Exercise: Materials

21st FLUKA Beginner's Course

ALBA – Barcelona, Spain

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Exercise: Materials

Aim of the exercise:

1- Learn how to assign material to an object

2- Learn how to define your own materials

3- Learn how to change the input file

Exercise: Materials

Copy the input file from the example_running.inp in a new directory:

```
mkdir ex_Materials ;
cp ../Examples/example_running/example_running.inp ex_Materials/ex_Materials.inp;
cd ex_Materials
```

Open the file ex_Materials.inp with FLAIR (flair ex_Materials) or with your preferred editor to edit the input file and…

- add two **compound** materials: BEER and CO_2 (before or after the Geometry, i.e. before GEOBEGIN or after GEOEND)
- assign respectively to target (TARGET) and surrounding region (VOID)

Run ex_Materials.inp from the terminal, 3 cycles, 5000 primaries:

```
$FLUPRO/flutil/rfluka –N0 -M3 ex_Materials
```

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Tip I: to define a compound material you need both a MATERIAL card (to define, among other properties, material name and density) and a COMPOUND card (to define the composition)

(see the FLUKA basic input lecture or the FLUKA manual)

Tip II: use predefined FLUKA materials as components for your component material (BEER and CO_2)

Tip III: ETHANOL is a compound material too (density: 0.789 g/cm^3)

BEER composition (MASS content):

90 % WATER , 10 % ETHANOL (CH_3CH_2OH)

BEER density: 1 g/cm^3

CO_2 density: 0.001965 g/cm^3

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Compare with the previous example (example_running directory):

- The probability that a primary proton undergoes an inelastic collision (BEAMPART Star Density in the .out file)
- The ENERGY density into the TARGET and the region around it (VOID)

Output from example_running:

1Region # name	volume in cubic cm	ALL-PART Star Density Stars/cm**3 /one beam particle	BEAMPART Star Density Stars/cm**3 /one beam particle	ENERGY Density GeV/cm**3 /one beam particle	EM-ENRGY Density GeV/cm**3 /one beam particle
1 BLKHOLE	1.000000000D+00	0.000000000D+00	0.000000000D+00	2.846591377D+00	4.592296368D-02
2 VOID	1.000000000D+00	0.000000000D+00	0.000000000D+00	0.000000000D+00	0.000000000D+00
3 TARGET	1.000000000D+00	1.985600000D+00	4.568000000D-01	4.774223812D-01	1.342799637D-01
Total (integrated over volume):		1.985600000D+00	4.568000000D-01	3.324013758D+00	1.802029273D-01

Output from ex_Materials:

1Region # name	volume in cubic cm	ALL-PART Star Density Stars/cm**3 /one beam particle	BEAMPART Star Density Stars/cm**3 /one beam particle	ENERGY Density GeV/cm**3 /one beam particle	EM-ENRGY Density GeV/cm**3 /one beam particle
1 BLKHOLE	1.000000000D+00	0.000000000D+00	0.000000000D+00	3.451731025D+00	4.637843745D-02
2 VOID	1.000000000D+00	3.300000000D-02	2.000000000D-02	6.262586343D-03	9.331739073D-04
3 TARGET	1.000000000D+00	1.428000000D-01	1.134000000D-01	2.946018522D-02	4.201055244D-03
Total (integrated over volume):		1.758000000D-01	1.334000000D-01	3.487453796D+00	5.151266660D-02

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Using FLAIR :

- assign the change momentum to the proton beam (4.34 GeV/c)
- modify the beam angular divergence to a FLAT distribution
- change the name of a body in the geometry

Open the ex_Materials.inp file with your preferred editor and see how the input file has changed.

Note the change of sign in WHAT(3), in the BEAM card.