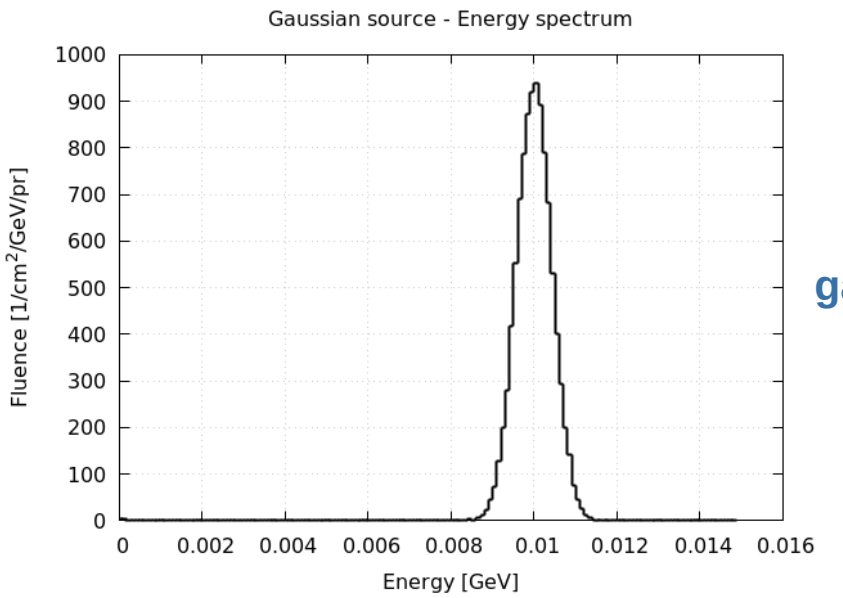
- To plot (in the Plot tab), select the name of a plot on the left side, then click the **Plot** button on the Ribbon



Expected results

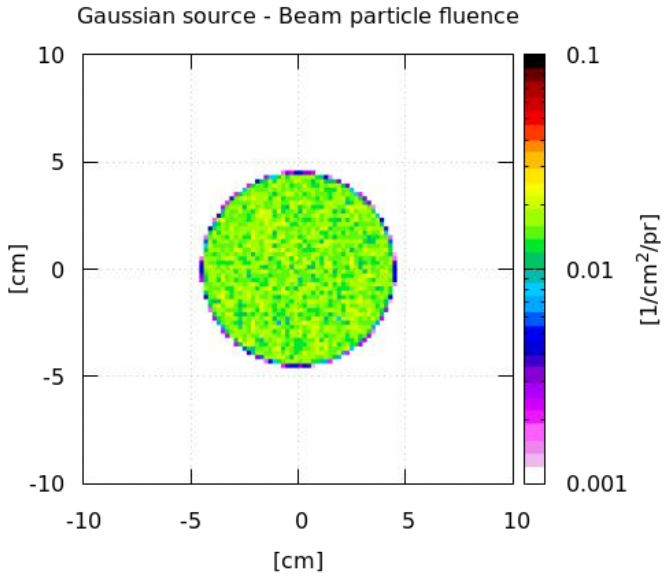
beam_side

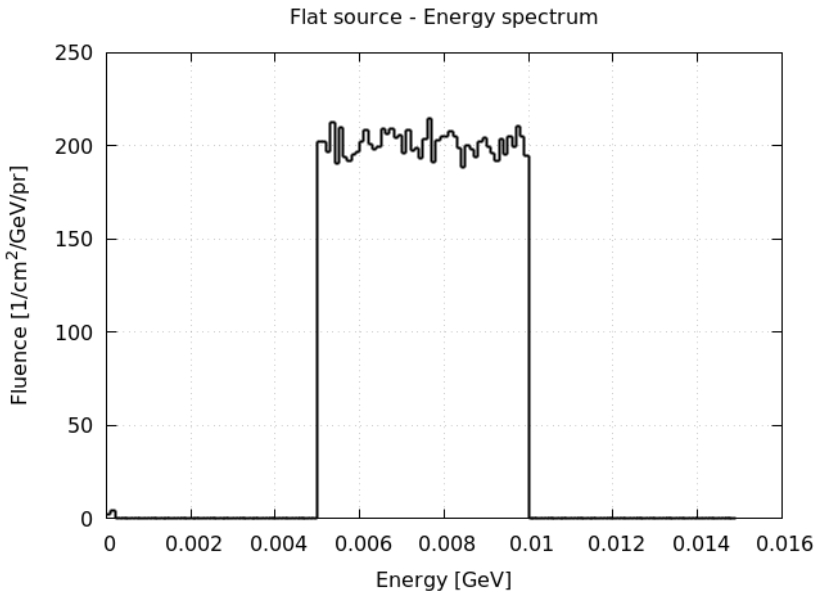




gaussian_spectrum

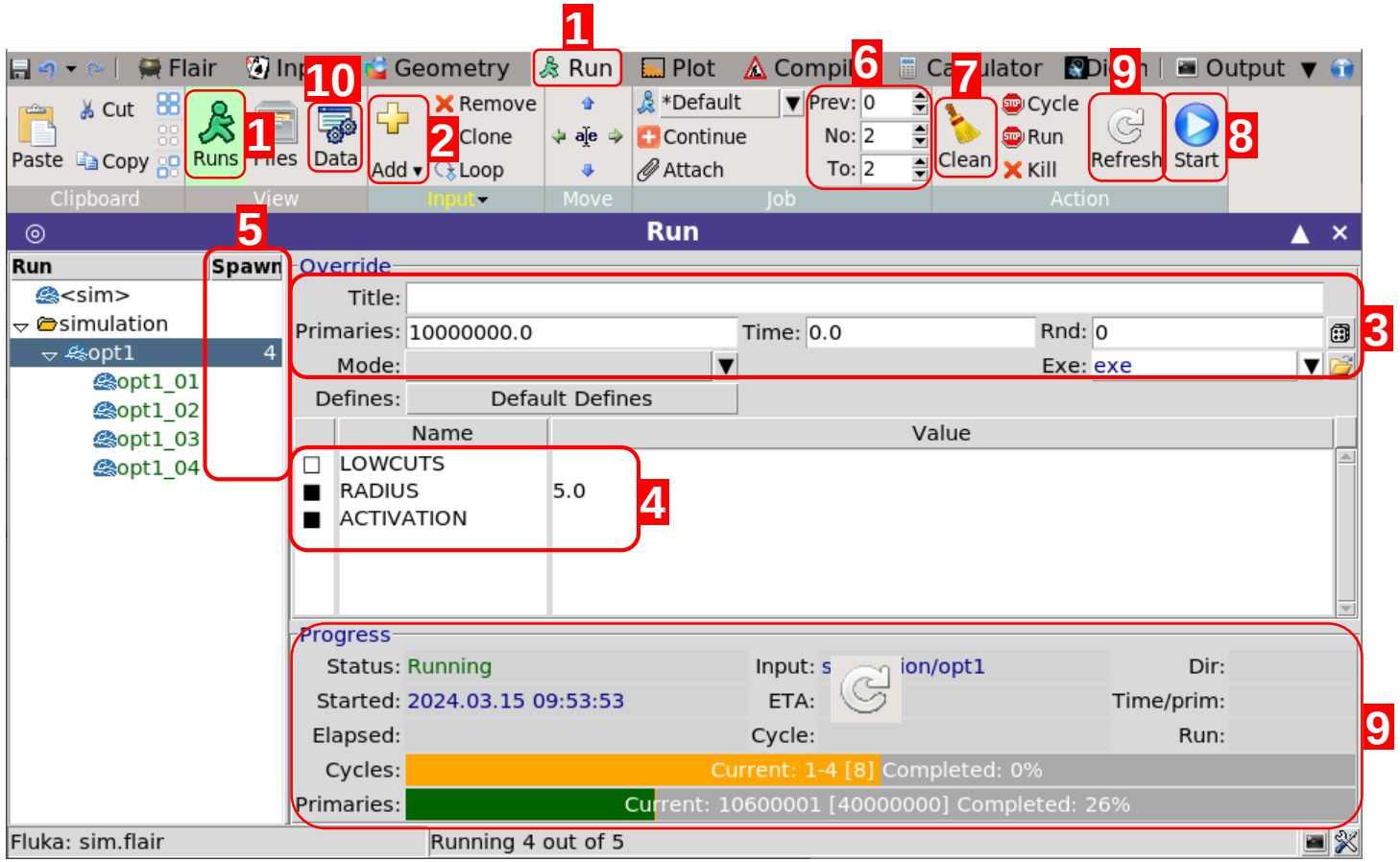
beam_spot





flat_spectrum

Flair Cheat Sheet



Remember!

- You can **STOP** or **KILL** the run.
- You can edit your input while the simulation runs.

!!! WARNING !!!

- Mind the memory and CPU usage of your simulations!

1. Go to the ***Run* tab**, select ***Runs* view**.
2. Add **new folder** + Add **new run**.
3. Override the input run info:
   - **Number of primaries**
   - Title / Max. time per cycle / Seed / Exec.
4. Override/Define variables.
5. **Recommended:** Increase number of spawns
6. Set number of cycles per spawn
   - Recommend at least 5 cycles in total.
   - `num_cycles_tot = num_cycles_per_spawn * num_spawns`
7. ***Clean*** run files after change to input or run settings.
8. Click ***Start*** to launch the simulations.
9. Monitor the progress. Click ***Refresh*** to force update.
10. After all cycles end:
    - Go to the ***Data*** ( ) tab.
    - Click ***Process*** ( ) to combine all cycles and create simulation data files.
    - You may need to refresh ( ) and scan ( ) if detectors are missing.

FLUKA