



# How to use FLUKA and flair simulation for beginner

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# Outline



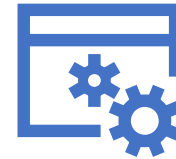
**Introduction**



**Create a model**



**Export picture  
from flair**



**Run FLUKA in  
server**

A blue ribbon graphic with a 3D effect, featuring a dark blue shadow on the left side. The word "Introduction" is written in white, bold, sans-serif font across the center of the ribbon.

# Introduction

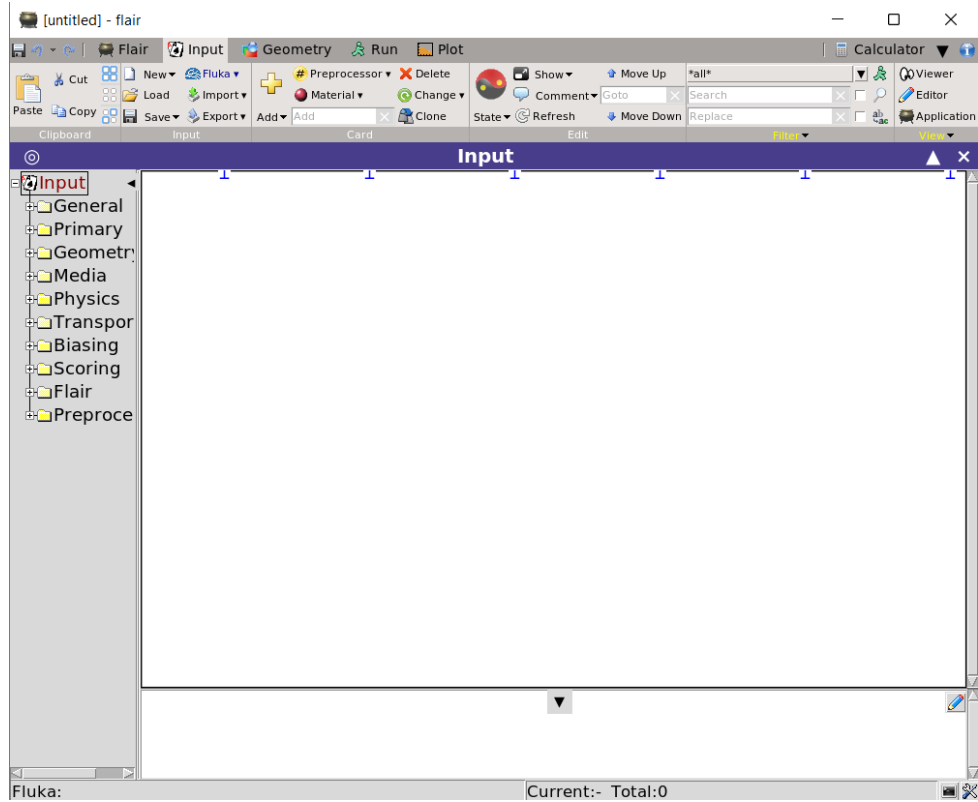


- FLUKA is Monte-Carlo simulation package which is a tool for calculations of particle transport and interactions with matter
- FLUKA can simulate with high accuracy the interaction and propagation in matter of about 60 different particles, including photons and electrons from 100 eV–1 keV to thousands of TeV, neutrinos, muons of any energy, hadrons of energies up to 20 TeV (up to 10 PeV by linking FLUKA with the DPMJET code)

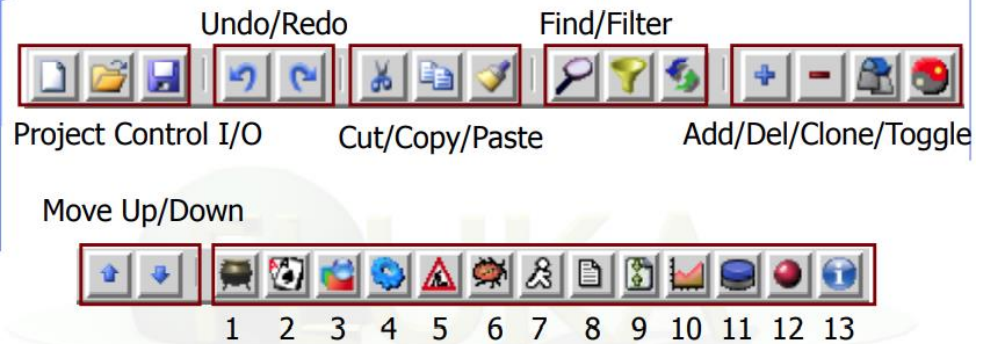




- flair is an advanced user-friendly interface for FLUKA to facilitate the editing of FLUKA input files, execution of the code and visualization of the output files.



## Toolbar



### Quick Access to:

- |                                          |                                    |
|------------------------------------------|------------------------------------|
| 1. Project Frame                         | 7. Run/monitor simulations         |
| 2. Input Editor                          | 8. View output files               |
| 3. Geometry Editor (if installed)        | 9. Data merging                    |
| 4. Process Summary                       | 10. Plots                          |
| 5. Compile executables/Add user routines | 11. Databases (not yet functional) |
| 6. Debug Geometry                        | 12. Material Database              |
|                                          | 13. Help                           |

# How to create a model? (using flair)

1. **Beam**
2. **Geometry**
3. **Region**
4. **Assign material**

[untitled] - flair

The screenshot displays the FLAIR software interface. At the top, there is a toolbar with icons for File, Edit, and various simulation actions. The 'New' button is highlighted with a red box, and its dropdown menu is open, listing several input types: basic, decay, empty, heavy-ions, lattice, void, and voxel. The 'basic' option is currently selected and highlighted in yellow. Below the toolbar is a navigation pane on the left showing a hierarchical tree structure with folders for General, Primary, Geometry, Media, Physics, Transport, Biasing, Scoring, Flair, and Preprocessor. The main workspace area is currently empty, with a dark blue bar at the bottom labeled 'Input'. On the right side, there are search and filter controls, including a search bar with the text '\*all\*', a 'Goto' field, and a 'Filter' dropdown menu.



The screenshot shows the Flair software interface. At the top, there is a menu bar with options: Flair, Input, Geometry, Run, Plot. Below the menu bar is a toolbar with icons for Cut, Copy, Paste, New, Load, Import, Save, Export, Preprocessor, Delete, Change, Show, Comment, Goto, Move Up, Move Down, Search, and Replace. A red box highlights the '+' icon in the toolbar, which has opened a dropdown menu. The menu has the following items: General, Primary, Geometry (highlighted), Media, Physics, Transport, Biasing, Scoring, Flair, Preprocessor, MUPHOTON, PAIRBREM, EMFCUT, BEAM, and SOURCE. The 'Geometry' item is highlighted, and a sub-menu is open showing options: Body, Transform, END, GEOBEGIN, GEOEND, LATTICE, LATTSNGL, PLOTGEOM, REGION, and VOXELS. On the left side, there is a tree view showing the project structure under 'Input': General, Primary, Geometry, Media (with sub-items MATERIAL, COMPOUND, LOW-MAT, MAT-PROP, ASSIGNMA), Physics, Transport, Biasing, Scoring, Flair, and Preprocessor. On the right side, there is a text editor showing a portion of an input file. The text includes: 'P28 tube bare-64:', a long string of numbers '12345678901234567890123456789012345', and several physics parameters: 'Mat: VACUUM', 'Step: 1', 'All E: off', 'Giant Dipole: On', 'Type: transport', 'e-e+ Threshold: Kinetic', 'e-e+ Ekin: 0.001', 'gamma: 1.E-4', 'Reg: @LASTREG', 'Beam: Momentum', 'p: 10000.0', 'Part: #1-#6', 'Shape(X): Rectangular', 'Delta x: #1-#6', 'Shape(Y): Rectangular', 'Delta y: #1-#6', and 'sdum: neut'.

# Beam and position of beam

Define the beam characteristics

**BEAM**

Beam: Energy ▾

E: 1e-06

Part: NEUTRON ▾

$\Delta p$ : Flat ▾

$\Delta p$ :

$\Delta\phi$ : Flat ▾

$\Delta\phi$ :

Shape(X): Rectangular ▾  $\Delta x$ :

Shape(Y): Rectangular ▾  $\Delta y$ :

Define the beam position

**BEAMPOS**

x: 0

y: 0

z: 20

cosx:

cosy:

Type: NEGATIVE ▾

x-coordinate y-coordinate and z-coordinate of the spot center.

direction cosine of the beam

direction of the beam (Positive  $\uparrow$ , Negative  $\downarrow$ )

```
*...+...1...+...2...+...3...+...4...+...5...+...6...+...7...+... ▾  
BEAM          -1E-06                                     NEUTRON
```

```
*...+...1...+...2...+...3...+...4...+...5...+...6...+...7...+... ▾  
BEAMPOS      0.          0.          20.          NEGATIVE
```

\* If we use source.f, we don't create BEAMPOS card.

# Geometry

◆ **GEOBEGIN** Accuracy: Option: ▾  
Geometry: ▾ Out: ▾ Paren:  
Title: Fmt: COMBNAME ▾  
Black body  
● **SPH** blkbody x: 0.0 y: 0.0 z: 0.0  
R: 100000.0  
Void sphere  
● **SPH** void x: 0.0 y: 0.0 z: 0.0  
R: 10000.0  
Cylindrical target  
● **RCC** target x: 0.0 y: 0.0 z: 0.0  
Hx: 0.0 Hy: 0.0 Hz: 10.0  
R: 5.0  
◆ **END**

Sphere shape ←

Cylindrical ←

```
*...+...1...+...2...+...3...+...4...+...5...+...6...+...7...+... |
SPH blkbody 0.0 0.0 0.0 100000.0
*...+...1...+...2...+...3...+...4...+...5...+...6...+...7...+...
RCC target 0.0 0.0 0.0 0.0 0.0 10.0 5.0
```

# Region

Black hole

 **REGION** BLKBODY Neigh: 5

expr: +blkbody -void

Void around

 **REGION** VOID Neigh: 5

expr: +void -target

Target

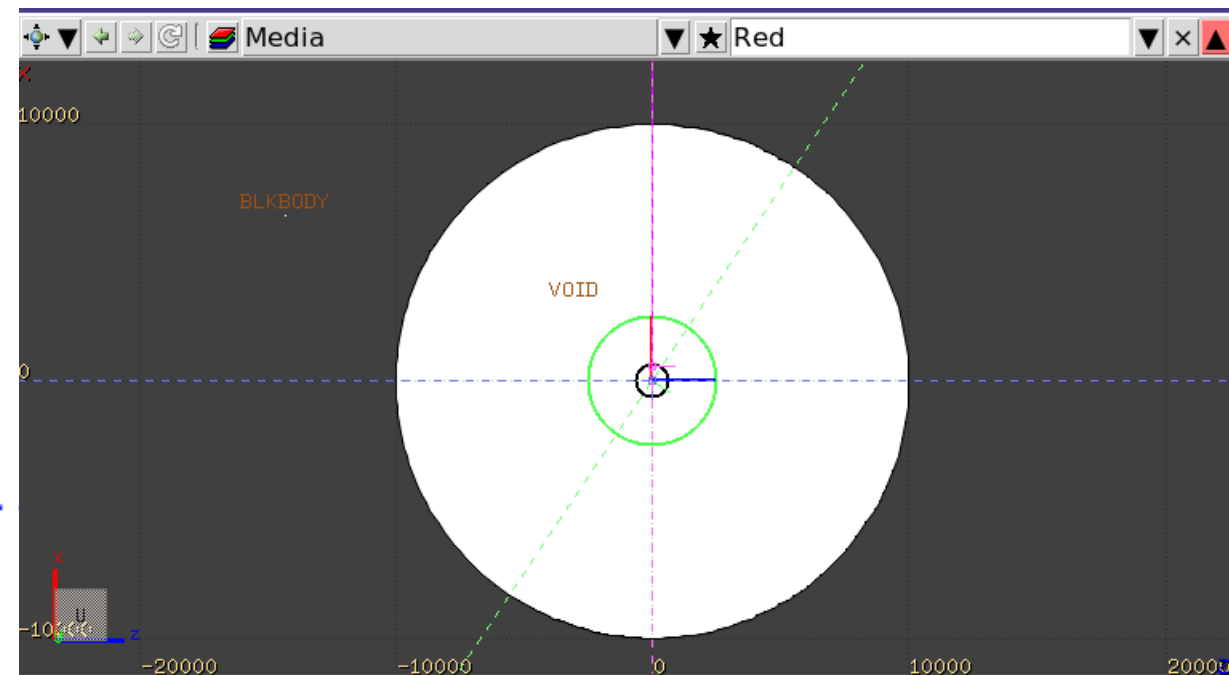
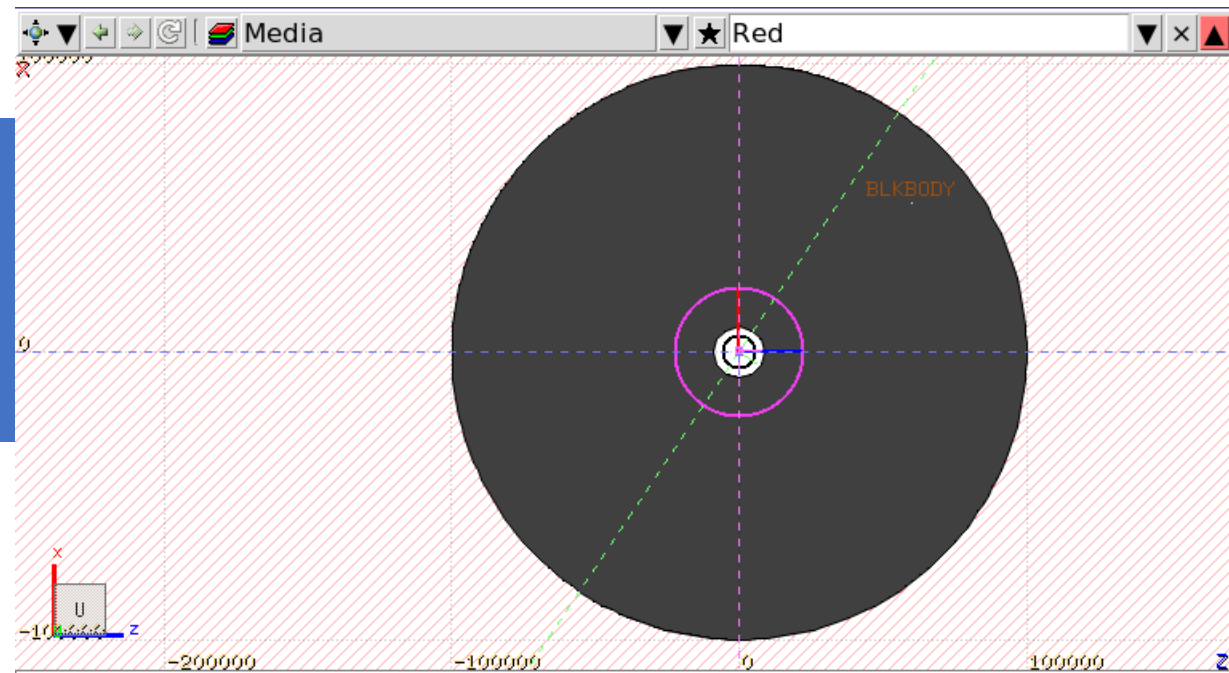
 **REGION** TARGET Neigh: 5

expr: +target

◆ **END**

↕ **GEOEND** : ▼

\*...+...1...+...2...+...3...+...4...+...  
BLKBODY 5 +blkbody -void



# Concept

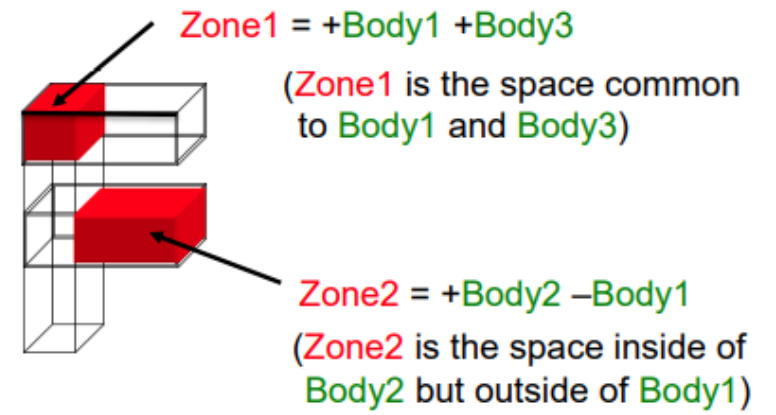
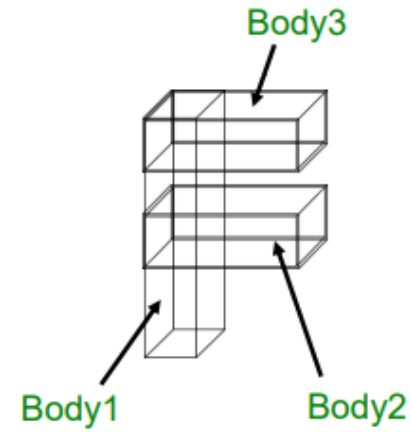
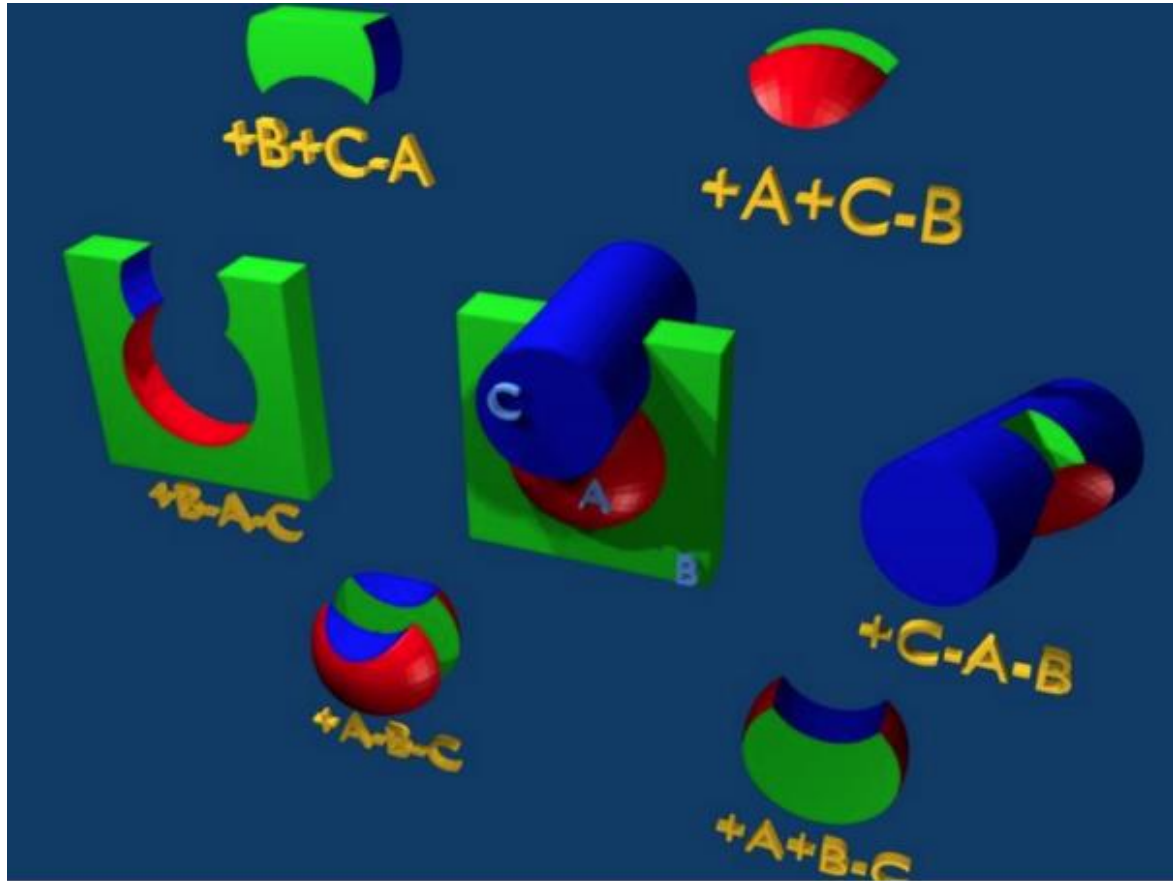
Regions are defined as combinations of bodies obtained by boolean operations:

	Union	Subtraction	Intersection
Name based format		-	+
Fixed format	OR	-	+
Mathematically	$\cup$	-	$\cap$

Regions but must be of homogeneous material composition.



Each point of space must belong to one and only one region!



# Assign Material

...+...1...+...2...+...3...+...4...+...5...+...6...+...7..

➤ <b>ASSIGNMA</b>	Mat: BLCKHOLE ▼	Reg: BLKBODY ▼	to Reg: ▼
	Mat(Decay): ▼	Step:	Field: ▼
➤ <b>ASSIGNMA</b>	Mat: VACUUM ▼	Reg: VOID ▼	to Reg: ▼
	Mat(Decay): ▼	Step:	Field: ▼
➤ <b>ASSIGNMA</b>	Mat: COPPER ▼	Reg: TARGET ▼	to Reg: ▼
	Mat(Decay): ▼	Step:	Field: ▼

Material

Name of Geometry

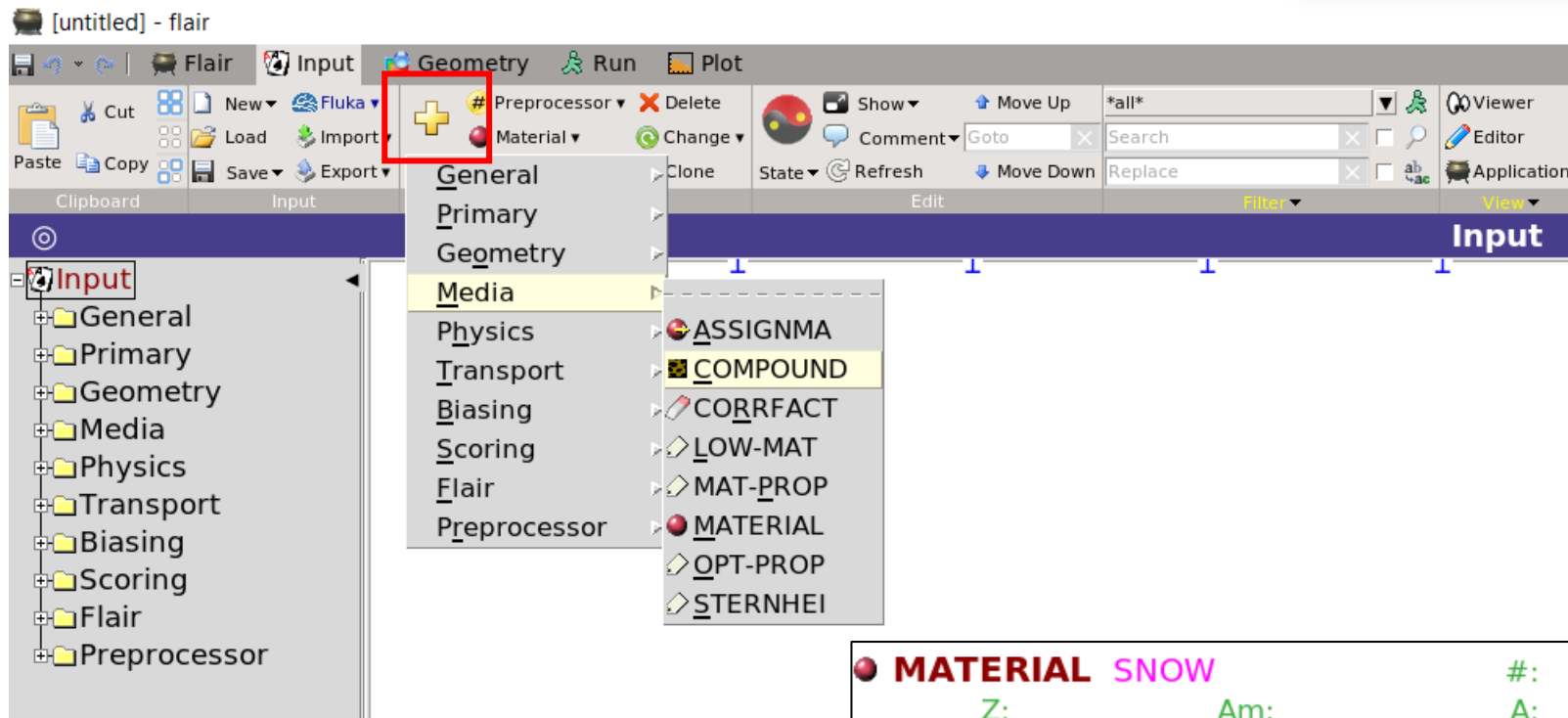
# Materials and compound

The screenshot displays the Flair software interface with the following components:

- Toolbar:** Includes icons for Cut, Copy, Paste, New, Load, Import, Save, Export, Add, Preprocessor, Delete, Change, Show, Comment, Goto, Move Up, Move Down, Search, Replace, Filter, Viewer, Editor, and Application.
- Input List:** A list of materials is shown, with "Material" highlighted in red. The list includes: 099 A-150 Tiss. Equiv. Plastic, 1,2 - Ethanediol, 1,2 Dichloroethane, 1,2-dichlorobenzene C6\_H4\_Cl2, 1,2-dichloroethane C2\_H4\_Cl2, 1,3,5 - Cyclo-Heptatriene, 1,3-Propanediol, 1,5 - Pentanediol, 1-Chloro Hexadecane, 1-Chloro Hexane, 1-Chloro Propane, 1-Chlorobutane, 101 Acetylene, 103 Adipose Tissue (ICRP), 104 Air dry (near sea level), 106 Aluminum Oxide, 111 B-100 Bone-Equivalent Plastic, 119 Bone, Compact (ICRU), 120 Bone, Compact (ICRP), and 126 C-552 air-equivalent plastics.
- Material Properties Dialog:** A dialog box titled "C2H4x properties" is open. It contains the text: "Select the additional properties of material 'C2H4x' to be added in the input". Below this are several checkboxes:  MAT-PROP: pressure, ionization potential;  DPA: DPA damage threshold;  STERNHEI: Sternheimer parameters;  CORRFACT: Density correction factor. At the bottom, there are three buttons: "Selected Only", "All the above", and "Only MATERIAL card".
- Material Card:** A detailed card for "Polyethylene (C2H4)x" is shown. It includes the following information:
  - MATERIAL C2H4x**: #,  $\rho$ : 0.94
  - COMPOUND C2H4x**: Mix: Mass, Elements: 1..3, f1: 0.143711, M1: HYDROGEN, f2: 0.856289, M2: CARBON, f3, M3
  - MAT-PROP**: Type: Gas, pressure, RHOR, Ionization: 57.4, Mat: C2H4x, to Mat, Step



# Materials and compound




**MATERIAL** SNOW #: ρ: 0.37  
Z: Am: A: dE/dx: ▼  
**COMPOUND** SNOW ▼ Mix: Atom ▼ Elements: 1..3 ▼  
f1: 2.0 M1: HYDROGEN ▼ f2: 1.0 M2: OXYGEN ▼  
f3: M3: ▼

# Scoring

Set the random number seed

 **RANDOMIZ**      Unit: 01 ▼      Seed:

Set the number of primary histories to be simulated in the run

 **START**      No.:      Core: ▼  
Time:      Report: default ▼

 **STOP**

### Geometry

Geometry Layers Errors

Filter

Type	Name
SPH	blkbody
SPH	void
RCC	target
REGION	BLKBODY
REGION	VOID
REGION	TARGET
BEAM	NEUTRON

Borders

Red

3D

Green

Media

Blue

Lattice

Magenta

A blue speech bubble graphic with a white question mark. The bubble is rectangular with a pointed bottom-left corner and a dark blue shadow on the right side. The text is centered in white.

**How to run  
FLUKA?**

# Running FLUKA in server



Materials are used → .inp files, mgdraw.f and source.f



Create executable file by using **`$ ifluka -m fluka -o {executable file name} mgdraw.f source.f`**



Run by using **`$ rfluka -N{start cycle} -M{end cycle} -e {executable file name} {.inp file}`**



Or using nohup **`$ nohup rfluka -N{start cycle} -M{end cycle} -e {executable file name} {.inp file} &`**



We will get \*\_counts files



**Thank you for your  
attention**



