Exercise 8:Thresholds

Beginners FLUKA Course

Exercise 8:Thresholds

Aim: "see" the effect of different threshold settings

- Easier with thin layers and with interfaces between strongly different materials -> change the layout
- Observables:
  - dose deposition,
  - backscattered electrons
- Practice also preprocessor directives in the input file

Instructions

- changes to the geometry / beam

- Create a folder called ex8, download the solution of ex5 (only ex5.inp) from the website, rename it to ex6.inp and open it in *flair*
- Change the target layer thicknesses to 50 microns each
- Change the target radius to 5 mm
- Change the BEAM to 10 MeV electrons
- Change the beam size to Annular, 1mm radius
- Change the materials of the region *TARGS2* to Lead. Change the material of region *TARGS3* to Aluminum. (H2O-Pb-Al)
- Change the air around to Vacuum

Exercise 8:Thresholds

Instructions

-general settings

- thin layers, low thresholds→ need high tracking precision
- set PRECISION as default
- Switch on single scattering at boundaries (find how..)

-prepare a set of different thresholds, with different "#define"

- Define 3 preprocessor variables, for instance HI-T , LOW-T, VLOW-T
- Prepare a structure and fill it with EMFCUT and DELTARAY cards to have, in all materials
  - #if HI-T
    - electrons: 1 Mev kinetic , 5 kev photons
  - #elif LOW-T
    - electrons: energy corresponding to a range ≈ ½ of the Pb thickness - 5 kev photons
  - #elif VLOW-T
    - electrons: energy corresponding to a range ≈ z bin size, in Pb, 5 kev photons
  - #endif

SAME energy thresholds in all materials

- HINT: go to http://physics.nist.gov/PhysRefData/Star/Text/contents.html

Exercise 8:Thresholds

Instructions

-scoring

- One USERBIN scoring DOSE over the target, 1 micron bins along z, 5 microns bins in the radial direction
- One USRBDX to score electrons and positrons EXITING from the first target layer back into vacuum. One single bin in angle.

-running

in the RUN window of Flair

- click on the **+** button in the Run/Input frame
- choose a name for the first threshold option , i.e. ex8_ht
- select the correct directive in the "Defines"frame
- run 5 runs , 100000 primaries each
- do the same for the other thresholds

Exercise 8:Thresholds

results

-PLOT

for each threshold: 1-d projection along z of the dose

try to set the same y-scale for the three plots

(set yscale [xx : yy] in the gnuplot options)

compare

for each threshold: the usrbdx output. Try to put all three on the same plot

If you have time

Change the BEAM to 4 MeV protons

run with the proton threshold at 1MeV and 100 keV

plot the dose deposition and see the difference

(using #define)

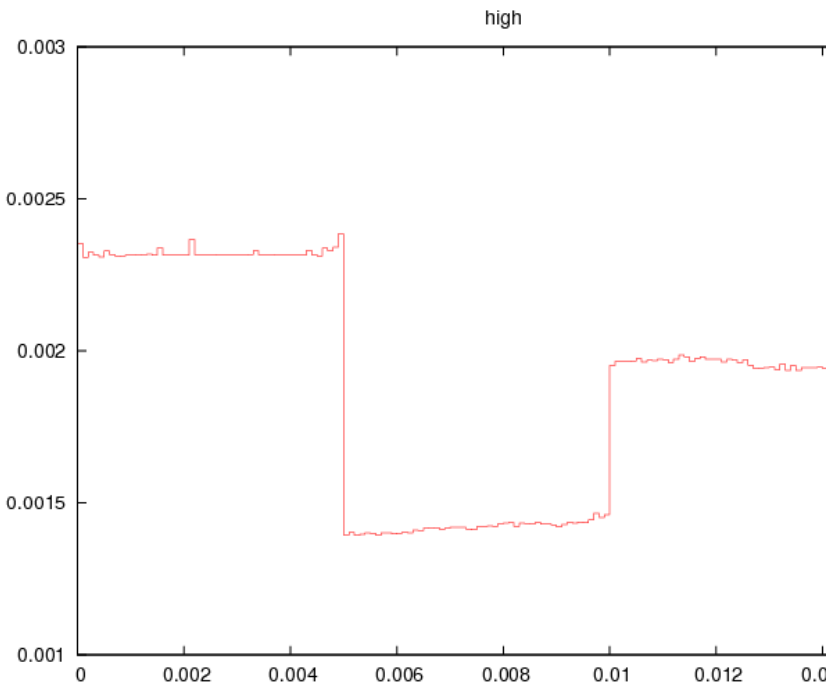
Exercise 8:Solution

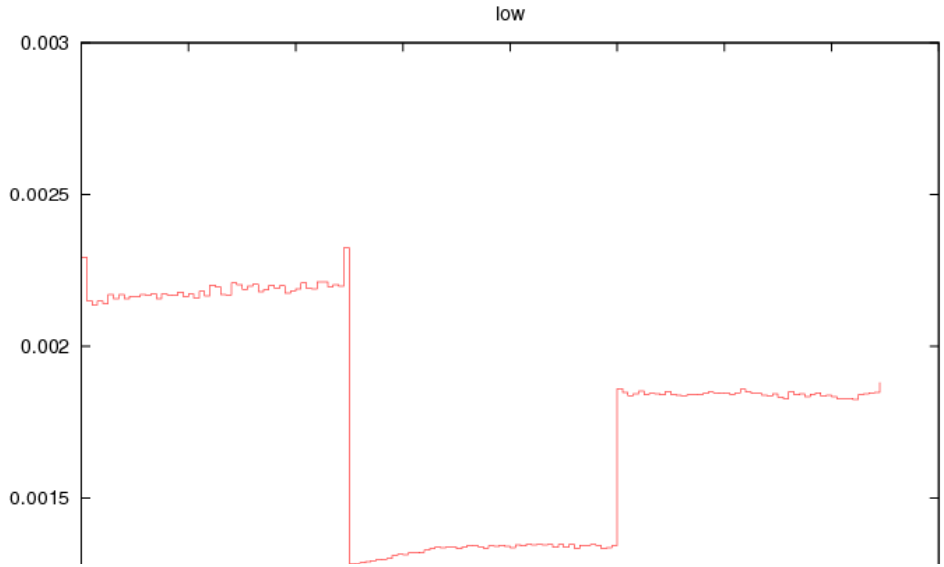
results

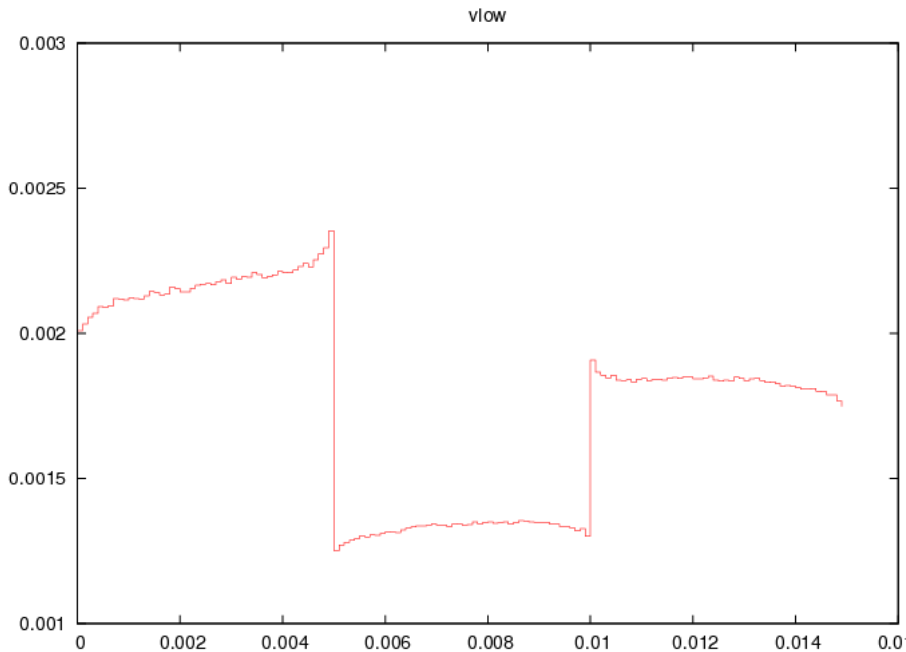
- **“low threshold”**
- **25μ Pb = 2.8 10^{-2} g/cm² ➔ 100 keV**
-
- **very-low threshold**
- **1μ Pb = 1.1 10^{-3} g/cm² → 10 keV (or 12, but we choose a round number for easyness..)**

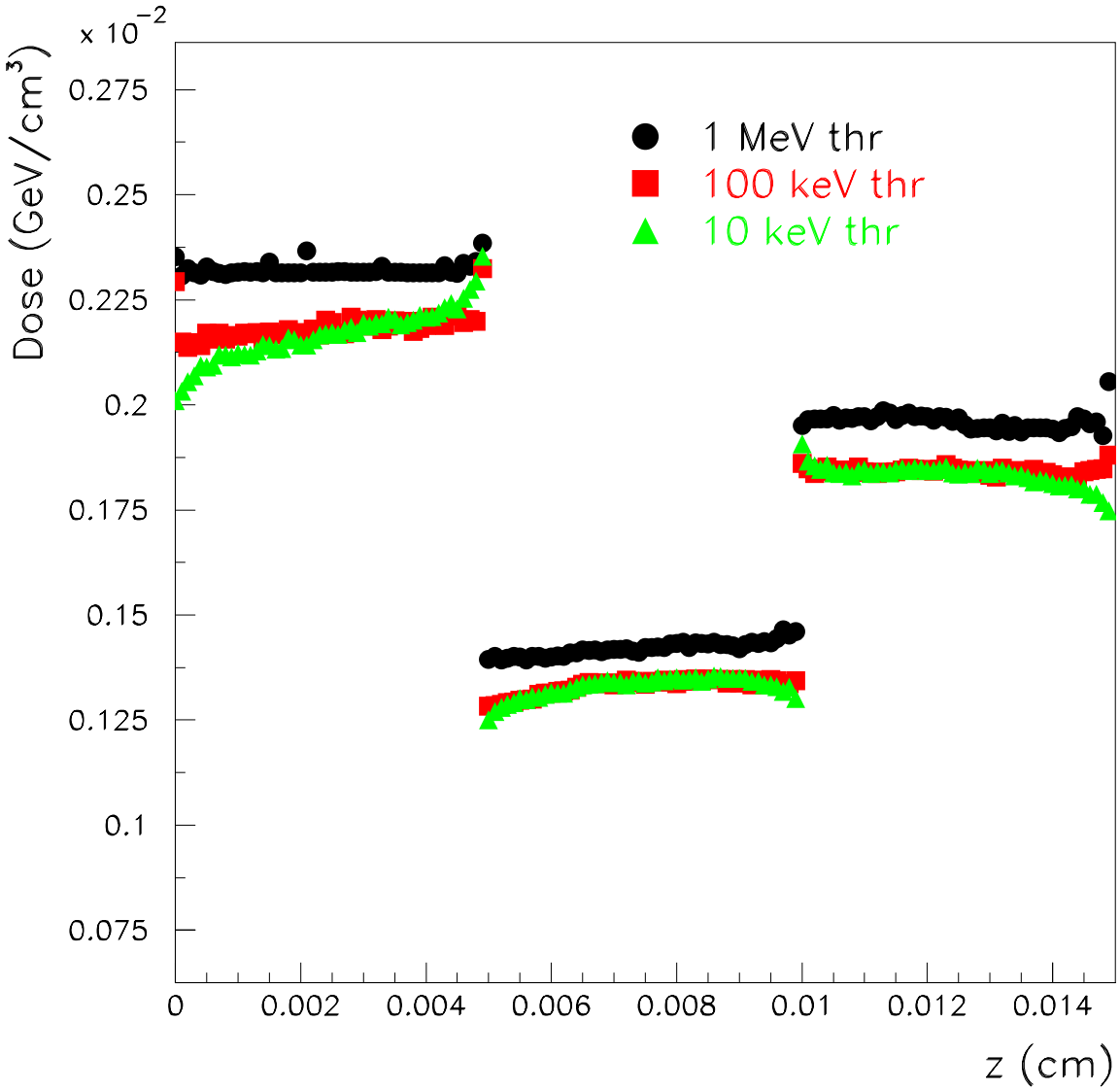
- **to be set : EMFCUT with PROD-CUT**
- **EMFCUT with BLANK**
- **DELTARAY (in case we run protons later..)**
- **Warning: to set KINETIC energy in EMFCUT the value must be NEGATIVE, otherwise it sets the TOTAL energy**

Exercise 8:Solution

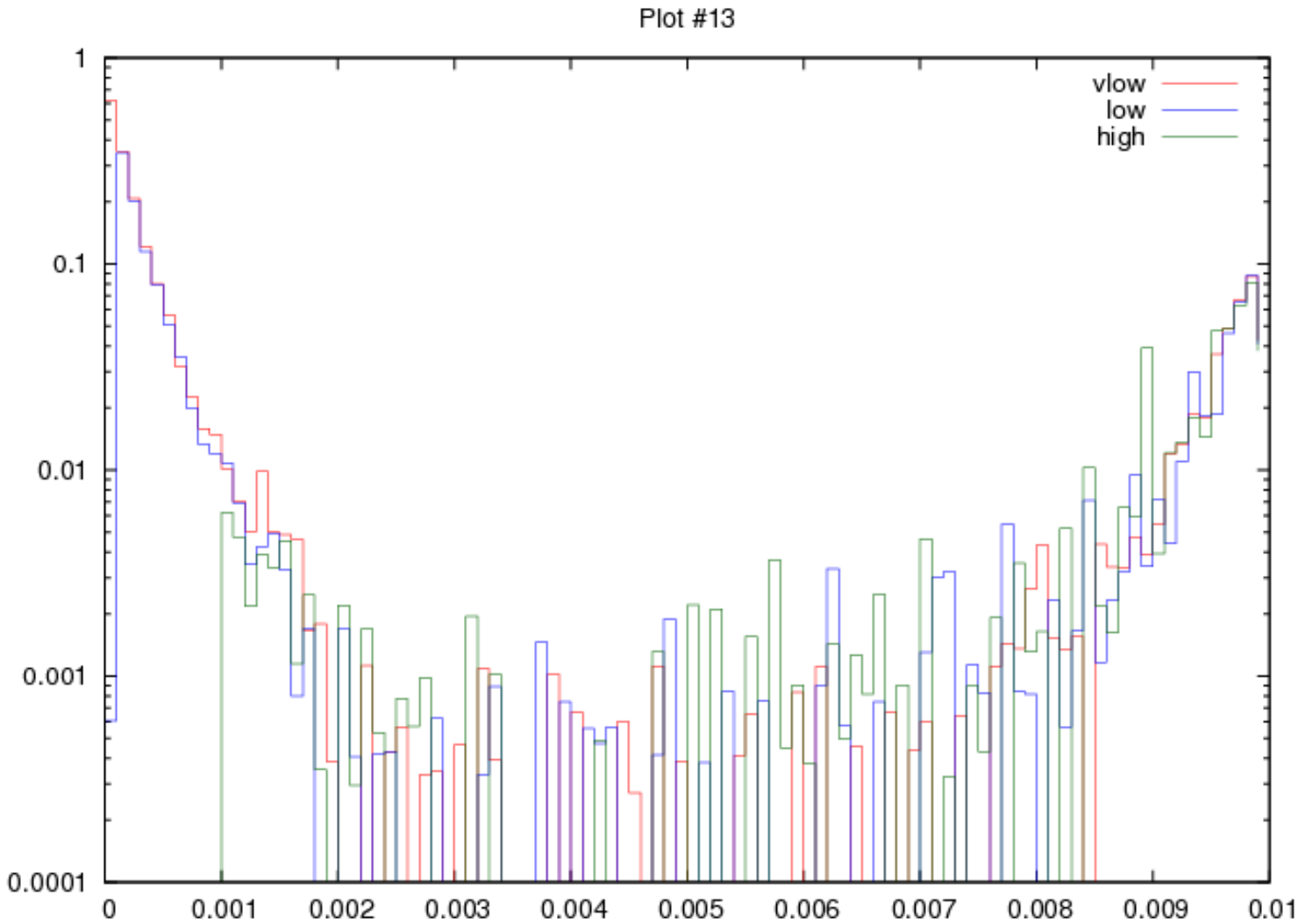




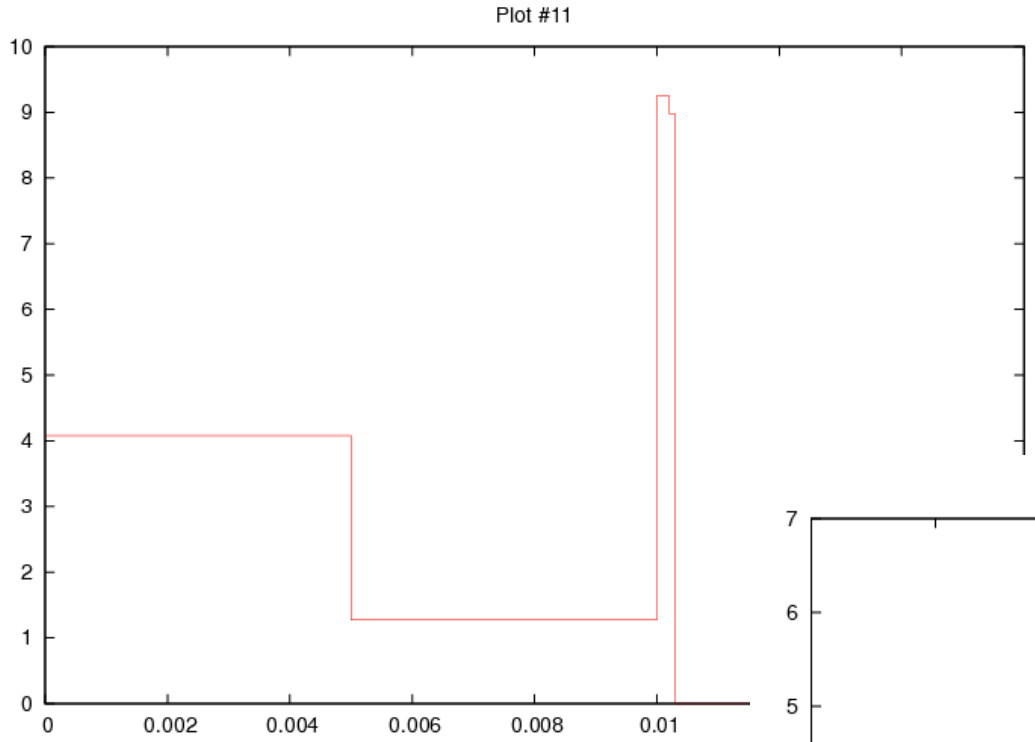


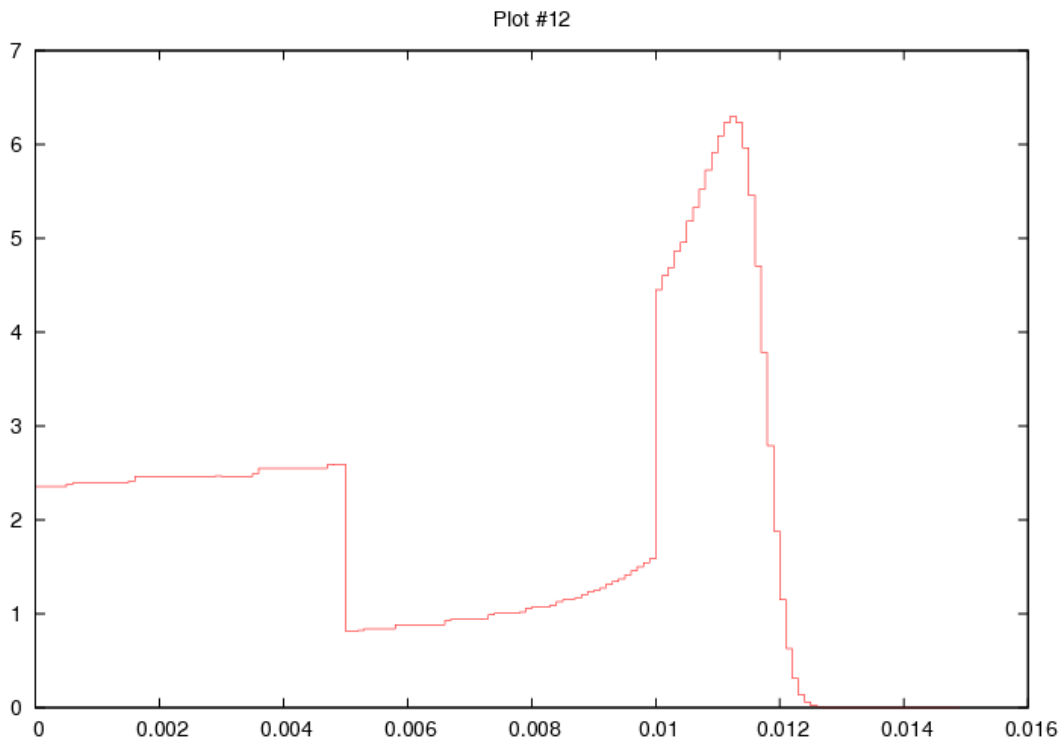

x 10^-2
Dose (GeV/cm^3)
0.275
0.25
0.225
0.2
0.175
0.15
0.125
0.1
0.075
1 MeV thr
100 keV thr
10 keV thr
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
z (cm)

ex 8 : backscattering



ex8 : protons


Plot #11
10
9
8
7
6
5
4
3
2
1
0
0
0.002
0.004
0.006
0.008
0.01


Plot #12
7
6
5
4
3
2
1
0
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0.016